

2019 - 2028

Corporate Energy Plan



Region of Waterloo

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Executive summary

This 2019-2028 Corporate Energy Plan (“Plan”) reviews and updates the Region of Waterloo 2014-2024 Plan. It meets the requirements of Ontario Regulation 507/18 which requires public agencies to review and update their energy conservation and demand management plans every five years. The 2014-2018 actions from the previous plan were reviewed and the energy achievements and challenges from the last 5 years have been collected. Recommendations have been incorporated into this Plan to make its implementation even more effective.

This 2019-2028 Plan shows that the previous Plan was very successful in the first period of its implementation between 2014 and 2018. It promoted the benefits of energy management on Regional operation cost reductions and sustainability.

Numerous energy conservation measures were implemented in the 2014-2018 period, resulting in \$5.07 million in energy savings and 2,240 tonnes of GHG emissions reduction. Energy measures implemented covered a broad range of energy management practices including energy planning, training, audits, studies, projects and communication.

The 2019-2028 Plan update includes energy conservation recommendations for the next 10 years. It will be reviewed and updated again every 5 years, always looking ahead 10 years, consistent with the Region’s Budget planning processes. The recommendations will improve the efficacy of this Plan towards sustainable energy savings by promoting collaboration, reviewing processes, training and energy funding coordination between Regional departments.

The goals of the 2019-2028 Plan are to manage energy consumption effectively and sustainably and in order to meet these strategic goals, the Plan lists capital and non-capital energy measures for



implementation. The non-capital energy measures such as process reviews, training and studies aim to lead to the development of a longer sustainable culture on energy usage. Their associated energy savings will be known only after their implementation resulting in more energy efficiency opportunities identified and new energy measures implemented.

The plan also includes capital energy conservation measures, planned and currently included in the 2019-2028 ten-year capital forecast, such as heating, ventilation and air-conditioning upgrades, lighting retrofits and processes modifications with expected \$300,000 savings and 1,030 tonnes of GHG emissions reduction annually. In total, the Plan identifies over 350 energy conservation measures for implementation in the next 10 years. After all projects are implemented, it will result in \$3.0 million in annual cost savings that is expected to last another 5 years when the projects will reach the end of their lifetime. This will result in an estimated 20-year forecasted savings of over \$30 million.

This Plan aims to build on of the most successful components of the previous Plan, leading to the development of a sustainable culture of energy usage by incorporating energy management into everyday Regional activities and decision-making.

1. Background

The Regional Municipality of Waterloo (“the Region”) services one of the largest and fastest growing urban areas in Ontario and energy consumption has a significant impact on the Regional operations budget. In 2018, the Region spent approximately \$19.3 million on 136 million kWh of electricity, and \$2.7 million on 9 million m³ of natural gas. Energy management through the Plan implementation 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 environmental sustainability.


Following the requirements of the Ontario Regulation 397/11, under the authority of Ontario’s Green Energy Act, 2009, the Region developed its first Corporate Energy Plan in 2014, called the 2014-2024 Corporate Energy Plan. The 2014-2024 Plan set out the strategy and actions to effectively and sustainably manage the Region’s corporate energy use to deliver service excellence to facility users and to minimize environmental impacts of energy use. With the repeal of the Green Energy Act, 2009, the energy conservation and demand management plan portion of the regulation was reinstated in the Electricity Act, O. Reg. 507/18. The 507/18 Regulation also requires a review and update of the Plan every five years, beginning in 2019.

The information requested about the review and update of energy conservation and demand management plans is defined in the Regulation, section 6 (3) as below:

- A description of current and proposed measures for conserving and otherwise reducing energy consumption and managing its demand for energy;
- A revised forecast of the expected results of the current and proposed measures;
- A report of the actual results achieved;
- A description of any proposed changes to be made to assist the public agency in reaching any targets it has established or forecasted.

The Region is committed to improving its energy conservation measures and find more opportunities for energy savings in the next 10 years. The next sections of this Plan address the requirements above and details how the Region plans to improve its energy management through its 2019-2028 Plan implementation.





2. Review of 2014 to 2018 Corporate Energy Plan period



The 2014-24 Plan formalized an energy management framework to provide the basis for delivering an energy management program for the Region. It aligned with the Region's strategic goals with energy management and greenhouse gas emission reductions. It also listed guiding principles of energy vision to transform the Region into an organization that continually seeks to conserve energy, improve energy efficiency and build a sustainable energy infrastructure.

The 2014-24 Plan recommended that the Region consider energy performance improvement in the processes of designing, upgrading and renovating facilities, equipment, building systems, and processes that can all significantly impact energy consumption.

During the first five years of that Plan, the Region assessed, developed and implemented energy conservation measures with the collaboration of several areas of the Region. Staff explored new opportunities

of energy management and cost reductions associated with the ongoing work of asset management, project management, operations and maintenance teams.

In some cases, more opportunities for energy measures could have been assessed if energy management had been included earlier in planning, designing and decision-making. In other situations, energy measures were assessed but not developed for implementation mostly due to reasons of economic factors, technology challenges or systems not suited to the energy improvement measures.

2.1 Energy conservation measures implemented in 2014-2018

This Plan defines energy conservation measures as any type of practice that results in short, mid or long-term reduction of consumption of energy in a variety of energy management practice categories such as training, communication, studies, capital projects, operations efficiency and energy policies.

The following sections detail some of the energy measures implemented in the first five years of the 2014-24 Corporate Energy Plan.

- Energy studies
- Solar photovoltaic (PV) net-metering
- Light-emitting diode (LED) lighting
- Sub-metering
- Energy efficiency integration to capital renewal projects
- Energy measures integration to new construction projects
- Training in energy efficiency
- Energy efficiency in operation and maintenance
- Energy procurement review
- Energy management software assessment

2.1.1 Energy studies

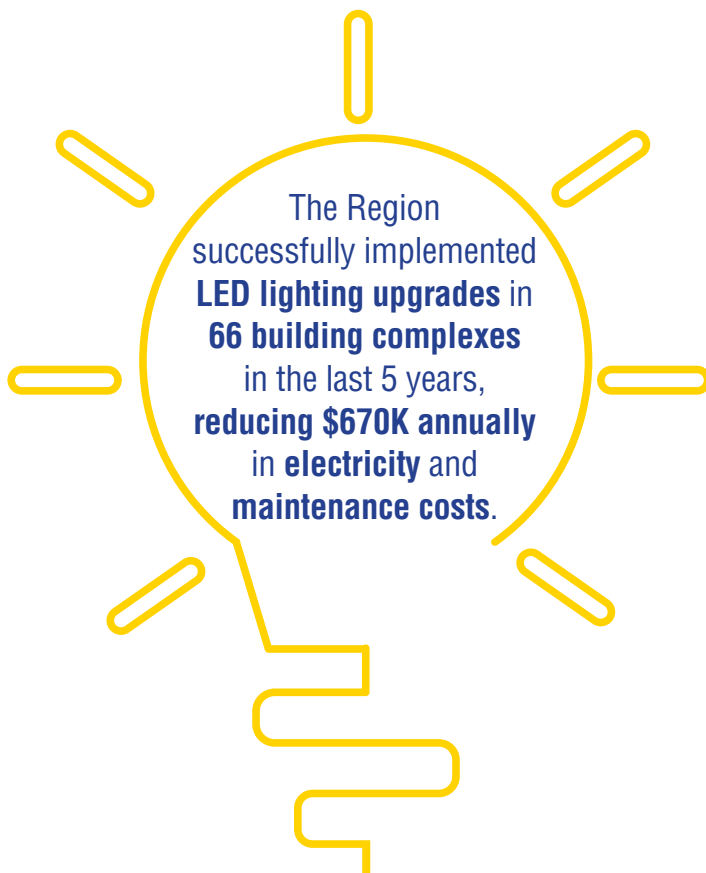
In the last 5 years, energy studies were conducted on Regional Facilities with high energy consumption, exploring opportunities for energy conservation, efficiency and on-site generation. The studies evaluated: retrofits and replacements of existing assets with more efficient ones; optimization of operations of specific systems; and viability of site generation and renewable energy systems. Depending on the size of the facility and its operations complexity, the studies were conducted following the scope below:

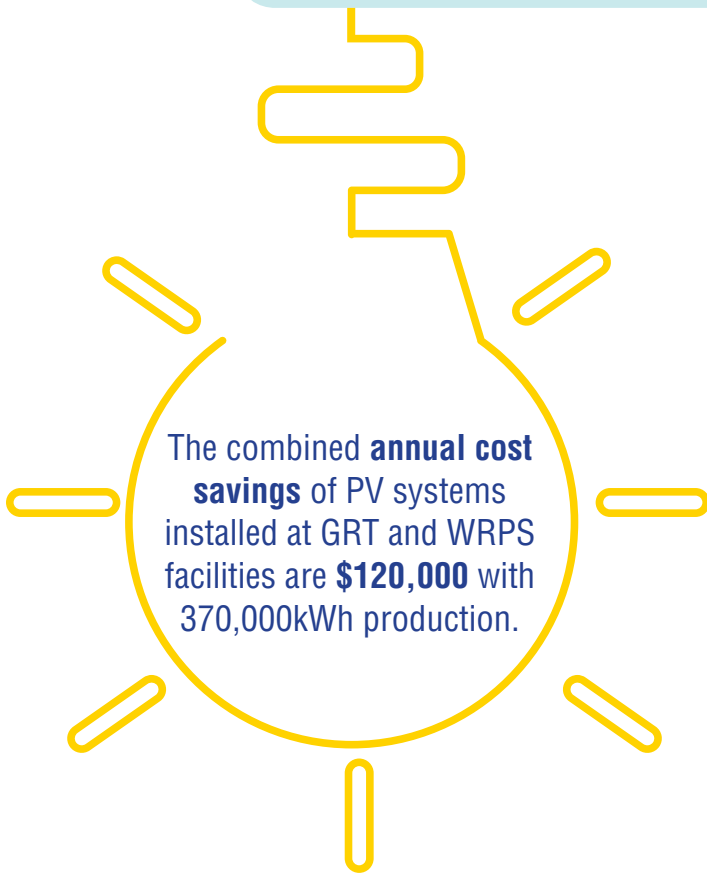
- ASHRAE energy audit levels I or II
- Building envelope audits
- On-site generation and battery-storage feasibility studies
- Asset recommissioning processes

In total, 68 comprehensive energy studies were conducted in the last 5 years, as listed in Appendix A. The reports of the studies recommended several types of energy measures be implemented. The most significant ones are identified below. From the measures, 120 projects were developed and implemented, resulting in cumulative 22,013,746 kWh savings of electricity and 721,054 m³ of natural gas savings, as listed in Appendix B.

Type of energy measures recommended by energy studies

- Solar Photovoltaic (PV) net-metering
- Lighting-Emitting Diode (LED) lighting upgrades
- Variable frequency drive
- Appliances replacements
- Water efficiency measures
- Heating, ventilation and air-conditioning (HVAC) free-cooling
- General operation improvements
- Building Automation System (BAS) reprogramming
- HVAC control improvements
- Lighting control improvements
- Building envelope improvements
- Electric vehicle charging station
- Sub-metering
- Water piping insulation
- Electronic thermostats
- HVAC upgrades
- Elevator modernizations
- Geothermal system
- Utility account rate class change
- Demand management contract
- Street lighting retrofit





2.1.2 Solar Photovoltaic (PV) net-metering

In 2014, the Region installed PV net-metering systems at Grand River Transit (GRT) Chandler (287kW) and at Waterloo Regional Police Service (WRPS) (43kW) facilities. The combined annual cost savings of these PV systems are \$120,000 with 370,000kWh production. Both facilities were initially designed to accommodate PV systems on their roof, with adequate space for the electrical systems and minimal rooftop obstructions for optimal conditions.

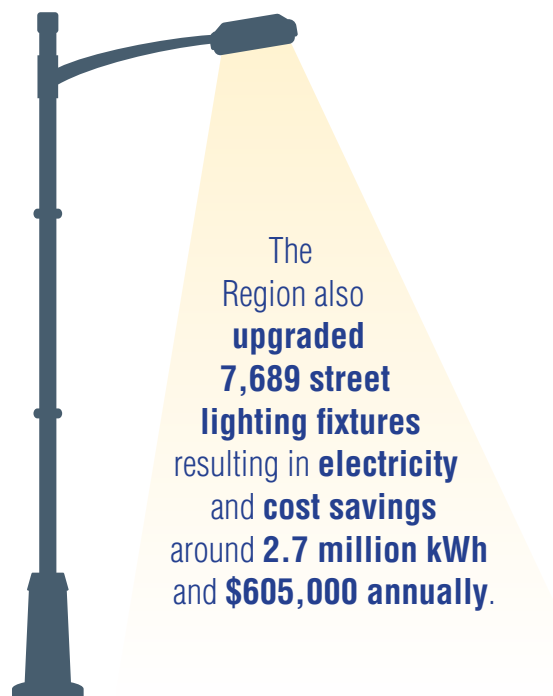
In addition to the lifecycle cost savings, there is environmental impact associated with the clean electricity from 40 tonnes of greenhouse gas (GHG) avoided annually.

2.1.3 Lighting-Emitting Diode (LED) lighting

The Region successfully implemented LED lighting upgrades in 66 building complexes in the last 5 years, reducing electricity and maintenance costs by \$670,000 annually, and will continue to assess and upgrade lighting throughout its facilities. Lighting upgrade projects also included the assessment of existing lighting levels for building code requirement compliance, installation of occupancy sensors and daylighting technology when feasible. The LED lighting technology is now used for all lighting retrofits due to its cost reduction in the last 5 years, proving it to be an economic, efficient and reliable technology.

The Region also upgraded 7,689 street lighting fixtures resulting in energy savings around 2.7 million kWh annually.

LED technology has proven to be a reliable technology in Regional buildings. Operating cost reductions are achieved due to reduced maintenance requirements and lower energy consumption. LED lighting fixtures require less replacement of parts due to lower equipment failure rate. On average, it uses half of the electricity used by conventional lighting technology.

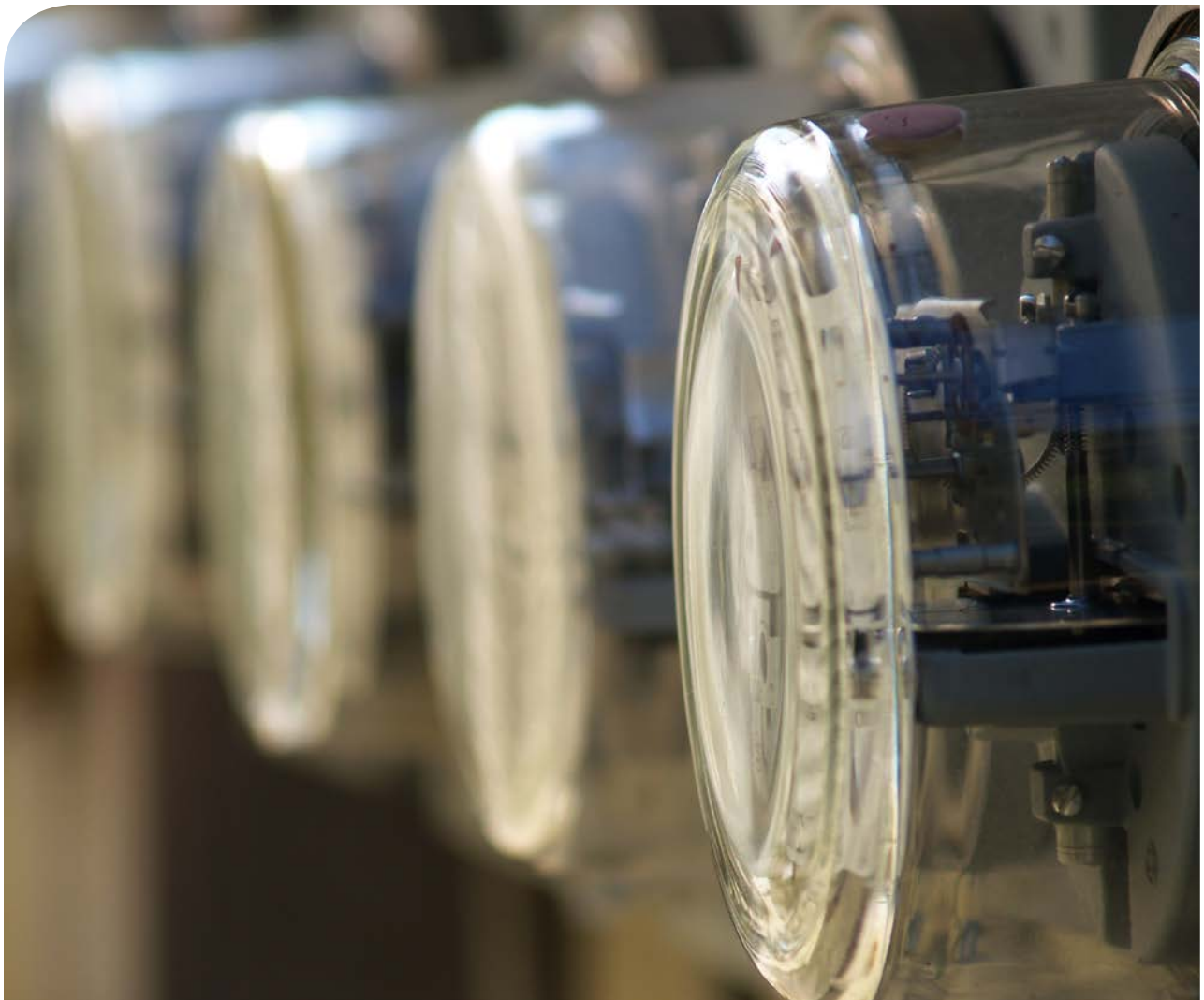


2.1.4 Sub-metering

Sub-metering has significantly reduced in cost in the last few years. Sub-meters were installed in 24 facilities during the energy management plan implementation as listed below. The sub-meters have contributed significantly as a tool to identify energy savings opportunities. Sub-metering on its own does not provide energy savings; it must be part of a comprehensive process of data acquisition, analyses, reporting and actions taken to address the issues reported. The Region will implement a new process for sub-metering that will include water leak detection and energy consumption reporting, both integrated with the corporate asset

management program. This process aims to integrate energy consumption assessment with operations and maintenance practices, supported by utility consumption reports generated by sub-metering and utility invoices.

Due to development of sub-metering technology, wireless connectivity and cost reduction, new sub-metering concepts are available where the Region could pay monthly fees to have data and analytics available. This would improve the efficacy of the sub-meters leading to actions to address energy consumption anomalies detected and consequently providing utility and operation cost savings.





Facilities with sub-meters installed in 2014-2018

Facility complex	Meter type
Airport Operations Centre	Electricity
Grand River Transit Chandler	Electricity, Water and Gas
Weber Street Courthouse	Electricity, Water and Gas
Waterloo Research & Training	Electricity
Police Headquarters	Water
Paulander Housing Complex	Water
College Housing Complex	Water
Franklin Housing Complex	Water
Public Health Building	Water
Maple Grove Rd Operations Centre	Water
Regional Administration Headquarters	Natural Gas and Water
Police South Division	Water
Police North Division	Electricity and Natural Gas
Ken Seiling Waterloo Region Museum	Electricity and Natural Gas
Kingscourt Housing Complex	Water
150 Main	Water
Sunnyside Long-term Care Facility	Natural Gas
Church Street Housing Complex	Water
Galt Wastewater treatment plant (WWTP)	Electricity
Kitchener WWTP	Electricity
Preston WWTP	Electricity
Elmira WWTP	Electricity
Hespeler WWTP	Electricity
Conestogo WWTP	Electricity
St. Jacob's WWTP	Electricity
Heidelberg WWTP	Electricity
Waterloo WWTP	Electricity

2.1.5 Energy efficiency integration into capital renewal projects

The Region reviewed the capital renewal program planned for the current year and recommended

efficiency improvement on projects that effect energy consumption, through incorporating energy life cycle costs on the specs of renewal upgrades. The projects below are examples of capital renewal projects with energy efficiency improvements.

Capital renewal projects with energy efficiency upgrades 2014-2018

Year	Facility	Project
2017	Waterloo Regional Housing	Upgrade air-conditioning of lounges of 16 Housing complexes
2017	Waterloo Regional Police HQ	Upgrade of building automation system
2015-2017	150 Main Street, Cambridge	Upgrade of HVAC system
2016	Public Health Services	Upgrade of cooling system
2016	Administration HQ	Upgrade of boilers
2018	Sunnyside	Upgrade of HVAC system
2016	Airport Terminal	Upgrade of Heating system
2016	Operations Centre	Upgrade of HVAC system
2015-2016	Administration HQ	Upgrade of building automation system
2015-2016	GRT Charles Terminal	Upgrade of HVAC system
2015-2016	GRT Conestoga	Upgrade of HVAC system
2015	Waterloo Regional Police HQ	Upgrade of building envelope
2016	Waterloo Regional Housing	Upgrade of 629 furnaces
2018	Waterloo Regional Housing	Upgrade of 92 furnaces
2017	Waterloo Regional Housing	Bathrooms at 206 units upgraded with LED lighting and water efficiency measures
2019	Waterloo Regional Housing	Bathrooms at 465 units upgraded with LED lighting and water efficiency measures
2019-2020	Waterloo Regional Housing	Upgrade of windows at 790 units
2016	Waterloo Regional Housing	Upgrade of air-handling at 8 buildings
2015	Waterloo Regional Housing	Upgrade of 147 furnaces
2015	Operations Centre	Upgrade of HVAC system
2014	Administration HQ	Upgrade of lighting control
2014	Administration HQ	Upgrade of cooling tower
2014	150 Main	Upgrade of canopy lighting
2014	GRT Strasburg	Upgrade of roof-top units
2014	Sunnyside Home	Demand and control ventilation
2016-2018	Mannheim, Wellesley, Shades Mill, Turnbull and Pinebush water treatment plants (WTP)	Upgrade of HVAC system

As part of the Region's performance management system, processes are continuously being improved, including those that ensure capital renewal projects capture all the available energy savings possible. Identifying these opportunities as part of the capital renewal planning will lead to improvements with matching budgets to the available energy management opportunities.

2.1.6 Energy measures integration into new construction projects

In 2005, Regional Council directed staff to design and build all new buildings and major renovations larger than 500m² to meet or exceed the LEED Silver standard. Since then, the Region has built 11 facilities certified to LEED Silver or better, and contributed to an estimated annual energy cost savings of \$2.1 million/year when compared to a base (non-LEED) building. Four new LEED certified facilities are planned for the next few years.

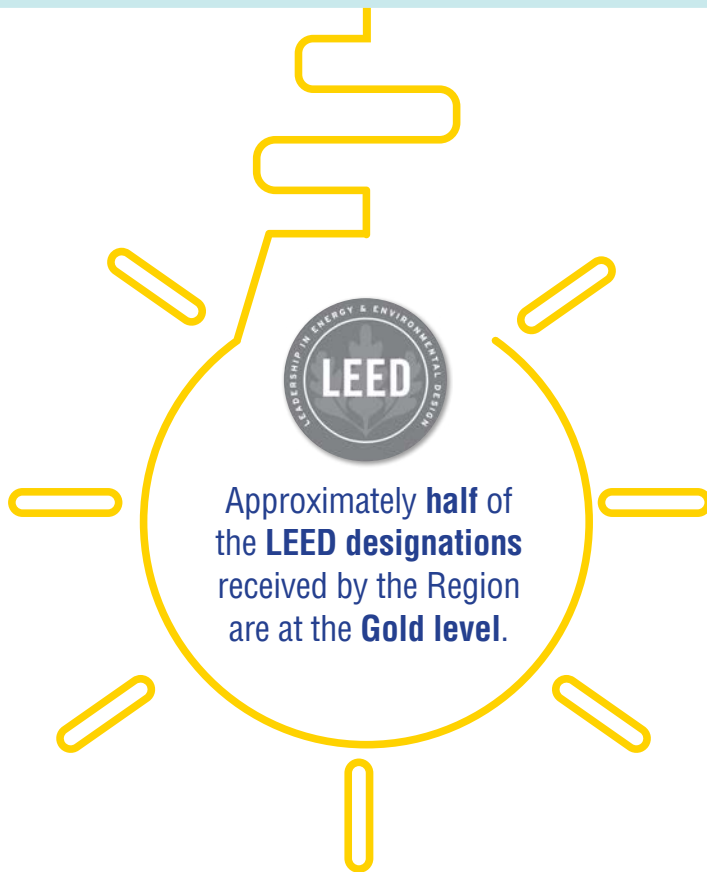


Where feasible, the Region has exceeded the set standard of LEED Silver by targeting and achieving LEED Gold certification. Approximately half of the designations received by the Region are at the Gold level. The two most recent LEED facilities built, the Courthouse at 20 Weber and the Grand River Transit (GRT) Chandler Maintenance Facility, together save \$200,000 in utilities cost per year.

Regional facilities with LEED certification

Year	Facility name	LEED level
2005	Paramedic Services Fleet Centre	Gold
2009	WRPS Investigative Building	Gold
2011	Waterloo Landfill South Workshop	Silver
2011	Mannheim Water Treatment Plant Expansion	Silver
2012	Airport Combined Service Maintenance Facility	Silver
2012	Christopher Children's Centre	Gold
2012	Waterloo Region Museum	Silver
2013	Sunnyside Supportive Housing & Wellness Centre	Silver
2013	Waterloo Regional Police Services North Division	Gold
2015	Old Courthouse	Gold
2015	GRT Chandler Maintenance Facility	Gold
2018-19	Paramedic Services North HQ fleet Centre	Silver
2018-21	GRT Northfield maintenance facility	Silver
2018-21	Police Central Division	Silver
2020-21	Police gun range expansion	Silver





The Region's adopted minimum standard of LEED Silver, only applies to new facilities with over 500 m² (5,400 ft²) of occupied space. Those facilities that don't apply are still designed to achieve high energy efficiency levels through adoption of several energy efficient features such as LED lighting and controls, heat recovery, high efficiency boilers and furnaces, and utility sub-metering. Internal processes to improve the exploration of energy efficiency features as part of the design process will be discussed.

New Regional facilities with energy efficient features

Year	Facility name
2014	Kitchener Paramedic Service Station
2015	Philipsburg Paramedic Service Station
2016	GRT Cambridge Center Station
2017-18	GRT Fairview Mall Station
2017-18	Cambridge Landfill Employee and Equipment Facility

2.1.7 Training in energy efficiency

Training in energy efficiency has been given to Facilities operations and maintenance (O&M) staff in the last 5 years. Thirty eight people from Facilities Management participated in a 9-day course that improved job skills and knowledge to make workplaces more comfortable, energy-efficient and environmentally friendly. Training successfully raised awareness about the impact of operations and maintenance on energy consumption of facilities. It also improved staff's knowledge and skills required to find opportunities to operate and maintain the facilities more efficiently.

In the next five years, other department areas such as asset management and project management will be trained on energy management related to their processes. Training will increase staff awareness about energy management opportunities when planning capital renewal projects, in addition to awareness of risk management from replacing assets that are most likely to fail. Discussions about energy efficiency of assets beyond building code minimum requirements will continue and will be further incorporated into the design process. Training ensures that energy savings opportunities are input in the planning and design stages of any new assets of the Region.



2.1.8 Energy efficiency in operation and maintenance

Operation and Maintenance (O&M) have done energy management through the implementation of recommissioning processes and daily checks of energy consumption of major buildings. The O&M team plays an important role by identifying potential energy savings during their daily operation tasks and by replacing faulty assets with more efficient ones during corrective maintenance. The fifty five energy studies conducted under this Plan involved the O&M team participation with recommendations for energy performance improvement. It has been proven that there is a significant potential to save energy by running the buildings more efficiently and garnering O&M involvement in decision-making of projects related to energy consumption. A key factor for this achievement was the implementation of energy training to O&M staff.

2.1.9 Energy procurement review

One of the opportunities explored for cost savings through electricity rates was the Ontario provincial policy on electricity demand called the Industrial Conservation Initiative (ICI) that took effect in January 1, 2017. The ICI sets the minimum peak demand to 1MW. Local distribution companies (LCD) customers with a peak demand greater than 1 MW but less than or equal to 5 MW may opt in to the ICI to be charged as a Class A customer. Class A customers are charged the global adjustment (GA) differently from Class B customers that may lead to significant savings depending on the load profile of the facility and its ability to reduce demand during peak hours. All Regional facilities were assessed for this program resulting in three facilities being eligible for the ICI program and over a million dollars in electricity cost savings.

The following accounts switched to Class A for the 2017/2018 period

Facility	Annual cost savings
Waterloo Wastewater Treatment Plant	\$470,000
Galt Wastewater Treatment Plant	\$420,000
Hidden Valley Water Pumping Station	\$140,000
Total	\$1,030,000

The following accounts have switched to Class A for the 2018/2019 period

Facility	Annual cost savings
Waterloo Wastewater Treatment Plant	\$390,000
Galt Wastewater Treatment Plant	\$370,000
Hidden Valley Water Pumping Station	\$170,000
Kitchener Wastewater Treatment Plan	\$290,000
Total	\$1,220,000

Government energy policies and funding initiatives can play a significant role in energy management and cost reduction when part of decision-making processes. These policies can result in significant cost savings depending on their suitability to Regional facilities. Regional departments have evaluated these policies and included their impact in feasibility studies of energy projects. The ICI program is a good example where government policies for energy cost savings resulted in as much cost savings as from large intensive capital energy projects.

The Region has also explored opportunities to purchase electricity directly from electricity retailers at fixed rates for Regional buildings. However, due to Ontario electricity market regulated price options, building electricity load profiles and policy changes lowering electricity costs, such as Fair Hydro Plan and Industrial Conservation Initiative, The Region is taking advantage of the Ontario market options and recent policies, and is not purchasing electricity from electricity retailers at fixed rates.

The Region has also reviewed if corporate facilities have their billing rate structure assigned correctly by local distribution companies and made changes accordingly. The Region explored purchasing green electricity from electricity retailers that supply renewable electricity. Electricity generation in Ontario has reduced its emissions through phase out of coal and increased renewable energy, and therefore, the cost-benefit of green electricity purchasing was not viable.

2.1.10 Energy management software assessment

The existing energy management software has been used by the Region for many years and will be replaced with new software. The new software will provide features that allow an energy management program to conduct investigation of energy opportunities in corrective and preventive maintenance processes, capital renewal projects and greenhouse emissions reporting.

The new energy management system will be part of the asset management software, integrated in one system. Asset management will get the benefit from this integration by having the energy management component included in the asset lifecycle management, fulfilling some provisions of the Municipal Asset Management Planning Regulation, O. Reg. 588/17 that states that asset management must include measurement of energy usage and operating efficiency, and mitigation approaches of reductions of greenhouse gas emissions.



2.2 Summary of the first five years of the Corporate Energy Plan

The review of the Plan for the 2014-2018 period shows that recommended energy conservation measures were implemented, not only capital energy projects such as LED lighting, building envelope upgrades and LEED buildings, but also energy management concepts such as Management commitment to energy performance, life cycle cost assessments and energy management training for behaviour change.

The application of the Plan as a guideline for energy management revealed challenges for incorporating energy management mainly because the Region is a large corporation with several internal processes taking place in different departments. The 2019-2028 Plan will implement energy management more effectively into processes, as listed in section 4.3.3 of this plan, to ensure that departments consistently assess energy performance while conducting business. The next sections of this Plan make recommendations to improve the implementation of energy management measures.

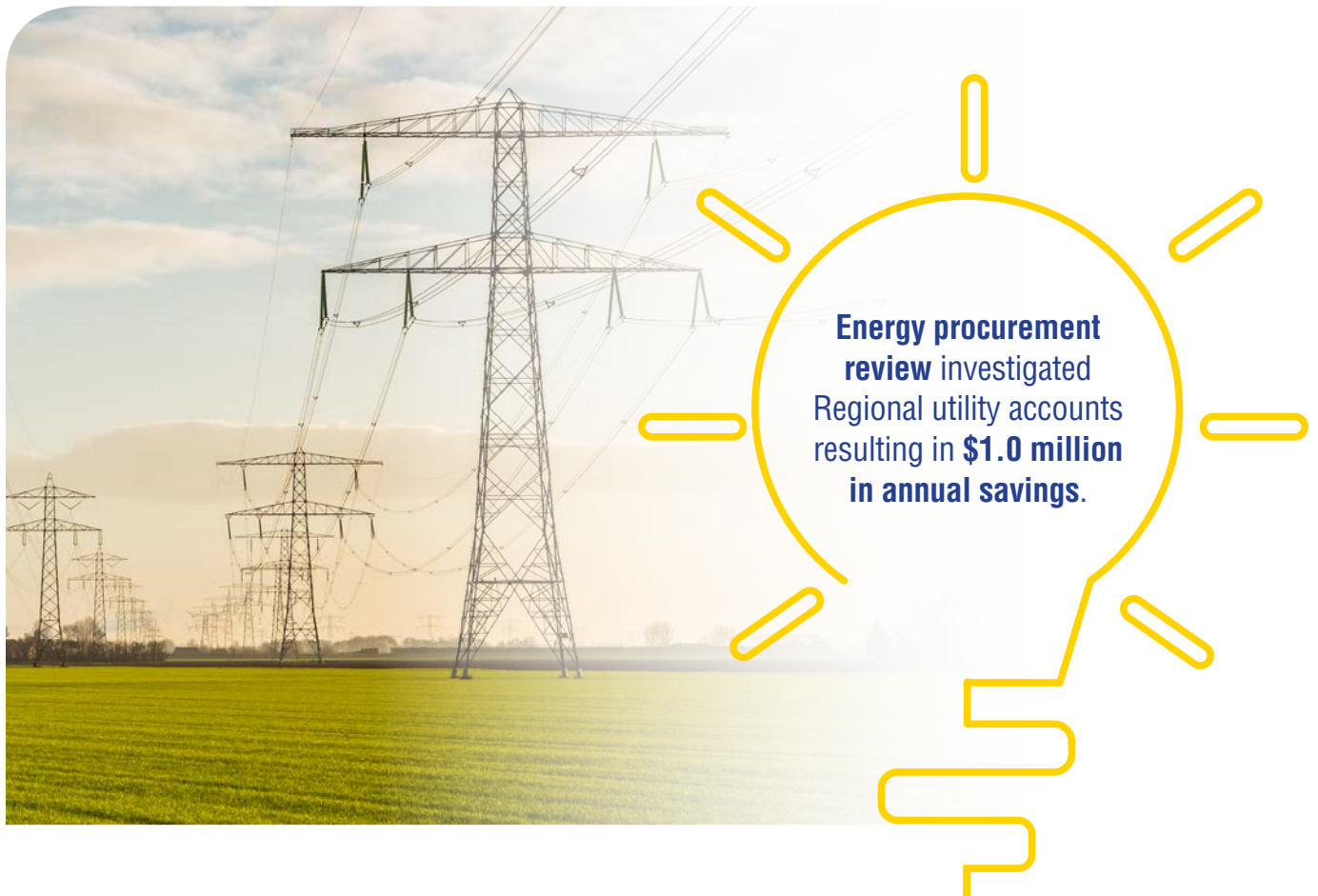
The following table summarizes the most significant energy conservation measures implemented in the past 5 years. Over 68 energy studies were conducted for energy conservation measure recommendations resulting in 120 projects. The Region invested in renewable energy generation in the last 5 years resulting in 380MWh generated annually. Energy efficiency from energy measures resulted in \$5.07 million cost savings, 2,240 tonnes of GHG emissions avoidance, 22,013,000 kWh of electricity saved and 721,000 m³ of natural gas saved in 5 years. Energy procurement opportunities were explored and implemented, resulting in \$1million savings per year. LEED buildings were built resulting in \$200,000 utility cost savings per year. Energy measures implemented in the last five years will provide \$1.01million in energy cost savings annually for another ten years, when they reach the end of their lifetime.

2014-2018 summary of energy measures implemented

Energy measure	Year	Performance indicators
Energy Studies	2014 - 2018	68 energy studies conducted, resulting in 120 energy measures
Solar Photovoltaic Net-Metering	2013 - 2014	330 KWp of PV generation installed, generating 370MWh annually
LED Lighting Retrofit of Facilities	2014 - 2018	114 sites upgraded with LED lighting saving \$670,000 annually
LED Street Lighting Retrofit	2016 - 2018	7,689 luminaires replaced saving \$605,000 annually
Sub-metering Installation	2015 - 2017	24 sites with sub-meters installed
Capital Renewal Projects Reviews	2014 - 2018	26 capital renewal projects reviewed with energy measures incorporated
New Construction Projects	2014 - 2018	2 new LEED Silver buildings were built resulting in \$200,000 utility cost savings annually
Training in Energy Efficiency	2014 - 2018	38 building operators were trained in energy management
Operation and Maintenance Efficiency Improvement	2014 - 2018	5 buildings recommissioned resulting in \$240,000 cost savings annually
Energy Procurement Review	2017 - 2018	Utility accounts were reviewed resulting in \$1.0 million in annual savings
Energy Management Software Assessment	2014 - 2016	Adopted an energy management systems integrated with asset management
Capital Energy Projects	2014 - 2018	120 energy cost savings projects implemented, resulting in \$3.44 million in energy savings in 5 years
GHG Reduction	2014 - 2018	2,240 Tonnes of GHG avoided from energy savings
Computer Servers Virtualization	2015 - 2018	50% of servers were moved to virtualization mode resulting in planned server room footprint reduction by 50%
Implemented Energy Consumption Reporting	2014 - 2018	10 large facilities with daily electricity consumption reports sent automatically for consumption assessment
Adoption of Server Virtualization Infrastructure Standard	2014 - 2016	Approved server virtualization standards for the Region
Implement Server Virtualization	2014 - 2018	Move current servers (50% of total servers) to new infrastructure
Investigate Desktop Virtualization Infrastructure	2018	Approved desktop virtualization standards for the Region
Wastewater Aeration Process Improvements	2014 - 2018	13 sites implemented—includes blower replacements and refurbishments, dissolved oxygen control, diffuser replacement and piping upgrades

2. Review of 2014 to 2018 Corporate Energy Plan period

Energy measure	Year	Performance indicators
Process Pumping Efficiency Improvements	2014 - 2018	86 sites implemented including upgrades/right sizing, replacements and refurbishments
Water System Optimization through Pressure Zones	2015 - 2018	2 sites implemented
Major Wastewater Treatment Facility Upgrades	2014 - ongoing	7 sites implemented—includes energy efficient equipment, electrical equipment, improved process control and improved sludge management
Water Disinfection Process Improvements	2017	4 sites implemented—includes system replacements, reduced system output and system removals at some sites
Water Processes Decommissioned	2017	3 sites implemented, eliminating pumping and treatment costs
Process facility conversion from Electricity to NG	2016 - 2018	4 sites implemented from electric to gas heating
Sanitary Collection System Rehabilitation Program	2016 - ongoing	2 collection systems reducing extraneous flows and its energy required to pump and treat flows





3. Corporate energy initiatives for 2019-2028 period

3.1 Purpose, goals and objectives

The Region of Waterloo is an energy-conscious organization that continually seeks to conserve energy and is committed to support current and future energy needs of the Region in a financially, socially and environmentally responsible manner. This directs the Plan goals of managing energy consumption effectively and sustainably and the strategic objectives in order to achieve these goals in the next 2019-2028 Plan period.



Plan goals	Strategic objectives
1. Effectively manage the Region's corporate energy use to deliver service excellence to facility users.	1.1. Improve energy efficiency through implementation of energy efficiency projects and facilities energy efficient operations. 1.2. Improve asset management through incorporating energy management in asset life-cycle decisions. 1.3. Regularly review opportunities related to energy procurement options. 1.4. Manage energy costs by investing in innovative on-site energy management and generation.
2. Sustainably manage the Region's corporate energy use to minimize environmental impacts of energy use.	2.1. Reduce GHG emissions by managing energy consumption. 2.2. Develop a renewable energy investment strategy to reduce GHG emissions.

These goals directly support Region's community greenhouse gas emission reduction target of 80% below 2010 levels by 2050. It also supports the Community Energy Investment Strategy for Waterloo Region issued in February 2018.

3.2 Energy baseline for 2019-2028 Energy Plan

It is important to track progress towards the goals and objectives listed in section 4.1 to ensure that the Plan has been implemented effectively. Tracking progress involves selection of appropriate metrics that depend on the type of energy measures implemented.

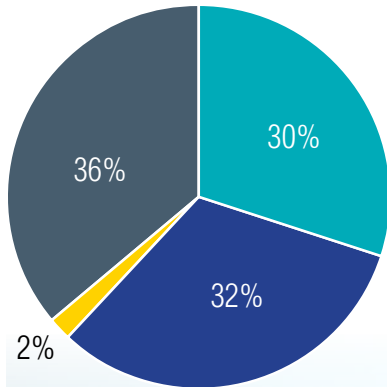
Energy measures have energy reductions reasonably estimated or measured and the impact on energy consumption immediately seen after their implementation. Energy measures that result in immediate energy reduction are mostly capital renewal and operation efficiency projects, such as lighting retrofits, HVAC replacements, recommissioning and renewable generation projects. The metrics that will be used for this type of energy measure are the same ones used for the 2017 Broader Public Sector (BPS) report (Appendix D): kWh/sf and kWh/ML. These metrics will be the baseline for the 2019-2028 Plan, grouped below by facility type.

2018 Region of Waterloo corporate energy consumption grouped by facility type

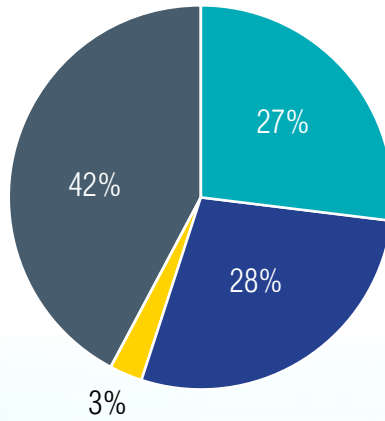
Facility type	Building area (ft ²)	Electricity (MWh)	Natural gas (m ³)	ekWh/ft ²	ekWh/ML
Administrative offices and related facilities	688,755	6,000	477,388	16	-
Ambulance stations and associated offices and facilities	30,212	356	75,216	38	-
Cultural Facilities	107,387	1,794	182,253	35	-
Facilities related to the pumping of sewage	10,680	1,072	2,389	-	184
Facilities related to the pumping of water	211,513	14,143	19,780	-	568
Facilities related to the treatment of sewage	217,791	41,930	1,474,012	-	960
Facilities related to the treatment of water	283,003	26,295	395,965	-	1,059
Police stations and associated offices and facilities	286,040	4,710	469,969	34	-
Public libraries	27,709	233	37,395	23	-
Storage facilities where equipment or vehicles are maintained, repaired or stored	534,574	5,923	1,673,184	44	-
Airport	63,090	2,342	84,882	51	-
Bus Terminal	27,635	937	59,819	57	-
Children Centre	37,074	353	69,106	29	-
Long Term Care	145,142	3,974	527,920	66	-
Social Housing	3,519,531	14,249	3,037,839	13	-
Street and Traffic Lights	-	5,575	-	-	-
Waste Management	122,221	3,411	219,627	47	-
Other (Voice Radio, Temporary, Safety village, etc.)	304,713	2,881	227,335	17	-
Grand total	6,617,070	136,177	9,034,079	-	-

Summary of 2018 Region of Waterloo energy consumption

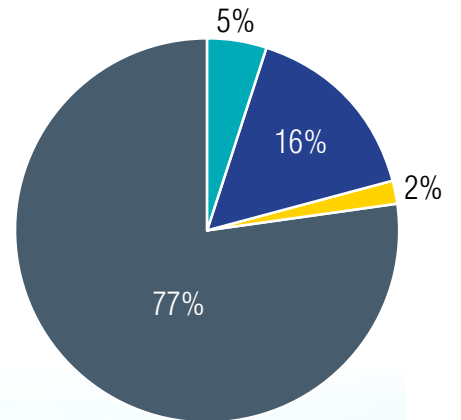
2018 Electricity use
(136 million kWh)



2018 Energy costs
(\$22 million)



2018 Natural gas use
(9 million m³)



Water Wastewater Waste Management Non-process



There are also energy measures that result in energy efficiency not immediately seen: process changes, training and communication. These measures promote, develop and sustain energy conservation for future years. They will be tracked based on the number of measures explored, reviewed or implemented, as per performance indicators listed on “2014-2018 Summary of Energy Measures Implemented” and “2019-2028 Energy Management Actions” tables” on sections 2.2 and 4 respectively.

3.3 2019-2028 Plan implementation strategy

In order to implement this Plan in the period of 2019-2028, establishing the processes necessary for energy management based on best practices and standards, the following approach will be used:

- Review of the energy Plan steering team and energy planning working group
- Increase collaboration
- Review of processes
- Energy conservation communication plan
- Renewable energy investment plan
- Funding coordination
- Reporting on energy Plan progress
- Training in energy management

3.3.1 Review of the energy plan steering team and energy planning working group

The existing energy plan steering team (EPST) and energy planning working group (EPWG) are responsible for administering and implementing the Plan. Membership will consist of representatives of the following divisions responsible for the majority of the Region’s energy consumption: Information Technology (IT), Waterloo Regional Housing (WRH), Transit Services (TS), Water Services (WS), Rapid Transit (RT), Facilities and Fleet Management (FFM) and Waste Management (WM).

Representatives of Regional departments involved in processes that significantly affect energy consumption will be designated to participate in the EPST and EPWG in the next Plan period of 2019-2028. This will promote ownership of the Plan among members. An EPWG terms of reference for this working group will be developed to facilitate its activities.

3.3.2 Increase collaboration

The achievement of this Plan depends on collaboration of external partners and internal collaboration of Regional departments. The EPWG will seek collaboration, looking for additional opportunities to share information and resources in order to support this Plan implementation. Partners involved with this Plan will include local utility companies, the Regional affordable housing community and Regional departmental staff involved with design, purchase, construction and management of Regional facility assets.

3.3.3 Review of processes

The Region is transitioning from low-cost to higher-cost energy measure opportunities, with energy savings alone no longer being enough to make capital intensive energy measures feasible. To keep pursuing energy efficiency in Regional facilities with the implementation of new feasible energy measures, the Region will improve the integration of energy measure assessments into Regional processes of programs that procure assets, services or products that effect energy consumption.

The incremental cost of implementing energy measures into procurement programs is typically lower than upgrading to such a solution after a conventional system has been implemented, making this the most promising approach for developing feasible energy measures. This integration will combine energy benefits of cost savings with program benefits of risk mitigation and operational cost reductions, making not only energy measures, but also asset, services and products procurement more cost effective.

3. Corporate energy initiatives for 2019-2028

The review of Regional processes of programs for asset renewal, new assets and operations and maintenance (O&M) will be conducted to identify energy measure opportunities. These reviews will be applied to Regional programs in the divisions of Information Technology (IT), Waterloo Regional Housing (WRH), Transit Services (TS), Water Services (WS), Rapid Transit (RT), Facilities and Fleet Management (FFM) and Waste Management (WM).

It is expected that the reviews will integrate Regional departments towards energy management goals and initiatives of energy consumption, costs and carbon emission reductions. This integration enables the Region to achieve continual energy performance improvement because every time a specific process is conducted, whether a new request for proposal for building designing, or a new preventive maintenance procedure, energy consumption will be taken into consideration.

Regional departments will be involved to identify which processes have the highest impact on energy consumption, prioritizing reviews, identifying, quantifying and incorporating energy management in the processes under review.

It is expected that these reviews will determine how much energy a facility, equipment or system is using, its energy costs, and the options to be explored for energy use reduction.

Tasks will be conducted to initiate and support process reviews:

- Report energy consumption of the process under review to show the existing impact of the process on energy consumption and its comparison to similar ones;
- Provide training to give staff appropriate skills for reviewing the processes;
- Support innovation for new products, services and methods as an important goal of reviews that is widely supported by Regional strategic plan values.



Processes will be identified and reviewed in the next 5 years. The following processes have been identified and will be recommended for review:

- Asset condition assessments and energy efficiency audits
- Asset design
- Asset maintenance and operation (O&M)
- Data Collection, Quality and Availability

3.3.3.1 Asset condition assessments and energy efficiency audits

Both assessments trigger upgrades of existing assets leading to energy and capital renewal projects. The integration of energy projects with capital renewal projects suggests that processes of identifying both types of projects could be merged in some circumstances, optimizing both processes and improving the following points:

- Clearer project charters with energy efficiency requirements
- Energy measures to be explored in the asset design process
- Extra time and budget to discuss different energy measures scenarios
- Internal and external funding opportunities

3.3.3.2 Asset design

Reviews will discuss energy measure opportunities to be taken into consideration in the design of facility assets, renovations, modifications, equipment, assets and processes that have significant impact on energy use. Regional departments will review request for proposals (RFP) templates to discuss how to improve the RFP scope of work for requesting energy performance improvement and O&M cost reduction assessments, showing cost/benefit analyses of different scenarios during the design of assets. Reviews will also discuss ways of incorporating innovation, targeting efficiency such as procurement of more efficient technologies, improvement of asset controls by investigation of new sensors, and BAS integration and designs. Collection and analysis of energy consumption and O&M data of past retrofits will be requested to be conducted in the scope of work to assist with making better decisions about asset design.

3.3.3.3 Asset maintenance and operations

Preventive and corrective maintenance and building operation procedures that effect energy consumption will be discussed and reviewed to incorporate most recent best practices targeting energy efficiency. Examples of these best practices to improve effectiveness of energy efficiency in HVAC maintenance are the inclusion of specific tasks to be performed during maintenance, such as adjustments to ventilation demand settings and controls, fine-tuning of economizer operations and appropriate air balancing, regular compressor leak tests, general optimization of HVAC systems schedules and set points.

3.3.3.4 Data collection, quality and availability

Data availability is essential to review and integrate energy management with decision-making. The review of processes that can lead to new asset operating modes, energy measures, capital renewal planning or maintenance procedures needs good quality data to support changes. Data that supports energy measures varies but mostly can be summarized as utility consumption and rates, weather, asset efficiency and capacity, and parameters of processes that affect energy consumption such as amount processed and number of users.

Processes for collecting data and making it available will be reviewed aiming for data quality improvement. Data is collected from utility bills, assets and sub-meters. It also comes from the asset management system that stores data originated from processes such as capital renewal projects and daily maintenance documentation.

In summary, process reviews will give important results such as feasible capital energy projects, energy efficient capital renewal projects, energy efficiency in operations and maintenance, supporting the Region's strategic objectives, leading to effective and sustainable energy management of Regional energy.

3.3.4 Energy conservation communication plan

It is expected that regular corporate communication of energy measures implemented by the Region will impact behaviour change towards energy conservation. A communication process for energy measures promotion will be developed to communicate internally about Regional energy goals and accomplishments, and also to get comments or suggestions from any person in the organization regarding energy conservation opportunities.



The Region has planned **5 new installations of photovoltaic (PV) systems** for the next 5 years totaling 430kW. The **annual cost savings** are expected to be **\$157,000**, and **53 tonnes of GHG emissions avoided** annually.

3.3.5 Renewable energy investment plan

Regional energy plan goals on sustainable energy management and lower environmental impacts from energy consumption require energy conservation, energy efficiency and also renewable energy systems (RES).

The Region has implemented several RES in the last 10 years including geothermal, solar electricity and solar hot water (Appendix F). Usually renewable energy projects require significant internal capital funding, when external funding programs are not available, and have longer payback compared to energy efficiency and conservation projects.

Experience shows that the design and installation of RES in new buildings are more cost effective than in existing buildings due to extra cost of substantial modifications on existing building structure to accommodate RES. The incorporation of design of RES during the design stage of new buildings requires extra discussions, time and additional budget, sometimes unexpected depending

when the RES was incorporated in the design process.

The Region has already planned 5 new installations of photovoltaic (PV) systems for the next 5 years at the following new sites:

- Grand River Transit (GRT) Northfield (250kW)
- Paramedic Services at Waterloo Region Emergency Services Training and Research Centre (WRESTRC) (110kW)
- GRT Chandler (50kW)
- Paramedic Services at Philipsburg (10kW)
- Museum (10kW)

The combined annual cost savings of these five PV systems is expected to be \$157,000, and 53 tonnes of GHG emissions avoided annually. These PV projects are expected to have payback periods of 8-10 year, and lifetime of 25 years.

The Region has designed new buildings with

provisions to accommodate PV roof-top installation. During the design of new buildings, regardless of existing immediate funding for PV installation, the future energy needs of the building and its PV rooftop generation capacity is assessed, including payback and annual savings. The roof structure, electrical room, conduits and other provisions are considered to be incorporated to support PV in the future. This design strategy will be expanded to other types of RES. This renewable energy investment plan will anticipate the requirements of renewable energy projects making the development of RES more effective.

3.3.6 Funding coordination

Internal and external funding for energy measure financing will be explored and incorporated into the budget accounts allocated for purchase of new assets. These accounts will include budget for capital renewal plans, new constructions, operation and maintenance activities, and energy measures. Coordination will be required to include energy measures and their extra funding into the budget accounts as soon as the need for a new asset is identified and its budget account created. Funds for energy measures and asset management funds will be spent simultaneously on projects.

External funding and partnerships with local distribution companies, federal and provincial governments have been considered already by the Region. New opportunities have been explored constantly due to funding program changes and updates.

Financial parameters applied to feasibility studies will be more specific to each type of energy measure under assessment, considering longer paybacks to fit the Regional plan long-term view of managing energy effectively and sustainably. It is expected that funding coordination, partnerships and financial reviews will improve energy measure planning.

3.3.7 Reporting on Energy Plan progress

Tracking progress of the Plan to ensure its effectiveness involves: periodic meetings of the EPST and the EPWG, data collection and calculation of indicators, and regular reporting. The EPST and EPWG will meet regularly to share and discuss recent energy measures assessed, new funding availability, challenges and solutions for the implementation of energy measures initially planned on section 5 of this Plan. The evaluation of targets and progress of this Plan will be done through the indicators already determined in section 4 of this report.

3.3.8 Training in energy management

The goal of energy management training is to increase the capacity of Regional staff to identify energy measure opportunities in their own roles and responsibilities, promoting overall energy efficiency in the Region.

The following outlines training objectives:

- Identify training opportunities for Regional staff and how their roles and decisions can effect energy consumption in the Region.
- Educate staff on the importance of energy management and how it affects service delivery for internal and external customers.
- Support staff with the knowledge and resources to include energy management in Regional processes, preparing them to make decisions about better energy management practices in their daily tasks and responsibilities.

Energy training will also extend to occupants (clients/tenants) of facilities. Occupant behaviour has significant impact on energy consumption. Occupants will benefit from lower energy costs due to lower energy consumption. Opportunities for promoting and engaging occupants on energy conservation will be explored.



4. Corporate Energy Plan actions

To achieve the goals of this energy Plan, recommended tasks listed in the schedule below will be conducted. Also, new energy measures may arise from the energy plan working group meetings and will be added to the list below. Actions will focus on the following Regional divisions: Information technology (IT), Waterloo Regional Housing (WRH), Transit Services (TS), Water Services (WS), Rapid Transit (RT), Facilities and Fleet Management (FFM), and Waste Management (WM).



The process of **treating and distributing water is energy intensive**, however the Region continues to see a **steady decrease in electricity consumption** each year within its water facilities, achieving a **16% decrease over the past 5 years**.

2019-2028 Energy management actions

Actions (non-capital measures)	Group responsible	Year	Performance indicator	Strategic objective
Review of Regional processes for energy measures opportunities identification	FFM	2019-2024	# of processes reviewed # of procedures changed or created	1.2
Support the implementation of energy measures of Regional departments	FFM	2019-2020	# of energy projects involved and implemented	1.2
Integration of O&M with energy management: tune-ups & recommissioning	FFM	2019-2020	# of assets tune-ups # of re-commissioning projects	1.1
Implement a database of energy studies and projects implemented for future decision-making	FFM	2019-2020	# of projects in the database # of communications from it	1.4
Implement a metering process: data acquisition / reporting / action / measurement	FFM	2019-2020	# of metering pilots implemented	1.1
Incorporate budget for energy measures into Region's asset capital programs	FFM	2019-2024	# of asset planned with energy measures budgets incorporated	1.1
Continuation of LEED Policy emphasizing energy conservation measures	FFM	2019-2024	# of reviews to incorporate energy measures in LEED buildings	2.1
Include lifecycle costs (capital, O&M and energy) assessment in templates of RFP	FFM	2019-2020	# of RFP's templates changed	1.2

4. Corporate Energy Plan actions

Actions (non-capital measures)	Group responsible	Year	Performance indicator	Strategic objective
Review asset design checklists to include energy measures relevant for new facilities	FFM	2019 - 2020	# of reviews per year	1.1
Develop energy best practices for maintenance towards energy savings	FFM	2019 - 2020	# of PM's reviewed	1.1
Develop a plan for implementation of energy measures with long payback: building envelope, water mains, etc.	FFM	2019 - 2020	# Write the plan for these energy measure categories with funding, opportunities and schedule	1.2
Procurement: develop a process for evaluating and approving energy supply opportunities	FFM	2019 - 2020	Develop a standard operating procedure for energy procurement	1.3
Develop a renewable energy investment plan	FFM	2020 - 2021	Issue a plan for renewables	2.2
Develop internal and external partnership process for assessing collaboration opportunities	FFM	2019 - 2024	# of partnerships developed	1.4
Identify and implement training opportunities for energy management	FFM	2019 - 2020	# of people trained	1.1
Develop Energy conservation measures communication process	FFM	2019 - 2020	# of corporate communications issued about energy on Regional website, morning memo, etc.	1.1
Review of energy information systems to improve processes that collect and input data into the systems: Docs, Lucity, EEMS, CSV, Finance systems, etc.	FFM	2019 - 2020	# of systems reviewed # of processes changes	1.1

Actions (non-capital measures)	Group responsible	Year	Performance indicator	Strategic objective
Improve energy management collaboration with Regional departments	FFM	2019 - 2024	External collaboration: # of participations in funding programs, workshops and training offered by the Region and external institutions Internal collaboration: # of energy measures involved, recommended, discussed, adopted or shared with EWPG	1.2
Continue to evaluate emerging technologies and energy efficiency in the master planning process	WS	2019 - 2024	Develop Master Plan	1.1
Conduct energy studies and asset condition assessments	WS	2019 - 2024	# of studies/assessments completed	1.2
Explore energy measure opportunities in new Transportation Infrastructure	TS	2019 - 2024	# of energy measure assessments in the design of new assets	2.1
Monitor electricity consumption of LRT for energy savings opportunities exploration	RT	2019 - 2024	Annual report about LRT consumption for energy measures investigation	1.1
Evaluation of energy standards: LEED, Passive Housing and Net-Zero Carbon	FFM	2024 - 2028	# of processes re-evaluated	2.1
Consolidation of processes reviews	FFM	2024 - 2028	# of processes re-evaluated	2.1

4. Corporate Energy Plan actions

Actions (non-capital measures)	Group responsible	Year	Performance indicator	Strategic objective
Implementation of energy management software and IT tools	FFM	2019 - 2020	# of energy software and IT tools reviewed and implemented	1.1
Pilot project on passive housing	FFM	2024 - 2028	# pilots implemented	2.1
Pilot project on net-zero energy	FFM	2024 - 2028	# pilots implemented	2.1
Renewable energy system plan implementation	FFM	2024 - 2028	# systems implemented	2.1
Renewal/replacement of aged and inefficient process equipment	WS	2019 - 2024	# of sites upgraded	1.1
Implement process sub-metering with SCADA upgrades	WS	2019 - 2024	# of sites upgraded	1.1
Improve automated data collection and management to optimize process energy use	WS	2019 - 2024	# of sites implemented	1.1
Implement server virtualization	IT	2019 - 2024	90% of servers planned to be virtualized	1.1
Implement desktop virtualization	IT	2019 - 2024	Server room footprint reduction by %	1.1
Consider Energy Metering Tools on new IT infrastructure planning for energy cost assessment	IT	2019 - 2024	Final report about desktop virtualization assessment	1.1
Other capital energy measures are listed in Appendix E	FFM	2019 - 2024	Implement projects to save \$300,000 annually and 1,030 tonnes of GHG emissions reduction annually # of projects planned vs. implemented and cost savings	1.1

5. Appendices

Appendix A: Energy studies

Facility complexes assessed through energy studies (2014-2018)

Facility complex	Type	Energy audit type
Albert	Housing	Building Envelop Audit
Alison	Housing	Building Envelop Audit
Amos	Housing	Building Envelop Audit
Ballantyne	Housing	Building Envelop Audit
Bechtel	Housing	Building Envelop Audit
Cambridge Bus Terminal	Transit	Walk-through/ASHRAE Level I
Cambridge Children's Centre	Daycare	Walk-through/ASHRAE Level I
Champlain	Housing	Building Envelop Audit
Chandler	Transit	Walk-through/ASHRAE Level I
Christopher Children's Centre	Daycare	Walk-through/ASHRAE Level I
Church	Housing	Walk-through/ASHRAE Level I & Building Envelop Audit
College	Housing	ASHRAE Level II & Building Envelop Audit
Concession	Housing	Walk-through/ASHRAE Level I
Courthouse	Office	Walk-through/ASHRAE Level I
Doon	Museum	Walk-through/ASHRAE Level I & Recommissioning
East	Housing	Building Envelop Audit
Erb	Waste Management	ASHRAE Level II
Erb WRESTRC	Office	Walk-through/ASHRAE Level I
Fourth	Housing	Building Envelop Audit & Walk-through/ASHRAE Level I
Gail	Housing	Building Envelop Audit
Grand	Housing	Walk-through/ASHRAE Level I
GRT North	Transit	Recommissioning
GRT South	Transit	Walk-through/ASHRAE Level I & Recommissioning
High	Housing	Building Envelop Audit
Holborn	Housing	Walk-through/ASHRAE Level I
Joseph Schneider House	Museum	Walk-through/ASHRAE Level I

Facility complex	Type	Energy audit type
Kinsmen Children's Centre	Daycare	Walk-through/ASHRAE Level I
Langs	Housing	Building Envelop Audit
Lorraine	Housing	ASHRAE Level II
Lumsden	Housing	Building Envelop Audit
Magor	Housing	Building Envelop Audit
McDonald	Housing	Building Envelop Audit
Montcalm	Housing	ASHRAE Level II & Walk-through/ASHRAE Level I
Mooregate	Housing	Walk-through/ASHRAE Level I
Operations Centre	Office / Storage / Maintenance	ASHRAE Level II
Overlea	Housing	Building Envelop Audit & Walk-through/ASHRAE Level I
Paulander	Housing	Building Envelop Audit
Philipsburg Yard	Road Service	Walk-through/ASHRAE Level I
Police South Division	Police	ASHRAE Level II
Queenston	Housing	ASHRAE Level II
Radford	Housing	Building Envelop Audit
Regina	Housing	Walk-through/ASHRAE Level I
Rouse	Housing	Building Envelop Audit
Sekura	Housing	Building Envelop Audit
Southwood	Housing	Building Envelop Audit
Valleyview	Housing	Walk-through/ASHRAE Level I
Weichel	Housing	Walk-through/ASHRAE Level I
Wilson	Housing	Walk-through/ASHRAE Level I
Airport	Airport	ASHRAE Level II & Recommissioning
Heidelberg Yard	Road Service	Walk-through/ASHRAE Level I
Water and Wastewater sites	Various	Process Specific Energy Audits

Appendix B: Energy savings from projects

Electricity and Natural Gas savings of projects implemented between 2014 and 2018

Project type	kWh	m3
BAS Programming	300,450	-
Building Envelope Improvement	95,538	-
Controls	20,958	-
Elevator Modernization	660,000	-
Free Cooling	21,700	-
HVAC Controls	629,390	4,575
LED Lighting Upgrade	15,373,411	-
Lighting	9,229	-
Lighting Controls	418,890	-
Lighting Upgrade	195,275	-
New Appliances	93,300	-
Occupancy Sensors	781,567	-
Operations Improvements	25,713	7,500
Recommissioning	1,172,196	555,789
Solar PV FIT	1,190,000	-
Solar PV net Metering	1,815,000	-
Variable Frequency Drive	401,128	-
Building Envelope Improvement	-	190
Heating Efficiency Improvement	-	153,000
Total Savings	22,013,746	721,054



Appendix C: LED lighting retrofit

Buildings with LED retrofit implemented between 2014 and 2018

Project #	Complex name	Municipality	Building type
1	150 Main	Cambridge	Office
2	Airport - Main Terminal	Breslau	Airport
3	Albert	Waterloo	Housing
4	Alison	Cambridge	Housing
5	Amos	Waterloo	Housing
6	Ayr	Ayr	Library
7	Ballentyne	Cambridge	Housing
8	Bechtel	Cambridge	Housing
9	Bishop	Cambridge	Housing
10	Brybeck	Kitchener	Housing
11	Cambridge Landfill	Cambridge	Office
12	Chalmers	Cambridge	Housing
13	Church	Kitchener	Housing
14	College	Kitchener	Housing
15	Concession	Cambridge	Housing
16	Conestoga Blvd Ops Centre	Cambridge	Transit
17	Courtland	Kitchener	Housing
18	Crosshill Transfer Station	Crosshill	Waste Management
19	East	Cambridge	Housing
20	Fairway	Kitchener	Housing
21	Greenfield	Kitchener	Housing
22	Guerin	Kitchener	Housing
23	Heidelberg Yard	Heidelberg	Road Service
24	Henry	Wellesley	Housing
25	High	Waterloo	Housing
26	Holborn	Kitchener	Housing
27	Joseph Schneider Haus	Kitchener	Museum
28	Kinzie	Kitchener	Housing
29	Kitchener Landfill	Kitchener	Waste Management
30	Laboratory	Cambridge	Office
31	Langs	Cambridge	Housing
32	Lorraine	Kitchener	Housing

Project #	Complex name	Municipality	Building type
33	Lumsden	Cambridge	Housing
34	McDonald	Cambridge	Housing
35	Mckay	Cambridge	Housing
36	Montcalm	Kitchener	Housing
37	Mooregate	Kitchener	Housing
38	Morgan	Kitchener	Housing
39	Mulberry	Cambridge	Housing
40	Museum	Kitchener	Museum
41	Philipsburg	Wilmot	Road Service
42	Police Central Division	Kitchener	Police
43	Police Headquarters	Cambridge	Police
44	Public Health	Waterloo	Office
45	Queenston	Kitchener	Housing
46	Radford	Cambridge	Housing
47	Regina	Waterloo	Housing
48	Regional Administration Building	Kitchener	Office
49	Rouse	Cambridge	Housing
50	Rutherford	Kitchener	Housing
51	Shelly	Kitchener	Housing
52	Snyder	Elmira	Housing
53	Stewart	Cambridge	Housing
54	Strasburg	Kitchener	Housing
55	Strasburg Road Ops Centre	Kitchener	Transit
56	Sunnydale	Waterloo	Housing
57	Sunnyside Home	Kitchener	Housing
58	Sunnyside Home	Kitchener	Social Services
59	Thaler	Kitchener	Housing
60	Water	Cambridge	Housing
61	Waterloo Landfill	Waterloo	Waste Management
62	Weber	Kitchener	Housing
63	Weichel	Kitchener	Housing
64	Windom	Kitchener	Housing
65	Wres Training & Research	Waterloo	Office
66	Wyatt	Elmira	Housing
67	Water and Wastewater sites (48 sites)	Various	Water Services

Appendix D: 2017 Broader Public Sector (BPS) Report

The full report is available on the Region's website at: www.regionofwaterloo.ca/en/living-here/energy-management.aspx

Region's Facilities	Energy Intensity (ekWh / sqft)	Energy Intensity (ekWh / Mega Litre)
Administrative offices and related facilities, including municipal council chambers	17	Not applicable
Ambulance stations and associated offices and facilities	41	Not applicable
Cultural facilities	35	Not applicable
Facilities related to the pumping of sewage	Not applicable	209
Facilities related to the pumping of water	Not applicable	586
Facilities related to the treatment of sewage	Not applicable	901
Facilities related to the treatment of water	Not applicable	1,085
Police stations and associated offices and facilities	33	Not applicable
Public libraries	23	Not applicable
Storage facilities where equipment or vehicles are maintained, repaired or stored	41	Not applicable



Appendix E: Budget allocation for energy measures 2019 – 2028

The plan includes capital energy conservation measures, planned and currently included in the 2019-2028 ten-year capital forecast with expected \$300,000 savings and 1,030 tonnes of GHG emissions reduction annually. Other capital-intensive initiatives that will be identified during the implementation of this Plan will have their costs submitted for approval.

Year of implementation / type of project	Building type	# of projects
2019		75
Electricity and Water Efficiency Upgrade	Housing	21
Energy Audits	Office	1
	Police	1
Energy Management Training	NA	1
Geothermal Study	Museum	1
	Operations	1
Heating, Ventilation and Air-conditioning efficiency Upgrade	Housing	1
	Museum	1
	Police	1
Implement VFDs and automation controls	Water Treatment Plant (WTP)	3
	Daycare	1
LED Lighting Retrofit	GRT	1
	Housing	19
	Museum	1
	Operations	1
PV Solar Electricity System Installation	GRT	1
	Museum	1
	Emergency Services	1
Power monitoring integration into SCADA	Wastewater Treatment Plant (WWTP)	6
Process & energy use optimization through automation controls	WWTP	2
Solar Domestic Hot Water Systems Installation	Sunnyside	2
Solar Wall Space Heating Installation	Housing	1
	Airport	1
Sub-metering Installation	Office	1
	Police	1
	Sunnyside	1
Water Efficiency Upgrade	GRT	1
Windows Efficiency Upgrade	Daycare	1

Year of implementation / type of project	Building type	# of projects
2020		56
Appliance Efficiency Upgrade	Housing	2
Biogas utilization through the installation of cogeneration facilities	WWTP	3
Building Automation System Upgrade	Airport	3
	Landfill	1
	Museum	2
	Office	3
	Police	2
	Sunnyside	1
	Operations	1
	Emergency Services	1
	Building Systems Re-commissioning	Police
Various		1
Compressor Efficiency Upgrade	Airport	1
Door Efficiency Upgrade	Housing	3
Elevator Efficiency Upgrade	Office	2
Energy Audits	Housing	1
Energy Efficiency Upgrades	Various	1
Energy Management Training	NA	1
Heating Controls Installation	Housing	2
	Police	1
Heating Efficiency Upgrade	Office	1
	Police	2
Heating, Ventilation and Air-conditioning Controls Upgrade	Office	1
Heating, Ventilation and Air-conditioning efficiency Upgrade	Housing	1
	Museum	1
	Office	1
	Police	1
Kitchen Equipment Efficiency Upgrade	Museum	1
LED Lighting Retrofit	Police	2
Lighting Controls Upgrade	GRT	1
Solar Domestic Hot Water Systems Installation	Housing	1
Space Cooling Efficiency Upgrade	Office	1
Windows Efficiency Upgrade	GRT	1
	Office	2
Process & energy use optimization through automation controls	WWTP	4
Process modifications & upgrades to improve energy use	Water Treatment Plant (WTP)	1
	WWTP	1

Year of implementation / type of project	Building type	# of projects
2021		47
Appliance Efficiency Upgrade	Daycare	1
Battery Storage Study	GRT	1
Building Automation System Upgrade	Police	1
Building Envelope Efficiency Upgrade	Housing	1
Door Efficiency Upgrade	Daycare	1
	Landfill	1
	Museum	1
	Operations	1
Electricity and Water Efficiency Upgrade	Housing	1
Energy Efficiency Upgrades	Various	1
Energy Management Training	NA	1
Heating Controls Installation	Museum	1
	Police	1
	Operations	2
Heating Efficiency Upgrade	GRT	1
	Housing	2
	Landfill	3
	Office	2
	Police	1
	Operations	1
Heating, Ventilation and Air-conditioning Controls Upgrade	Housing	2
	Office	1
Heating, Ventilation and Air-conditioning efficiency Upgrade	Housing	1
	Police	4
Process decommissioning	WTP	2
Process upgrades incorporating energy efficiency	WTP	6
Process & energy use optimization through automation controls	WWTP	2
Water Efficiency Upgrade	GRT	1
Windows Efficiency Upgrade	Housing	2
	Operations	1

Year of implementation / type of project	Building type	# of projects
2022		42
Appliance Efficiency Upgrade	Housing	3
	Police	1
Building Systems Re-commissioning	Office	1
Disinfection process replacement	WWTP	1
Door Efficiency Upgrade	Housing	2
Electricity and Water Efficiency Upgrade	Housing	1
Energy Efficiency Upgrades	Various	1
Energy Management Training	NA	1
Heating Controls Installation	Airport	1
	Daycare	1
	Operations	2
	Emergency Services	1
Heating Efficiency Upgrade	Daycare	1
	GRT	1
	Housing	2
	Office	1
	Police	2
	Sunnyside	1
Heating, Ventilation and Air-conditioning Controls Upgrade	GRT	1
	Office	1
	Emergency Services	1
Heating, Ventilation and Air-conditioning efficiency Upgrade	Housing	3
	Museum	1
	Police	1
	Operations	2
LED Lighting Retrofit	Housing	1
Process modifications & upgrades to improve energy use	WTP	1
Process modifications & upgrades to improve energy use	WWTP	1
Solar Domestic Hot Water Systems Installation	Laboratory	1
Space Cooling Efficiency Upgrade	Operations	1
Sub-metering Installation	Various	1
Windows Efficiency Upgrade	Operations	1
Battery Storage Pilot	GRT	1

Year of implementation / type of project	Building type	# of projects
2023		27
Appliance Efficiency Upgrade	Daycare	1
	Housing	1
Building Automation System Upgrade	Office	1
Compressor Efficiency Upgrade	GRT	1
Electricity and Water Efficiency Upgrade	Housing	4
Energy Efficiency Upgrades	Various	1
Energy Management Training	NA	2
Heating Controls Installation	Daycare	1
	Museum	2
Heating Efficiency Upgrade	Airport	1
	Daycare	1
	Housing	2
	Museum	1
Heating, Ventilation and Air-conditioning Controls Upgrade	Office	1
Heating, Ventilation and Air-conditioning efficiency Upgrade	GRT	1
	Emergency Services	1
Kitchen Equipment Efficiency Upgrade	Daycare	2
LED Lighting Retrofit	Museum	1
PV Solar Electricity System Installation	GRT	1
Space Cooling Control Upgrade	Airport	1



Year of implementation / type of project	Building type	# of projects
2024		42
Appliance Efficiency Upgrade	Housing	2
Building Envelope Efficiency Upgrade	Housing	3
Building Systems Re-commissioning	Various	1
Compressor Efficiency Upgrade	Operations	1
Door Efficiency Upgrade	Daycare	1
	GRT	1
	Housing	9
Electricity and Water Efficiency Upgrade	Housing	2
Elevator Efficiency Upgrade	Police	1
Energy Efficiency Upgrades	Various	1
Heating Controls Installation	Operations	1
Heating Efficiency Upgrade	Museum	1
	Emergency Services	2
Heating, Ventilation and Air-conditioning Controls Upgrade	Airport	1
	Office	1
Heating, Ventilation and Air-conditioning efficiency Upgrade	Airport	1
	Housing	1
	Museum	1
	Police	1
LED Lighting Retrofit	Operations	1
PV Solar Electricity System Installation	Emergency Services	1
Process modifications & upgrades to improve energy use	WWTP	1
Sub-metering Installation	Office	1
	Various	1
Water Efficiency Upgrade	Office	1
Water distribution system optimization	Water Distribution System	1
Windows Efficiency Upgrade	Housing	3



Year of implementation / type of project	Building type	# of projects
2025		24
Appliance Efficiency Upgrade	Housing	4
Building Automation System Upgrade	Office	2
Door Efficiency Upgrade	Daycare	1
	Housing	2
Energy Efficiency Upgrades	Various	1
Heating Controls Installation	Housing	1
	Operations	2
	GRT	1
Heating Efficiency Upgrade	Museum	1
	Emergency Services	2
Heating, Ventilation and Air-conditioning efficiency Upgrade	Housing	2
	Museum	1
Passive Housing	Housing	1
Sub-metering Installation	Various	1
Water Efficiency Upgrade	Office	1
Windows Efficiency Upgrade	Housing	1
2026		6
Door Efficiency Upgrade	Housing	1
Heating Efficiency Upgrade	Housing	2
LED Lighting Retrofit	Housing	1
Net Zero Building	Library	1
Renewable Energy	Various	1
2027		4
Energy Efficiency Upgrades	Various	1
Net Zero Building	Sunnyside	1
PV Solar Electricity System Installation	Police	1
Renewable Energy	Various	1
2028		2
Energy Efficiency Upgrades	Various	1
Renewable Energy	Various	1
Grand Total		327

Appendix F: Renewable energy generation facilities

Renewable energy systems annual energy production in 2018

Facility #	Name	System type	Size	Energy production (MWh)
1	ROW Beechwood	Photovoltaic	5 kW	6
2	ROW Wilson	Photovoltaic	8 kW	11
3	ROW College	Photovoltaic	8 kW	10
4	ROW Mulberry	Photovoltaic	9 kW	11
5	ROW Church	Photovoltaic	9 kW	11
6	ROW PSV	Photovoltaic	20 kW	23
7	ROW Concession	Photovoltaic	30 kW	42
8	ROW Lorraine	Photovoltaic	30 kW	29
9	ROW WRPS	Photovoltaic	30 kW	28
10	ROW Bishop	Photovoltaic	50 kW	54
11	ROW Manitou Reservoir	Photovoltaic	54 kW	116
12	ROW Grand	Photovoltaic	75 kW	74
13	ROW Mannheim Water Treatment	Photovoltaic	100 kW	112
14	ROW Westgate	Photovoltaic	120 kW	120
15	ROW Ottawa Reservoir	Photovoltaic	190 kW	651
16	ROW Operations Centre	Photovoltaic	240 kW	218
17	ROW GRT	Photovoltaic	250 kW	352
18	ROW Library Headquarters	Geothermal	10 ton	90
19	Sunnyside Supportive Housing	Geothermal	97 ton	134
20	ROW Beechwood	Solar Hot Water	190 W	3



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