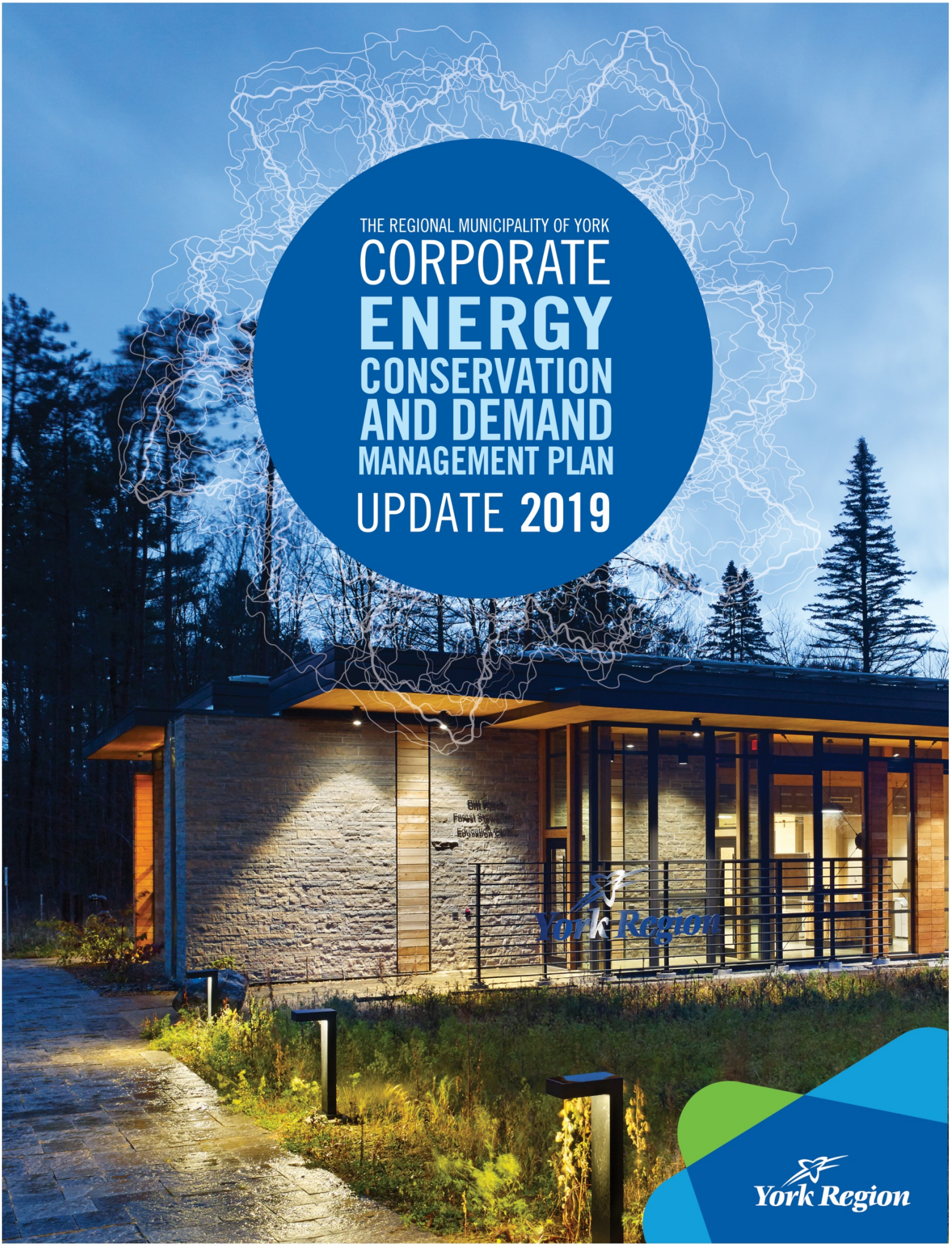
THE REGIONAL MUNICIPALITY OF YORK
CORPORATE
ENERGY
CONSERVATION
AND DEMAND
MANAGEMENT PLAN
UPDATE 2019
York Region
York Region

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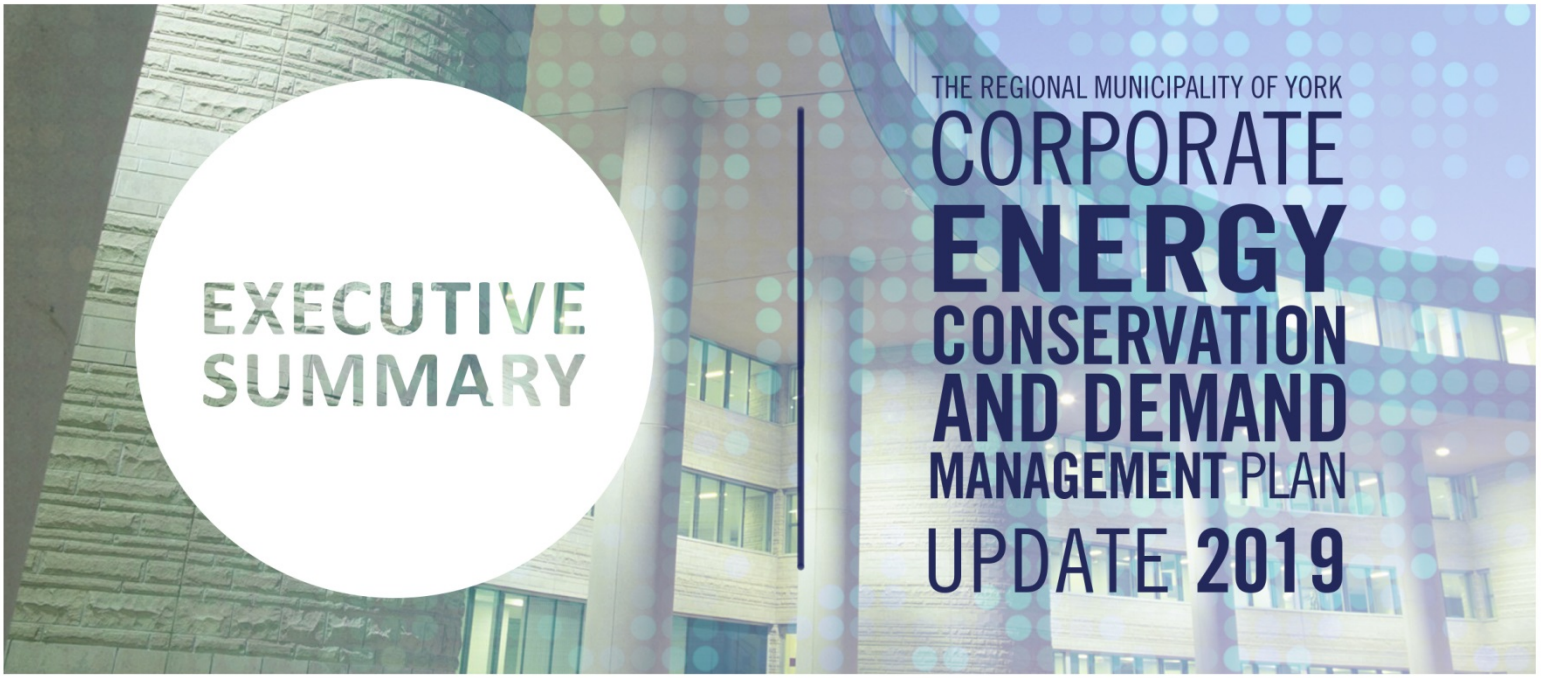


Executive Summary

The Regional Municipality of York is an upper-tier municipality comprised of nine local municipalities in Ontario with a population of 1.2 million residents in 2016 spread across an area of 1,762 square kilometres[1]. By 2051, the Region's population is forecast to be 2.1 million residents. York Region has adopted the goal of Living Sustainably through its innovative long-term strategy; Vision 2051[2]. As the cornerstone of the plan, "Conservation First" is engrained in all aspects of this Energy Conservation and Demand Management Plan. Efforts focus on the conservation of resources within the Region's control while providing the community with quality services across all departments and operations.

In an ever-changing provincial and federal political climate, communities across Canada, including York Region, have long been leaders in energy and greenhouse gas emissions reduction planning. Supported by Canada's participation in worldwide efforts to limit greenhouse gas emissions through treaties such as the Paris Agreement[3], and the 2016 Pan-Canadian Framework on Clean Growth and Climate Change[4], Ontario is gradually transitioning into a low-carbon economy. Using 2005 greenhouse gas emission levels as its base, the Province is currently targeting a 30 per cent reduction in emissions by 2030[5]. Vision 2051 challenges York Region to achieve net-zero carbon by 2051.

The Environmental Commissioner of Ontario's 2018 Greenhouse Gas Progress Report on climate action in Ontario identifies cities and towns, which include transportation sources, as accounting for

[1] Statistics Canada, 2017. *York, RM, Ontario, Census Profile, 2016 Census,* www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E, accessed Sept 4, 2018.
[2] York Region, 2011. *Vision 2051*, www.york.ca/vision2051, accessed September 4, 2018.
[3] United Nations, 2016. *Paris Agreement, Treaty Collection*, https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&lang=en, accessed Sept 4, 2018.
[4] Environment and Climate Change Canada (ECCC), 2016. *Pan-Canadian Framework on Clean Growth and Climate Change*, http://publications.gc.ca/collections/collection_2017/eccc/En4-294-2016-eng.pdf, accessed Sept 4, 2018.
[5] Preserving and Protecting our Environment for Future Generations, A Made-in-Ontario Environment Plan - https://prod-environmental-registry.s3.amazonaws.com/2018-11/EnvironmentPlan.pdf

more than 70 per cent of provincial greenhouse gas emissions[6]. Municipalities play a key role in affecting these emissions through their control of local standards and infrastructure planning.

The Electricity Act, 1998 through Ontario Regulation 507/18[7], requires the Region to develop an Energy Conservation and Demand Management Plan (Energy Plan). Conservation and emissions goals set in York Region's Energy Plan are driven by Vision 2051's aspiration to achieve net-zero carbon by 2051. Accordingly, the Region's Energy Plan includes targets that exceed legislated mandates and attempts to encompass the entirety of its corporate service delivery.

York Region prepared its first Energy Plan in 2014, fulfilling legislated requirements. An update was completed in 2016 to provide more detail on specific measures, targets and forecasts, and to expand the scope to include the majority of corporate greenhouse gas emissions. Accomplishments from the 2016 Energy Plan include:

- Energy audits to identify energy conservation opportunities, and retrofit projects to optimize efficiencies of existing systems at Regional buildings.
- Installation of 375 kW of emission free solar photovoltaic generation, producing approximately $150,000 in annual revenues.
- Water conservation and inflow and infiltration prevention programs that reduced the amount of water and wastewater requiring treatment by 10.6 mega-litres per day.
- Collaboration with provincial partners leading to the Council approval of six battery electric transit bus pilot project.
- Integrated 18 hybrid and plug-in hybrid electric vehicles into the corporate fleet to achieve better fuel economy as compared to standard internal combustion engine alternatives.
- Application of anti-idle and hybrid technologies that reduced ambulance fuel consumption by 84,500 litres since 2017.

Mandated by Ontario Regulation 507/18, public agencies must update their Energy Conservation and Demand Management Plan every five years, and include the following:

[6] Environmental Commissioner of Ontario, 2018. Climate Action in Ontario: What's Next? 2018 Greenhouse Gas Progress Report, https://docs.assets.eco.on.ca/reports/climate-change/2018/Climate-Action-in-Ontario.pdf, accessed Oct 5, 2018.
[7] Government of Ontario, 2018. *O. Reg. 507/18 Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans under the Electricity Act*, 1998, www.ontario.ca/laws/regulation/r18507, accessed January 31, 2019. Formerly O. Reg. 397/11 under the Green Energy Act, 2009. *Bill 34 Green Energy Repeal Act, 2018* moves relevant sections of the *Green Energy Act, 2009* to the *Electricity Act, 1998.*

- A summary of the annual energy consumption and greenhouse gas emissions for operations.
- A description of the goals and objectives for conserving and reducing energy consumption and managing energy demand.
- A description of current and proposed measures for conserving and otherwise reducing energy consumption and managing its demand for energy.
- A forecast of the expected results based on current and proposed measures.
- A report of actual results achieved to date.
- A description of any proposed changes to be made to assist the public agency in reaching any targets it has established or forecasts it has made[8].

The annual Corporate Energy Report is a related document that summarizes annual emissions from delivery of the corporation's services and informs Council and the public of the Region's progress toward achieving the targets established in the Energy Plan.

The Energy Plan focuses exclusively on corporate-wide energy consumption and greenhouse gas emissions resulting from York Region's service delivery to residents. It does not include community generated greenhouse gas emissions or emissions outside the geographic boundary of the Region. Community initiatives that cover a broader scope, including climate change adaption and mitigation will be captured in the Regional Climate Change Action Plan, which is currently under development and anticipated to be complete by the end of 2019. The difference between the two plans is illustrated in Table 1 below. This Energy Plan includes emissions over which York Region has direct control and third-party operations that the Region can influence.

[8] Government of Ontario, 2018. *O. Reg. 507/18 Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans under the Electricity Act*, 1998, www.ontario.ca/laws/regulation/r18507, accessed January 31, 2019.

Table 1: Comparison of Plan Contents

Energy Plan	Energy Conservation and Demand Management Plan	Climate Change Action Plan
Regulative Authority	Electricity Act, 1998 (O. Reg. 507/18)	Growth Plan
Scope	Corporate Emissions	Community Emissions
Area of Focus	• Buildings • Fleet • Water and Wastewater • Transit • Streetlights, Signals, Beacons, and Transit Shelters • Renewable Energy	• Municipal • Commercial • Residential • Industrial • Institutional • Transportation

The Energy Plan covers the 2019 to 2051 timeframe, assessing the Region's emissions reduction potential to 2051, incorporating projections for Regional services, industry trends and anticipated technological innovation. The Energy Plan provides short-term (ending in 2025), medium-term (ending in 2030) and long-term (ending in 2051) planning horizons for energy conservation initiatives and emissions targets. Analysis is based on corporate energy and greenhouse gas emission data available for the most recent year (2017) at the time of the Energy Plan development, trends since 2006, and anticipated growth to 2051 from Regional plans and strategies.

Short-term recommendations (2019 – 2025) integrate planned initiatives within each department. Confidence in the forecasted emissions reduction potential of planned initiatives for the short-term is high because initiatives are based on existing and proven technologies. In some cases, pilot programs associated with a planned initiative are in progress, supporting the potential for greenhouse gas emissions reduction. Emission reduction forecasts of recommendations and targets in the medium- and long-term planning horizon are less certain because the potential for emerging technologies may not be proven and corresponding business cases may need to be developed to justify investments. The potential for changes to federal and provincial legislation, funding opportunities, technological advances, and service demands over future decades will unlock opportunities to strengthen York Region's ability to reach its Vision 2051 aspirational goal of net-zero carbon by 2051. These changes will be captured in subsequent updates to the Energy Plan.

In addition to Vision 2051, other York Region plans and strategies include the 2019 to 2023 Strategic Plan,[9] Regional Official Plan,[10] Transportation Master Plan,[11] and Water and Wastewater Master Plan.[12] These plans and strategies provide further direction for sustainability goals in our communities

[9] York Region, 2015. *2015-2019 Strategic Plan*, www.york.ca/wps/portal/yorkhome/yorkregion/yr/plansreportsandstrategies/strategicplan, accessed Sept 4, 2018.
[10] York Region, 2010. *Regional Official Plan*, www.york.ca/wps/portal/yorkhome/yorkregion/yr/regionalofficialplan, accessed Sept 4, 2018.
[11] York Region, 2016 (1). *Transportation Master Plan*, www.york.ca/wps/portal/yorkhome/yorkregion/yr/plansreportsandstrategies/transportationmasterplan, accessed Sept 4, 2018.
[12] York Region, 2016 (2). *Water and Wastewater Master Plan*, www.york.ca/wps/portal/yorkhome/yorkregion/yr/plansreportsandstrategies/waterandwastewatermasterplan/waterandwastewatermasterplan, accessed Sept 4, 2018.

and set the expectation for the Region to continue to be a municipal leader. These strategies, along with input from staff, form the basis of the targets and initiatives detailed in the updated Energy Plan.

Initiatives in the Energy Plan were identified through a combination of staff workshops, interviews, a review of other peer municipalities, and input from internal and external subject matter experts. Initiatives were prioritized using a Sustainable Return on Investment framework. A Sustainable Return on Investment analysis of each initiative was conducted based on the relative strength of its financial, environmental, and social merits.

The Energy Plan includes an implementation framework that considers elements of governance, collaboration, procurement, funding, evaluation of future initiatives, reporting, and a communication strategy.

CORPORATE ENERGY CONSUMPTION AND GREENHOUSE GASES – PAST, PRESENT AND FUTURE

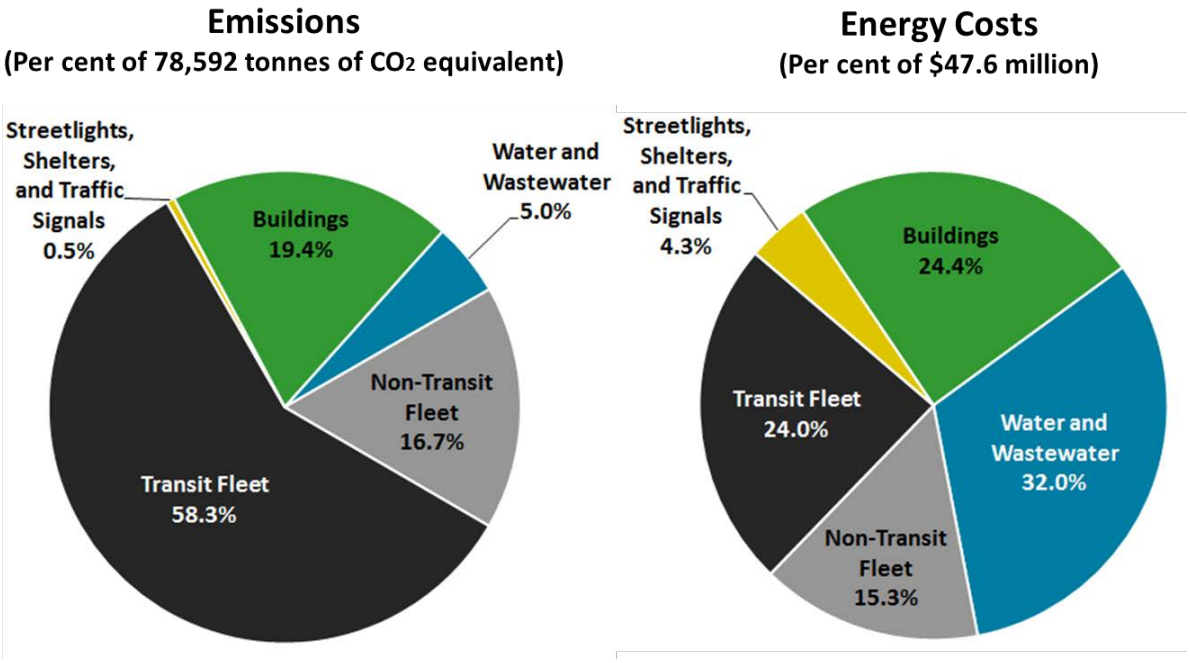
York Region owns and operates over $12.3 billion in assets in the form of buildings, transit vehicles, fleet vehicles, water and wastewater facilities, and supporting infrastructure[13]. The operation of these corporate assets emitted 90,999 tonnes[14] of carbon dioxide equivalent tonnes of greenhouse gases in 2017, which represent a small fraction (1 to 3 per cent[15]) of the total greenhouse gases emitted by the greater Regional community.

This version of the Energy Plan has been updated to more accurately reflect the Region's contribution to total greenhouse gas emissions resulting from electricity consumption. As a secondary source of energy, upstream emissions associated with electricity generation vary over time based on generation sources. Sources of electricity generation range from near-zero carbon emitters such as hydro, nuclear, wind and solar to heavy emitters such as coal, oil and natural gas. The Region has adopted use of the annual National Inventory Report published by the Federal Ministry of Environment and Climate Change as the main source for determining emission conversion factors for the current Energy Plan and all future annual reports and Energy Plans. Accordingly, the 2019 Energy Plan more accurately accounts for Ontario's clean electricity generation to reflect the closing of coal-fired generators and generation using nuclear and renewable sources. The upcoming 2018 Corporate Energy Report will also use this updated methodology and restate historical reporting of greenhouse gas emissions.

The updated methodology provides more accurate reporting and results in a smaller environmental impact from the Region's operations. By reflecting Ontario's low-carbon electricity grid in the Region's emissions calculation, the Region's annual emissions are 14 per cent lower; down from 90,999 tonnes to 78,592 tonnes of greenhouse gases. The reduction targets set by the Region have also been lowered by the same proportion, resulting in a neutral impact to the Region's ability to achieve its targets.

[13] York Region, 2018 (2). *Corporate Asset Management Policy*, www.york.ca/wps/portal/yorkhome/newsroom/news/corporateassetmanagementpolicy, accessed Sept 4, 2018.
[14] 2017 Corporate Energy Report to Council, http://www.york.ca/wps/wcm/connect/yorkpublic/b261002e-1a9f-4ee0-9f47-ff4f8c66c356/jun+7+energy+ex.pdf?MOD=AJPERES
[15] International Council for Local Environmental Initiatives (ICLEI) Canada – 2016 York Region Energy Conservation and Demand Management Plan Update

Figure 1: Current York Region Greenhouse Gas Emissions and Cost Breakdown (2017)



York Region's 2017 corporate greenhouse gas emissions and energy costs by source are summarized in Figure 1 above. In 2017, transit buses and vehicle fleets accounted for over 75 per cent of the Region's corporate emissions, but only 39 per cent of the total energy cost. In comparison, water and wastewater processing and streetlights represented only five per cent of total corporate emissions, but 36 per cent of the Region's total energy cost. These differences are due to the fact that electricity in Ontario is a lower emission and higher cost source of energy compared to fossil fuels. Accordingly, York Region stands to gain more cost savings from water, wastewater and streetlight energy efficiency measures compared to those which provide larger emission reductions based on savings in gasoline and diesel consumption. Staff will continue to balance cost and emission savings in prioritizing future projects, by applying a fiscally responsible approach.

The Energy Plan focuses on reducing energy and greenhouse gas emissions through three key pathways. These in order of priority are:

- Focus on conservation leading to reduced demand
- Improvements in energy efficiency to reduce fuel consumption
- Switching to renewable energy and less emission intense alternatives with the aim of achieving net-zero carbon

The objective is to help chart the path for York Region towards its aspirational goal of net-zero carbon by 2051. To achieve this goal, short, medium, and long-term initiatives have been proposed in the Energy Plan and summarized in Table 2 below:

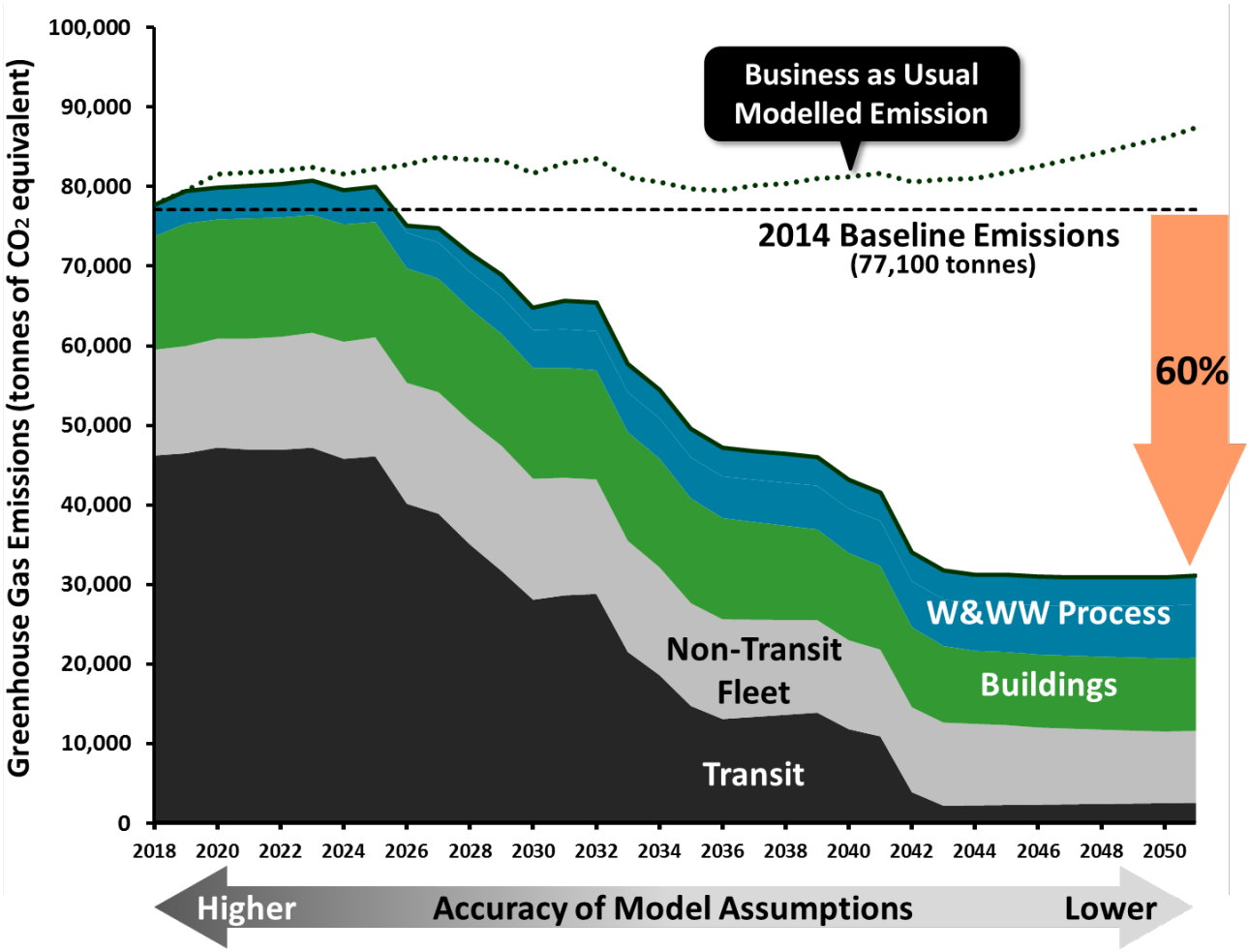
Table 2: Summary of Proposed Initiatives

Category	Initiative
Transit	Pilot Projects and Evaluation of Technology a: Hybrid Diesel-Electric b: Battery Electric c: Hydrogen Fuel Cell • Prove a viable zero carbon-emissions technology for Transit bus operations, the Region's single largest source of annual corporate emissions
	Mobility as a Service • Create a seamless link between all forms of available transportation (bus, taxi, subway, etc.) using cell phone applications to minimize use of single occupant vehicles
Buildings	De-Carbonization Plans and Strategies a: Energy Projects b: Existing Buildings (Deep Energy Retrofits) c: New Buildings (Construction Standards and Guidelines) • Reduce building energy consumption and carbon emissions through conservation and energy efficiency
	Ongoing-Commissioning • Ensure optimized building system functionality and operations through low/no cost measures
	Energy Performance Building Monitoring: Energy Data Management and Dashboards • Track and monitor performance using statistical analysis and real-time analytics while optimizing building operations and occupant comfort • Inform operations of equipment malfunction and corrective action
	Alternative Work Strategies and Supportive Policies • Minimize emissions associated with commuting and occupied spaces
Buildings (HYI)	Housing York Inc. – Energy and Utility Management Plan Implementation • Energy efficiency plan for social housing
Buildings (MRF)	Materials Recovery Facility (100 Garfield Wright) Energy Study • Energy efficiency study to optimize energy use and costs from waste processing including blue box materials
Water and Wastewater	Water Conservation and Sanitary Sewer Inflow and Infiltration Reduction Programs • Reduced water consumption leading to lower energy consumption (water-energy nexus)
	Water and Wastewater Facility Energy Conservation • Efficiency measures leading to reduced energy consumption

Category	Initiative
Non-Transit Fleet	Electric Vehicle Strategy • Fuel switching from gasoline/diesel to electricity to reduce emissions
	Vehicle Right-Sizing • Match the need with the type of vehicle to ensure the most efficient vehicle is used at all times
	Anti-Idling Policy • Automated engine shut-down to conserve fuel lost to unnecessary engine idling
	Driver Training Programs • Ensure driver training in energy efficient vehicle operations
	Fleet Route Planning • Achieve the same result with fewer kilometers driven through pre-planned routes
	Active and Sustainable Transportation Options • Enable and optimize transportation through public transit, carpools, cycling or walking
Streetlights, Transit Shelters, and Traffic Signals	Intersection Streetlight Conversion to Light Emitting Diode (LED) Technology • Application of LED technology to substantially reduce energy consumption compared to High Pressure Sodium fixtures currently in use
	Adaptive Streetlight Technologies • Dimmed streetlights that increase illumination when vehicles are present
	Alternative Energy Sources for Stationary Assets • Solar powered transit shelters, signal beacons, and weather stations
Renewables	Application of Renewable Energy Technologies • Replace existing energy sources with renewable energy alternatives to minimize emissions

Figure 2 below illustrates the impact of proposed initiatives that are grouped into four areas of focus: Transit, Non-Transit Fleet, Buildings, and Water and Wastewater Processes.

Figure 2: Forecasted Business as Usual Greenhouse Gas Emissions and Impact of Proposed Initiatives



A business as usual model representing the Region's corporate greenhouse gas emissions was developed for the updated Energy Plan to examine the potential magnitude of greenhouse gas reduction opportunities if no conservation or emissions reduction activities were to be implemented. If the Region elected to take no further action, emissions are forecasted to be 87,400 tonnes per year in 2051; an increase of 13 per cent over the 2014 emissions baseline. However based on full implementation of all proposed initiatives in Table 2 above, emissions are forecasted to decrease to 30,600 tonnes of greenhouse gases; a 60 per cent reduction compared to the 2014 baseline. Over the course of the next 33 years, it is estimated that York Region could potentially avoid the cumulative release of approximately 927,000 tonnes of greenhouse gases which is equivalent to:

- Eliminating the annual emissions from 5,500 passenger vehicles
- Annual carbon sequestration of a mature forest the size of Newmarket (approximately 38 km^2)

If all recommendations in the Energy Plan are successfully implemented by 2051, it is forecasted that the Region will still emit 30,600 tonnes of greenhouse gas emissions per year. One alternative to achieve the aspirational Vision 2051 target of net-zero carbon would be to offset the remaining 30,600 tonnes of greenhouse gas emissions per year through the purchase of renewable energy credits and carbon offsets. To do so, it is anticipated the annual cost of purchasing offsets would be

$7 to $8.5 million[16] per year starting in 2051 and continuing until the Region successfully eliminated any remaining emissions. Although reducing emissions through carbon offsetting may be considered for future versions of the Energy Plan; carbon offsets and renewable energy credits are currently not recommended because their benefits lack the fiscal and long-term benefits offered by energy conservation and optimized efficiency.

Table 3 highlights the short-term (2019 – 2025) components and associated capital investments proposed in the Energy Plan.

Table 3: Proposed Capital Costs for 2019 - 2025 Initiatives

Component	Estimated Capital Cost ($ millions)	Estimated Cumulative Energy Cost Savings ($ millions)	Estimated Greenhouse Gas Reductions (tonnes)
Buildings	$5.90	$6.10	9,600
Water and Wastewater	$3.60	$5.00	900
Fleets	$0.34	$0.15	500
Electric Transit Bus Pilot	$7.74	$1.20	3,600
Streetlights	$1.50	$2.40	400
Total	**$19.08**	**$14.85**	**15,000**

Initiatives proposed in the Energy Plan will require investments from each department that may be incremental to their current ten-year budgets. The Energy Plan is designed to minimize the financial impact on existing capital budgets by leveraging existing plans, planned asset replacement cycles, external funding, and internal reserves[17] that support Regional sustainability initiatives. Furthermore the decreasing trends in the cost of energy efficient and renewable alternatives, in some cases, are nearing parity to original business cases. In the short-term, the Region is adapting to recent reductions in provincial incentives and funding to support initiatives. Departments will continue to develop business cases based on own-source revenue for funding and lifecycle cost savings as justification for conservation investments. However, staff remain optimistic that in the longer-term, additional provincial and federal funding may become available based on the impacts of climate change.

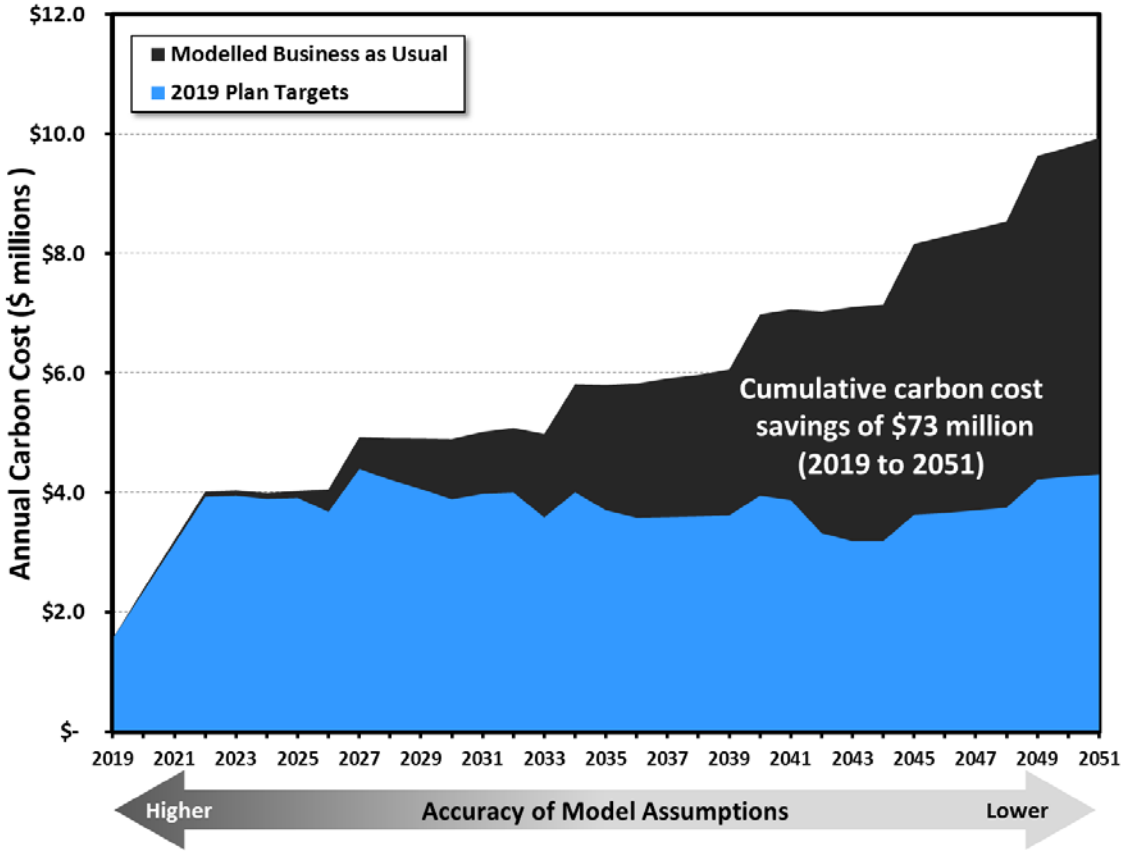
The Region will strive to achieve its aspirational goal of net- zero carbon through an iterative process that updates Energy Plans every five years. Each update will reflect shifts in federal and provincial regulations, funding, industry development, advances in technology, and global prices for energy and carbon that yield opportunities for the Region over time. The experience with battery electric bus

[16] Based on a carbon offset cost of $30 per tonne of carbon equivalent
[17] Green Energy Reserve Fund – Bylaw 2016-78 https://www.york.ca/wps/wcm/connect/yorkpublic/e8b6bbe3-0bb3-4fb3-8771-265f51ff5026/2016-78.pdf?MOD=AJPERES

technology is an illustration of this point. The 2016 Energy Plan proposed an indeterminate period beyond 2030 for a shift away from diesel transit buses. However, battery electric technology has advanced so rapidly that the Council approved the purchase of six electric buses in January 2019, which will be piloted on two Newmarket routes, based on the financial and environmental merits of the project. If successful, full rollout of battery electric buses has the potential to cut corporate emissions in half by 2051.

Figure 3 illustrates the financial cost forecast of Regional greenhouse gas emissions. To date, there has been little direct cost to producers and consumers for emitting greenhouse gases. Business cases that support conservation have largely relied upon savings from the reduced purchase of fuel and from incentive programs. In 2019, the Federal government imposed a carbon tax of $20 per tonne of carbon dioxide equivalent (tonnes of greenhouse gases). The rate is expected to rise by $10 per year until it reaches $50 per tonne of carbon dioxide equivalent in 2022. Accordingly, by 2022, it is forecasted that the Region will be required to pay an additional $4 million per year for greenhouse gas emissions in the form of additional fuel costs. The Energy Plan proposes conservation initiatives to minimize further impacts and avoid a further $5.4 million[18] in carbon taxes per year by 2051; resulting in $73 million of cumulative savings from 2019 to 2051.

Figure 3: Annual Cost of Greenhouse Gas Emissions



[18] $50 per tonne in 2022 and forecasted $10 increments based on an estimated 2.5 percent annual inflation rate

Table 4 presents short, medium and long-term greenhouse gas emission reduction targets proposed in the Energy Plan.

Table 4: Corporate Greenhouse Gas Emissions and Targets

Year Ending:	2020	2025	2030	2051
Emissions Target (tonnes of carbon dioxide equivalent):	79,900	79,800	64,600	30,600
Change from 2014 Baseline:	+4%	+4%	-16%	-60%

Note: 2014 Baseline Emissions = 77,118 tonnes of carbon dioxide equivalent

York Region is investing in infrastructure and service delivery to support future population growth. The Energy Plan builds on departmental master plans and strategies that indicate a need for increases in infrastructure and operational capacity. In the short-term (2019-2025), there are increasing trends in the number of buildings, vehicles, transit services, water and wastewater infrastructure. These factors contribute to an increase in annual corporate emissions in the short-term. Energy conservation initiatives are important in limiting short-term emissions growth to the projected four per cent and subsequent reductions leading to a 60 per cent decline in emissions by 2051.

The 2019 Energy Plan identifies opportunities to make prudent investments in the future of the Region and its residents. It charts a feasible course in line with Vision 2051, to position York Region as a leader in reducing greenhouse gas emissions. Through a commitment to conservation and increased efficiency, the Region is well positioned to meet the aspirational goal of zero carbon by 2051.

This Energy Conservation and Demand Management Plan was approved by York Region Council on May 16, 2019[19].

[19] https://yorkpublishing.escribemeetings.com/filestream.ashx?DocumentId=5345

Introduction

When York Region developed its innovative Vision 2051 long-term strategy, it solidified its vision of making the Regional Municipality of York a strong, caring and safe community[20]. As one of the fastest growing communities in Canada, York Region recognized the importance of effective planning by developing Vision 2051 and using it as a road map for eight key guiding principles; which include **Living Sustainably**[21].

"Living Sustainably

In 2051, sustainability can be practiced in everyday life through climate resiliency, innovative water conservation and reuse, water resource protection, waste reduction, energy conservation and greenhouse gas reduction."

[20] York Region, 2011. *Vision 2051*, www.york.ca/vision2051, accessed September 4, 2018.
[21] ibid. Pg. 13

In the context of energy conservation and demand management, Living Sustainably to York Region means[22]:

- Providing an energy efficient urban form and buildings that facilitate reduced energy demand, and options for local renewable and alternative energy systems.
- Delivering innovative programming to achieve water conservation, water resource protection, energy conservation, and greenhouse gas reduction in water and wastewater infrastructure.
- Reducing dependency on non-renewable, carbon-based energy sources by diversifying local energy supply, prioritizing local energy generation and distribution and using renewable and alternative energy sources.
- Promoting an energy efficient transportation network and reducing fossil fuel emissions by promoting walking, cycling and public transit.
- Promoting fuel efficiency, emissions reductions, renewable fuels and the necessary infrastructure to support a low-carbon transportation system.
- Encouraging energy and water efficient new building construction and retrofits to existing building stock, such that buildings can contribute to energy efficiency and water management.
- Creating energy efficient water and wastewater systems.
- Advocating for increased energy efficiency and building standards to move toward net-zero carbon buildings.
- Encouraging initiatives that move toward net-zero carbon by 2051.

These objectives were prominent within the development of this 2019 update to the Energy Conservation and Demand Management Plan (Energy Plan). Consistent with these objectives is the concept of “Conservation First”; the idea that York Region will focus its efforts on energy conservation and energy efficiency for corporate service delivery that is within its control or influence. This approach to energy use will enable the Region to continue to deliver quality services to its residents and meet its commitments to reduce corporate greenhouse gas emissions for future generations.

[22] Ibid. Pg. 17, 26, and 27

Background and Context

ABOUT YORK REGION

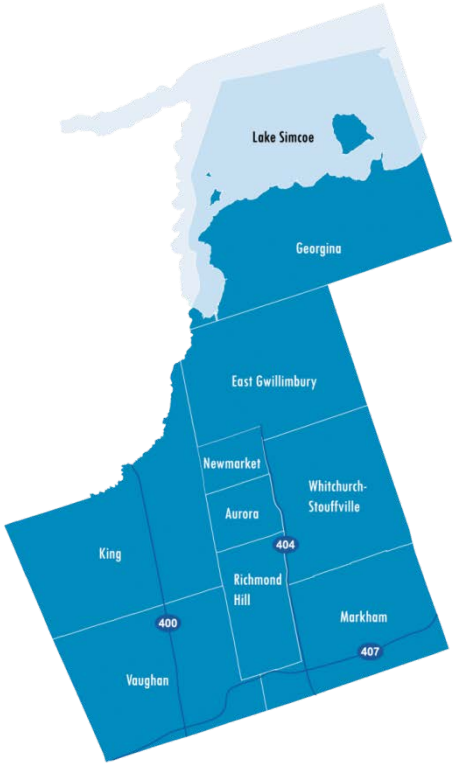
The Regional Municipality of York is an upper-tier municipality comprised of nine local municipalities in Ontario with a 2016 population of 1.2 million residents spread across an area of 1,762 square kilometres[23]. Based on projections of recent rapid growth, York Region is expected to grow 36 per cent by 2030, and 91 per cent by 2051[24]. In 2051, York Region's population is estimated to be 2.1 million residents.

York Region delivers a wide range of services to its residents and visitors that include:

- Court Services
- Family and Children's Services
- Housing Services
- Paramedic and Seniors Services
- Planning and Economic Development
- Police Services

[23] Statistics Canada, 2017. *York, RM, Ontario, Census Profile, 2016 Census,* www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E, accessed Sept 4, 2018.
[24] York Region, 2018 (1). *Data provided to Stantec Consulting Ltd. in spreadsheet 'York Population Forecast" on May 31, 2018.*

- Public Health
- Regional Roads
- Solid Waste Management
- Transit
- Water/Wastewater Treatment, Pumping and Storage
- Regional Forests and Tree Canopy



To support these services, York Region owns and/or operates over $12.3 billion in assets in the form of buildings, transit vehicles, fleet vehicles, water and wastewater facilities as well as all supporting infrastructure[25].

In 2017, the operation of these corporate assets collectively emitted 90,999 tonnes[26] of greenhouse gases (carbon dioxide and equivalents), representing only a small fraction (1 to 3 per cent[27]) of the total greenhouse gases emitted by the greater Regional community. In addition to York Region's Vision 2051 long-term strategy and York Region's 2019 to 2023 Strategic Plan[28], York Region has a number of policies in place to manage the energy use and greenhouse gas emissions from its corporate assets. The following summarizes some of the policies that apply to sustainability within various York Region strategic documents.

The Regional Official Plan[29]

- Air Quality and Climate Change policy to reduce vehicle emissions through community design, reduced single occupancy automobile use, and public transit service.
- A community focused Sustainable Cities, Sustainable Communities policy for buildings in the community including:
  - Consideration of new buildings to be designed and certified to LEED® Silver, Gold or Platinum standards.
  - Review of sustainable building incentive programs.
  - Consideration of on-site renewable or alternative energy systems to produce up to 25 per cent of building energy use in new buildings.

[25] York Region, 2018 (2). *Corporate Asset Management Policy*, www.york.ca/wps/portal/yorkhome/newsroom/news/corporateassetmanagementpolicy, accessed Sept 4, 2018.
[26] York Region, 2017 Corporate Energy Report to Council, http://www.york.ca/wps/wcm/connect/yorkpublic/b261002e-1a9f-4ee0-9f47-ff4f8c66c356/jun+7+energy+ex.pdf?MOD=AJPERES
[27] International Council for Local Environmental Initiatives (ICLEI) Canada – 2016 York Region Energy Conservation and Demand Management Plan Update
[28] York Region, 2015. *2015-2019 Strategic Plan*, accessed April 7, 2019.
[29] York Region, 2010. *Regional Official Plan*, www.york.ca/wps/portal/yorkhome/yorkregion/yr/regionalofficialplan, accessed Sept 4, 2018.

- A corporately focused energy and utilities policy for corporately owned buildings and assets including:
    - Implementing progressively higher LEED® standards for all new Regional buildings and re-examining these standards periodically.
    - Retrofitting existing Regional buildings to improve energy conservation and incorporate renewable energy sources.
    - Preparing an energy conservation and demand management plan.
    - Purchasing a portion of electricity used in Regional buildings from clean and emissions-free sources.
    - Investigating methods to reduce electricity use during normal- and high-demand periods.
    - Incorporating energy efficient technologies and alternative fuels into the Regional fleet, including transit, police and public works vehicles.
    - Developing and operating an energy-from-waste system for York Region.
    - Developing a tracking system to monitor and set a target to reduce greenhouse gas emissions from Regional operations.
- Water and Wastewater Servicing policies to design and operate water and wastewater facilities to reduce energy use and to incorporate energy-recovery systems where possible.

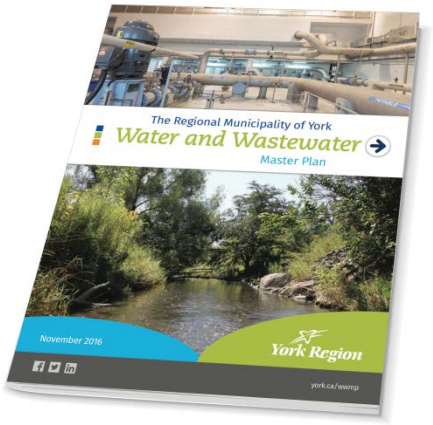
Transportation Master Plan[30]

York Region's Transportation Master Plan is a long-term investment plan that will enable the Region to keep up with the pace of growth in a manner that is sustainable and responsible. The Transportation Master Plan has a 25-year outlook and provides progressive policy and network recommendations to respond to and create an advanced interconnected system of mobility in the Greater Toronto and Hamilton Area. The Transportation Master Plan strives to give York Region residents and businesses a competitive advantage, making York Region the best place to live, work, and play in the Province. The Transportation Master Plan recognizes climate change as a major issue and discusses the use of electric vehicles and alternative/sustainable modes of transportation as means of decreasing emissions of greenhouse gases.

One of the direct actions from the development of the Transportation Master Plan, is a commitment by York Region to review land use policies near facilities to promote energy conservation, efficiency, improved air quality and climate change initiatives so that their long-term operation and economic role is protected, where applicable or feasible[31].

[30] York Region, 2016 (1). *Transportation Master Plan*, http://www.york.ca/wps/portal/yorkhome/yorkregion/yr/plansreportsandstrategies/transportationmasterplan accessed Sept 4, 2018.
[31] Ibid pg 123

Water and Wastewater Master Plan[32]



The Water and Wastewater Master Plan guides investments in water and wastewater systems to support York Region's projected growth to 2041. The Water and Wastewater Master Plan aligns with Vision 2051 by striving to provide cost-effective and sustainable water and wastewater services through innovation and integration. Climate resiliency, water conservation and reuse, and energy conservation are concepts embedded in the approach to ensure sustainability. One of the screening criteria used for establishing servicing concepts is net reduction in energy use, chemical consumption, and greenhouse gas emissions. Economic, environmental and social dimensions are part of the One Water vision, which complements energy and greenhouse gas emissions reduction goals throughout York Region. Energy conservation concepts include:

- Implementing the long-term water conservation and water reuse strategy.
- Implementing the sanitary sewer inflow and infiltration reduction strategy.
- Enhancing integration between water and wastewater asset renewal and growth projects.
- Developing climate change adaptation and mitigation strategies for water and wastewater.
- Continuing water and wastewater energy optimization and renewable energy projects.
- Ensuring water and wastewater financial sustainability.

In 2010, as part of the Province's approval of the Southeast Collector Trunk Sewer Individual Environmental Assessment, York Region committed to developing a long-term water conservation strategy as well as a sanitary sewer inflow and infiltration reduction strategy. The noted strategies aim to achieve targeted reductions in water demand and extraneous sanitary sewer flows by 2031, which are expected to inherently reduce greenhouse gas emissions through lower energy used for pumping and treatment.

REGULATORY CONTEXT

Communities across Canada, including York Region, have long been leaders in energy and greenhouse gas emissions reduction planning. Community efforts and an overall change in consciousness across the country have solidified greenhouse gas emissions policies and regulations at both the federal and provincial level.

[32] York Region, 2016 (2). *Water and Wastewater Master Plan*, www.york.ca/wps/portal/yorkhome/yorkregion/yr/plansreportsandstrategies/waterandwastewatermasterplan/waterandwastewatermasterplan, accessed Sept 4, 2018.

Federal Context

In December 2015, Canada participated in the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change and committed to the Paris Agreement - a binding treaty on climate action for 195 countries that starts in 2020[33]. While previous treaties focused on capping greenhouse gas emissions globally, the aim of the Paris Agreement was to keep a global temperature rise this century below two degrees Celsius; accomplished through greenhouse gas emissions reductions. This shift emphasized the impact of greenhouse gas emissions in the atmosphere on global warming and climate change.

As part of the Paris Agreement and previous agreements through the United Nations Framework Convention on Climate Change, the government of Canada prepares and submits an annual greenhouse gas inventory[34]. These annual inventories form the basis for Canada's greenhouse gas emissions reduction efforts and provide a model for Canadian communities and corporations to follow in support of Canada's global commitments. The 2016 Pan-Canadian Framework on Clean Growth and Climate Change (the Framework) was developed with the provinces and territories as a plan to meet Canada's greenhouse gas emissions reduction targets, grow the economy, and build resilience to a changing climate[35]. The Framework sets a target of 30 per cent greenhouse gas emissions reduction below 2005 levels by 2030. However, the sum of emissions reductions listed in the Framework shows that Canada's achievable reductions are currently 21 per cent below 2005 levels[36].

While some of the initiatives in Canada's plan revolve around the provision of funding, such as the $2 billion Low Carbon Economy Fund to support provincial and territorial emissions reduction actions, the current focus of the federal government is the development of a Pan-Canadian approach to pricing carbon pollution. At the time of writing this Plan, guidance on this approach stated that all Canadian jurisdictions were required to pass carbon pricing legislation by 2018 through either an explicit price-based system or a cap and trade system. Jurisdictions that do not meet this obligation default to the Federal price-based system[37].

The Federal price-based system starts at a carbon price of $20 per tonne of carbon dioxide equivalent (greenhouse gas emissions) in 2019 and increases by $10 per year until it reaches $50 per tonne of carbon dioxide equivalent in 2022. The government of Canada requires large single-facility greenhouse gas emitters of greater than 10,000 tonnes of carbon dioxide equivalent to report their greenhouse gas emissions annually. There are no federal greenhouse gas reporting or planning requirements for municipalities whose facilities do not meet this threshold.

[33] United Nations, 2016. *Paris Agreement, Treaty Collection*, https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&lang=en, accessed Sept 4, 2018.
[34] UNFCCC, 2018. *National Inventory Submissions 2018*, https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2018, accessed Sept 4, 2018.
[35] Environment and Climate Change Canada (ECCC), 2016. *Pan-Canadian Framework on Clean Growth and Climate Change*, http://publications.gc.ca/collections/collection_2017/eccc/En4-294-2016-eng.pdf, accessed Sept 4, 2018.
[36] ECCC, 2018 (1). *Progress towards Canada's greenhouse gas emissions reduction target*, www.canada.ca/en/environment-climate-change/services/environmental-indicators/progress-towards-canada-greenhouse-gas-emissions-reduction-target.html, accessed Sept 4, 2018.
[37] ECCC, 2018 (2). *Guidance on the pan-Canadian carbon pollution pricing benchmark*, www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework/guidance-carbon-pollution-pricing-benchmark.html, accessed Sept 4, 2018.

Provincial Context

At the time of writing this Plan, the Province's Made-in-Ontario Environment Plan provides details of Ontario's transition into a low-carbon economy and sets a greenhouse gas target of 30 per cent reduction below 2005 levels by 2030[38]. This target is in line with the current Federal target for greenhouse gas emissions reduction.

In September of 2018, the Environmental Commissioner of Ontario released its most recent annual report on Climate Action in Ontario[39]. This report recognizes that Ontario has a climate challenge, that the provincial government has an essential role in meeting this challenge and that business, municipalities, and citizens have been taking advantage of available opportunities and are ready to do even more. The Environmental Commissioner's report identifies cities and towns, which include transportation, the largest single emitter in Ontario, as accounting for more than 70 per cent of provincial greenhouse gas emissions. Municipalities play a key role in affecting these emissions through their control of local standards and infrastructure planning. While over 350 municipalities across Canada have committed to taking action on climate change through voluntary programs, the Environmental Commissioner's report states that municipalities in Ontario require more concrete provincial leadership and financial assistance to reach their greenhouse gas reduction goals. The Environmental Commissioner's report makes several recommendations to accelerate greenhouse gas emissions reductions, including expansion of non-emitting renewable electricity sources such as wind and solar; enhancing the uptake of electric vehicles including buses and expansion of public transportation systems; and beginning the transition to electric water and space heating in buildings.

Through Ontario's Cap and Trade Program[40] enacted in 2016, the Province put a price on carbon pollution and allowed for the trading of carbon offset credits. This Program, along with the phase-out of coal in electricity production achieved early success for the Province toward meeting its shorter-term emissions reduction goals. Although the *Cap and Trade Cancellation Act* (Bill 4)[41] has been passed, the Province still requires large single-facility emitters of greater than 10,000 tonnes of greenhouse gas emissions to report on their greenhouse gas emissions annually, which aligns with current Federal requirements[42]. Many municipalities may not have single facilities that meet this threshold, a different regulation, *Ontario Regulation 507/18* (*O. Reg. 507/18*), requires the annual energy and greenhouse gas emissions reporting from prescribed sources of emissions (e.g. buildings, water and wastewater treatment plants, garages, etc.). In addition, *O. Reg. 507/18* requires municipalities to develop five-year Energy Conservation and Demand Management Plans[43]. Generally, an Energy Conservation and Demand Management Plan must consist of the following:

[38] Preserving and Protecting our Environment for Future Generations, A Made-in-Ontario Environment Plan - https://prod-environmental-registry.s3.amazonaws.com/2018-11/EnvironmentPlan.pdf
[39] Environmental Commissioner of Ontario, 2018. Climate Action in Ontario: What's Next? 2018 Greenhouse Gas Progress Report, https://docs.assets.eco.on.ca/reports/climate-change/2018/Climate-Action-in-Ontario.pdf, accessed Oct 5, 2018.
[40] Government of Ontario, 2016. *O. Reg 144/16 Cap and Trade Program*, https://www.ontario.ca/laws/regulation/160144, accessed January 2019
[41] Government of Ontario, 2018. *Bill 4, Cap and Trade Cancellation Act*, https://www.ola.org/en/legislative-business/bills/parliament-42/session-1/bill-4, accessed January 2019
[42] Government of Ontario, 2018. *O. Reg. 390/18 Greenhouse Gas Emissions: Quantification, Reporting and Verification*, www.ontario.ca/laws/regulation/r18390, accessed Sept 4, 2018.
[43] Government of Ontario, 2018. *O. Reg. 507/11 Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans*, www.ontario.ca/laws/regulation/r18507, accessed January 31, 2019.

- A summary of the annual energy consumption and greenhouse gas emissions for operations.
- A description of the goals and objectives for conserving and reducing energy consumption and managing energy demand.
- A description of previous, current and proposed actions to conserve energy and reduce demand, including a forecast of expected results for current and proposed solutions.

O. Reg. 507/18 emphasizes transparency and requires public agencies to prepare, publish on its website, make available to the public in printed form, and implement their five-year Energy Conservation and Demand Management Plans. Public agencies are also required to submit annual reports on their energy use and greenhouse gas emissions to the Ministry of Energy, as well as publish and make the annual emissions reports available online and in print format.

York Region prepared its first Energy Plan in 2014, fulfilling the requirements of *O. Reg. 507/18*. The initial Energy Plan, which provided high-level direction to York Region, was followed by an update completed in 2016 that provided more detail on specific measures, targets and forecasts.

To meet the requirements of a five-year update in 2019, this document herein is considered to be the current version of the Energy Plan, and has been updated as required by *O. Reg. 507/18* to include all the requirements of the original Energy Plan, as well as:

1. A description of current and proposed measures for conserving and otherwise reducing energy consumption and managing its demand for energy.
2. A revised forecast of the expected results of the current and proposed measures.
3. A report of the actual results achieved.
4. A description of any proposed changes to be made to assist the public agency in reaching any targets it has established or forecasts it has made[44].

With York Region's goal to be a leader in the community in an ever-changing regulatory context, the current Energy Plan will position York Region on the path toward its Vision 2051 aspirational goal of net-zero carbon by 2051.

[44] Government of Ontario, 2018. *O. Reg. 507/18 Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans under the Electricity Act*, 1998, www.ontario.ca/laws/regulation/r18507, accessed January 31, 2019.

SCOPE OF ENERGY CONSERVATION AND DEMAND MANAGEMENT PLAN

This Energy Plan is a corporate-wide plan that focuses exclusively on greenhouse gas emissions resulting from York Region's service delivery to residents. It does not include community generated greenhouse gas emissions or emissions that are outside the geographic boundary of the Region. Community initiatives that cover a broader scope, including climate change adaption and mitigation will be captured in the Regional Climate Change Action Plan, which is currently under development and anticipated to be complete by the end of 2019. The difference between the two plans is illustrated in Table 5 below.

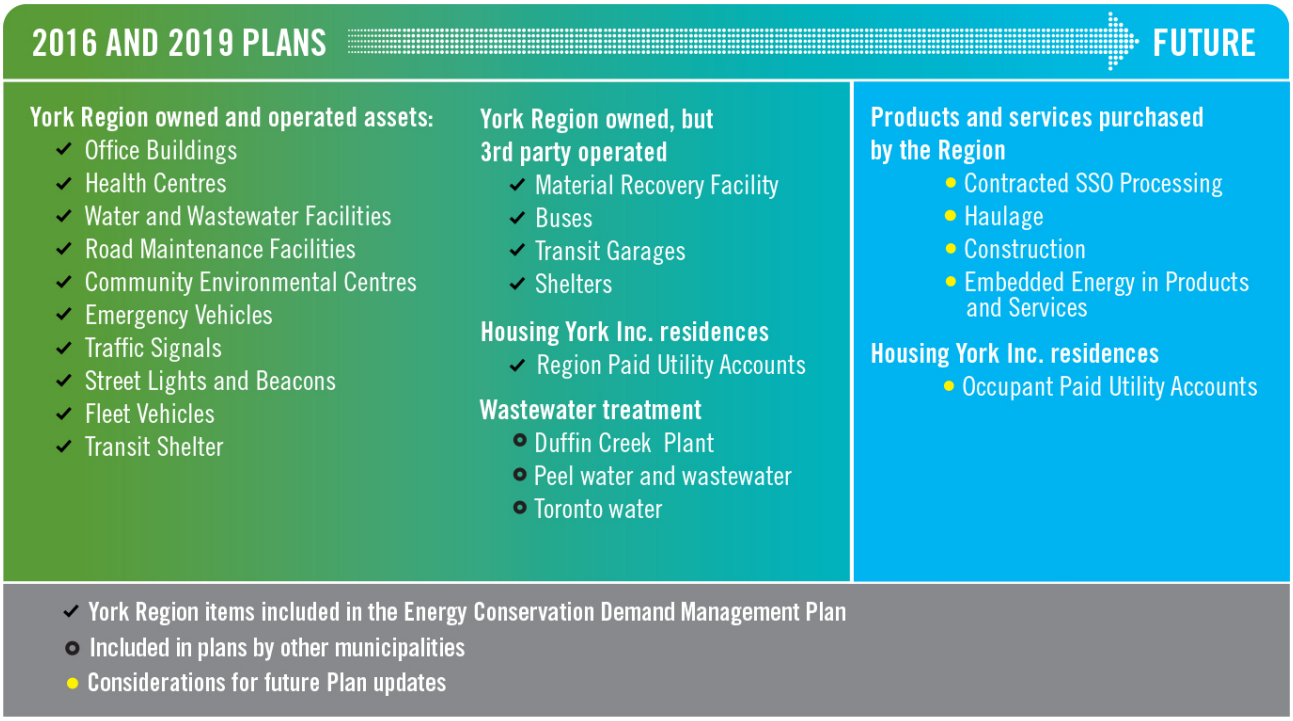
Table 5: Comparison of Plan Contents

Energy Plan	Energy Conservation and Demand Management Plan	Climate Change Action Plan
Regulative Authority	Electricity Act, 1998 (O. Reg. 507/18)	Growth Plan
Scope	Corporate Emissions	Community Emissions
Area of Focus	• Buildings • Fleet • Water and Wastewater • Transit • Streetlights, Signals, Beacons, and Transit Shelters • Renewable Energy	• Municipal • Commercial • Residential • Industrial • Institutional • Transportation

Municipal operations form a small subset of overall community greenhouse gas emissions (1 to 3 per cent[45]), but initiatives and assets under municipal control, such as the provision of transit services, do have an impact on community greenhouse gas emissions. Only emissions over which York Region has direct control, and third-party operations that the Region can influence, are included in this Energy Plan. Figure 4 below illustrates the relationship between the greenhouse gas emissions and the scope of the Plan.

[45] International Council for Local Environmental Initiatives (ICLEI) Canada – 2016 York Region Energy Conservation and Demand Management Plan Update

Figure 4: Scope of the Plan



A summary of the different types of assets included in this Plan are provided in Table 6 below. Assets are grouped by their emissions within the Plan.

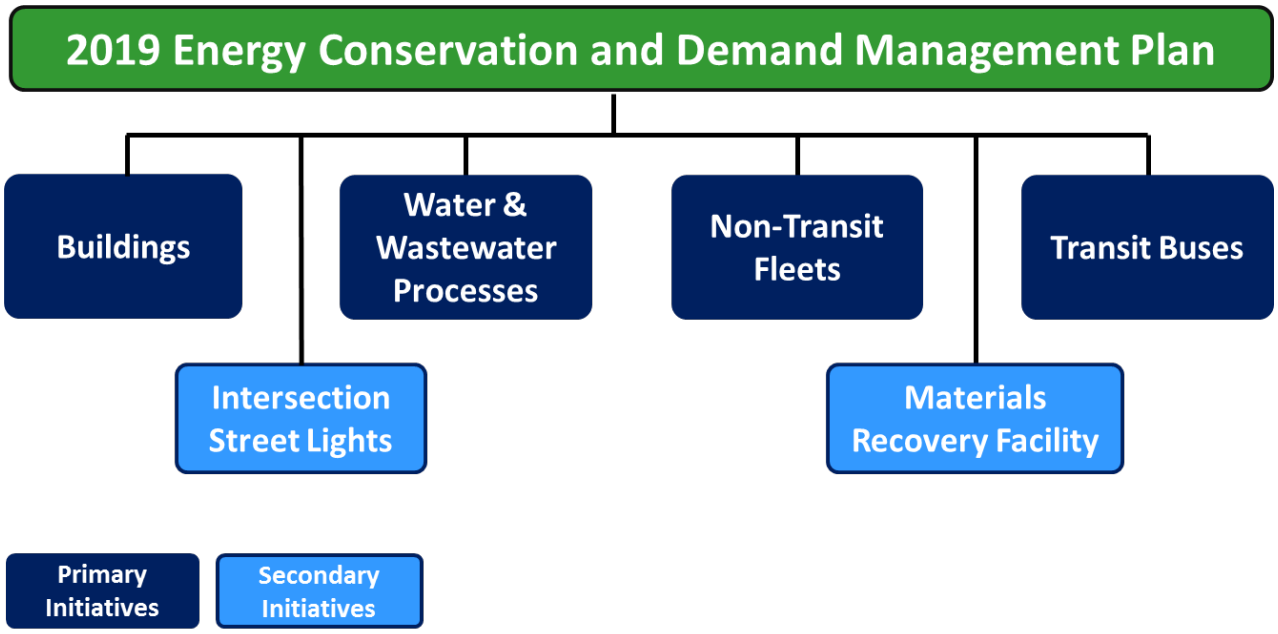
Table 6: York Region Assets

Transit	Buildings	Non-Transit Fleet	Water and Wastewater
Conventional buses Mobility plus buses Rapid transit buses	Waste management facilities Paramedic response stations Police services stations Housing York Inc. Long-term care facilities Transit garages Vehicle storage and maintenance	Light, medium, and heavy-duty vehicles Plug-in hybrid Off-road Tractors and construction Police vehicles Ambulance and medical Air and marine	Water treatment and pumping Water storage Wastewater treatment and pumping Odour control

While O. Reg. *507/18* only requires the inclusion of corporately-owned buildings in emissions reduction and planning activities, York Region has produced a comprehensive Energy Plan that spans the entirety of its corporate related service delivery and activities.

The Energy Plan proposes initiatives to reduce energy consumption and greenhouse gas emissions across all lines of Regional service delivery. Primary initiatives (Figure 5) afford the greatest potential for conservation. Secondary initiatives are also important but their potential is much more limited.

Figure 5: Primary and Secondary Initiatives in the Plan



The Energy Plan covers the 2019 to 2051 timeframe, assessing the Region's emissions reduction potential by 2051, given current understanding of the trends, technologies and the future. The Energy Plan provides short-term (ending in 2025), medium-term (ending in 2030) and long-term (ending in 2051) planning horizons. Analysis is based on corporate energy and greenhouse gas emissions data available for the most recent year at the time of the Energy Plan development (2017), trends since 2006, and anticipated growth to 2051 from Regional plans and strategies.

Short-term recommendations (2019 – 2025) integrate planned initiatives within each of the Region's core areas of business. Confidence in the forecasted emissions reduction potential of planned initiatives in the short-term is high because the initiatives are based on existing and proven technologies. In some cases, pilot programs associated with a planned initiative are in progress, supporting the potential for greenhouse gas emissions reduction. Emission reduction forecasts of recommendations and targets in the medium- and long-term planning horizon are less certain because the potential for the associated emerging technologies may have not yet been proven and corresponding business cases may need to be developed to justify investments. The potential for changes to federal and provincial legislation, funding opportunities, technological advances, and service demands over future decades will unlock opportunities to strengthen York Region's ability to reach its Vision 2051 goal of net- zero carbon by 2051. These changes will be captured in subsequent updates to the Energy Plan.

The Energy Conservation and Demand Management Plan Update Development Process

This Energy Plan was based on corporate energy and greenhouse gas emissions available for the most current year (2017) at the time of the Energy Plan development, trends since 2006, and anticipated growth to 2051. The identification of initiatives for incorporation into the Energy Plan was completed through a combination of York Region staff workshops, interviews, a review of peer and other municipalities, and input from internal and external subject matter experts.

WORKSHOPS

Four workshops facilitated sharing of best practices and identification of key initiatives with York Region staff providing specific guidance and direction on the program components and enabling factors for each area of focus.

A series of interviews with York Region staff with knowledge of street lighting, active transportation and renewable energy was also conducted to inform the process in those secondary categories.

A final workshop with York Region's inter-departmental Energy Conservation and Demand Management Plan

- May 29, 2018 Water and Wastewater
- June 11, 2018 Buildings
- June 14, 2018 Transit Fleet
- June 21, 2018 Non-Transit Fleet
- June 26, 2018 Sustainable Return on Investment

Steering Committee provided an opportunity to solidify the methodology used for prioritizing actions using a Sustainable Return on Investment model.

York Region staff were able to come together through these workshops and interviews to provide a unified vision for the Energy Plan.

PEER MUNICIPALITY REVIEW AND SUBJECT MATTER EXPERT INTERVIEWS

A review of energy conservation and efficiency policies, programs, and actions from peer cities and municipalities was conducted as part of this Energy Plan process. This review consisted of a desktop review complemented by direct telephone interviews with municipal contacts. The peer municipality review included an assessment of the following cities and municipalities:

- Canada: Peel Region, Durham Region, City of North Vancouver, City of Burlington, Waterloo Region, City of Toronto
- United States: New York City
- Europe: London

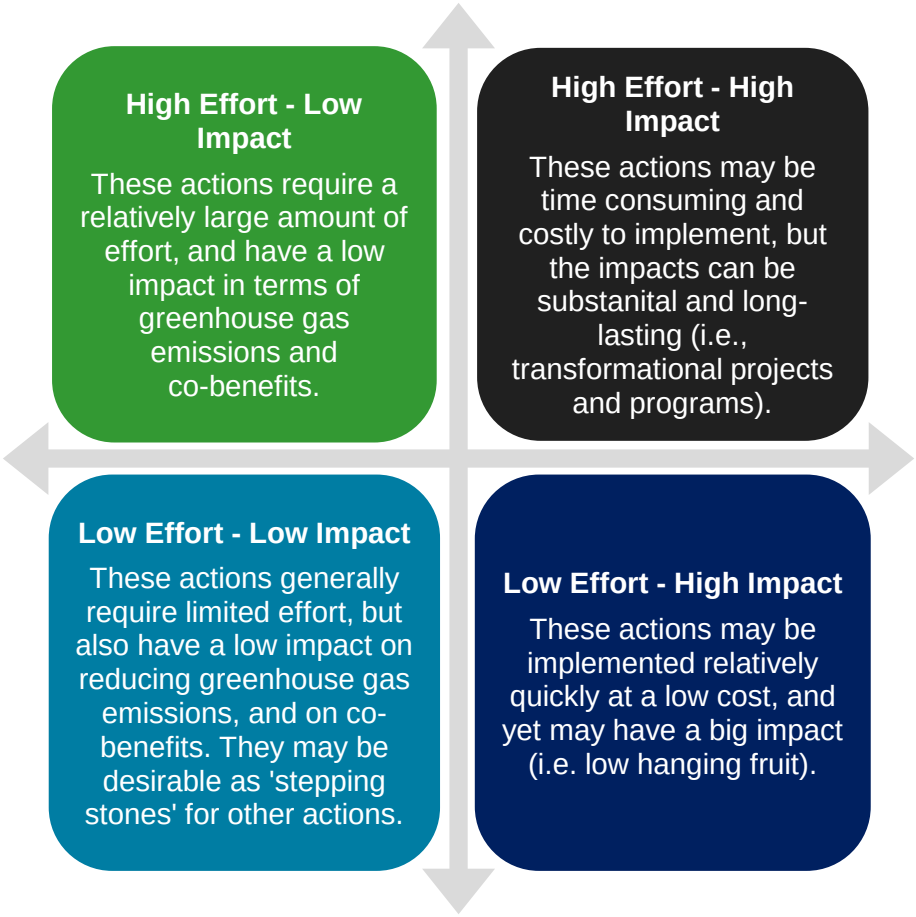
In addition to the review of municipalities, interviews were conducted with external subject matter experts with expertise in municipal government energy conservation and emissions reduction strategies.

Information garnered from other municipalities helped shape the development of this Energy Plan. Most notably, municipalities with a rapidly growing population are challenged to meet their absolute emissions targets; however, absolute emissions reductions are the key to reversing the impacts that the accumulations of greenhouse gases are having on the global environment. The Region's Energy Plan reflects this reality and projects future absolute corporate emissions to increase in support of growth until 2025 before beginning to fall toward its 2051 goal. Energy consumption and emissions are not distributed equally within corporate service delivery. This Energy Plan has initiatives that span all lines of business but those that have the greatest opportunity to deliver emissions reductions are specifically called out for consideration. Finally, municipalities can take a leadership role and influence sectors outside of its direct control through incentives, education, and policy decisions. This Energy Plan considers the broader implications of proposed initiatives such as an Electric Vehicle Charging Policy and its potential to influence private vehicle purchase decisions.

PRIORITIZING ACTIONS - SUSTAINABLE RETURN ON INVESTMENT

York Region identified actionable energy and greenhouse gas reduction opportunities and strategies that could be deployed to achieve York Region's Vision 2051 goals. To prioritize greenhouse gas reduction actions, a Level of Effort versus Level of Impact approach was deployed (Figure 6).

Figure 6: Level of Impact and Level of Effort Matrix



The Energy Plan incorporates a Sustainable Return on Investment framework to project evaluation. The Sustainable Return on Investment framework considers both financial and non-financial (environmental and social) impacts that may not be reflected in conventional business cases that only consider financial benefits. Advanced software applications like RETScreen[46] are available that have been specifically designed to quantify both financial and environmental project benefits. Once the social benefits have been identified for the project, the Sustainable Return on Investment approach allows for the weighting of these factors to represent the comprehensive value added of each project.

On June 26, 2018, a workshop was held with members of York Region's Energy Conservation and Demand Management Plan Steering Committee to develop a shared understanding of the Sustainable Return on Investment methodology and complete a paired comparison to determine weightings for three impact areas based on York Region's strategic priority areas. The impact areas and weightings are presented in Table 7.

[46] Natural Resources Canada, *RETScreen, available at:* https://www.nrcan.gc.ca/energy/software-tools/7465

Table 7: Impact Area Weightings Used in the Sustainable Return on Investment Analysis

Impact Area	Strategic Priority Area	Weighting
Economic Sustainability The impact that costs/investments has on support networks and the community.	Economic Vitality, and Good Government	33%
Environmental Sustainability A smaller negative impact and/or a greater positive impact on the environment results in improved resilience and more efficient operations.	Sustainable Environment	50%
Social Sustainability An increase in access, and fair and equitable treatment results in a strengthened sense of community.	Healthy Communities	17%

Using the assessments of each action from the workshops, and the above weightings, a Sustainable Return on Investment impact score was assigned, and compared against its estimated level of effort using the level of impact and effort matrix. Actions identified as having a high impact were considered as part of the analysis.

GREENHOUSE GAS MODEL AND FORECAST

A model of "business as usual" greenhouse gas emissions (measured in tonnes of carbon dioxide equivalent) was developed to project future Regional emissions through to 2051 and to test opportunities for reductions. The model uses a combination of projected service levels and population growth rates developed by Regional departments. Where service level projections were unavailable, indicators of current energy performance were developed (GJ/m^2, L/km, GJ/m^3 water, etc.) and applied to anticipated growth in service levels (e.g., new floor area of buildings). Several assumptions were made as part of the business as usual forecast model and have been included in the end notes. [i]

WHAT'S DIFFERENT ABOUT THIS PLAN?

The operation of Regional corporate assets in 2017 collectively emitted 90,999 tonnes[47] of carbon dioxide equivalent (tonnes of greenhouse gases). This version of the Plan has been updated to more accurately reflect the Region's contribution to total greenhouse gas emissions resulting from electricity consumption. As a secondary source of energy, upstream emissions associated to electricity generation vary over time based on generation sources ranging from near-zero carbon emitters such as hydro, nuclear, wind and solar to heavy emitters such coal, oil and natural gas. The Region has adopted the annual National Inventory Report published by the Federal Ministry of Environment and Climate Change as the main source of emission conversion factors for all upcoming reports. Accordingly, the 2019 Energy Plan, and future Corporate Energy Reports to Council, more accurately

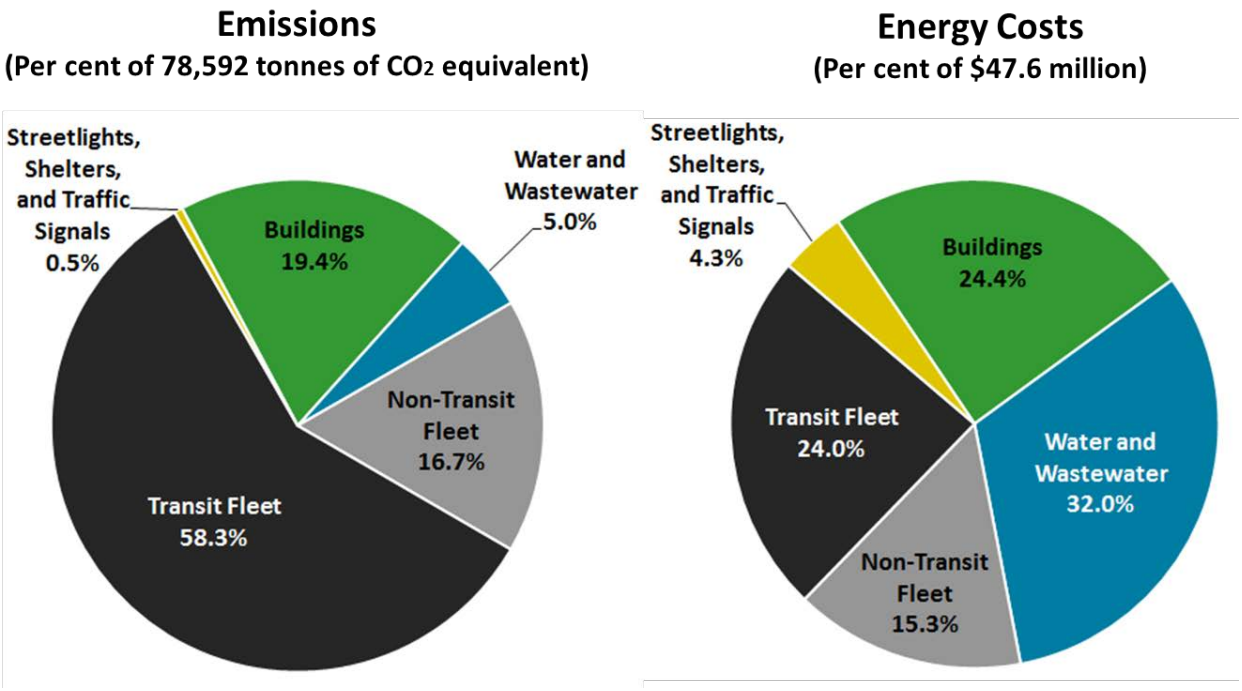
[47] 2017 Corporate Energy Report to Council, http://www.york.ca/wps/wcm/connect/yorkpublic/b261002e-1a9f-4ee0-9f47-ff4f8c66c356/jun+7+energy+ex.pdf?MOD=AJPERES

accounts for Ontario's clean electricity generation to reflect the closing of coal-fired generators and generation using nuclear and renewable sources.

By reflecting Ontario's low-carbon electricity grid in the Region's emissions calculation, the Region's 2017 annual emissions are 14 per cent lower; down from 90,999 tonnes to 78,592 tonnes of greenhouse gases. The reduction targets set by the Region have also been lowered by the same proportion, resulting in a neutral impact to the Region's ability to achieve its targets.

The relative contribution to York Region's 2017 corporate greenhouse gas emissions and cost by source are summarized in Figure 7 below.

Figure 7: Current York Region Greenhouse Gas Emissions Breakdown (2017)



In 2017, transit buses and vehicle fleets accounted for over 75 per cent of the Region's corporate emissions, but only 39 per cent of the total energy cost. In comparison, water and wastewater processing and street lighting represented only five per cent of total corporate emissions, but 36 per cent of the Region's total energy cost. These differences are accounted for by the fact that electricity in Ontario is a lower emission and higher cost source of energy compared to fossil fuels. Accordingly, York Region stands to gain significant electricity cost savings associated to water and wastewater processes and streetlight energy efficiency measures compared to those which provide larger emission reductions based on savings in natural gas, gasoline and diesel consumption. Staff will continue to balance cost and emission savings in prioritizing future projects, by applying a fiscally responsible approach.

Corporate Energy Consumption – Where Are We Now?

Regional municipalities are centers of communication, commerce, and culture. They are also a significant and growing source of energy consumption and greenhouse gas emissions. Cities and regional centers have the opportunity to affect considerable change on greenhouse gas emissions levels on a global scale as they are responsible for more than 70 per cent of global energy-related greenhouse gas emissions[48].

CURRENT ENERGY AND GREENHOUSE GAS EMISSIONS

In 2017, York Region's corporate greenhouse gas emissions amounted to 78,592 tonnes, or 66.9 kilograms per person in the community. These greenhouse gas emissions were the direct result of key services provided by York Region, which are categorized below by area of focus.

- **Transit Fleet**: York Region's transit fleet in 2018 comprised of 103 rapid transit buses, 437 conventional buses, 20 mobility plus buses, and 101 other mobility plus vehicles. Emissions from this category are the result of diesel fuel combustion.

- **Buildings**: York Region's facilities consume electricity and natural gas to heat, cool, ventilate, and illuminate administrative buildings, solid waste facilities, and social housing residences. An list of York Region buildings and their associated annual greenhouse gas emissions since 2014 is available on the Region's website[49].

[48] C40 Cities, 2018. *Why Cities?, https://www.c40.org/why_cities*, accessed August 21, 2018.
[49] York.ca – Energy Reporting

- **Non-Transit Fleet**: York Region's non-transit fleet vehicles include police, ambulance, construction vehicles and equipment, and light duty vehicles for corporate use. The majority of non-transit fleet vehicles consume gasoline.

- **Water and Wastewater**: The treatment and movement of water and wastewater at York Region is accomplished largely by electrically driven pumps and processes. Diesel fuel used for backup electricity generation and natural gas used in conditioned spaces constitute a smaller proportion of greenhouse gas emissions for this category.

- **Streetlights, Traffic Signals and Transit Shelters**: At York Region, these items are all powered exclusively by electricity.

Table 8 provides a breakdown of the 2017 greenhouse gas emissions, energy, and cost by category and illustrates the challenges that departments will face in prioritizing their corresponding projects to ensure a balance between cost and environmental savings.

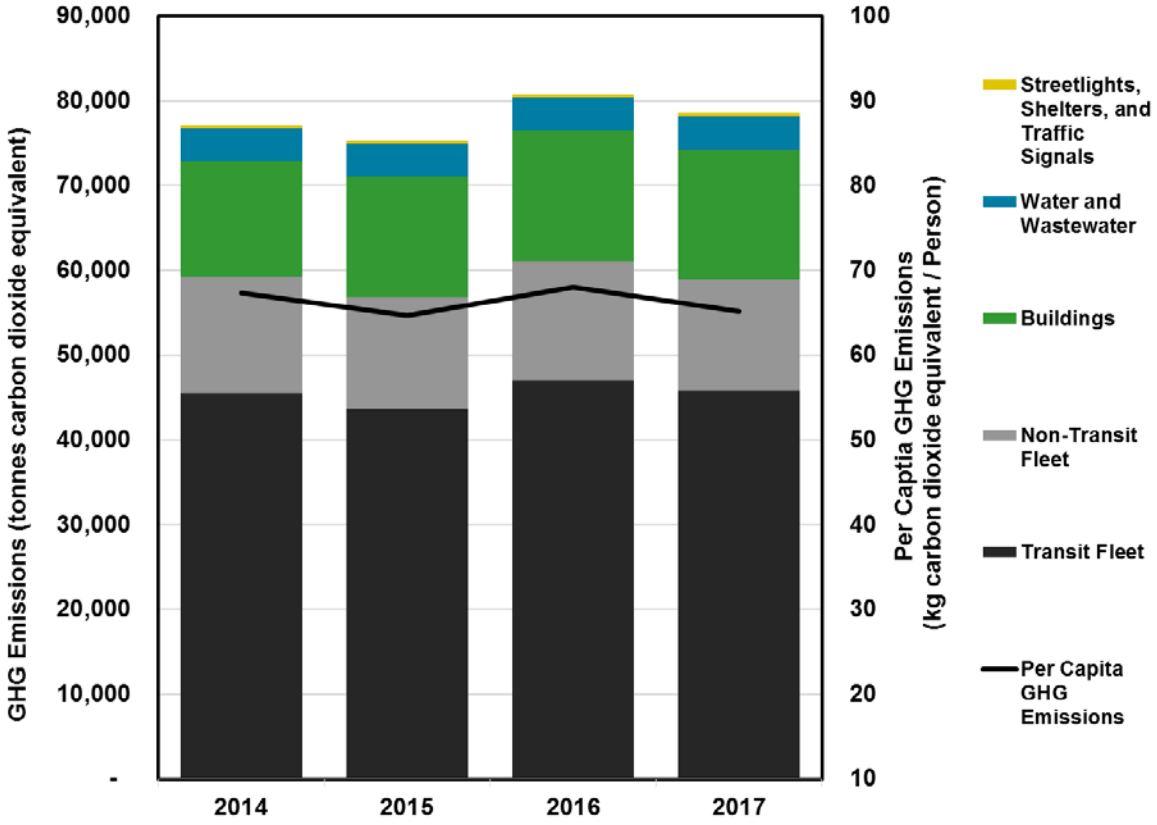
Table 8: 2017 Energy and Greenhouse Gas Emissions by Category

Category	Greenhouse Gas Emissions (tonnes of carbon dioxide equivalent)		Energy (gigajoules)		Cost (in $ millions)	
Transit Fleet	45,828	58%	632,900	41%	15.23	24%
Buildings	15,271	19%	622,100	40%	11.63	32%
Non-Transit Fleet	13,116	17%	21,000	1%	7.28	15%
Water and Wastewater	3,957	5%	248,500	16%	11.42	24%
Streetlights, Signals and Transit Shelters	420	1%	37,800	2%	2.06	4%
Total	**78,592**	**100%**	**1,562,300**	**100%**	**$47.62**	**100%**

HISTORICAL TRENDS

York Region has recorded corporate greenhouse gas emissions since 2006 and chose 2014 as its baseline reporting year for its Energy Plans to align with the start of regulatory reporting required by *O. Reg. 507/18*. Since 2014, York Region's population and greenhouse gas emissions from corporate operations have increased five per cent and two per cent respectively. On a per capita basis, greenhouse gas emissions from corporate operations have decreased three per cent since the 2014 baseline year. Unfortunately, absolute emissions reductions are the key to reversing the impacts that the accumulations of greenhouse gases are having on the global environment.The relationship between absolute and per capita emissions is illustrated in Figure 8 below.

Figure 8: Annual Absolute and Per Capita Greenhouse Gas Emissions



As with any growing municipality, the increase in population is often the largest driver of greenhouse gas emissions growth due to the increased demand for Regional services and infrastructure to support them. A more dramatic rise in greenhouse gas emissions has been mitigated as a result of the implementation of energy efficiency and reduction actions by York Region, as well as the greening of the provincial electrical grid.

PAST INITIATIVES

York Region's original Energy Plan, produced in 2014 and updated in 2016, was developed from input provided by staff, industry best practices, and a review of peer municipalities. The 2016 Energy Plan identified a number of emissions reduction initiatives for York Region. Table 9 to Table 14 present a summary of these initiatives and their status.

Table 9: Status of 2016 Energy Conservation and Demand Management Plan Initiatives - Transit

Category	Initiative	Initiative Status	Details
2016-T1	Operator Behaviour	Complete	The driver training and anti-idling policy initiatives have been implemented as planned. Transit initiatives T1, T2, and T4 have improved transit bus fuel efficiency by four per cent which is a savings of approximately 400,000 litres of diesel fuel per year.
2016-T2	In-Vehicle Technology	In Progress/ Complete	The initiative is in progress. It is a series of technologies that have been rolled out at various levels. For example, 51 buses had an electric fan installed as part of the mid-life program, and new buses will have software to control transmissions systems based on topography and other factors, as well as electric fans and driver support systems installed.
2016-T3	Electric Buses	In Progress	The initiative is in progress. Electric buses will be piloted on Newmarket transit routes in late 2019/early 2020.
2016-T4	Enabling Program Components	In Progress	The vehicle retrofit, refurbishment and replacement program, and fuel consumption tracking programs have been implemented. The On-Demand Roll Out program is in the process of implementation.

Table 10: Status of 2016 Energy Conservation and Demand Management Plan Initiatives - Buildings

Category	Initiative	Initiative Status	Details
2016-B1	New Building Design (LEED® Certification Requirements for New Buildings)	In Progress	Currently new buildings are being built to LEED® Silver standard. York Region is in the process of evaluating the benefits of earning both a LEED® Silver or Gold certification and Passive House certification to reduce building energy consumption and emissions.
2016-B2	Existing Building Retrofits (Building Conditions Assessment and Audits)	In Progress	Phase I was the completion of 24 of 27 building audits to identify future energy projects. Phase II will be to prioritize projects, develop business cases, and build into future budgets.
2016-B3	Operations, Maintenance and Behavior Change	Not Initiated	This initiative is included in the Sustainable Building Policy for the updated Plan which includes training for staff, dashboards, outreach and education to occupants, and analytics for monitoring performance.
2016-B4	Deep Building Retrofits	Not Initiated	Successfully completing Deep Building Retrofits will require a detailed list of initiatives and a strategy for logistics and budget. The Region is in the identification of initiatives phase.

Category	Initiative	Initiative Status	Details
2016-B5	Housing York Inc. New Building Design (LEED® Certification Requirements for New Buildings)	In Progress	Housing York Inc. builds to a LEED® Silver certification level but does not certify opting to save the administration fee to build additional housing units. Housing York Inc. is in the process of developing its own Energy and Utilities Management Plan that aligns with Vision 2051 and the York Region Energy Plan.
2016-B6	Housing York Inc. Existing Building Retrofits	In Progress	The initiative has not been fully implemented. Housing York Inc. is in the process of developing its own Energy and Utilities Management Plan that aligns with Vision 2051 and the York Region Energy Plan.
2016-B7	Housing York Inc. Operations, and Maintenance and Tenant Behavior Change	In Progress	Housing York Inc. has conducted tenant awareness campaigns that yielded early benefits. Continuous follow up is required to maintain results over time.
2016-B8	Enhanced Energy Technical Standards	In Progress	York Region is in the process of developing the Sustainable Building Policy to replace the current LEED® Silver certification requirement.
2016-B9-1	Energy Data Management	In Progress	York Region has put processes in place to collect energy data and is planning to purchase a next-generation energy data analytics package in 2019 to enhance energy data management.
2016-B9-2	Energy Performance Labelling	In Progress	York Region purchases only EnergyStar certified equipment and these benefits are reflected in current energy and greenhouse gas emission inventory.
2016-B9-3	Energy Dashboards	In Progress	This initiative has been identified as a must-have for the Region's purchase of a next-generation energy management solution.
2016-B9-4	Enforcement of Technical Standards and Guidelines	Not Initiated	This initiative will be considered once initiative B1 has been approved by Council.

Table 11: Status of 2016 Energy Conservation and Demand Management Plan Initiatives – Non-Transit Fleet

Category	Initiative	Initiative Status	Details
2016-F1	Fuel Efficiency and Vehicle Replacement	In Progress	A York Region staff member has recently been seconded to the one-year Green Fleet Coordinator role (2016-F6). These initiatives are the responsibility of the Green Fleet Coordinator to accomplish during his tenure and are in progress.
2016-F2	Anti-Idling Policy	In Progress	
2016-F3	Efficient Driver Training	In Progress	
2016-F4	Personal Vehicle Use Reduction	In Progress	
2016-F5	Electric Vehicles	In Progress	
2016-F6	Enabling Program Components (Green Fleet Coordinator)	Complete	York Region hired a Green Fleet Coordinator on a one-year secondment to expedite the completion of non-transit fleet initiatives in the current version of the Plan.

Table 12: Status of 2016 Energy Conservation and Demand Management Plan Initiatives - Water and Wastewater

Category	Initiative	Initiative Status	Details
2016-W1	Water Conservation	In Progress	This ongoing initiative strives to reduce water consumption and wastewater flows which have a direct influence on energy use and greenhouse gas emissions. This initiative is part of the 2011 Long-Term Water Conservation Strategy and its 2018 update submitted to the Province.
2016-W2	Energy Audit Program	In Progress	Energy auditing of water and wastewater facilities is ongoing.
2016-W3	Optimization of the Aeration Process	In Progress	A project to optimize the aeration process at the Keswick Water Resource Recovery Facility (WRRF) was initiated in 2017 and is currently in the feasibility assessment stage. This initiative has also been expanded to include projects related to: • Water and wastewater processes optimization (including Keswick WRRF compressor replacement; heating, ventilation and air conditioning optimization at Maple Pumping Station; and pump optimization at numerous facilities). • Energy conservation including facility lighting retrofits and installation of pump variable frequency drives.

Category	Initiative	Initiative Status	Details
2016-W4	On-Site Energy Generation and Recovery	Complete	The micro-hydro turbines pressurized system water pilot and the micro-hydro turbine gravity-fed system pilot initiatives were evaluated and deemed financially unviable. The feasibility study for the Keswick WRRF heat recovery project is complete, detailed design is ongoing and start of construction is expected in 2019.
2016-W5	Pressure District Energy Optimization Pilot Project	In Progress	The initiative has been implemented for Maple Pumping Station and the Pressure District 7 pumps. An energy dashboard was developed to display pump efficiency data to operators in support of efforts to optimize performance.
2016-W6	Enabling Program Components	In Progress	Enabling Program Components, such as sub-meter installation and monitoring system development for facility energy use benchmarking and tracking, continue to evolve to support energy conservation and emissions reductions.

Table 13: Status of 2016 Energy Conservation and Demand Management Plan Initiatives - Streetlights, Traffic Signals, Transit Shelters

Category	Initiative	Initiative Status	Details
2016-S1	Street Light Conversion	In Progress	All Region controlled traffic signals have been converted to light emitting diodes technologies. Region controlled traffic intersection lights operate using high pressure sodium illumination. York Region needs to complete a traffic safety illumination study before conversion. The outstanding intersection street lights represent less than 1 per cent of the total electricity used for lights, signals, and beacons.

Table 14: Status of 2016 Energy Conservation and Demand Management Plan Initiatives - Renewable Energy Generation

Category	Initiative	Initiative Status	Details
2016-R1	Renewable Energy	Complete	York Region installed 16 new solar arrays bringing its total generation up to 375 kW (AC). Future projects are on hold with the cancellation of the Fit and MicroFIT programs in Ontario.

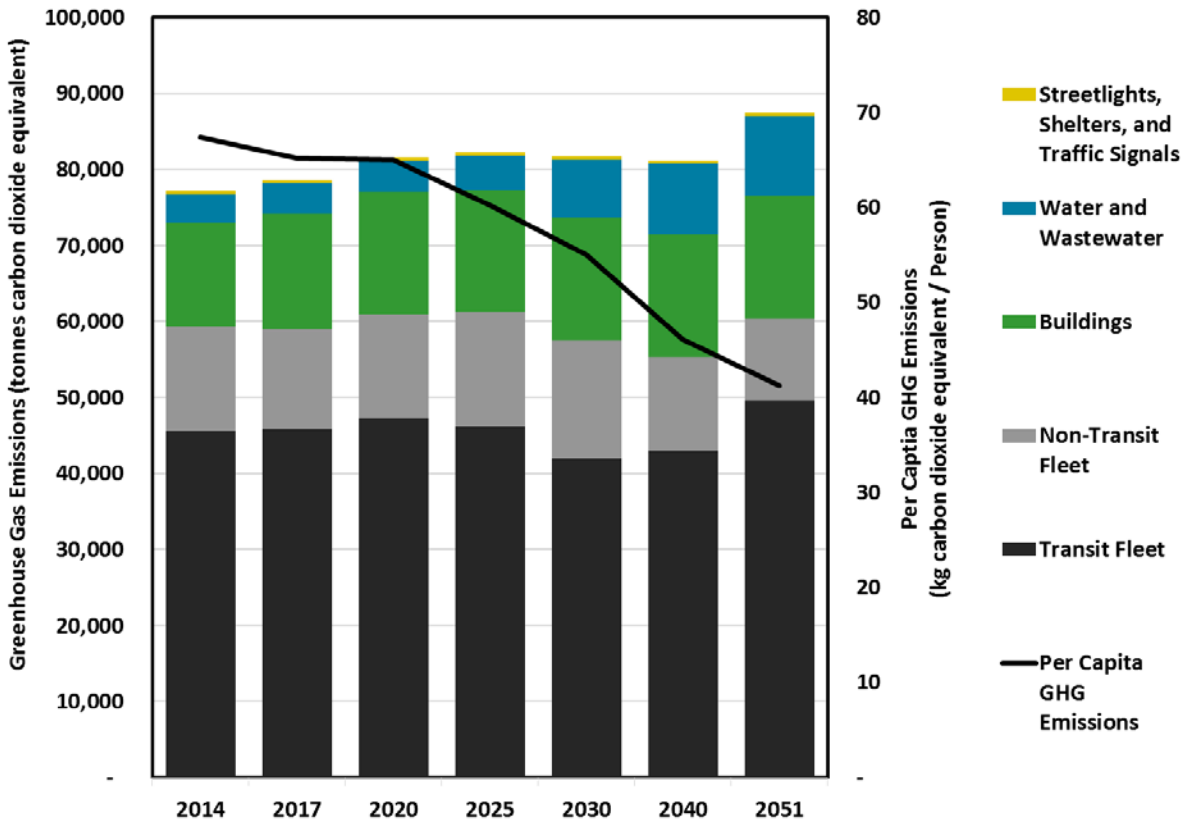
Forecasts and Targets – Where Are We Going?

BUSINESS AS USUAL FORECAST

A forecast representing York Region's corporate business as usual greenhouse gas emissions was developed for this Plan to examine the potential magnitude of greenhouse gas reduction opportunities (Figure 9). The business as usual scenario assumes that York Region will not implement any of the energy saving and greenhouse gas emissions reduction initiatives proposed in this Plan. The Region's corporate emissions have been modelled to be 87,400 tonnes of greenhouse gases by 2051, an increase of 13 per cent over the 2014 emissions baseline. Per capita emissions are predicted to decrease over the same period since the community serviced by York Region is a high growth municipality.

To estimate future greenhouse gas emissions, York Region's 2017 energy use was increased proportionally to meet higher service demand levels as a result of an increasing Regional population and service growth rates (e.g. number of transit users). The business as usual forecast also accounted for planned structural changes at York Region, such as new buildings and facilities, building energy efficiency upgrades, and greenhouse gas reduction initiatives set by the Provincial and the Federal governments (e.g. vehicle fuel-economy standards).

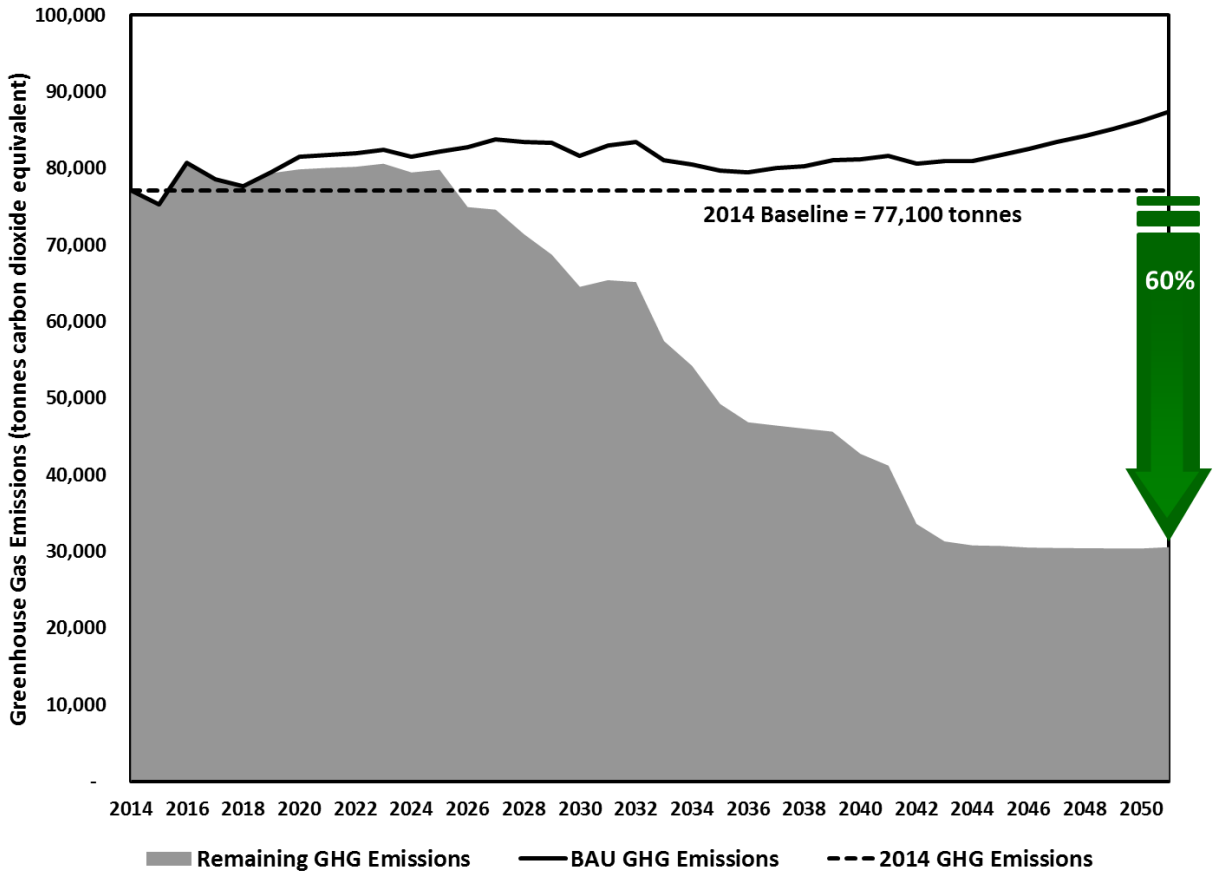
Figure 9: Forecasted Greenhouse Gas Emissions Under a Business as Usual Scenario



TARGETS

To better understand the effect of future energy and greenhouse gas savings initiatives and facilitate the setting of short- and medium-term targets, the business as usual future scenario was adjusted to reflect the estimated savings if York Region were to implement the initiatives proposed in this Plan. The lists of initiatives proposed in the following sections are anticipated to result in an emissions reduction of 60 per cent by 2051; a decrease of 46,500 tonnes of greenhouse gases as compared to the 2014 baseline (Figure 10).

Figure 10: Forecasted Business as Usual Greenhouse Gas Emissions and Reduction Opportunity

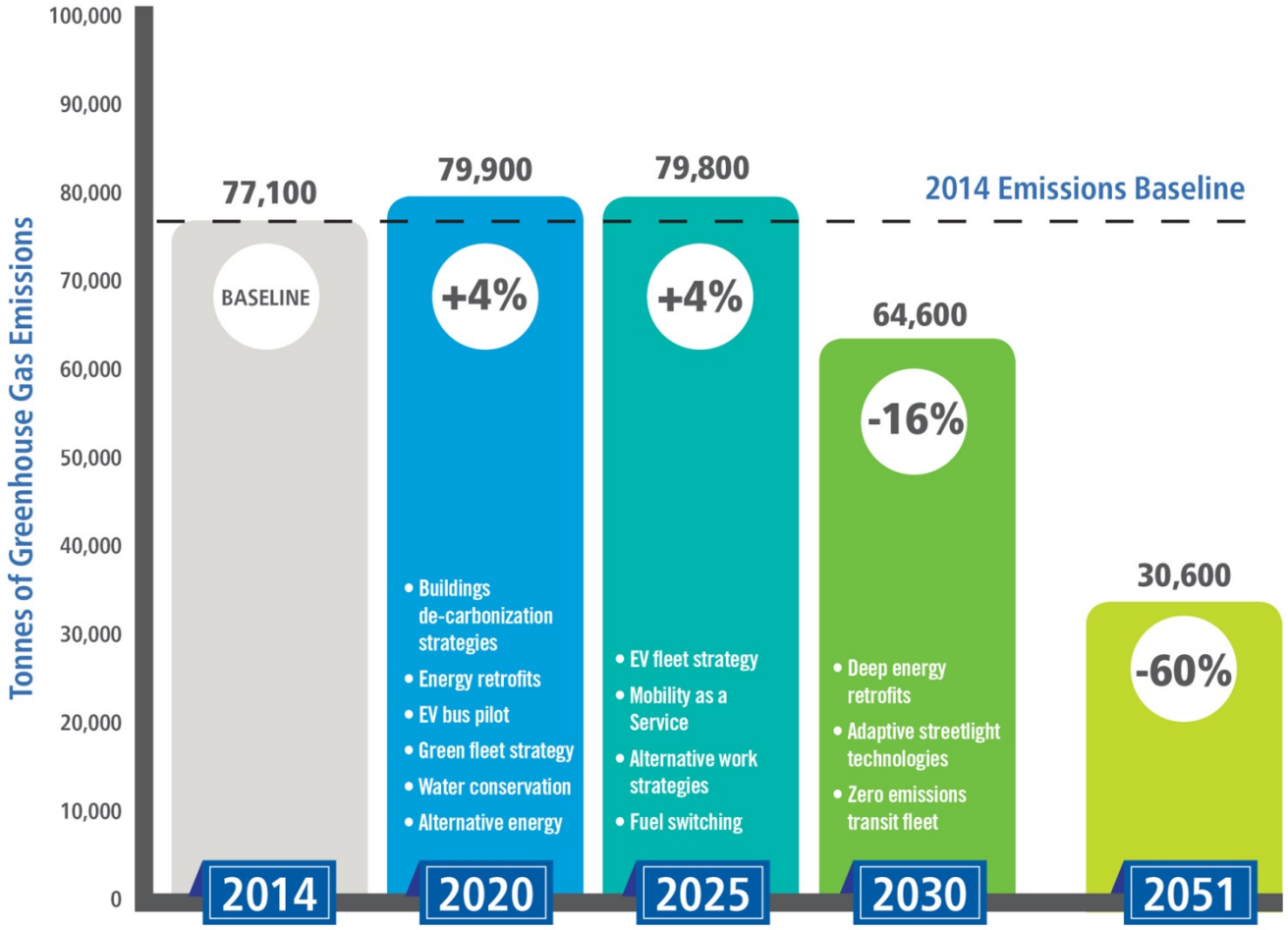


Interim targets are important to ensure that each generation of staff are making a concerted effort toward the aspirational 2051 goal. Figure 11 below illustrates this Plan's short-, medium- and long-term greenhouse gas emission targets based on the estimated potential of the initiatives proposed. Progress will be informed to Council through the annual Corporate Energy Report.

The largest investment, approximately $240 million over 33 years, will be to replace diesel transit buses with zero-carbon emissions technologies. In January 2019, Council approved a $7.74 million investment to pilot battery electric transit buses on two transit routes. Once proven, the conversion to battery electric transit buses will occur beyond 2025 and in concert with Transit's current replacement schedule. The other large investment, deep energy building retrofits, is targeted for closer to 2030. The

balance of required investments, such as water and wastewater conservation programs, is small but continuous over time and necessary to achieve long term benefits.

Figure 11: Corporate Greenhouse Gas Emissions Targets 2021 to 2051



York Region's absolute emissions are projected to increase until 2025 in order to support anticipated future Regional population growth. The main reasons for emissions growth are increases in:

- Buildings owned and operated by the Region.
- Corporate fleet size and distances travelled.
- Expansion of transit, ambulance, and police services.
- Social housing units.
- Water and wastewater treatment and pumping.

Each of these points is reflected in the various departmental plans and strategies designed to meet a greater demand in the future for Regional services.

Energy Conservation and Demand Management Initiatives – How Will We Get There?

The objective of this Energy Plan is to position York Region to achieve its long-term aspirational goal of net-zero carbon emissions by focusing on reducing energy and greenhouse gas emissions through three key pathways, namely:

- Focus on conservation leading to reduced demand
- Improvements in energy efficiency to meet service requirements using less fuel
- Switching to renewable and less emissions intense alternatives with the aim of achieving net-zero carbon

To achieve its long-term goal, short-term initiatives have been identified in this report that build momentum and lay the groundwork for deeper energy and greenhouse gas reduction actions to be implemented post-2030.

The proposed list of initiatives represent best-practice information collected from regional and local government peers as well as input from York Region staff and industry experts. Ranking of initiatives is based on a Sustainable Return on Investment analysis that gives priority to actions that have an average, high or very high impact rating. Most importantly, these initiatives are within York Region's control, and are strategically aligned to advance York Region towards its Vision 2051 aspirational goals.

The proposed initiatives in Table 15 have been split into two categories:

- **Leading Initiatives** – These initiatives result in direct energy and greenhouse gas reductions, as well as other benefits.
- **Supporting Initiatives** – These initiatives facilitate or provide the policy frameworks necessary to support leading initiatives but do not have directly quantifiable greenhouse gas emissions reductions.

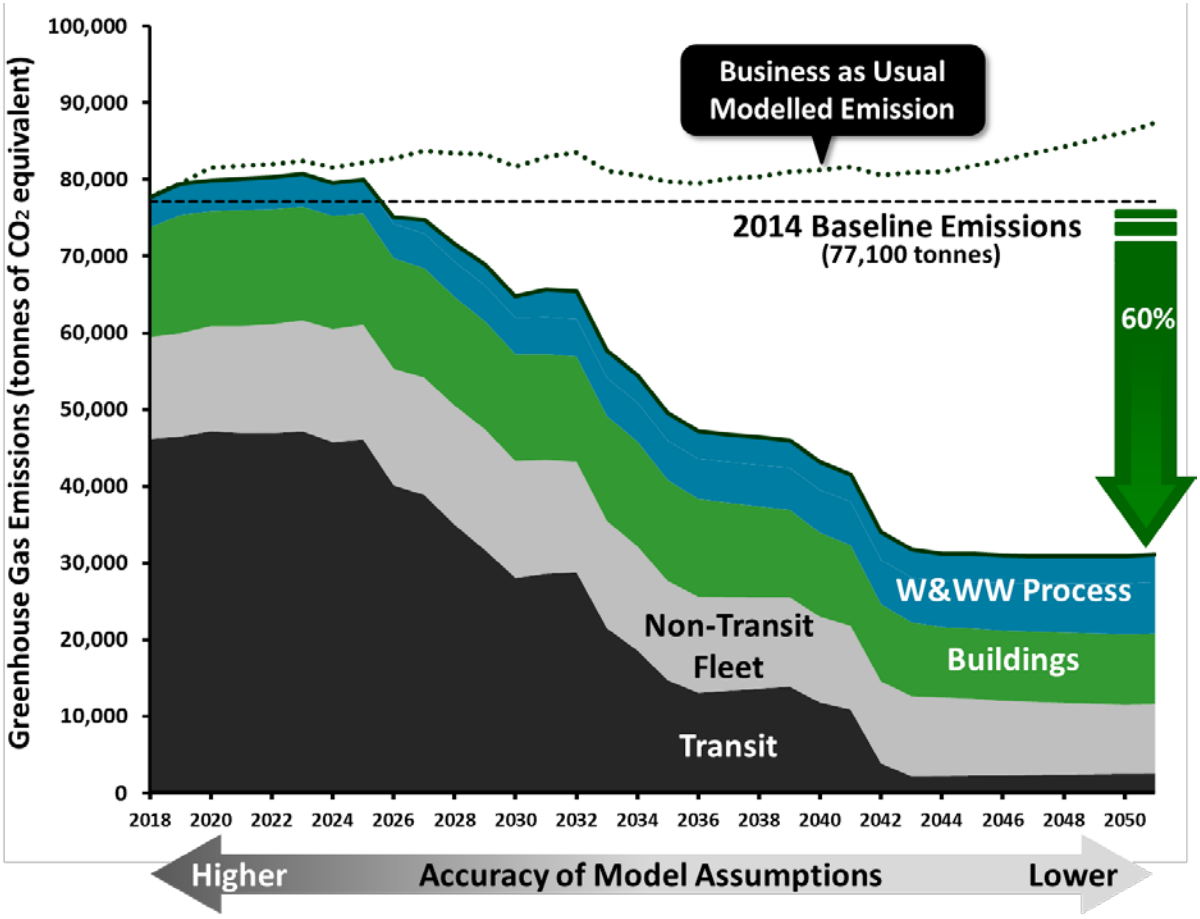
Table 15: Summary of Proposed Initiatives

Category	Action #	Initiative
Transit	T1	Pilot Projects and Evaluation of Technology T1a: Hybrid Diesel-Electric T1b: Battery Electric T1c: Hydrogen Fuel Cell
	T2	Mobility as a Service • Create a seamless link between all forms of available transportation (bus, taxi, subway, etc.) using cell phone applications to minimize use of single occupant vehicles
Buildings	B1	De-Carbonization Plans and Strategies: B1a: Energy Projects B1b: Existing Buildings (Deep Energy Retrofits) B1c: New Buildings (Construction Standards and Guidelines) • Reduce energy consumption and carbon emissions through energy efficiency
	B2	Ongoing-Commissioning • Ensure optimized building system functionality and operations through low/no cost measures
	B3	Energy Performance Building Monitoring: Energy Data Management and Dashboards • Tracking and monitoring using statistical analysis and real-time analytics to optimize setback and scheduling • Inform operations of equipment malfunction and corrective action
	B4	Alternative Work Strategies and Supportive Policies • Minimize emissions associated to commuting and reduction in occupied spaces
	B5	Housing York Inc. – Energy and Utility Management Plan Implementation • Energy efficiency plan for social housing
	B6	Materials Recovery Facility (100 Garfield Wright) Energy Study • Energy efficiency study
Non-Transit Fleets	F1	Electric Vehicle Strategy • Fuel switching from gasoline/diesel to electricity to reduce emissions

Category	Action #	Initiative
	F2	Vehicle Right-Sizing • Match the need with the type of vehicle to ensure the most efficient vehicle is used at all times
	F3	Anti-Idling Policy • Automated engine shut-down to conserve fuel lost to unnecessary engine idling
	F4	Driver Training Programs • Ensure driver training in energy efficient vehicle operations
	F5	Fleet Route Planning • Achieve the same result with fewer kilometers driven through pre-planned routes
	F6	Active and Sustainable Transportation Options • Enable and maximize transportation through public transit, carpools, cycling or walking
	F7	Enabling Actions • Initiatives that do not directly reduce greenhouse gas emissions but does support other initiatives that do (collaboration with local municipalities for example)
Water and Wastewater Processes	W1	Water Conservation and Sanitary Sewer Inflow and Infiltration Reduction Programs • Reduced water consumption and wastewater flows leading to lower energy consumption (water-energy nexus)
	W2	Water and Wastewater Facility Energy Conservation, Process Optimization and Renewable Energy Projects • Energy efficient projects including lighting and HVAC upgrades, wastewater aeration blower optimization, and wastewater effluent heat recovery
Streetlights, Signals, Beacons, and Transit Shelters	S1	Intersection Streetlight Conversion to Light Emitting Diode (LED) • LED consumes less energy compared to High Pressure Sodium (HPS)
	S2	Adaptive Streetlight Technologies • Dimmed streetlights that increase illumination when vehicles are present
	S3	Alternative Energy Sources for Stationary Assets • Solar powered transit shelters, signal beacons, and weather stations
Renewable Energy	R1	Application of Renewable Energy Technologies • Replace existing power with clean renewable energy

Figure 12 illustrates the impact of the proposed list of initiatives by area of focus.

Figure 12: Forecasted Business as Usual Greenhouse Gas Emissions and Impact of Proposed Initiatives



Based on the proposed initiatives, corporate emissions have the potential to decrease to 30,600 tonnes of greenhouse gases in 2051; a 60 per cent reduction compared to the 2014 baseline. It is estimated that the cumulative emissions savings from these initiatives over the next 33 years will avoid the release of approximately 927,000 tonnes of greenhouse gases. To put this into context, 927,000 tonnes of greenhouse gas emissions is equivalent to:

- Eliminating the annual emissions from 5,500 passenger vehicles
- Annual carbon sequestration of a mature forest almost the size of Newmarket (approx. 38 km^2)

If all recommendations in the Energy Plan are successfully implemented by 2051, it is forecasted that the Region will still emit 30,600 tonnes of greenhouse gas emissions per year. One alternative to achieve the aspirational Vision 2051 target of net-zero carbon would be to offset the remaining 30,600 tonnes of emissions per year through the purchase of renewable energy credits and carbon offsets. The anticipated annual cost to do so would be approximately $7 to $8.5 million[50] per year starting in 2051 and continuing until the Region successfully eliminated all remaining emissions. Although reducing emissions through carbon offsetting may be considered for future versions of the Energy Plan, carbon offsets and renewable energy credits are currently not recommended because

[50] Based on a carbon offset cost of $100 per tonne of carbon equivalent

their benefits lack the fiscal and long-term benefits offered by energy conservation and optimized efficiency. Future iterations of the Energy Plan will report on evolving technologies and the corresponding adaptation by the Region to help close the 30,600 tonne emissions shortfall.

Table 16 highlights the short-term (2019 – 2025) components and associated capital investments proposed in the Energy Plan.

Table 16: Proposed Capital Costs for 2019 - 2025 Initiatives

Component	Estimated Capital Cost ($ million)	Estimated Cumulative Energy Cost Savings ($ million)	Estimated Greenhouse Gas Reductions (tonnes)
Buildings	$5.90	$6.10	9,600
Water and Wastewater	$3.60	$5.00	900
Fleets	$0.34	$0.15	500
Electric Transit Bus Pilot	$7.74	$1.20	3,600
Streetlights	$1.50	$2.40	400
Total	**$19.08**	**$14.85**	**15,000**

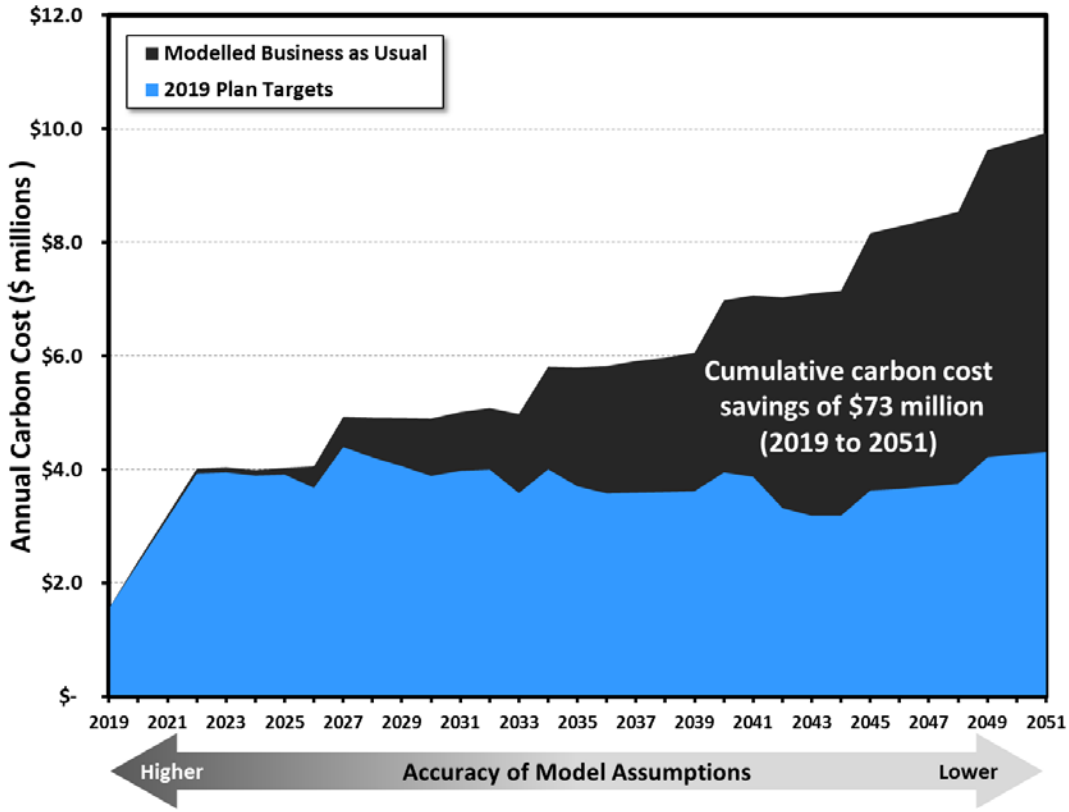
Initiatives proposed in the Energy Plan will require investments from each department that may be incremental to their current ten-year budgets. The Energy Plan is designed to minimize the financial impact on existing capital budgets by leveraging existing plans, planned asset replacement cycles, external funding, and internal reserves[51] that support Regional sustainability initiatives. Furthermore decreasing trends in the cost of energy efficient and renewable alternatives, in some cases, are near parity to original business cases. In the short-term, the Region is adapting to recent reductions in provincial funding and incentives to support initiatives. Departments will continue to develop business cases based on own-source revenue for funding and lifecycle cost savings as justification for conservation investments. However, staff remain optimistic that in the longer-term, additional provincial and federal funding may become available based on the impacts of climate change.

To date, there has been little direct cost to producers and consumers for emitting greenhouse gases. Business cases that support conservation have largely relied upon savings from the reduced purchase of fuel and from incentive programs. In 2019, the Federal government imposed a carbon tax of $20 per tonne of carbon dioxide equivalent (tonnes of greenhouse gases). The rate is expected to rise by $10 per year until it reaches $50 per tonne of carbon dioxide equivalent in 2022. Accordingly, by 2022, the Region is forecasted to be required to pay an additional $4 million for greenhouse gas emissions from operational activities in the form of additional fuel costs. Figure 13 illustrates the financial cost of

[51]Green Energy Reserve Fund – Bylaw 2016-78 https://www.york.ca/wps/wcm/connect/yorkpublic/e8b6bbe3-0bb3-4fb3-8771-265f51ff5026/2016-78.pdf?MOD=AJPERES

greenhouse gas emissions for the Region and the potential for cost avoidance through energy conservation.

Figure 13: Annual Cost of Greenhouse Gas Emissions



Energy conservation initiatives proposed in the Plan have the potential to avoid a cumulative $73 million[52] in federal carbon taxes from 2019 to 2051. The added cost of fossil fuel will become part of any future energy efficiency business cases.

The initiatives that are in place in this Energy Plan are discussed in greater detail in the following sections. End notes for specific initiatives have been provided to clarify data sources and assumptions used to derive projected greenhouse gas emission reductions, cost estimates, per unit costs, and annual energy savings.

Economic values presented in initiative tables in the following sections have been discounted to present day dollars using a discount rate of 5.0 per cent.

[52] Based on $50 per tonne in 2022 and stepped increases of $10 based on a 2.5 percent annual inflation rate

TRANSIT

Transit plays a critical role in York Region. It transports people throughout the community, reduces traffic congestion and greenhouse gas emissions by reducing the number of single occupant vehicles, and supports compact community developments. In 2018, York Region Transit accomplished this with 561 diesel buses and support vehicles which collectively account for almost half of the Region's annual energy usage and 58 per cent of its annual corporate greenhouse gas emissions.

York Region Transit has made considerable progress on the greenhouse gas reduction initiatives that were proposed in the 2016 Energy Plan. These actions have offset some of the increase in greenhouse gas emissions in York Region operations overall. Some of the initiatives successfully completed by York Region Transit include implementation of a vehicle retrofit, refurbishment and replacement program, fuel consumption tracking, driver training, and anti-idling programs. York Region Transit has also installed a series of fuel efficiency technologies in its bus fleet such as electric fan upgrades (mid-life), driver support systems, and topography dependent transmission shifting. York Region Transit has recently approved a pilot of zero-carbon emissions transit buses. Because transit bus emissions represent over half of the Region's current annual corporate greenhouse gas emissions, York Region Transit has a significant role in the Region's ability to achieve its aspirational Vision 2051 corporate goals.

Most of the transit initiatives identified in 2016 Energy Plan are currently underway and have been accounted for in the business as usual greenhouse gas emission forecast. These actions include:

- 2016-T1: Operator Behavior
- 2016-T2: Vehicle Right-Sizing
- 2016-T3: In-Vehicle Technologies
- 2016-T4: Service Optimization

The following is a list of the proposed transit initiatives for the current Plan that are discussed in detail in the following sections:

- T1: Pilot Projects and Evaluation of Technology
  - T1a: Hybrid Diesel-Electric
  - T1b: Battery Electric
  - T1c: Hydrogen Fuel Cell
- T2: Mobility as a Service (MaaS)

Other actions were identified but were either considered to be too far into the future to reliably predict the outcome of the technology (e.g. autonomous vehicles), or the initiatives did not sufficiently advance the Region toward its goal of net-zero carbon (e.g. compressed natural gas buses).

Compared to the 2014 baseline, transit emissions are expected to increase by 4 per cent in 2020 and then fall to a 1 per cent increase by 2025. By 2030 and 2051 emissions are expected to decline below the 2014 baseline emissions by 38 per cent and 94 per cent respectively (Table 17).

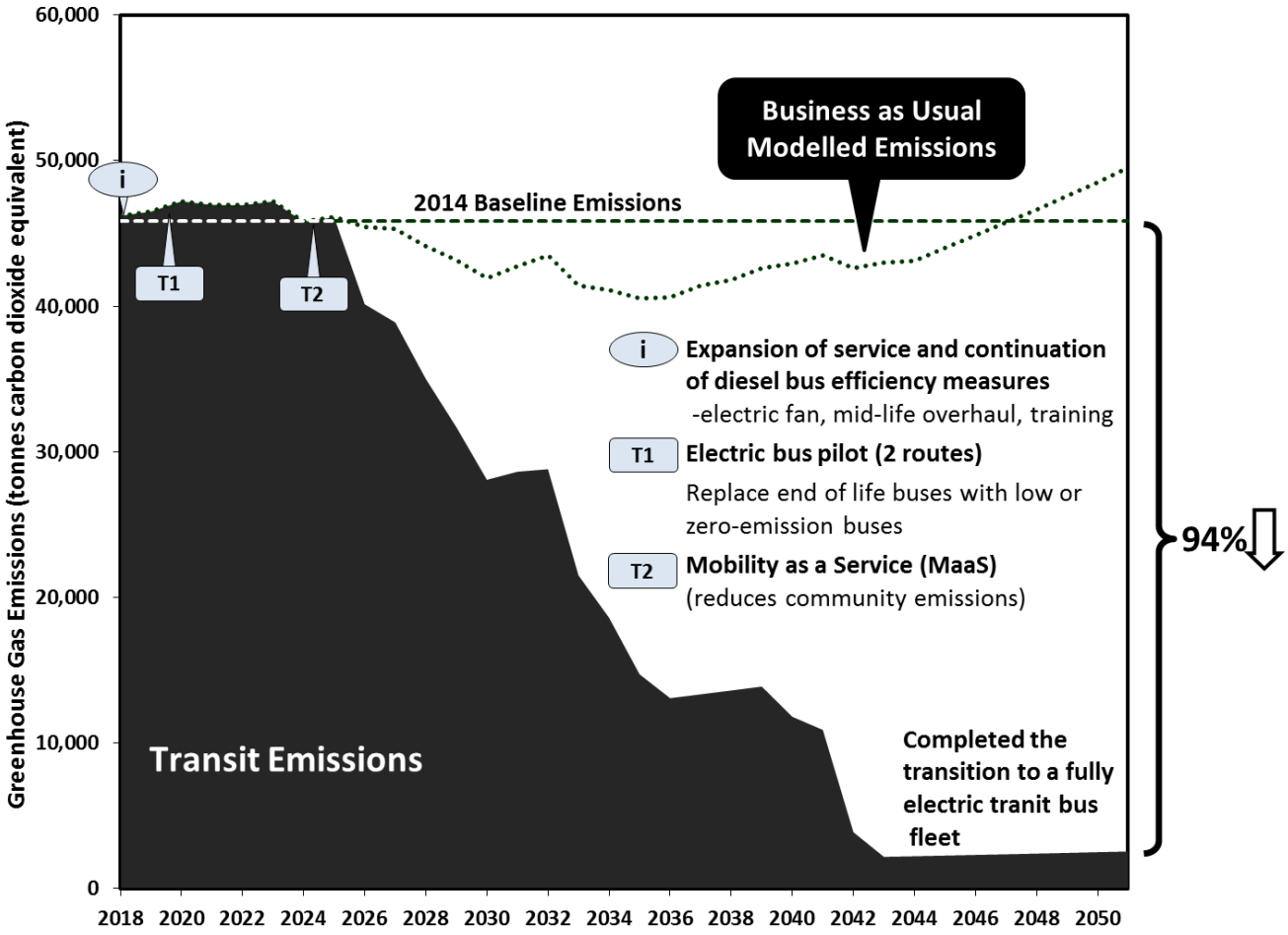
Table 17: Transit Greenhouse Gas Emissions Targets

Year Ending:	**2020**	**2025**	**2030**	**2051**
Emissions Target ***(tonnes of carbon dioxide equivalent)*****:**	47,200	46,100	28,100	2,600
Change from 2014 Baseline:	4%	1%	-38%	-94%

Table Note:
2014 Baseline Emissions = 45,570 tonnes of carbon dioxide equivalent

Figure 14 below illustrates the progression of greenhouse gas emissions reductions over time and identifies important milestones considered by the Plan in the development of short- and medium-term targets. The figure compares the forecasted emissions with the 2014 baseline and shows the impact from proposed initiatives.

Figure 14: Forecast of Transit Greenhouse Gas Emissions



T1: Pilot Projects and Evaluation of Technology

York Region Transit's next five-year Plan cycle (2019-2025) will be dedicated to the evaluation and proving of viable low-carbon emission and zero-carbon emission propulsion systems. Because the life-cycle of a transit bus at York Region can be up to 18 years, transit choices made in 2031 will still have an impact in 2051. The next five-year Plan cycle for York Region Transit will be about considering future demand, verifying assumptions, proving technologies, and developing business plans and implementation strategies.

From York Region Transit's alternative fuel study that evaluated potential propulsion technologies for transit buses, three technologies were identified as deserving further consideration: hybrid diesel-electric, battery electric, and hydrogen fuel cells.

T1a: Hybrid Diesel-Electric

Hybrid diesel-electric propulsion systems have already been integrated into other transit systems in Ontario. Data for hybrid diesel-electric technologies are readily available to the Region and do not require pilot-scale testing. Hybrid diesel-electric technologies represent an improvement in fuel efficiency and emissions reductions over conventional diesel transit buses. However, this technology

is not a zero-carbon propulsion system which means that it is only a fall-back scenario if zero-carbon technologies cannot be found or a successful business case developed for zero-carbon technologies. Ideally, York Region Transit hopes to skip this technology and implement zero-carbon transit solutions at the earliest opportunity. Table 18 presents the greenhouse gas emissions reduction and possible savings from the replacement of conventional diesel buses with hybrid diesel-electric buses if this step is necessary.

Table 18: Estimated Benefits from Hybrid Diesel-Electric Buses[ii]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative GHG Reduction (tCO_2e)
T1a: Hybrid Diesel-Electric Buses	$32.5 million	12,200	$2,664	$32.5 million	30,300	$1,073	60,000

Notes to Table:
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent

T1b: Battery Electric

Battery electric propulsion technology is currently the desired path for the Region because it has the potential to reduce transit fleet emissions by 90 per cent over its diesel counterpart. The technology itself is near-zero carbon emissions since approximately 90 per cent of Ontario's electricity is generated by sources which do not emit greenhouse gases[53]. There are several technical challenges that will need to be resolved for this initiative to be viable, including determining the appropriate type of electric vehicle and charging infrastructure, installing such infrastructure, training drivers and maintenance staff on battery electric vehicles, and planning service delivery within the limitations of battery electric systems. In addition to their environmental benefits, battery electric buses are also quiet and are anticipated to require less maintenance. Since battery-electric buses have no combustion engine, the maintenance costs and time associated with fueling and replacing transmission oil, antifreeze, filters, fan belts, and radiators are expected to be non-existent. Furthermore, administrative costs such as emissions testing for re-licensing are also expected to be saved. Table 19 presents the greenhouse gas emissions reduction and possible savings from the conversion to fully battery electric buses.

[53] Government of Canada, National Energy Board, 2017. Canada's Renewable Power Landscape 2017 – Energy Market Analysis, www.neb-one.gc.ca/nrg/sttstc/lctrct/rprt/2017cndrnwblpwr/prvnc/on-eng.html, accessed February 1, 2019.

Table 19: Estimated Benefits from Electric Buses[iii]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO2e)	Cost per tonne of GHG Reduction ($/tCO2e)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO2e)	Cost per tonne of GHG Reduction ($/tCO2e)	Cumulative GHG Reduction (tCO2e)
T1b: Electric Buses	Council Approved (in progress)	3,600	~$725	$46 million	45,800	$1004	746,000

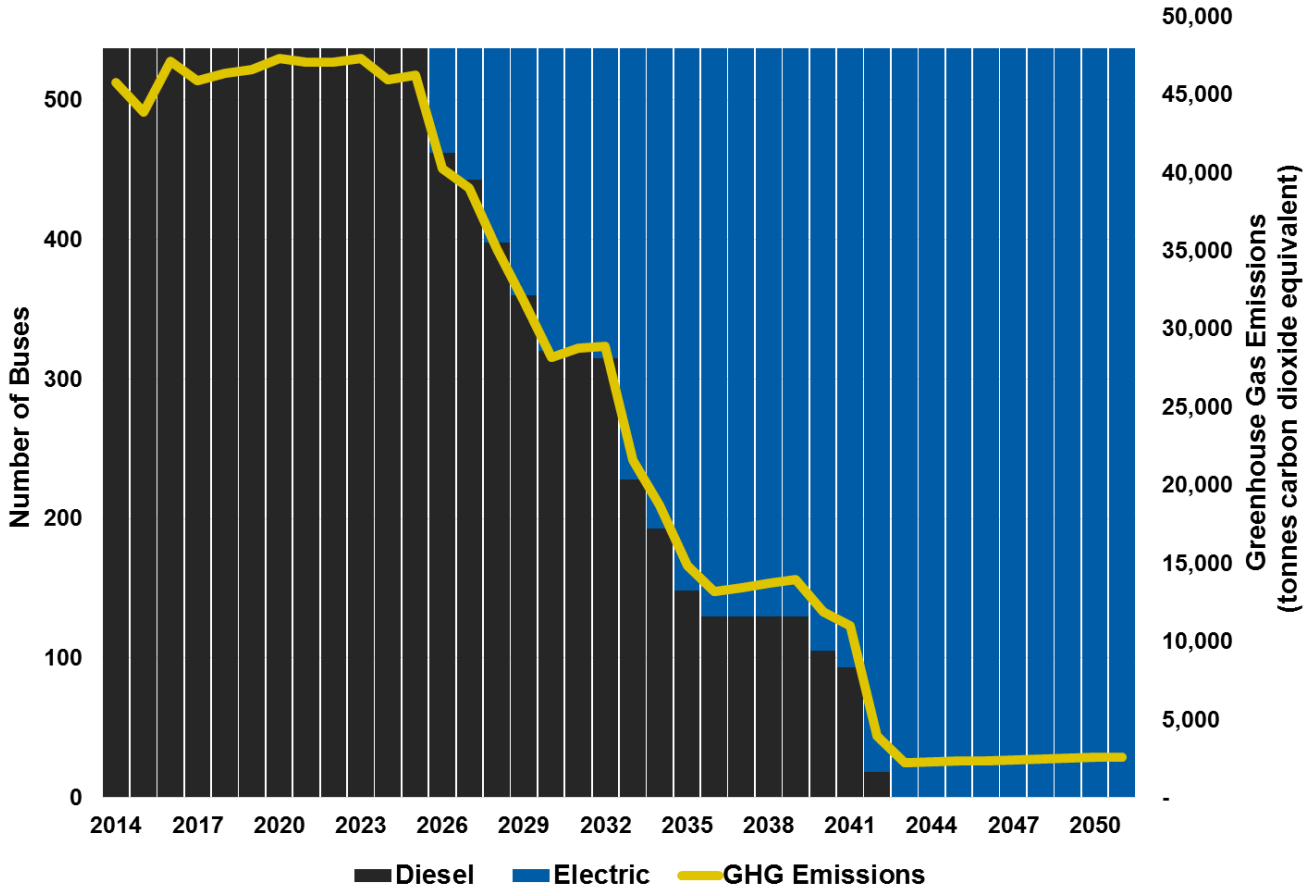
Notes to Table:
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent

Battery electric buses are still in their infancy relative to the adoption of hybrid diesel-electric technology. Exclusive of the infrastructure required to support the vehicle, battery electric buses are purchased at a premium over conventional diesel buses. In addition to proving the technology, a pilot program carried out by the Region will serve to support a business case and identify how operating savings can potentially offset some of the additional capital cost. As general adoption of the technology progresses, it is anticipated that the premium to purchase both the infrastructure and vehicles will fall over time.

The battery electric technology pilot test has gained the support of the local electricity distribution company; Newmarket-Tay Power Distribution Inc., which will offset a portion of the Region's capital costs and risk.

The impact on greenhouse gas emissions by switching to electric buses using the current bus fleet replacement rate is presented in Figure 15. The Energy Plan model assumes that the number of buses will not significantly change in the future, but that increased demand will be met with an increase in the number of kilometres travelled.

Figure 15: Bus Fleet Fuel Switching Transition and Transit Greenhouse Gas Emissions Forecast



T1c: Hydrogen Fuel Cell

Hydrogen fuel cell buses are a concept for York Region Transit to consider in the future. Although hydrogen fuel cells are a near-zero carbon emissions technology, the infrastructure required to support this technology is very different from that required by battery electric technologies. The Region's financial resources are currently limited to conducting a pilot study on only one technology and chose battery electric instead of hydrogen fuel cell technology since the former has the support of the local electricity distribution company as well as the Region.

T2: Mobility as a Service (MaaS)

Mobility as a Service or MaaS is an emerging trend that aims to encourage a shift away from single vehicle use and toward active transportation and transit. MaaS embraces the use of mobile technologies to support multi-modal trips including walking; riding conventional buses, rapid transit, and taxis; and/or using car-share and bike-share services. In addition to supportive infrastructure changes (rapid bus lanes, bike lanes, bike racks on buses, etc.), York Region Transit is currently working on the development of a mobile application that will support MaaS by providing options to the community on how to make their trip. This mobile application will eventually include ride-sharing

(Uber/lyft) options, on-demand services, and active transportation options such as walking and bike-sharing. Typically, with MaaS mobile systems, users either pre-pay for the service as part of a monthly mobility subscription or pay as they go using a payment account linked to the service. The principle behind MaaS is to make shared mobility so convenient that people will move away from personal vehicle use thus easing road congestion and reducing greenhouse gas emissions.

This initiative is a supporting action and therefore no greenhouse gas emissions reduction has been estimated for this initiative in this Energy Plan.

BUILDINGS

York Region owns or leases 123 facilities including: courts, hangars, paramedic response stations, administrative buildings, residence buildings, garages and vehicle storage. A buildings policy for Region facilities has been in place since 2006, which includes a requirement that all Region buildings with a floor area over 500 m^2 achieve a minimum Leadership in Energy and Environmental Design (LEED®) Silver certification. To date, York Region has 17 buildings that have achieved LEED® certification (1 Platinum, 5 Gold, 10 Silver, 1 Certified), and another 6 in various stages of design and construction that are expected to at least achieve a LEED® Silver certification.

York Region's buildings, social housing, and facility portfolio accounted for nearly 40 per cent of the total Region annual energy use in 2017 and 19 per cent of its annual greenhouse gas emissions. With an average life-cycle of 65+[54] years, many, if not most, of the Region's current building stock will still be active in 2051. Building certifications are an important first step toward reducing greenhouse gas emissions from energy consumption. However, achieving net-zero carbon emitting buildings will require more than a LEED® certification. New building construction will need to meet a higher standard of energy efficiency and existing buildings will require deep energy retrofits that radically overhaul the building envelop to reduce energy consumption, or a complete replacement of the building with one built to a higher energy standard.

Maintenance and ongoing-commissioning, a process of continuous monitoring, adjustment, and upgrades like building automation systems and energy sub-metering, will be key to maintaining the status quo. Building condition assessments and behavioral change programs are also important initiatives that will complement these actions. One of the most cost-effective greenhouse gas emissions avoidance measures is to improve existing building utilization rates therefore minimizing the number of new buildings requiring future construction.

[54] RSMeans construction industry cost database - https://www.rsmeans.com/

York Region's forecast of office space needs for the corporation estimates that to serve the projected annual year-over-year population growth of 2.1 per cent, staff levels will also need to increase proportionally over the same period. Policies that support enhanced staff mobility, hoteling, and improved space layouts, are currently being examined by the Region's Corporate Services Department to achieve the same level of functionality and comfort without the need for additional buildings or facilities. If additional buildings are needed, it remains undetermined what the form of ownership this will take (i.e. construct new, purchase existing, or lease).

At the time of the development of this Energy Plan, only the buildings already planned or in construction were considered. Using increased facility utilization methods, the Plan proposes that no new administrative building floor space will be added to the Region's portfolio post-2026. Although no additional buildings were included beyond this, the Plan accommodates the possibility of new buildings meant to replace older less functional buildings that may be beyond upgrading. The buildings initiatives presented herein leverage existing programs already underway, which include the required LEED® Silver performance benchmark for new construction, the ongoing implementation of building condition assessments and energy audits, the implementation of energy data management systems, building sub-meters, data analytic systems, and building energy management dashboards for operational staff.

The following is a list of the proposed building initiatives that are discussed in detail in the following sections:

- B1: De-Carbonization Plans
  - B1a: Energy Projects (Upgrade building technologies and energy efficiency)
  - B1b: Existing Buildings (Deep Energy Retrofit Analyses)
  - B1c: New Buildings (Construction Standards and Guidelines)
- B2: Ongoing-Commissioning
- B3: Energy Performance Building Monitoring: Energy Data Management and Dashboards

- B4: Alternative Work Strategies and Supportive Policies
- B5: Housing York Inc. – Energy and Utility Management Plan Implementation
- B6: Materials Recovery Facility – Energy Study

Compared to the 2014 baseline, building greenhouse gas emissions are expected to increase by seven per cent in 2020, and then fall to a four per cent increase in 2025 and almost back to the 2014 baseline by 2030. By 2051, building emissions are projected to decline 34 per cent below the 2014 baseline (Table 20). No significant early greenhouse gas emission reductions are expected from buildings as the key initiatives, like deep energy retrofits, are not expected to be implemented until 2035 or later.

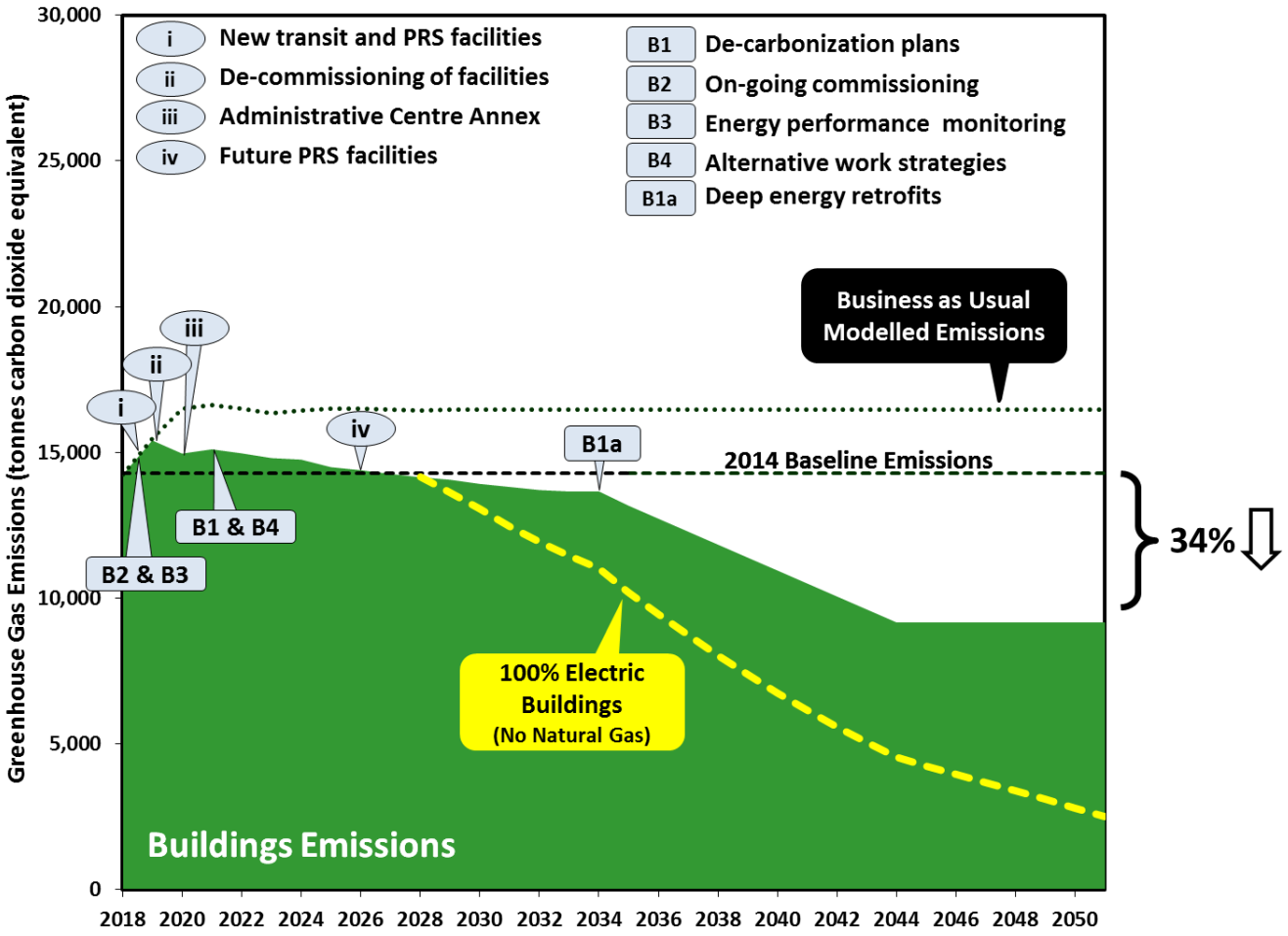
Table 20: Buildings Greenhouse Gas Emissions Targets

Year Ended:	2020	2025	2030	2051
Emissions Target *(tonnes of carbon dioxide equivalent)*:	14,600	14,200	13,700	9,000
Change from 2014 Baseline:	7%	4%	<1%	-34%

Table Note:
2014 Baseline Emissions = 13,679 tonnes of carbon dioxide equivalent

Figure 16 illustrates the progression of greenhouse gas emissions reductions over time and identifies important milestones considered by the Plan in the development of short- and medium-term targets. The figure compares the forecasted emissions with the 2014 baseline and shows the impact from proposed initiatives.

Figure 16: Forecast of Buildings Greenhouse Gas Emissions



B1: De-Carbonization Plans

Vision 2051 guides the Region to achieve zero carbon from Region buildings by 2051. Converting this guidance into action requires a unifying de-carbonization plan for each Region building; both existing and those considered for future construction.

B1a: Energy Projects

Several building energy audits have been completed on Regional facilities. These energy audits review building thermal performance, load distribution, existing equipment and controls schedules, occupancy patterns, lighting, and efficiency systems to identify energy and emission reduction opportunities. Typical recommendations range from lighting system upgrades, Building Automation Systems (BAS) upgrades, the use of insulation and weather-stripping, the installation of variable speed motors, and the installation of heat recovery systems. A series of high priority energy projects has been recommended and is included as part of the de-carbonization plan.

The energy and greenhouse gas savings from energy projects are presented in Table 21.

Table 21: Estimated Benefits from Building Energy Projects[iv]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative GHG Reduction (tCO_2e)
B1a: Energy Projects	$5.7 million	9,300	$613	$5.7 million	17,700	$322	52,900

Notes to Table:
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent

B1b: Existing Buildings (Deep Energy Retrofits)

Existing buildings are the largest source of greenhouse gas emissions in the buildings category of corporate emissions, and will remain so with the addition of planned future buildings.

De-carbonizing existing buildings will require deep energy retrofits that upgrade or replace equipment and building envelopes (e.g. roof, walls, windows) to achieve large energy and greenhouse gas emission reductions. The objective of deep energy retrofits is to create a building that can be heated and cooled with the minimum of energy. Deep energy retrofits involve at a minimum:

- Replacing the roof
- Replacing fenestrations (e.g. doors, windows, louvers, etc.)
- Harnessing sunlight for heat and illumination

A study conducted by Natural Resources Canada (NRCAN) estimates that deep energy retrofits can achieve upwards of a 60 per cent reduction in energy consumption and a similar reduction in greenhouse gas emissions[55]. Without deep energy retrofits in the Region's current portfolio of buildings, emissions reduction can be reduced simply by switching fuels for heat and hot water from natural gas to electricity. The potential for emissions reductions are illustrated in Figure 16 (above) by the yellow dashed line; a reduction of 6,600 tonnes of greenhouse gas emissions by 2051. However, this will come at a cost of approximately $8 million[56] per year to the Region's operating budget because electricity is more expensive than natural gas.

The next step in the plan to de-carbonize is to re-think heating, ventilation, and air conditioning (HVAC) systems. A significantly reduced building energy demand means smaller mechanical systems and options for cleaner fuel sources. Electrically driven heat-pumps generate significantly fewer greenhouse gas emissions than a natural gas boiler or furnace.

The final step to de-carbonize Regional buildings and achieve net-zero carbon can be to generate the electricity necessary to operate the mechanical systems through solar photovoltaics, wind power, or a presently unknown future clean technology. The option also exists for the Region to purchase Renewable Energy Credits (RECs) or plant trees to offset the remainder of its building emissions.

[55] Natural Resources Canada, 2018. *Retrofitting*, www.nrcan.gc.ca/energy/efficiency/buildings/20707, accessed on Sept 4, 2018.
[56] Using 2018 cost of electricity ~$0.19 per kWh

This Energy Plan recognizes that deep energy retrofits require a significant capital investment and that the Region has not accommodated for them in its current ten-year budgets. The current Plan recommends that in the term of this Plan, the Region develop long-term de-carbonization plans and strategies for each of its buildings that can be initiated when conditions arise in support of successful business cases. Having a plan will align the end-of-life rehabilitation initiatives for individual building components (e.g. roof, windows, mechanical equipment, etc.) with the Region's long-term de-carbonization efforts. De-carbonization plans should include a business case assessment that clearly defines capital budget requirements and the offsetting energy cost savings that will be reflected in future operating budgets. In collaboration with finance, a timeline that targets 2051 for all existing buildings to have had a deep energy retrofit completed is necessary if the Region is to achieve its Vision 2051 goal.

The energy and greenhouse gas savings from deep energy retrofits are presented in Table 22. The table reflects the reality that deep energy retrofits are not in the current ten-year capital budget.

Table 22: Estimated Benefits from Deep Energy Retrofit Activities[v]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative GHG Reduction (tCO_2e)
B1b: Deep Energy Retrofits	-	-	-	-	-	-	50,800

Notes to Table:
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent

B1c: New Buildings (Construction Standards and Guidelines)

The current LEED® Silver instruction for new and renovated Regional buildings will not achieve the Vision 2051 goal of net-zero carbon buildings. In fact, no single standard or guideline will achieve all of the Region's objectives for its buildings (e.g. net-zero carbon, occupant comfort, functionality, etc.). At the time that this Plan was developed, the Region has started the development of a Sustainable Buildings Policy. The Policy will encourage new buildings to earn both a LEED® Gold certification and be certified to the Passive House standard. Passive House specifically focuses on energy efficiency and thermal comfort. A Passive House certified building can significantly reduce energy costs and greenhouse gas emissions by up to 90 per cent[57] as compared to basic building code standards.

Passive House designs are expected to make efficient use of the sun, internal heat sources and heat recovery, rendering conventional heating systems unnecessary throughout even the coldest of winters. During warmer months, Passive House designs make use of passive cooling techniques such as strategic shading to keep occupants comfortably cool. The Passive House standard adopts an 'all or

[57] The Pembina Institute, 2016. *Accelerating Market Transformation for High-Performance Building Enclosures: State of market, policy developments, and lessons learned from the Passive House movement*, http://www.pembina.org/reports/passive-house-report-2016.pdf, accessed August 3, 2018.

nothing' certification approach whereas LEED® offers a graded certification approach (i.e. Platinum, Gold, Silver, or Certified).

York Region has not identified any plans for new building construction beyond what is already accounted for in this Plan. The first application of the Sustainable Building Policy will likely take the form of major renovations to existing Region buildings. This Sustainable Building Policy initiative is complementary to initiative B1b: Existing Buildings (Deep Energy Retrofits).

Supporting the Sustainable Building Policy are technical standards that direct contractors and project staff to focus on specific areas of performance that are important to the Region (e.g. energy and water efficiency, waste diversion, sub-metering, etc.). Strong enforcement of technical standards and accountability will limit the number of future retrofits and change orders and ensure that the Region receives long-term value for its investments. It is recommended that the Region develop a process with clear lines of accountability for all parties involved with the design, construction, and major renovation of Region buildings to follow. This will ensure the Sustainable Building Policy and technical standards are being met throughout.

This is a supportive action with no quantifiable benefits because there are no new buildings or major renovations that this initiative would apply to in the foreseeable future.

B2: Commissioning and Ongoing-Commissioning

Commissioning verifies that a building has been constructed to its proper specifications. The best time to commission a building is during construction, with special attention being paid to the building envelope. The building envelope influences most aspects of building performance such as energy consumption, occupant comfort and durability over the life of the entire building (65+ years). It is recommended that re-commissioning of buildings be scheduled before the warrantee period has expired on the building and on at least a five-year cycle or when the function of a building changes.

Ongoing-commissioning is the continuous commissioning of a building's entire systems over a specified period of time (typically every one to two years) to verify continuous peak performance over its useful life. Ongoing-commissioning and re-commissioning are important for reducing operating costs, risk of failures, to inform retrofit opportunities/future de-carbonization plans, and to extend the useful life of the assets.

Various pre- and post-implementation commissioning case studies show efficiency improvements on the order of five to 30 per cent through improved operations and maintenance. The studies also show that the resulting simple payback periods are less than two years[58]. Commissioning activities typically include:

- Alignment of the equipment to the manufacturers recommended settings
- Adjusting reset and set-back temperatures and temperature settings
- Staging/sequencing of boilers, chillers, and air handling units
- Adjusting and repairing dampers and economizers
- Modifying control strategies for standard hours of operation
- Eliminating simultaneous heating and cooling
- Balancing and adjusting of air and water distribution
- Verifying controls and control sequencing, including enabling and re-enabling automatic controls for set points, weekends, and holidays

Ongoing commissioning aligns with the existing building condition assessments and energy audit programs and can inform future plans to de-carbonize the Region's building portfolio. Table 23 summarizes the benefits from ongoing commission.

Table 23: Estimated Benefits from Ongoing-Commissioning Activities[vi]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative GHG Reduction (tCO_2e)
B2: Ongoing Commissioning	$190,500	310	$615	$571,000	2,800	$204	26,800

Notes to Table:
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent

To limit the impact of occupant behaviour on building performance, it is recommended that York Region use change management techniques to help occupants understand and adapt to the defined parameters (i.e. temperature range, light, air flows, etc.) for conditioned spaces.

[58] Office of Energy Efficiency and Renewable Energy, 2010. *Operations & Maintenance Best Practices: A Guide to Achieving Operational Efficiency,* https://www.energy.gov/sites/prod/files/2013/10/f3/omguide_complete.pdf August 3, 2018.

B3: Energy Performance Monitoring - Energy Data Management and Dashboards

Low-energy buildings do not always operate as they were designed resulting in poor energy performance. Annual energy performance reporting, through Energy Star Portfolio Manager or a third-party energy management system, can close the gap between predicted and actual energy use. Providing building operators with energy management dashboards will enable buildings to benchmark energy performance against prior year data and to other buildings in the portfolio that are of similar typology to identify underperformers and the need for improvements.

The Region currently has energy management dashboards to collect energy data; however, it is planning to acquire a next-generation energy data analytics software package to best analyze the findings.

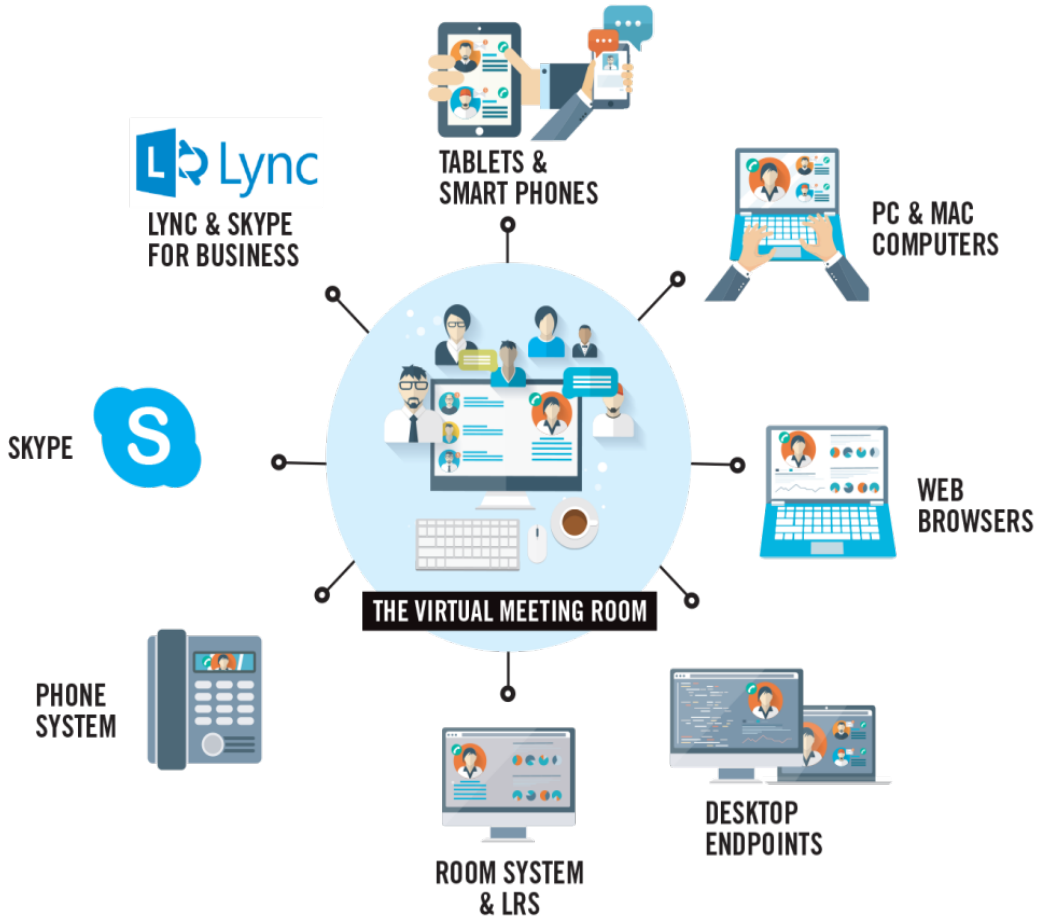
This is a supportive action and thus no greenhouse gas benefit can be accurately estimated specifically for the initiative within this Energy Plan.

B4: Alternative Work Strategies and Supportive Policies

A cost-effective energy and greenhouse gas reduction measure that the Region can deploy is the implementation of policies that allow for more flexible work environments and to dis-incentivize travel. These policies may include:

- **Alternative work schedules:** This strategy allows workers to vary their hours from day to day or compress more working hours into fewer days.
- **Telecommuting**: This strategy enables staff to work from home offices or other alternative spaces.
- **Shared offices and hoteling**: This strategy provides a flexible work environment that allows for better space utilization.
- **Virtual meeting rooms**: This strategy upgrades existing on-site meeting and board rooms so that they can support virtual and in-person meetings that create the same experience for the user as face-to-face meetings (Figure 17). York Region already has technology available to support virtual meetings (i.e., teleconferencing, use of webcams or Skype, and Lync, a messaging/net meeting service that works on individual computers with cameras). By creating a cultural shift away from in-person meetings, York Region can reduce travel related costs to both staff time and reimbursement of fees and also reduce greenhouse gas emissions.

Figure 17: Virtual Meeting Room Example



York Region's Property Service Branch is currently working on an initiative in support of virtual meetings and alternative working arrangements. The City of Edmonton recently prepared a table listing various alternative work strategies, the primary benefit and outcome drivers, related information technology requirements, and space and people tools that are required to support the implementation and management of alternative work strategies.

This is a supportive action, with the potential greenhouse gas benefit not easily quantified for this Energy Plan.

B5: Housing York Inc. – Energy and Utilities Management Plan Implementation

Housing York Inc. provides affordable housing in York Region and is a separate legal entity solely owned by The Regional Municipality of York. The Climate Change and Energy Conservation Group at the Region and Housing York Inc. staff participate in working groups and share best management practices. Housing York Inc. has developed its own Energy and Utilities Management Plan (EUMP) to be a partner in achieving Vision 2051's aspirational goal of zero carbon from buildings. The EUMP is scheduled for quarter four of 2019 and, if approved, will be implemented over a five year term starting in 2020. Phase two is scheduled for 2024 to coincide with the EUMPs revision. Housing York Inc.'s

Energy and Utilities Management Plan includes the following categories of initiatives listed in Table 24 below.

Table 24: Housing York Inc. Energy Utility Management Plan – Key Milestones (2020 to 2024)

Time Period	Key Phase Milestone
2020 – 2024	**De-Carbonization Plan:** • Start work on a unifying long-term vision for how Housing York Inc. will achieve its Vision 2051 goal of net-zero carbon for new and existing buildings. **New Construction:** • 100 per cent LEED® Silver certified (or equivalent energy and utility consumption performance levels) **Existing Construction:** • Perform energy audits across portfolio • Perform net-zero energy feasibility study • Installing highly efficient energy reducing equipment/measures • Commissioning and re-commissioning **Renewable Energy:** • Perform detailed renewable energy feasibility study across portfolio • Install rooftop photovoltaic system at one property (minimum) **Utility Consumption (Natural Gas/Electricity/Water):** • Convert one natural gas heated building to renewable energy sources • 50 per cent of apartment buildings to have low-flow water fixtures installed **Greenhouse Gas Emissions:** • Target 15 per cent greenhouse gas emissions reduction from 2017 levels by end of 2024 Phase one EUMP

B6: Materials Recovery Facility - Energy Study

The Materials Recovery Facility (MRF) located at 100 Garfield-Wright Boulevard in East Gwillimbury collects and sorts the contents of curbside blue bins and organics. Materials that can be recycled are separated from the waste stream and sold back to the market. The Materials Recovery Facility is unique from other facilities because the building and equipment are owned by the Region, but the operation of the facility is under a contract with a third-party. Additionally, Extended Producer Responsibility legislation is anticipated to transfer the role of recycling from the municipality to the companies that are producing and selling the

products. Therefore, the future of this facility after 2023 is largely unknown. The challenge for moving forward with energy conservation at the Materials Recovery Facility is that a business case must achieve a very short payback (less than 3 to 4 years) within which to recover the initial investment.

A summary of future potential initiatives is provided in Table 25 below. No greenhouse gas emissions savings from potential initiatives have been included in this Energy Plan due to the uncertainty related to the facility.

Table 25: Proposed Energy Efficiency Initiatives for Materials Recovery Facility

Proposed Initiatives	
Power Factor Correction	Install capacitor bank to correct low power factor. Estimated savings of $1,200 per month on utility invoice demand cost may be achieved. Project payback is estimated to be about 1.5 – 2 years.
Night Setback/Setup	Execute temperature setbacks/setups in occupied areas. Project payback is estimated to be 0.5 year.
T8 Light Bulb to Light Emitting Diode (LED) Retrofit	Install “Plug and Play” LED bulbs that can fit into the existing T8 fixtures. Payback is estimated to be six (6) years. Financials improve if done as part of the regular replacement cycle for burned out T8 bulbs.

Additional energy conservation opportunities exist (Table 26) but require the future of the Materials Recovery Facility to be known so that a business case can be developed that will successfully recover the initial project investment.

Table 26: Other Potential Energy Conservation Measures (post 2024)

Potential Future Initiatives (Post 2024)	
Building Controls	Save up to 15 per cent in energy costs by installing a Building Automation System to control the operation of the facility’s ventilation and thermal comfort levels.
Occupancy Lighting Controls	Save up to 30 per cent by installing occupancy sensors in offices, lunch/break rooms, washrooms, and sorting rooms.
Pressure Differential Sensors	Save up to 10 per cent in filter and labour costs by using sensors to indicate when ventilation filters need to be changed
Light Emitting Diode (LED) Exit Signs	Save up to 50 per cent on exit lighting costs by replacing incandescent exit signs with LED lamps or entirely new LED exit signs.
Thermal Solar Wall and Solar Roof Panels	Offset heating costs with solar wall preheating of ventilation air. Generate some of the site’s electricity with solar panels installed on the roof.
Low-flow Water Closets and Urinals	Save 30 per cent on water costs by installing low-flow fixtures, toilets, and urinals.
Vending-Misers	Install Vending-Misers on vending machines to reduce energy consumption for refrigeration and display lighting.
Building Re-commissioning	Save 10-20 per cent on energy costs by re-commissioning building systems every five years.

Potential Future Initiatives (Post 2024)	
Staff Training	Train staff to identify and act on energy saving opportunities such as turning off computer monitors at night and computers, printers, and other equipment over weekends.
Control Changes to Variable Frequency Drive (VFD)	Set VFD motors to bypass as most are currently operating at 100 per cent.

NON-TRANSIT FLEET

York Region owns over 1,200 vehicles that are operated by York Region Police, Paramedic and Seniors Services, Roads Branch, Transportation Services, and Environmental Services, among others. Non-transit fleet fuel consumption amounts to only 1 per cent of the annual total energy consumed by the Region, but 17 per cent of its 2017 greenhouse gas emissions. The bulk of the fuels used by the fleet are gasoline and diesel which have higher greenhouse gas intensities than other fuels like natural gas and electricity.

Non-transit fleet greenhouse gas emissions are the direct result of a wide and varied range of services delivered to the community. No single measure can eliminate all non-transit fleet greenhouse gas emissions; a suite of strategies and actions are required for a balanced overall reduction. These initiatives include:

- F1: Electric Vehicle Strategy
- F2: Vehicle Right-Sizing
- F3: Anti-Idling Policy
- F4: Driver Training Programs
- F5: Fleet Route Planning
- F6: Active and Sustainable Transportation Options
- F7: Enabling Actions

Compared to the 2014 baseline, non-transit fleet emissions are expected to increase by less than 1 per cent in 2020, 9 per cent in 2025, 11 per cent in 2030 and then decline 34 per cent by 2051 (Table 27).

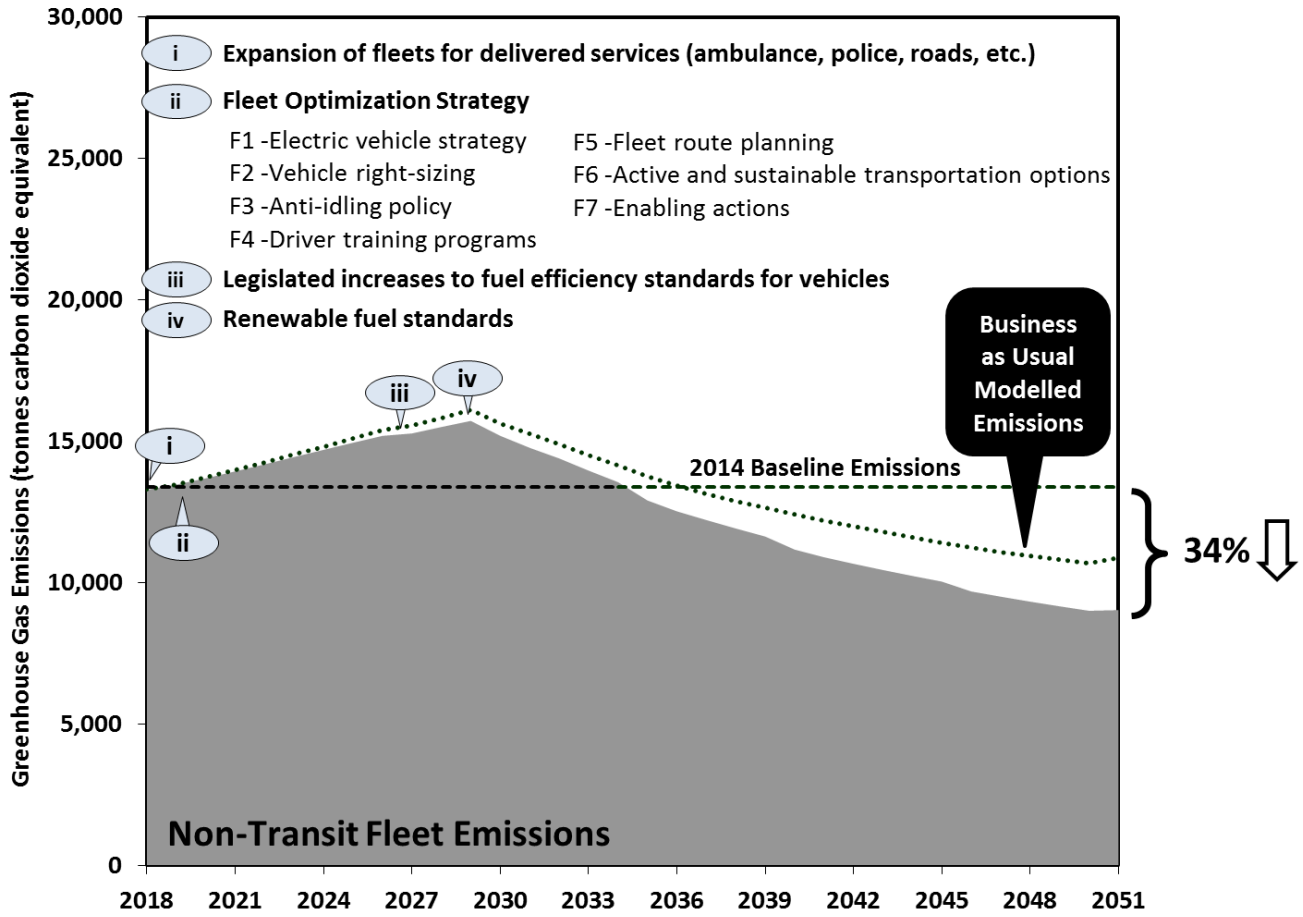
Table 27: Non-Transit Fleet Greenhouse Gas Emissions Targets

Year Ended:	2020	2025	2030	2051
Emissions Target (tonnes of carbon dioxide equivalent):	13,700	14,900	15,200	9,000
Change from 2014 Baseline:	<1%	+9%	+11%	-34%

Table Note: 2014 Baseline Emissions = 13,669 tonnes of carbon dioxide equivalent

Figure 18 illustrates the progression of greenhouse gas emissions reductions over time and identifies important milestones considered by the Plan in the development of short- and medium-term targets. The figure compares the forecasted emissions with the 2014 baseline and shows the impact from proposed initiatives.

Figure 18: Forecast of Non-Transit Fleet Greenhouse Gas Emissions

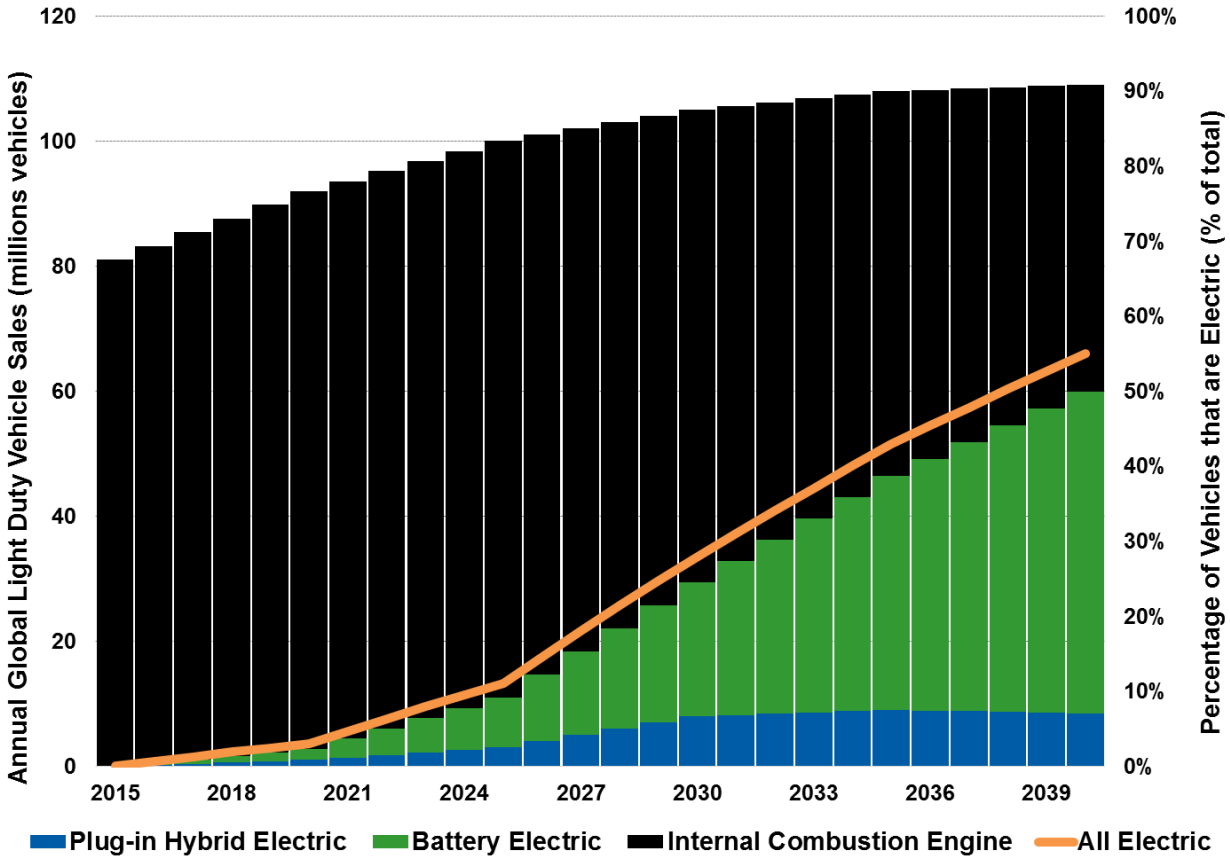


F1: Electric Vehicle Strategy

According to Bloomberg New Energy Finance, by 2040, nearly 55 per cent of vehicle sales will be electric. Cost parity to equivalent gasoline powered vehicles is projected by the mid-2020s[59] (Figure 19). The variety and types of electric vehicles available for sale over the next five years are also expected to expand from the current offering of light-duty vehicles to pick-up trucks and sports utility vehicles. As the battery life, charge time, and cost-parity of electric vehicles have improved, it is now feasible for York Region to reduce energy and greenhouse gas emissions from its non-emergency fleet through the purchase and use of electric vehicles (including the use of Plug-In Hybrid technology). This will not only support corporate needs but will encourage the public to make their own investments in electric vehicle technology as well.

York Region is currently working on an electric vehicle charging policy through its fleet greening strategy so that the Region can make financially prudent decisions regarding the purchase, operation, and maintenance of its light duty non-emergency electric vehicle fleet.

Figure 19: Forecasted Electric Vehicle Global Sales[60]



[59] Bloomberg New Energy Finance, 2018, *Electric Vehicle Outlook 2018,* https://about.bnef.com/electric-vehicle-outlook/, accessed August 15, 2018.
[60] Bloomberg Finance, 2018. *Electric Vehicle Outlook 2018*, https://about.bnef.com/electric-vehicle-outlook/, accessed on Sept 4, 2018.

At a minimum, a green fleet strategy is recommended to:

- Establish an electric vehicle target for light duty vehicles (e.g. require a minimum of 50 per cent of annual light-duty vehicle purchases to be electric vehicles by 2030, etc.).
- Determine a process that incorporates vehicle right-sizing requirements to identify which vehicles can be replaced with electric vehicles.
- Include electric vehicle charging infrastructure, or at a minimum, rough-ins during construction to support future vehicle charging infrastructure (electric vehicle ready) as part of the Region's buildings technical standards.
- Establish a plan to install electric vehicle infrastructure that:
    - Serves daytime public and non-fleet charging and nighttime fleet charging (where feasible).
    - Identifies priority locations and opportunities to develop integrated multimodal mobility hubs that include electric vehicle infrastructure on York Region-owned property.
    - Identifies suitable locations for cost-effective charging to allow for a range of vehicle types and charges.
    - Identifies priority areas for the co-location of electric vehicle infrastructure that supports both light-duty and heavy-duty vehicles.
    - Identifies opportunities to upgrade charging infrastructure at Region properties to allow for sub-metering of charging activity, improve remote management capabilities, and increase charging options.
    - Includes a system to monitor billing and electricity use for the electric vehicle fleet to allow for tracking, allocating, and reporting of costs and benefits.
    - Includes a phased approach to address increased charging access (e.g. encourage other types of electric vehicles, encourage at-home charging when feasible, etc.).

While many non-essential service vehicles can soon be replaced with electric vehicles that are available on the market, York Region's capability to replace emergency vehicles or heavy-duty vehicles with vehicles that use alternative fuels and/or low emissions fuels will rely upon the advancement of electric vehicle technology and enabling legislation. Specifically, legislated emergency service demands will take precedence over the Energy Plan recommendations wherever the two are in conflict.

Table 28 presents the greenhouse gas reduction and possible savings from the implementation of an electric vehicle strategy for the non-transit, non-emergency fleet.

Table 28: Estimated Benefits from Electric Vehicle Strategy[vii]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative GHG Reduction (tCO_2e)
F1: Electric Vehicle Strategy	$343,000	280	$1,225	$470,000	1,650	$285	26,600

Notes to Table:
Cost parity is expected by 2025.
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent

F2: Vehicle Right-Sizing

York Region has a corporate vehicle replacement program and practice for all non-transit fleet which requires the purchase of the most fuel-efficient vehicles appropriate for York Region operations, while considering the lifecycle cost of the vehicle. A vehicle right-sizing replacement program is recommended to be data driven using available telematics data. Telematics is a Global Positioning System (GPS) device that is used to monitor vehicle fuel consumption, speed, hard acceleration, idling, and real-time location of the vehicle (for route planning). Telematics data and fueling technologies will support a York Region Low-Carbon Vehicle Standard and create a hierarchy of most-preferred to least-preferred technologies based on greenhouse gas emissions for a range of operational activities. It is also recommended that York Region develop a policy or guideline that assigns vehicles based on identified need rather than driver preference.

Using a Low-Carbon Vehicle Standard, life cycle analysis, and vehicle operational demands, York Region will be able to purchase vehicles that provide the same level of operational service and the highest possible greenhouse gas reductions. It is estimated that a telematics and vehicle right-sizing program can achieve upwards of 10 to 17 per cent in greenhouse gas reductions from non-transit fleet operations[61]. For the purposes of this plan, a 10 per cent reduction was estimated.

Table 29 presents the greenhouse gas reduction and possible savings from the implementation of a vehicle right-sizing program.

[61] City of Richmond, 2013, *Green Fleet Action Plan*, https://www.richmond.ca/__shared/assets/Green_Fleet_Action_Plan38974.pdf, accessed August 12, 2018.

Table 29: Estimated Benefits from Vehicle Right-Sizing[viii]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative GHG Reduction (tCO_2e)
F2: Vehicle Right-Sizing	-	200	-	-	850	-	4,500

Notes to Table:
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent

F3: Anti-Idling Policy

Some corporate vehicles at York Region have anti-idling technology installed which ensures that vehicles can maintain interior temperature, power to equipment, and battery charge without wasteful fuel consumption and the additional generation of greenhouse gas emissions.

Similar to the 2016 Energy Plan update, it is recommended that York Region develop an appropriate anti-idling policy applicable to all staff that also recognizes the needs of emergency services. For example, medicine and patients must be kept within a specific temperature range and thus ambulances will need to idle to maintain such temperatures. Similarly, power must be supplied to run equipment and interior lights without drawing down too much power from the battery. All staff should be engaged on an ongoing basis about the vehicle anti-idling systems, policies, and the importance of not idling vehicles unnecessarily.

An anti-idling policy is a best management practice that should be deployed and enforced as part of a broader fleet fuel management strategy to reduce fleet fuel usage. On this basis, no greenhouse gas emissions reduction has been estimated for this initiative for this Energy Plan.

F4: Driver Training Programs

Although York Region has an employee driver training program, its focus is on driver safety as opposed to efficient vehicle operation. As a result of the stakeholder workshops, similar to the 2016 Energy Plan update, it is recommended that York Region develop a formal Efficient Driver Training program that would teach employees fuel efficient driving practices including: optimal driving behaviours, anti-idling, hypermiling (a driving practice utilizing efficient stopping and acceleration), ridesharing, and vanpooling.

This is a best management practice and thus no greenhouse gas emissions reduction has been estimated for this initiative for this Energy Plan.

F5: Fleet Route Planning

Fleet route planning involves the consolidation and elimination of trips using information technology and route optimization. Using telematics, it is recommended that York Region study vehicle routes to see if they are optimal in terms of fuel and driver time efficiency. During this review, York Region is recommended to consider other technologies or opportunities to reduce travel.

No greenhouse gas emissions reduction has been estimated for this initiative for this Energy Plan.

F6: Active and Sustainable Transportation Options

Active transportation and other sustainable transportation options, like electric vehicle car sharing, electric bikes, virtual meetings, and alternative work arrangements, can play key roles in reducing York Region's greenhouse gas emissions as well as potentially reduce costs associated with employee travel. In 2017, staff drove their personal vehicles approximately 4 million kilometres for corporate use, consumed 396,000 litres of gasoline, emitted 916 tonnes of greenhouse gases, and was reimbursed $2.2 million by York Region. Comparatively, conversion to a fully electric vehicle fleet pool along with supporting policies had the potential to save the Region up to $1.5 million of its 2017 mileage reimbursement costs (does not include capital cost of electric fleet)[62].

York Region can expand active transportation programs and facilities for Region staff in all locations, by providing employee transit programs, access to electric bikes, access to vehicles for sharing etc. Concurrently, the uptake on these options could be supported with programs or policies that dis-incentivize personal vehicle use for corporate business purposes. An example exists in Ontario's Public Service where meetings beyond 24 kilometres' distance from an employee's home or office are required to be attended by tele/video conference or through the use a fleet vehicle. If staff choose to attend in person, their mileage is not reimbursed. A complimentary course of action for the Region is the necessity to have fuel efficient (ideally electric) vehicles available for staff that do choose to attend using a fleet vehicle. The use of tiered mileage reimbursement rates can also serve to limit personal vehicle use. For example, staff could be reimbursed based on an annual declining scale such as 55-cents for the first 2,500 kilometres per year, 49-cents for the next 2,500 kilometres, and 35-cents beyond that. This policy will have implications for the Region's contract with its Unions but can be a discussion point in future negotiations.

The accounting for employee mileage can be used as a baseline for estimating the value of alternative transportation options and to support an associated business case.

F7: Enabling Actions

The initiatives identified for the non-transit fleet are being led by the Green Fleet Coordinator (a 2016 Energy Plan update initiative). This is an internal one-year secondment position focusing on implementing the non-transit fleet initiatives, as well as the following:

[62] This is based on an estimated fuel, insurance, maintenance and repair costs of $0.17 per km value derived in the study - Jens Hagman, Sofia Ritzén, Jenny Janhager Stier, Yusak Susilo, 2015, *Total Cost Of Ownership And Its Potential Implications For Battery Electric Vehicle Diffusion*, https://ac.els-cdn.com/S2210539516000043/1-s2.0-S2210539516000043-main.pdf?_tid=b99b0ef6-a9ab-4703-b6d7-385464efaf4f&acdnat=1536605285_7d23708686c57d48b64fc04702ea2d9b, accessed August 12, 2018.

- Meeting and collaborating with lower tier municipalities to share best practices, seek funding opportunities, etc.
- Leading and coordinating a Green Fleet Working Group.
- Promoting and educating the value of green fleets to various York Region stakeholders.

No greenhouse gas emissions reduction has been estimated for this initiative for this Energy Plan.

WATER AND WASTEWATER

As a regional municipality, York Region is the wholesale supplier of water and wastewater services to its nine local municipalities, and is responsible for bulk supply, treatment and storage of drinking water, and conveyance and treatment of wastewater. This infrastructure equipment operates 24 hours a day, seven days a week, and accounted for 16 percent of the Region's total energy use and 5 per cent of its greenhouse gas emissions in 2017.

The water and wastewater initiatives presented herein leverage existing programs already underway, including the water conservation, sanitary sewer inflow and infiltration reduction, and process energy programs. These programs are managed by the Infrastructure Asset Management branch and are reported annually to the Province and/or internally.

For this Energy Plan, York Region's energy-related water and wastewater initiatives have been organized into two main categories:

- W1: Water Conservation and Sanitary Sewer Inflow and Infiltration Reduction Programs; and,
- W2: Water and Wastewater Facility Energy Conservation, Process Optimization and Renewable Energy Projects.

Compared to the 2014 baseline, water and wastewater emissions are expected to increase by up to 158 per cent by 2051 (Table 30) through the addition of the Upper York Water Reclamation Centre (Upper York WRC) that is scheduled to begin operation in 2026. The Upper York WRC requires an additional level of water treatment, called reverse osmosis, which is a very energy intensive process. Although water and wastewater emissions are anticipated to increase overall, the above actions will help to reduce energy consumption within the current processes.

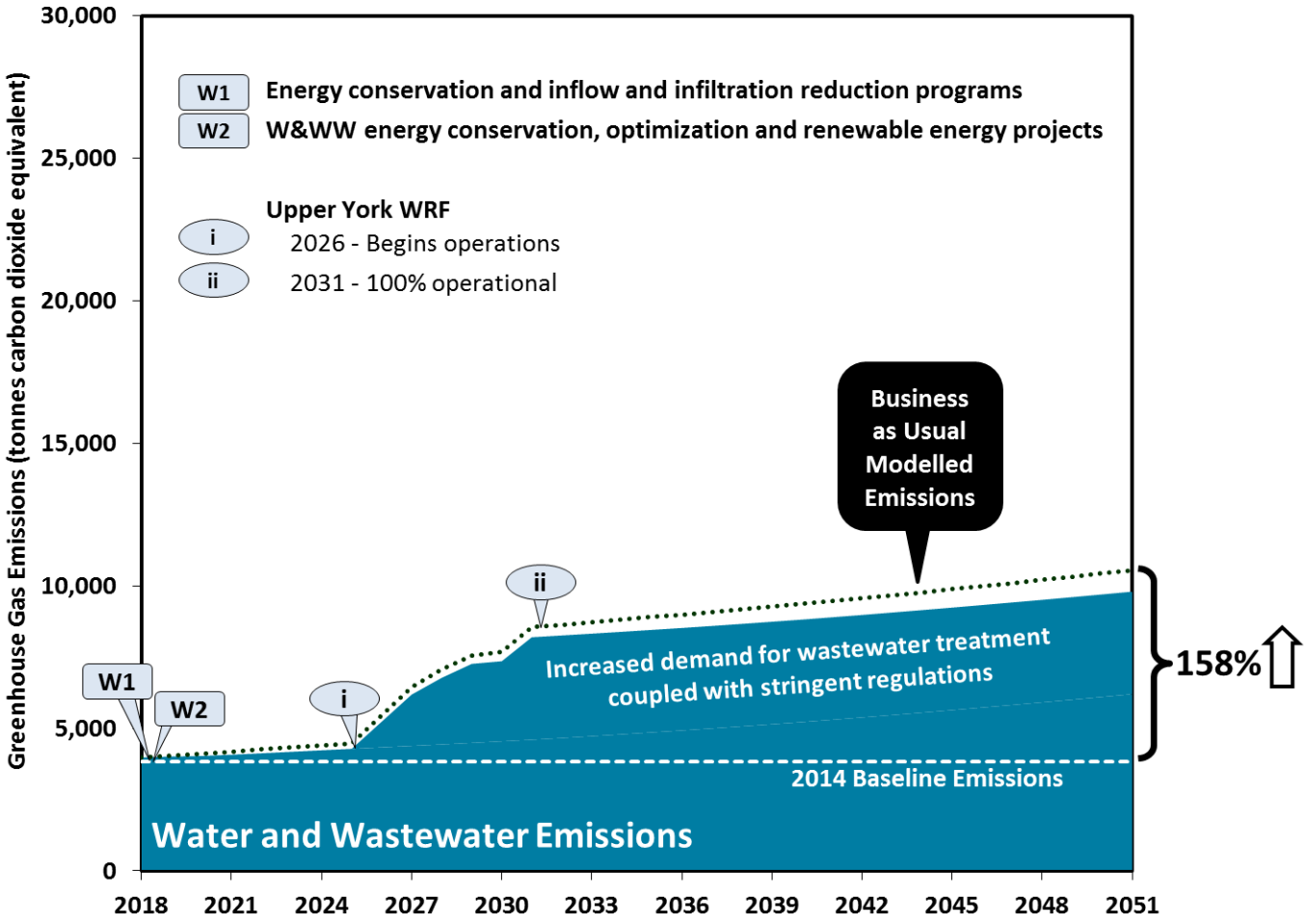
Table 30: Water and Wastewater Greenhouse Gas Emissions Targets

Year Ended:	2020	2025	2030	2051
Emissions Target (tonnes of carbon dioxide equivalent):	4,000	4,300	7,300	9,800
Change from 2014 Baseline:	+6%	+13%	+92%	+158%

Table Note:
2014 Baseline Emissions = 3,832 tonnes of carbon dioxide equivalent

Figure 20 illustrates the progression of greenhouse gas emissions changes over time and identifies important milestones considered by the Plan in the development of short- and medium-term targets. The figure compares the forecasted emissions with the 2014 baseline and shows the impact from proposed initiatives.

Figure 20: Forecast of Water and Wastewater Greenhouse Gas Emissions

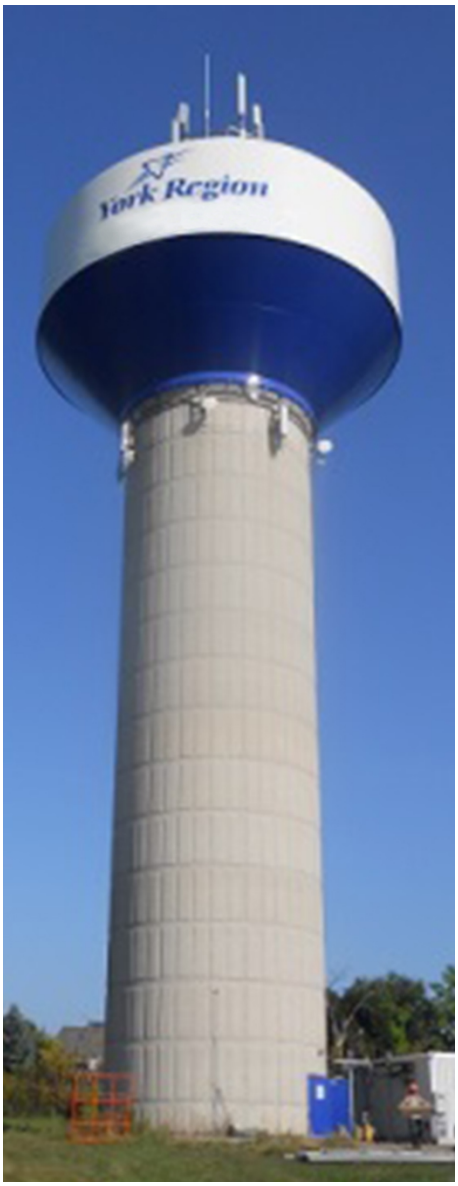


W1: Water Conservation, and Sanitary Sewer Inflow and Infiltration Reduction Programs

The Long-Term Water Conservation Strategy[63] identifies a suite of program components that aim to reduce daily and peak water uses and water losses from the distribution system (listed below). The strategy, which was last updated in 2016, highlighted the importance of water reuse to achieve the program's long-term goal.

Long-Term Water Conservation Strategy Program Components have been categorized as follows:

- Programs for industrial/commercial/institutional high water users
- Programs for small businesses
- Outdoor peak demand reduction
- Education and outreach
- Non-revenue water
- Residential new development
- Water reuse
- Collaboration and advocacy
- Big data analytics



The Sanitary Sewer Inflow and Infiltration Reduction Strategy[64] outlines efforts required to reduce inflow and infiltration of groundwater and storm water into the Regional and local municipal sanitary sewer systems. The key program components are as follows:

- Program Area 1 – Inflow and infiltration program goals and targets
- Program Area 2 – Monitor and analyzing flows
- Program Area 3 – Investigate and rehabilitate
- Program Area 4 – Design and construction
- Program Area 5 – Financial management
- Program Area 6 – Communication, education and advocacy
- Program Area 7 – Report inflow and infiltration reductions
- Program Area 8 – Innovation and adaptation

Water conservation and sanitary sewer inflow and infiltration

[63] York Region, 2016. *Long-Term Water Conservation Strategy*, https://www.york.ca/wps/wcm/connect/yorkpublic/ad0e7ca5-70e9-47f3-98ca-077ff35c0c00/2016_LTWCS_Update_%2B_Annual_Report.pdf?MOD=AJPERES, accessed on January 2019.

[64] York Region, 2016. *Inflow and Infiltration Reduction Strategy* https://www.york.ca/wps/wcm/connect/yorkpublic/45d5dff9-7075-4d58-8660-1c1453d6a110/2016_I_I_Executive_Symmary_%28AODA%29.pdf?MOD=AJPERES, accessed on January 2019.

reduction initiatives can reduce both the demand for water as well as the amount of wastewater that needs to be treated. These programs in turn reduce the amount of energy consumed and greenhouse gas emissions released.

Table 31 presents the greenhouse gas reduction and possible savings for York Region based on the reduced amount of water and wastewater pumped and treated, resulting from both programs.

Table 31: Estimated Benefits from Water Conservation, and Sanitary Sewer Inflow and Infiltration Reduction Programs[ix]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative GHG Reduction (tCO_2e)
W1: Water Conservation, Sanitary Sewer Inflow and Infiltration Reduction Programs	-	500	-	-	1,400	-	9,400

Notes to Table:
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent

W2: Water and Wastewater Facility Energy Conservation, Process Optimization and Renewable Projects

Approximately 90 per cent of the energy used in water and wastewater facilities is from electricity. The remaining use of energy is diesel fuel consumed for monthly emergency generator testing and natural gas for heating (natural gas is present at 13 facilities only). Wastewater facilities have potential for on-site energy generation and heat recovery by capturing energy and heat within the system. A suite of projects, initiatives and/or activities has been proposed which include the following:

- **Energy Conservation**:
  - Light emitting diode (LED) lighting retrofits
  - Installation of variable frequency drives to optimize pump usage to match flows
  - Improvement/addition of heating, ventilation and air conditioning controls
- **Process Optimization**:
  - Optimization of wastewater aeration blowers
  - Full-scale implementation of real-time pump efficiency monitoring to optimize pump usage strategies
  - Installation of energy sub-meters, monitoring of high energy use processes and implementation of targeted optimization works

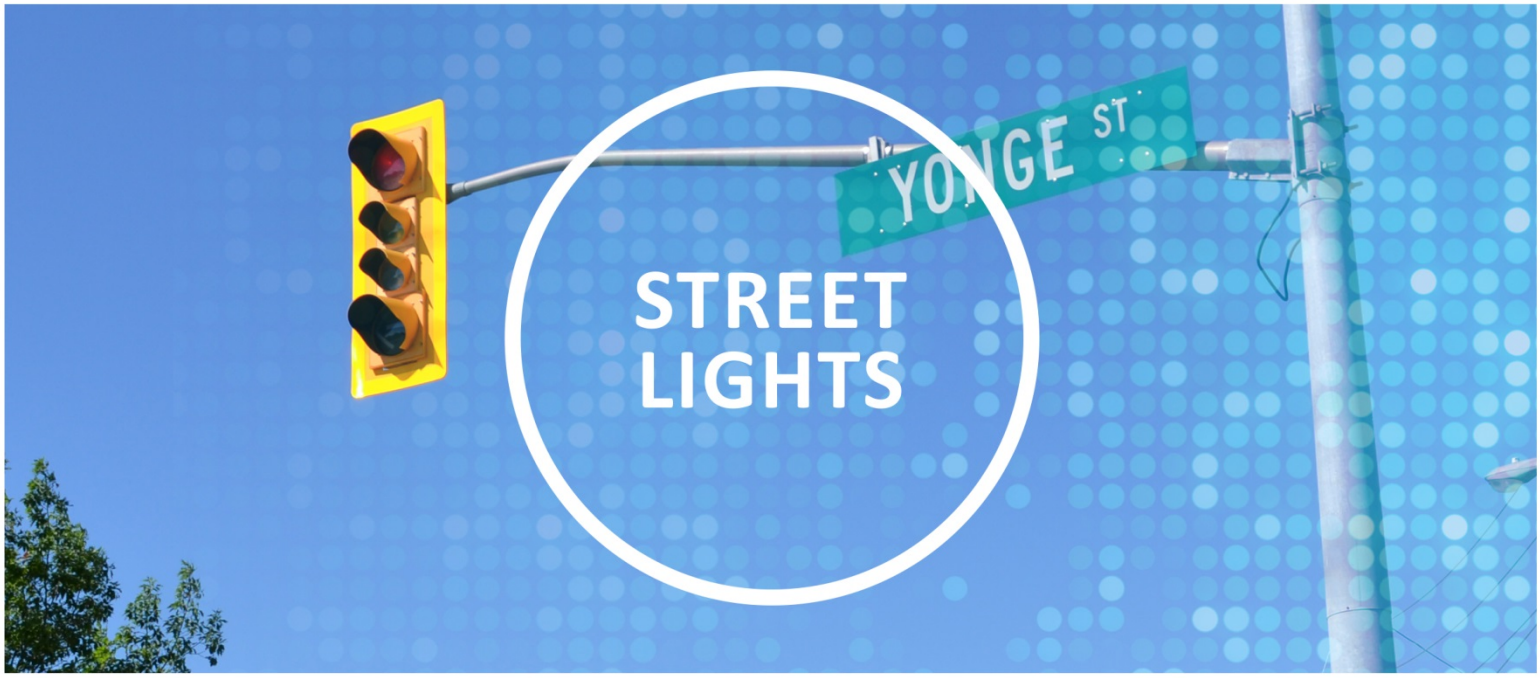
- **Renewable Energy**:
  - Implementation of wastewater processes heat recovery systems
  - Photovoltaic solar installations

Table 32 presents the greenhouse gas reduction and possible savings based on the above energy reduction initiatives.

Table 32: Estimated Benefits from Water and Wastewater Energy Conservation, Process Optimization and Renewable Energy Projects[x]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative GHG Reduction (tCO_2e)
W2: Water and Wastewater Facility Energy Conservation, Process Optimization and Renewable Energy Projects	$3.6 million	400	$9,231	$3.9 million	850	$4,588	4,600

Notes to Table:
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent



STREETLIGHTS, TRAFFIC SIGNALS, BEACONS, AND TRANSIT SHELTERS

York Region is responsible for the operation and maintenance of streetlights, traffic lights, and beacons at Regional intersections. All traffic signals, beacons, and a small fraction of streetlights have already been converted to light-emitting diodes (LED). Intersection street lighting is predominantly high-pressure sodium technology, which is much less energy efficient than LED. Converting intersections to LED requires careful engineering to ensure that the intersection remains properly illuminated. Motor vehicle collisions in an intersection caused by improper illumination would expose the Region to the risk of being sued for contributing to the cause of the accident. Intersection illumination using high-pressure sodium technology represents approximately 0.5 per cent of York Region's total electricity consumption for street and traffic lighting.

York Region Transit has approximately 85 transit shelters that are connected to the electricity distribution system. These shelters provide illumination for safety and advertising. Opportunities exist for solar photovoltaics and battery storage to provide all of the electricity needs required to service individual transit shelters.

To reduce energy and greenhouse gas emissions in this category, the following initiatives are proposed:

- S1: Intersection streetlight LED replacement study
- S2: Adaptive streetlight technologies
- S3: Alternative energy sources for stationary assets (transit shelters)

Compared to the 2014 baseline, greenhouse gas emissions from streetlights, transit shelters, and traffic signals are expected to remain constant in 2020, and decrease 25 per cent by 2025 through to 2051 (Table 33). The above actions are estimated to mitigate an increase in emissions when they are implemented post-2020. Traffic signals and beacons have already been converted to LED.

Table 33: Streetlights, Transit Shelters, and Traffic Signals Greenhouse Gas Emissions Targets

Year Ended:	2020	2025	2030	2051
Emissions Target (tonnes of carbon dioxide equivalent):	400	300	300	200
Change from 2014 Baseline:	0%	-25%	-25%	-50%

Notes to Table:
2014 Baseline Emissions = 398 tonnes of carbon dioxide equivalent

S1: Intersection Streetlight Light Emitting Diode Replacement

Intersection high-pressure sodium streetlights do not contribute a significant amount of greenhouse gas emissions in York Region, but converting to light emitting diode (LED) illumination will significantly reduce maintenance costs and ensure uniform illumination and technology across all Regional roads. It is recommended that York Region conduct a study of intersection illumination and convert all of its remaining streetlights to LED.

Table 34 presents the possible savings and greenhouse gas reductions from converting high-pressure sodium streetlights to light emitting diode streetlights. These savings have the potential to accumulate much faster should York Region aggressively complete this initiative.

Table 34: Estimated Benefits from Streetlight Light Emitting Diode Replacement[xi]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative GHG Reduction (tCO_2e)
S1: Streetlight Light Emitting Diode Replacement	$1.3 million	380	$3,421	$1.9 million	920	$2,120	4,9000

Notes to Table:
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent

S2: Streetlights: Adaptive Streetlight Technologies

Adaptive streetlight technologies use sensors to anticipate and then illuminate areas based on movement of pedestrians, cyclists and vehicles. These systems are designed to communicate the change in traffic to light poles downstream, increasing light output in a fluid, real-time response. It is

estimated that adaptive street lighting programs could reduce energy and greenhouse gas emissions by a minimum of 20 per cent[65].

It is recommended that York Region consider a pilot project to assess suitability and the business case for deployment. If the initiative is viable, it could be implemented as part of the streetlight light emitting diode replacement initiative (S1). On this basis, no greenhouse gas emissions reduction has been estimated for this initiative for this Energy Plan.

S3: Alternative Energy Sources for Stationary Assets

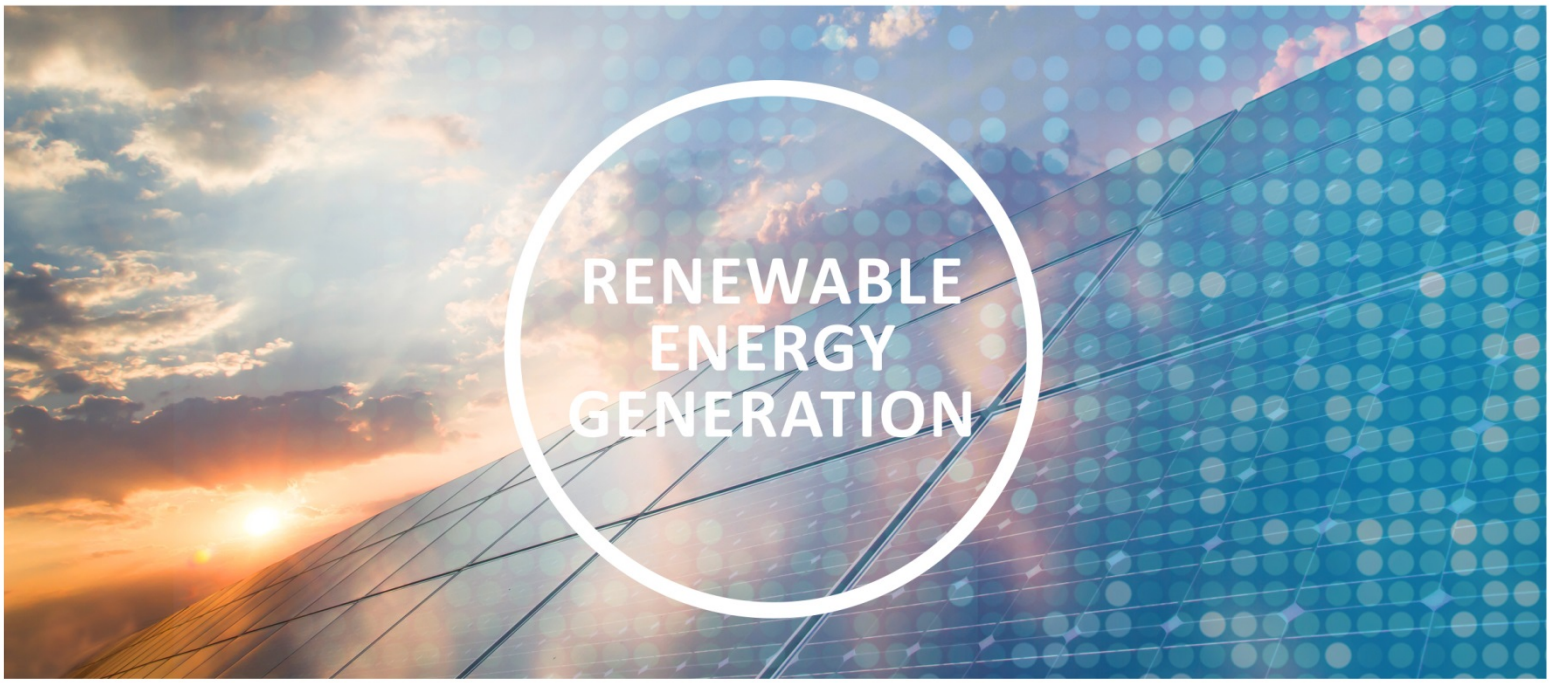
There exists an opportunity to install solar photovoltaic systems on transit shelters. The projected cost is disproportionately high for the relatively lower greenhouse gas emissions reductions because this initiative would replace grid generated electricity that is already very clean in Ontario and will likely be much cleaner in the future. Table 35 presents the possible savings and greenhouse gas reductions that could result from installing solar photovoltaic systems on transit shelters.

Table 35: Estimated Benefits from Alternative Energy Sources for Stationary Assets[xii]

Initiative	2019 to 2025			2019 to 2030			2019 to 2051
	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative Capital Cost ($)	Cumulative GHG Reduction (tCO_2e)	Cost per tonne of GHG Reduction ($/tCO_2e$)	Cumulative GHG Reduction (tCO_2e)
S3: Alternative Energy Sources for Stationary Assets	$230,000	55	$4,182	$360,000	140	$2,571	500

Notes to Table:
GHG = greenhouse gas
tCO_2e = tonnes of carbon dioxide equivalent

[65] Lightsavers Canada, 2017, *The Realized Results of LED Streetlights: Seizing the Opportunity*, https://static1.squarespace.com/static/546bbd2ae4b077803c592197/t/5a5f7a7253450ae87511ffb3/1516206708558/CUIPublication.TheRealizedResultsofLEDStreetlights.2017.pdf, accessed August 12, 2018.



RENEWABLES

Renewable energy is derived from sources that are not depleted when used (e.g. the sun, wind, water, or from heat contained in the ground). Renewable energy also includes biomass – or plant matter - which is grown, harvested, and transferred into energy by one of several processes. Onsite renewable energy generation opportunities available to York Region include:

- Solar photovoltaic (PV) panels to convert sunlight directly into electricity
- Geo-exchange systems that use ground source heat pumps to transfer heat to the ground in summer and extract heat from the ground in winter
- Renewable natural gas (RNG) derived from biogas at sewage treatment facilities
- Micro-hydro turbines that generate energy from water and wastewater systems

R1: Renewables

At the time of this Energy Plan development, a business case could not be developed for the majority of renewable technologies available to the Region. These technologies are as follows:

- Solar PV and micro-hydro turbines – Ontario's FIT and MicroFIT contracts that previously made renewable energy a financially viable option for York Region to pursue have recently been cancelled by the Province. Until these technologies evolve, or other funding sources become available that enable them to achieve price parity to the electrical grid, solar PV and micro-hydro turbines will not be an economically viable option in the short term (up to 2025).

- Wind powered systems – Wind energy technologies can be classified into two broad categories: large scale utility systems, which are the typical wind farms that require large tracts of land and extensive associated electrical infrastructure (substations, etc.), and micro-turbine systems that can be installed on buildings for local power use. Large scale utility systems are not supported at the local political level. The cost of micro-turbine systems has improved over the last decade but there remain several cost barriers to investment which include upgrading buildings to accommodate the infrastructure and the completion of wind-power assessments to determine the feasibility and location for installation.
- Renewable Natural Gas (RNG) – The market for RNG has expanded over the last five years as a result of an increased demand and improved technologies. York Region could employ wastewater and/or solid waste streams to generate RNG if the capital and infrastructure is first put in place. Currently, 90 per cent of York Region's bio-solids are sent to Duffin Creek Water Pollution Control Plant in Durham Region where it is converted to heat and energy for use in their own processes.

York Region does have the option of purchasing Renewable Energy Credits (RECs) or RNG from utility and non-utility third-parties which would entitle York Region to claim the environmental benefit and apply these against its greenhouse gas inventory. However, these mechanisms last only as long as the term of the contract and have no long-term benefit to the Region as compared to investment in self-generated energy.

Due to current funding and cost restrictions, no greenhouse gas emissions reductions from renewable energy generation have been included in this Energy Plan.

Implementation Framework

The Energy Plan is legislated to be updated every five years, with this version of the plan fulfilling the 2019 requirements. The following implementation framework focuses primarily on the five- and ten-year planning horizon. Changes to federal and provincial legislation and regulations, as well as technological advances are anticipated over the next decade that will impact the adoption and implementation of longer term initiatives. The following are the framework's core elements:

- Governance and collaboration
- Procurement
- Funding opportunities and challenges
- Evaluating future initiatives
- Reporting

- Communication strategy

GOVERNANCE AND COLLABORATION

Success of the Energy Plan program relies on ongoing collaboration and participation across departments and divisions. Staff from all departments are recommended to use this Energy Plan as a guide for decision-making, as this Plan contains initiatives that will help bring York Region closer to its energy and greenhouse gas emissions related objectives. The following provides an overview of actions needed to ensure that York Region is continuing its Energy Plan efforts.

Energy Performance Measures Incorporated into Budget Planning

Successful energy and greenhouse gas management depends on the integration of key environmental measures into the “business as usual” conduct of the organization. Specifically, this requires that life cycle costs, and energy and greenhouse gas metrics are integrated into budget and capital planning, strategic planning, purchasing policies, preventative maintenance plans, environmental management plans, and asset management plans. It also requires the continual assessment of energy and greenhouse gas performance by implementing procedures and measures that encourage energy conservation and increase efficiency to reduce greenhouse gas emissions. This will also require adequate allocation of staff and financial resources.

Based on stakeholder feedback across all categories, it is recommended that life cycle energy and greenhouse gas emissions reduction measures be incorporated as part of the rationale for budget requests; that these measures feed into the annual budgeting process, and that projects be examined with consideration to the total life cycle cost of the asset. Success means that these measures are incorporated into the initial stages of operational and capital project planning, and those options for energy efficiency and conservation are considered, evaluated, and quantified in terms of life cycle cost, which includes capital cost, maintenance, and greenhouse gas reductions. This ensures that projects that have longer payback periods but do make significant contributions to greenhouse gas emission reductions are able to proceed and assist York Region towards its net-zero carbon vision.

Coordinate and Facilitate Implementation through the Climate Change and Energy Conservation Group

It is recommended that Climate Change and Energy Conservation staff continue to be the lead for coordinating the implementation of the Energy Plan. These staff can serve as facilitators to departments for efficiency and greenhouse gas emissions reduction initiatives and will prepare the annual Corporate Energy Report to Council on the progress of the Region towards its aspirational Vision 2051 target.

Maintain Internal Multi-Departmental Energy Conservation and Demand Management Plan Steering Committee

York Region has an established multi-departmental Energy Conservation and Demand Management Plan Steering Committee which meets quarterly to ensure that energy and greenhouse gas savings initiatives move forward across York Region. This committee helps share best practices between departments, provides updates on emission reduction strategies across all departments, prioritizes work, and collaborates on shared initiatives that flow into annual work plans and budgets. Members of the committee act as ambassadors of energy conservation and demand management and represent the needs of the community.

Create and Maintain Energy-Focused Departmental Working Groups

This Plan recommends that staff working groups continue, or be created if necessary, to implement the Plan initiatives. The following three working groups provide a forum for discussion and collaboration on energy initiatives and emission reduction strategies relating their subject expertise:

- Energy, Water, and Wastewater (EW3) Working Group (Existing Plan and Initiative)
- Green Buildings Working Group (Proposed Initiative)
- Green Fleet Working Group

It is recommended that the working groups meet to:

- Encourage adoption and investigation of energy savings practices and measures as part of daily operations.
- Recommend energy management policy and program decisions on behalf of their business units.
- Serve as a directional body for initiation, coordination, and implementation of greenhouse gas emissions reduction initiatives.
- Assist in making decisions on plans and programs related to energy and greenhouse gas emission reductions.

- Provide support to formal reporting, as well as education and awareness programs to inform staff of greenhouse gas emission reduction initiatives.

It is recommended these working groups continue to meet at specified intervals to discuss issues, opportunities, and progress on the Energy Conservation and Demand Management Plan.

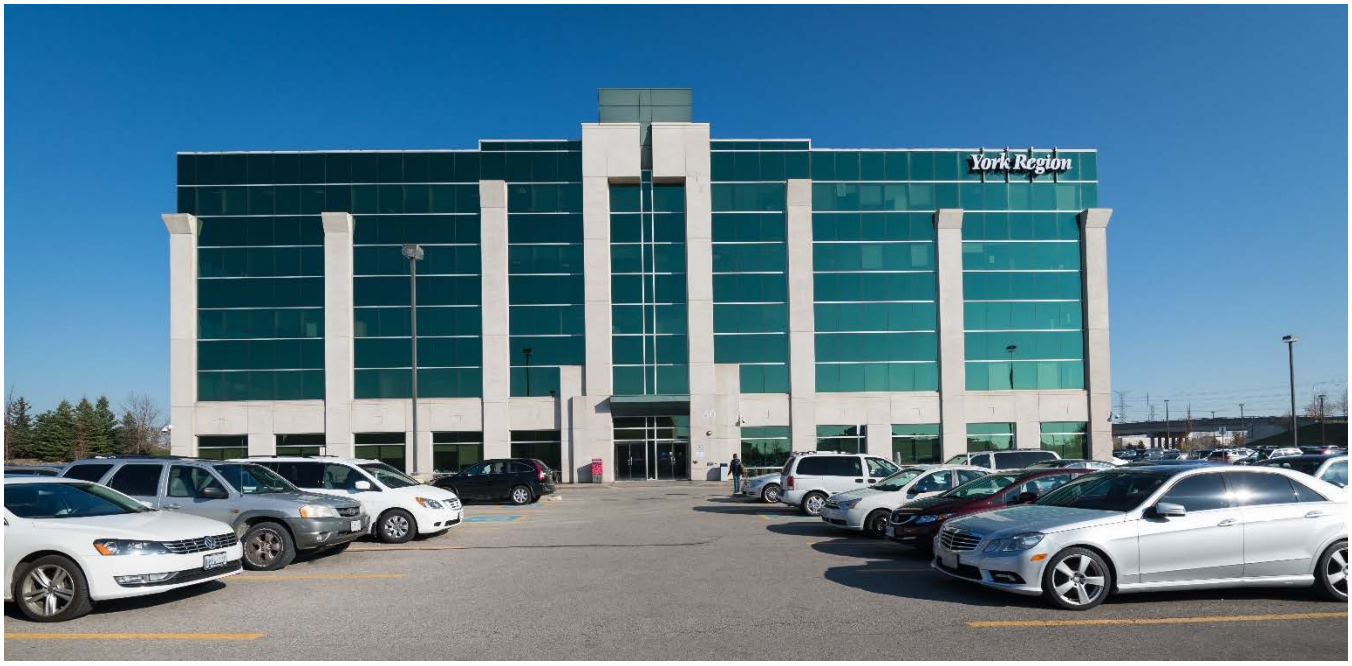
Alignment with Other Regional Plans

The Energy Plan reflects the shared priorities of other Regional strategic documents such as the Strategic Plan (2015-2019), Regional Official Plan (2010) and Vision 2051 (2011). Future updates to the Energy Plan should build on the most up to date versions of the above as well as other plans such as the Transportation Master Plan (2016), the Water and Wastewater Master Plan (2016) and the Long-Term Water Conservation Strategy (2016). Conversely, updates to these important Regional documents should also consider the most current version of the Energy Plan in their future updates. This will help ensure that the decisions made today set a course for the desired future of York Region.

PROCUREMENT

York Region has supported the purchase of green products in principle, but currently does not have a sustainable procurement policy that applies to the entire Region. The lack of a sustainable procurement policy makes it difficult for York Region staff to enforce sustainable procurement either internally or with vendors. The intent of green procurement is to shift spending away from goods and capital assets that have a greater greenhouse gas footprint (e.g., appliances that use more energy) and towards those that have a smaller energy and greenhouse gas footprint over the item's lifespan.

The interest in green procurement reflects a growing market preference for environmentally superior goods and capital assets referencing environmental and corporate social responsibility standards. However, identifying and verifying the relative environmental benefits of products and establishing which products are actually "green" or "greener" is challenging. There is a general lack of industry standards and accepted criteria for valuation. Many factors throughout the entire life cycle of a product and its packaging supply chain including its use and disposal can be included or excluded in an analysis. Other environmental aspects that may be included are items such as recycled content, renewable versus non-renewable resource inputs, greenhouse gas emissions and embodied energy, other contaminant emissions, energy efficiency, and waste production and reduction. Economic, social and cultural aspects of procurement include ethical and fair-trade practices such as economic and employee equity, worker health and safety, child labour, and community economic development.



To reduce greenhouse gas emissions from products and services, it is recommended that York Region employ a sustainable products ranking framework. A sustainable products ranking framework would enable York Region to clearly assess the degree to which environmental and social considerations have been addressed over the life cycle of a good or capital asset. Such a framework is designed to compare, rank and weigh purchases based on set Regional requirements (e.g., cost, efficiency, etc.) as well as the degree to which the environmental and social impacts of concern have been reduced or eliminated. Each purchase would be assessed against a base case product for which no identifiable efforts have been made to reduce the environmental or social impacts. Such a framework, its requirements, criteria and processes would need to be documented and reside in a formal Regional sustainable procurement policy. In the case of capital goods, like buildings, the framework would incorporate green performance requirements/objectives and performance metrics such as Energy Use Intensity (EUI), Thermal Energy Demand Intensity (TEDI) and/or greenhouse gas intensity and would undergo an energy and greenhouse gas emissions life cycle assessment to quantify the energy and greenhouse gas emission impact that would be incurred over the life of the asset. These performance targets could then be carried through into contractual requirements, along with associated penalties for non-compliance.

Contracted Services

While contracted third-party greenhouse gas emissions assessment is not included in the Energy Plan, York Region may benefit from the creation of programs and policies that encourage the reduction of third-party emissions above-and-beyond Regional corporate emissions. It is recommended that York Region develop a program or contract requirements for all third-party service providers to include an estimate of energy use and greenhouse gas emissions associated with the offered services, as well as the identification of energy efficiency/conservation or emission reduction programs. York Region Transit is currently using this model for its garages which has already yielded benefits in terms of energy cost savings and greenhouse gas emissions reductions.

FUNDING OPPORTUNITIES AND CHALLENGES

Green Energy Reserve Fund

The Green Energy Fund was developed to support the implementation of energy efficiency or conservation projects that might not meet typical return on investment requirements. The fund grows with deposits from solar project revenues and savings from successful energy conservation projects. The Climate Change and Energy Conservation Group is currently managing the administration, disbursement, and replenishment of the Fund. Access to funds is achieved through the preparation of a business case and subsequent approval by the Energy Plan Steering Committee and Council.

External Funding Opportunities

With the cancellation of the Provincial energy and greenhouse gas reduction programs and the negative impact that this may have on some of York Region's current energy and greenhouse gas reduction initiatives (e.g. the electric bus trial, FIT-Program, GreenOn Social Housing Repair Program, etc.), it is clear York Region cannot solely rely on external funding sources if it wishes to achieve its Vision 2051 goals. It is therefore recommended that York Region begin to proactively plan by incorporating capital and operating costs of the proposed initiatives into future budgets. This will allow York Region to take advantage of external funding opportunities when they are available, but not have to rely on these external sources to move forward with initiatives.

EVALUATING FUTURE INITIATIVES

This Energy Plan contains a list of recommended initiatives to be completed over the 2019 to 2051 time-frame. Implementing the initiatives requires dedicated resources and systems in place to ensure that the strategies and actions identified are implemented and tracked so that long-term goals are met. To support future planning and prioritization of initiatives, a Sustainable Return on Investment process - which consists of identifying and weighing criteria, was created to help staff prioritize future initiatives. It is a process that enables both Council and staff to understand how their priority action recommendations contribute to York Region's 2051 vision and other sustainability objectives. This tool can also be helpful when making decisions regarding policy, planning, and large capital investments. The Sustainable Return on Investment process can be used beyond Council reporting to provide guidance and inform new Region policy and strategic planning documents.

The Sustainable Return on Investment ratings that were developed for this Energy Plan were made with input from York Region staff across multiple departments, including the Energy Conservation and Demand Management Plan Steering Committee. The Sustainable Return on Investment process involves:

1. Using a paired comparison analysis to provide weightings on economic, social and environmental impact areas in accordance with their relative importance to one another.

2. Scoring the initiatives against the weighted sustainability criteria to determine a total Sustainable Return on Investment score.

3. Evaluating the initiatives by assessing the impact and effort.

The Sustainable Return on Investment weightings developed for this Energy Plan, summarized in Table 7 (page 16) in the Prioritizing Actions Section, can be applied to any future identified initiatives or any current initiatives where the technology or funding considerations have changed. At this time, York Region has set the following weightings to be used for evaluating initiatives, which can be revisited if required in the future: Environmental Sustainability (50 per cent); Economic Sustainability (33.3 per cent); Social Sustainability (16.7 per cent).

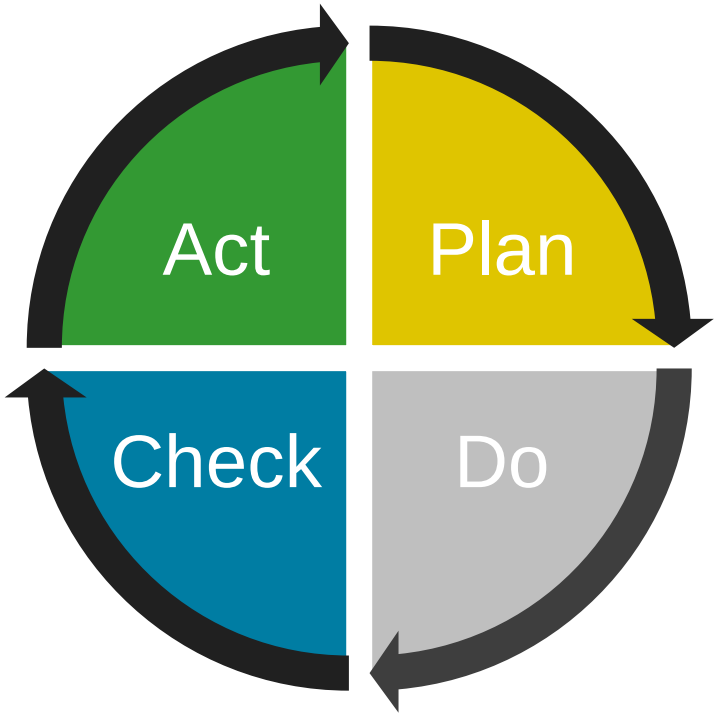
Before applying the weightings above, an environmental, economic and social score must be applied to each initiative. For this Energy Conservation and Demand Management Plan, to estimate the energy, cost and greenhouse gas reductions/savings, various assumptions were made to provide York Region with a range of potential energy and greenhouse gas savings associated with each initiative. It should be noted that these savings are estimates and are based on industry best practices and available data. The actual savings observed by York Region will be largely dependent on various factors (e.g., adoption, use of technology, available funds, etc.) that may be outside of York Region's control. Items which could not be quantified were rated qualitatively as low, medium or high and a similar approach can be taken to score future initiatives.

A key aspect to maintaining the feasibility of the Energy Plan is to be adaptive to changes. Recognizing the potential to adapt and improve over time and to fulfill the requirements of *O. Reg. 507/18*, York Region will review the Energy Plan every five years so that new technologies and changes to York Region are considered and incorporated. This will involve re-examining greenhouse gas emissions forecasts, Sustainable Return on Investment priority weightings, climate action focus areas, failures, and successes, as well as updating the list of initiatives.

REPORTING

An ongoing feedback loop, known as the Deming Cycle, can facilitate the continuous improvement of the Energy Plan, and promote its use as a living document. Moving forward, Plan progress towards climate action targets, greenhouse gas emission forecasts, Sustainable Return on Investment weightings, and the priority of the initiatives will be regularly reassessed and refined. The four components of the Deming Cycle, shown below in Figure 21, are Plan-Do-Check-Act. A run through the Plan-Do-Check-Act cycle can occur on an annual basis to coincide with York Region's annual budget cycle for planning each year's capital and operating budgets.

Figure 21: The Deming Cycle: Plan-Do-Check-Act



A monitoring framework provides York Region with a task list of items to track that will help re-assess the effectiveness of the 2019 and 2025 initiatives, greenhouse gas emissions, and other activities contained within the Energy Plan over time (the “check” component of the cycle). A monitoring framework assists with answering:

1. Direct progress towards the vision and targets
2. Primary indicators including progress made towards the 2051 target
3. Progress on other indicators that provide indirect measures of energy and greenhouse gas impacts
4. Secondary indicators including progress made towards related targets, such as change in the number of electric buses
5. Progress on Energy Plan implementation including the number of initiatives completed, in-progress, and those that have not commenced

The indicators listed in Table 36 below have been selected based on best practices and suited to the needs of York Region. They use readily available data sources and allow for the comparison over time of where York Region stands with respect to greenhouse gas emissions reductions.

Table 36: Key Performance Indicators (KPI)

Key Performance Indicator (KPI)	Measurement
Building Energy Intensity	Energy use per unit area
Building Emissions Intensity	Greenhouse gas emissions per unit area
Building Energy Cost Intensity	$ per unit area
Non-Transit Fuel Efficiency	Fuel quantity per kilometer
Non-Transit Total Fuel Used	Fuel quantity
Non-Transit Number of Vehicles in Different Classes	Number of vehicles with greater fuel efficiency, hybrid, electric vehicle etc.
Transit Fuel Efficiency	Fuel quantity per kilometer
Transit Total Fuel Used	Fuel quantity
Transit Number of Vehicles in Different Classes	Number of vehicles with greater fuel efficiency, hybrid, electric vehicle etc.
Water Efficiency	Energy use per quantity of water, Water delivered per person
Wastewater Efficiency	Energy use per quantity of water, Water processed per person
Street Lights	Energy use per light
Renewable Energy Generation	Quantity of energy produced

The implementation of the Energy Plan (the “plan and do” components of the cycle) will require the formulation of an annual work plan to define what actions will be undertaken annually. To aid in successful implementation, the annual work plan should tie into departmental business plans and budgets to ensure responsibilities and resources are allocated accordingly. Progress will be reported to the following stakeholders as noted in the following sections.

Reporting to Ministry of Energy

In compliance with Regulation (*O.Reg. 507/18*), York Region must continue to report its annual energy use and greenhouse gas emissions using the Ministry of Energy template on an annual basis. York Region produced and submitted its first Energy Conservation and Demand Management Plan in 2014 with an update in 2016 to meet the requirements of the Electricity Act, 1998 and *O. Reg. 507/18*. In addition to ongoing monitoring and reporting, the initiatives and underlying assumptions of this Energy Plan will be frequently examined to facilitate the integration of any major developments. The Energy Plan will adapt and respond to the changes in federal and provincial level climate action commitments as they occur.

Reporting to Council

Environmental Services continues to report to Council on the state of greenhouse gas emission reduction within York Region through the annual Corporate Energy Report. The annual Corporate Energy Report informs the Region on the progress it is making in relation to its five, ten and Vision 2051 targets. The Corporate Energy Report is recommended to include an update using the KPIs identified to outline key achievements from the previous year, and provide updates on planned initiatives for the subsequent planning period.

COMMUNICATIONS STRATEGY

The overall goal of the Communication Strategy is to outline tools and techniques to assist York Region staff with ongoing internal communication about the Energy Plan, including implementation and results. The Communication Strategy is focused on internal communication for Regional staff and Council and is not directed toward community members or partners.

Objectives

The three objectives of the Communication Strategy are:

- To communicate the presence of the Energy Conservation and Demand Management Plan
- To share progress toward the goals and targets
- To motivate multiple audiences about what they can do to reduce York Region's energy use and greenhouse gas emissions

Guiding Principles

The following key principles will guide staff's implementation of the Communications Strategy:

- Collaboration
- Openness and transparency
- A commitment to focused action
- A commitment to story-telling, and staff's personal connection to corporate emission reduction

Key Messages

The following simple, key messages will form the basis for the Communications Strategy:

- York Region is taking action to reduce corporate energy use and greenhouse gas emissions. There is an Energy Conservation and Demand Management Plan that will guide the Region's actions for the next five years.
- Reducing energy use not only reduces costs, but it is also beneficial for the environment.

- All staff members have a role to play in reducing corporate energy use.

Audiences

The intended audiences for the Communications Strategy are:

- Regional Operational Staff
- Regional Managerial Staff
- Council

Responsibility

Responsibility of the Plan implementation is currently through the Energy Conservation and Demand Management Plan Steering Committee. All departments are represented on the Committee by senior staff that have decision making authority.

Tactics

The Communications Strategy includes a series of strategic tactics (Table 37).

Table 37: Suggested Communication Tactics

Tactic	Description/Rationale
Continue hosting quarterly Energy Conservation and Demand Management Plan Steering Committee Meetings	Continue to host York Region's established multi-stakeholder committees with representatives from across the organization. The intent of these meetings is to: • Share best practices between departments • Provide status/progress updates on emission reduction strategies across all departments • Prioritize work • Share funding opportunities • Collaborate on shared initiatives that flow into annual work plans and budgets. Members of the Steering Committee will continue to act as ambassadors of energy conservation and demand management.
Share the results of the Energy Conservation and Demand Management Plan Steering Committee actions	Find a mechanism to succinctly and clearly share the work of the Committee and Energy Conservation and Demand Management Plan progress with other Regional leaders. Develop a half-page infographic template and share, on a quarterly basis, a few of the following items: • Secured funding • Progress towards emission reduction • New initiatives • Success stories • Images of staff

Tactic	Description/Rationale
Continue to develop an annual Corporate Energy Report	The Strategic Energy Initiatives Coordinator will continue to gather information from all departments, and report annually on emission reductions. Ensure the development of a one-page, graphic summary document. This can be used to communicate results with a wide range of audiences.
Implement targeted energy skills training	Implement specialized training opportunities as per the Energy Conservation and Demand Management Plan actions.
Implement general energy skills training for all Regional staff	Develop (or adopt) a stand-alone webinar that would be suitable for all Regional staff. The webinar could cover: • The presence of the Energy Conservation and Demand Management Plan • The role of all staff members in contributing to emission reductions • Easy tips and reminders for every day corporate emission reductions
Work to integrate key messaging into existing Regional communications tools	Work alongside Corporate Communications to share tips and reminders about emission reductions with all Corporate staff. Some ideas include: • Developing an automatic screensaver • Writing and sharing success stories in York Beat, York Matters and ENV Commissioner's Connection • Developing a York Beat advertisement
Create (and publicize) a "Bright Lights" program	Create a staff-based program to celebrate success. Work with the Corporate Communications team and Human Resources to develop a staff recognition program. This could include: • Seeking nominations for staff that have made a difference with energy efficiency • Developing short vignettes • Circulating stories and photos on York Beat
Ensure open lines of communication	Ensure that staff across the corporation have knowledge of, and access to, an Energy Conservation and Demand Management Plan information-sharing portal. This portal might be used to: • Share innovative ideas • Identify areas of concern • Provide feedback or solutions
Embed results in performance plans	Consider the inclusion of emission reduction targets in select employee's performance reviews. This would serve to recognize specific staff for their success in helping to achieve the targets.

Recommendations

Table 38 includes supporting details for each of the tactics.

Table 38: Timing and Responsibility of Suggested Communication Tactics

Tactic	Audiences	Level of Effort	Timing
Continue hosting quarterly Energy Conservation and Demand Management Plan Steering Committee Meetings	Senior leaders, representing key departments		Quarterly, ongoing
Share the results of the Energy Conservation and Demand Management Plan Steering Committee	Regional Leadership Council		Quarterly, ongoing
Continue to develop a Corporate Energy Report	Council All Regional staff		Annually
Implement targeted energy skills training	Specific, pre-identified staff		End of Year Two
Implement general energy skills training	All Regional staff		End of Year Two
Work to integrate key messaging into existing Regional communications tools	All Regional staff		End of Year One
Create (and publicize) a “Bright Lights” program	All Regional staff		End of Year One
Ensure open lines of communication	All Regional staff		End of Year One
Embed results in performance plans	Specific, pre-identified staff		End of Year Three

End Notes

[i] **BAU Model Assumptions / Notes:**

- Real energy consumption and cost data was available from the Region from 2006 to 2017.
- Regional population data was available from the Region for the years 2016 to 2023.
- Regional staff population data was available from the Region for the years 2013 to 2017.
- Annual Regional transit ridership data was available from the Region for the years 2006 to 2020.
- Linear regression methods were used to estimate future Regional population, staff population, EMS, police and transit populations.
- Buildings and facilities that are either planned, or in the process of being built, have been included in the forecast – these are as follows:
  - Community & Health Services Building
  - Transportation Services Building
  - Corporate Services Building
  - Upper York Water Reclamation Centre
- The existing building stock is expected to be better utilized to support an increasing population and thus no additional buildings beyond those planned or in the process of being built are planned.
- Buildings at the following locations will be sold or decommissioned:
  - 22 Prospect Street
  - 225 Industrial Pky S. Unit 30
  - 225 Industrial Pky S. Unit 6 & 8
  - 80 Bayview Parkway
  - 620 Steven Court
- It is assumed that the Region vehicle population would turn-over at a similar rate to the Canadian population (9.66 years)
- It is assumed that the planned Federal light-duty vehicle, light duty truck, and heavy-duty vehicle fuel efficiency standards will be implemented and fully adopted in vehicles by 2027.
- It is assumed that the Federal government will increase the Renewable Fuel Regulation requirements by 2030 by 5% for gasoline, and 2% for diesel.
- No existing buses will have topography dependent transmission systems or Driver Support Systems installed, and the remaining 116 will have an electric fan installed (mid-life).
- New buses are assumed to have topography dependant transmission systems, an Electric Fan, and a Driver Support System installed which is estimated to result in an estimated 12.68% improvement in fuel economy.
- Transit vehicle right-sizing is already occurring to which the benefits have already been recognized in the reduction of historical energy consumption.
- Transit will continue to use and purchase diesel buses.
- Future wastewater processing, future water storage, pumping, streetlight, and transit shelter energy usage will increase proportionally to the regional population growth rate.
- Future employee mileage will increase proportionally to the regional staff population growth rate.
- Future police vehicle energy use and mileage will increase proportionally to the police staff population growth rate.
- Future EMS vehicle energy use and mileage will increase proportionally to the EMS staff population growth rate.
- Future transit vehicle energy use and mileage will increase proportionally to the change in transit rider populations.
- Unlike prior years, no renewable energy credits (RECs) are purchased from 2018 onwards.
- There are no new solar PV installations, and the current solar PV systems continue to operate as intended.
- The fuel mix used to generate electricity in Ontario does not change from what is occurring in the 2017 reporting year.
- Forecasted energy cost data was provided by the Region:
  - Electricity costs were assumed to increase by 4.3% annually.
  - Natural gas costs were assumed to decrease by 2.1% in 2018, and 2.9% in 2019, and then increase 5.0% in 2020, 0.3% in 2021, 12.1% in 2022, and then level out to a 1.1% increase

from 2023-2051. The estimate assumes that the Annex will come online in 2019 and that no current Regional locations will be closed as a result.
    - Diesel, gasoline and propane costs were assumed to increase 2.0% annually.

[ii] **Transit: Hybrid Diesel-Electric Buses Initiative Assumptions / Notes:**

- A discount rate of 5.0% was used to estimate the PV of the initiative. This discount rate was set by the Region.
- Emissions reductions reflect impact of switching buses in the York Region Transit (YRT) fleet from high carbon fuels to lower emissions technologies. This plan proposes that all buses will begin to be replaced with hybrid diesel-electric between 2019 and 2025.
- To model the emissions impacts of a switch to hybrid diesel-electric vehicles, VKT was reassigned to hybrid diesel-electric from existing fuel types based on the year a bus(es) would be replaced. Emissions from those vehicles was then modelled based on kWh/km for existing hybrid diesel-electric bus technology.
- The model assumes a 20% reduction in fuel consumption for hybrid diesel-electric buses.
- It is assumed that hybrid diesel-electric buses have a 25% premium ($137,500) over the typical diesel bus ($550,000).
- Cost savings for the d hybrid diesel-electric buses reflect reduced fuel costs from improved fuel economy.
- Any operating and capital costs associated with the plan will be submitted to Council for consideration as part of the annual budget process.

[iii] **Transit: Electric Buses Initiative Assumptions / Notes:**

- A discount rate of 5.0% was used to estimate the PV of the initiative. This discount rate was set by the Region.
- Any buses that need to be replaced before 2026 were assumed to be conventional diesel and any post-2026 were assumed to be electric.
- To model the emissions impacts of a switch to electric vehicles, VKT was reassigned to hybrid diesel-electric and EVs from existing fuel types based on the year a bus(es) would be replaced. Emissions from those vehicles was then modelled based on kWh/km for existing electric bus technology.
- The model assumes that an electric bus will operate 1.45 kwh / km.
- It is assumed that EV buses have a 100% premium ($600,000) over the typical diesel bus ($600,000).
- The Capital premium for Electric buses will fall to an average of 35% by 2026.
- Capital costs and maintenance / operational savings were provided by the Region.
- There is considerable uncertainty about what associated infrastructure costs, and avoided maintenance costs would be, as such only the costs of the buses have been included.
- Cost savings reflect the reduced $/km cost of fuel associated with switching from gasoline and diesel to electricity. Cost savings are also reduced based on the cost of electricity.
- Because of uncertainty around future fuel costs, actual savings associated with EV technology may vary. The data presented in this plan should be understood as illustrative planning examples which can serve to assist in setting priorities for the Region's Transit operations.
- Any operating and capital costs associated with the plan will be submitted to Council for consideration as part of the annual budget process.

[iv] **Buildings**: **Energy Projects Initiative Assumptions / Notes:**

- A discount rate of 5.0% was used to estimate the PV of the initiative. This discount rate was set by the Region.
- Planned energy retrofits are assumed to achieve the estimated energy reductions.

[v] **Buildings**: **Deep Energy Retrofit Initiative Assumptions / Notes:**

- A discount rate of 5.0% was used to estimate the PV of the initiative. This discount rate was set by the Region.
- A 50% reduction in natural gas energy usage was assumed to occur with the implementation of this initiative. A study of buildings that have undergone deep retrofits in the Northwest region of the United States, considered to be leading nationally in such activities, identified energy savings ranging from 38–79 percent, with average savings of 51 percent.
- A cost of $25/ft^2 was used to estimate the cost of the initiative. This is in line with the 2016 Energy Conservation and Demand Management Plan Update, and the literature. Cost estimates for deep retrofits vary widely, anywhere from $2/ft2 to over $100/ft2 (Source: Guide to building the case for

deep energy retrofits (RMI); The economics of green retrofits (Nils Kok); How to calculate and present deep retrofit value (RMI)).

- Any operating and capital costs associated with the Plan will be submitted to Council for consideration as part of the annual budget process.
- It is assumed that the retrofits would not occur until 2035 and would take 10 years to implement at all Regional buildings. The start year was based on the building condition assessment assessments completed by the Region to date.
- PV savings are a result of reduced energy costs associated with increased building efficiency. They do not include assumptions about other operating and maintenance cost savings.
- In some cases – with newer facilities or facilities where there is no significant potential for retrofit measures, saving may be less than 50%, however, this may be compensated for by deeper savings elsewhere.
- Actual retrofit potential for any given facility will require a more detailed study of building characteristics and potential savings.

[vi] **Buildings**: **Ongoing Commissioning Initiative Assumptions / Notes:**

- A discount rate of 5.0% was used to estimate the PV of the initiative. This discount rate was set by the Region.
- A 15% reduction in energy usage was assumed to occur with the implementation of this initiative. According to NRCAN, retro-commissioning can yield energy savings of 5 to 15 percent with a typical payback period of less than three years in most cases. Furthermore, the largest meta-analysis of U.S. retro-commissioning projects, conducted by the Lawrence Berkeley National Laboratory, which incorporated 332 projects in 561 existing buildings across 21 states, determined an average annual energy savings of 16 percent, with lower and upper bounds of 9 percent and 31 percent respectively.
- A cost of $\$0.27/ft^2$ was used to estimate the cost of the initiative. This is based on the Lawrence Berkeley National Laboratory study which found that the median commissioning costs of $\$0.27/ft^2$ [with an inter-quartile range of $0.13 to $0.45] and payback times of 0.7 years [0.2 years to 1.7 years].
- The initiative excludes any buildings that have had energy audits already completed.
- The initiative does not include HYI or waste/water facilities.
- It is assumed that the initiative would commence in 2024 and take ten years to complete all buildings.
- It is assumed that once a building was retro-commissioned it maintained the energy efficiency benefits.
- PV savings are a result of reduced energy costs associated with increased building efficiency. They do not include assumptions about other operating and maintenance cost savings.

[vii] **Non-Transit: EV Strategy Initiative Assumptions / Notes:**

- A discount rate of 5.0% was used to estimate the PV of the initiative. This discount rate was set by the Region.
- Any operating and capital costs associated with the plan will be submitted to Council for consideration as part of the annual budget process.
- The Bloomberg 2018 EV Sales Forecast was applied to estimate the adoption rates of EVs which was 3% in 2020, 28% in 2030, 43% in 2035, and 55% by 2040.
- It was assumed that a $3,000 premium would be paid for each EV until 2025 when it is estimated that light duty vehicle (LDV) EVs will reach cost parity with their gasoline and diesel counterparts.
- Capital costs were provided by the Region
- It was assumed that only LDVs and employee mileage would be converted. Emergency vehicles are excluded.
- To model the emissions impacts of a switch to electric vehicles, a percentage of total projected VKT was reassigned to EV from existing fuel types. Emissions from those vehicles were then modelled based on kWh/Km for current EVs on the Canadian market and the associated grid electricity generation emission coefficient.
- The model does not include operations and maintenance costs associated with EV or traditional vehicles, or the potential cost of training maintenance staff employed by the Region to work on EVs.
- Cost savings for EV reflect the reduced $/km cost of fuel associated with switching from gasoline and diesel to electricity.

- Because of the volatility of fuel costs, actual savings associated with EV technology may vary. The figures presented here should be understood as illustrative planning examples which can serve to assist in setting priorities for the Region's fleet operations.

[viii] **Non-Transit: Vehicle Right Sizing Initiative Assumptions / Notes:**

- A discount rate of 5.0% was used to estimate the PV of the initiative. This discount rate was set by the Region.
- Targeted overall greenhouse gas reduction of 10%, supported by other actions to reduce demand. Other cities, like the City of Richmond has estimated reduction a reduction of 16% with a target of 7%.
- No cost for telematics has been estimated as this would be completed on a pilot basis.
- It is assumed that no additional vehicle costs would be incurred as vehicles would be right sized as they near their end of life.
- Cost savings reflect the estimated reduction in fuel use.
- Any operating and capital costs associated with the plan will be submitted to Council for consideration as part of the annual budget process.

[ix] **Water Conservation, and Sanitary Sewer Inflow and Infiltration Reduction Initiative Assumptions / Notes:**

- Energy and greenhouse gas savings are based on avoided water and wastewater treatment and pumping energy cost by reducing the demand.
- The water portion is based on the water conservation program and two of its main components: residential (without multi-residential) LCD reduction and ICI program.
- The Residential program is aiming to reduce water consumption from 187 litres per person per day (LCD) in 2017 to 150 LCD, which is 1.1 LCD/year. The savings were estimated by interpolating water saving from 2017 to 2051 and multiplying by the forecasted residential population.
- The ICI program tracks water savings per year from various projects and similar annual water savings were assumed to continue to 2051.
- The combined volume of water saved from the residential and ICI programs was multiplied by the water system energy intensity figure of 242 kWh/ML (which represents the last 3-year average kWh/L from 2015 to 2017).
- The wastewater portion is based on water conservation program and the Sanitary Sewer Inflow and Infiltration reduction program.
- It was assumed that all the water saved from the water conservation program will result in less wastewater generated.
- The I&I program was estimated to reduce extraneous sewer flows by 584 ML/year until 2031. This is based on the program goal of saving 40 MLD by 2031. By 2017, 17.59 MLD of I&I was reduced, which means that from 2017 to 2031 (14 years) 22.41 MLD will need to be reduced. Using the figure of 22.41 MLD over 14 years yields a reduction of 1.6 MLD/year and thus 584 ML/year.
- The combined volume of wastewater saved from the Water Conservation and I&I programs was multiplied by the wastewater system energy intensity figure of 291 kWh/ML (which represents the last 3-year average kWh/L from 2015 to 2017).

[x] **Water and Wastewater Energy Conservation, Process Optimization, and Renewable Energy Project Initiative Assumptions / Notes:**

- A list of possible water and wastewater energy conservation, process optimization and renewable energy initiatives, their implementation timing, and their estimated energy reduction benefit was provided by the Region.
- There is an opportunity to switch diesel generators to natural gas generators in conjunction with the utilization of battery storage which can provide critical power reliability as needed. Switching diesel generators to natural gas is not planned until 2025 as York Region will likely be required to undergo various environmental approvals before the fuel switching activities can occur. Battery technology is an ever-evolving technology and should be explored first as a pilot to assess the business case prior to full adoption.
- Capital costs were provided by the Region.

[xi] **Streetlight LED Replacement Initiative Assumptions / Notes:**

- A discount rate of 5.0% was used to estimate the PV of the initiative. This discount rate was set by the Region.
- The Region estimates a cost of $421/unit.
- It is assumed that all conversions can be completed by 2035, with Markham being completed prior to 2020.
- Emissions reductions are a direct result of reduced electricity consumption resulting from improved lighting efficiency.
- Costs only include retrofits to existing lighting, where new lighting is installed it is assumed that LED will be the standard technology and will not incur additional costs to the Region.
- Cost savings are a direct result of reduced electricity consumption resulting from improved lighting efficiency.
- Any operating and capital costs associated with the plan will be submitted to Council for consideration as part of the annual budget process.

[xii] **Streetlights: Alternative Energy Sources for Stationary Assets Initiative Assumptions / Notes:**

- A discount rate of 5.0% was used to estimate the PV of the initiative. This discount rate was set by the Region.
- It is assumed that 85 units to be replaced and would be installed over the next 12 years.
- It is assumed that all new shelters will go directly to off-grid technology.
- A cost of $4,642 per installation was applied which is based on BC Transit's solar PV transit shelter initiative.
- Emissions reductions are a result of reductions to the amount of electricity drawn from the Ontario grid due to on-site solar generation. kWh generated through solar installations are assumed to be zero carbon.
- Any operating and capital costs associated with the plan will be submitted to Council for consideration as part of the annual budget process.