ENERGY CONSERVATION AND DEMAND MANAGEMENT PLAN

Update 2019

Town of The Blue Mountains

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Abbreviations

Abbreviation	Full Name
AMO	Association of Municipalities of Ontario
BAS	Building Automation System
BAU	Business as Usual
BCA	Building Conditions Assessment
CAFE	Corporate Average Fuel Economy
CO_2e	Carbon Dioxide Equivalent
DHW	Domestic Hot Water
ECDM	Energy Conservation and Demand Management
EV	Electric Vehicle
FCM	Federation of Canadian Municipalities
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GJ	Gigajoule
HDV	Heavy Duty Vehicle
HVAC	Heating, Ventilation and Air Conditioning
ICC	Internal Cost of Carbon
ISI	Institute for Sustainable Infrastructure
LAS	Local Authority Services
LCA	Life Cycle Analysis
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LDT	Light Duty Truck
LDV	Light Duty Vehicle
MDV	Medium Duty Vehicle
NRCAN	Natural Resources Canada
OEM	Original Equipment Manufacturer
PV	Photovoltaic
REC	Renewable Energy Credit
RNG	Renewable Natural Gas
VFD	Variable Frequency Drive

Executive Summary

The following report presents the Energy Conservation and Management Plan (ECDM) for the corporate operations of the Town of The Blue Mountains (the Town). The objective of the ECDM Plan is to move the Town closer to reducing its corporate GHG emissions by 40% below 2005 levels by 2025 and its long-term target of achieving carbon neutrality by 2050 by establishing short-term initiatives that build momentum and lay the groundwork for deeper energy and GHG emissions reduction actions to be implemented post-2025. The ECDM Plan also meets the requirements of the *Ontario Regulation 507/18 Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans* (*O. Reg. 507/18*, formerly *O. Reg. 397/11*).

The ECDM Plan was based on corporate energy and GHG emissions available for the most current year, 2018, and trends since the 2005 base year as well as anticipated growth to 2050. In 2018, the Town's corporate GHG emissions amounted to 1,012 tonnes of carbon dioxide equivalent (tCO_2e) – a decline of 36.5% from the 2005 base year. The Town's business as usual (BAU) GHG emissions are forecasted to be approximately 786 tCO_2e in 2050, a decrease of 22.3% from the 2018 reporting year which is the direct result of energy and GHG reduction actions already underway at the Town, the province of Ontario, and at the federal level (e.g., vehicle fuel standards, etc.). Based on the analysis presented in the ECDM Plan, achieving carbon neutrality by 2050 will require the Town to utilize a combination of renewable energy credits (REC), renewable natural gas (RNG) certificates, and carbon offsets. The level of dependence on these last resort options will largely be dependent upon "greening" the electricity grid, the increased adoption and available supply of biofuels, and the adoption of zero-emissions technologies yet to be developed.

The identification of initiatives for incorporation into the ECDM Plan was done through a combination of staff engagement, currently and formerly completed location-based site visits, a best-in-class review of other municipalities and input from internal and external subject matter experts. The proposed initiatives are summarized in Table E-1.

This ECDM Plan was approved by Town Council on February 10, 2020. Adoption of the ECDM Plan does not commit Council or the Town to the initiatives proposed. All initiatives will come to Council as either part of annual budget deliberations or as a specific request.

Table E.1 2019 ECDM Plan Initiatives

#	Sector	Initiative	Action Type	Implementation Date
B1	Buildings & Facilities	Develop a Low Carbon Building Policy	Policy	2025
B2	Buildings & Facilities	Investigate Additional Energy Conservation Opportunities	Project	2025
B3	Buildings & Facilities	Accelerate Building LED Replacements	Project	2025
B4	Buildings & Facilities	Prioritize Deep Energy Retrofits Over Like-For-Like Replacements	Project	2030
B5	Buildings & Facilities	Implement a Building Commissioning Program	Program	2025
B6	Buildings & Facilities	Implement an Energy Performance Monitoring Program	Program	2025
B7	Buildings & Facilities	Hire a Dedicated Energy Manager	Project	2021
F1	Fleet & Equipment	Develop a Low Carbon Fleet Management Policy	Process	2025
F2	Fleet & Equipment	Opportunistically Switch Light Duty Vehicles (LDV) to Electric	Process	2025
F3	Fleet & Equipment	Pilot New Technologies & Techniques	Project	2030
C1	Corporate	Incorporate Life Cycle Considerations into Capital Planning and Purchases	Process	2030
C2	Corporate	Develop an Internal Cost of Carbon (ICC) Policy	Policy	2025
C3	Corporate	Develop a Carbon Neutral Policy	Policy	2030
C4	Corporate	Develop a Sustainable Infrastructure Policy	Policy	2025

1.0 OVERVIEW

1.1 ABOUT THE TOWN

The Town of The Blue Mountains (the Town) is located in a seasonally driven touristic area and recreational destination. With a population of 7,025 residents in 2016, the Town is expected to grow 2.3% by 2030 and 8.9% by 2050.

To support the local community, the Town owns and/or operates buildings, fleet vehicles, water and wastewater facilities, waste management facilities as well as supporting infrastructure. The operation of these corporate assets collectively contributes to greenhouse gas (GHG) emissions in the Town and provides opportunities for energy conservation and GHG emissions reductions.

In addition to the Town's Corporate Strategic Plan[1], the Town Sustainable Path[2] document provides the overall vision for the community's goals in sustainability and sets the tone for the Town to become a leader in sustainable resource management. The Sustainable Path establishes a number of goals and targets that are directly tied to the energy performance of the Town. These include:

- Increase the Town's use of and capacity for renewable energy sources.
- Provide municipal leadership by implementing various energy conservation demonstration projects throughout the community and promoting energy conservation through programs such as community conservation challenges.
- Supply 30% of the community's energy consumption with renewable energy that is both environmentally and socially acceptable.
- Adopt strategies to reduce the community's cumulative GHG emissions and move toward carbon neutrality.
- Establish a three-stage GHG emissions reduction target: 20% below 2005 emissions by 2016, 40% below 2005 by 2025, and carbon neutrality by 2050.

The Town has embarked on several conservation projects, and as a member of Partners for Climate Change Protection, the Town is part of a network of Canadian municipalities that have committed to reducing GHG emissions by 40% below 2005 levels by 2025 and achieving carbon neutrality by 2050.

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[1] The Town of The Blue Mountains, *the Corporate Strategic Plan 2015-2020*, www.thebluemountains.ca/document_viewer.cfm?doc=39, accessed August 2019.
[2] The Town of The Blue Mountains, *The Blue Mountains Sustainable Path*, www.thebluemountains.ca/document_viewer.cfm?doc=537, accessed August 2019.

1.2 ONTARIO REGULATION 507/18

The *Ontario Regulation 507/18 Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans* (*O. Reg. 507/18*, formerly *O. Reg. 397/11*) under the *Electricity Act* currently requires local governments to report on energy and GHG emissions from owned and operated buildings and to produce ECDM Plans. These ECDM Plans are required to be updated every five years. Local governments are also required to submit annual reports on energy use and GHG emissions to the Ministry of Energy, Northern Development and Mines (the Ministry). Municipalities must also publish online and make available to the public the annual emissions reports and the ECDM Plans.

The Town prepared its first ECDM Plan in 2014, fulfilling regulatory obligations. This current 2019 update to the 2014 ECDM Plan fulfills the requirement of a five-year update, and includes the requisite information in the original ECDM Plan, as well as the *O. Reg. 507/18* requirements for an ECDM Plan update, including:

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

The preparation of the ECDM Plan provided the Town the opportunity to re-evaluate the status of corporate emissions and understand how corporate emissions have changed compared to the baseline, as well as provide a short-term and long-term business-as-usual forecast, with and without planned energy reduction initiatives, in order to compare to corporate targets. The implementation of this ECDM Plan will place the Town on a trajectory towards achieving its 2025 reduction target and 2050 carbon neutrality goals.

1.3 SCOPE

The Town's ECDM Plan is a corporate-wide plan that focuses exclusively on GHG emissions that are directly controlled by the Town and does not address community GHG emissions or emissions that are outside the geographic boundary of the Town. Although municipal operations form a small subset of overall community GHG emissions, initiatives and assets under local government control may have an indirect impact on community GHG emissions. The assets which the Town has direct control over which are included in this ECDM Plan are summarized in the table below, and do not include GHG emissions from third-party contractors, construction activities, or business (air and ground) travel. This ECDM Plan also does not include any GHG emissions or emissions reduction activities from residential, institutional, commercial and industrial waste from the Town-owned waste management facility. The reduction and

diversion of community waste and associated emissions as well as targets are covered in depth by the Town's Waste Diversion Plan[3].

Table 1. List of Town Assets Included in ECDM

Buildings & Facilities	Fleet & Equipment	Water, Wastewater & Solid Waste Facilities	Streetlights & Traffic Signals
Administrative buildings	Light duty vehicles (LDV)	Wastewater treatment plants	Streetlights
Fire stations	Medium duty vehicles (MDV)	Water pumping stations	Traffic signals
Police stations	Heavy duty vehicles (HDV)	Wastewater pumping stations	
Community centers	Off road vehicles	Solid waste management facility	
Cultural facilities	Other equipment		
Storage facilities			

This ECDM Plan covers a horizon from 2020 to 2050, in two successive five-year strategies including short-term (ending in 2025) and medium-term (ending in 2030) planning periods, followed by a long-term (ending in 2050) planning period. The recommendations made for the first five years integrate relevant planned initiatives that are based on actions identified by Town staff using existing and proven technologies. Actions in the medium-term planning horizon, shift momentum towards more aspirational targets. These program components provide the Town with an opportunity to slow and reverse GHG emissions growth. Initiatives identified in the long-term are more transformational in nature. These initiatives are based on best available technology to date but recognize that the business case for selecting specific solutions will need to be identified in the coming years. Potential changes to federal and provincial legislation, funding opportunities, as well as technological advances over future decades will help reduce the Town's GHG emissions.

[3] The Town of The Blue Mountains, *Waste Diversion Plan (2012)*, https://thecif.ca/pdf/reports/407-Blue_Mountain_WRP.pdf, accessed August 2019.

1.4 METHODS

The ECDM Plan was based on corporate energy and GHG emissions available for the most current year, 2018, and trends since 2014 as well as anticipated growth to 2050. The identification of initiatives for incorporation into the ECDM Plan was done through a combination of Town staff workshops, location-based site visits, a best-in-class review of other municipalities and input from internal and external subject matter experts.

Two workshops with Town staff facilitated sharing of best practices and identification of key ECDM Plan components, initiatives, and enabling factors. These were completed during February and March 2019. A review of energy conservation and GHG policies, programs, and initiatives from peer cities and municipalities was also conducted and included an assessment of the following cities and municipalities:

- Canada: City of Vancouver, City of North Vancouver, West Vancouver, City of Burlington, City of Toronto, City of Edmonton, City of Calgary, Region of York
- United States: New York City, City of Seattle, City of San Francisco
- Europe: London, United Kingdom
- New Zealand: City of Auckland

Topics which were covered during the reviews included:

- GHG reduction targets and performance against targets
- Actions for energy conservation and GHG emissions reductions
- Financing approaches
- Barriers and challenges
- Recommendations

Town staff reviewed the draft ECDM Plan prior to its finalization.

2.0 2018 CORPORATE ENERGY & GHG EMISSIONS

Cities are centers of communication, commerce, and culture. They are also a significant and growing source of energy consumption and GHG emissions. Cities and regional centers have the opportunity to affect considerable change on GHG emissions levels on a global scale as they are responsible for more than 70% of global energy related GHG emissions[4].

2.1 CURRENT ENERGY & GHG EMISSIONS

In 2018, the Town's s corporate GHG emissions amounted to 1,012 tonnes of carbon dioxide equivalent (tCO_2e), or 143 kilograms CO_2e per person in the community. These GHG emissions were the direct result of the provision of key services by the Town, which are organized into the following sectors.

- **Buildings & Facilities:** The Town's building and facilities consume electricity, natural gas and other fuels to heat, cool, ventilate, and illuminate administrative, police, and fire buildings, park facilities, and community and recreation centers.
- **Fleet & Equipment:** The Town's fleet vehicles includes light, medium and heavy-duty vehicles for corporate use. The majority of vehicles consume gasoline and diesel.
- **Water, Wastewater & Solid Waste Facilities:** To manage and treat solid waste, water and wastewater, the Town operates and manages waste, water, and wastewater infrastructure which consume energy and release GHG emissions. The GHG emissions included in this ECDM are limited to emissions from building and process operation and do not include emissions from community waste.
- **Streetlights & Traffic Signals:** The Town operates over 800 LED streetlights and traffic signals. These assets are powered by electricity.

Table 2 below presents the breakdown of the 2018 energy and GHG emissions by sector.

Table 2. 2018 Corporate Energy and GHG Emissions by Sector

Sector	Energy (GJ)		GHG Emissions (tCO_2e)	
Buildings & Facilities	8,350	26.6%	289	28.6%
Fleet & Equipment	7,676	24.4%	554	54.8%
Water, Wastewater & Solid Waste Facilities	14,520	46.2%	164	16.2%
Streetlights & Traffic Signals	861	2.7%	5	0.5%
Total	**31,406**	**100.0%**	**1,012**	**100.0%**

[4] Environmental Commissioner of Ontario, *Climate Action in Ontario – What's Next (2018)*, https://docs.assets.eco.on.ca/reports/climate-change/2018/Climate-Action-in-Ontario.pdf, accessed August 2019.

Although buildings and waste facilities account for over 70% of the Town's energy usage, this sector's GHG footprint is much smaller than expected as more than 95% of Ontario's electricity generation is from non-GHG emitting sources (nuclear, hydro, wind and solar) [5].

Diesel, propane, and gasoline used in the operation of fleet and equipment accounted for almost 55% of the Town's overall energy profile. A breakdown of GHG emissions is provided in Figure 1 while a breakdown by energy use in each sector is presented in Figure 2 below.

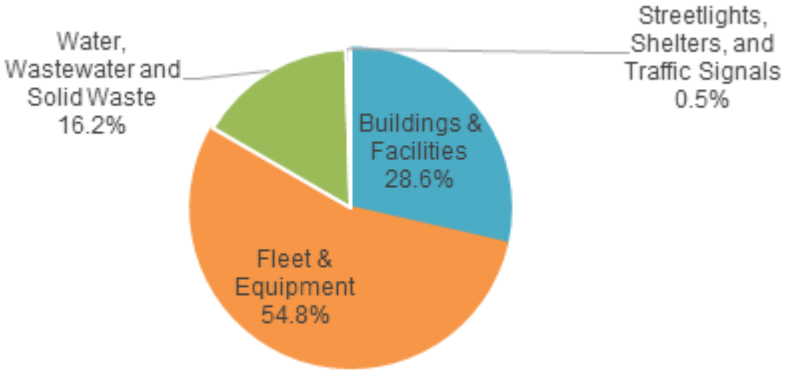

Figure 1. GHG Emissions (tCO_2e) by Sector

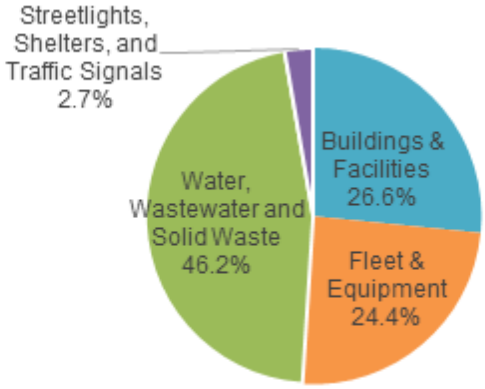

Figure 2. Energy Use (GJ) by Sector

[5] IESO, *2018 Electricity Data*, www.ieso.ca/en/Corporate-IESO/Media/Year-End-Data, accessed August 2019.

2.2 HISTORICAL TRENDS

The Town first began tracking corporate GHG emissions in 2005. Since 2005, The Town's population has increased 3.4% while GHG emissions have decreased 36.5% (Figure 3) [6]. On a per capita basis, GHG emissions have decreased 38.6% since 2005. Figure 4 demonstrates the Town's energy use in gigajoules (GJ) over the same period. While recent years show similar trends in energy use as in GHG emissions, the sharp decrease in GHG emissions between 2005 and now is coupled with a sharp increase in energy use. As with any growing Town, the increase in population is often the largest driver of GHG emissions growth due to the increased demand for local services and infrastructure systems. However, a more dramatic rise in GHG emissions has been mitigated as a result of the implementation of energy efficiency and reduction actions by the Town, as well as the greening of the provincial electrical grid. The greening of the provincial electrical grid also explains the decrease in emissions from 2005 despite a marked increase in energy use.

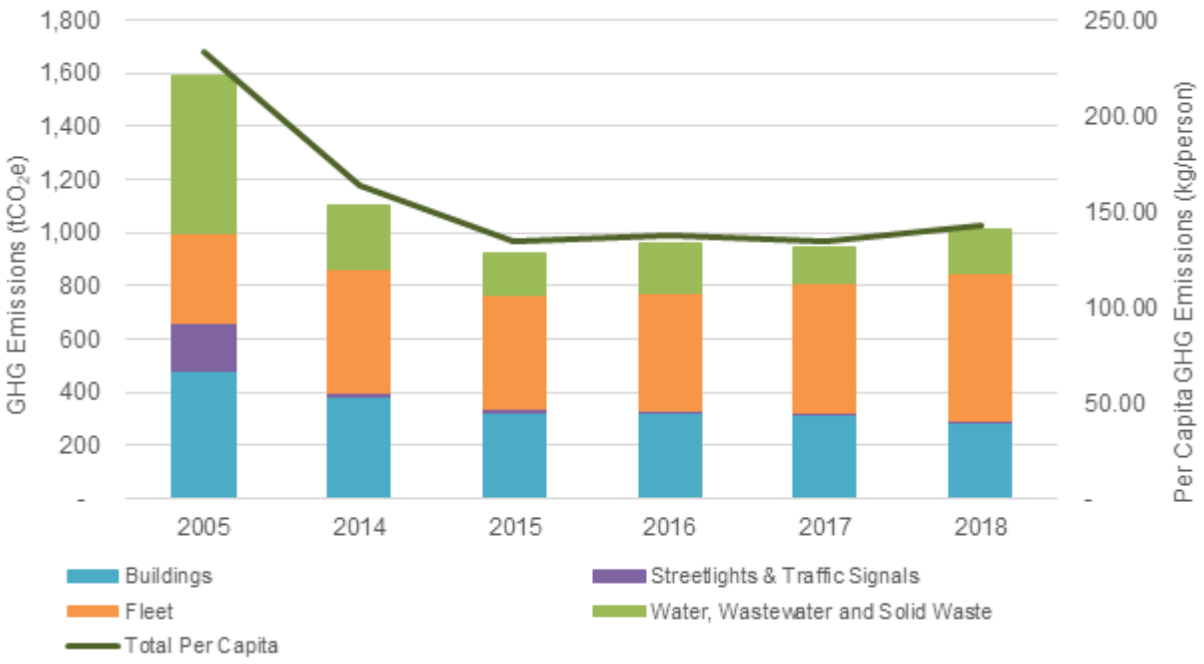

Figure 3. Annual Absolute and Per Capita GHG Emissions

[6] Based on a 2005 value of 1,593 t CO_2e, updated using the most recently available information on emission factors in Ontario in 2005. Note that this value is different from the original value calculated by the Town in 2005.

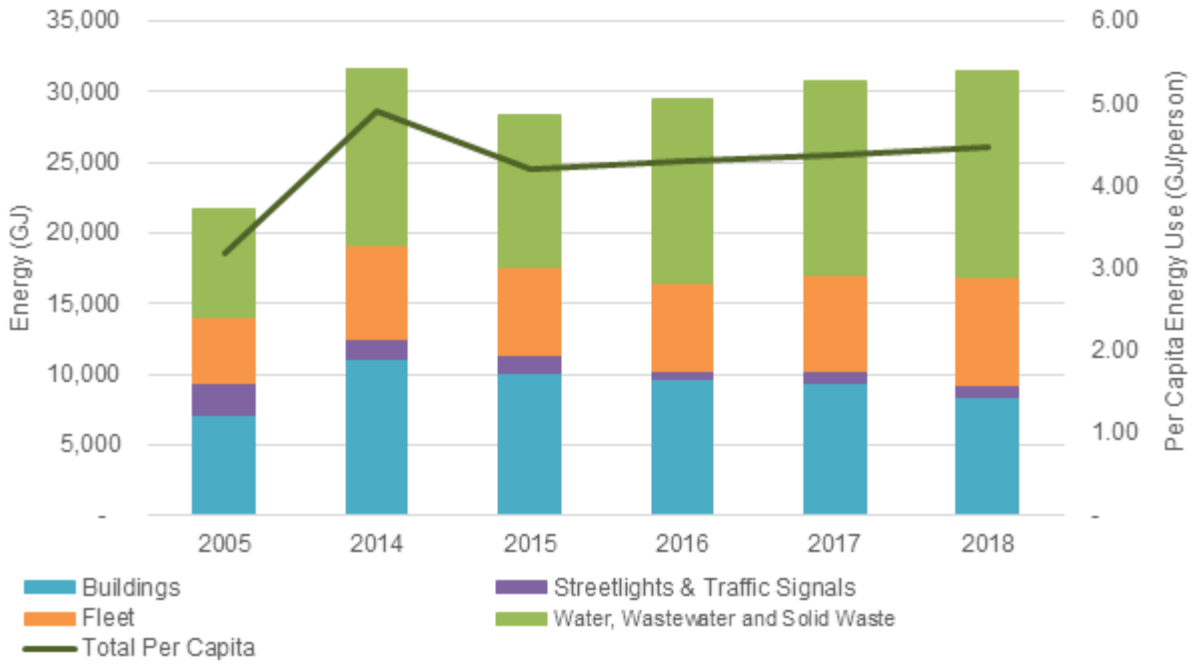

Figure 4. Annual Absolute and Per Capita Energy Use

2.3 PAST INITIATIVES

The Town's original 2014 ECDM Plan was developed based on information and input provided by Town staff. The 2014 ECDM Plan identified program and project initiatives for the Town, most of which have been implemented.

Table 3 presents a summary of program initiatives and their implementation status.

Table 3. Summary of 2014 ECDM Program Initiatives Status

Program Name / Initiative	Description	Status / Comment
Endorse Energy Management Plan and Conservation Targets	Establish conservation targets for the Town	Complete
Energy Monitoring and Reporting Program	Establish a reporting framework for energy management for Staff and Council	Partially Complete
Energy Reserve Fund	Develop a reserve that is dedicated to implementing energy conservation and efficiency projects	Not Complete

Program Name / Initiative	Description	Status / Comment
Staff Energy Efficiency Incentive & Rewards Program	A program that engages and celebrates energy conservation action within the workplace	Not Complete
Investigate Bulk / Collaborative Procurement of Natural Gas	Determine benefit of natural gas bulk purchasing	Complete

Table 4 presents a summary of project initiatives and their implementation status.

Table 4. Summary of 2014 ECDM Project Initiatives Status

I.D. #	Facility / Operation	Energy Conservation Opportunity Description	Status
1	L.E. Shore Memorial Library	Lighting Retrofit	Complete
2		HVAC Replacement & Thermostat Upgrades	Complete
3	Beaver Valley Community Centre	Compressor Replacement	Complete
4		Implement radiant heating seating policy	Complete
5		Implement Water Conservation Initiatives	Complete
6		Install Occupancy Sensors /LED Exit Signage	Complete
7		Replace Domestic Hot Water (DHW) Boiler	Planned
8		Upgrade Air Handling Heating System	Planned
9		Investigate Additional Energy Conservation Opportunities	On-Going
10	Thornbury Water Treatment Plant	Replacement of High Lift Pumps	Complete
11		Upgrade Facility Heating System	Complete
12	Ravenna Works Yard	Investigate Geothermal Heating Installation	Not complete as the Yard is under review
13	Craigleith Wastewater Treatment Plant	Update Facility Lighting, Exit Signage & Install Occupancy Sensors	Complete
14	Street Lighting	Conversion to LED lights and fixtures	Complete
15	Town Infrastructure	Investigate Renewable Energy Generation Initiative	Not Complete
16	Multiple Sites (Landfill, works yard, BVCC)	Minor lighting retrofits (Save-On-Energy program)	Complete

2.4 GHG EMISSIONS FORECAST TO 2050

A model of business as usual (BAU) GHG emissions was developed to project future Town GHG emissions through to 2050 to examine the possible magnitude of GHG reduction opportunities (Figure 5). To estimate the future GHG emissions, the Town's most recently available (2018) energy use was grown proportionally to higher service demand levels as a result of an increasing population and planned structural changes, such as new buildings and facilities, as well as planned GHG reduction initiatives set by the provincial and the federal governments (e.g. vehicle fuel-economy standards). The Town's BAU emissions are forecasted to be approximately 786 tCO_2e in 2050, a decrease of 22.3% from the 2018 reporting year which is the direct result of energy and GHG reduction actions already underway at the Town, Province, and at the Federal level.

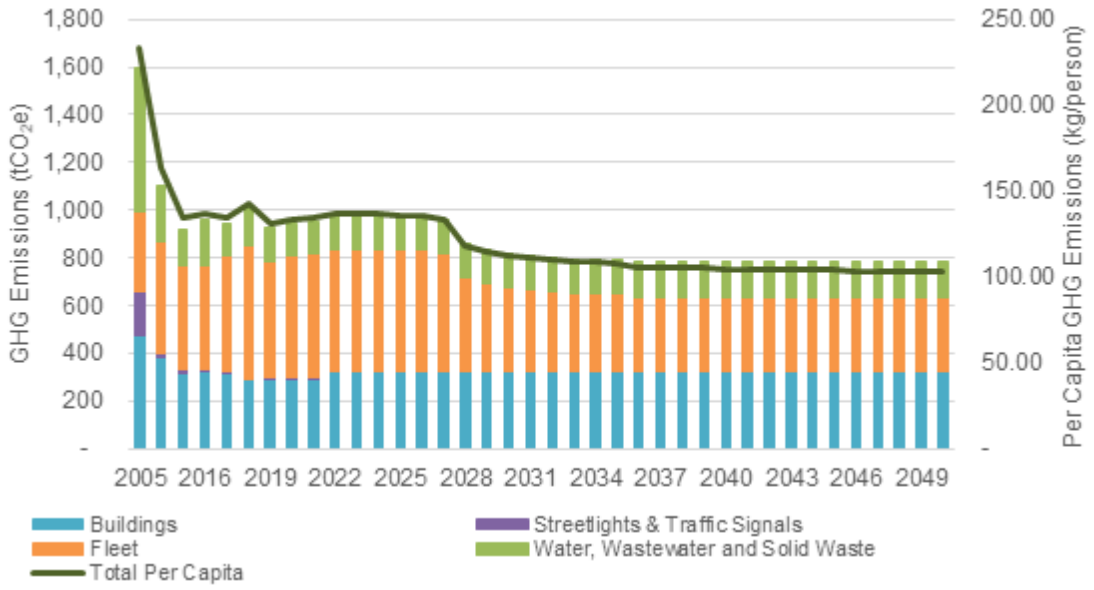

Figure 5. Forecasted GHG Emissions Under a BAU Scenario

2.5 GHG REDUCTION TARGETS

The Town has committed to reducing its corporate GHG emissions by 40% below 2005 levels by 2025 and achieving carbon neutrality by 2050. To achieve these targets today, the Town will need to implement the initiatives identified in this ECDM Plan and would need to procure a combination of renewable energy certificates (REC), renewable natural gas (RNG), and carbon offsets (Figure 6).

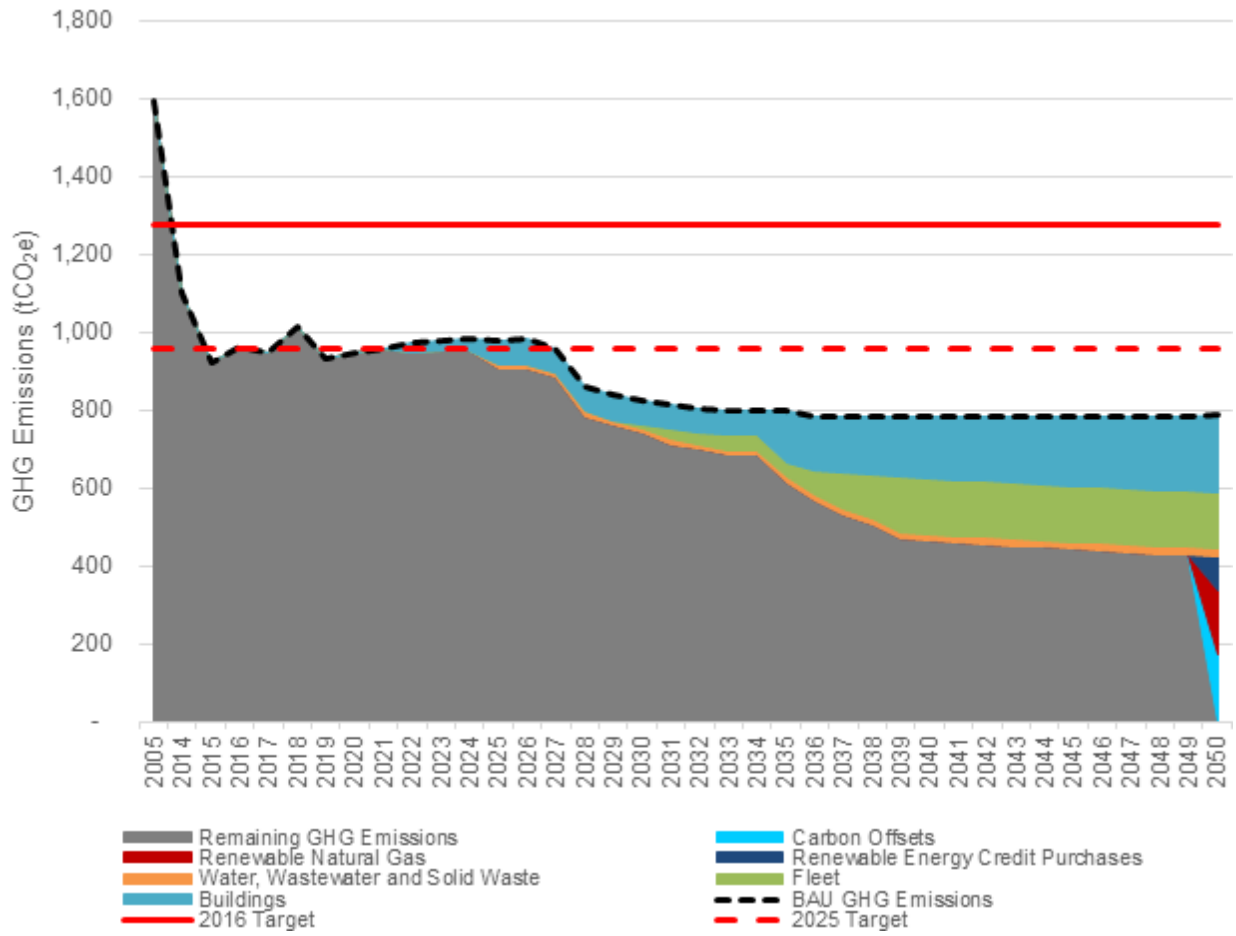

Figure 6. Forecasted BAU GHG Emissions and Impact of Proposed Initiatives

The ECDM Plan aspires to the objective of achieving carbon neutrality by the year 2050. To achieve this long-term goal, short-term initiatives have been identified in this report that build momentum and lay the groundwork for deeper energy and GHG reduction actions to be implemented post-2030. The initiatives fall into three categories:

- **Process:** Improvements or alternatives to current process-based operations that are quicker and more straightforward at a low or no additional cost (e.g. energy tracking, green procurement standards)
- **Program:** Improvements that take longer to implement with moderate costs (e.g. retro-commissioning program, building monitoring program, fleet utilization, etc.)
- **Project:** Capital projects to upgrade equipment and facilities and are usually more costly to implement with detailed planning required (e.g. converting natural gas fired boilers to heat pumps, converting fleet to electric, etc.)

The proposed list of initiatives in Table 5 represents best-practice information collected from similar regional and local governments as well as input from staff and experts.

Table 5. 2019 ECDM Plan Initiatives

#	Sector	Initiative	Action Type	Implementation Date
B1	Buildings & Facilities	Develop a Low Carbon Building Policy	Policy	2025
B2	Buildings & Facilities	Investigate Additional Energy Conservation Opportunities	Project	2025
B3	Buildings & Facilities	Accelerate Building LED Replacements	Project	2025
B4	Buildings & Facilities	Prioritize Deep Energy Retrofits Over Like-For-Like Replacements	Project	2030
B5	Buildings & Facilities	Implement a Building Commissioning Program	Program	2025
B6	Buildings & Facilities	Implement an Energy Performance Monitoring Program	Program	2025
B7	Buildings & Facilities	Hire a Dedicated Energy Manager	Project	2021
F1	Fleet & Equipment	Develop a Low Carbon Fleet Management Policy	Process	2025
F2	Fleet & Equipment	Opportunistically Switch Light Duty Vehicles to Electric	Process	2025
F3	Fleet & Equipment	Pilot New Technologies & Techniques	Project	2030
C1	Corporate	Incorporate Life Cycle Considerations into Capital Planning and Purchases	Process	2030
C2	Corporate	Develop an Internal Cost of Carbon (ICC) Policy	Policy	2025
C3	Corporate	Develop a Carbon Neutral Policy	Policy	2030
C4	Corporate	Develop a Sustainable Infrastructure Policy	Policy	2025

3.0 BUILDINGS & FACILITIES

In 2018, the Town's buildings and facilities portfolio accounted for 27% of its energy use and 29% of its annual GHG emissions. With an average lifecycle of greater than 50 years, many of the Town's current building stock will still be operational in 2050. A summary of energy and GHG emissions by facility type is presented in Table 6 which shows that community centers, storage facilities, and water/sewage treatment are the largest GHG emission sources.

Table 6. 2018 Energy and GHG Emissions by Building / Facility Classification

Classification	Energy (GJ)	GHG Emissions (tCO_2e)	Percent of Building & Facility GHG Emissions	Energy Intensity (GJ/m2 or GJ/ML)[1]	Energy Intensity Compared to Provincial Average[2]
Administrative offices and related facilities, including municipal council chambers	1,774	27	6.1%	1.40	+17%
Community centers	3,044	111	24.5%	1.26	+39%
Cultural facilities	122	4	0.9%	0.55	-42%
Facilities related to the pumping of sewage	1,945	30	6.7%	0.73	-96%
Facilities related to the pumping of water	1,988	11	2.5%	1.92	-87%
Facilities related to the treatment of sewage	6,838	38	8.4%	2.72	-62%
Facilities related to the treatment of water	3,313	57	12.6%	2.24	-77%
Fire stations and associated offices and facilities	1,061	43	9.4%	0.69	-24%
Police stations and associated offices and facilities	436	1	0.3%	0.52	-56%
Landfill facility	147	27	6.0%	1.02	-6%
Public libraries	805	32	7.1%	0.89	+2%
Storage facilities where equipment or vehicles are maintained, repaired or stored	1,055	65	14.4%	1.02	-6%
Other	342	6	1.2%	n.a.	n.a.
Total	**22,869**	**453**	**100.0%**	**n.a.**	**n.a.**

Notes:
1 GJ/ML = GJ per megaliter of water serviced. Metric used only for facilities related to treatment and/or pumping of water or sewage
2 Provincial data obtained from broader public sector reporting datasets provided by Ontario Ministry of Energy, Northern Development & Mines, most recent data (2016) averaged by facility operation with anomalies removed (www.ontario.ca/data/energy-use-and-greenhouse-gas-emissions-broader-public-sector). Positive value indicates the Town's value is higher than average, while negative value indicates it is lower.

Green building certifications are an important first step toward reducing GHG emissions from energy consumption. However, achieving zero-carbon emitting buildings, as part of a comprehensive strategy to achieve carbon neutral operations, will require more than the Town's current policy of LEED® Silver certification for new buildings. New buildings will need to be "net-zero energy ready' which means they will be highly efficient buildings that can easily accommodate future renewable energy add-ons, such as rooftop solar panels, that will enable them to produce at least as much energy as they consume. Existing buildings and facilities will require deep energy retrofits that radically overhaul the building envelope to reduce energy needs or a complete replacement of the building to a higher energy standard. Maintenance and ongoing-commissioning programs - a process of ongoing monitoring, adjustment, and retrofitting with new technologies like building automation systems upgrades, and energy sub-metering will be key to maintaining energy and GHG reductions. Building condition assessments (BCA) and behavioral change programs are also important initiatives that will complement retrofit and building monitoring programs. One of the most cost-effective GHG emissions avoidance measures is to improve existing building utilization rates therefore minimizing the number of new buildings requiring construction in the future.

The following is a list of the proposed building and facility initiatives for the Town:

- B1: Develop a Low Carbon Building Policy
- B2: Implement Building Energy Conservation Projects
- B3: Accelerate Building LED Replacement program
- B4: Prioritize Deep Energy Retrofits Over Like-For-Like Replacements
- B5: Implement an Ongoing Commissioning Program
- B6: Implement an Energy Performance Monitoring Program
- B7: Hire a Dedicated Energy Manager

Compared to the 2005 base year, after the planned expansion of the library and roads yard, the business as usual building GHG emissions are expected to remain relatively stable by 2050 (Figure 7).

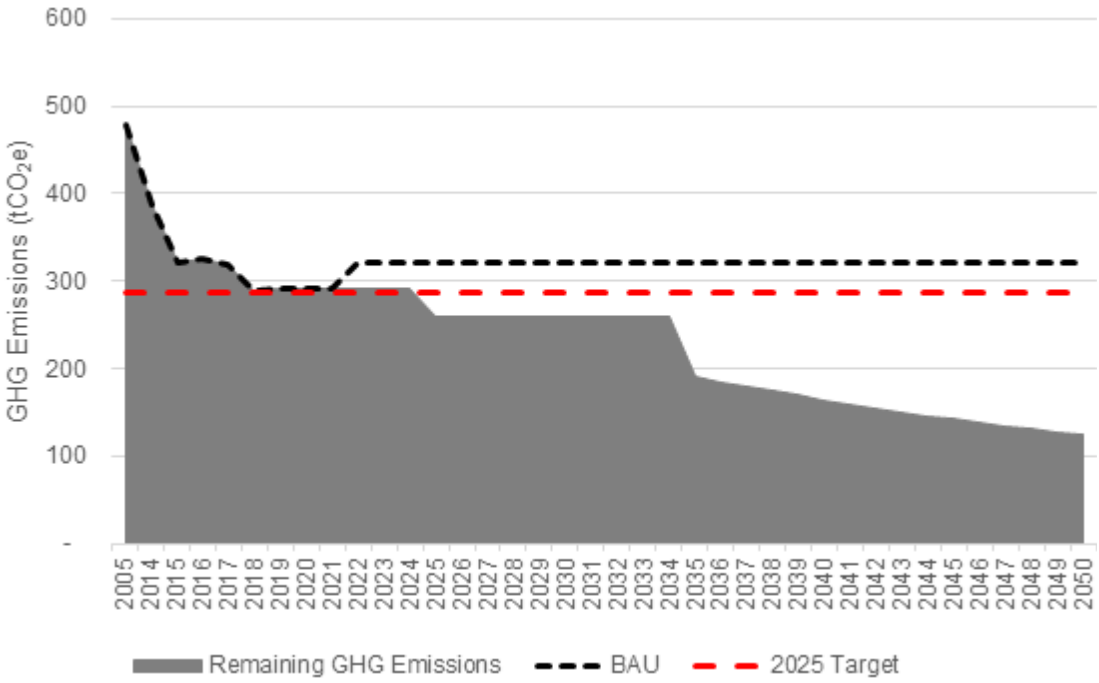

Figure 7. Forecast of Buildings GHG Emissions

With the proposed building and facility initiatives it is estimated that the Town could reduce GHG emissions by up to 66% below 2005 levels by 2050. The Town could further reduce building and facility GHG emissions to zero, using a combination of RNG, RECs and carbon offsets as described below.

Renewable Energy Credits (REC) represent the environmental attributes associated with renewable electricity generated from wind, solar electric, biomass, biogas, small scale hydro, geothermal, etc. Since these renewable energy resources generate very few GHG emissions as they produce energy, they represent an indirect GHG emissions reduction. For every unit of electricity (megawatt hour) generated from a renewable-energy project, a corresponding REC can be created and sold, to be purchased by corporations like the Town for GHG emissions reduction purposes.

Renewable Natural Gas (RNG) is natural gas that is derived from organic waste material sources such as food waste, garden and lawn clippings, animal waste, paper, cardboard, wood, and solid waste. Common facilities that produce RNG include wastewater treatment plants and landfills. RNG provides GHG emissions reductions in comparison to traditional natural gas as it avoids emissions associated with gas extraction, refining, transportation, and storage. RNG also enables the capture of GHG emissions such as methane (CH_4) from landfill gas for beneficial reuse as a heating source. RNG contracts can be purchased by municipalities looking to reduce emissions.

Carbon offsets are "created" when a project reduces, removes, or sequesters a measurable amount of GHG emissions that would otherwise have been released to the atmosphere. They generally represent direct, or on-site, GHG emission reductions or removals. For example, the capture and destruction of methane (CH_4) at a landfill gas capture system to generate energy is a direct GHG emission reduction and may be considered a carbon offset. Credits from these projects may be purchased in order to offset a corporation's GHG emissions.

An estimate of possible GHG reductions is presented in Table 7, including all identified buildings and facility initiatives as well as the long-term (by 2050) procurement of RNG, RECs and carbon offsets.

Table 7. Estimated GHG Emission Reductions From Buildings

Year Ended	2020	2025	2030	2040	2050
Buildings & Facilities Business as Usual Forecasted GHG Emissions (tCO_2e)	292	321	321	321	321
Buildings & Facilities Emissions Reductions (tCO_2e)	-	62	62	157	321
Remaining GHG Emissions (tCO_2e)	292	259	259	165	-
Change from 2005 Base Year	-38.9%	-45.8%	-45.8%	-65.6%	-100.0%

Notes to table: 2005 Base Year = 479 tCO_2e

It is recommended that the Town focus on energy conservation building retrofits and low- or zero-carbon technologies first and to treat the use of RNG, RECs and carbon offsets as a last resort option to be used only when there are policy or technological barriers that cannot be overcome. The challenge to the proposed approach will require a culture shift to move away from 'like-for-like' replacements and towards recognizing energy and GHG reduction opportunities on a lifecycle basis which will require paying a premium for low- and zero-carbon technologies.

B1: Adopt a Low Carbon Building Policy

The current LEED® Silver building directive will not enable the Town to achieve its goal of carbon neutrality by 2050. To keep in line with best practices, it is recommended that the Town consider developing a building policy that requires all new buildings and major renovations achieve a minimum 25% energy and GHG efficiency improvement beyond the Ontario Building Code, SB-10 Division 3 (2017) and be certified to the Passive House standard.

Passive House designs 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. A Passive House certified building can significantly reduce energy costs and GHG emissions by up to 90 per cent as compared to basic building code standards.

Passive House Buildings are different from Net Zero buildings in that a Passive House building will operate on the absolute minimum amount of energy required, whereas a Net Zero building is designed to generate as much energy as it uses over a year. The Passive House standard adopts an 'all or nothing' design approach which is different from LEED which offers a graded approach to certification – i.e. silver, gold, platinum. There are three levels of Passive House – Classic, Plus and Premium. Passive House Classic does not account for renewable energy, whereas Plus and Premium incorporate metrics for renewable energy generation on- or off-site.

Meeting a Passive House requirement for new buildings would be relatively straightforward but is likely to be problematic for major renovations of existing building stock due to the nature of the existing design and remaining building materials that can hinder the necessary energy efficiency requirements. As part of the development of this new policy, the Town may wish to undertake an energy modelling study on a Town building or facility that is set to be retrofitted in the future to understand the depth of renovation required and the range of costs that may need to be planned for with future retrofits. The recommended outcome of this exercise would also be technical standards that direct contractors and project staff to focus on specific areas of performance.

The creation of a Low Carbon Building Policy will require staff time, but the implementation of a site visit and energy modelling study involving a computer simulation of a building to identify energy consumption sources, patterns and conservation opportunities, will likely cost upwards of $50,000 to $60,000.

B2: Investigate Additional Energy Conservation Opportunities

In the 2014 ECDM Plan, several building energy conservation opportunities were recommended, and most were completed. The scope of the energy audits included reviewing building thermal performance, load distribution, existing equipment and controls schedules, occupancy patterns, lighting, and efficiency systems to identify energy and emission reduction opportunities. The recommendations ranged from lighting system upgrades, Building Automation Systems (BAS) upgrades, the use of insulation and weather-stripping to installing variable speed motors, and the installation of heat recovery systems.

It is recommended that the Town continue to investigate energy conservation opportunities and implement those that meet the Town's return on investment requirements after an internal cost of carbon (ICC) lens has been applied (Initiative C2). This will require the Town to make available funding or financing and be willing to invest in more expensive higher efficiency low-carbon technologies. In the short term, the Town should focus on completing energy audits and implementing energy reduction initiatives at its top energy consuming locations which include:

- Beaver Valley Community Centre
- Thornbury Water Treatment Plant
- Ravenna Works Building
- L.E. Shore Memorial Library
- Craigleith Wastewater Treatment Plant

During the development of the ECDM, an energy opportunity assessment was completed by Stantec Consulting Ltd. at the Craigleith Wastewater Treatment Plant and the Landfill Operation Building to assess if the installation of energy reduction measures were possible. The assessment concluded that the following energy conservation actions could be implemented at the Craigleith Wastewater Treatment Plant:

- Correct poor load / power factor by at the Main Administrative Building:
  - Minimizing operation of idling or lightly loaded motors.
  - Avoiding operation of equipment above its rated voltage.
  - Replacing standard Original Equipment Manufacturer (OEM) motors as they burn out with higher energy-efficient motors.
- Install capacitors in the AC circuit at the Main Administrative Building to decrease the magnitude of reactive power.
- Replace single pane windows to double or triple glazed at the Main Administrative Building.
- Reseal windows and doors at the Main Administrative Building.
- Install programmable thermostats at the Main Administrative Building, Bay Area and Blower Room.
- Upgrade all lights and signage to LED lights and fixtures at all buildings.
- Introduce outside air into Main Administrative Building when temperature is below 18°C for free cooling.
- Install variable frequency drives (VFD) on building exhaust fans at all buildings and waste pumps at Building #3.
- Spray foam all buildings to increase R-Value.

Based on the energy consumption and the findings from the energy opportunity assessment, it is recommended that the Town complete a detailed energy audit at the Craigleith Wastewater Treatment Plant within the next six months.

It is also recommended that the Town will continue to seek out funding opportunities and incentives, such as the saveONenergy incentive program, the Federation of Canadian Municipalities (FCM) Green Municipal Fund, and the Federal Community Infrastructure Improvement Fund to improve the business case for high GHG reduction actions that have a longer or lower financial return on investment.

As grants and funding programs typically have detailed requirements or are only available for a short duration of time, the Town may need to consider the use of a combination of other financing vehicles, like implementing the Town's energy reserve fund, using green debt financing (e.g., green bonds), or utilizing energy performance contracts.

B3: Accelerate Building LED Replacements

Significant energy savings can be achieved through an accelerated building LED replacement program in collaboration with the Local Authority Services (LAS) a subsidiary of the Association of Municipalities of Ontario (AMO) that provides services tailored for the municipal sector. The initiative would require the completion of lighting inventories and audits, and the installation of LED lighting, electronic ballasts, LED

Exit signs, lighting controls / motion sensors, etc. Over the next 12 months, it is recommended that the Town engage with LAS on their facility lighting service to estimate the cost, energy reductions, timing and return on investment of this initiative.

B4: Prioritize Deep Energy Retrofits Over Like-For-Like Replacements

Deep energy retrofits simultaneously retrofit or replace equipment and building envelope infrastructure (e.g. roof, walls, windows) to achieve large energy and GHG emission reductions and tend to be informed by building condition assessments and commissioning activities. Deep energy retrofits typically involve:

- Significantly reconfiguring the interior
- Replacing the roof
- Adding or rearranging windows for increased daylight
- Replacing the HVAC systems with renewable technologies like ground-source heat pumps.

Natural Resources Canada (NRCAN) estimates that deep energy retrofits can achieve upwards of a 60% reduction in energy consumption which directly translates to a similar reduction in GHG emissions.[7] A decrease in energy demand means smaller mechanical systems and options for cleaner fuel sources. Electrically driven heat-pumps generate significantly fewer GHG emissions than a natural gas boiler or furnace.

Deep retrofits require a significant capital investment and long-term planning. At present, the Town has not accommodated for this initiative in its five to ten-year budgets, and thus the action retrofits would not likely occur until 2030 or later making this a long-term initiative. As a prerequisite to deep energy retrofits, in the short-term, it is recommended that the Town use Building Conditions Assessments (BCA) and energy audits to develop energy and water performance baselines. This would enable the Town to forecast and plan for additional capital costs and provide Council with a clear business case as to why the upgrades are occurring and the rationale for not seeking a 'like-for-like' replacement long before the capital is required.

B5: Implement a Building Commissioning Program

Commissioning verifies that a building has been constructed to its proper specifications. The best time to commission a building is during design and construction, with special attention being paid to the building envelope. Post-construction, continuous commissioning of a building's entire systems over a specified period of time (typically every 1-2 years) is recommended to maintain continuous peak performance over its useful life. Ongoing-commissioning and re-commissioning are important because they reduce operating costs, reduce the risk of failures, and inform retrofit opportunities and deep energy retrofit plans before they are due. Various pre- and post-implementation commissioning case studies have shown efficiency improvements on the order of 5% to 30% because of improved operations and maintenance.

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[7] Natural Resources Canada, 2018. *Retrofitting*, www.nrcan.gc.ca/energy/efficiency/buildings/20707, accessed on Sept 4, 2018.

The studies also show that the resulting simple payback periods are typically less than 2 years[8]. Typical commissioning activities include:

- 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.
- Air and water distribution balancing and adjustments.
- Verifying controls and control sequencing, including enabling and re-enabling automatic controls for set points, weekends, and holidays.

It is recommended that this initiative be implemented immediately as the commissioning of buildings would occur on a five-year cycle at least or when the function of a building or facility changes.

B6: Implement an Energy Performance Monitoring Program

Low-energy intensive buildings do not always operate as they were designed resulting in poor energy performance. Annual energy performance reporting, whether through Energy Star Portfolio Manager or a third-party energy management system, can close the gap between predicted and actual energy use and provide support to an ongoing building commissioning program (Initiative B5). Providing building operators with energy management dashboards will enable them to benchmark their energy performance against prior year data and buildings in the portfolio that are of similar typology to identify underperformers and the need for improvements. Over time, energy performance monitoring can also result in the identification of opportunistic business changes like adjusting how facilities are programmed and managed (e.g., establishing temperature and environment policies for staff and patrons, closing facilities, etc.).

It is recommended that the Town utilize a no-cost energy monitoring and benchmarking programs like the LAS system, or Energy Star Portfolio Manager to track and assess energy and water consumption. Although there are no associated costs with the use of the LAS system or Energy Star Portfolio Manager, the Town will need staff resources to orientate, upload building and facility data, and track and report on performance over time.

B7: Hire a Dedicated Energy Manager

Currently at the Town, energy management is primarily a responsibility of each building / facility manager and therefore the attention to energy management varies between departments. With limited tools and resources available to Town staff for energy efficiency planning and implementation, opportunities to reduce energy and water consumption can and are often missed. The hiring of a dedicated Energy

[8] 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, accessed August 3, 2018.

Manager would address this issue. The Energy Manager would be responsible for the deployment of the proposed initiatives in this ECDM and for monitoring energy and GHG performance at the Town level to improve overall energy performance.

As the hiring of an Energy Manager is fundamental to the success of the ECDM, it is recommended that the Town prioritize this initiative.

4.0 FLEET & EQUIPMENT

The Town owns and operates a variety of vehicles to perform daily operations. These include road insured vehicles such as light duty trucks (LDT) and off-road equipment like back-hoes which utilize either gasoline or diesel fuel. Corporate fuel usage is influenced by the size of the vehicle fleet, the vehicle operators and the efficiency of the individual vehicles. In 2018, fleet and equipment accounted for 55% of the Town's GHG emissions. A breakdown of fuel consumption and GHG emissions by Town Division is presented in Table 8.

Table 8. 2018 Fleet Fuel Consumption and GHG Emissions by Division

Division	Diesel (L)	Gasoline (L)	GHG Emissions (tCO_2e)	Percent of Total Sector GHG Emissions
Fire	5,789	6,039	31	5.6%
Building	-	3,284	8	1.4%
By-law	-	7,019	16	2.9%
Short Term Accommodation	-	759	2	0.3%
Roads - Administration	25,182	8,775	93	16.8%
Roads - Winter Control	59,131	8,851	192	34.6%
Engineering	-	1,215	3	0.5%
Landfill	31,626	5,839	105	19.0%
Cemetery	-	654	2	0.3%
Community Services	-	-	-	0.0%
Parks and Trails	6,915	11,264	46	8.3%
Tomahawk	-	973	2	0.4%
Harbour	-	1,259	3	0.5%
Beaver Valley Community Centre	-	59	0	0.0%
Development Engineering	-	108	0	0.0%
Locates	-	1,028	2	0.4%
Water Meters	-	1,451	3	0.6%
Water	2,050	9,658	28	5.1%
Wastewater	713	6,569	17	3.1%
Total	**131,406**	**74,808**	**554**	**100.0%**

The above table shows that the top two fuel consumers and generators of GHG emissions are the Roads (51.5%) and Landfill Division (19.0%) due to the nature of their operations and the size of the fleet.

Compared to the 2005 base year, fleet and equipment business as usual GHG emissions are expected to decline post 2030 as a result of the expected changes to the Corporate Average Fuel Economy (CAFE) Standards and tailpipe GHG emissions standards for light duty and heavy-duty vehicles starting in 2027. Figure 8 shows that emissions reductions from fleet and equipment will not be sufficient to achieve either the 2025 or the 2050 GHG reduction targets. This is due to a limited number of available low- or no-emission heavy duty vehicle and equipment options currently available for purchase, and many of those that are available do not meet occupational health and safety requirements. Over time as the market conditions in this area improve, it is recommended that the Town consider pilot testing of hybrid or fully electric heavy equipment and off-road vehicles prior to purchasing.

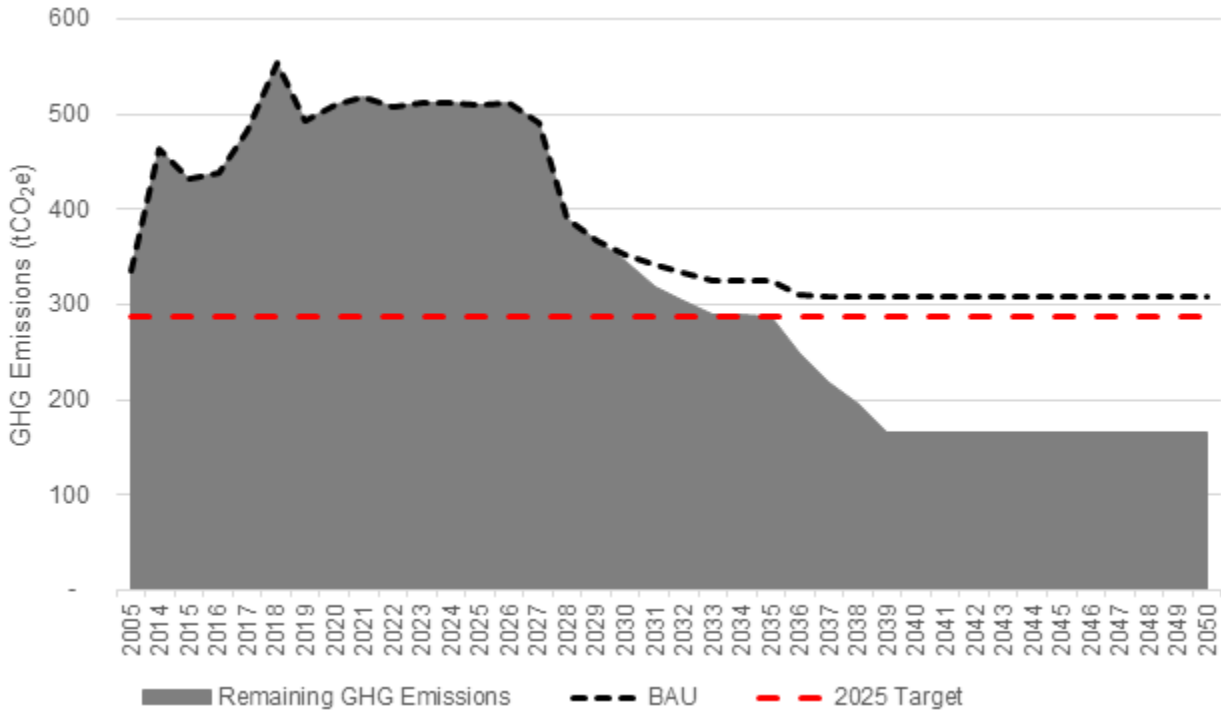

Figure 8. Forecast of Fleet & Equipment GHG Emissions

Based on the proposed actions, it is estimated that fleet can reduce its GHG emissions by up to 50% by 2050 as a result of fleet optimization, reduction and the conversion of light duty vehicles and trucks to electric (Table 9). The conversion of heavy-duty fleet to electric or the use of biofuels would reduce GHG emissions further.

Table 9. Estimated GHG Emission Reductions From Fleet & Equipment

Year Ended	2020	2025	2030	2040	2050
Fleet & Equipment Business as Usual Forecasted GHG Emissions (tCO_2e)	510	510	352	309	308
Fleet & Equipment Emissions Reductions (tCO_2e)	-	<1	6	144	143
Remaining GHG Emissions (tCO_2e)	510	510	346	165	165
Change from 2005 Base Year	51.8%	52.0%	3.1%	-50.8%	-50.8%

Notes to table: Fleet & Equipment 2005 Base Year = 336 tCO_2e

Fleet and equipment GHG emissions are the direct result of a wide and varied range of services delivered to the community. As no single measure can eliminate fleet and equipment GHG emissions, a suite of strategies is required which include:

- F1: Develop a Low Carbon Fleet Management Policy
- F2: Opportunistically Switch Light Duty Fleet to Electric
- F3: Pilot New Technologies & Techniques

F1: Develop a Low Carbon Fleet Management Policy

The purpose of a Low Carbon Fleet Management Policy is to reduce the environmental impact of the Town's vehicle and equipment fleet by reducing associated fuel consumption and GHG emissions, while maintaining or improving the level of service offered to the community. As it relates to energy and GHG emissions management, the Low Carbon Fleet Management Policy would include guidance on:

- **Procurement Standardization**: Procurement standardization aims to minimize fleet and equipment diversity as much as possible which can lead to economic savings, lower maintenance costs, increased operational efficiency and safety, improved vendor relations, and support the migration to renewable fuels. It is recommended that standardization be focused on purchasing fuel vehicles and equipment appropriate for Town operations, while accounting for lifecycle costs, and heavily weighting items that are renewably powered or electric. This will require the development of a low-carbon vehicle standard to create a hierarchy of most-preferred to least preferred technologies based on GHG emissions for a range of operational activities.
- **Life Cycle Costing**: Life cycle costing identifies when vehicle and equipment assets should be replaced to minimize the total cost of ownership to the Town. Lifecyle analysis also provides optimal timing for replacement, based on anticipated use, and can be used to assign actual asset costs, based on actual use, to end users. It is recommended that the vehicle and equipment life cycle replacement and cost assignment program feed into the Town's asset management and financial systems.

- **Vehicle Right Sizing**: Vehicle right sizing assigns vehicles based on identified need rather than driver preference. It is recommended that the policy afford appropriate Town staff with the ability to allocate vehicles for staff based on the functional needs required with the objective of rationalizing fleet assets, reducing fuel consumption and GHG emissions, and increasing fleet efficiencies.

Using life cycle costing while assessing vehicle operational demands and GHG emissions, the Town will be able to purchase vehicles that provide the same level of operational service and achieve the highest possible GHG emissions reduction. It is estimated that a low carbon fleet management policy and supporting actions such as vehicle rightsizing can achieve upwards of 10-17% in GHG reductions from fleet[9,10].

It is recommended that the Town prioritize the development of the Low Carbon Fleet Management Policy as it will guide the implementation of the remaining fleet and equipment initiatives.

F2: Opportunistically Switch Light Duty Fleet to Electric

According to Bloomberg New Energy Finance, by 2040, nearly 55% of vehicle sales will be electric, and are projected to achieve cost parity to their equivalent gasoline powered vehicle by the early 2020s (Figure 9). It is anticipated that by 2025 light duty electric vehicles (EV) will reach cost parity with their gasoline and diesel counterparts[11].

The variety and types of electric vehicles available for sale are also expected to expand significantly from the current offering of light-duty vehicles to pick-up trucks and SUVs over the next five years. As the battery life, charge time, cost-parity of electric vehicles have improved significantly, it is now feasible for the Town to opportunistically reduce energy and GHG emissions from its light duty vehicle (LDV) fleet by replacing these with electric vehicles. This will not only support corporate needs but will encourage the public to make their own investments in electric vehicle technology as well.

To move forward with this initiative, in the short-term, the Town will need to identify a process that incorporates vehicle right-sizing requirements to identify which vehicles can be replaced with electric vehicles. Over the medium-term, it is recommended that the Town complete an EV adoption study to identify where fleet can be converted to EV and what EV infrastructure will need to be planned for.

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[9] City of Richmond, *Green Fleet Action Plan,* www.richmond.ca/__shared/assets/Green_Fleet_Action_Plan38974.pdf, accessed August, 2019.
[10] CAPCOA, *Quantifying Greenhouse Gas Mitigation Measures,* www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf, accessed August, 2019.
[11] Bloomberg New Energy Finance, 2018, *Electric Vehicle Outlook 2018,* https://about.bnef.com/electric-vehicle-outlook/, accessed August 15, 2018.

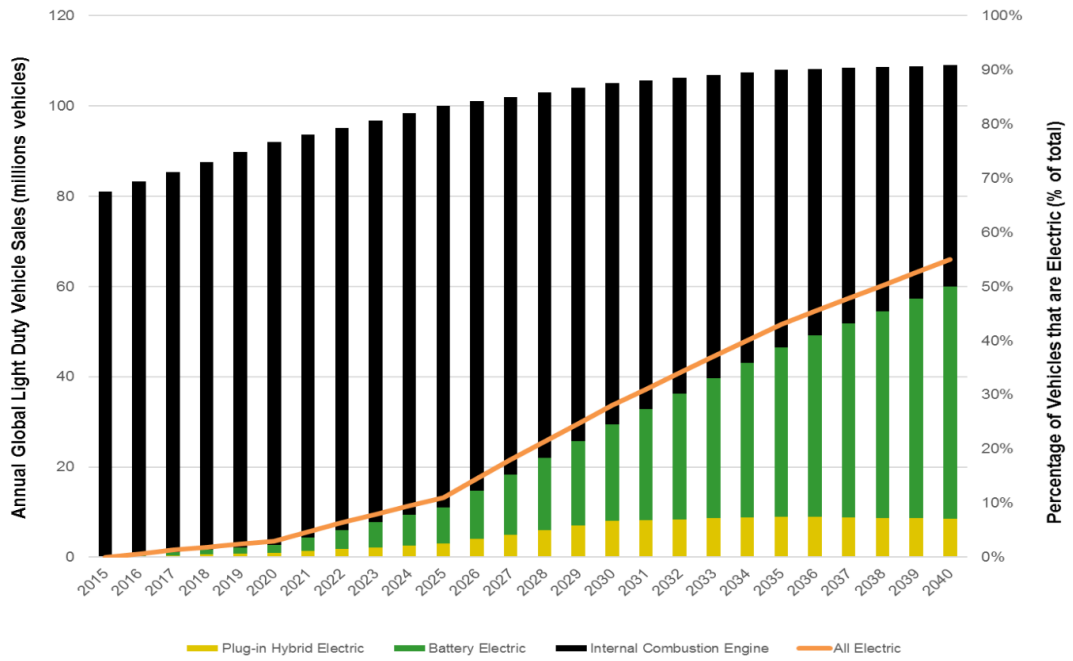

Figure 9. Forecasted Electric Vehicle Global Sales[12]

F3: Pilot New Technologies and Techniques

It is recommended that the Town investigate pilot projects utilizing electric vehicle and other heavy truck hybrid technologies as they become available and recommend unique opportunities which result in cost effective and reduced fuel consumption and GHG emissions. For instance, during the waste collection contract vehicles retender in 2023, the Town could explore the procurement of heady duty vehicle or low-carbon technology vehicles.

It is also recommended that the Town evaluate its current practices to take advantage of techniques that can result in lower fuel consumption, such as the naturalization of the Town's parkland areas. This initiative would not only reduce the amount of energy-intensive grass mowing areas, thus reducing fuel use, but would also synergistically benefit local air quality and plant biodiversity. Staff time previously used for grass moving could be switched to establishing and maintaining naturalized areas.

[12] Bloomberg Finance, 2018. *Electric Vehicle Outlook 2018*, https://about.bnef.com/electric-vehicle-outlook/, accessed on Sept 4, 2018.

5.0 CORPORATE

The Town has both a responsibility and an opportunity to respond to the causes and impacts of climate change and has recognized this by committing to carbon neutral operations by 2050. The achievement of this important GHG reduction target requires both "conservation first" actions like those already identified in this ECDM Plan, but also a change in how the Town internalizes and prioritizes energy and GHG reductions. The following initiatives set these important foundations:

- C1: Incorporate Life Cycle Considerations into Capital Planning and Purchases
- C2: Establish an Internal Cost of Carbon (ICC)
- C3: Develop a Carbon Neutral Policy
- C4: Develop a Sustainable Infrastructure Policy

C1: Incorporate Life Cycle Considerations into Capital Planning and Purchases

Like most local governments, the Town must often prioritize competing financial priorities, which can result in a procurement culture where the lowest bid is often seen as the most viable and best value for taxpayers. The result, however, is a system that defaults to 'like-for-like' replacements, penalizes higher cost energy and GHG emission reduction technologies and best-practices, and does not account for the GHG footprint of the products or services being provided. For example, NRCAN estimates that 20% of Canada's GHG emissions are embodied in the construction sector – which are not accounted for in most municipal GHG accounting systems.[13]

To shift the current Town culture and narrative, it is recommended that the Town integrate Life Cycle Analysis (LCA) processes into budget and capital planning, strategic planning, purchasing policies, preventative maintenance plans, environmental management plans, and asset management. It is also recommended that life cycle energy and GHG 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 in consideration to the total life cycle of the asset. Success means that these measures are incorporated into the initial stages of operational and capital project planning, and that options for energy efficiency and conservation are considered, evaluated and quantified in terms of life cycle, which includes cost, maintenance and energy and GHG reductions.

As LCAs can be burdensome, it is recommended that the LCA process be first completed for capital projects over $100,000. This will require a study to develop LCA criteria for different infrastructure types, assess which LCA tools could meet the Town's needs, the development of technical guidance, and LCA training for Town staff. To follow through on the recommendations of the LCA process, the Town will need

[13] NRCAN, *Energy and Greenhouse Gas Emissions*, https://www.nrcan.gc.ca/energy-and-greenhouse-gas-emissions-ghgs/20063, accessed August 2019.

to expand budgets to allow for additional funds to accommodate premium products that have longer life expectancy and/or less maintenance.

C2: Establish an Internal Cost of Carbon (ICC)

Climate change impacts are expected to have serious negative effects on global economic growth and development. In 2005, the UK government commissioned an independent economic review called The Stern Review, which concluded, "the benefits of strong and early action far outweigh the economic costs of not acting."[14] Using results from economic models, the review estimated that if we do not act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global Gross Domestic Product (GDP) annually – potentially as much as 20% of GDP. In contrast, the costs of implementing actions to reduce GHG emissions and mitigate the impacts of climate change could be limited to around 1% of global GDP annually.

Although the social and environmental benefits of reducing energy and GHG emissions are well established, their recognition or importance in decision making processes are often under-represented. Applying an internal cost of carbon (ICC) allows organizations to better account for these benefits and is a key component to moving an organization towards its energy and GHG reduction targets. To support many of the proposed initiatives, it is recommended that the Town establish an ICC which would be used to calculate the value (expressed as a cost) of GHG emissions associated with decision-making in respect to all Town assets and infrastructure.

It is recommended that the Town consider aligning its policy with best practice and other Canadian municipalities which establishes the ICC at \$150/tCO_2e.

C3: Develop a Carbon Neutral Policy

The Town has committed to carbon neutral operations by 2050. To achieve this with current technologies available today, the Town would need to:

- Renovate the existing building and facility stock to operate at or close to zero-emissions performance.
- Switch all large and heavy-duty equipment to biodiesel fuels.
- Transition heavy duty fleet and equipment to electric where there are no conflicts with occupation health and safety.
- Where possible, install solar photovoltaic (PV) systems on all Town buildings and facilities.
- Reduce the balance of the Town's GHG emissions through the purchase of RECs, RNG, and carbon offsets.

[14] Nicholas Stern. *The Economics of Climate Change: The Stern Review*. Cambridge University Press, January 2007. http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

As there are several carbon offset and REC types, standards, vintages, and providers, it will be necessary for the Town to create a Carbon Neutral Policy that provides clear direction around purchasing, generating, using and retiring these climate change commodity instruments. For example, the policy should clearly define:

- procurement criteria (e.g., local, additional, vintage, serialized, verified, ownership over environmental attributes, etc.)
- acceptable price ranges
- contract terms
- application (e.g., RECs can only be applied to electricity GHG emissions)
- whether/when the Town should generate its own RECs
- reporting and tracking of use

This process might include engaging on a long-term power purchase agreement for green electricity which would provide price and market stability.

The development of a policy will require staff time and, possibly, external consultant support on an as needed basis.

C4: Develop a Sustainable Infrastructure Policy

Numerous infrastructure sustainable rating systems are available to facilitate and assess sustainable practices throughout the various phases of a project's life cycle. Many of these systems, like GreenRoads and CEEQUAL/ BREEAM, are infrastructure type specific (transportation, water, and roads) and do not always assess the holistic nature and impacts of a project. Envision, developed by the Institute for Sustainable Infrastructure (ISI), is a comprehensive rating system that assesses not only individual project performance, but also how the project contributes to the sustainability of the community it is situated. It includes 5 main categories of assessment: Quality of Life, Leadership, Resource Allocation, Natural World and Climate and Risk.

A sustainable infrastructure policy and associated rating system will aid the implementation of this ECDM Plan, requiring designers to reduce embodied, construction and operational GHG emissions and energy usage over a project's life cycle. For example, the use of the Envision framework would require that staff investigate and identify opportunities to install renewable energy generation infrastructure.

It is recommended that the Town consider use of the Envision ISI Framework for certain corporate capital projects where it would be advantageous to evaluate infrastructure sustainability in detail.

6.0 ECDM PLAN IMPLEMENTATION

6.1 GOVERNANCE AND COLLABORATION

The Town Solid Waste Division currently holds the responsibility of leading the implementation of the ECDM Plan. This responsibility includes:

- Ensuring the Town meets all energy related regulatory requirements
- Serving as a primary point of contact for all energy related matters
- Generating and distributing reports to Council and Staff
- Monitoring and verification of energy performance
- Completing grant and incentive applications
- Promotion of energy education and awareness
- Acting as a resource in the planning, development and implementing of energy efficiency projects

Having a dedicated Energy Manager (see Initiative B7) would allow for better focus on governance and project implementation. It would also result in continuous and more focused monitoring and tracking of results.

Individual departments will be responsible for the project management of the implementation of the specific policy and program initiatives, ideally with support from a new Energy Manager. Projects will be implemented on a case-by-case basis and brought forth for Council's consideration and approval as necessary.

6.2 MONITORING EXISTING & EVALUATING NEW INITIATIVES

This ECDM Plan contains a list of recommended initiatives to be completed over the next ten years as well as longer term initiatives to 2050. Implementing the initiatives requires dedicated resources and systems in place to ensure that the policies, programs, and projects recommended are implemented and tracked so the Town's GHG emissions reduction targets are met. The intention of the ECDM Plan is to dovetail energy conservation, energy demand management, and GHG emissions as part of the Town normal course of business for asset retrofits, renewals and life cycle replacement projects. Success in this endeavor requires incorporating conservation and demand management options at the initial design stages. In so doing, this ensures that options for improving energy efficiency are considered, evaluated, and quantified in terms of life cycle costing analysis, including cost, maintenance, GHG reductions and other co-benefits that may accrue to the Town. When evaluating future initiatives, a Town checklist should include the following:

- Project base case
- Energy efficient options
- Project costs (base case vs. energy efficient case)

- Project savings (in terms of energy, maintenance, avoided GHG emissions)
- Maintenance savings
- Financial benefits
- Environmental benefits
- Co-benefits
- Incentives/funding available
- Overall benefits
- Life cycle analysis recommendations

This ECDM Plan will be in place for five years until an update to the Plan will be initiated as part of the requirements of *O. Reg. 507/18*s. At that point, the initiatives herein will be evaluated in consultation with the various Town departments, as part of the departmental strategic operations planning process. This will be an opportunity to review and prioritize potential strategies based on resources and emerging technological opportunities.

6.2.1 FUNDING

Wherever possible, the Town should take advantage of funds to speed up the implementation of project initiatives. For example, the Town could submit an application to Infrastructure Canada for federal funding under the Community, Culture and Recreation Fund to support the energy projects at the identified community centers under the basis that the retrofits would reduce GHG emissions, but also support using the community centers as ‘cooling centers’ during heatwaves.

Other opportunities for funding are identified under specific initiative categories throughout this ECDM Plan. As these programs are subject to political changes, the Town should proactively plan and incorporate capital and operating costs of the proposed initiatives into future budgets. This will enable the Town to take advantage of external funding opportunities when they are available, but not have to rely on these external sources to move forward on initiatives.

6.3 REPORTING & COMMUNICATION

6.3.1 Monitoring & Reporting

An ongoing feedback loop, known as the Deming Cycle, facilitates continuous improvement and can be used to facilitate the continuous improvement of the ECDM Plan ensuring that it remains as a living document. Moving forward, making progress towards the Town’s GHG reduction targets, GHG emission forecasts, and the priority of the initiatives will be regularly reassessed and refined. The four components of the Deming Cycle, shown below in Figure 10, are “plan, do, check and act.” A run through the plan-do-check-act cycle should occur on an annual basis and should coincide with the Town’s annual budget cycle for planning each year’s capital and operating budgets.

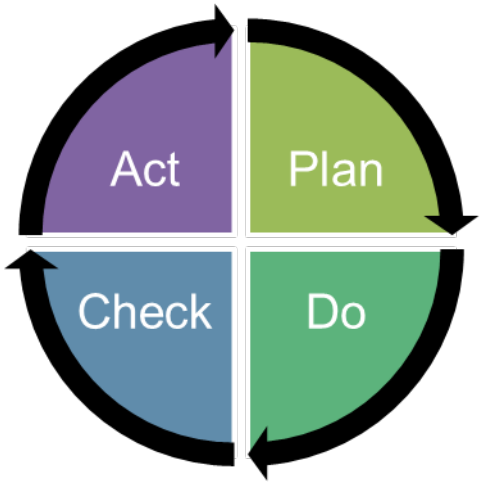

Figure 10. The Deming Cycle (Plan-Do-Check-Act)

A monitoring framework provides the Town with a task list of items to track that will help re-assess the effectiveness of ECDM Plan initiatives, GHG emissions, and other activities contained within the ECDM Plan over time (the "check" components of the cycle). Monitoring includes two components. The first is the monitoring of the ECDM Plan initiatives - what is being done, who is doing it, is the activity funded, etc. The second component is the compilation of the energy and GHG emissions inventory to monitor the success of the ECDM Plan initiatives. Tracking, measuring, and sharing progress towards the GHG emission reduction targets and the initiatives identified in the ECDM Plan is essential to maintaining momentum for change. The success of the ECDM Plan will be measured by the results achieved relative to prior reporting years.

On an annual basis, it is recommended that an Energy and GHG Emissions Report be prepared, which should include at a minimum:

- Current energy and GHG emissions profile in aggregate and broken down by asset.
- Change in energy and GHG emissions from the prior year and the baseline.
- Follow up actions from the prior year's report.
- A description of the work that has been completed.
- Extent to which GHG emissions reduction have been met.
- Identification of any issues or challenges faced in advancing each initiative.
- An indication of progress toward achieving each initiative, using the following scale:
  - Not Started: The initiative has not been implemented.
  - On Track: The initiative has been implemented. For various initiatives, progress will be measured through quantitative and qualitative primary indicators (Table 10) and secondary indicators (as identified).
  - Outstanding: An issue, barrier and/or challenge is prohibiting the initiative from being implemented.
  - Delayed: The initiative has been delayed or placed on hold.

  - Completed: The initiative has been completed.
- List of new initiatives to address issues, barriers and challenges.
- Timing and assigned responsibilities of the initiatives.

Table 10. ECDM Plan Key Performance Indicators

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
Fleet Fuel Efficiency	Fuel quantity per kilometer
Fleet Total Fuel Used	Fuel quantity
Fleet Number of Vehicles in Different Classes	Number of vehicles with greater fuel efficiency, hybrid, electric vehicle etc.
Streetlights	Energy use per light

The implementation of the ECDM Plan (the “plan and do” components of the cycle) will require the formulation of an annual work plan to define what actions are 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 identified stakeholders, as noted in the following section.

6.4 COMMUNICATION STRATEGY

The overall goal of the communication strategy is to outline tools and techniques to assist the Town with ongoing internal communication about the ECDM Plan, including implementation and progress towards targets. The communication strategy is focused on internal communication for Town staff and council and is not designed to be public. The key objectives of the strategy are:

- To communicate the presence and importance of the ECDM Plan
- To share progress towards the GHG emission reduction targets
- To motivate multiple audiences about what they can do to reduce the Town’s energy use and GHG emissions
- To communicate coming changes in business practices to support the ongoing implementation of the ECDM Plan

It is recommended that GHG emissions quantification and reporting follow best practice reporting protocols like the ICLEI GHG Protocol, or the World Resources Institute GHG Protocol.

6.4.1 Tactics

The communications strategy includes a series of strategic tactics (Table 11).

Table 11. Suggested Communication Tactics

Tactic	Description/Rationale
Host quarterly ECDM Plan Meetings	The intent of these meetings is to: • Share best practices between departments • Provide status/progress updates on Energy conservation and GHG emission reduction strategies across all departments • Prioritize work • Share funding opportunities • Collaborate on shared initiatives that flow into annual work plans and budgets. Once a year the team will review the ECDM Plan and progress towards its goals.
Develop an annual corporate Energy and GHG Emissions Progress Report	The Environmental Initiatives Division will gather information from all departments, and report annually on energy and GHG emissions. They will also ensure the development of a one-page, graphic summary document which can be used to communicate results with a wide range of audiences including internal staff and Council.
Increase awareness of the ECDM Plan and implement general energy skills training for all staff	Develop (or adopt) a stand-alone webinar that would be suitable for all Town staff. The webinar could cover: • The presence of the ECDM Plan • The role of all staff members in contributing to energy conservation and GHG emission reductions • Easy tips and reminders for every day corporate energy conservation and GHG emission reductions
Work to integrate key messaging into existing communications	Work alongside Human Resources to share tips and reminders about energy conservation and GHG emission reductions with all staff.
Create (and publicize) a “Bright Lights” program	Create a staff-based program to celebrate success. Suggest working with the 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
Facilitate open lines of communication	Ensure that staff across the corporation have knowledge of, and access to an ECDM Plan information-sharing portal. This portal might be used to: • Share innovative ideas • Identify areas of concern • Provide feedback or solutions

6.4.2 Recommendations

The following table includes supporting details for each of the tactics.

Table 12. Timing and Responsibility of Suggested Communication Tactics

Tactic	Audiences	Level of Effort				Timing
		Very Low	Low	Med	High	
Host quarterly ECDM Plan Meetings	Senior leaders, representing key departments					Quarterly, Ongoing
Develop an annual corporate Energy and GHG Emissions Progress Report	Council All staff					Annually
Increase awareness of the ECDM Plan and implement general energy skills training for all staff	All staff					End of Year Two
Work to integrate key messaging into existing communications	All staff					End of Year One
Create (and publicize) a “Bright Lights” program	All staff					End of Year One
Facilitate open lines of communication	All staff					End of Year One