

2019 - 2023 ENERGY CONSERVATION AND DEMAND MANAGEMENT PLAN

REGIONAL MUNICIPALITY OF NIAGARA

May 13, 2019



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EXECUTIVE SUMMARY

The Ontario Provincial Government has committed to help public agencies better understand and manage their energy consumption. As part of this commitment, Ontario Regulation 507/18 under the Electricity Act requires public agencies, including municipalities, municipal service boards, school boards, universities, colleges and hospitals to report on their energy consumption and greenhouse gas (GHG) emissions annually, to develop and implement an Energy Conservation and Demand Management (ECDM) Plan, and to update their ECDM Plan every five years.

Regional Municipality of Niagara is committed to developing and executing on strategies to reduce environmental impact and ensure regulatory compliance, in accordance with Ontario Regulation 507/18.

The 2014 Energy Conservation and Demand Management Plan had a goal to reduce overall energy consumption by 5% of 2011 levels by 2018. Additionally, the 2013 Corporate Climate Change Action Plan had a goal to reduce overall GHG emissions to 2006 levels by 2016. Table 1 compares the target and 2018 total electricity and natural gas consumption. The Regional Municipality of Niagara **was** able to meet both these goals.

Table 1: Regional Municipality of Niagara 2014 ECDM goal summary

		Target	2018 Total
Electricity Consumption	[kWh]	85,636,545	67,308,849
Natural Gas Consumption	[m ³]	5,094,537	5,055,885

Table 2 summarizes the energy consumption and GHG emissions for Regional Municipality of Niagara facilities for 2018. This is the baseline which the current goal will be based on.

Table 2: Regional Municipality of Niagara 2018 baseline summary

		Administrative Offices	Ambulance Stations	Storage Facilities	Police Stations	Long-term Care	Water/Waste Water Facilities	Total
Electricity Consumption	[kWh]	4,307,978	905,517	1,371,921	6,057,105	11,001,475	43,664,852	67,308,849
Natural Gas Consumption	[m ³]	381,503	112,135	219,542	496,113	1,725,893	2,120,699	5,055,885
GHG Emissions	[mtCO ₂ e]	906	251	473	1,197	3,732	5,881	12,440

The electricity consumption and GHG emissions reduction goals the Regional Municipality of Niagara will achieve by 2023 are summarized in Table 3.

Table 3: Regional Municipality of Niagara 2023 goals summary

		Administrative Offices	Ambulance Stations	Storage Facilities	Police Stations	Long-term Care	Water/Waste Water Facilities	Total
Electricity Consumption Reduction	[kWh]	176,719	358,357	836,511	182,438	705,778	3,064,802	5,324,605
Electricity Consumption Reduction	[%]	4.1	40	61	3	6.4	7	7.9
Scope 1 GHG Emissions Reduction	[mtCO ₂ e]	140	15	88	84	94	-	421
Scope 1 GHG Emissions Reduction	[%]	19	7.1	20	8.5	2.9	-	4.4
Implementation Cost	[\$]	316,255	154,464	116,282	630,469	566,234	1,493,575	3,277,281

*Reductions based on 2018 energy consumption and GHG emissions.

In summary, the goal for the 2019 Energy Conservation and Demand Management Plan is to reduce electricity consumption by **7.9%** (5,324,605 kWh) and Scope 1 GHG emissions by **4.4%** (421 mtCO₂e) of the 2018 baseline values by 2023. This is expected to require an investment of approximately **\$3,277,281**.

The importance of meeting these goals is not solely due to the environmental impacts. There are significant financial impact as well due to escalating utility costs. Table 4 summarizes the increase in overall utility costs in 2023 if no action is taken.

There is an estimated **\$972,222** increase in overall utility costs in 2023 if electricity and natural gas consumption remains at 2018 levels.

Table 4: Escalating utility cost impact summary

		Administrative Offices	Ambulance Stations	Storage Facilities	Police Stations	Long-term Care	Water/Waste Water Facilities	Total
Electricity Consumption Cost Increase	[\$]	53,805	11,310	17,135	75,651	137,405	545,361	840,667
Natural Gas Consumption Cost Increase	[\$]	9,927	2,918	5,713	12,909	44,908	55,181	131,555
Total Cost Increase	[\$]	63,732	14,227	22,847	88,560	182,313	600,542	972,222

*Costs based on 2018 baseline energy consumption and the following rates: \$0.12/kWh electricity, \$0.25/m³ natural gas, and 2%/year escalation.

1 INTRODUCTION

The Niagara Region commissioned WalterFedy for consulting services to develop the five year Energy Conservation and Demand Management (ECDM) plan that is due on the Region's website by July 1, 2019.

This ECDM plan was created in accordance with the requirements described in Ontario Regulation 507/18 under the Electricity Act. It is broken up into sections according to the building categories which make up the largest percentage of Regional Municipality of Niagara's energy consumption. Looking at each building category separately will provide a detailed examination of energy performance, and allow for specific goals to be set. Each section can be separated into three main parts - past, present, and future:

- The past examines historical energy consumption and GHG emissions, as well as energy conservation measures (ECMs) that have been implemented since the 2014 ECDM plan.
- The present examines whether the goals of the 2014 ECDM plan have been met, and sets goals for the 2019 CDM plan to be met by 2023.
- The future examines what ECMs are already planned for the future, as well as proposed ECMs which should be completed in order for the Regional Municipality of Niagara to meet the goals established within this plan.

All three parts are vital and will come together to form a complete roadmap with an overall objective of determining the priorities, technologies, projects, and opportunities to achieve the Regional Municipality of Niagara's energy and GHG goals. These goals will be in line with local, provincial, federal government, and global initiatives as defined in the Paris Agreement.

Note that not all buildings the Regional Municipality of Niagara owns and leases are included. The regulation only requires the inclusion of buildings which have utilities paid by the Regional Municipality of Niagara, and fall under the following categories:

- Administrative offices and related facilities.
- Public libraries.
- Cultural facilities, indoor recreational facilities, and community centres.
- Ambulance stations and associated offices and facilities.
- Police stations and associated offices and facilities.
- Storage facilities.
- Buildings or facilities related to the treatment of water or sewage.
- Parking garages.

Long-term care homes are not required to be included, but they have volunteered to be a part of the ECDM Plan.

1.1 Organization Energy Management

The Energy Management section for the Regional Municipality of Niagara is under the Construction, Energy & Facilities Management Division, within the Enterprise Resource Management Services Department. There is a Manager of the Energy Management section and an Energy Project Manager in Water & Wastewater.

Energy management is a shared responsibility across the various departments of the Regional Municipality of Niagara. Each department ultimately needs to budget for the projects that will impact their operational cost.

Niagara Region currently does not have an Energy Policy. However, this plan will tie into the Asset Management Plan, and going forward, it will become more apparent how beneficial energy conservation is for operating budgets, as well as corporate responsibility.

1.2 Acronyms

A list of acronyms used in this report is as follows:

- GHG - Greenhouse gas
- ECDM - Energy conservation and demand management
- BPS - Broader public sector
- ECM - Energy conservation measure
- kWh - Kilowatt-hour
- mtCO₂e - Metric tonne of carbon dioxide
- PV - Photovoltaic

1.3 Building Categories

This report has sections separated by building category as reported through the Broader Public Sector (BPS) Energy Use and Greenhouse Gas Emissions reporting program. The list below clarifies the building categories which are included in each section (Report Category - BPS Category):

- Administrative offices - Administrative offices and related facilities, including municipal council chambers
- Ambulance stations - Ambulance stations and associated offices and facilities
- Storage facilities - Storage facilities where equipment or vehicles are maintained, repaired or stored
- Police stations - Police stations and associated offices and facilities
- Long-term care - Long-term care
- Water/Waste water facilities - Facilities related to the treatment of water, Facilities related to the treatment of sewage, Facilities related to the pumping of sewage

2 OVERALL

2.1 Baseline

2.1.1 Energy Consumption

Energy consumption can be separated into two categories - electricity and natural gas. Electricity is measured in kilowatt-hours (kWh) while natural gas is measured in cubic meters (m³).

Figure 1 summarizes the Regional Municipality of Niagara's annual electricity and natural gas consumption from 2014 - 2018.

Historical data for Niagara Region buildings from 2014 - 2016 was obtained through the Broader Public Sector (BPS) Energy Use and Greenhouse Gas Emissions reporting program, while data from 2017 - 2018 was provided by the Regional Municipality of Niagara. The building categories are specified by the BPS reporting. Facilities falling into the Other category include child care centres, and early learning and family centres.

2.1.2 GHG Emissions

GHG emissions is typically measured in metric tonnes of carbon dioxide (mtCO₂e). To illustrate, a typical passenger vehicle emits approximately 4.6 mtCO₂e per year. GHG emissions can be broken down into three categories - Scope 1, Scope 2, and Scope 3.

Scope 1 emissions are defined as direct emissions from sources owned or controlled by the organization. An example of this would be the emissions from the burning of natural gas or propane in on-site equipment. This is typically the second largest contributor to a facility's GHG emissions.

Scope 2 emissions are defined as indirect emissions from sources owned or controlled by the organization. An example of this would be the downstream emissions from electricity purchased from the grid for use in on-site equipment. This is typically the smallest contributor to a facility's GHG emissions.

Scope 3 emissions are defined as emissions from sources not owned or directly controlled by the organization. An example of this would be emissions from vehicles used in employee travel and commuting. Scope 3 emissions were not included in this inventory as it is difficult to quantify, and data is not readily available. However, this would typically be the largest contributor to a facility's or organization's GHG emissions.

Figure 2 summarizes the Regional Municipality of Niagara's GHG emissions from 2014 - 2018. It is separated into Scope 1 and 2 emissions. It can be seen that Scope 1 and 2 emissions can be directly tied to a facility's electricity and natural gas consumption.



Figure 1: Annual electricity and natural gas consumption

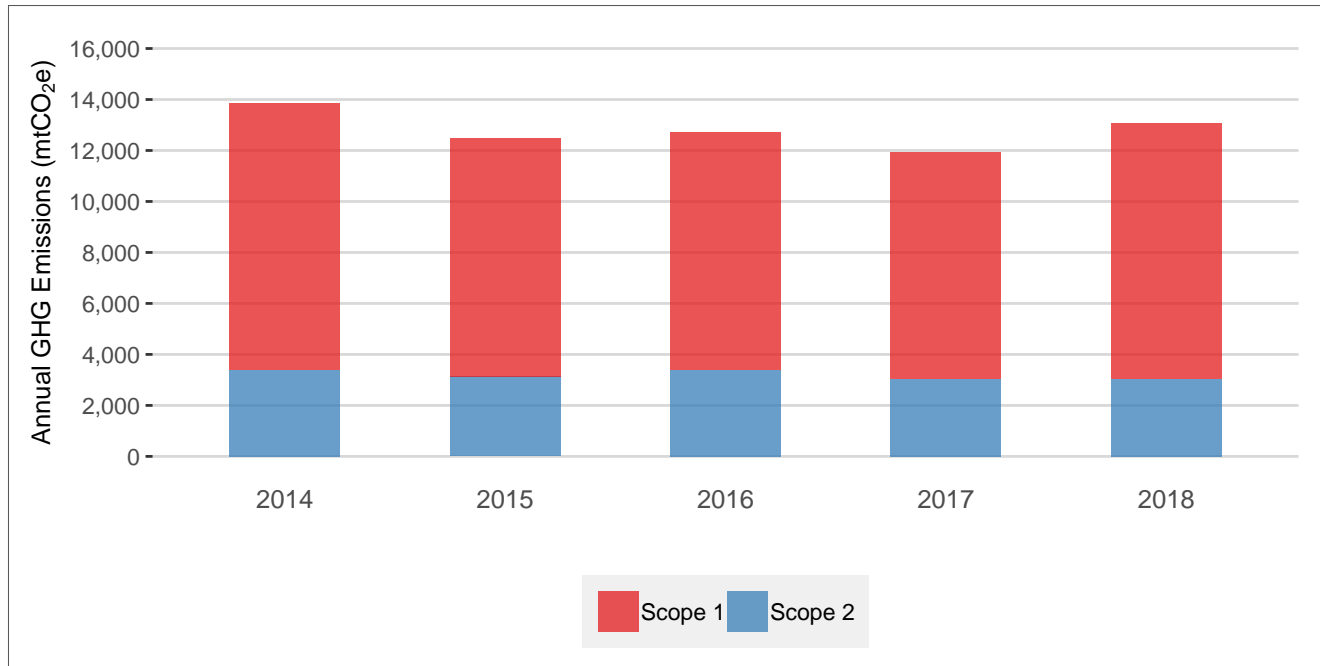


Figure 2: Annual GHG emissions

2.2 Energy Conservation Measures

Energy savings and capital costs were tracked for many of the energy conservation measures (ECMs) implemented and planned at the Regional Municipality of Niagara. Some energy savings and capital cost values are missing as it was not possible to accurately quantify the values.

2.2.1 Previous ECMs

A number of energy conservation measures (ECMs) have been implemented since the 2014 CDM plan was completed in an effort to achieve the goals set out in the plan. A list of the ECMs implemented to date is summarized in Table 5. Where available, both electricity and natural gas savings along with project capital costs are presented. Project details were not available for all energy projects completed which is reflected as missing data. Figure 3 summarizes the estimated annual savings by building category as a result of the implemented ECMs.

Table 5: Previous ECMs summary table

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
Niagara Region - Decew Water	Interior Lighting Upgrade	2015	92,591		59,000
Niagara Region - Fort Erie Wastewater	Exterior Lighting Upgrade	2015	11,509		115,800
Niagara Region - Grimsby Wastewater	Exterior Lighting Upgrade	2015	132,353		107,465
Niagara Region - Welland Water	Complete Plant Upgrade	2015	376,456	2,100	
NRPS Welland Gun Range (Training Centre)	DHW Heater Replacement	2015	0	303	7,000
5th Avenue Reservoir	Exterior Lighting Upgrade	2016	4,200		5,332
Kent Ave Pump Station	Interior Lighting Upgrade	2016			9,876
Lakeshore Road Pump Station	VFD Upgrades	2016	122,007		27,862
Niagara Region - Decew Water	Interior Lighting Upgrade	2016			9,585
Niagara Region - Grimsby Wastewater	HVAC Replacement	2016			288,152
Port Dalhousie Wastewater	Exterior Lighting Upgrade	2016			18,885
St. Catharines Regional Child Care Centre	Built-up Roof Replacement	2016	1,735	362	59,500
William Street Wastewater Pump station	VFD Upgrades	2016	80,568		
LTC Rapelje Lodge	Exterior/Interior Lighting Upgrade	2017	132,000	0	375,815
Niagara Falls Community Services Employment Office	Heating Boiler Plant Upgrade	2017	0	3,695	70,000
Niagara Falls Wastewater	Exterior Lighting Upgrade	2017	69,031		185,617
Niagara Falls Wastewater	Exterior Lighting Upgrade	2017	3,200		9,552
Niagara Falls Wastewater	Interior Lighting Controls	2017			5,405
Niagara Region - Decew Water	Exterior Lighting Upgrade	2017			120,000
Niagara Region - Grimsby Wastewater	Interior Lighting Upgrade	2017			92,150
Niagara Region - Welland Wastewater	Boiler Replacement	2017	0	14,120	375,000
Port Colborne Water	Exterior Lighting Upgrade	2017			8,885
Port Weller Wastewater	Energy Audit	2017			55,483
Ridgeway Ambulance Base	DHW Heater Replacement	2017	0	80	7,000
St. Catharines Community Services Employment Office	LED Lighting Retrofit	2017		0	63,000
LTC Northland Pointe	Installation of Ozone Generator Injection System	2018	0	19,000	17,525
Niagara Falls Wastewater	Exterior Lighting Upgrade	2018	69,792		284,867
Niagara Falls Wastewater	Admin Area Lighting Upgrade	2018			10,000
Niagara Region - Grimsby Wastewater	BAS Controls Upgrade	2018			7,575
Port Dalhousie Wastewater	Exterior Lighting Upgrade	2018			44,530
Port Weller Wastewater	Exterior Lighting Upgrade	2018			270,000
Seaway Pollution Control	Energy Audit	2018			43,053

Note: Costs and energy savings provided by Regional Municipality of Niagara.

2.2.2 Current ECMs

In addition to the ECMs already implemented, there are a number of ECMs which have already been planned for the remainder of 2019. A list of the ECMs planned for implementation are summarized in Table 6. Where available, both electricity and natural gas savings along with project capital costs are presented. Project details were not available for all energy projects planned which is reflected as missing data.

Table 6: Current ECMs summary table

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
Central Maintenance - Water & Wastewater Services	LED Lighting Retrofit	2019	3,279	0	288
Central SPS	Exhaust Fan Replacement	2019			
Central SPS	Exterior Lighting Upgrade	2019	35,612		29,832
Central SPS	Interior Lighting Upgrade	2019	4,545		9,633
Dain City PS	Interior Lighting Upgrade	2019	8,301		10,000
Garner Ave	Exterior Lighting Upgrade	2019			25,000
LTC The Meadows of Dorchester	Installation of Ozone Generator Injection System	2019	0	19,000	17,525
LTC The Meadows of Dorchester	LED Lighting Retrofit	2019	152,777	0	400,000
LTC Woodlands of Sunset	Installation of Ozone Generator Injection System	2019	0	19,000	17,525
Niagara Falls Wastewater	Energy Audit	2019			45,780
Niagara Falls Water	Boiler Replacement	2019			400,000
Niagara Falls Water	Interior Lighting Upgrade	2019	23,113		16,789
Niagara Region - Decew Water	Exterior Lighting Upgrade	2019	60,200		120,000
Niagara Region - Welland Water	Boiler Replacement	2019			400,000
Niagara Region HQ - John Campbell Building West	LED Lighting Retrofit	2019		0	
Port Colborne Water	Boiler Replacement	2019			
Public Works Service Centre	LED High Bays	2019	16,336	0	3,628
Seaway Pollution Control	Exterior/Interior lighting Upgrade	2019			320,000
SPS Region Wide	Small Business Lighting Retrofit	2019			
Welland Community Services Employment Office	LED Lighting Retrofit	2019	30,600	0	11,352
Welland Patrol Yard	LED Lighting Retrofit	2019	18,042	0	5,352
Welland PH Satellite Office/Sexual Health Centre (Division St)	LED Lighting Retrofit	2019	2,875	0	480

Note: Costs and energy savings provided by Regional Municipality of Niagara.

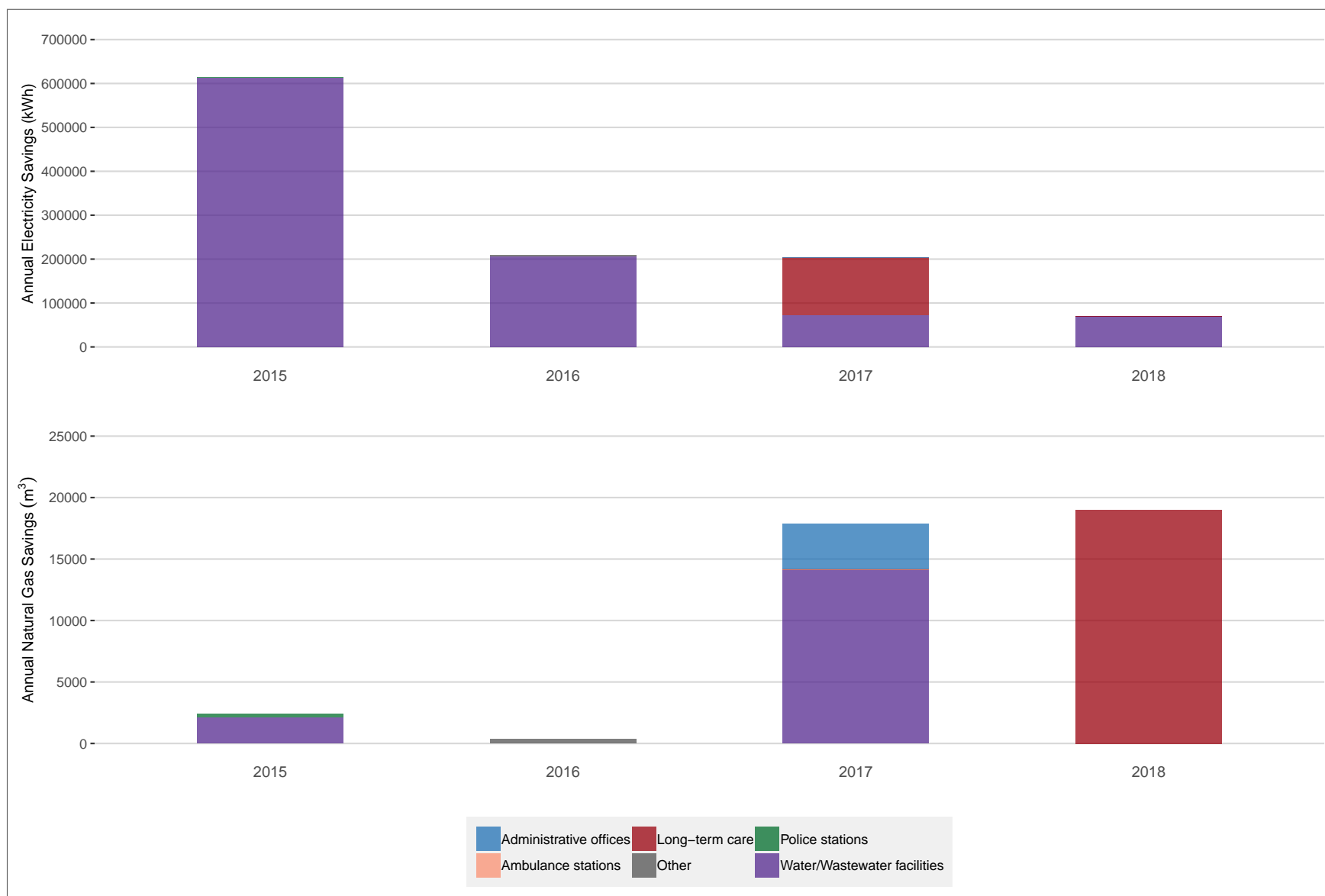


Figure 3: Annual electricity and natural gas savings from implemented ECMs

3 ADMINISTRATIVE OFFICES

3.1 Baseline

A list of the facilities included in this section are summarized in Table 7.

Table 7: Administrative offices facilities list

Building	Address	Municipality	Area [sqft.]
Fort Erie Public Health	1264 Garrison Road	Fort Erie	3,549
Niagara Falls Community Services Employment Office	5853 Peer Street	Niagara Falls	21,710
Niagara Falls PH Satellite Office/Sexual Health Centre	5710 Kitchener Street	Niagara Falls	7,890
Niagara Region HQ - Environmental Centre	3501 Schmon Parkway	Thorold	18,996
Niagara Region HQ - John Campbell Buildings East and West, Data Centre	1815 Sir Isaac Brock Way	Thorold	197,710
St. Catharines Community Services Employment Office	234 Bunting Road	St. Catharines	29,504
St. Catharines Public Health Sexual Health Centre	277 Welland Avenue	St. Catharines	5,704
Welland Community Services Employment Office	250 Thorold Road	Welland	25,870
Welland PH Satellite Office/Sexual Health Centre (Division St)	200 Division Street	Welland	18,030

3.1.1 Energy Consumption

Figure 4 summarizes the administrative offices' annual electricity consumption from 2014 - 2018. Historical data for Niagara Region buildings from 2014 - 2016 was obtained through the Broader Public Sector (BPS) Energy Use and Greenhouse Gas Emissions reporting program, while data from 2017 - 2018 was provided by the Regional Municipality of Niagara.

This data was normalized by building area to account for any building additions or buildings taken offline in the time period. A trend of increasing electricity consumption can be seen from 2016 onwards. This could result from a variety of factors such as changes in operational procedures, building occupancy, annual temperatures, and sources of data.

3.1.2 GHG Emissions

Figure 5 summarizes the administrative offices' GHG emissions from 2014 - 2018. It is separated into Scope 1 and 2 emissions. Scope 1 and 2 emissions are directly tied to a facility's electricity and natural gas consumption. This data was normalized by building area to account for any building additions or buildings taken offline in the time period.

3.2 Energy Conservation Measures

3.2.1 Previous ECMs

A number of energy conservation measures (ECMs) have been implemented since the 2014 CDM plan was completed in an effort to achieve the goals set out in the plan. A list of the ECMs implemented to date is summarized in Table 8.

Table 8: Previous ECMs summary table for administrative offices

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
Niagara Falls Community Services Employment Office	Heating Boiler Plant Upgrade	2017	0	3,695	70,000
St. Catharines Community Services Employment Office	LED Lighting Retrofit	2017		0	63,000

Note: Costs and energy savings provided by Regional Municipality of Niagara.

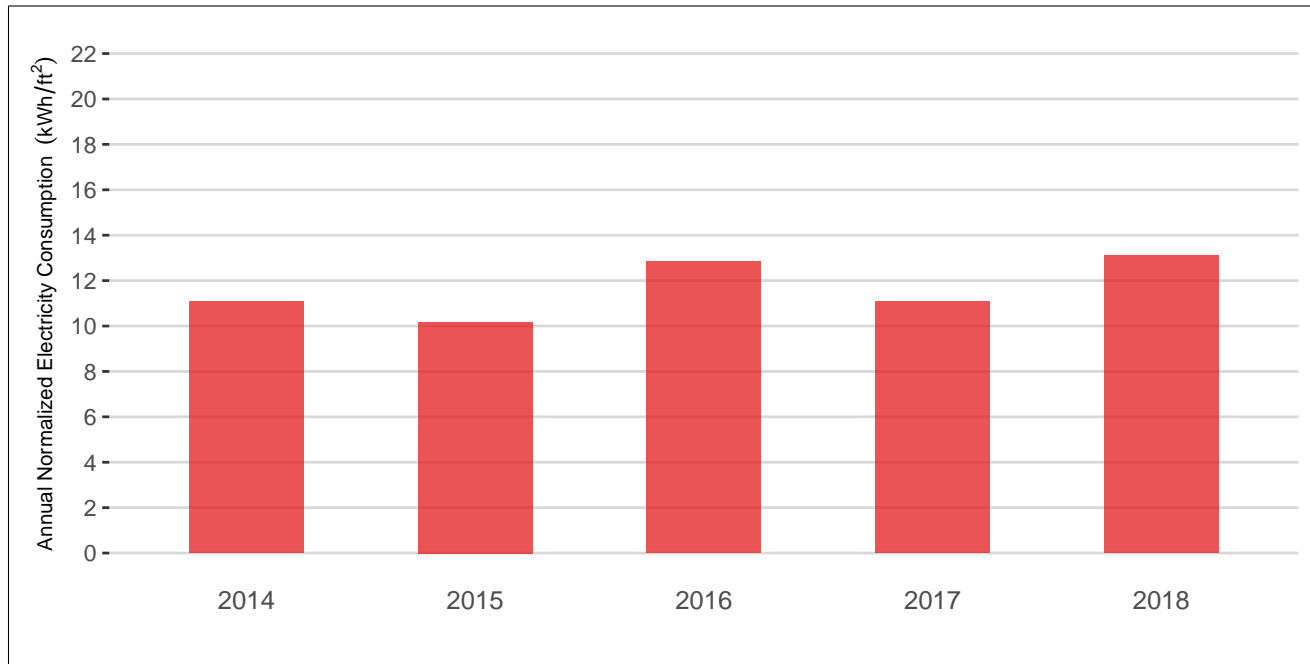


Figure 4: Annual normalized electricity consumption for administrative offices

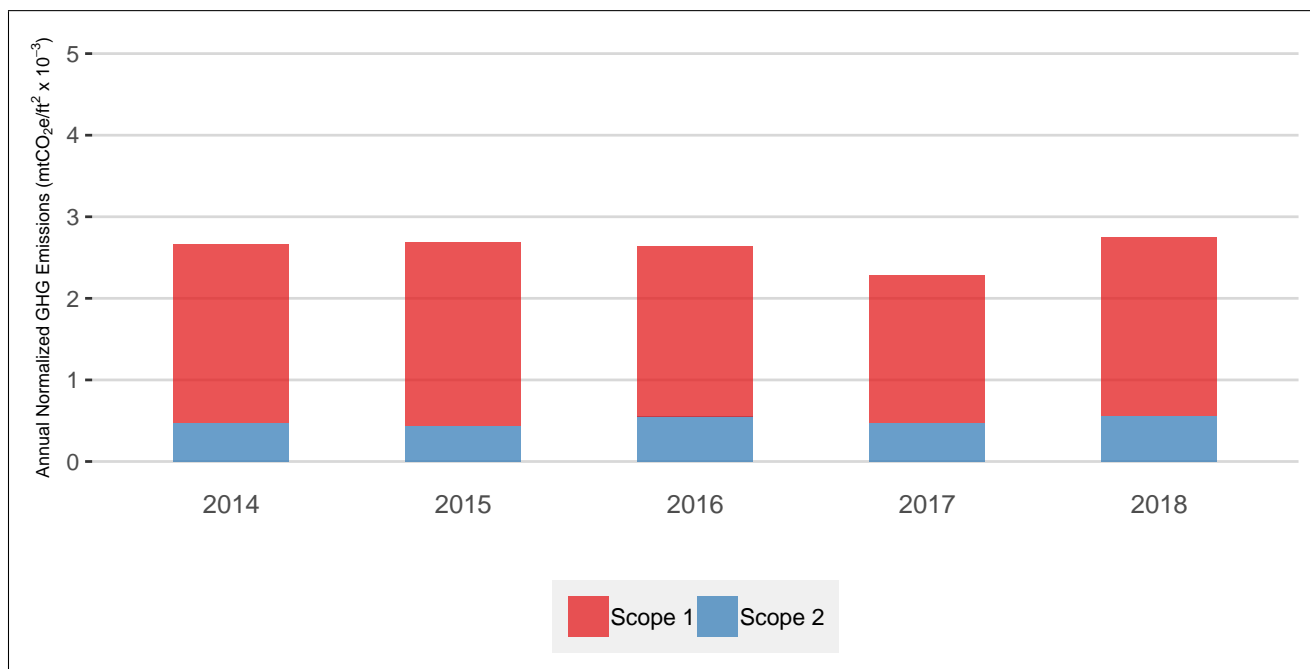


Figure 5: Annual normalized GHG emissions for administrative offices

3.2.2 Current ECMs

In addition to the ECMs already implemented, there are a number of ECMs which have already been planned for the remainder of 2019. A list of the ECMs planned for implementation is summarized in Table 9.

Table 9: Current ECMs summary table for administrative offices

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
Niagara Region HQ - John Campbell Building West	LED Lighting Retrofit	2019		0	
Welland Community Services Employment Office	LED Lighting Retrofit	2019	30,600	0	11,352
Welland PH Satellite Office/Sexual Health Centre (Division St)	LED Lighting Retrofit	2019	2,875	0	480

Note: Costs and energy savings provided by Regional Municipality of Niagara.

3.2.3 Proposed ECMs

There are a number of energy conservation opportunities across the various facilities in the Regional Municipality of Niagara. This section takes a closer look at historical energy use, completed energy audits, and energy use trends to identify the ECMs proposed for implementation from 2019 - 2023.

A number of energy audits were completed for many of Regional Municipality of Niagara's facilities in 2012. These energy audits evaluated various ECMs and estimated their energy savings and implementation costs. However, not all ECMs evaluated are financially feasible.

Table 10 summarizes ECMs evaluated in the energy audits which met the following criteria: capital cost < \$1/kWh of electricity saved, and simple payback < 10 years. This ensures that the proposed ECMs are financially feasible and provide good value to the Regional Municipality of Niagara.

Table 10: Energy audit proposed ECMs summary table for administrative offices

Building	ECM	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]	Simple Payback [Years]
Niagara Region HQ - Environmental Centre	Upgrade Faucet Aerators to High Efficiency	1,793	0	200	1.0
Niagara Falls PH Satellite Office/Sexual Health Centre	Upgrade Faucet Aerators	1,270	0	300	2.0
Former Fort Erie PH Satellite Office/Sexual Health Centre	Relamp Exit Signs to LED Type	1,600	0	400	2.1
Niagara Falls PH Satellite Office/Sexual Health Centre	Relamp Exit Signs to LED Type	2,050	0	585	2.3
Former Fort Erie PH Satellite Office/Sexual Health Centre	Relamp T12 Lights to T8 High Efficiency	2,522	0	2,250	7.5

Note: Costs and energy savings provided by Regional Municipality of Niagara.

However, not all facilities had energy audits completed, and completing solely the ECMs summarized in Table 10 will not result in noticeable overall energy consumption and GHG emissions reductions. Therefore, the energy use must be looked at in more detail to determine where additional ECMs may lie.

A separate benchmarking analysis was completed on all Regional Municipality of Niagara facilities. This analysis compared Regional Municipality of Niagara facilities' electricity use intensity (EUI) (kWh/sqft) and greenhouse gas intensity (GHGI) (mtCO₂e/sqft) to those of facilities in other municipalities in southern Ontario, and other facilities owned by Regional Municipality of Niagara.

The analysis was able to determine which Regional Municipality of Niagara facilities have poorer energy performance compared to the Ontario median, as well as the top 33% of Regional Municipality of Niagara facilities.

As these are buildings of the same type, they should theoretically all perform at a similar degree of energy performance. Therefore, it should be possible for buildings performing worse than the Ontario median/Regional Municipality of Niagara top 33% to implement energy efficiency retrofits, operations improvements, and behavioral changes to reach that same level of energy performance.

Two scenarios were considered:

1. **Minimum:** If Regional Municipality of Niagara buildings with worse energy performance than the Ontario median improved to that level.
2. **Maximum:** If Regional Municipality of Niagara buildings with worse energy performance than the top 33% of Regional Municipality of Niagara buildings improved to that level.

A checklist of measures to consider for investigation/implementation are included in the Appendices. Through a thorough investigation and implementation of the opportunities described in the Appendices, it is expected that the energy performance of the administrative office facilities will fall somewhere between the minimum and maximum scenarios. Based on these definitions, The Regional Municipality of Niagara should satisfy at least the **minimum** scenario.

The total cost associated with implementing measures to satisfy the minimum scenario is approximated based on square footage of a building, but will also depend on its existing level of energy performance (i.e. a poorer performing building will need to implement more ECMs, meaning the capital cost required will be higher). The estimated costs are summarized in Table 11.

Table 11: Implementation cost table for administrative offices

Building	Area [sqft]	Cost Per sqft [\$ /sqft]	Implementation Cost [\$]
Fort Erie Public Health	3,549	5.7	20,229
Niagara Region HQ - Environmental Centre	18,996	3.5	66,486
Niagara Region HQ - John Campbell Buildings East and West, Data Centre	197,710	0.92	181,893
Niagara Falls PH Satellite Office/Sexual Health Centre	7,890	0.92	7,259
Welland Community Services Employment Office	25,870	0.92	23,800
Welland PH Satellite Office/Sexual Health Centre (Division St)	18,030	0.92	16,588
Total	272,045	-	316,255

Note: Implementation costs based on previous experience.

3.3 Goals

The goal will be to satisfy the minimum scenario by 2023, but the maximum scenario shows what is possible with additional effort. The reductions required for both scenarios are summarized in Table 12.

Table 12: Goal summary for administrative offices

		Minimum	Maximum
Electricity Consumption Reduction	[kWh]	176,719	1,399,284
Electricity Consumption Reduction	[%]	4.1	32
Scope 1 GHG Emissions Reduction	[mtCO ₂ e]	140	140
Scope 1 GHG Emissions Reduction	[%]	19	19
Implementation Cost	[\$]	316,255	-

*Reductions based on 2018 energy consumption and GHG emissions.

In summary, the goal is to satisfy the **minimum** scenario by reducing electricity consumption by **4.1%** (176,719 kWh) and Scope 1 GHG emissions by **19%** (140 mtCO₂e) of the 2018 baseline values by 2023. This is expected to require an investment of approximately **\$316,255**.

4 AMBULANCE STATIONS

4.1 Baseline

A list of the facilities included in this section are summarized in Table 13.

Table 13: Ambulance station facilities list

Building	Address	Municipality	Area [sqft.]
Abbey Road EMS Base	655 Niagara Street	Welland	1,750
Fort Erie Ambulance Base	650 Gilmore Road	Fort Erie	6,440
Grimsby Ambulance Base	10 Iroquois Trail	Grimsby	3,358
Niagara Falls Ambulance Base	5685 North Street	Niagara Falls	5,990
NOTL Ambulance Base	176 Wellington Street	Niagara-on-the-Lake	2,190
Pelham Ambulance Base	183 Highway 20 West	Pelham	3,357
Port Colborne Ambulance Base and Apt.	42 Dolphin Street	Port Colborne	7,065
Ridgeway Ambulance Base	369 Gorham Road	Fort Erie	3,360
Smithville (West Lincoln) Ambulance Base	110 West Street	West Lincoln	3,474
St. Catharines Linwell Road Ambulance Base	337 Linwell Road	St. Catharines	2,100
St. Catharines Ontario Street Ambulance Base	139 Ontario Street	St. Catharines	9,408
Thorold EMS Station at HQ	3450 Merrittville Highway	Thorold	3,470
Welland Ambulance Base	580 King Street	Welland	6,792

4.1.1 Energy Consumption

Figure 6 summarizes the ambulance stations' annual electricity consumption from 2014 - 2018. Historical data for Niagara Region buildings from 2014 - 2016 was obtained through the Broader Public Sector (BPS) Energy Use and Greenhouse Gas Emissions reporting program, while data from 2017 - 2018 was provided by the Regional Municipality of Niagara.

This data was normalized by building area to account for any building additions or buildings taken offline in the time period. The electricity and natural gas consumption remains relatively constant from year to year. There are minor fluctuations which can be the result of a number of factors such as changes in operational procedures, building occupancy, annual temperatures, and sources of data.

4.1.2 GHG Emissions

Figure 7 summarizes the ambulance stations' GHG emissions from 2014 - 2018. It is separated into Scope 1 and 2 emissions. Scope 1 and 2 emissions are directly tied to a facility's electricity and natural gas consumption.

4.2 Energy Conservation Measures

4.2.1 Previous ECMs

A number of energy conservation measures (ECMs) have been implemented since the 2014 CDM plan was completed in an effort to achieve the goals set out in the plan. A list of the ECMs implemented to date is summarized in Table 14.

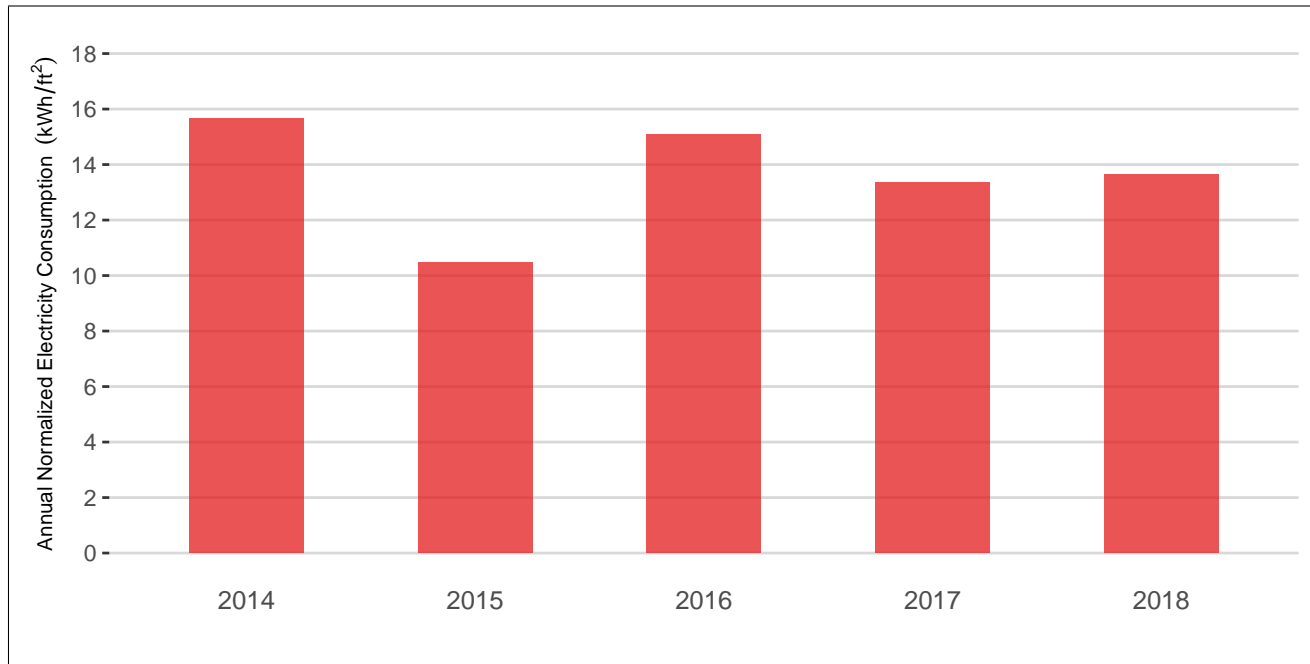


Figure 6: Normalized annual electricity consumption for ambulance stations

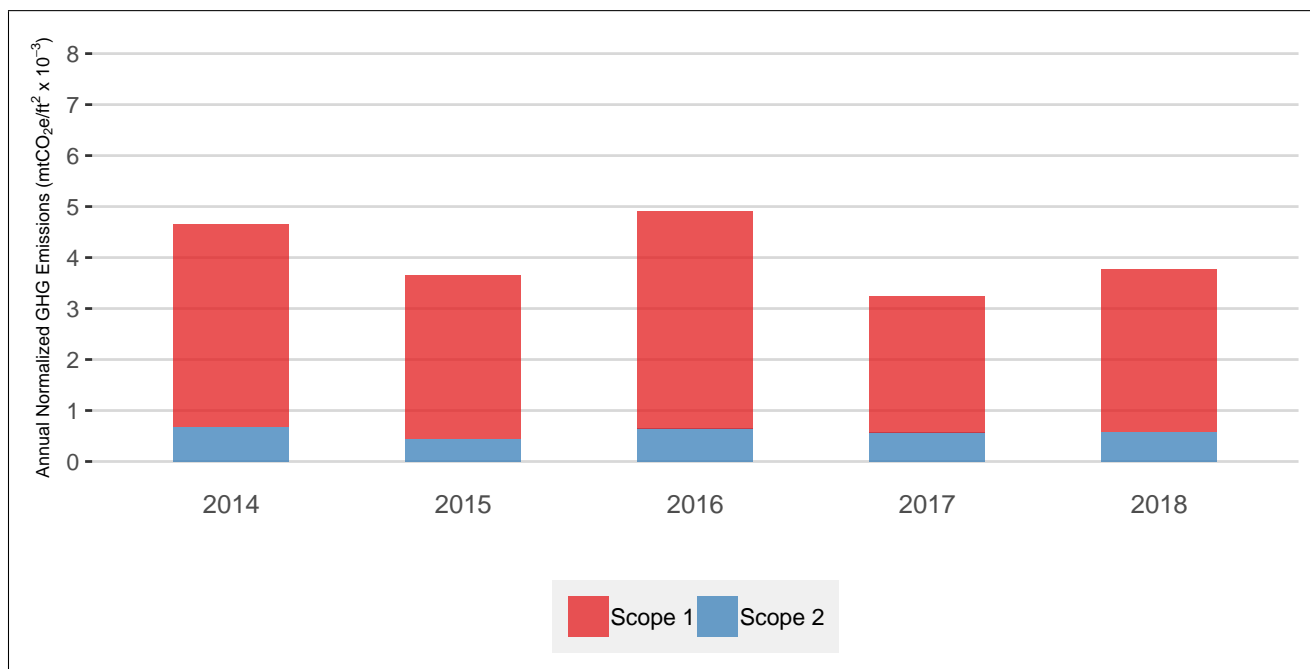


Figure 7: Annual normalized GHG emissions for ambulance stations

Table 14: Previous ECMs summary table for ambulance stations

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
Ridgeway Ambulance Base	DHW Heater Replacement	2017	0	80	7,000

Note: Costs and energy savings provided by Regional Municipality of Niagara.

4.2.2 Current ECMs

There are currently no other ECMs planned for the ambulance stations.

4.2.3 Proposed ECMs

There are a number of low cost and high value energy conservation opportunities across the various facilities in the Regional Municipality of Niagara. This section takes a closer look at historical energy use, completed energy audits, and energy use trends to identify the ECMs proposed for implementation from 2019 - 2023.

A number of energy audits were completed for many of Regional Municipality of Niagara's facilities in 2012. These energy audits evaluated various ECMs and estimated their energy savings and implementation costs. However, not all ECMs evaluated are financially feasible.

Table 10 summarizes ECMs evaluated in the energy audits which met the following criteria: capital cost < \$1/kWh of electricity saved, and simple payback < 10 years. This ensures that the proposed ECMs are financially feasible and provide good value to the Regional Municipality of Niagara.

Table 15: Energy audit proposed ECMs summary table for ambulance stations

Building	ECM	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]	Simple Payback [Years]
Port Colborne Ambulance Base	Implement Lockable Thermostat Covers on Unit Heaters	66	1,994	150	0.2
Niagara Falls Ambulance Base	Install Lockable Thermostat Covers for Unit Heaters	6,519	0	200	0.2
Port Colborne Ambulance Base	Upgrade Shower Heads	571	0	60	0.6
Niagara Falls Ambulance Base	Upgrade Shower Heads to High Efficiency	390	0	60	1.2
Port Colborne Ambulance Base	Upgrade Faucet Aerators	270	0	60	1.2
Port Colborne Ambulance Base	Relamp Exit Signs to LED Type	680	0	200	1.7
Niagara Falls Ambulance Base	Relamp Exit Signs to LED Type	455	0	130	2.2
Port Colborne Ambulance Base	Relamp T12 Lights to T8 High Efficiency	6,998	0	3,000	2.5
NOTL Ambulance Base	Relamp Exit Signs to LED Type	455	0	130	2.6
St. Catharines Linwell Road Ambulance Base	Relamp Exit Signs to LED Type	455	0	130	2.6
St. Catharines Ontario Street Ambulance Base	Relamp Exit Signs to LED Type	2,277	0	650	2.8
St. Catharines Linwell Road Ambulance Base	Upgrade Shower Heads	74	0	60	6.0

Note: Costs and energy savings provided by Regional Municipality of Niagara.

However, not all facilities had energy audits completed, and completing solely the ECMs summarized in Table 20 will not result in noticeable overall energy consumption and GHG emissions reductions. Therefore, the energy use must be looked at in more detail to determine where additional ECMs may lie.

A separate benchmarking analysis was completed on all Regional Municipality of Niagara facilities. This analysis compared Regional Municipality of Niagara facilities' electricity use intensity (EUI) (kWh/sqft) and greenhouse gas intensity (GHGI) (mtCO₂e/sqft) to those of facilities in other municipalities in southern Ontario, and other facilities owned by Regional Municipality of Niagara.

The benchmarking analysis was able to determine which Regional Municipality of Niagara facilities have poorer energy performance compared to the Ontario median, as well as the top 33% of Regional Municipality of Niagara facilities.

As these are buildings of the same type, they should theoretically all perform at a similar degree of energy performance. Therefore, it should be possible for buildings performing worse than the Ontario median/Regional

Municipality of Niagara top 33% to implement energy efficiency retrofits, operations improvements, and behavioral changes to reach that same level of energy performance.

Two scenarios were considered:

1. **Minimum:** If Regional Municipality of Niagara buildings with worse energy performance than the Ontario median improved to that level.
2. **Maximum:** If Regional Municipality of Niagara buildings with worse energy performance than the top 33% of Regional Municipality of Niagara buildings improved to that level.

A checklist of measures to consider for investigation/implementation are included in the Appendices. Through a thorough investigation and implementation of the opportunities described in the Appendices, it is expected that the energy performance of the ambulance station facilities will fall somewhere between the minimum and maximum scenarios. Based on these definitions, The Regional Municipality of Niagara should satisfy at least the **minimum** scenario.

The total cost associated with implementing measures to satisfy the minimum scenario is approximated based on square footage of a building, but will also depend on its existing level of energy performance (i.e. a poorer performing building will need to implement more ECMs, meaning the capital cost required will be higher). The estimated costs are summarized in Table 16.

Table 16: Implementation costs table for ambulance stations

Building	Area [sqft]	Cost Per sqft [\$ /sqft]	Implementation Cost [\$]
Grimsby Ambulance Base	3,358	5.7	19,141
Fort Erie Ambulance Base and Police Station	14,000	5.7	79,800
St. Catharines Linwell Road Ambulance Base	2,100	3.5	7,350
Abbey Road EMS Base	1,750	3.5	6,125
Niagara Falls Ambulance Base	5,990	3.5	20,965
Welland Ambulance Base	6,792	0.92	6,249
St. Catharines Ontario Street Ambulance Base	9,408	0.92	8,655
Ridgeway Ambulance Base	3,360	0.92	3,091
Pelham Ambulance Base	3,357	0.92	3,088
Total	50,115	-	154,464

Note: Implementation costs based on previous experience.

4.3 Goals

The goal will be to satisfy the minimum scenario by 2023, but the maximum scenario shows what is possible with additional effort. The reductions required to satisfy each scenario are summarized in Table 17.

Table 17: Goal summary for ambulance stations

		Minimum	Maximum
Electricity Consumption Reduction	[kWh]	358,357	578,559
Electricity Consumption Reduction	[%]	40	64
Scope 1 GHG Emissions Reduction	[mtCO ₂ e]	15	27
Scope 1 GHG Emissions Reduction	[%]	7.1	13
Implementation Cost	[\$]	154,464	-

*Reductions based on 2018 energy consumption and GHG emissions.

In summary, the goal is to satisfy the **minimum** scenario by reducing electricity consumption by **40%** (358,357 kWh) and Scope 1 GHG emissions by **7.1%** (15 mtCO₂e) of the 2018 baseline values by 2023. This is expected to require an investment of approximately **\$154,464**.

5 STORAGE FACILITIES

5.1 Baseline

A list of the facilities included in this section are summarized in Table 18.

Table 18: Storage facilities list

Building	Address	Municipality	Area [sqft.]
Central Maintenance - Water & Wastewater Services	980 Major Street	Welland	25,391
Pelham Patrol Yard	1495 Victoria Avenue	Pelham	4,140
Public Works Service Centre	3547 Thorold Townline Road	Thorold	45,730
Smithville Patrol Yard	3112 Thirty Road	West Lincoln	10,200
Thorold Patrol Yard	3557 Thorold Townline Road	Thorold	5,940
Welland Patrol Yard	745 Doans Ridge Road	Welland	6,140
Westwood EMS Fleet Centre	2 Westwood Court	Niagara-on-the-Lake	14,892

Note that the Public Works Service Centre and Patrol Yard areas are for the main heated buildings and do not include the additional unheated structures on the site, which also use electricity for lighting.

5.1.1 Energy Consumption

Figure 8 summarizes the storage facilities' annual electricity consumption from 2014 - 2018. Historical data for Niagara Region buildings from 2014 - 2016 was obtained through the Broader Public Sector (BPS) Energy Use and Greenhouse Gas Emissions reporting program, while data from 2017 - 2018 was provided by the Regional Municipality of Niagara.

This data was normalized by building area to account for any building additions or buildings taken offline in the time period. The electricity and natural gas consumption remains relatively constant from year to year except for a decrease in electricity consumption in 2015 and an increase in GHG emissions in 2016. There are other minor fluctuations which can be the result of a number of factors such as changes in operational procedures, building occupancy, annual temperatures, and sources of data.

5.1.2 GHG Emissions

Figure 9 summarizes the storage facilities' GHG emissions from 2014 - 2018. It is separated into Scope 1 and 2 emissions. Scope 1 and 2 emissions are be directly tied to a facility's electricity and natural gas consumption.

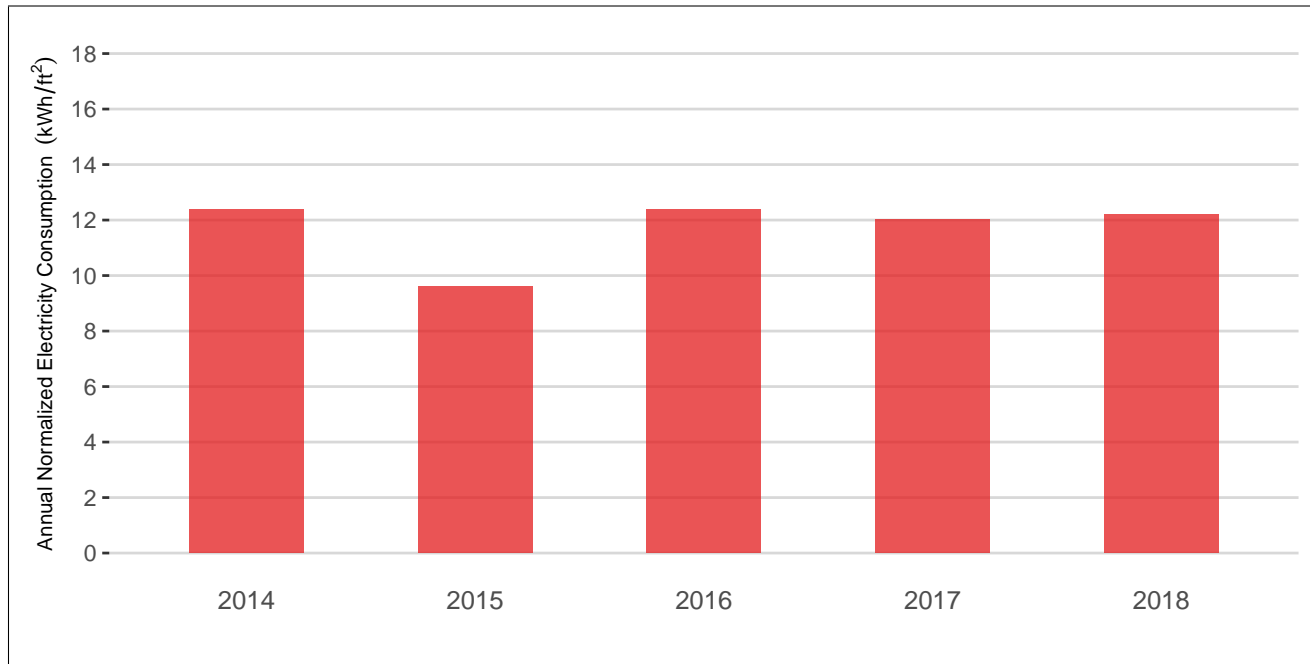


Figure 8: Normalized annual electricity consumption for storage facilities

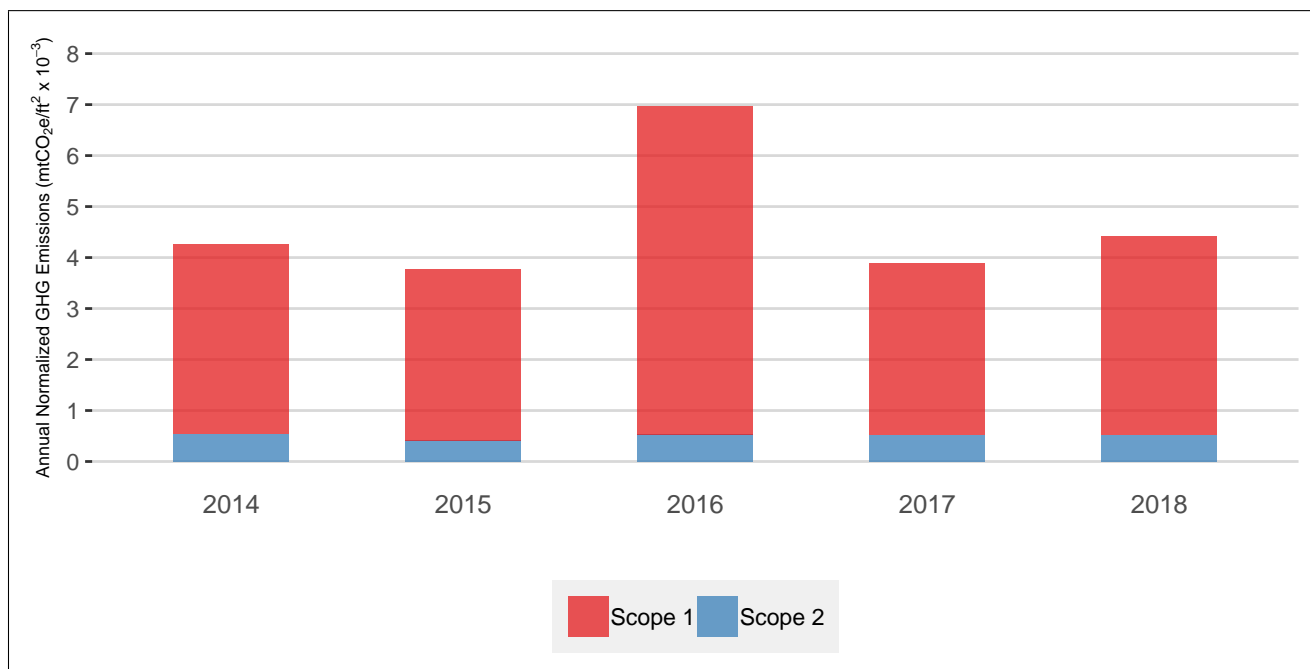


Figure 9: Annual normalized GHG emissions for storage facilities

5.2 Energy Conservation Measures

5.2.1 Previous ECMs

There were no previous ECMs completed for the storage facilities.

5.2.2 Current ECMs

In addition to the ECMs already implemented, there are a number of ECMs which have already been planned for the remainder of 2019. A list of the ECMs planned for implementation is summarized in Table 19.

Table 19: Current ECMs summary table for storage facilities

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
Central Maintenance - Water & Wastewater Services	LED Lighting Retrofit	2019	3,279	0	288
Public Works Service Centre	LED High Bays	2019	16,336	0	3,628
Welland Patrol Yard	LED Lighting Retrofit	2019	18,042	0	5,352

Note: Costs and energy savings provided by Regional Municipality of Niagara.

5.2.3 Proposed ECMs

There are a number of energy conservation opportunities across the various facilities in the Regional Municipality of Niagara. This section takes a closer look at historical energy use, completed energy audits, and energy use trends to identify the ECMs proposed for implementation from 2019 - 2023.

A number of energy audits were completed for many of Regional Municipality of Niagara's facilities in 2012. These energy audits evaluated various ECMs and estimated their energy savings and implementation costs. However, not all ECMs evaluated are financially feasible.

Table 20 summarizes ECMs evaluated in the energy audits which met the following criteria: capital cost < \$1/kWh of electricity saved, and simple payback < 10 years. This ensures that the proposed ECMs are financially feasible and provide good value to the Regional Municipality of Niagara.

Table 20: Energy audit proposed ECMs summary table for storage facilities

Building	ECM	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]	Simple Payback [Years]
Smithville Patrol Yard	Install Furnace Programmable Thermostat and Implement Setbacks	560	1,921	200	0.4
Pelham Patrol Yard	Install Furnace Programmable Thermostat and Implement Setbacks	266	869	200	0.7
Pelham Patrol Yard	Upgrade Faucet Aerators	823	0	100	1.0
Smithville Patrol Yard	Upgrade Faucet Aerators	823	0	100	1.0
Pelham Patrol Yard	Upgrade Shower Heads	211	0	60	2.0
Smithville Patrol Yard	Upgrade Shower Heads	211	0	60	2.0

Note: Costs and energy savings provided by Regional Municipality of Niagara.

However, not all facilities had energy audits completed, and completing solely the ECMs summarized in Table 20 will not result in noticeable overall energy consumption and GHG emissions reductions. Therefore, the energy use must be looked at in more detail to determine where additional ECMs may lie.

A separate benchmarking analysis was completed on all Regional Municipality of Niagara facilities. This analysis compared Regional Municipality of Niagara facilities' electricity use intensity (EUI) (kWh/sqft) and greenhouse gas intensity (GHGI) (mtCO₂e/sqft) to those of facilities in other municipalities in southern Ontario, and other facilities owned by Regional Municipality of Niagara.

The benchmarking analysis was able to determine which Regional Municipality of Niagara facilities have poorer energy performance compared to the Ontario median, as well as the top 33% of Regional Municipality of Niagara facilities.

As these are buildings of the same type, they should theoretically all perform at a similar degree of energy performance. Therefore, it should be possible for buildings performing worse than the Ontario median/Regional Municipality of Niagara top 33% to implement energy efficiency retrofits, operations improvements, and behavioral changes to reach that same level of energy performance.

Two scenarios were considered:

1. **Minimum:** If Regional Municipality of Niagara buildings with worse energy performance than the top 33% of Regional Municipality of Niagara buildings improved to that level.
2. **Maximum:** If Regional Municipality of Niagara buildings with worse energy performance than the Ontario median improved to that level.

A checklist of measures to consider for investigation/implementation are included in the Appendices. Through a thorough investigation and implementation of the opportunities described in the Appendices, it is expected that the energy performance of the storage facilities will fall somewhere between the minimum and maximum scenarios. Based on these definitions, The Regional Municipality of Niagara should satisfy at least the **minimum** scenario.

The total cost associated with implementing measures to satisfy the minimum scenario is approximated based on square footage of a building, but will also depend on its existing level of energy performance (i.e. a poorer performing building will need to implement more ECMs, meaning the capital cost required will be higher). The estimated costs are summarized in Table 21.

Table 21: Implementation costs table for storage facilities

Building	Area [sqft]	Cost Per sqft [\$ /sqft]	Implementation Cost [\$]
Thorold Patrol Yard	5,940	5.7	33,858
Welland Patrol Yard	6,140	3.5	21,490
Pelham Patrol Yard	4,140	3.5	14,490
Smithville Patrol Yard	10,200	0.92	9,384
Central Maintenance - Water & Wastewater Services	25,391	0.92	23,360
Westwood EMS Fleet Centre	14,892	0.92	13,701
Total	66,703	-	116,282

Note: Implementation costs based on WF previous energy audit experience.

5.3 Goals

The goal will be to meet the minimum scenario by 2023, but the maximum scenario shows what is possible with additional effort. The reductions required to satisfy each scenario are summarized in Table 22.

Table 22: Goal summary for storage facilities

		Minimum	Maximum
Electricity Consumption Reduction	[kWh]	836,511	842,842
Electricity Consumption Reduction	[%]	61	61
Scope 1 GHG Emissions Reduction	[mtCO ₂ e]	88	131
Scope 1 GHG Emissions Reduction	[%]	20	30
Implementation Cost	[\$]	116,282	-

*Reductions based on 2018 energy consumption and GHG emissions.

In summary, the goal is to satisfy the **minimum** scenario by reducing electricity consumption by **61%** (836,511 kWh) and Scope 1 GHG emissions by **20%** (88 mtCO₂e) of the 2018 baseline values by 2023. This is expected to require an investment of approximately **\$116,282**.

6 POLICE STATIONS

6.1 Baseline

A list of the facilities included in this section are summarized in Table 23.

Table 23: Police station facilities list

Building	Address	Municipality	Area [sqft.]
NRPS Grimsby #8 District	45 Clarke Street	Grimsby	8,180
NRPS HQ / #2 District	5700 Valley Way	Niagara Falls	207,000
NRPS Police Fleet	3551 Thorold Townline Road	Thorold	19,050
NRPS Police Tactical Unit	2 Cushman Road	St. Catharines	18,352
NRPS Port Colborne #6 District	501 Fielden Avenue	Port Colborne	5,260
NRPS St. Catharines #1 District	68 Church Street	St. Catharines	75,280
NRPS Welland #3 District	5 Lincoln Street	Welland	25,995
NRPS Welland Gun Range (Training Centre)	107 Seneca Trail	Welland	21,480
Welland Court Site	445 East Main Street	Welland	20,397

6.1.1 Energy Consumption

Figure 10 summarizes the police stations' annual electricity and natural gas consumption from 2014 - 2018. Historical data for Niagara Region buildings from 2014 - 2016 was obtained through the Broader Public Sector (BPS) Energy Use and Greenhouse Gas Emissions reporting program, while data from 2017 - 2018 was provided by the Regional Municipality of Niagara.

This data was normalized by building area to account for any building additions or buildings taken offline in the time period. The electricity consumption has a noticeable decrease from 2016 onwards while natural gas consumption remains relatively constant from year to year. These observations can be the result of a number of factors such as changes in operational procedures, building occupancy, annual temperatures, and sources of data.

6.1.2 GHG Emissions

Figure 11 summarizes the police stations' GHG emissions from 2014 - 2018. It is separated into Scope 1 and 2 emissions. Scope 1 and 2 emissions are directly tied to a facility's electricity and natural gas consumption.

6.2 Energy Conservation Measures

6.2.1 Previous ECMs

A number of energy conservation measures (ECMs) have been implemented since the 2014 CDM plan was completed in an effort to achieve the goals set out in the plan. A list of the ECMs implemented to date is summarized in Table 24.

Table 24: Previous ECMs summary table for police stations

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
NRPS Welland Gun Range (Training Centre)	DHW Heater Replacement	2015	0	303	7,000

Note: Costs and energy savings provided by Regional Municipality of Niagara.

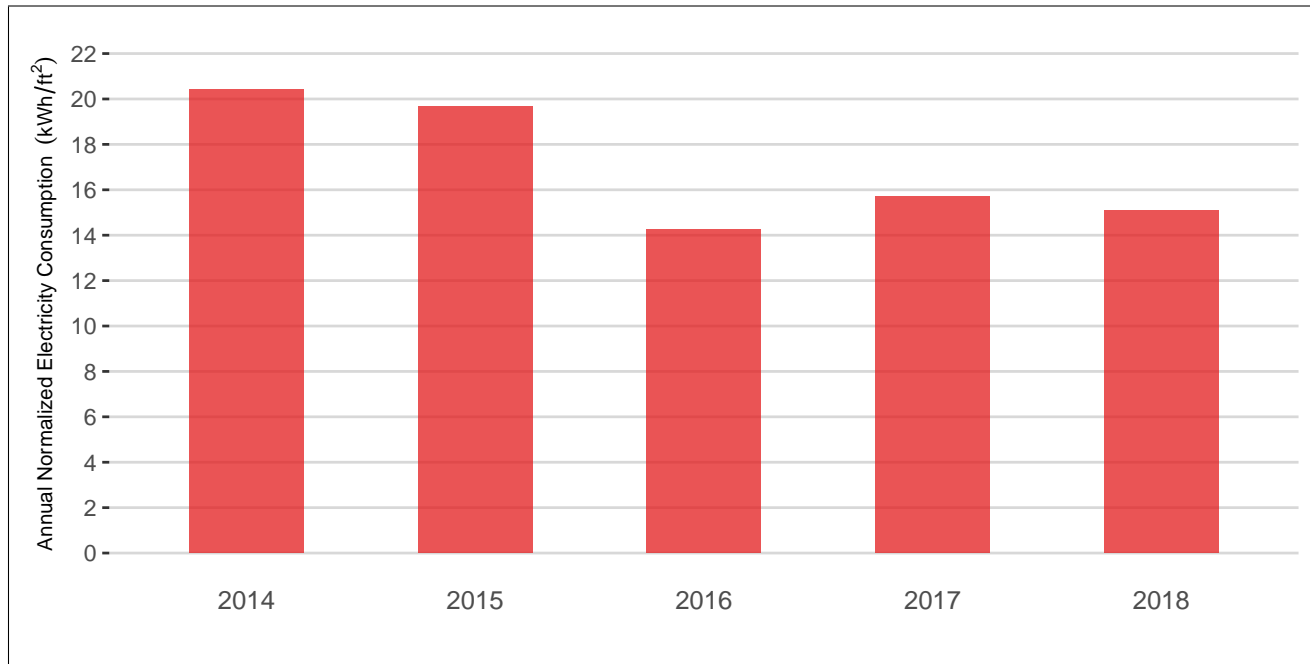


Figure 10: Normalized annual electricity consumption for police stations

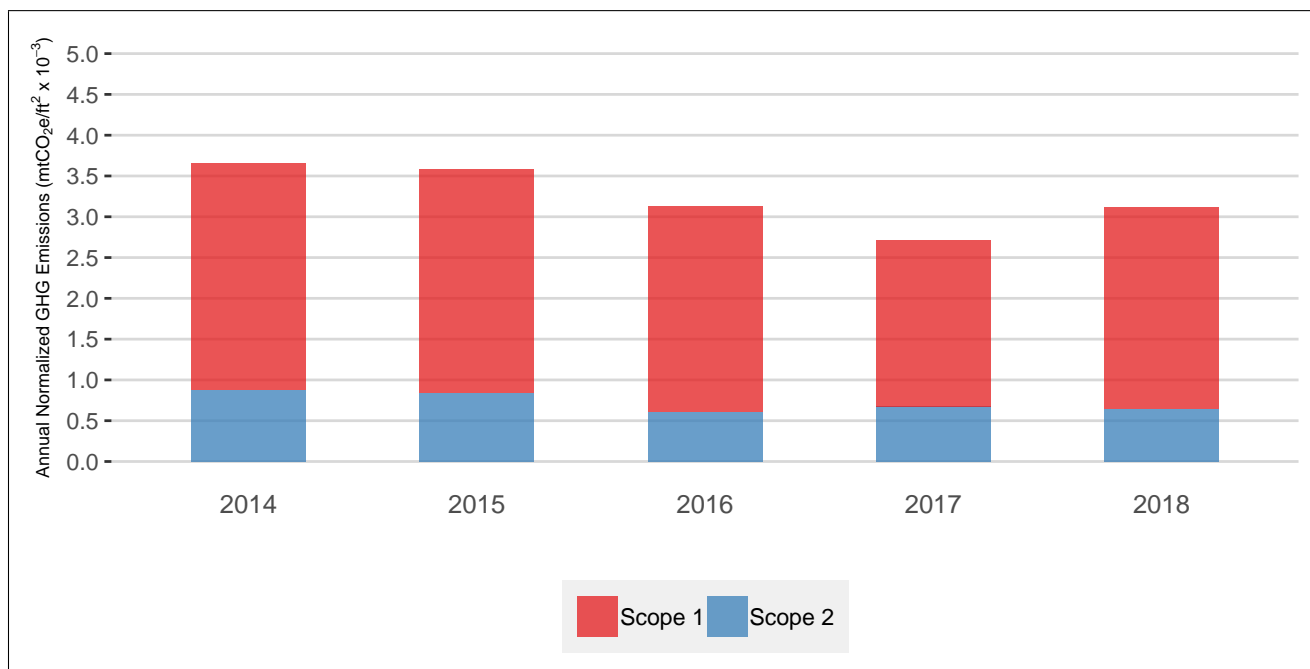


Figure 11: Annual GHG emissions for police stations

6.2.2 Current ECMs

There are currently no other ECMs planned for the police stations.

6.2.3 Proposed ECMs

There are a number of energy conservation opportunities across the various facilities in the Regional Municipality of Niagara. This section takes a closer look at historical energy use, completed energy audits, and energy use trends to identify the ECMs proposed for implementation from 2019 - 2023.

A number of energy audits were completed for many of Regional Municipality of Niagara's facilities in 2012. These energy audits evaluated various ECMs and estimated their energy savings and implementation costs. However, not all ECMs evaluated are financially feasible.

Table 25 summarizes ECMs evaluated in the energy audits which met the following criteria: capital cost < \$1/kWh of electricity saved and simple payback < 10 years. This ensures that the proposed ECMs are financially feasible and provide good value to the Regional Municipality of Niagara.

Table 25: Energy audit proposed ECMs summary table for police stations

Building	ECM	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]	Simple Payback [Years]
NRPS Port Colborne #6 District	Relamp Exit Signs to LED Type	2,505	0	715	2.6

Note: Costs and energy savings provided by Regional Municipality of Niagara.

However, not all facilities had energy audits completed, and completing solely the ECMs summarized in Table 20 will not result in noticeable overall energy consumption and GHG emissions reductions. Therefore, the energy use must be looked at in more detail to determine where additional ECMs may lie.

A separate benchmarking analysis was completed on all Regional Municipality of Niagara facilities. This analysis compared Regional Municipality of Niagara facilities' electricity use intensity (EUI) (kWh/sqft) and greenhouse gas intensity (GHGI) (mtCO₂e/sqft) to those of facilities in other municipalities in southern Ontario, and other facilities owned by Regional Municipality of Niagara.

The benchmarking analysis was able to determine which Regional Municipality of Niagara facilities have poorer energy performance compared to the Ontario median, as well as the top 33% of Regional Municipality of Niagara facilities.

As these are buildings of the same type, they should theoretically all perform at a similar degree of energy performance. Therefore, it should be possible for buildings performing worse than the Ontario median/Regional Municipality of Niagara top 33% to implement energy efficiency retrofits, operations improvements, and behavioral changes to reach that same level of energy performance.

Two scenarios were considered:

1. **Minimum:** If Regional Municipality of Niagara buildings with worse energy performance than the Ontario median improved to that level.
2. **Maximum:** If Regional Municipality of Niagara buildings with worse energy performance than the top 33% of Regional Municipality of Niagara buildings improved to that level.

A checklist of measures to consider for investigation/implementation are included in the Appendices. Through a thorough investigation and implementation of the opportunities described in the Appendices, it is expected that the energy performance of the storage facilities will fall somewhere between the minimum and maximum scenarios. Based on these definitions, The Regional Municipality of Niagara should satisfy at least the **minimum** scenario.

The total cost associated with implementing measures to satisfy the minimum scenario is approximated based on square footage of a building, but will also depend on its existing level of energy performance (i.e. a poorer performing building will need to implement more ECMs, meaning the capital cost required will be higher). The estimated costs are summarized in Table 26.

Table 26: Implementation costs table for police stations

Building	Area [sqft]	Cost Per sqft [\$ / sqft]	Implementation Cost [\$]
NRPS Port Colborne #6 District	5,260	3.5	18,410
NRPS Welland #3 District	25,995	3.5	90,983
NRPS Grimsby #8 District	8,180	3.5	28,630
NRPS St. Catharines #1 District	75,280	3.5	263,480
NRPS HQ / #2 District	207,000	0.92	190,440
Welland Court Site	20,397	0.92	18,765
NRPS Welland Gun Range (Training Centre)	21,480	0.92	19,762
Total	363,592	-	630,469

Note: Implementation costs based on previous experience.

6.3 Goals

The goal will be to satisfy the minimum scenario by 2023, but the maximum scenario shows what is possible with additional effort. The reductions required to satisfy each scenario are summarized in Table 27.

Table 27: Goal summary for police stations

		Minimum	Maximum
Electricity Consumption Reduction	[kWh]	182,438	1,035,199
Electricity Consumption Reduction	[%]	3	17
Scope 1 GHG Emissions Reduction	[mtCO ₂ e]	84	184
Scope 1 GHG Emissions Reduction	[%]	8.5	19
Implementation Cost	[\$]	630,469	-

*Reductions based on 2018 energy consumption and GHG emissions.

In summary, the goal is to satisfy the **minimum** scenario by reducing electricity consumption by **3%** (182,438 kWh) and Scope 1 GHG emissions by **8.5%** (84 mtCO₂e) of the 2018 baseline values by 2023. This is expected to require an investment of approximately **\$630,469**.

7 LONG TERM CARE

7.1 Baseline

A list of the facilities included in this section are summarized in Table 28.

Table 28: Long-term care facilities list

Building	Address	Municipality	Area [sqft.]
LTC Deer Park Villa	150 Central Avenue	Grimsby	50,941
LTC Gilmore Lodge	50 Gilmore Road	Fort Erie	48,824
LTC Linhaven	403 Ontario Street	St. Catharines	143,936
LTC Northland Pointe	2 Fielden Avenue	Port Colborne	98,361
LTC Rapelje Lodge	277 Plymouth Road	Welland	78,695
LTC The Meadows of Dorchester	6623 Kalar Road	Niagara Falls	78,016
LTC Upper Canada Lodge	272 Wellington Street	Niagara-on-the-Lake	46,796
LTC Woodlands of Sunset	920 Pelham Street	Welland	75,670
New Fort Erie LTC site	200 Garrison Road	Fort Erie	0

7.1.1 Energy Consumption

Figure 12 summarizes the long-term care facilities' annual electricity consumption from 2014 - 2018. Historical data for Niagara Region buildings from 2014 - 2016 was obtained through the Broader Public Sector (BPS) Energy Use and Greenhouse Gas Emissions reporting program, while data from 2017 - 2018 was provided by the Regional Municipality of Niagara.

This data was normalized by building area to account for any building additions or buildings taken offline in the time period. The electricity and natural gas consumption remains relatively constant from year to year. There are minor fluctuations which can be the result of a number of factors such as changes in operational procedures, building occupancy, annual temperatures, and sources of data.

As demonstrated in this ECDM Plan, the long term care homes contribute significantly to the overall energy consumption of the Regional Municipality of Niagara. It should be noted that these facilities are residential healthcare facilities serving vulnerable residents in Niagara. Contributing to the energy consumption within the LTC homes are factors such as:

- Residential healthcare occupancy 24/7.
- Legislated minimum temperature requirements of 22°C.
- The comfort of the occupants who are generally aged and may suffer from complex health issues. Each facility attempts to maintain comfortable temperatures within resident spaces at 24 - 25°C.
- Each LTC home operates a commercial on site laundry for resident personal clothing as well as linens.
- Each LTC home operates a full service commercial kitchen responsible for preparing and serving all meals and snacks 24/7.

Prior to October 2014, the division operated a centralized commercial laundry located at Linhaven, 403 Ontario Street, St. Catharines. This centralized laundry processed approximately 1,000,000 lbs of linens per year for the entire division. In October 2014, this operation was decentralized and linens were processed at each site independently. There was no reduction of processed laundry during this decentralization, but rather just redistribution among the eight facilities.

7.1.2 GHG Emissions

Figure 2 summarizes the long-term care facilities' GHG emissions from 2014 - 2018. It is separated into Scope 1 and 2 emissions. Scope 1 and 2 emissions are directly tied to a facility's electricity and natural gas consumption.

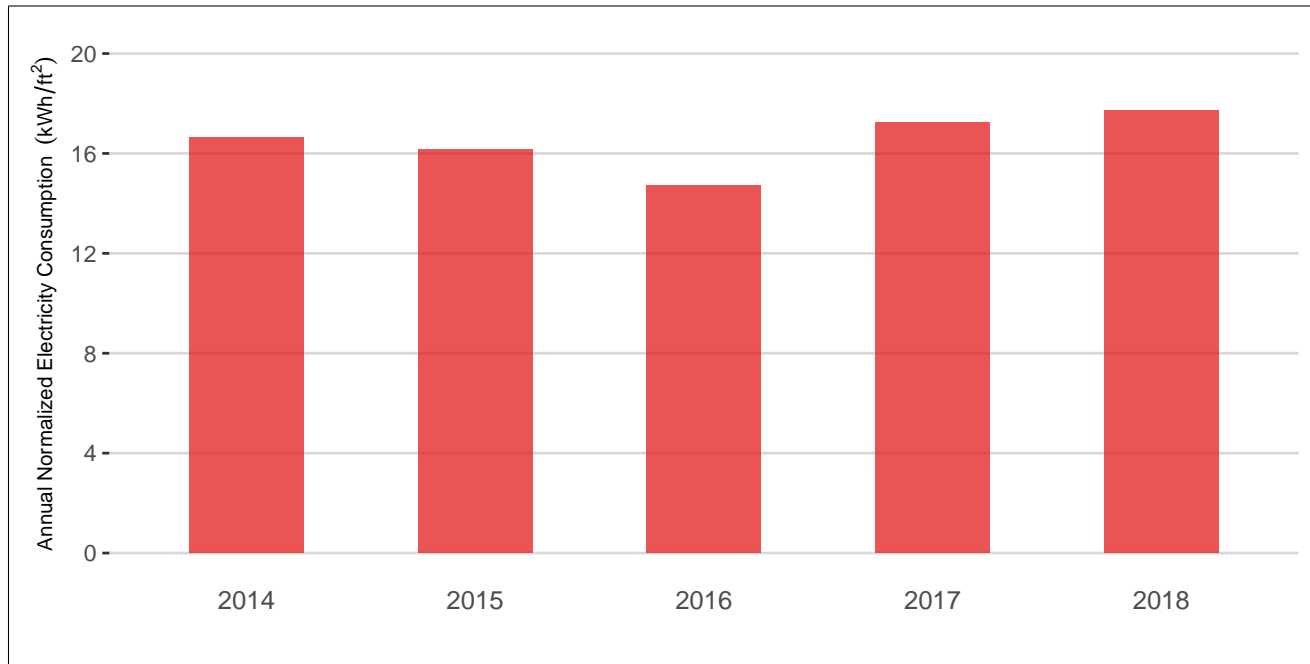


Figure 12: Normalized annual electricity consumption for long-term care facilities

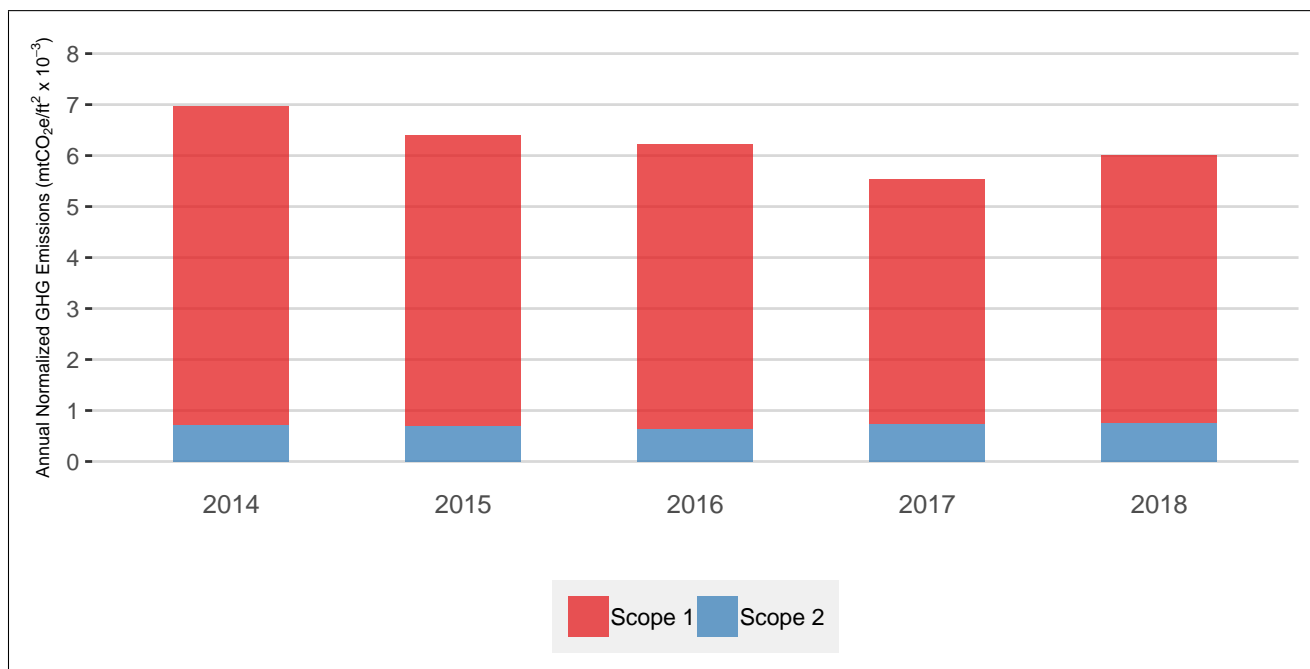


Figure 13: Annual GHG Emissions for long-term care facilities

7.2 Energy Conservation Measures

7.2.1 Previous ECMs

A number of energy conservation measures (ECMs) have been implemented since the 2014 CDM plan was completed in an effort to achieve the goals set out in the plan. A list of the ECMs implemented to date is summarized in Table 29.

Table 29: Previous ECMs summary table for long-term care facilities

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
LTC Rapelje Lodge	Exterior/Interior Lighting Upgrade	2017	132,000	0	375,815
LTC Northland Pointe	Installation of Ozone Generator Injection System	2018	0	19,000	17,525

Note: Costs and energy savings provided by Regional Municipality of Niagara.

7.2.2 Current ECMs

In addition to the ECMs already implemented, there are a number of ECMs which have already been planned for the remainder of 2019. A list of the ECMs planned for implementation is summarized in Table 30.

Table 30: Current ECMs summary table for long-term care facilities

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
LTC The Meadows of Dorchester	Installation of Ozone Generator Injection System	2019	0	19,000	17,525
LTC The Meadows of Dorchester	LED Lighting Retrofit	2019	152,777	0	400,000
LTC Woodlands of Sunset	Installation of Ozone Generator Injection System	2019	0	19,000	17,525

Note: Costs and energy savings provided by Regional Municipality of Niagara.

7.2.3 Proposed ECMs

There are a number of energy conservation opportunities across the various facilities in the Regional Municipality of Niagara. This section takes a closer look at historical energy use, completed energy audits, and energy use trends to identify the ECMs proposed for implementation from 2019 - 2023.

A number of energy audits were completed for many of Regional Municipality of Niagara's facilities in 2015. These energy audits evaluated various ECMs and estimated their energy savings and implementation costs. However, a large number of ECM recommendations resulted from the energy audits. The list was narrowed down to ECMs which fit the following criteria: simple payback < 10 years, electricity consumption savings > 45,000 kWh, and cost per kWh saved < \$0.50. The list of proposed ECMs is summarized in Table 31.

Table 31: Energy audit proposed ECMs summary table for long-term care facilities

Building	ECM	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]	Simple Payback [Years]
LTC Linhaven	Install a Timer on the DHW Recirculation Loop Pumps	48,783	11,723	2,400	0.3
LTC Northland Pointe	Common Area Lighting Retrofit	194,880	0	45,327	2.1
LTC Northland Pointe	Install Variable Speed Drive on Two Existing MUA Units	83,532	0	20,000	2.2
LTC Deer Park Villa	Common Area Lighting Retrofit	48,708	0	11,525	2.3
LTC Woodlands of Sunset	Common Area Lighting Retrofit	83,762	0	21,598	2.4
LTC Linhaven	Common Area Lighting Retrofit	93,336	0	30,334	3.4

Note: Costs and energy savings provided by Regional Municipality of Niagara.

A separate benchmarking analysis was completed on all Regional Municipality of Niagara facilities. This analysis compared Regional Municipality of Niagara facilities' electricity use intensity (EUI) (kWh/sqft) and greenhouse gas intensity (GHGI) (mtCO₂e/sqft) to those of facilities in other municipalities in southern Ontario, and other facilities owned by Regional Municipality of Niagara.

The benchmarking analysis revealed that Regional Municipality of Niagara's long-term care facilities perform comparably to the Ontario median. However, there is still room for improvement as indicated by the ECMs presented in the energy audits.

Additionally, Linhaven, Upper Canada Lodge, and Gilmore Lodge are being redeveloped in the near future. It is recommended that energy efficiency upgrades be considered during that process.

7.3 Goals

Table 32 summarizes the reductions and costs associated with implementing all ECMs listed in Table 30 and Table 31.

Table 32: Goal summary for long-term care facilities

Electricity Consumption Reduction	[kWh]	705,778
Electricity Consumption Reduction	[%]	6.4
Scope 1 GHG Emissions Reduction	[mtCO ₂ e]	94
Scope 1 GHG Emissions Reduction	[%]	2.9
Implementation Cost	[\$]	566,234

*Reductions based on 2018 energy consumption and GHG emissions.

In summary, the goal is to reduce electricity consumption by **6.4%** (705,778 kWh) and Scope 1 GHG emissions by **2.9%** (94 mtCO₂e) of the 2018 baseline values by 2023. This is expected to require an investment of approximately **\$566,234**.

8 WATER/WASTE WATER FACILITIES

8.1 Baseline

A list of the facilities included in this section are summarized in Table 33.

Table 33: Water/wastewater facilities list

Building	Address	Municipality	Area [sqft.]
Anger Avenue Wastewater Treatment Plant / Anger Avenue S.P.S.	1 Anger Avenue	Fort Erie	39,139
Baker Road Wastewater Treatment Plant	160 Lake Street	Grimsby	46,396
Crystal Beach Wastewater Treatment Plant	500 Ridgeway Road	Fort Erie	39,195
Decew Falls Water Treatment Plant	2700 Decew Road	Thorold	59,003
Grimsby Water Treatment Plant	300 North Service Road	Grimsby	38,016
Lincoln/Grimsby booster station	10 Iroquois Trail (B)	Grimsby	1,536
Niagara Falls Wastewater Treatment Plant (S-1)	3450 Stanley Avenue	Niagara Falls	45,858
Niagara Falls Water Treatment Plant	3599 Macklem Street	Niagara Falls	62,610
Niagara on the Lake Wastewater Treatment Plant	1738 Lakeshore Road	Niagara-on-the-Lake	4,155
Port Colborne Water Treatment Plant	323 King Street	Port Colborne	24,924
Port Dalhousie Waste Water Treatment Plant (P9)	40 Lighthouse Road	St. Catharines	40,796
Port Weller Wastewater Treatment Plant	27 Lombardy Avenue	St. Catharines	35,726
Queenston Wastewater Treatment Plant	5 River Frontage Road	Niagara-on-the-Lake	155
Rose Hill Water Treatment Plant / Rose Hill WTP Backwash P.S	300 Rosehill Road	Fort Erie	18,741
Seaway Wastewater Treatment Plant	30 Prosperity Avenue	Port Colborne	42,187
Welland Wastewater Treatment Plant	505 River Road	Welland	44,687
Welland Water Treatment Plant / Welland WTP Backwash Pumping Station	4 Cross Street	Welland	28,432

8.1.1 Energy Consumption

Figure 14 summarizes the water/waste water facilities' annual electricity consumption from 2014 - 2018. Historical data for Niagara Region buildings from 2014 - 2016 was obtained through the Broader Public Sector (BPS) Energy Use and Greenhouse Gas Emissions reporting program, while data from 2017 - 2018 was provided by the Regional Municipality of Niagara. Note, electricity consumption data for Decew Falls Water Treatment Plant was not available for 2017 - 2018.

8.1.2 GHG Emissions

Figure 2 summarizes the water/waste water facilities' GHG emissions from 2014 - 2018. It is separated into Scope 1 and 2 emissions. Scope 1 and 2 emissions are directly tied to a facility's electricity and natural gas consumption.

8.2 Energy Conservation Measures

8.2.1 Previous ECMs

A number of energy conservation measures (ECMs) have been implemented since the 2014 CDM plan was completed in an effort to achieve the goals set out in the plan. A list of the ECMs implemented to date is summarized in Table 34.

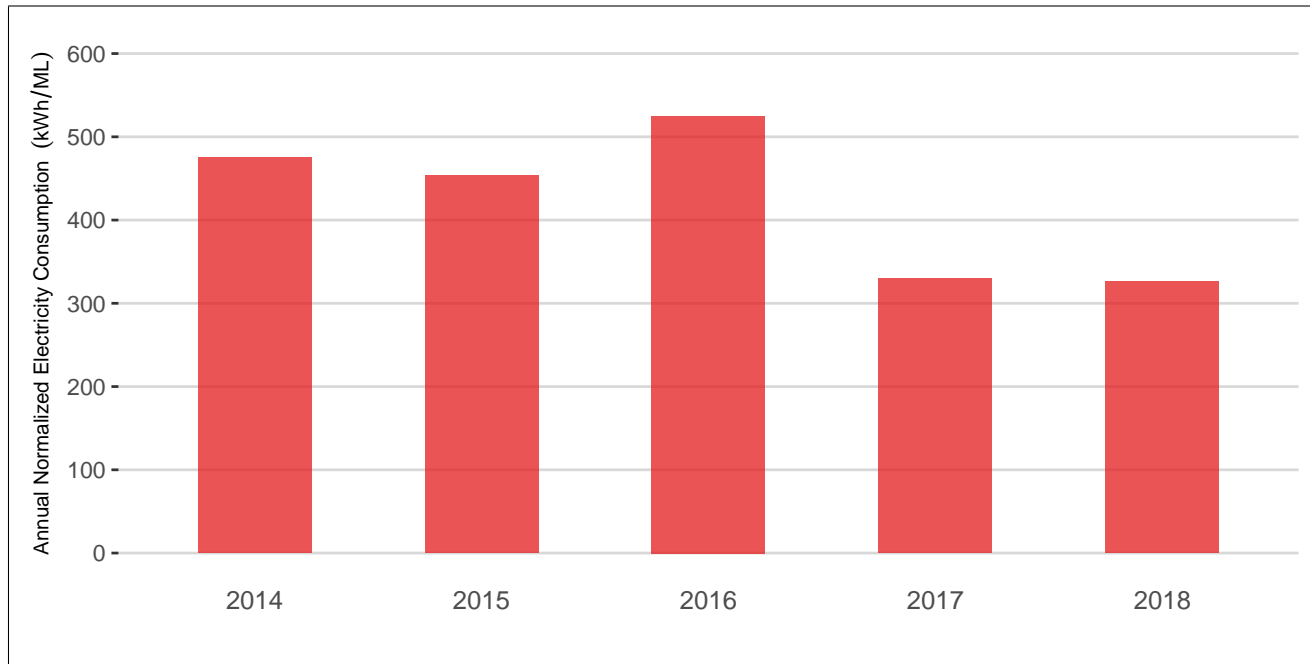


Figure 14: Normalized annual electricity consumption for water/wastewater facilities

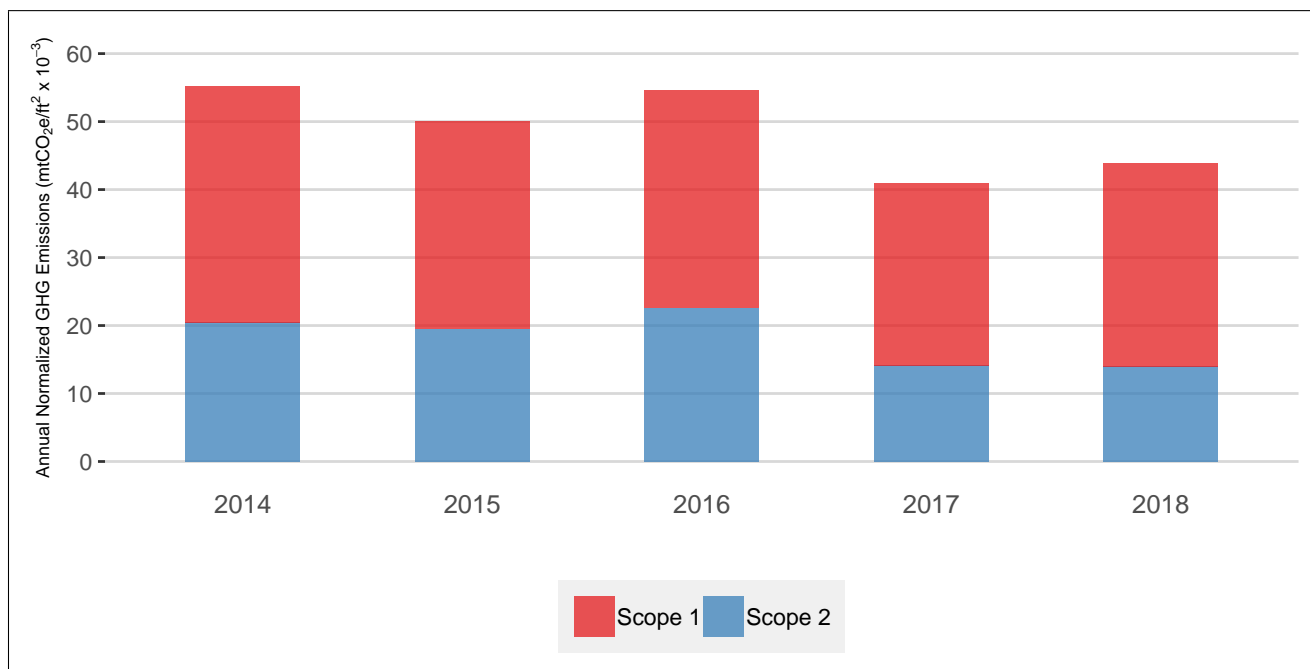


Figure 15: Annual GHG emissions for water/wastewater facilities

Table 34: Previous ECMs summary table for water/wastewater facilities

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
Niagara Region - Decew Water	Interior Lighting Upgrade	2015	92,591		59,000
Niagara Region - Fort Erie Wastewater	Exterior Lighting Upgrade	2015	11,509		115,800
Niagara Region - Grimsby Wastewater	Exterior Lighting Upgrade	2015	132,353		107,465
Niagara Region - Welland Water	Complete Plant Upgrade	2015	376,456	2,100	
5th Avenue Reservoir	Exterior Lighting Upgrade	2016	4,200		5,332
Kent Ave Pump Station	Interior Lighting Upgrade	2016			9,876
Lakeshore Road Pump Station	VFD Upgrades	2016	122,007		27,862
Niagara Region - Decew Water	Interior Lighting Upgrade	2016			9,585
Niagara Region - Grimsby Wastewater	HVAC Replacement	2016			288,152
Port Dalhousie Wastewater	Exterior Lighting Upgrade	2016			18,885
William Street Wastewater Pump station	VFD Upgrades	2016	80,568		
Niagara Falls Wastewater	Exterior Lighting Upgrade	2017	69,031		185,617
Niagara Falls Wastewater	Exterior Lighting Upgrade	2017	3,200		9,552
Niagara Falls Wastewater	Interior Lighting Controls	2017			5,405
Niagara Region - Decew Water	Exterior Lighting Upgrade	2017			120,000
Niagara Region - Grimsby Wastewater	Interior Lighting Upgrade	2017			92,150
Niagara Region - Welland Wastewater	Boiler Replacement	2017	0	14,120	375,000
Port Colborne Water	Exterior Lighting Upgrade	2017			8,885
Port Weller Wastewater	Energy Audit	2017			55,483
Niagara Falls Wastewater	Exterior Lighting Upgrade	2018	69,792		284,867
Niagara Falls Wastewater	Admin Area Lighting Upgrade	2018			10,000
Niagara Region - Grimsby Wastewater	BAS Controls Upgrade	2018			7,575
Port Dalhousie Wastewater	Exterior Lighting Upgrade	2018			44,530
Port Weller Wastewater	Exterior Lighting Upgrade	2018			270,000
Seaway Pollution Control	Energy Audit	2018			43,053

Note: Costs and energy savings provided by Regional Municipality of Niagara.

8.2.2 Current ECMs

In addition to the ECMs already implemented, there are a number of ECMs which have already been planned for the remainder of 2019. A list of the ECMs planned for implementation is summarized in Table 35.

Table 35: Current ECMs summary table for water/wastewater facilities

Building	ECM	Year Completed	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]
Central SPS	Exhaust Fan Replacement	2019			
Central SPS	Exterior Lighting Upgrade	2019	35,612		29,832
Central SPS	Interior Lighting Upgrade	2019	4,545		9,633
Dain City PS	Interior Lighting Upgrade	2019	8,301		10,000
Garner Ave	Exterior Lighting Upgrade	2019			25,000
Niagara Falls Wastewater	Energy Audit	2019			45,780
Niagara Falls Water	Boiler Replacement	2019			400,000
Niagara Falls Water	Interior Lighting Upgrade	2019	23,113		16,789
Niagara Region - Decew Water	Exterior Lighting Upgrade	2019	60,200		120,000
Niagara Region - Welland Water	Boiler Replacement	2019			400,000
Port Colborne Water	Boiler Replacement	2019			
Seaway Pollution Control	Exterior/Interior lighting Upgrade	2019			320,000
SPS Region Wide	Small Business Lighting Retrofit	2019			

Note: Costs and energy savings provided by Regional Municipality of Niagara.

8.2.3 Proposed ECMs

There are a number of low cost and high value energy conservation opportunities across the various facilities in the Regional Municipality of Niagara. This section takes a closer look at historical energy use, completed energy audits, and energy use trends to identify the ECMs proposed for implementation from 2019 - 2023.

A number of energy audits were completed for many of Regional Municipality of Niagara's facilities from 2014 - 2018. These energy audits evaluated various ECMs and estimated their energy savings and implementation costs. The list was narrowed down to ECMs which fit the following criteria: simple payback < 10 years and cost per kWh saved < \$0.50. The list of proposed ECMs is summarized in Table 36.

Table 36: Energy audit proposed ECMs summary table for water/wastewater facilities

Building	ECM	Electricity Savings [kWh/year]	Natural Gas Savings [m ³ /year]	Capital Cost [\$]	Simple Payback [Years]
Port Dalhousie Waste Water Treatment Plant (P9)	Review Degritting Operation	330,000	0	0	0.0
Port Dalhousie Waste Water Treatment Plant (P9)	SRT Control	876,000	0	0	0.0
Port Weller Wastewater Treatment Plant	Low Lift Pumping Optimization	20,200	0	0	0.0
Port Weller Wastewater Treatment Plant	Upgrade of Aeration System	884,760	0	0	0.0
Port Weller Wastewater Treatment Plant	Control of Flow to 1-4 RAS Pumps	108,000	0	0	0.0
Port Weller Wastewater Treatment Plant	Outdoor Photocells	1,440	0	0	0.0
Port Weller Wastewater Treatment Plant	Odour Control Fan	25,800	0	600	0.2
Port Weller Wastewater Treatment Plant	Pre-precipitation with Alum	120,000	0	5,000	0.3
Port Dalhousie Waste Water Treatment Plant (P9)	Electric Baseboards and Unit Heater Controls	199,000	0	14,575	0.7
Port Weller Wastewater Treatment Plant	Unit Heater Controls	65,000	0	7,026	0.7
Port Weller Wastewater Treatment Plant	4' T8 Bulb Enhancement	1,700	0	250	1.0
Port Dalhousie Waste Water Treatment Plant (P9)	Building Envelope Leaks	7,700	0	946	1.1
Port Dalhousie Waste Water Treatment Plant (P9)	Bypass Screen Building Operation	149,000	0	22,000	1.3
Rose Hill Water Treatment Plant / Rose Hill WTP Backwash P.S	Upgrade LLP1, LLP4	108,801	0	40,704	3.9
Rose Hill Water Treatment Plant / Rose Hill WTP Backwash P.S	Upgrade LLP3	35,630	0	25,440	8.8

Note: Costs and energy savings provided by Regional Municipality of Niagara.

A separate benchmarking analysis was completed on all Regional Municipality of Niagara water/waste water facilities. This analysis compared Regional Municipality of Niagara facilities' electricity use intensity (EUI) (kWh/sqft) and greenhouse gas intensity (GHGI) (mtCO₂e/sqft) to those of facilities in other municipalities in southern Ontario, and other facilities owned by Regional Municipality of Niagara.

Although Regional Municipality of Niagara's water/waste water facilities perform comparably to the Ontario median, there is still room for improvement as indicated by the ECMs presented in the energy audits.

8.3 Goals

Table 37 summarizes the reductions and costs associated with implementing all ECMs listed in Table 35 and Table 36.

Table 37: Goal summary for water/wastewater facilities

Electricity Consumption Reduction	[kWh]	3,064,802
Electricity Consumption Reduction	[%]	7
Scope 1 GHG Emissions Reduction	[mtCO ₂ e]	-
Scope 1 GHG Emissions Reduction	[%]	-
Implementation Cost	[\$]	1,493,575

*Reductions based on 2018 energy consumption and GHG emissions.

In summary, the goal is to reduce electricity consumption by **7%** (3,064,802 kWh) of the 2018 baseline values by 2023. This is expected to require an investment of approximately **\$1,493,575**.

9 RENEWABLE GENERATION

9.1 Solar PV

Solar PV has been installed at a total of 24 facilities since 2015 as a means of renewable generation. None of the electricity generated by these installations is used on site as they feed back into the grid through the IESO's microFIT program. Table 38 summarizes the total electricity generated, revenue earned, and GHG emissions reductions for all installations from 2015 - 2018. Please refer to Appendix C for a breakdown of this information by facility.

Table 38: Solar PV 2015 - 2018 generation summary

Electricity Generated	[kWh]	878,470
Revenue Earned	[\$]	318,025
GHG Emissions Reduced	[mtCO ₂ e]	344
Equivalent Trees Planted	-	1,151

10 GOALS SUMMARY

10.1 Previous

The previous ECDM plan had a goal of reducing overall energy consumption by 5% from 2011 levels by 2018. This can be interpreted as a 5% reduction on both electricity and natural gas. Table 39 compares the target and 2018 total electricity and natural gas consumption. The goal is to be below the target values, and The Regional Municipality of Niagara **did** meet their overall goal.

Table 39: Regional Municipality of Niagara 2014 ECDM goal summary

		Target	2018 Total
Electricity Consumption	[kWh]	85,636,545	67,308,849
Natural Gas Consumption	[m ³]	5,094,537	5,055,885

Additionally, the 2013 Corporate Climate Change Action Plan (CCCAP) had a goal to return to 2006 GHG emissions levels by 2016. Table 40 compares the target and 2016 total GHG emissions. The goal is to be below the target value, and The Regional Municipality of Niagara **did** meet this goal.

Table 40: Regional Municipality of Niagara 2013 CCCAP goal summary

		Target	2016 Total
GHG Emissions	[mtCO ₂ e]	39,162	12,852

10.2 Current

The electricity consumption and GHG emissions reduction goals the Regional Municipality of Niagara will achieve by 2023 are summarized in Table 41.

In summary, the goal is to reduce electricity consumption by **7.9%** (5,324,605 kWh) and Scope 1 GHG emissions by **4.4%** (421 mtCO₂e) of the 2018 baseline values by 2023. This is expected to require an investment of approximately **\$3,277,281**.

Additionally, the 2013 CCCAP had a goal to reduce GHG emissions by 10-15% of 2006 levels by 2020. The goals outlined in this ECDM plan are in line with the goals set in the 2013 CCCAP, and meeting the goals outlined in this ECDM plan will actually exceed the goals outlined in the 2013 CCCAP.

Table 41: Regional Municipality of Niagara 2023 goals summary

		Administrative Offices	Ambulance Stations	Storage Facilities	Police Stations	Long-term Care	Water/Waste Water Facilities	Total
Electricity Consumption Reduction	[kWh]	176,719	358,357	836,511	182,438	705,778	3,064,802	5,324,605
Electricity Consumption Reduction	[%]	4.1	40	61	3	6.4	7	7.9
Scope 1 GHG Emissions Reduction	[mtCO ₂ e]	140	15	88	84	94	-	421
Scope 1 GHG Emissions Reduction	[%]	19	7.1	20	8.5	2.9	-	4.4
Implementation Cost	[\$]	316,255	154,464	116,282	630,469	566,234	1,493,575	3,277,281

*Reductions based on 2018 energy consumption and GHG emissions.

Figure 16 summarizes the results of achieving the goals set in this plan. It compares the estimated 2023 values (red bars) to the 2018 values (black outline).

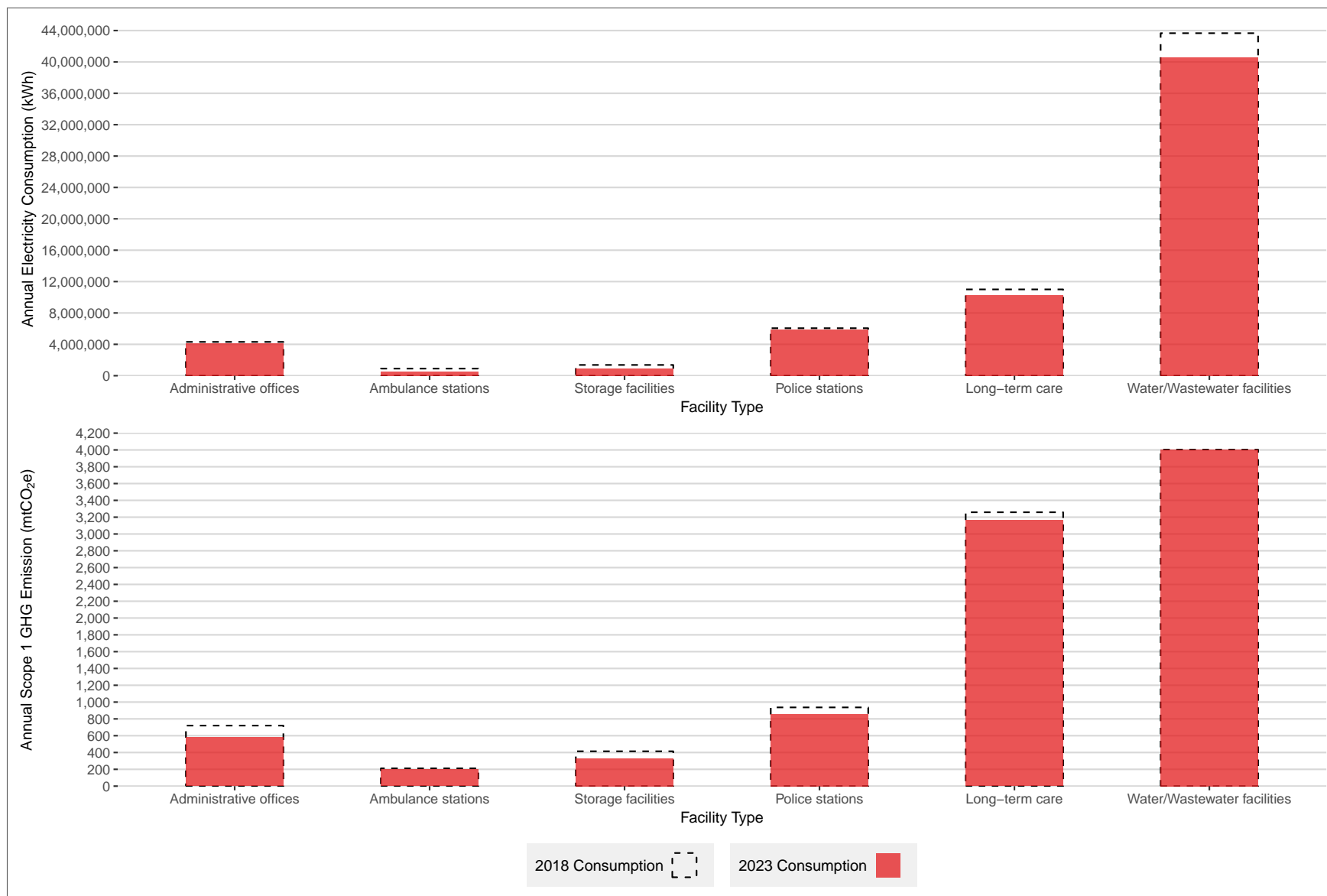


Figure 16: Comparison of baseline and projected consumption values

The importance of meeting these goals is not solely due to the environmental impacts. There are significant financial impact as well due to escalating utility costs. Table 42 summarizes the increase in overall utility costs in 2023 if no action is taken.

Table 42: Escalating utility cost impact summary

		Administrative Offices	Ambulance Stations	Storage Facilities	Police Stations	Long-term Care	Water/Waste Water Facilities	Total
Electricity Consumption Cost Increase	[\$]	53,805	11,310	17,135	75,651	137,405	545,361	840,667
Natural Gas Consumption Cost Increase	[\$]	9,927	2,918	5,713	12,909	44,908	55,181	131,555
Total Cost Increase	[\$]	63,732	14,227	22,847	88,560	182,313	600,542	972,222

*Costs based on 2018 baseline energy consumption and the following rates: \$0.12/kWh electricity, \$0.25/m³ natural gas, and 2%/year escalation.

There is an estimated **\$972,222** increase in overall utility costs in 2023 if electricity and natural gas consumption remains at 2018 levels.

10.3 Action Plan

Below are the actions that need to be taken in order to achieve the goals set in Section 10.2. Additionally, The Regional Municipality of Niagara will be reviewing the plan on an annual basis to track actual performance, and plan for capital project that will drive the Region to meet the goals set.

- **Administrative offices**

1. Ensure all planned ECMs will be implemented by 2023 (Table 9).
2. Ensure updated energy audits are completed on facilities performing worse than the Ontario median by 2023 to investigate potential measures for 2024 ECDM plan update.
3. Ensure energy audits review ECM list in Appendices and investigate ones which have not been implemented.
4. Implement recommendations from energy audits.
5. Obtain utility incentives (IESO, Enbridge) when implementing ECMs, and document estimated electricity and natural gas savings as they are completed.

- **Ambulance stations**

1. Ensure updated energy audits are completed on facilities performing worse than the Ontario median by 2023 to investigate potential ECMs for 2024 ECDM plan update.
2. Ensure energy audits review ECM list in Appendices and investigate ones which have not been implemented.
3. Implement recommendations from energy audits.
4. Obtain utility incentives (IESO, Enbridge) when implementing ECMs, and document estimated electricity and natural gas savings as they are completed.

- **Storage facilities**

1. Ensure updated energy audits are completed on facilities performing worse than the Niagara Region top 33% by 2023 to investigate potential ECMs for 2024 ECDM plan update.
2. Ensure energy audits review ECM list in Appendices and investigate ones which have not been implemented.
3. Implement recommendations from energy audits.
4. Obtain utility incentives (IESO, Enbridge) when implementing ECMs, and document estimated electricity and natural gas savings as they are completed.

- **Police stations**

1. Ensure updated energy audits are completed on facilities performing worse than the Ontario median by 2023 to investigate potential ECMs for 2024 ECDM plan update.

2. Ensure energy audits review ECM list in Appendices and investigate ones which have not been implemented.
3. Implement recommendations from energy audits.
4. Obtain utility incentives (IESO, Enbridge) when implementing ECMs, and document estimated electricity and natural gas savings as they are completed.

- **Long-term care**

1. Ensure all planned ECMs will be implemented by 2023 (Table 30).
2. Ensure all proposed ECMs will be implemented by 2023 (Table 31). Prioritize ECMs with largest potential electricity and natural gas savings.
3. Consider energy efficiency systems when redeveloping Linhaven, Upper Canada Lodge, and Gilmore Lodge.
4. Obtain utility incentives (IESO, Enbridge) when implementing ECMs, and document estimated electricity and natural gas savings.
5. Have updated energy audits completed by 2023 to investigate potential ECMs for 2024 ECDM plan update, prioritizing largest facilities first.

- **Water/waste water facilities**

1. Ensure all planned ECMs will be implemented by 2023 (Table 35).
2. Ensure all proposed ECMs will be implemented by 2023 (Table 36). Prioritize ECMs with largest potential electricity and natural gas savings.
3. Obtain utility incentives (IESO, Enbridge) when implementing ECMs, and document estimated electricity and natural gas savings.
4. Have updated energy audits completed by 2023 to investigate potential ECMs for 2024 ECDM plan update, prioritizing facilities performing worse than the Ontario median first.

10.4 Additional Strategies

The following strategies should also be considered from a strategic energy management perspective:

- Implement life cycle cost purchasing practices
 - Money spent achieving energy efficiency is often overlooked in the decision making process.
 - Make use of life cycle cost analysis on all new construction, major renovations and equipment over \$50,000 rather than simply evaluating first costs.
 - Consider energy efficiency upgrades during renovations or equipment replacements rather than purchasing "like for like".
- Establish purchasing specifications of energy efficiency equipment and services
 - Establish efficiency specifications for standard equipment routinely replaced (e.g. lights, motors, HVAC equipment).
 - Develop engineering tender documents that favour energy efficient equipment rather than lowest capital cost.
 - Establish efficiency standards for design and construction, building operations, and maintenance services.
- Monitor, track, and reward progress
 - Record metrics (electricity consumption savings, natural gas consumption savings, capital costs, etc.) for all major ECM projects implemented.
 - Establish a reward/recognition program for successes to encourage participation.

DISCLAIMER AND LIMITATION OF LIABILITY

This document was prepared by WalterFedy for the above stated client ("Client") for the specific purpose and use by the client, as described in the report and subsequent scope of work agreement. This report was completed based on the information that was available at the time of the report preparation and completion, and is subject to all limitations, assumptions and qualifications contained herein. Any events or circumstances that have occurred since the date on which the report was prepared, are the responsibility of the client, and WalterFedy accepts no responsibility to update the report to reflect these changes.

WalterFedy agrees that this report represents its professional judgement and any estimates or opinions regarding probable costs, schedules, or technical estimates provided represent the professional judgement in light of WalterFedy's experience as well as the information available at the time of report preparation. In addition, WalterFedy accepts no responsibilities for changes in market or economic conditions, price fluctuations for labour and material costs, and therefore makes no representations, guarantees or warranties for the estimates in this report. Persons relying on such estimates or opinions do so at their own risk.

WalterFedy agrees with the Client that it will provide under this Agreement the standards of care, skill and diligence normally provided in the performance of services in respect of work similar to that contemplated by this Agreement. WalterFedy at its own expense carries professional liability insurance to the extent that it deems prudent and WalterFedy's liability under this Agreement to the Client for any claim in contract or in tort related to the services provided under this Agreement howsoever arising shall be limited to the extent that such liability is covered by such professional liability insurance from time to time in effect including the deductible therein, and which is available to indemnify WalterFedy and in any event WalterFedy's liability under this Agreement shall be limited to loss or damage directly attributable to the negligent acts of WalterFedy, its officers, servants or agents, or its failure to provide the standards of care, skill and diligence aforesaid. In no event shall WalterFedy be liable for loss or damage caused by delays beyond WalterFedy's control, or for loss of earnings or for other consequential damage howsoever caused.

The errors and omissions policies are available for inspection by the Client at all times upon request. If the Client, because of its particular circumstances or otherwise, desires to obtain further insurance to protect it against any risk beyond the coverage provided by such policies, WalterFedy will co-operate with the Client to obtain such insurance at the Client's expense.

The Client, in consideration of the provision by WalterFedy of the services set forth in this Agreement, agrees to the limitations of the liability of WalterFedy aforesaid. The Client shall have no right of set-off against any billings of WalterFedy under this Agreement.

Appendix A: ECM Checklist

Behavioural ECMs

ECM	Utility	Energy Savings		
		Potential	Implementation Cost	Feasibility
Close overhead doors when not in use	Natural gas	High	Low	High
Turn off equipment when not in use (computers, lights, etc.)	Electricity	Medium	Low	High
Install window films to control solar heat gain	Electricity	Medium	Medium	Medium
Use recommended thermostat setpoints	Both	Low	Low	Medium
Clear baseboard heaters of obstructions	Both	Low	Low	Medium
Make use of natural light whenever possible	Electricity	Low	Low	Medium
Avoid use of electric heaters	Electricity	Low	Low	Medium
Optimize dishwasher operation (only run when full)	Natural gas	Low	Low	Medium

Operational ECMs

ECM	Utility	Energy Savings		
		Potential	Implementation Cost	Feasibility
Implement temperature setbacks on thermostats	Both	High	Low	High
Optimize operating schedules for HVAC equipment	Both	Medium	Low	High
Review and optimize existing building controls	Both	Medium	Low	High
Control entrance heaters to run only when required	Both	Medium	Low	High
Optimize outside air volume brought to indoor spaces	Both	Medium	Medium	High
Optimize operating schedules for fans and pumps	Electricity	Medium	Medium	Medium

Retrofit ECMs

ECM	Utility	Energy Savings		
		Potential	Implementation Cost	Feasibility
Install smart thermostats to automatically control temperature setpoints	Both	High	Low	High
Install interior LED lighting	Electricity	High	Medium	High
Install exterior LED lighting	Electricity	High	Medium	High
Install VFDs on suitable fans and pumps	Electricity	High	Medium	High
Investigate power factor correction	Electricity	Medium	Low	High
Install motion sensors in occasional use spaces to control lighting	Electricity	Medium	Low	High
Install timers/photosensors on outdoor and daylight interior lighting	Electricity	Medium	Low	High
Convert to radiant heaters in garage/storage areas	Natural gas	Medium	Low	High
Install air curtains on overhead doors	Natural gas	Medium	Low	High
Replace older equipment with energy efficient models	Both	Medium	Medium	Medium
Replace roll up doors with high speed variant	Natural gas	Medium	Medium	Medium
Improve insulation in aging building envelope (roofs, windows, walls)	Both	Low	High	Low
Install CO2 sensors in garage areas to control exhaust fans	Both	Low	Low	Low
Ensure all appliances are EnergyStar rated	Electricity	Low	Low	Low
Install low flow plumbing fixtures	Natural gas	Low	Low	Low
Install condensing boilers	Natural gas	Low	Medium	Low

Appendix B: LTC ECM List

Building	ECM	Electricity Savings	Natural Gas Savings	Capital Cost	Simple Payback
		[kWh]	[m3]	[\$]	
LTC Gilmore Lodge	Staff Engagement Strategy	3,621	708	-	0.0
LTC Gilmore Lodge	Install Occupancy Controls for Cold Vending Machines	2,357	-	404	1.8
LTC Gilmore Lodge	Install eTemp Energy Saving Device for Commercial Refrigerators	13,400	-	2,595	2.0
LTC The Meadows of Dorchester	Staff Engagement Strategy	7,072	465	-	0.0
LTC The Meadows of Dorchester	Install Occupancy Controls for Cold Vending Machines	1,120	-	189	1.8
LTC The Meadows of Dorchester	Install eTemp Energy Saving Device for Commercial Refrigerators	16,200	-	5,190	3.4
LTC Upper Canada Lodge	Staff Engagement Strategy	3,030	701	-	0.0
LTC Upper Canada Lodge	Install Occupancy Controls for Cold Vending Machines	1,120	-	189	1.7
LTC Upper Canada Lodge	Install eTemp Energy Saving Device for Commercial Refrigerators	13,400	-	2,595	1.9
LTC Woodlands of Sunset	Staff Engagement Strategy	6,836	874	-	0.0
LTC Woodlands of Sunset	Install Occupancy Controls for Cold Vending Machines	2,357	-	404	1.6
LTC Woodlands of Sunset	Install eTemp Energy Saving Device for Commercial Refrigerators	16,200	-	5,190	3.0
LTC Deer Park Villa	Change Set-point on Fan Thermostat in Elevator Machine Room	542	-	-	0.0
LTC Deer Park Villa	Staff Engagement Strategy	4,651	481	-	0.0
LTC Deer Park Villa	Bedrooms Lighting Retrofit	15,118	-	3,556	2.3
LTC Deer Park Villa	Install Occupancy Controls for Cold Vending Machines	1,120	-	189	1.7
LTC Deer Park Villa	Install eTemp Energy Saving Device for Commercial Refrigerators	12,200	-	3,460	2.8
LTC Rapelje Lodge	Staff Engagement Strategy	7,054	1,203	-	0.0
LTC Rapelje Lodge	Install a Timer on the DHW Recirculation Loop Pump	475	3,254	200	0.2
LTC Rapelje Lodge	Install Occupancy Controls for Cold Vending Machines	3,224	-	404	1.2
LTC Rapelje Lodge	Install eTemp Energy Saving Device for Commercial Refrigerators	13,400	-	2,595	1.9
LTC Linhaven	Staff Engagement Strategy	13,313	3,038	-	0.0
LTC Linhaven	Install Variable Speed Drive on Existing Main Loop Circulating Pump	44,915	-	20,000	4.6
LTC Linhaven	Insulate Accessible Distribution Pipes in Crawl Space	4,584	-	270	0.6
LTC Linhaven	Install Occupancy Controls for Cold Vending Machines	2,357	-	427	1.9
LTC Linhaven	Install eTemp Energy Saving Device for Commercial Refrigerators	12,200	-	3,460	2.9
LTC Northland Pointe	Staff Engagement Strategy	6,836	874	-	0.0
LTC Northland Pointe	Insulate Accessible Condensing and Heating Pipes on the MUA Units	5,405	-	2,592	4.4
LTC Northland Pointe	Install Occupancy Controls for Cold Vending Machines	2,357	-	404	1.6
LTC Northland Pointe	Install eTemp Energy Saving Device for Commercial Refrigerators	16,200	-	5,190	2.9

Appendix C: List of Solar PV Installations

Address	Installed Size [kW]	Total Electricity Generated [kWh]	Total Revenue [\$]	Total GHG Reduced [mtCO ₂ e]	Equivalent Trees Planted
1 Bowden Street	10	18,610	4,299.97	7.30	24
10 Iroquois Trail (A)	10	26,530	18,850.23	10.40	35
110 West Street	10	44,530	17,634.85	17.46	58
139 Ontario Street	10	46,650	17,695.09	18.29	61
179 Carlton Street	10	38,600	14,977.29	15.13	51
1815 Sir Isaac Brock Way	10	26,120	6,814.28	10.24	34
183 Highway 20 West	10	44,430	17,093.86	17.42	58
200 Division Street	10	30,850	7,135.12	12.09	40
25 Bruce Street	10	39,000	14,956.87	15.29	51
250 Thorold Road	10	29,670	6,585.75	11.63	39
277 Plymouth Road	10	27,090	6,347.14	10.62	35
317 Albany Street	10	29,460	9,809.62	11.55	39
337 Linwell Road	10	42,160	15,627.47	16.53	55
3390 Fifth Avenue	10	N/A	N/A	N/A	N/A
347 Baker Road	10	N/A	N/A	N/A	N/A
3557 Thorold Townline Road	10	26,500	7,292.25	10.39	35
369 Gorham Road	10	44,850	17,766.39	17.58	59
42 Dolphin Street	10	45,150	17,580.98	17.70	59
4281 Kent Avenue	10	N/A	N/A	N/A	N/A
45 Clarke Street	10	45,090	17,374.19	17.67	59
501 Fielden Avenue	10	46,010	17,078.00	18.03	60
6271 Glengate Street	10	40,040	15,862.15	15.70	52
650 Gilmore Road	10	46,750	18,515.98	18.33	61
745 Doans Ridge Road	10	41,740	18,140.61	16.36	55
7775 Jubilee Drive	10	30,830	7,022.59	12.08	40
920 Pelham Street	10	27,880	7,558.39	10.93	37
94 Catherine Street	10	39,930	16,006.12	15.65	52
Total	270	878,470	318,025.19	344.36	1151