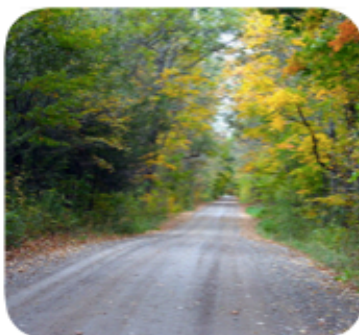




Corporate Energy Management Plan 2019-2024



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Municipality of Trent Hills



This document was prepared for the Municipality of Trent Hills by IndEco Strategic Consulting Inc.

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IndEco Strategic Consulting Inc. 2019

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Executive summary

Context

North American municipalities are increasingly focusing on energy as a strategic priority – to reduce operating costs, prepare for rising utility costs, and to demonstrate their commitment to long-term sustainability. In Ontario, the provincial government is allocating millions of dollars to energy conservation and demand management (CDM) programs, providing energy consumers with significant incentives to upgrade their facilities and equipment. The Government of Ontario has also expressed a commitment to greening public sector buildings and developed *Regulation 397/11* under the *Green Energy and Green Economy Act (2009)* to advance this goal. Although that regulation was repealed, it was replaced by an almost identical regulation 507/18 under the *Electricity Act (1998)*. Under the regulation, all public agencies – including the Municipality of Trent Hills – are required to report their energy use and greenhouse gas (GHG) emissions on an annual basis and are required to submit updates to their 5-year energy conservation and demand management plans in 2019.

The *Corporate Energy Management Plan (CEMP)* provides a 5-year roadmap for energy management in the Municipality of Trent Hills. It focuses on the use of electricity and natural gas in municipal facilities. It covers the period from July 2019 to June 2024 and is designed to help the Municipality comply with the energy CDM planning requirements of Ontario *Regulation 507/11* under the *Electricity Act (1998)*.

The CEMP addresses buildings, technologies, and street and traffic lights – as well as people, processes, and information.

Objectives and targets

Energy efficiency presents a valuable opportunity to reduce or avoid future costs. Investing in energy management and implementing the actions identified in the CEMP will provide benefits for Trent Hills. Not only will it result in energy intensity and GHG savings, but it will also provide for staff engagement, lower risk exposure, and demonstrated leadership by the Municipality. The objectives outlined in this plan support the Sustainable Natural Environment goals in the Municipality's Joint Official Plan, which are:

1. To preserve and enhance the natural environment so that it will continue to sustain life, maintain health and provide a high standard of living.
2. To ensure that the relationship between the natural and built environments, and the principle of preserving resources and protecting the natural environment for future generations, will

form a basis for the planning and development of the Planning Area.

The objectives of the Municipality of Trent Hills' 2019 5-year *Corporate Energy Management Plan* are:

1. To further build a culture of conservation in the Municipality, so that efficient use of energy and limiting greenhouse gas emissions is part of the day-to-day activities of staff.
2. To eliminate the use of fuel oil in Municipal facilities.
3. To establish a corporate structure and processes to manage energy and greenhouse gas emissions.
4. To ensure the public is aware of the Municipality's initiatives to reduce energy use and greenhouse gas emissions.

The CEMP establishes the following quantitative targets to guide the Municipality's efforts on energy management from 2019 to 2024:

- Reduce electricity use by 2% per year
- Reduce fuel oil use by 100%
- Reduce other fossil fuel use by 2% per year.

These goals and targets are only for the 5-year period of this plan. In the longer-term the Municipality of Trent Hills strives to operate as efficiently as possible and to provide leadership in energy efficiency to other municipalities.

Scope and method

The CEMP addresses buildings, technologies, and street and traffic lights – as well as people, processes, and information. The plan draws on information from a number of sources: interviews and meetings with Municipality staff, and a review of Municipality policies, plans and programs.

The first step in the process was to identify and define the preferred state / vision of energy management for Trent Hills. This was developed in a workshop with key Municipality staff.

The second step involved defining the present state of energy use in the Municipality by reviewing the Municipality's energy management practices. Information was obtained through interviews with key staff and a review of the Municipality's key policies, plans, programs, and reports related to energy.

The third step involved developing technical and organizational actions to assist the Municipality in moving from its present to its preferred state of energy management. The organizational actions, which relate to corporate processes, were identified through interviews, and a strategic planning session. The actions are grouped in the CEMP according to the following categories:

- **Organizational and operational commitment** – measures related to policies, targets, operations, and resources required to enable energy management and the other actions;
- **Technological requirements** – measures that impact both new and existing buildings and equipment; and
- **Communication and education** – measures related to communicating and educating about modifications to save energy.

These actions are categorized into three time periods for implementation:

1. Priority actions – Year 1 (July 2019 – June 2020)
2. Medium-term actions – Years 2 and 3 (July 2020 – June 2022)
3. Longer-term actions – Years 4 and 5 (July 2022 – June 2024).

Many of the priority actions are foundational and put in place the structures and practices that will facilitate on-going energy efficiency within the Municipality.

Priority actions include short-term improvements to the Municipality of Trent Hills' energy performance. Priority actions can be implemented and completed within the first years of the plan. Medium-term or long-term opportunities focus on deeper retrofits, building efficiency, technological innovations, and fuel switching. Medium-term and long-term actions also include the constant monitoring and reporting on implemented actions.

Capital costs and savings

To implement the CEMP, the Municipality will need to make capital investments in energy efficiency over the five-year period. However, these investments will yield significant returns.

While project-specific funding will be developed and refined as the plan is implemented, based on typical costs for energy savings, the average annual incremental capital requirement to achieve the targets is estimated at \$50,000.

Introduction

There are multiple reasons why Trent Hills wants to reduce its energy use:

- The growing concern about climate change is one that exists within the scientific community as well as the public. Climate change directly affects populations by causing serious hazards, such as extreme cold and hot weather, floods, and droughts. Rural communities are highly dependent upon natural resources that are affected by climate change. These communities will become more vulnerable as the impacts progressively increase and shift the locations where rural activity can exist.
- Energy is a significant expense for the Municipality. Prices are rising and are volatile.
- Financial incentives are available to assist in energy and emissions reductions, but there is uncertainty about their continuing availability in the future. This may be an opportunity that will be lost.

As a result of these matters, more aggressive targets and actions should be adopted by the Municipality.

The Municipality of Trent Hills' *Corporate energy management plan* (CEMP) provides a roadmap for energy management in the Municipality of Trent Hills. The CEMP describes the energy management activities that the Municipality as a corporation can take over the next 5 years to increase its energy efficiency, reduce its energy demand, and minimize its environmental footprint. It is also designed to help the Municipality comply with the energy conservation and demand management planning requirements of Ontario *Regulation 507/19* under the *Electricity Act (1998)*.

The CEMP is organized as follows:

- Preferred state of energy management
- Present state of energy management
- Objectives and targets
- Priority actions
- Capital costs
- Communication and engagement
- Conclusion and recommendations

The CEMP for the Municipality of Trent Hills is a 5-year plan covering the period from July 2019 to June 2024.

The plan supports goals set out in the Joint Official Plan related to Sustainable Natural Environment, which are:

1. To preserve and enhance the natural environment so that it will continue to sustain life, maintain health and provide a high standard of living.
2. To ensure that the relationship between the natural and built environments, and the principle of preserving resources and protecting the natural environment for future generations, will form a basis for the planning and development of the Planning Area.

The planning process

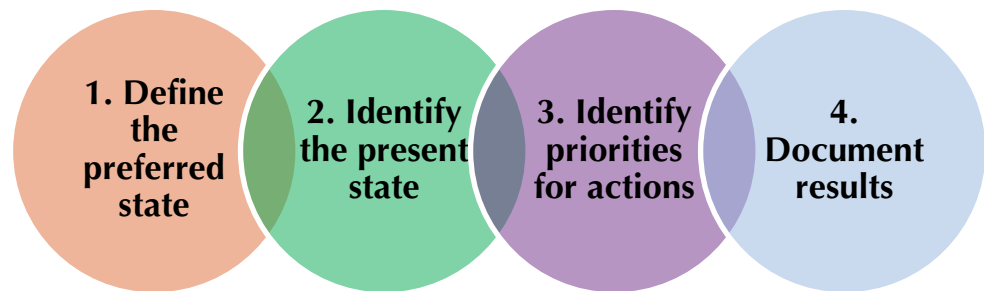


Figure 1 The key steps of our strategic approach for developing the plan

Defining the preferred state involved exploring where the Municipality of Trent Hills would like to be with respect to energy management. The elements of the preferred state were identified through interviews with staff, a review of jurisdictional best practices, and during the strategic planning session. The preferred state informs the CEMP's objectives, targets, and actions.

Identifying the present state involved exploring where the Municipality is now with respect to energy management. Energy data analysis; interviews; a review of the Municipality's existing policies, plans, and past energy efficiency projects; and benchmarking were among the inputs that were used to identify the present state.

Developing actions involved identifying technical measures (i.e. measures identified from the facility audits) and organizational measures (i.e. measures related to corporate processes that also produce real energy savings and help to enable the technical measures) to help the Municipality move towards the preferred state. Actions were identified through interviews, the strategic planning session, and the jurisdictional review of best practices. They were grouped according to the following categories:

Organizational and operational commitment – measures related to policies, targets, operations, and resources required to enable energy management and the other actions;

Technological requirements – measures that impact both new and existing buildings and equipment; and

Communication and education – measures related to communicating and educating about modifications to save energy.

Setting priorities involved determining the timeframe for implementation of each action in the CEMP. All operations and measures were prioritized based on their importance and ease of implementation.

Preparing the Draft and Final Plan involved documenting the results of the planning process. As described in the section of this report, *Updating and reporting on the plan*, the CEMP will be reviewed annually and updated at the end of the five years.

Inputs to the planning process included:

- Analysis of the Municipality of Trent Hills' utility energy use data;
- Review of existing policies, plans, and the 2014 CEMP;
- Interviews with municipality staff;
- A strategic planning workshop with key staff members.

Framework for planning

The Municipality's CEMP addresses buildings and technologies, including street and traffic lights – as well as people, processes, and information. The CEMP centers on the Municipality's facilities and technologies. It aims to ensure that existing and any new facilities are built and operated as efficiently and sustainably as possible. The Municipality's supporting organizational policies and processes, monitoring and tracking systems, and communication and engagement tools allow this to happen.

Over the period of the plan, Trent Hills plans to broaden the scope to include other uses of energy, notably energy used by the Municipality's fleets.

Preferred state of energy management

The preferred state was identified through interviews with key staff members, review of other plans, reviewing the best practices on energy efficiency in other jurisdictions, and through a strategic planning workshop.

Trent Hills' vision for the future is also known as the preferred state. The preferred state is defined as where the Municipality of Trent Hills wants to be regarding energy management. The preferred state sets out the long-term direction for energy management within the Municipal corporation. The highlighted box below describes the preferred state for the Municipality.

Trent Hills will set targets and milestones for making progress towards the preferred state. The short and longer-term actions are aimed to bring the Municipality closer to the preferred state outlined below.

The Municipality of Trent Hills' preferred state

1. The Municipality of Trent Hills reduces its carbon emissions from its activities and includes renewable energy, where feasible, in its facilities.
2. Trent Hills has clear, measurable goals being pursued by all departments and staff members.
3. The Municipality of Trent Hills staff members have the training and information they require to effectively and efficiently manage their energy use and emissions within their areas of responsibilities.
4. The Municipality is communicating its efforts and achievements to the public.
5. Trent Hills is aware of and taking advantage of funding opportunities and financial incentives for maximizing efficiency and reducing emissions.
6. The Municipality continuously measures and monitors energy use and greenhouse gas emissions to ensure continual improvement.
7. The Municipality of Trent Hills has an energy committee to track, analyze, and report energy use and carbon emission trends. These findings are reported to the Council as well as the public.
8. The Corporation as well as the community of Trent Hills are well educated on the energy management plan and overall trends in energy use throughout the Municipality.

Present state of energy management

Corporate energy and emissions

The previous CEMP was adopted in 2014. In this section, we review changes in energy use over time as a result of the initiatives since then. The data reported in this section draw on utility data for 2014 through 2018. The energy sources graphed in the following sections are electricity, fuel oil and natural gas.

The overall target defined in the previous plan was to reduce the consumption of fuels and electricity by an average of 2% per year between 2014 and 2020. There were specific targets to implement energy audits on all municipal facilities, to reduce total energy consumption by 5% during the 5 years, and to reduce energy consumption in the 3 arenas by 3% during the fiscal year of 2012.

In this section we review:

- Overall trends in energy use in the Municipality of Trent Hills;
- Trends amongst specific building types;
- Energy use intensities (EUI) in the highest energy using buildings; and
- Overall trends in greenhouse gas emissions in the Municipality of Trent Hills

The graph below shows how electricity, natural gas and fuel oil use has changed since the last plan.

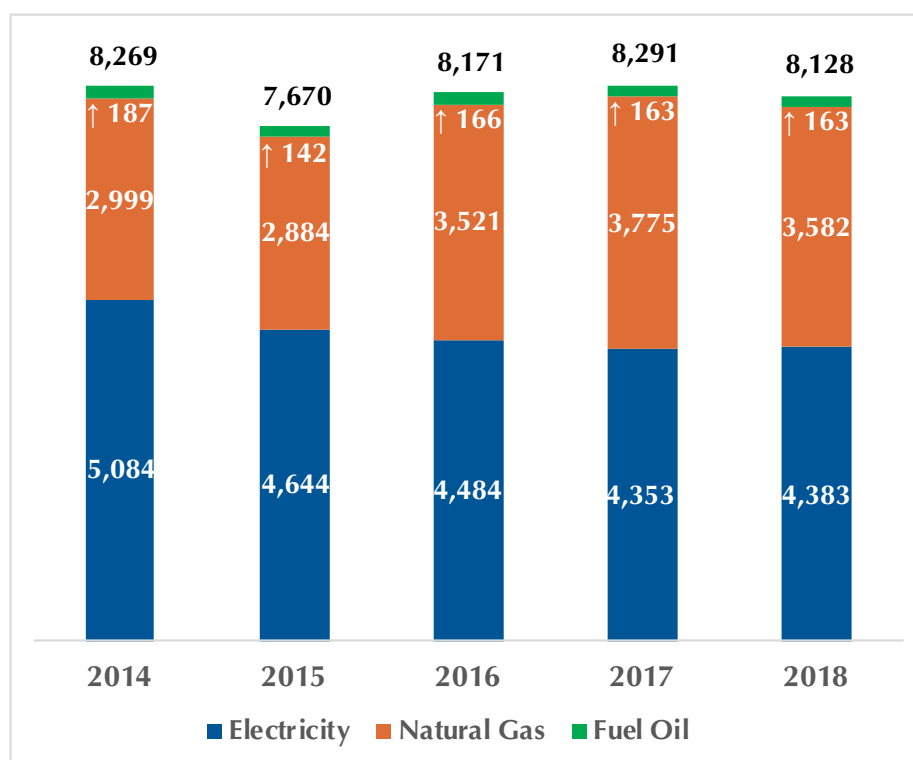


Figure 2 Municipality of Trent Hills trends on energy use by facilities, including buildings and parks (eMWh) 2014-2018

The municipality has made significant progress in reducing electricity use; use in 2018 was less than that in 2014 by 14%. However, consumption of natural gas increased by roughly 600 eMWh, over the course of the last five years. The amount of fuel oil used remained quite constant over the last three years, but it is lower than in 2014 by 24 MWh.

There are only two facilities using fuel oil. These are the Seymour public works depot, and the Hastings public works depot. The Seymour depot uses 86% of the total fuel oil.

The table below shows the amount of fuel oil used in each facility over the last five years.

Table 1 Fuel oil use by facility 2014-2018 (ekWh)

Public Works Facility	2014	2015	2016	2017	2018
Hastings Depot	24,438	19,953	17,201	18,322	22,159
Seymour Depot	162,202	121,549	148,762	144,736	140,817
Total	186,640	141,502	165,963	163,058	162,976

Even though the Seymour depot has a larger floor area than the Hastings depot, the intensity of Seymour is still much higher than that of Hastings, with 26 ekWh/ft² compared to just 15 ekWh/ft².

Energy saving initiatives taken

The Municipality has taken a number of initiatives to reduce energy use over the last five years. These include:

- A lighting retrofit in Campbellford Arena, estimated to save 14,000 kWh of electricity per year, and associated savings from reduced heat on the ice.
- Adjusting the aeration cycles in the oxidation ditch of the Hastings wastewater treatment facility.
- Modifications to digester blowers at the Hastings WWTP to increase efficiency
- Lowering the heat in many rooms at the Hastings WWTP.
- Using biogas at the Campbellford facility to heat all the buildings and the digester (mid-2017)
- Replacing pumps with higher efficiency models at the Campbellford WWTP (late 2017)
- Retrofitting lights to LEDs and replacing the gas furnace at the Hastings Fire Station
- Lowering the ceiling in the old Campbellford Fire Station to reduce the heating requirements
- Replacing appliances in fire stations with more efficient models
- Replacing the boiler at the Fleet Shop with a higher efficiency model
- Retrofitting streetlights with LED lamps.

Trends across specific building types

Energy use in administration buildings dropped in 2016 but has been increasing since then. Energy use in fire stations has fallen since 2014 (20%), while use in most other facilities, such as community centres, has remained relatively constant. There was a 38% increase in the use of energy for water treatment plants from 2014 to 2018.

Energy use in indoor recreational facilities has increased significantly with the new Hastings Fieldhouse. This air structure building is a very high user of energy. It is the second largest energy user, behind the Campbellford Arena with its indoor ice rink.

There are a variety of reasons why natural gas and electricity consumption could have increased across facilities. Energy use is affected by the number of hours a building is operating, the number of people using the building, the months the building is being operated, and weather. The highest energy using facilities include the indoor recreational facilities. Use at these will be affected by the length of the season over which they are operated.

Table 2 below shows how total energy use changed by facility type from 2014 to 2018.

Table 2 Trent Hills percentage change in energy use by facility type, 2014 to 2018

Facility type	% change
Administrative offices and related facilities, including municipal council chambers	1%
Community centres	8%
Cultural facilities	4%
Facilities related to the pumping of sewage	6%
Facilities related to the treatment of sewage	-55%
Facilities related to the treatment of water	38%
Fire stations and associated offices and facilities	-20%
Indoor ice rinks	6%
Indoor recreational facilities	1269%
Other	-25%
Public libraries	0%
Storage facilities where equipment or vehicles are maintained, repaired or stored	-4%

The biggest change is in indoor recreational facilities. The increase seen in that facility type is primarily due to the opening of the Hastings Fieldhouse. The jump in energy for this facility type was in 2016, when the Fieldhouse opened, and there was an increase of almost 800 eMWh compared to the previous year.

For indoor ice rinks there was an improvement in the energy used in the Campbellford arena due to the lighting retrofit project. There was a decrease of 52,000 kWh of electricity in 2018. 2018 also saw a decrease in the amount of natural gas used by the Campbellford arena.

The second largest change from 2014 to 2018 was the decrease in energy use in wastewater treatment facilities. From 2014 to 2017, there was an average decrease of about 10% of energy per year. In 2018 there was a more dramatic drop of 37% compared to the previous year.

The energy use in fire stations decreased since 2014, due to measures listed above.

Energy intensive buildings in the Municipality

Energy use intensity (EUI) is a measure of the energy use per unit. For buildings this is typically measured in energy units per unit floor area. By accounting for floor area, it is possible to compare buildings of different sizes. This benchmarking helps to identify high energy using facilities.

Table 3 shows an overview of corporate facilities with the highest energy use intensity.

Table 3 Corporate buildings with the highest energy use intensity (2018)

Building	2018 Energy use (ekWh)	Gross floor area (ft ²)	2018 Energy use intensity (ekWh/ft ²)
Campbellford Library	296,074	6,288	47
Campbellford Public Works Depot	145,271	4,096	35
Hastings Fieldhouse	1,468,761	50,301	29
Campbellford Fire Department	165,201	6,808	24
Hastings Fire Department	86,594	4,312	20
Fleet Shop	46,635	2,400	19
Memorial Community Hall	42,532	2,426	18

Of the seven facilities, Campbellford Library, Campbellford Public Works Depot and the Hastings Fieldhouse have the highest EUIs.

Streetlighting energy use

The Municipality has made good progress on reducing energy use for streetlighting, as illustrated below.

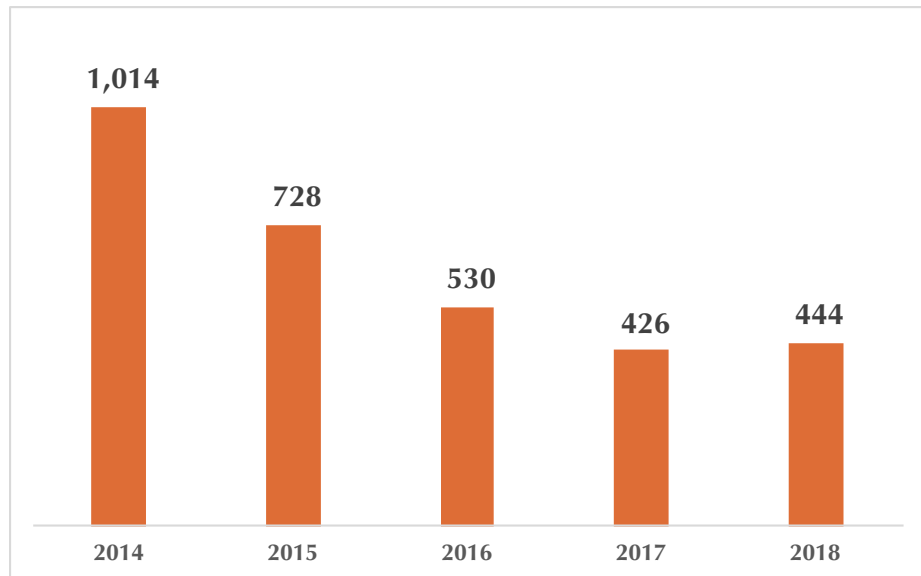


Figure 3 Energy use for streetlighting including park and traffic lights 2014-2018 (MWh)

Overall trends in GHG emissions in Trent Hills

Figure 4 shows the greenhouse gas emissions from facilities for the Municipality of Trent Hills from 2014 to 2018, separated by energy source.

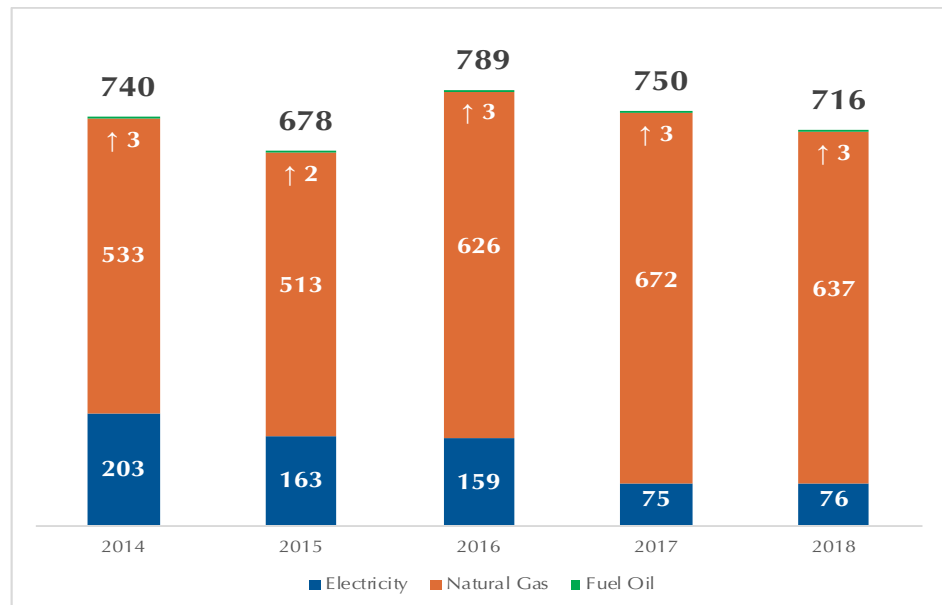


Figure 4 Municipality of Trent Hills greenhouse gas emissions from 2014-2018 (t CO₂eq)

Compared to the quantity of greenhouse gases produced by natural gas and electricity use in Trent Hills, the emissions from fuel oil are very small.

Overall emissions of greenhouse gases associated with electricity have declined significantly in Ontario since the phase out of coal-fired generation. The change in GHG emission intensity of Ontario electricity is illustrated in Table 4. Carbon intensity of electricity was fairly constant since 2014, with a recent drop in 2017, and electricity related carbon emissions thus are reflective of overall electricity consumption. Although Environment and Climate Change Canada has not released the 2018 greenhouse gas inventory yet, IESO data indicate that the intensity of electricity went up somewhat in 2018.

Table 4 Greenhouse gas intensity of Ontario electricity (generation) 2012–2017

Year	GHG intensity of electricity (g CO ₂ eq/kWh)
2012	96.096
2013	76.012
2014	40.011
2015	35.011
2016	35.548
2017	17.298

SOURCE: (Environment and Climate Change Canada, 2019b)

Facilities related to the treatment of water and of sewage, indoor recreational centres and indoor ice rinks display the largest carbon footprint across facility types, contributing to 67% of all emissions. Facilities related to the treatment of sewage, of which there are two, led with 22% of the whole Municipality's emissions. Indoor recreational centres, indoor ice rinks and facilities for the treatment of water are each contributing approximately 15% of overall greenhouse gas emissions.

Objectives and targets

Objectives

The primary objectives of the Municipality of Trent Hills' 5-year *Corporate energy management plan* are to achieve the following:

1. To further build a culture of conservation in the Municipality, so that efficient use of energy and limiting greenhouse gas emissions is part of the day-to-day activities of staff.
2. To entirely eliminate the use of fuel oil in any Municipality activities and facilities.
3. To establish a corporate structure and processes to manage all energy and greenhouse gas emissions
4. To ensure the public is aware of the Municipalities initiatives to reduce energy use and greenhouse gas emissions.

These goals are only for the 5-year period of this plan. In the longer-term the Municipality of Trent Hills strives to operate as efficiently as possible and to provide leadership in energy efficiency to other municipalities.

Targets

Figure 5 illustrates the set of quantitative targets that should guide the Municipality's efforts on energy management from 2019 to 2024.

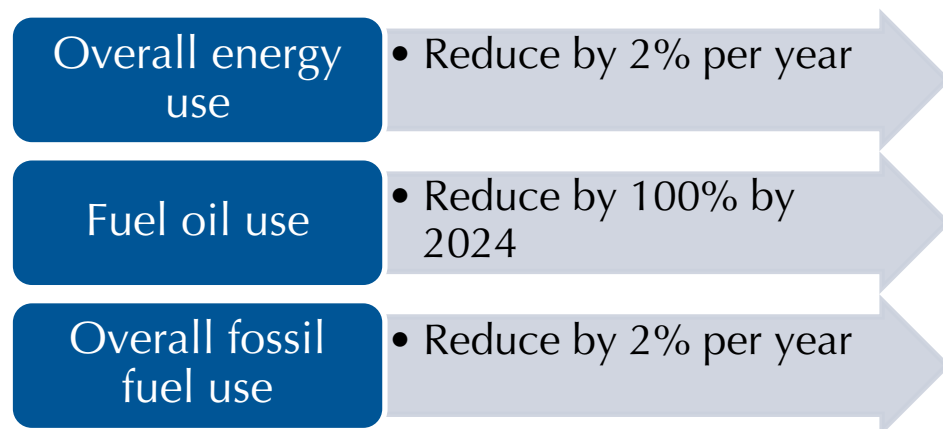


Figure 5 Targets for 2019-2024

Table 5 shows the energy use and greenhouse gas reductions associated with the above targets. These are calculated as reductions from the base level of 2018.

Table 5 Energy targets for 2019-2024

Target area	2018 baseline	2020 target	2022 target	2024 target
Electricity (kWh)	4,383,000	4,300,000 <i>(2% reduction)</i>	4,100,000 <i>(6% reduction)</i>	3,900,000 <i>(10% reduction)</i>
Natural gas (ekWh)	3,654,000	3,600,000 <i>(2% reduction)</i>	3,400,000 <i>(6% reduction)</i>	3,400,000 <i>(6% reduction)</i>
Fuel oil (ekWh)	163,000	138,550 <i>(15% reduction)</i>	138,550 <i>(15% reduction)</i>	- <i>(100% reduction)</i>
Propane (ekWh)	0	14,000 <i>(increase)</i>	13,400 <i>(-4% from 2020)</i>	12,300 <i>(-8% from 2020)</i>
GHG emissions (t)	7,430	7,280 <i>(2% reduction)</i>	6,900 <i>(7% reduction)</i>	6,510 <i>(12% reduction)</i>

The strategy for facilities consists of increasing energy efficiency, which reduces the use of electricity and natural gas. This also includes implementation of renewable energy sources (including biogas) in the long term.

Targets have been set in units of total energy use, rather than energy intensity (for example kilowatt hours per square metre). This reflects Trent Hills' goal for an absolute reduction in emissions and energy use. Energy intensity measures will still be useful in benchmarking facilities – comparing the performance of Trent Hills facilities, for example, to those of other municipalities. For benchmarking of current use, see Appendix B.

Key performance indicators

The targets suggest key performance indicators:

- Total GHG emissions – kilograms of carbon dioxide equivalent
- Total energy use – gigajoules or megawatt-hour equivalent
- Total electricity demand – gigajoules or megawatt-hours
- Total fossil fuel demand for buildings – natural units (e.g. cubic metres of natural gas) and gigajoules or megawatt-hour equivalent
- Total fuel oil demand – natural units (i.e. litres)

Secondary performance indicators include:

- Energy intensity of buildings – energy use per unit floor area or per volume of flow
- Thermal energy intensity of buildings – thermal energy (in particular fossil energy) per unit floor area
- Weather normalized energy use – weather corrected total energy use

Disaggregated data are desirable wherever possible, e.g. per building, per function, etc.

Updating and reporting on the plan

The *Corporate energy management plan* is a living document and should be reviewed at least once a year. As part of the annual review, the following steps should be completed:

- Track the activities that have been implemented, based on a checklist of all of the actions included in the CEMP;
- Track quantitative progress towards targets;
- Note any updates to the CEMP, based on audits, organizational changes, or lessons from past projects;
- Identify the priority actions for the upcoming year, and secure funding and resources for their implementation;
- Compile an updated report annually describing projects implemented, progress towards targets, updates to the CEMP, and priority actions for the upcoming year; and
- Update the public reports to highlight projects completed, status of CEMP, and corporate commitment to energy management;
- In 2024, report on implementation of the CEMP as required under *Regulation 507/18*. Include details on: energy and GHG emissions for 2022 or 2023; current and proposed energy conservation and demand management measures; a report on results achieved; and a revised forecast of the expected results of the current and proposed measures.

Priority actions

Actions under the plan are presented according to the time they are to be taken: in the first year or in years 2-5.

Year 1 actions

The table below presents all the priority actions that should be implemented in year 1 of the CEMP (July 2019 – June 2020). The numbering is not an indication of importance.

Organizational and operation commitment

1. Formally adopt 5-year corporate targets for energy intensity and GHG emissions
2. Formally adopt interim targets to assist in tracking progress towards 5-year goals
3. Develop a process for updating the CEMP in the interim and after 5 years and ensure compliance with the *Electricity Act* reporting requirements
4. Establish an Energy Committee with responsibility for implementing the plan and tracking progress
5. Integrate energy considerations into other plans (e.g. the asset management plan) as they are being developed
6. Encourage other levels of government to fund capital improvements that reduce energy use and greenhouse gas emissions
7. Track incentive availability and apply for incentives where possible to support initiatives
8. Perform walk-throughs of buildings to identify saving opportunities
9. Assess the need for additional staff training

Technological requirements

10. Undertake LED retrofits in administrative building
 11. Incorporate motion detectors on lighting where appropriate
 12. Retrofit lighting in Warkworth fire station
 13. Upgrade UV filtration at Campbellford WWTP
 14. Replace oil burner at Seymour depot with propane radiant heater(s)
 15. Develop, plan and build new Campbellford fire station to high standards of energy performance
-

Communication and education

- 16. Make information on energy use available to responsible staff
 - 17. Report accomplishments on an annual basis to Council and public.
-

Medium and longer-term actions (years 2-5)

The table below presents the medium-term and longer-term actions that should be implemented in years 2-5 of the CEMP (2020-2024).

Organizational and operational commitment

- 18. Re-affirm commitment to targets and update targets, if required, to reflect progress.
 - 19. Track and assess progress on interim targets and actions each year
 - 20. Detailed look at existing operations
 - 21. Use targeted energy audits on buildings where energy use appears particularly high relative to benchmarks or that do not seem to be operating properly
 - 22. Implement sub-metering of key energy areas in major facilities for measurement of individual unit and device consumption
 - 23. Use life-cycle analyses of products to support decision making
-

Technological requirements

- 24. Install air curtains in facilities where doors often remain open to prevent air from escaping or entering heated or cooled spaces, such as loading docks
 - 25. Build the new arena to high standards of energy performance
 - 26. Retrofit lighting to LEDs in the Fieldhouse
 - 27. Upgrade the aeration system at the Campbellford WWTP to fine bubble diffusers
 - 28. Move Seymour depot operations to new public works depot, and eliminate fuel oil use
 - 29. Choose high efficiency models when replacing furnaces
-

Communication and education

- 30. Provide enhanced training for all staff on the importance of energy, and their contribution to energy management.
 - 31. Educate building users on energy usage, and changes over time.
-

Capital costs

In order to achieve the targets indicated for the next 5 years, and for the Municipality of Trent Hills to move towards its preferred state, funding will be required by the Corporation to follow through with the projects. Specific costs for the particular projects will need to be determined and refined over the course of the plan.

A preliminary estimate can be made for overall incremental costs based on typical energy saving costs of \$0.25/kWh.¹ Table 6 provides an estimate of the funding required to meet the targets set out in the plan based on the typical cost of saving. Actual funding needs may change as the plan is implemented.

The table below uses the target amounts of energy reduction indicated in Table 5 under Objectives and targets. The estimates were calculated as reductions from the base year of 2018 (rounded to nearest \$10,000).

Table 6 Preliminary estimates of costs of implementing the plan by year

Source	2020	2021	2022	2023	2024
Electricity	\$20,000	\$30,000	\$30,000	\$30,000	\$30,000
Natural Gas	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
Fuel Oil	\$10,000	\$0	\$0	\$0	\$0
Total	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000

¹ Where efficiency improvements are made while otherwise upgrading equipment or facilities, only the *incremental* cost of efficiency improvements is attributable to the energy initiative.

Communication and engagement

The following section focuses on employee engagement, behaviour changes, and communication. This section compliments and explores the high-level communication actions that are required to implement the plan.

Interactive workshop

The staff planning workshop which took place during the development of the CEMP engaged participants through a series of brainstorming and structured discussions on energy management. The purpose of the workshop session was to develop group consensus on what are the Trent Hills priorities for reducing energy and increasing efficiency in Municipal operations. The workshop session identified what actions are required to move towards the preferred state for the Municipality of Trent Hills, and participants rated these on ease of implementation and importance.

Workshop participants agreed that the establishment of an energy committee is a priority action for the Municipality.

Staff training

As identified in actions this section provides further information on three types of training that are needed in the Municipality of Trent Hills.

- General training on energy efficiency for all staff members. This includes both operational and management staff;
- Project specific training for facilities staff; and

All staff training

As identified during the staff workshop, management and operational staff need to be provided training on energy efficiency. The training can be provided as a half-day or full-day workshop or offered monthly. It would be a great idea to provide staff with interactive quizzes or test to ensure that staff members are completing the requiring training and learning as they do. Once completing a series of training programmes, staff members can be eligible to receive a certificate. Training and orientation for all new hires should always include energy conservation training.

Behavioural changes and communication

Understanding and encouraging one another to talk about energy efficiency, and what staff are doing at the local scale is fundamental to improving the Municipality of Trent Hills' energy management.

Establishing and implementing a behaviour change program would be the most effective for communicating the importance of behaviour change and energy awareness. A combination of this will not only allow for energy and emission reductions, but significantly help the Municipality with energy efficiency savings.

There are various initiatives that can be taken in order to shift energy-conscious behaviour within facilities:

- Ongoing monitoring and reporting
- Operator training
- Energy training for all staff
- Updating the public on CEMP progress and achievements.

Public engagement

One of the main priorities of the Municipality of Trent Hills identified through the staff interviews and workshop was to educate and inform the community on the Municipality's successes and progress as the plan is implemented. It should be conveyed to the public that conservation efforts are a high priority to the Municipality.

This communication can be done in a multitude of ways. One which was discussed in the workshop is to have intermittent reports on the progress of the plan, including measurables and explanations of changes. These reports will be made to Council and be made available to the public on the municipal website.

Conclusion and recommendations

In the past 5 years, overall greenhouse gas emissions have decreased as a result of better energy efficiency in many facilities. However, the progress was not as successful as was hoped for in the previous plan. In the past few years, the need for greater commitment to reducing climate change has become much more pressing, and it is now a matter of citizens' health and well-being. The Municipality of Trent Hills is committed to going further in the next 5 years to reduce its impact on climate change and to reduce its exposure to rising energy prices.

Although the municipality has made good progress in some areas, additional technological, behavioural, and operational changes need to occur within facilities to reduce energy use and help the Municipality move towards its goal of reducing overall emissions from its operations and establishing better communication about energy.

On the facilities side, a simultaneous reduction in use of natural gas and electricity is required. Concurrently, Trent Hills will take advantage of opportunities to reduce overall electricity and natural gas use through conservation initiatives, drawing as appropriate on third-party incentives to help support these. The new buildings, such as the new fire station and recreational facility, will be designed and operated to be more energy efficient than the older buildings they replace.

The Municipality will also aim to completely eliminate its use of fuel oil within the next five years. Oil is used for the Seymour public works depot, as well as the Hastings public works depot.

The Municipality of Trent Hills will also focus on improving its communication with staff, Council and the citizens about energy and climate issues while undergoing these improvements. An energy committee will be established, and walk-throughs of facilities will be performed in order to better understand the Municipality's functions. Changes to equipment and operating practices will be documented and will be presented to Council and the public. Additionally, the goals, achievements and efforts of the Municipality will be continuously demonstrated to the community to present a sense of leadership.

These changes are essential to meeting the objective of reducing emissions, and for building a culture of conservation in the Municipality of Trent Hills.

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Appendix A. Facility GHG emissions 2014-2018

The following table shows facility GHG emissions from 2014-2018 in kilograms of CO₂eq. These are the combined total emissions from electricity, natural gas and fuel oil. The spark lines on the far right give an indication of trends in individual buildings over the 5 years. Facilities are sorted from the largest to the smallest GHG emitters in 2018.

Table 7 GHG emissions from 2014-2018 of Trent Hills facilities (kg CO₂eq)

Facilities	2014	2015	2016	2017	2018	
Hastings Fieldhouse		38,663	178,448	179,196	193,564	— ■ ■ ■ ■
Campbellford Wastewater Plant	202,551	174,136	171,564	132,589	83,232	■ ■ ■ ■ —
Hastings Water Filtration Plant	71,148	58,700	61,205	67,664	78,045	■ — ■ ■ ■
Campbellford Arena	70,113	69,095	73,480	91,024	69,697	■ — ■ ■ —
Campbellford Library	43,244	39,523	32,201	40,003	39,710	■ ■ ■ ■ ■
Campbellford Public Works Depot	25,688	25,387	22,474	23,553	25,843	■ ■ ■ ■ ■
Warkworth Arena	39,945	32,246	30,312	26,380	25,361	■ ■ ■ ■ —
Clock Tower Cultural Centre	29,048	20,722	21,367	23,879	20,635	■ ■ ■ ■ —
Warkworth Town Hall/Library	18,883	17,956	15,440	16,150	20,006	■ ■ ■ ■ ■
Warkworth Water Treatment Plant			14,051	15,895	19,859	■ ■ ■ ■
Trent Hills Public Works -- Percy Depot	19,998	17,802	13,960	13,418	18,248	■ ■ ■ ■ ■
Municipal Office	14,427	12,352	12,265	13,024	13,763	■ ■ ■ ■ ■
Campbellford Water Filtration Plant	22,384	18,658	18,548	9,445	9,573	■ ■ ■ ■ —
Hastings Fire Department	14,367	15,029	8,668	7,699	9,259	■ ■ ■ ■ —
Fleet Shop	10,098	9,421	7,723	8,081	8,296	■ ■ ■ ■ —
Campbellford Heritage Centre	2,170	5,919	6,969	7,218	7,726	■ ■ ■ ■ ■
Campbellford Pool	20,849	10,549	3,506	16,199	6,876	■ ■ ■ ■ —
Memorial Community Hall	5,975	6,895	5,962	6,951	6,680	■ ■ ■ ■ ■
Forrest Dennis Srs. Centre	7,463	6,831	6,893	5,756	6,632	■ ■ ■ ■ ■
Warkworth Fire Department	11,485	9,738	8,141	4,108	6,162	■ ■ ■ ■ —
120 Grand Road	1,235	5,627	6,014	4,852	5,889	■ ■ ■ ■ ■
Old Seymour Township Office	5,665	5,922	4,635	5,099	5,854	■ ■ ■ ■ ■
Hastings Wastewater Plant	18,805	13,824	13,898	5,109	5,125	■ ■ ■ ■ —
Trent Hills Public Works -- Seymour Depot	4,486	3,783	4,254	4,184	4,117	■ ■ ■ ■ ■
Hastings Civic Centre/Library	4,331	3,347	3,621	2,034	3,846	■ ■ ■ ■ ■
Streetlights - Campbellford 2	1,619	1,337	1,317	883	3,543	■ ■ ■ ■ ■
Streetlights - Campbellford	27,211	14,577	8,120	3,507	3,533	■ ■ ■ ■ —
Campbellford	7,225	5,771	5,563	2,617	2,858	■ ■ ■ ■ —
Hastings Village Marina	3,245	3,178	2,478	2,088	2,480	■ ■ ■ ■ —
Old Warkworth Firehall	2,033	2,785	1,329	1,179	1,917	■ ■ ■ ■ —
Campbellford Pumping Station	4,877	3,261	4,115	2,607	1,889	■ ■ ■ ■ —

Facilities	2014	2015	2016	2017	2018	
Warkworth Water Filtration Plant	7,254	6,133	3,576	1,573	1,520	■ ■ ■ ■ ■
Trent Hills Public Works -- Hastings Depot	1,121	1,043	996	1,015	1,082	■ ■ ■ ■ ■
Saskatoon Ave High Lift Pump Stn					872	■
Campbellford Water Tower	1,864	1,601	926	477	452	■ ■ ■ ■ ■
Trent Hill Public Works -- Campbellford Depot	1,294	1,009	913	403	426	■ ■ ■ ■ ■
Pumping Station - Hastings Front	1,150	1,453	985	394	349	■ ■ ■ ■ ■
Trent Hills Public Works -- Fleet Depot	786	709	606	300	332	■ ■ ■ ■ ■
Streetlights - Hastings	775	640	630	307	307	■ ■ ■ ■ ■
Warkworth Pumping Station - Warkworth East	821	607	450	257	239	■ ■ ■ ■ ■
Streetlights - Campbellford Bridge	458	404	357	192	217	■ ■ ■ ■ ■
Old Mill Park - Campbellford	572	459	426	219	209	■ ■ ■ ■ ■
Hastings Memorial Arena	679	392	550	273	187	■ ■ ■ ■ ■
Splashpad	313	331	296	189	178	■ ■ ■ ■ ■
Campbellford Ball Park	434	299	275	106	124	■ ■ ■ ■ ■
Hastings Water Tower	307	245	226	109	114	■ ■ ■ ■ ■
PW - Percy Shop Light	293	140	265	138	79	■ ■ ■ ■ ■
Streetlights - Trent River	554	254	140	68	62	■ ■ ■ ■ ■
Trent Hills Public Works -- Radio Tower Depot	130	113	106	56	57	■ ■ ■ ■ ■
Pumping Station - Hastings Homewood	101	85	80	57	52	■ ■ ■ ■ ■
Trent Hills Public Works -- Radio DepotComm Tower	81	63	78	44	51	■ ■ ■ ■ ■
Warkworth Ball Park	38	51	60	40	43	■ ■ ■ ■ ■
Pumping Station	96	80	63	35	38	■ ■ ■ ■ ■
Campbellford Pumping	155	103	77	39	34	■ ■ ■ ■ ■
Park Lights - Hastings Playground	29	24	24	12	12	■ ■ ■ ■ ■
Park Lights - Hastings Gazebo	67	85	62	15	11	■ ■ ■ ■ ■
Campbellford Water Vault	15	41	24	9	11	■ ■ ■ ■ ■
Sentinel Lights - Trent River	40	33	32	16	11	■ ■ ■ ■ ■
Town Square					5	■
Streetlights - Trent Drive Waterfront	40	27	14	2	4	■ ■ ■ ■ ■
Warkworth Water Reservoir	10	7	7	4	4	■ ■ ■ ■ ■
Park Lights - Campbellford Gazebo	11	1	1	0	0	■ ■ ■ ■ ■
Hastings Ball Park	10	9	8	0	0	■ ■ ■ ■ ■
74 Collins Rd.		-	-	-	-	
Streetlights - Warkworth	7,144	3,539	1,501			■ ■ ■ ■ ■
Streetlights	75	62	61	27		■ ■ ■ ■ ■
Streetlights - Industrial Drive	705	304	96	43		■ ■ ■ ■ ■
Streetlights - Pine Ridge Subdivision	72	20				■ ■ ■ ■ ■
Streetlights - Petherick's Corners	61	50	49	22		■ ■ ■ ■ ■
Streetlights - Norham	797	658	648			■ ■ ■ ■ ■
Streetlights - Dartford	239	155	65			■ ■ ■ ■ ■
Streetlights - Whitehart Lane	173	151	215			■ ■ ■ ■ ■
Streetlights - Trentview Crescent	499	146				■ ■ ■ ■ ■
Streetlights - Hoards Station	107	88	87	39		■ ■ ■ ■ ■
Streetlights - Menie	30	1,480	2,536	1,135		■ ■ ■ ■ ■
Streetlights - Stanwood	72	21				■ ■ ■ ■ ■
Streetlights - Warkworth Town Hall	24	18	55	25		■ ■ ■ ■ ■
Streetlights - Little Fry Acres Road	40	1,639	3,088	1,105		■ ■ ■ ■ ■

Appendix B. Trent Hills benchmarked against provincial facilities

The following tables demonstrate how the energy intensity of Trent Hills facilities compare to the rest of Ontario.

The measurements for the energy intensity of the buildings takes into account heating degree days (HDD) which are a measure of the heating requirement for the buildings, to help account for the influences of seasonal temperature differences.

The data in the tables is for the year of 2016, as this is the latest year for which Ontario medians are available.

Table 8 Benchmarking Trent Hills facilities against other buildings in the Ontario Broader Public Sector (2016 data)

Operation Type	Provincial median (eWh/HDD/ft ²)	Mean for Trent Hills (eWh/HDD/ft ²)	% (Trent Hills vs provincial median)
Administrative offices and related facilities	6.20	4.21	68%
Community centres	5.00	2.36	47%
Cultural facilities	5.10	4.72	92%
Fire stations	5.40	5.99	111%
Indoor recreational facilities	7.40	5.99	81%
Public libraries	6.40	7.58	119%
Storage facilities or garages	5.80	4.93	85%

SOURCE: Ontario Ministry of Energy, Northern Development and Mines. 2019.

The Municipality of Trent Hills' average energy intensity was below that of the province for all facility types, except for fire stations and public libraries. Trent Hills has three fire stations, of which Fire Station 2 had the highest intensity, as shown in Figure 6.

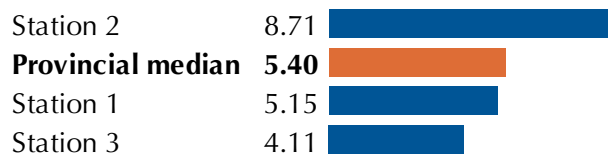


Figure 6 Energy intensity of Trent Hills fire stations versus the provincial median in 2016 (eWh/HDD/ft²)

The Hastings fire station (#2) has seen improvements in the last few years to improve energy efficiency. Within the last five years, staff upgraded to new LED lighting, and installed a new gas furnace. Although these improvements were expected to increase the energy efficiency of the facility, total energy usage went up from 2016 to 2018.

The Municipality has two public libraries. The Campbellford Branch had an energy intensity twice as high as that of the Warkworth Branch. These are 10.16 and 5.01 eWh/HDD/ft², respectively.

The following table shows how energy use of the Municipality of Trent Hills' wastewater and drinking water facilities compare to the provincial means in 2016 (Prosperity Group, 2018).

Table 9 Benchmarking Trent Hills facilities against other water and wastewater facilities in Ontario (2016 data)

Operation Type	Provincial Mean (ekWh/m ³)	Mean for Trent Hills (ekWh/m ³)	% (Trent Hills vs provincial mean)
Facilities related to the pumping of sewage	197.03	152.94	78%
Facilities related to the pumping of water	244.50	1,233.28	504%
Facilities related to the treatment of sewage	850.65	1,270.08	149%
Facilities related to the treatment of water	307.01	803.48	262%

SOURCE: Provincial data derived from Prosperity Group, 2018

The energy used in Trent Hills' facilities in 2016 was well above average, apart from the sewage pumping facilities. The facility with the highest intensity was the Warkworth Booster Pumping Station, at 2,361 ekWh/m³, which was far above the average for water pumping facilities.

For water treatment, the high number was due to the Warkworth Water Treatment Plant, whose intensity of 1,580 ekWh/m³ led to the high mean for those facilities.

Figure 7 shows how each individual water and wastewater facility in the Municipality compares to the provincial mean used above.

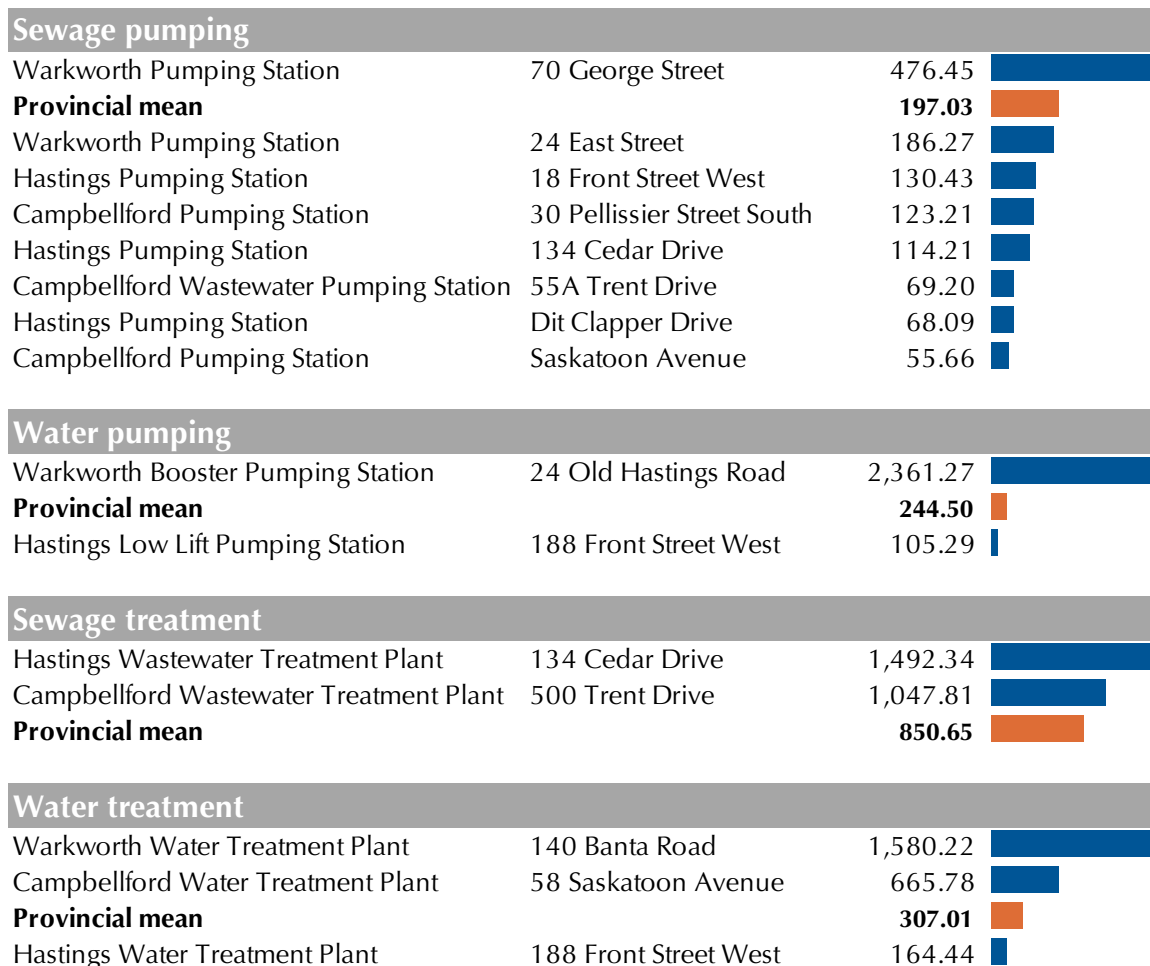


Figure 7 Energy intensity of Trent Hills water and wastewater facilities versus the provincial mean in 2016 (eWh/ML)

As noted in the text (p.9), energy use in wastewater treatment facilities in Trent Hills has declined significantly since 2016.

Appendix C. Incentive Programs

This section describes the financial incentives that are available to the Municipality of Trent Hills. These incentives include:

- utility incentives for electricity savings, and WWTP and DWTP efficiency offered by the Independent Electricity System Operator (IESO)
- utility incentives for natural gas savings offered by Enbridge Gas,
- those offered at the federal level,
- incentives offered by The Atmospheric Fund.

The Municipality of Trent Hills can take advantage of these incentives to implement some of the suggested technical measures. Forming partnerships with energy utilities allows for the expansion and access to energy efficiency programs within the Municipality.

For electricity, all applicable technical measures fall under the Save on Energy programs offered by the IESO.

For natural gas, all applicable technical measures fall under the programs offered by Enbridge Gas. Trent Hills can improve its long-term energy and environmental performance by considering these financial incentives.

C.1. INDEPENDENT ELECTRICITY SYSTEM OPERATOR (IESO)

Full details are available at: <https://saveonenergy.ca>.

Retrofit Program

The Retrofit programs provides incentives for electricity savings from lighting retrofits, lighting controls, HVAC redesigns, chiller replacements, variable speed drives, or improvements on thermal performance of a building envelope. There are two types of project applications: Prescriptive Track and Custom Track. This program also applies to wastewater and drinking water treatment plants.

Process & Systems Program

This program provides incentives for innovative changes, equipment retrofits, financial assistance for engineering studies, technical expertise from energy managers. This program also applies to wastewater and drinking water treatment plants.

Energy Performance Program

This incentive is ideal for improving the energy performance of an entire building. This program also applies to wastewater and drinking water treatment plants.

C.2. ENBRIDGE GAS

Full details are available at:

<https://enbridgesmartsavings.com/business-energy-management>

The Commercial Custom Retrofit Program

The program allows you to work with Enbridge Gas to identify energy efficiency opportunities. The program opportunities focus on reducing natural gas while saving money, and it includes financial assistance.

The Fixed Incentive Program

Enbridge Gas offers incentives to help offset the costs of implementing more efficient natural gas technologies in facilities, in both new and existing buildings. The program offers incentives for technologies such as heating and ventilation, air doors, high efficiency boilers, rapid air doors, a payback period calculator, insulation, and many more.

Trent Hills could look into this program for the installation of their air curtains, referred to as air doors here. The incentive varies depending on the size of the door.

The RunitRight program

The program identifies low or no-cost efficient energy operational improvements to implement in the Municipality. These improvements help reduce the amount of natural gas that will be used, as well as save money.

C.3.FEDERAL INCENTIVES

Full details are available at:

<https://fcm.ca/en/programs>

<https://www.nrcan.gc.ca/cleangrowth/20254>

The Federal Government of Canada offers funding, grants and incentive programs to encourage energy innovation, a clean economy, and to promote climate change action. The Federation of Canadian Municipalities (FCM) offers programs and tools to help municipalities build stronger communities. FCM supports a variety of opportunities such as plans, studies, pilot projects, capital projects, asset management grants, and partner grants. Additionally, through Natural Resource Canada's (NRCan) Innovation and Clean Growth Programs, there are incentives for projects that support key energy innovative areas. Below is a description of each.

The Green Municipal Fund-Energy

Full details are available at:

<https://fcm.ca/en/funding/gmf/pilot-project-retrofit-municipal-facilities>

<https://fcm.ca/en/funding/gmf/study-energy-recovery-district-energy>

This program funds studies, pilot and capital projects for different environmental sectors. Both grants and loans are available for municipal projects. Recipients can receive additional grant of up to 15 percent of their loan amount. The Green Municipal Fund can fund pilot projects of retrofits that improve energy efficient by at least 30% in municipal facilities or provide the funding for capital projects where renewable thermal energy is

used in new or existing facilities, to help the municipality reduce its greenhouse gas emissions.

Zero-emissions vehicles

Full details are available at:

<http://www.tc.gc.ca/en/services/road/innovative-technologies/zero-emission-vehicles.html>

The 2019 federal budget proposes strategic investments for Canadians to choose zero-emission vehicles. The government will provide \$300 million over the next three years to Transport Canada for the administration of a new program. Transport Canada will introduce a federal incentive of up to \$5,000 for electric battery or hydrogen fuel cell vehicles with a manufacturer's suggested retail price of less than \$55,000.

Electric Vehicle Infrastructure Demonstrations

Full details are available at:

<https://www.nrcan.gc.ca/energy/funding/icg/18386>

The Electric Vehicle Infrastructure Demonstrations are available for projects that need to investigate and understand the impacts and potential hurdles in the deployment of the next generation of charging infrastructure for electric vehicles.

The Low Carbon Economy Fund

Full details are available at:

<https://www.canada.ca/en/environment-climate-change/services/climate-change/low-carbon-economy-fund.html>

The Low Carbon Economy Fund supports the Pan-Canadian Framework on Clean Growth and Climate Change by leveraging investments in energy efficiency projects. The fund is designed to support projects that will generate clean growth, reduce greenhouse gas emissions, and align with Canada's Paris Agreement commitments. The fund is made up of two components:

1. Low Carbon Economy Leadership Fund
2. The Low Carbon Economy Challenge

The Low Carbon Economy Leadership Fund provides up to \$1.4 billion dollars to provinces and territories that have adopted the Pan-Canadian Framework. This funding is available for projects that will help reduce greenhouse gas emissions. Based on population, both provinces and territories are eligible to receive \$30 million plus for projects.

Similarly, the Carbon Economy Challenge can fund up to \$500 million dollars for projects across Canada that adopt the Pan-Canadian Framework, reduce greenhouse gas emissions, and generate clean growth.

Appendix D. List of acronyms

CO₂eq – a quantity of a greenhouse gas or collection of greenhouse gases expressed as a carbon dioxide (CO₂) equivalent

DWTP – drinking water treatment plant

ekWh – equivalent kilowatt-hour, a measure of energy. Electrical energy is typically measured in kilowatt-hours (kWh), but other forms of energy are not. ekWh is sometimes used to indicate that some or all of the energy quantity being reported is not electrical.

EUI – energy use intensity, for buildings it is typically measured in energy use per unit floor area

GHG – greenhouse gas, compounds that contribute to climate change

GWh – gigawatt-hour, a million kilowatt-hours. A measure of energy

HDD – heating degree days, measure of heating requirement for buildings

HVAC – heating, ventilation and air conditioning

IESO – Independent Electricity System Operator

KPI – key performance indicator

LED – light emitting diode

MWh – megawatt-hour, a thousand kilowatt-hours. A measure of energy

WWTP – wastewater (sewage) treatment plant

Appendix E.Greenhouse gas reduction targets adopted by municipalities and other levels of government

Municipality	Target	by	Relative to	Set in
Toronto	30%	2020	1990	2017
Toronto	65%	2030	1990	2017
Toronto	80%	2050	1990	2017
Burlington	Carbon neutral	2040		2015
Oxford County	100% renewable energy	2050		2015
Hamilton	20%	2020	2005	2014
Hamilton	50%	2030	2005	2014
Hamilton	80%	2050	2005	2012
Guelph	28%	2031	2011	2012
Markham	Net zero emissions	2050		2011
York Region	6%	2021	2014	2016
York Region	17%	2031	2014	2016
York Region	44%	2041	2014	2016
York Region	72%	2051	2014	2016
St. Catharines	30%	2030	2011	2014
Durham Region	80%	2050	1990	2012
London	10%	2020	2014	2014
Oakville	20%	2030	2014	2014
Oakville	80%	2050	2014	2014
Kingston	15%	2020	2011	2014
Kingston	30%	2030	2011	2014
Kingston	50%	2041	2011	2014
Vaughan	22%	2031	2013	2016
Ottawa	80%	2050	2012	2016
Greater Sudbury	80%	2050	1990	2016
Windsor	40%	2041	2014	2017

Region	Target	by	Relative to	Set in
Canada	40%	2030	2005	2017
Canada	80%	2050	2005	2017
Ontario	17%	2020	2005	2009
Ontario	30%	2030	2005	2018
Ontario	80%	2050	2005	2017

Appendix F. Energy density and conversion factors, and GHG emission factors

This section includes constants used in the analysis throughout the plan.

Energy density of fuels

Energy source	To convert	to	multiply by	Reference
Natural gas	m3	ekWh	10.63	a
Natural gas	m3	MJ	38.26	b
Diesel	L	ekWh	10.65	
Diesel	L	MJ	38.35	c
Gasoline	L	ekWh	9.29	
Gasoline	L	MJ	33.45	c
Any energy source	kWh	MJ	3.6	
Any energy source	MJ	ekWh	0.2778	
Propane	L	MJ	27.13	c
Propane	L	ekWh	7.536	
Light fuel oil	L	ekWh	10.78	
Light fuel oil	L	MJ	38.8	c
Heavy fuel oil	L	ekWh	11.806	
Heavy fuel oil	L	MJ	42.5	c

Global Warming Potential

GHG	CO ₂	CH ₄	N ₂ O	Reference
GWP	1	25	298	d

NOTE: 100-year GWPs

Emissions of Ontario fuels

Fuel	CO ₂	CH ₄	N ₂ O	CO ₂ eq	Reference
Natural gas (g CO ₂ eq/m ³)				1,891	a
Light fuel oil (Residential) (g CO ₂ eq/L)				2,735	a
Fuel oil 4&6 (g CO ₂ eq/L)				3,145	a
Diesel (g CO ₂ eq/L)	2681	0.133	0.4	2,804	e
Motor gasoline (g CO ₂ e/L)	2307	0.1	0.02	2,315	e
Propane (g CO ₂ eq/L)	1530.619	0.027	0.108	1,563	a

CO₂eq is the sumproduct of the emission factor of each contaminant and the global warming potential

GHG intensity of Ontario electricity

Year	Generation intensity	Consumption intensity	Units	Reference
2011	98.04	110	g CO ₂ e/kWh	f
2012	96.096	110	g CO ₂ e/kWh	g
2013	76.012	80	g CO ₂ e/kWh	g
2014	40.011	40	g CO ₂ e/kWh	g
2015	35.011	40	g CO ₂ e/kWh	g
2016	35.548	40	g CO ₂ e/kWh	g
2017	17.298	20	g CO ₂ e/kWh	g

NOTE: consistent with Ontario Ministry of Energy, Northern Development and Mines practice, generation emission factor is being used

References:

- a Kirschbaum, 2019
- b Statistics Canada, 2018 p.130
- c ECCC 2019, Part 2, p.204
- d ECCC 2019, PT1, p.18
- e ECCC 2019 PT2 p. 212
- f ECCC 2018, PT3, p.69
- g ECCC 2019 PT3, p.65

Appendix G. 2019 Energy and Conservation Demand Management (CDM) Plan update checklist as required under O. Reg. 507/18

G.1. CDM RESULTS

- ☐ The annual energy consumption during the last year for which complete information is available for a full year (2017) for the public agency and its operations.
- ☐ The public agency's goals and objectives for conserving and otherwise reducing energy consumption and managing its demand for energy.
- ☐ The public agency's actual results.

G.2. CURRENT AND PROPOSED MEASURES

- ☐ The public agency's current and proposed measures under its energy conservation and demand management plan.
- ☐ The revised forecast of the expected results of the current and proposed measures.
- ☐ Cost and saving estimates for its proposed measures.
- ☐ The estimated length of time the public agency's energy conservation and demand management measures will be in place.
- ☐ 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.

G.3. GENERATION

- ☐ A description of any renewable energy generation facility operated by the public agency and the amount of energy produced on an annual basis by the facility.
- ☐ A description of:
 - The ground source energy harnessed, if any, by ground source heat pump technology operated by the public agency.
 - The solar energy harnessed, if any, by thermal air technology or thermal water technology operated by the public agency.
 - The proposed plan, if any, to operate heat pump technology, thermal air technology or thermal water technology in the future.

G.4. APPROVAL AND POSTING

- ☐ Confirmation that the energy conservation and demand management plan has been approved by the public agency's senior management.
- ☐ By July 1, 2019 the CDM plan needs to be:
 - Published on the public agency's website (if there is one).
 - Published on the public agency's intranet site (if there is one).
 - Made available to the public in printed form at the head office.

SOURCE: Ontario Ministry of Energy, Northern Development and Mines



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