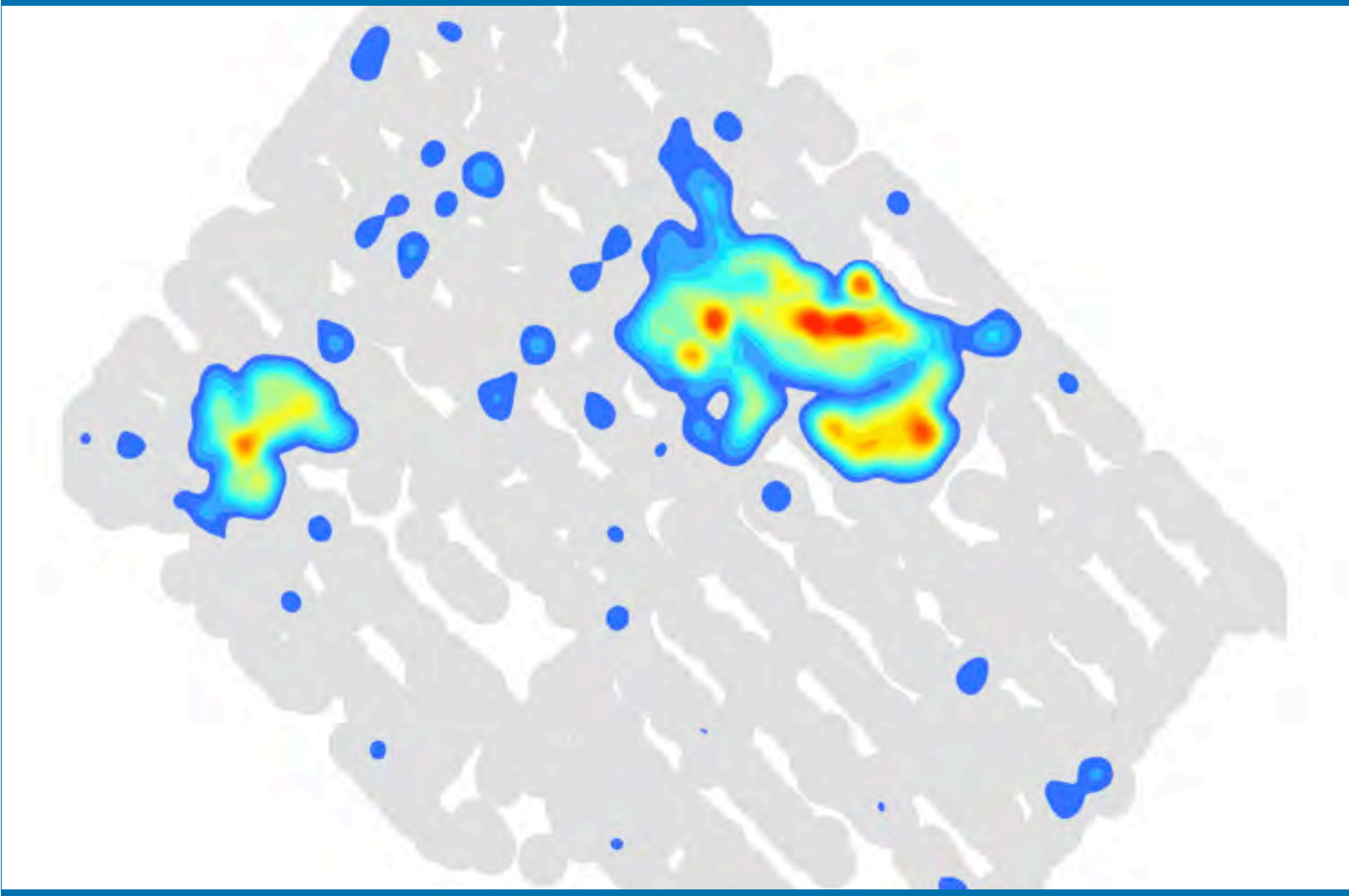
Halton Hills Mayor's Community Energy Plan
Town of Halton Hills

May 2015
FINAL



IndEco

Sustainability Solutions Group

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More information on sustainability initiatives is available via:
Sustainability Website: www.haltonhills.ca/sustainability
Project Webpage: www.haltonhills.ca/initiatives/CommunityEnergyPlan.php
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1 Acknowledgements

We would like to extend a special thank you to the Town of Halton Hills Steering Committee and Technical Advisory Committee for their time, dedication, and valuable input into the development of the plan.

Members of the Steering Commitee included:

- Mayor Rick Bonnette
- Jane Fogal, Regional Councillor, Ward 3 and 4
- David Smith, CAO
- John Linhardt, Executive Director of Planning and Chief Planning Officer
- Terry Alyman, Commissioner of Community and Corporate Services
- Stephen Hamilton, Manager of Facilities (Recreation & Parks)
- Simone Gourlay, Manager of Purchasing
- Damian Szybalski, Manager of Sustainability

Members of the Technical Advisory Committee included:

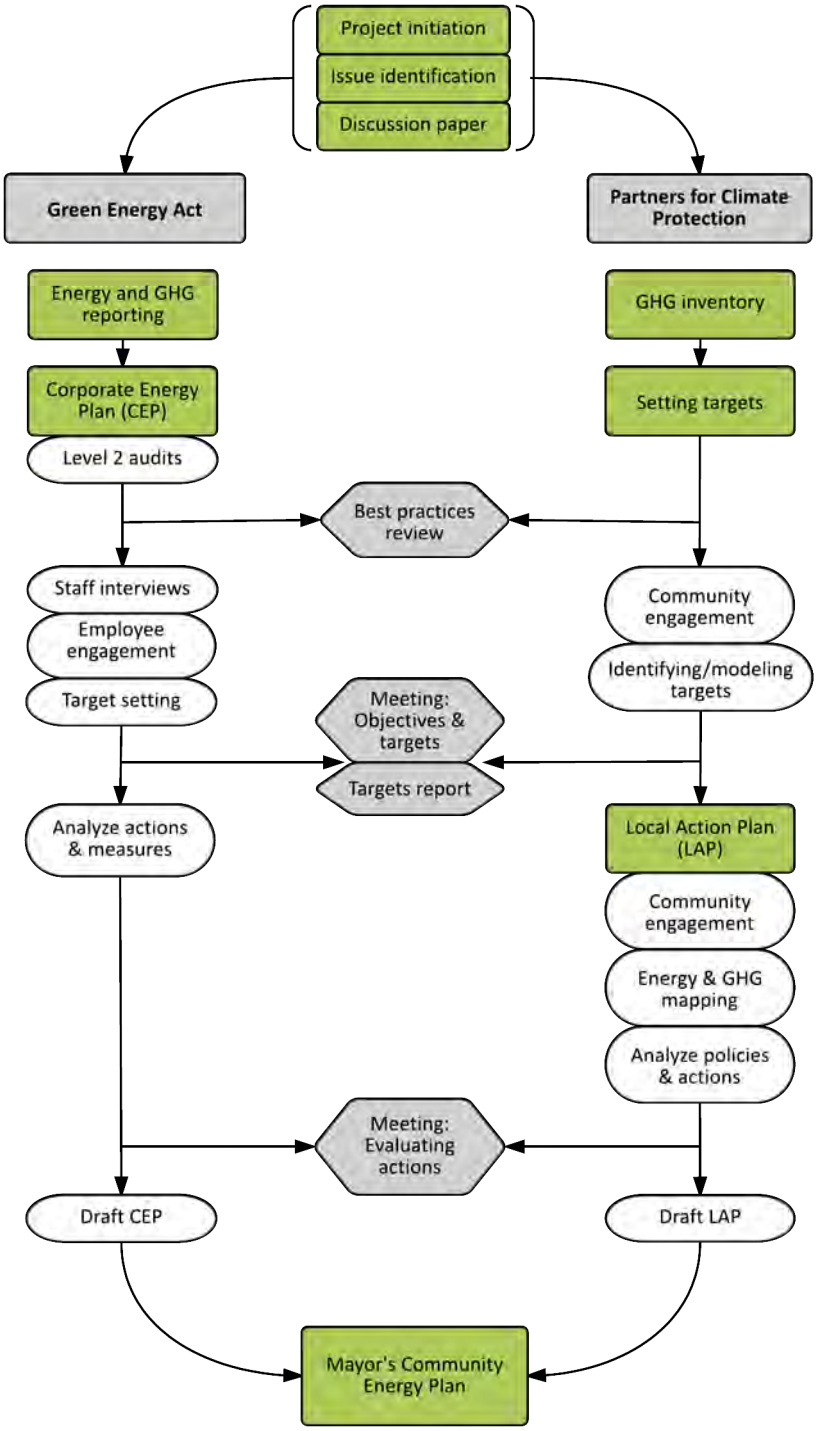
- Art Skidmore, President & CEO, Halton Hills Community Energy Corporation
- Linda Boyer, Conservation and Demand Management Officer, Halton Hills Hydro
- Gena Ali, Manager, Office of Sustainable Planning, Halton Region
- Arjun Rattan, Sustainability Analyst, Halton Region
- Suzanne Burwell, Environmental Sustainability Coordinator, Halton District School Board
- Bryan Boyce, Town Environmental Advisory Committee
- Ed Seaward, Manager, Market Opportunity Development, Union Gas

2 Executive Summary

The Town of Halton Hills Mayor's Community Energy Plan is designed to achieve the following objectives:

- To fulfill the reporting and planning requirements of *Regulation 397/11* under the *Green Energy and Green Economy Act*;
- To complete Milestones 1, 2, and 3 of the *Partners for Climate Protection Program* on both the community and corporate side;
- To take advantage of all available incentives for energy efficiency;
- To improve the Town's environmental and financial sustainability, through initiatives that are practical, affordable, reasonable, educational and enforceable;
- To identify and implement actions that reduce GHG emissions from corporate operations and from community activities; and
- To demonstrate the Town's leadership in energy and GHG emissions reduction.

The Town of Halton Hills Mayor's Community Energy Plan is a consolidated document created through the almagamation of the community-based Local Action Plan (LAP) and a Corporate Energy Plan (CEP). The LAP provides a framework for the Town of Halton Hills community to move towards a low carbon community, and was designed to meet and exceed Milestones 1, 2 and 3 of the Federation of Canadian Municipalities (FCM) Partners for Climate Protection (PCP) program, while the CEP provides a 5-year roadmap for energy management in the corporate Town of Halton Hills, and was designed to meet the energy conservation and demand management planning requirements of *Regulation 397/11* under the *Green Energy and Green Economy Act (2009)*. The LAP is being used as the basis for the structure of the Mayor's Community Energy Plan. The Corporate Energy Plan has been incorporated into the corporate section of the LAP as that section speaks specifically to corporate activities. The Mayor's Community Energy Plan was prepared through the following parallels processes:



It is important to note that some details may have changed since the respective components were created and approved. These details have been left as they existed in the original document to retain continuity with the original documents.

The following provides a summary of the findings of each of the LAP and CEP.

Local Action Plan (LAP)

The Town of Halton Hills has many of the key ingredients necessary to move towards a low

carbon community: the compact town centres of Acton and Georgetown, extensive greenspace that can act as a carbon sink, a local electricity distribution company (Halton Hills Hydro), an already approved plan toward intensification, and, in the form of Vision Georgetown, a rare opportunity to design a community from the ground up, incorporating the best possible strategies to reduce energy consumption and the greenhouse gas (GHG) emissions. In addition, numerous initiatives and projects are underway, giving the community a solid foundation on which to base future, even more ambitious efforts.

A key challenge that the Town of Halton Hills faces is its existing land-use patterns. These are difficult to revise and they commit community members to a reliance on private vehicles and to a widely dispersed municipal infrastructure that is costly to maintain. However, policies are in place that put the Town on a trajectory toward carbon reductions. This plan provides additional specificity and detail around the actions and strategies necessary to achieve those reductions.

This plan achieves and goes well beyond the three milestones of the Partners for Climate Protection, establishing a Greenhouse Gas Emissions (GHG) baseline, identifying GHG targets and creating a Local Action Plan. This effort included detailed modelling of land-use and transportation scenarios to evaluate the impact of potential land-use plans on energy and GHG emissions, the evaluation of actions in terms of their reduction of GHG emissions and energy, as well as cost savings and employment benefits. The plan included an extensive process of community engagement to identify existing assets in the community (green economy mapping), the development of land-use scenarios and the identification of potential actions. Actions were prioritized against a range of criteria and the details of implementing those actions were outlined.

The baseline was calculated for the year 2011 and the results are as follows:

Table 1 Baseline calculations for 2011

Category	Result
Total GHG emissions	618,465 tCO2e
GHG emissions/capita	10.5 tCO2e/capita
Energy/capita	168 GJ
VKT/Household	51,094 km

In order to identify GHG emissions reductions targets, three different scenarios were created representing different land-use patterns, levels of building efficiency and retrofits, transportation mode share and local agricultural production. The three scenarios did not vary significantly on land-use because of existing development commitments. Following careful deliberations by Town staff and the consulting team, Scenario 2 is recommended as a basis for establishing a GHG target. This scenario includes the existing intensification strategy approved by Council in combination with additional efforts in transportation, buildings and agriculture. Modeled results for this scenario found that overall GHG emissions will increase by just 3% in 2031 above 2011 levels, in spite of a a projected 68% increase in population over the same period. Per capita GHG emissions decrease by 35% in 2031 below 2011, a significant reduction. Table 2 provides a summary of the results of all three scenarios.

The purpose of the scenarios was to explore the impacts of 'pulling different levers' and to explore the 'what ifs' on community energy use and greenhouse gas emissions, rather than to define exactly what will happen by 2031, or to prescribe actions. The assumptions underlying the scenarios are not intended to be interpreted as the actions that will necessarily happen by 2031. However, the scenarios do provide direction and guidance in setting policy and implementing strategies.

Table 2 Projected GHG emissions to 2011 for three scenarios

	Total (tCO2e)			Per capita Total (tCO2e)		
Scenario	Baseline (2011)	2031	% change	Baseline (2011)	2031	% change
1- Moderate energy efficiency	618,465	720,291	+17%	10.5	8.3	-21%
2- Towards a low carbon community	618,465	638,353	+3%	10.5	6.8	-35%
3- Low carbon community (Recommended)	618,465	542,430	-12%	10.5	5.8	-45%

Energy costs for private and commercial transportation and private and commercial building totalled $321 million in 2011, and based on conservative cost-per-unit increases will climb to $426 million by 2031 in the absence of action. Scenario 2 achieves a gross reduction of $17 million in 2031 from reduced energy costs over Scenario 1. On a household basis, energy costs fall from $15,846 in 2011 to $12,037 in 2031 in Scenario 2, a savings of $3,809 per year per household. To achieve these reductions, the broader community (municipality, utilities and other businesses) would scale up investment to $9.4 million per year by 2031, an investment that would also generate approximately 218 additional jobs. Table 3 provides a detailed overview of the three scenarios.

Actions were identified through community engagement, GHG and energy modelling, best practices and a structured decision making process. The approach to recommending actions took into account areas where there are already policies or strategies that can be enhanced or activities that are already supported by the community. There was also focus on providing a shorter rather than longer list of actions recognising the resource constraints under which municipalities operate.

Most of the recommended actions fall within existing plans or strategies in place by the Town of Halton Hills. This plan brings those actions together in one package and articulates specific targets that those activities need to achieve. While there is time to achieve the target, the critical aspect is ensuring that the land-use patterns support mixed-use housing, district energy and transportation improvements as decisions on these issues now determine the viability or lack thereof for up to a hundred years, the lifetime of development projects.

The recommended actions will not achieve the targets modelled for Halton Hills alone, but they will help put Halton Hills on a path to achieving those targets. To be successful, GHG emissions need to be tracked on an ongoing basis and the plan needs to be revised every five years to reflect changing technologies and development trends. The recommended actions for the Town of Halton Hills are described in Table 17, and are listed on the following page.

As a community, these are recommended actions for the Town of Halton Hills:

- Continue to promote intensification
- Continue to encourage mixed-use developments
- Develop a program for property assessed payments for energy retrofits (PAPER)
- Implement a revolving loan fund
- Encourage the update of existing energy efficiency incentives and programs
- Expand the scope of the green development standards

- Introduce district energy in the Georgetown expansion, if confirmed to be feasible
- Support active transportation
- Increase GO Transit service
- Explore additional transportation linkages to other communities
- Enhance the smart commute program
- Expand the program to encourage walking to school
- Support local food and the farmers markets
- Develop an energy hub for energy conservation and renewable energy businesses
- Protect and enhance the forest areas of Halton Hills
- Continue to monitor progress toward achieving the plan
- Plan and design the Vision Georgetown community to be transit ready.

Table 3 Summary and results of the scenarios considered

	2011	2031		
	Baseline	S1: Moderate Energy Efficiency	S2: Towards a Low Carbon Community	S3: Low Carbon Community
Total GHG emissions (tCO2e)	618,465	720,291	638,353	542,430
GHG emissions per capita (tCO2e)	10.5	8.32	6.79	5.8
% change in GHG emissions/capita over baseline	N/A	-21%	-35%	-45%
% change in absolute GHG emissions over baseline	N/A	+17%	+3%	-12%
Energy/capita (GJ)	168	136	120	110
Vehicle kilometres travelled/capita (km)	51,094	42,127	37,365	28,354
Average trip length (km)	22	19.6	20	20
Total dwellings		11,080	13,740	13,740
# of dwellings within 500m of a commercial area	9,200	11,071	12,230	12,230
Transportation improvements		GO station in Georgetown and Acton with increased daily service.	GO station in Georgetown and Acton with increased daily service. Bus service between Georgetown and Acton. (The model is based on a change from infrequent to frequent (at least hourly) service).	GO station in Georgetown and Acton with increased daily service. Access to the Georgetown GO station from South West Georgetown via shuttle bus or similar method. Bus service from Acton to Georgetown and Milton.
Vehicle mode share	84%	82%	71%	54%
Dwellings connected to district energy by 2031	0	502	2,713	2,713
Local food production	5%	20%	20%	20%
Agricultural area	18,390	17,707	17,707	17,707
Total annual community energy costs	$321 million	$426 million	$409 million	$391 million
Annual household energy costs	$15,846	$13,587	$12,037	$11,379
New jobs created	N/A	N/A	218	237
Estimated annual damages resulting from GHG emissions generated in Halton Hills	$3 million - $41 million	$7 million - $74 million	$6 million - $65 million	$5.5 million - $55 million

Corporate Energy Plan (CEP)

The *Corporate Energy Plan (CEP)* provides a 5-year roadmap for energy management in the corporate Town of Halton Hills and focuses on the use of electricity and natural gas in Town facilities, as well as fuel usage by fleet vehicles. It covers the period from July 2014 to July 2019, and is designed to help the Town comply with the energy conservation and demand management planning requirements of *Regulation 397/11*.

The three main objectives of the CEP are to achieve the following:
1. The Town of Halton Hills is a national leader in the efficient management of energy in its operations.
2. The efficient use of energy is part of the day-to-day activities of Town staff.
3. The Town's environmental and financial sustainability are improved through energy management initiatives that are Practical, Affordable, Reasonable, Educational, and Enforceable.

In 2011, electricity consumption by the Town was 5,625,077 kWh and natural gas consumption was 679,065 m^3, resulting in an estimated annual cost of $892,000[1]. This translates into an average energy intensity of 31.30 ekWh/sqft. Additionally, the Town as a corporation produced 1,733,865 kg of GHG emissions in 2011. As identified throughout the CEP, the Town has significant opportunity to reduce its energy intensity and its GHG emissions. Based on the results of audits conducted on Town facilities, the CEP establishes the following quantitative targets to guide the Town's efforts on energy management from 2014 to 2019:

- 13% to 17% improvement in energy intensity; and
- 16% to 20% reduction in greenhouse gas emissions.

The CEP addresses Town buildings, technologies, and fleets – as well as people, processes, and information. The plan draws on information from three key sources: interviews, surveys, and meetings with Town staff, specifically the Technical Advisory Committee and the Steering Committee established for the plan; a review of Town policies, plans and programs; and a review of best practices in other jurisdictions.

The first step in the process was to identify and define the preferred state / vision of energy management for the Town. This was accomplished through interviews with key Town staff and through two strategic planning sessions held with members of the Technical Advisory Committee and the Steering Committee.

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

The third step involved developing technical and organizational actions to assist the Town in moving from its present to its preferred state of energy management. Technical actions were identified through ASHRAE Level 2 audits conducted on seven Town facilities of a variety of archetypes so that measures could be extrapolated across all Town buildings. The organizational actions, which relate to corporate processes, were identified through interviews, two strategic planning sessions,

1 This number only includes Town facilities and does not include the cost of streetlights. It is also important to emphasize that the cost of the Town's 2011 energy consumption is an estimate. This estimate is based on the actual amount of energy used (commodity costs only) at those Town facilities that are part of the *Green Energy Act* reporting. This estimate was derived by multiplying the electricity and natural gas amounts by the estimated average natural gas and electricity prices, rather than including the actual cost. The purpose of this estimate is to illustrate the magnitude of the opportunity offered by energy management.

a corporate-wide survey, and a jurisdictional review of best practices. The actions are grouped in the CEP according to the following categories:

- **Organizational commitment** – measures related to policies, targets, and resources required to enable energy management and the other actions;
- **Existing buildings and equipment** – measures, both technical and policy based, that impact existing buildings and equipment;
- **New buildings and equipment** – measures, both technical and policy based, that impact new buildings and equipment;
- **Monitoring and tracking** – measures related to evaluating, monitoring, and verifying energy data;
- **Communication and engagement** – measures related to encouraging behavioural modifications to save energy;
- **Fleets** – measures related to Town fleet vehicles that reduce energy consumption; and
- **Procurement and renewables** – measures related to the procurement of energy and renewable technologies.

These actions are categorized into three time periods for implementation:
1. Priority actions – Year 1 (July 2014 – July 2015)
2. Medium-term actions – Years 2 and 3 (July 2015 – July 2017)
3. Longer-term actions – Years 4 and 5 (July 2017 – July 2019)

The specific actions can be found in chapter 10 of this document.

Many of the priority actions are foundational and put in place the structures and practices that will facilitate on-going energy efficiency within the Town. The technical actions identified through the facility audit reports are grouped according to facility type and are allocated across the five years of the plan in order to facilitate an annual net capital cost of approximately $50,100 in each year for budgeting purposes.

A breakdown of the number of actions by importance are as follows:

- Priority actions (Year 1): 30
- Medium-term actions (Years 2-3): 39
- Longer-term actions (Years 4-5): 16

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

It will cost approximately $250,639 to implement all measures in the seven buildings that were audited as part of the planning process, as well as measures that were extrapolated to other buildings. If implemented according to the schedule, it will cost the Town approximately $50,100 each year over the next five years. The net present value (NPV) of implementing all the measures is $1,156,545.

The estimated energy intensity and GHG savings from the seven audited facilities are outlined below.

Table 4 Estimated energy intensity and GHG emissions savings from facility audits[2]

Facility	Energy intensity (ekWh/sqft)	GHG emissions (kg)
Mold-Masters Arena	6.0%	6.5%
Acton Arena	9.7%	9.2%
Gellert Community Centre	30.6%	36.5%
Cedarvale Community Centre	9.3%	9.6%
Civic Centre	25.6%	35.6%
Acton Library	28.8%	37.9%
Acton Firehall	12.1%	12.6%

2 Audit of Mold-Masters Arena only included the old section of the arena, as the new section was not complete at the time of the audit. Audit of Acton Library was conducted on the new Acton Library constructed in 2011.

3 Context

"No one can predict the consequences of climate change with complete certainty; but we now know enough to understand the risks. Mitigation – taking strong action to reduce emissions – must be viewed as an investment, a cost incurred now and in the coming decades to avoid the risks of very severe consequences in the future. If these investments are made wisely, the costs will be manageable, and there will be a wide range of opportunities for growth and development along the way."
Stern Review: The Economics of Climate Change, p. i (2006).

"It was barely 11 months ago in Doha [UN Climate Change negotiations] when my delegation appealed to the world … to open our eyes to the stark reality that we face … as then we confronted a catastrophic storm that resulted in the costliest disaster in Philippine history. Less than a year hence, we cannot imagine that a disaster much bigger would come. With an apparent cruel twist of fate, my country is being tested by this hellstorm called Super Typhoon Haiyan, which has been described by experts as the strongest typhoon that has ever made landfall in the course of recorded human history."
Ye Sano, Lead negotiator for Philippines at UN Climate Summit in Warsaw, 2013

"Let me highlight the one resource that is scarcest of all: time … we are running out of time. Time to tackle climate change. Time to ensure sustainable, climate-resilient green growth. Time to generate a clean energy revolution … We need you to step up. Spark innovation. Lead by action. Invest in energy efficiency and renewable energy for those who need them most – your future customers."
UN Secretary General Ban Ki Moon at the World Economic Forum, 2011

3.1. International context

In May 2013, global carbon dioxide (CO2) emissions reached 400 parts per million (ppm) for the first time in probably the last 3 million years[3]. This historic milestone, which was reached years before the scientific community expected, shows the degree to which humans are impacting the atmosphere and the climate. It also illustrates how we are entering uncharted territory, which is to say that we are embarking upon a period of uncertain and probably undesirable change. Not only is the earth getting warmer, positive feedback cycles threaten to further increase concentrations of greenhouse gas (GHG) emissions and/or hinder earth's ability to absorb these gases[4]. Although mean temperatures have increased and are projected to continue to rise, perhaps the most important impact in climate change is the potential for more, and more severe, extreme and unusual events such as heavy precipitation, floods, hurricanes and droughts[5]. Some of the most significant impacts of climate change that we can expect to see during the 21st

3 National Geographic Daily news. (2013) Retrieved January 2014 from: http://news.nationalgeographic.com/news/energy/2013/05/130510-earth-co2-milestone-400-ppm/

4 Examples of these cycles include increased water vapour in the atmosphere, loss of sea, permafrost degradation and ocean acidification.

5 IPCC Synthesis Report. (2007) Available from: http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html

century, as identified by the Intergovernmental Panel on Climate Change (IPCC), are as follows:

- Increases in extreme heat events, heat waves and heavy precipitation events.
- Decreases in water availability in arid and semi-arid areas, and in areas that depend on glacial sources for water.
- A significant rise in global sea levels. In 2007, the IPCC originally estimated a rise of approximately 18 to 59 centimetres by 2100, but this estimate has been updated to approximately 1 metre or more, based on rapid arctic warming trends (particularly in the Arctic) and accelerated rates of sea level rise that have been documented recently[6]. The IPCC estimates that by the end of the 21st century that sea level will rise in more than about 95% of the ocean area[7].
- Changes in the ranges of plant and animal species, increased ranges in disease vectors, and other large impacts to ecosystems.

In response to the reality of human-caused climate change (which has been well established by scientists since the late 1980s), the United Nations Framework Convention on Climate Change (UNFCC) treaty was negotiated in Rio de Janeiro in 1992. One hundred and fifty-four nations signed the treaty, pledging to reduce atmospheric GHGs with the goal of "preventing dangerous anthropogenic interference with Earth's climate system". However, the treaty had no binding limits or enforcement associated with it. In 1997, the Kyoto Protocol was established to set legally binding emissions targets to 2012 for 38 developed countries[8]. Kyoto was signed by over 150 countries, however the U.S. did not ratify the protocol and Canada withdrew from it in 2011.

Countries came together in Cancun in 2010, Copenhagen in 2011 and Doha in 2012 to try to establish global commitments to reduce GHGs beyond the first commitment period of Kyoto[9]. Little progress was made in these meetings, and after Doha only a timetable to adopt a global agreement by 2015, to be implemented by 2020, was established. Many organizations around the world criticized the agreement, stating that the outcomes were insufficient to stabilize global GHG concentrations, to limit the major impacts of climate change and to eventually stabilize global temperatures.

One common, and very difficult, question associated with climate change is, "How much do we have to mitigate?" The answer to this question is exceedingly complex, and brings to light a number of related questions, including:

- What is an acceptable amount of climate change that human and natural systems can handle?
- What is an appropriate amount of risk that we are willing to take regarding future changes?
- Who is responsible for mitigating climate change, and for responding to impacts?

None of these questions have clear answers. Regarding the amount of climate change that global systems can handle, 2 degrees Celsius is often cited as a margin of change that will result in an acceptable (although still significant) level of impacts.

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6 US National Research Council. (2010) Retrieved January 2014 from: http://www.epa.gov/climatechange/science/future.html

7 Intergovernmental Panel on Climate Change. (2014) Retrieved January 2014 from: http://www.ipcc.ch/

8 David Suzuki Foundation. (2009) Retrieved January 2014 from: http://www.davidsuzuki.org/issues/History%20of%20climate%20negotiations.pdf

9 UN Framework Convention on Climate Change. (2014) Retrieved January 2014 from: http://unfccc.int/2860.php

Independent of the efforts to mitigate climate change, major shifts are underway in the energy sector globally[10]. Major energy importers are becoming exporters and vice versa and the gravity of energy demand is switching to the emerging economies, particularly China, India and the Middle East. The increased share of unconventional oil and gas and renewables is reshaping the distribution system. Despite increases in the share of renewables, the global energy system accounts for two-thirds of global GHG emissions. Oil prices remain high, with Brent Crude at $110 per barrel, while in the U.S., natural gas trades at one-third of what Europe pays for imports and one-fifth of what Japan pays. The Middle East remains the only source of low-cost oil and all major existing fields are anticipated as declining, driving the search for unconventional sources. Renewables will account for nearly half of the increase in global power generation to 2035, a 45% overall expansion in renewables.

3.2. National context

3.2.1. Federal policy

In 1997 the Kyoto Protocol established legally binding emissions targets to be achieved by 2012 for 38 developed countries[11]. It was ratified by over 150 countries, not including the United States. Canada was the first and only country to withdraw from the Protocol in 2011, thus avoiding the mandatory purchase of carbon credits to achieve its target[12].

Under a voluntary agreement, the Copenhagen Accord, Canada adopted a voluntary target of -20% by 2020 over 2006 levels, deemed to be inadequate and a weakening of its previous Kyoto target[13]. Canada's national performance on climate change is generally perceived to be very poor[14] and Environment Canada reports that Canada will not achieve even its Copenhagen targets[15]. Canada has decided to link its climate policy with that of the United States, replicating fuel efficiency standards for passenger vehicles and light trucks and collaborating on emissions requirements for heavy duty vehicles while moving independently on the regulation of coal-fired electricity generation and for renewable content for diesel and gasoline fuels[16]. In 2010, Canada announced $400 million for financing climate change adaptation efforts by least developed countries.

A review of climate policy at the provincial level found that the plans were "all over the map",[17]

10 OECD/IEA. (2013) World Energy Outlook 2013. International Energy Agency.

11 David Suzuki Foundation. (2009) History of climate change negotiations. Retrieved January 2014 from: http://www.davidsuzuki.org/issues/History%20of%20climate%20negotiations.pdf

12 CBC. (2011) Canada pulls out of Kyoto Protocol. Retrieved January 2014 from: http://www.cbc.ca/news/politics/canada-pulls-out-of-kyoto-protocol-1.999072

13 Hare, B. et al. (2012) Climate Action Tracker. Ecofys, Climate Analytics and PIK. Retrieved January 2014 from: http://climateactiontracker.org/

14 Trio, W. and Milke, K. (2013) Climate Change Performance Index. Germanwatch and Climate Action Network. Retrieved January 2014 from: http://germanwatch.org/en/download/7158.pdf

15 Environment Canada. (2013) Canada's Emissions Trends. Retrieved January 2014 from: http://www.ec.gc.ca/ges-ghg/985F05FB-4744-4269-8C1A-D443F8A86814/1001-Canada's%20Emissions%20Trends%202013_e.pdf

16 Drexhage, J. and Murphy, D. (2010) Climate change and foreign policy in Canada: Intersection and influence. Canadian International Council. Retrieved January 2014 from: http://cic.verto.ca/wp-content/uploads/2011/05/Climate-Change-and-Foreign-Policy-in-Canada-John-Drexhage-Deborah-Murphy.pdf

17 David Suzuki Foundation. (2012) All over the Map 2012: A comparison of provincial climate change plans. Retrieved January 2014 from: http://www.davidsuzuki.org/publications/downloads/2012/All%20Over%20the%20Map%202012.pdf

while noting Quebec and B.C. have carbon taxes, Ontario's *Green Energy Act* has resulted in billions of dollars of investment in renewable energy, Nova Scotia has capped its emissions and a number of provinces have strengthened their building codes.

It is difficult to distinguish energy policy from climate policy in Canada. One of the most notable factors in the past ten years is the shift from supply constraints in natural gas to excess supply, with reduced prices and plans for export underway[18]. In large part this is attributed to new drilling techniques such as hydraulic fracturing. There is no federal policy on hydraulic fracturing and different provinces have different approaches with mature industries in B.C., Alberta and Saskatchewan, a nascent industry in New Brunswick and moratoriums in Nova Scotia, Quebec and Newfoundland, due to increasing environmental and health concerns. In 2012, the share of natural gas-fired electricity generation rose above the share of coal-fired generation in Canada and between 2005 and 2012 wind and solar generation doubled in Canada, though it still makes up just 3% of total electricity generation. The Federal Government has been actively promoting and supporting the development of the oil sands, including new pipelines to facilitate export, which would increase domestic oil prices. However, at this time there is considerable uncertainty around these pipelines.

3.3. Provincial context

3.3.1. Climate and energy policy

Ontario has developed firm targets for reducing its greenhouse gas emissions: 6% below 1990 levels by 2014, 15% by 2020 and 80% by 2050. The Province is planning to achieve these targets through:

- Phasing out coal-fired power plants and supporting more renewable energy;
- Creating a culture of conservation;
- Creating a cap-and-trade system for industry;
- Giving provincial sales tax breaks for energy-efficient products; and
- Introducing programs and incentives for consumers, businesses and municipalities to go green.[19]

Ontario's new Long-Term Energy Plan was released in 2013[20]. The Feed-in Tariff (FIT) was launched in 2009 and has resulted in more than 18,500 MW of renewable energy online or announced, generating 31,000 new jobs across the province. The Province is committed to an additional 150 MW for the FIT and 50 MW for the microFIT per year until 2018.

In 2007, the Ontario Government announced a legally binding phase-out of coal powered electricity generation by the end of 2014, a major initiative[21]. With a policy of conservation first, almost all growth in electricity demand out until 2032 will be accommodated through energy conservation. By 2025, renewable energy will represent about 50% of Ontario's installed

18 National Energy Board. (2013) Canada's Energy Future 2013: Energy supply and demand projections to 2035. Retrieved January 2014 from: http://www.neb-one.gc.ca/clf-nsi/rnrgynfmtn/nrgyrprt/nrgyftr/2013/nrgftr2013-eng.pdf

19 Ontario Ministry of the Environment. (2013) Retrieved January 2014 from: http://www.ene.gov.on.ca/environment/en/category/climate_change/index.htm

20 Government of Ontario. (2013) Achieving Balance: Ontario's Long-Term Energy Plan. Retrieved January 2014 from: http://www.energy.gov.on.ca/docs/LTEP_2013_English_WEB.pdf

21 Ontario Regulation 496/07, Ontario Regulation made under the *Environmental Protection Act*: Cessation of Coal Use – Atikokan, Lambton, Nanticoke and Thunder Bay Generating Stations.

capacity with a new procurement program launching in 2014. As a result the emissions factor for electricity will decrease significantly going forward. Nuclear will continue to play a significant role in electricity generation in Ontario. New conservation tools for municipalities include or will include on-bill financing and the use of Local Improvement Charges to recover energy efficiency and renewable energy investments through property taxes.

Under *Regulation 391/11* of the Ontario government's *Green Energy and Green Economy Act (2009)*, all public sector agencies are required to report their energy consumption and greenhouse gas (GHG) emissions on an annual basis starting in 2013, and were required to submit 5-year energy conservation and demand management plans in 2014.

The *Ontario Building Code* was updated in 2012 so that new houses are required to meet a rating of 80 or more against the EnerGuide Rating System, increasing the efficiency of a new home in 2012 by 40% over a home constructed in 2006. High-rise condominiums are required to be 25% more efficient than the *1997 Model National Energy Code for Buildings*[22]. Further enhancements are planned for 2017 that will result in an additional 15% reduction for homes and 13% reduction for large buildings. In February 2015, the Ontario Ministry of the Environment and Climate Change released a Climate Change Discussion Paper. This document outlines considerations that will shape the development of a long-term climate change strategy for Ontario.

3.3.2. Land-use planning in Ontario

Planning legislation at every level in Ontario currently emphasises land use that supports low carbon development through what we might characterize as smart growth policies. Ontario's *Planning Act* sets out the ground rules for land-use planning in Ontario and describes how land uses may be controlled, and who may control them. The Act aims to promote sustainable economic development in a healthy natural environment. It recognizes the decision-making authority of municipal councils in planning, while requiring that all decisions be consistent with the Provincial Policy Statement.

Municipalities' official plans must align with the Provincial Policy Statement (2005)[23]. They also must comply with the *Greenbelt Act and Plan* (2005), which provide protection to prime agricultural lands and other ecological features in Ontario. Finally, they must comply with the *Places to Grow Act* (2005) and Halton Hills must comply with the *Growth Plan for the Greater Golden Horseshoe Area* (2006), which guides decisions on transportation, infrastructure planning, land-use planning, urban form and housing in the area. The *Provincial Policy Statement* and the *Growth Plan for the Greater Horseshoe Area* emphasize the development of compact and complete communities, energy efficient buildings and renewable energy generation. One study estimated that growth management policies such as the *Growth Plan for the Greater Golden Horseshoe Area* could reduce GHG emissions from residential, commercial and personal transportation from between 5 and 12%[24].

The provincial growth plan, *Places to Grow*, is based on a 2031 planning horizon and requires

22 Government of Ontario. (2012) Climate vision: Climate change progress report. Retrieved January 2014 from: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_101103.pdf

23 Ontario Ministry of Municipal Affairs and Housing. (2013) Retrieved January 2014 from: http://www.mah.gov.on.ca/Page1485.aspx

24 MKJA. (2010) The capacity for integrated community energy solutions policies to reduce urban greenhouse gas emissions. Quality Urban Energy Systems of Tomorrow. Retrieved January 2014 from: http://questcanada.org/sites/default/files/publications/Final%20Full%20Study%20Report.pdf

the Region of Halton to accommodate 36,000 more people and 32,000 more jobs by the year 2021 than in the current Regional Official Plan, and an additional 130,000 people and 50,000 jobs between 2021 and 2031. Additionally, *Places to Grow* requires that, by the year 2015, 40% of annual residential development must occur through intensification within the urban areas existing in June 2006. In order to implement this intensification target, *Places to Grow* requires all Greater Golden Horseshoe municipalities to develop an intensification strategy and implement the strategy through amendments to their official plans. The Region of Halton, with the participation of the local municipalities, has addressed this requirement through Sustainable Halton[25].

Sustainable Halton is the region's growth management and land-use response to the province's *Places to Grow Plan*, the Provincial Policy Statement and the *Greenbelt Plan*. It involved research, public consultation, staff recommendations and Council approval of policy changes to the Region's Official Plan. The Sustainable Halton Process had three planning streams:

- The Growth Management Plan.
- The five-year Official Plan Review – Basic (ROPA 37).
- The five-year Official Plan Review – Comprehensive (ROPA 38).

Sustainable Halton has identified Halton's urban growth area to 2031 and what land will be preserved for wildlife, green space and farmland. Sustainable Halton aims to minimize urban sprawl and to protect natural resources, natural spaces and farmland. It clarifies what land will be reserved for business and residential use and plans for where roads, transit corridors, utilities and other regional infrastructure will go. Sustainable Halton aims to plan complete and sustainable communities where residents can ride the bus, walk or cycle as an alternative to using their cars, helping to reduce the impacts of urbanization such as urban sprawl, air pollution and climate change while preserving natural spaces and farmland.

3.3.3. Transportation policy

Since 2008, the Big Move has provided strategic direction for the multi-modal long-range regional transportation plan in the Greater Toronto and Hamilton region, guiding $16 billion in investments. An analysis of the Big Move in 2013 noted that vehicle ownership per household has increased, fuel prices have increased and the population is aging, increasing the need for accessible transit26. The Government of Ontario has incentives for electric vehicles including up to $8,500 for the purchase of a vehicle and green plates which provide priority access to HOV lanes.

3.3.4. Local governments

Given the lack of concrete action on the global level, local governments have been stepping up as champions for climate change action. Cities, towns and regions have been leading the way in mitigation planning and implementation for the last decade. The C40 Cities Climate Leadership Group (C40) represents a network of the world's megacities committed to addressing climate change[27]. ICLEI is an association that brings together urban sustainability professionals for shared learning, inspiration and collaboration. ICLEI runs programs and campaigns that help local governments move their sustainability initiatives forward via an array of innovative tools,

25 Halton Hills Intensification Opportunities Study. (2009) Retrieved January 2014 from: http://www.haltonhills.ca/initiatives/pdf/devAreas/intenseification/Intensification%20Strategy%20Report%20December%202009%20Draft.pdf

26 Metrolinx. (2013) The Big Move Monitoring Report.

27 C40 Cities Climate Leadership Group. (2014) Retrieved January 2014 from: http://www.c40.org/

resources, and partnerships[28].

Local governments have the ability to work closely with stakeholders, to capitalize on social networks and to act quickly to implement effective measures to address climate change.

Across Canada, 239 Canadian municipalities have signed on to the Federation of Canadian Municipalities' Partners for Climate Protection (PCP) program to reduce GHG emissions from community activities and corporate operations. The PCP's five-milestone framework enables municipalities to engage the community in identifying emissions reduction measures and implementation strategies that improve their "triple bottom line" sustainability.
The milestones are as follows:

- Milestone 1: Creating a greenhouse gas inventory and forecast;
- Milestone 2: Setting an emissions reductions target;
- Milestone 3: Developing a local action plan;
- Milestone 4: Implementing the local action plan; and
- Milestone 5: Monitoring progress and reporting results.

Figure 1. Acton Library- LEED® Certified

28 ICLEI Canada, Local Governments for Sustainability. (2014) Retrieved January 2014 from: http://www.icleicanada.org/about-iclei

4 The Town of Halton Hills

4.1. Mayor's Community Energy Plan

Energy use in communities is complex. It is influenced by geography, demographics, land use, transportation systems, and the local availability of energy resources. Municipalities face numerous challenges as they strive to ensure sustainable energy use, attract economic investment, maintain ecosystem integrity, and provide a high quality of life for residents.

The Mayor's Community Energy Plan includes practical actions that will increase energy efficiency, reduce operating costs, reduce greenhouse gas (GHG) emissions, and translate into measurable financial and environmental benefits. The objectives of the Mayor's Community Energy Plan include the following:

- To fulfill the reporting and planning requirements of *Regulation 397/11* under the *Green Energy and Green Economy Act*;
- To complete Milestones 1, 2, and 3 of the Partners for Climate Protection Program on both the community and corporate side;
- To take advantage of all available incentives for energy efficiency;
- To improve the Town's environmental and financial sustainability, through initiatives that are Practical, Affordable, Reasonable, Educational and Enforceable;
- To identify and implement actions that reduce GHG emissions from corporate operations and from community activities;
- To increase community awareness and demonstrate the Town's leadership in energy and GHG emissions reduction; and
- To build on the Town's long-standing commitment to energy conservation, Halton Hills Hydro's energy efficiency programs, and the Integrated Community Sustainability Strategy.

The Plan aligns with numerous energy and environmental initiatives of the federal, provincial and regional governments, and will further demonstrate the Town's leadership in corporate and community sustainability. It is an opportune time for the Mayor's Community Energy Plan, given the financial incentives available for energy efficiency from Halton Hills Hydro and Union Gas. These incentives will reduce the costs of implementing the actions identified in the Plan, and will further enhance the financial benefits of energy efficiency measures for the Town.

4.2. Supporting Efforts

The Town of Halton Hills already has a number of plans that support the efforts of the Mayor's Community Energy Plan. Summaries of those efforts are provided below to highlight synergies or supporting efforts already underway.

4.2.1. Town of Halton Hills Strategic Plan

The Halton Hills Strategic Plan identifies a community vision and corporate mission to plan for

a “vibrant urban and rural community”. The Strategic Plan also includes a comprehensive list of objectives to meet the Town’s strategic directions. The Mayor’s Community Energy Plan will advance a number of Strategic Directions, including to:

- Foster a healthy community;
- Preserve, protect and enhance the environment;
- Foster a prosperous economy;
- Achieve sustainable growth;
- Provide sustainable infrastructure & services; and
- Provide responsive, effective municipal government.

The objectives that specifically address energy and GHGs include:

- Developing innovative programs and partnerships related to sustainable design and energy efficiency;
- Encouraging improvements to air quality through facility management, land-use planning, transportation management and other programs, and working with other orders of government to address greenhouse gas emissions; and
- Conserving energy through community design, land-use planning, transportation planning, and the design/retrofitting of public and private buildings.

Within the Strategic Plan are actions that support each objective, further demonstrating the Town’s commitment to energy conservation and sustainability. Below is a list of key actions:

- Develop a Community Energy Plan, in cooperation with Halton Hills Community Energy Corporation;
- Establish minimum standards for sustainable design and energy efficiency for all new Town funded capital projects;
- Continue to encourage and promote sustainable design and energy efficiency to home and business owners, by way of policy development and/or by Town example of best practice implementation;
- Work with developers to facilitate best practices in sustainable design and energy efficiency objectives;
- Continue to monitor best-practices, and implement energy conservation in municipal buildings and infrastructure;
- Assess alternate fuel for fleet applications;
- Complete a comprehensive review of fleet composition to determine where efficiencies can be achieved through “right sizing”;
- Implement the Cycling Master Plan and the Active Transportation initiatives identified in the Transportation Master Plan; and
- Design new Facilities to incorporate LEED® Strategies.

4.2.2. Imagine Halton Hills

Imagine Halton Hills is the Town’s Integrated Community Sustainability Strategy (ICSS) and establishes environmental, social, economic, and cultural sustainability goals. Developed over two and a half years, Imagine Halton Hills engaged a full range of stakeholders to articulate a vision and goals. The vision is as follows: “In 2060, the urban and rural communities of Halton Hills balance economic prosperity with a deep commitment to the natural environment, while retaining viable local agriculture, and small-town feel and being socially equitable, culturally vibrant and strongly connected”. The vision is achieved through four pillars: Cultural Vibrancy, Economic Prosperity, Environmental Health and Social Well-being. Each pillar includes focus

areas, goals and indicators[29]. The following table illustrates how the focus areas support efforts to reduce energy and GHG emissions.

Table 5 Vision 'pillars', focus areas, and their support of GHG reductions

Pillar	Focus areas	Relationship with the Mayor's Community Energy Plan
Cultural vibrancy	Highly engaged citizens	Citizen involvement is critical to the success of a community energy plan.
	Inclusive to youth	Youth are often a major driver behind society's efforts to address climate change.
	Vital arts & culture sectors	Community art and culture is increasingly being used by communities to convey messages on energy and climate change.
	Inviting parks and trails	Trails enable people to travel without using the automobile.
	Diverse recreation & sports	Supporting active transportation reduces vehicle usage.
Economic prosperity	Diversified and resilient economy	Energy expenditures represent a major opportunity for new business including energy conservation and energy generation.
	Vibrant food and agriculture sector	Local food production reduces GHG emissions associated with transportation.
	Knowledge-based industry and research and innovation	New technologies can play a major role in reducing energy consumption and GHG emissions.
	Live-work opportunities	Live-work arrangements can reduce vehicular transportation.
	Green economy	The Green Economy unifies efforts to reduce GHG emissions and energy consumption with other endeavours to address environmental issues.
	Infrastructure	Infrastructure can act as a lever to support compact, complete and low carbon community development.
Environmental health	Natural heritage	In addition to supporting biodiversity, these areas are important carbon sinks.
	Air quality and GHG emissions	Direct goal to reduce GHG emissions.
	Land-use	Land-use is the most important lever municipalities have to create low carbon communities.
	Natural resources	Biomass could be a potential source of renewable heat.
	Consumption and waste generation	The breakdown of waste in a landfill is a major source of GHG emissions. Waste can also be a feedstock for energy generation.
	Energy	Halton Hills Hydro is an important partner in efforts to reduce energy and GHG emissions.
Social wellbeing	Housing	The location of housing determines whether key destinations are within walking and cycling distance. The design of housing influences household energy consumption.
	Transportation	The transportation system determines the reliance of people on fossil fuels for accessibility.
	Poverty	The ability of people to invest in energy saving and cost saving improvements is influenced by economic conditions.
	Learning	The capacity of people to learn individually and collectively influences their ability to adapt to major issues like climate change.

29 Town of Halton Hills. (2013) Imagine Halton Hills. Available at: http://haltonhills.ca/initiatives/Sustainability-Strategy.php

4.2.3. Halton Hills Intensification Opportunities Study

Council of the Town of Halton Hills adopted a new Official Plan in September 2006. The Official Plan was prepared to achieve conformity with the new Regional Official Plan (ROPA 25) and the 2005 Provincial Policy Statement. The Region of Halton approved the Halton Hills Official Plan, and the Plan came into effect on March 28, 2008.

The purpose of the Intensification Opportunities Study was to critically assess the capability of the Town to address the intensification policies contained in Places to Grow. The study evaluated how Halton Hills should achieve the Halton Region-wide 40% intensification target contained in the Greater Golden Horseshoe Growth Plan.

In particular, the Study identified areas for intensification, where residential and mixed-use development should be directed within the established urban areas of Georgetown and Acton. In addition, the Study updated the current inventory of individual intensification sites in Halton Hills, including a re-assessment of the intensification potential of those sites[30].

Increased density and mixed-used development is widely understood to result in reduced per capita energy consumption and GHG emissions for the following reasons:

- Houses tend to be smaller, reducing the area that is heated and cooled;
- Houses often share walls, increasing their efficiency;
- Denser communities tend to facilitate walking and cycling more readily; and
- Public transportation and district energy are more cost effective in denser locations.

4.2.4. Halton Hills Community Energy Corporation

Halton Hills Community Energy Corporation is a private corporation solely owned by the Town of Halton Hills. Halton Hills Hydro, a subsidiary of Halton Hills Community Energy Corporation, provides electricity distribution to approximately 23,000 customers. Halton Hills Hydro has a range of conservation demand management programs to achieve its 2014 peak demand reduction target of 6 MW and its energy-saving target of 23 MWh. Halton Hills Hydro has also pioneered projects such as pole-mounted solar panels, smart metering and time-of-use services.

4.3. Other policies and initiatives

In 2010, the Town of Halton Hills adopted a first generation Green Development Evaluation Checklist that enabled the assessment of all major residential housing developments against 23 criteria including Energy Star for New Homes and strategies to increase energy and water conservation, amongst other factors[31]. More recently, the Town has completed the Green Development Standards Study, which put in place more comprehensive 'second generation' green development requirements for new development, including residential and non-residential uses. This will translate into more efficient and thriving communities. A Corporate Sustainable Building Policy was adopted in 2013, establishing a minimum level of performance for new

30 Halton Hills Intensification Opportunities Study. (2009) Retrieved January 2014 from: http://www.haltonhills.ca/initiatives/pdf/devAreas/intenseification/Intensification%20Strategy%20Report%20December%202009%20Draft.pdf

31 Szybalski, D. (2010) Georgetown Provisional Water Allocation; Supplementary Report: Green Development & Other Matters. Retrieved January 2014 from: http://haltonhills.ca/calendars/2010/PDS-2010-0085.pdf

buildings, renovations, expansions and repairs[32].

A major project underway is Vision Georgetown. In May 2012, the Town of Halton Hills Council approved the Terms of Reference to develop a plan for Georgetown Expansion. Georgetown Expansion consists of 1,000 acres and will support a population of 20,000 people. The Town has embraced the Georgetown Expansion as an opportunity to create a sustainable community from scratch by including an assessment of district energy and green building standards such as LEED® for Neighbourhood Development[33].

Other related initiatives include the Green Plan (2007 and updated in 2009), the *S*mart Commute Program (2011), the Economic Development Strategic Action Plan (2012)[34] and the Transportation Master Plan (2011).

The Town's Environmental Advisory Committee has also investigated the impact of climate change on Halton Hills and has recommended that Halton Hills develop a climate change adaptation plan[35].

32 Town of Halton Hills. (2013) Corporate Sustainable Building Policy. New Release. Retrieved January 2014 from: http://www.haltonhills.ca/media/2013/1385669599.pdf

33 Burke, S. (2012) Southwest Georgetown Integrated Planning Project-Terms of Reference. Retrieved January 2014 from: http://www.haltonhills.ca/calendars/2012/PDS-2012-0038.pdf

34 The Economic Development Strategic Action Plan aims to enhance agriculture, active transportation and the downtown.

35 Town Environmental Advisory Committee. (2013) Preparing for change in our climate. Retrieved January 2014 from: http://haltonhills.ca/calendars/2013/October%2015,%202013%20TEAC%20preparing%20for%20change%20in%20the%20climate.pdf

5 Mayor's Community Energy Plan

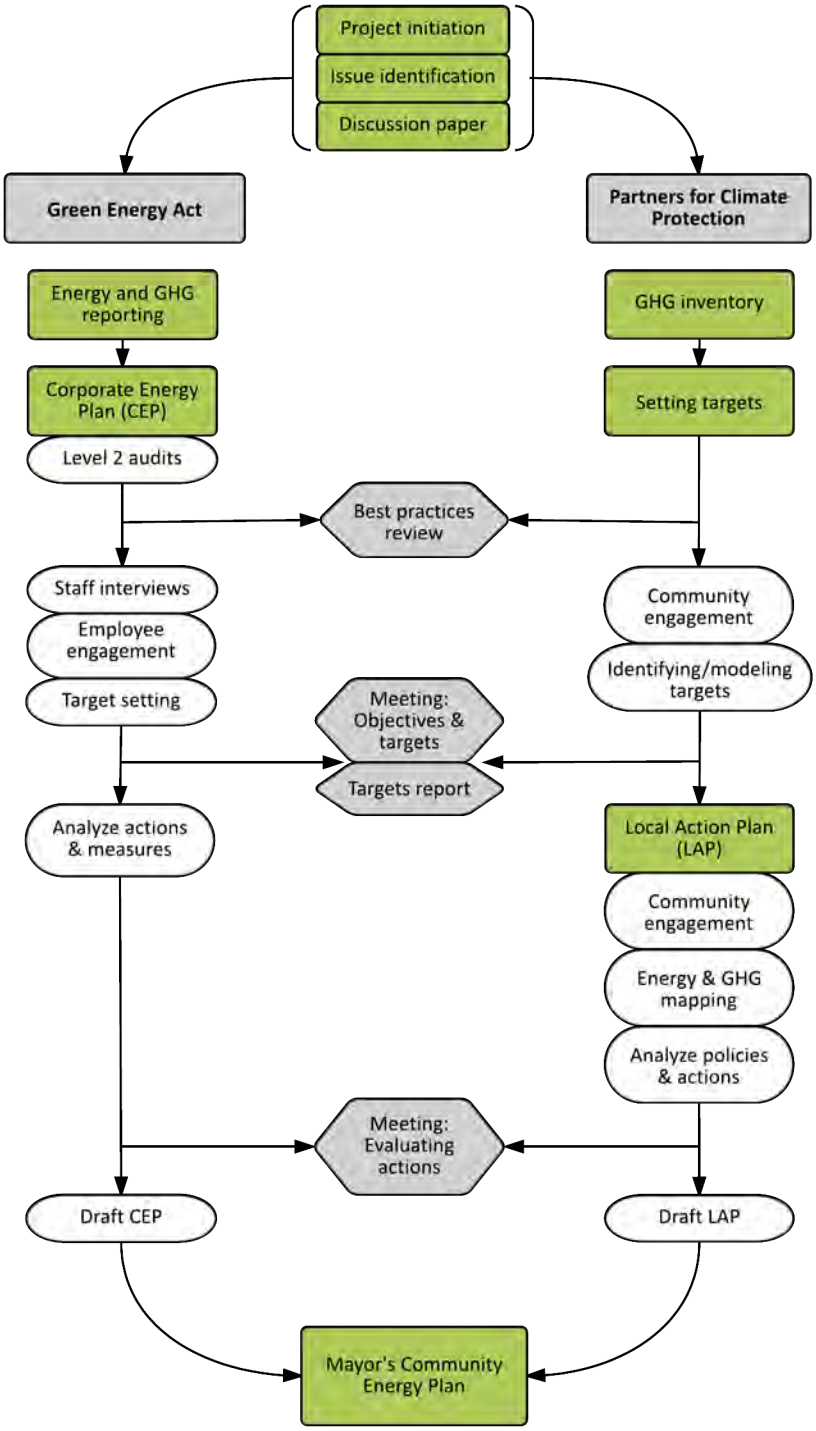
5.1. Project Scope

The Town of Halton Hills Mayor's Community Energy Plan is designed to achieve the following objectives:

- To fulfill the reporting and planning requirements of *Regulation 397/11* under the *Green Energy and Green Economy Act*;
- To complete Milestones 1, 2, and 3 of the *Partners for Climate Protection Program* on both the community and corporate side;
- To take advantage of all available incentives for energy efficiency;
- To improve the Town's environmental and financial sustainability, through initiatives that are practical, affordable, reasonable, educational and enforceable;
- To identify and implement actions that reduce GHG emissions from corporate operations and from community activities; and
- To demonstrate the Town's leadership in energy and GHG emissions reduction.

5.2. Method

The Mayor's Community Energy Plan was developed from the Local Action Plan (LAP) and Corporate Energy Plan (CEP), which were created in parallel with common elements. The diagram below outlines this process:



As mentioned above, a broad range of existing documents have informed the Mayor's Community Energy Plan including the Town's policies and plans (e.g. Integrated Community Sustainability Strategy, Strategic Plan, Official Plan, Green Plan, and Green Development Standards) ensuring that the Mayor's Community Energy Plan effectively advances the Town's long-term strategic goals. Relevant provincial and federal policies and initiatives have also informed the Plan including the *Ontario Green Energy Act, Ontario Growth Plan for the Greater Golden Horseshoe*, *Water Opportunities and Water Conservation Act*, and the *Ontario Building Code*.

Two background documents were prepared:

1. A **discussion paper** was developed highlighting the strategic importance of energy conservation and GHG emission reduction to the Town of Halton Hills. The paper describes the provincial and corporate and community context (Appendix 1).
2. In order to draw on lessons from other municipalities, a **best practices review** was completed (Appendix 2). The jurisdictional review of best practices has been used to assess the resource implications and likely impacts of projects, programs and policies.

A community engagement process and technical analysis component occurred throughout the development of the Mayor's Community Energy Plan. The community engagement process included the following activities:

- Workshops were facilitated on the vision and specific objectives of the Mayor's Community Energy Plan, based on the results of the interviews, employee engagement, and document review. Assumptions, scenarios and actions were presented and discussed.
- The community has provided input into the Climate Action Plan through the online crowdsourcing platform Ideascale, as well as the survey tool Survey Monkey. The greater community has been encouraged to submit comments and ideas regarding goals, priorities and ideas for actions.
- Interviews with Town staff (including department directors, the CAO, and O&M staff) have provided additional information on current and past programs, policies, plans and projects related to energy management.
- Two strategic planning sessions with the Town Technical Advisory Committee and the Steering Committee.
- A survey of Town staff regarding energy management and efficiency.
- A process of community outreach to prioritize actions was led by the Town of Halton Hills.
- The Town of Halton Hills and the consultant presented to a range of community groups.
- Workshops with the project's Steering and Technical Advisory committees.
- Community engagement and various community events.
- Social media postings.
- Newspaper advertising.

The technical analysis included the following activities:

- A Data, Methods and Assumption (DMA) manual has been prepared and the data requirements for the inventory have been identified in detail by sector, by source and by geographical area, in a tabular format to systemize the identification of data providers and information gaps (Appendix 3).
- Land-use scenarios were developed that represent current and future development patterns in Halton Hills based on existing planning strategies as well as possibilities for alternative development paths.
- The scenarios were modelled in GHGProof, an open source GHG modelling tool, to identify targets and actions.
- ASHRAE Level 2 audits of seven Town facilities.
- Benchmarking of Town facilities against comparable facilities.

6 Community Engagement

6.1. Engagement strategies

A series of community engagement events were held to help inform and shape the Mayor's Community Energy Plan.

In June 2013, community members and businesses in the Halton Hills area were asked to come together to map all the pieces of Halton Hill's green economy and identify opportunities to reduce energy/GHG emissions to help inform the Mayor's Community Energy Plan. The participants came together in a world café format and explored the existing green economy capacity, identified gaps and informed the development of GHG/energy scenarios and targets using local knowledge (Figure 2). A complete list of the existing activities or projects underway in Halton Hills had also been assembled. This exercise served as a benchmark or starting point from which to plot future actions to reduce energy and GHG emissions in Halton Hills. It also served to illustrate the extent of investment and economic development around activities that contribute to the green economy.

Figure 2. World Cafés

Figure 3. Results of Green Mapping (wordle format)

The first community engagement event targeted local businesses and a second, evening event was open to the public. Both events included an open house with poster boards of best practices from other jurisdictions, and a short presentation describing some of the highlights of the best practices. The first meetings also identified additional strategies to reduce GHG emissions in Halton Hills around key themes such as transportation, buildings, waste and energy, land use, food, water and education. These ideas helped formulate key strategies for Halton Hills and were integrated into the Mayor's Community Energy Plan (Figure 4).

The Town of Halton Hills followed this exercise with ongoing community outreach to prioritize actions including a presence at the Georgetown Farmers' Market (August 24 and September 21, 2013), Acton Fall Fair (September 14, 2013), Business Improvement Association and Chamber of Commerce presentations (October 17 and 18, 2013), Halton Forest Festival (October 19, 2013), the Mayor's Youth Advisory Committee (November 6, 2013) and Halton Hills Hydro (November 20, 2013). In each case participants were asked to engage in a "dotmocracy" exercise to prioritize actions (Figure 5). Figure 6 illustrates the results of those activities. In addition, comments and responses were analyzed using a wordle (Figure 7).

Figure 4. Strategies identified in the World Cafés

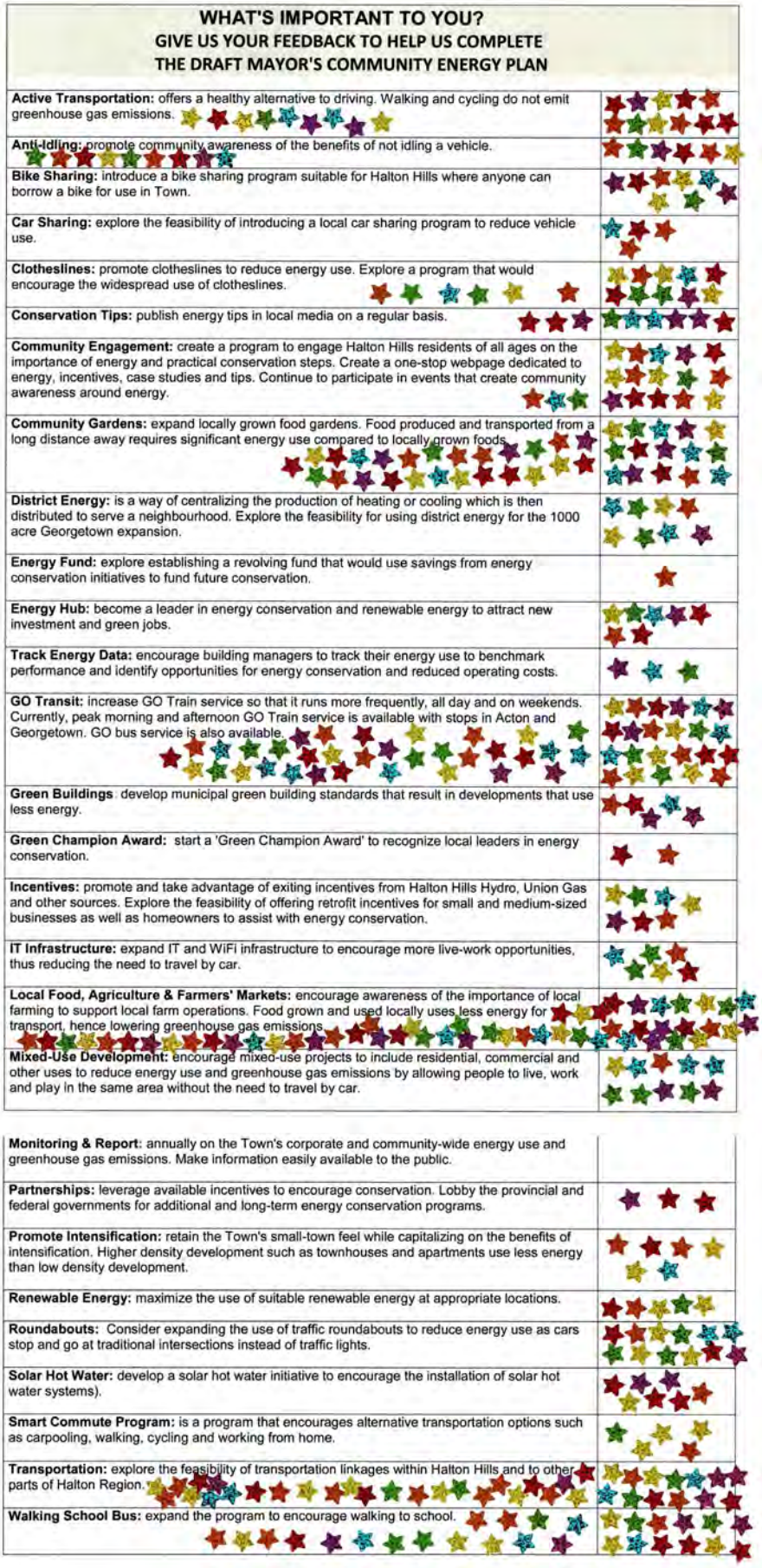


Figure 5. Dotmocracy

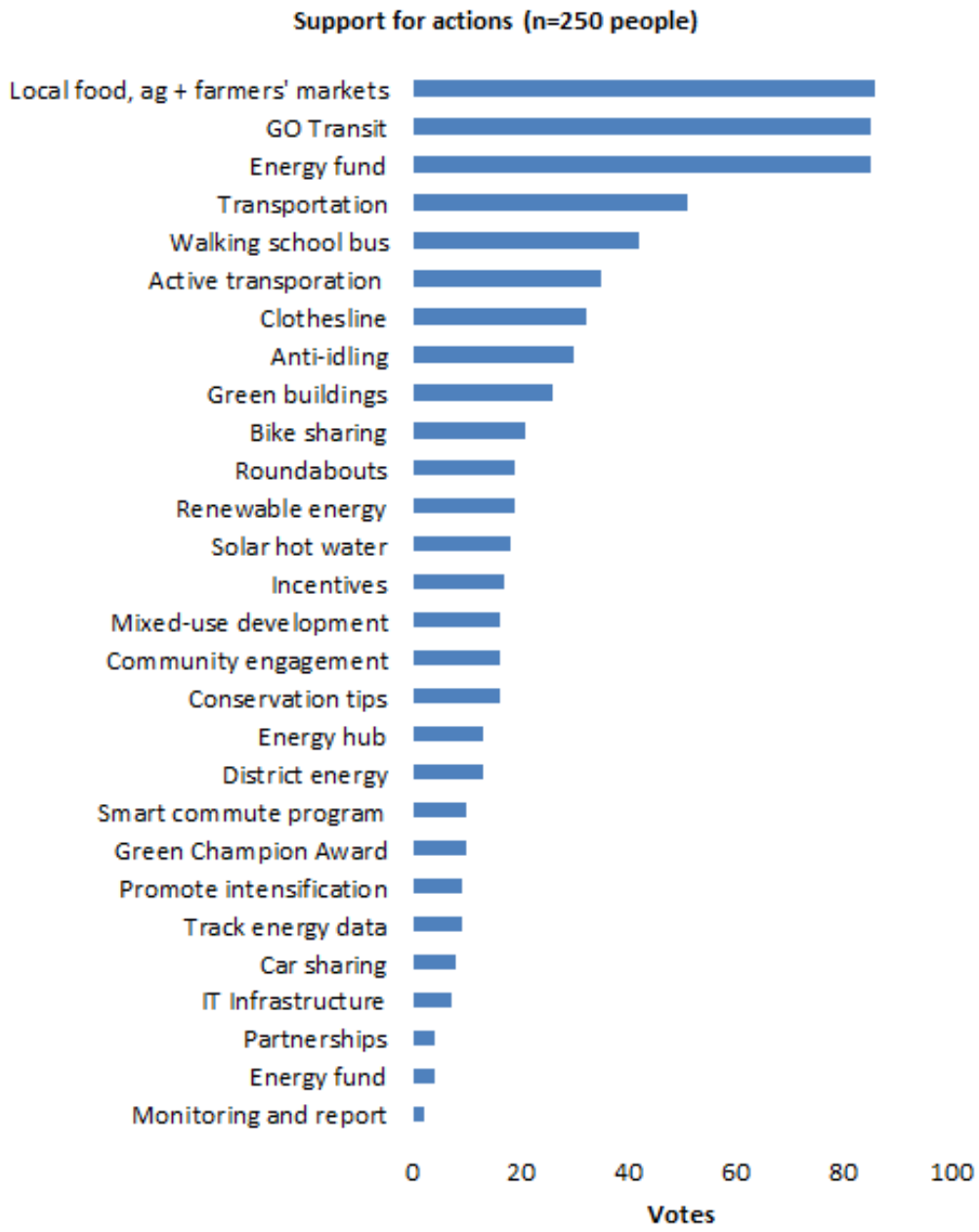


Figure 6. Results of dotmocracy prioritization of strategies and actions

The in-person engagement was supplemented by two streams of online engagement – a crowdsourcing platform called Ideascale and an online questionnaire tool called Survey Monkey. A total of 33 people filled out the Survey Monkey survey and 41 ideas were contributed to the Ideascale platform with 152 votes.

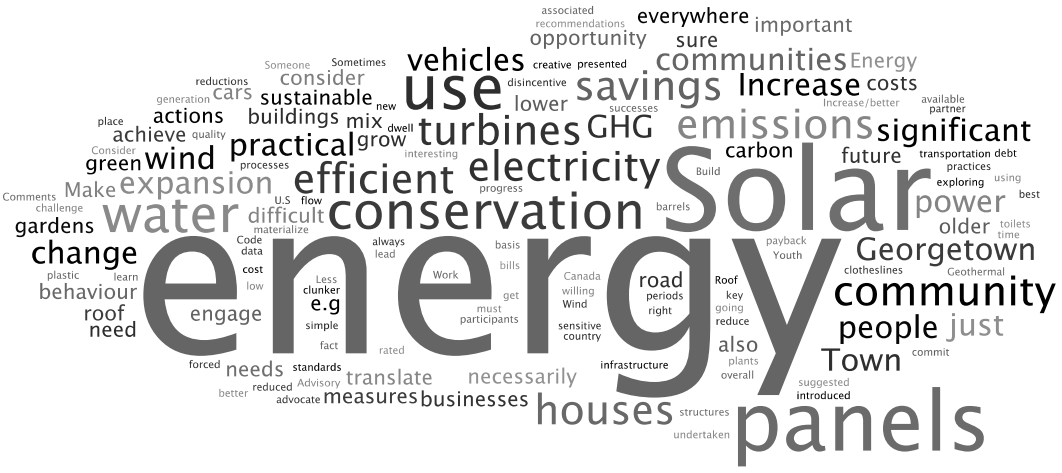


Figure 7. Word cloud of strategies and actions

Additionally, Town staff were engaged for the creation of the CEP portion of the Mayor's Community Energy Plan. This engagement was facilitated through interviews with Town staff (including department directors, the CAO, and O&M staff), two strategic planning sessions with the Town Technical Advisory Committee and the Steering Committee, and a survey of Town staff regarding energy managment and efficiency.

6.2. Community engagement results

There is a significant base of activity underway in Halton Hills that serves as a foundation of experience, infrastructure and enthusiasm for a higher level of ambition. The initiatives range from the installation of solar panels on power poles to energy initiatives in schools, from electric vehicle charging stations to hybrid and electric taxis, from the existing compact town centres to significant green spaces and from LEED^{R} projects to vibrant farmers' markets. An extensive list of potential strategies and actions were identified under the themes of buildings, transportation, land-use, food, waste, innovation and education, financial planning and energy. In the in-person engagement, transportation-related actions such as GO Transit, walking school bus and active transportation were rated most highly, along with supporting local food and agriculture, priorities which were echoed in the Survey Monkey, along with support for mixed-use developments, green buildings, renewable energy, additional incentives and community engagement. In Ideascale, educational efforts were rated most highly including a program to engage youth, social media and public information campaigns. Notably, of the 23 people who responded to a question on the likelihood of purchasing an electric car, only 3 were likely or very likely to make the purchase, while 6 were likely or very likely to purchase a hybrid, while 13 people were likely or very likely to purchase a bicycle. A quarter of the respondents were likely to move to higher density housing and 10 people were likely to purchase a solar hot water or solar electric system.

The details of the survey of Town staff as part of the corporate side can be seen in Appendix 6.

7 Modelling

7.1. Introduction

Land-use decisions determine transportation patterns, building design, public infrastructure and energy supply systems for fifty to hundreds of years into the future. Figure 8 shows the trickledown impacts of planning decisions. For example, long distances between where people live and where they work, play, study and shop results in a dependence on personal automobiles. Switching to public transit in this type of land-use configuration is very expensive and logistically challenging.

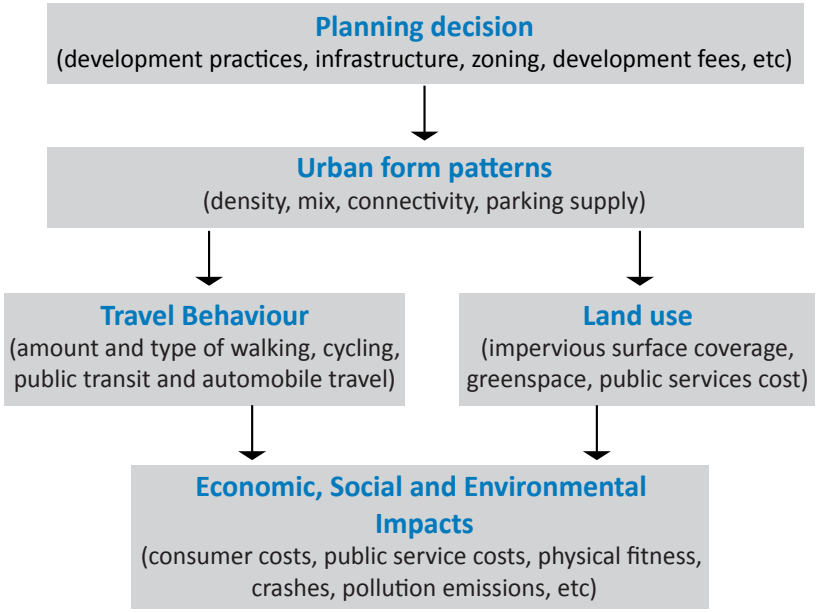


Diagram modified from Litman, T (2011)
Evaluating Transportation Land Use Impacts

Figure 8. Planning and land use

Land-use decisions result in a phenomenon called path dependence or "lock-in" where the investment in buildings and infrastructure is so large that it is difficult to back away from that investment even if there are significant financial, health and environmental costs to its ongoing operation and maintenance (Figure 9). In contrast, land-use patterns that support compact, complete communities broaden the spectrum of opportunities in the future, "keeping the options open." For example, the density associated with compact communities increases the economic feasibility of potential district energy systems or new transit routes, and also helps with many non-GHG related infrastructural systems like water and wastewater, schools and fire halls. Compact communities are also more liveable and vibrant, places where local business owners are able to set up shop and thrive, because they have regular local customers.

Compact, complete communities reduce household costs of energy for heating and cooling, and for transportation, as destinations tend to be closer, or even walkable. Municipal costs decline

when infrastructure is more compact and services are less spread out. This type of development also reduces the impact of escalating energy costs, both to the inhabitants and to society. Jaccard et al proposed a hierarchy of decisions for community energy planning based on the simple concept of whatever lasts longest is most important[36]. Land-use decisions have implications for 50 to 100 years and are therefore prioritized above building design (implications for 25 to 50 years) or the selection of energy-efficient equipment (implications for 5 to 20 years).

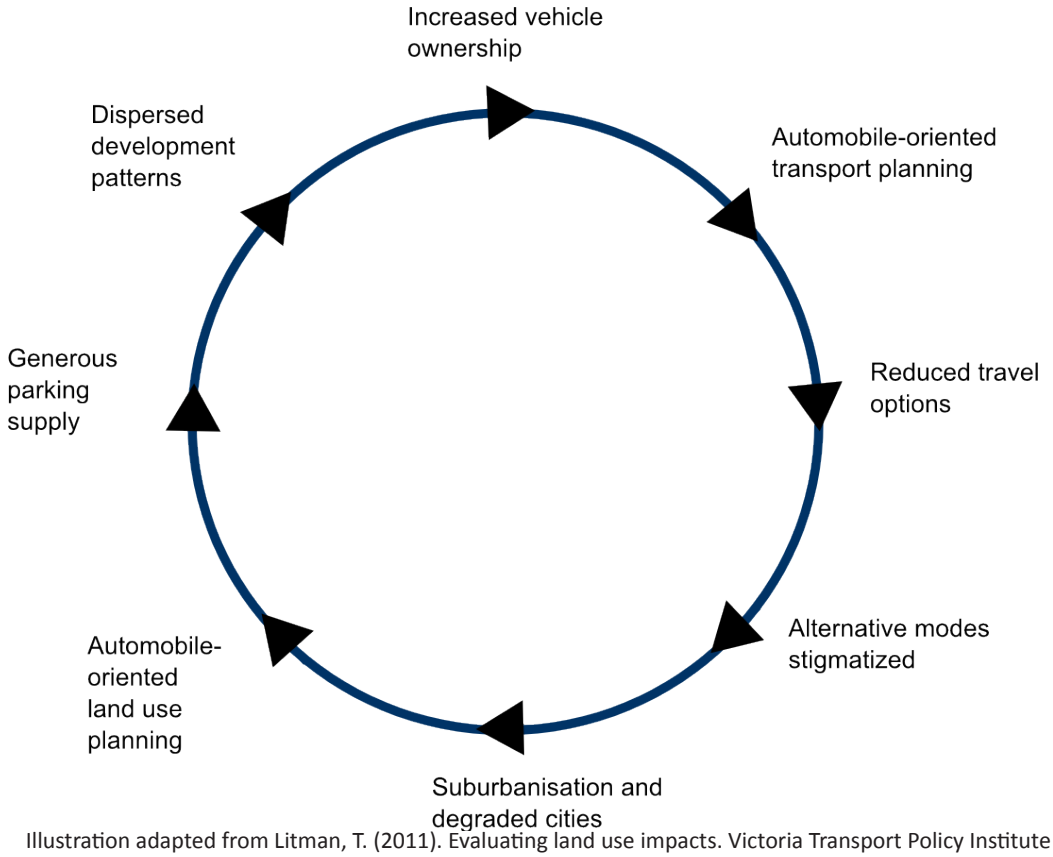


Illustration adapted from Litman, T. (2011). Evaluating land use impacts. Victoria Transport Policy Institute

Figure 9. Automobile use and lock-in

There are a range of other co-benefits to GHG reduction which merit further analysis, including:

- **Municipal capital and operating costs are significantly lower** in a community with low GHG emissions than one with high GHG emissions. A study by the IBI Group for the City of Calgary compared a scenario of growth that reflects current patterns and policies (dispersed scenario) with a scenario that intensifies population and jobs in existing areas (recommended scenario)[37]. IBI Group found that the dispersed scenario would cost the municipality 33% more to build than the recommended scenario with additional savings for operations and maintenance. Water and wastewater systems alone would be 55% cheaper in the recommended scenario. Other savings would be found in road construction, transit costs, fire stations, recreation centres and schools.
- Land-use planning which reduces GHG emissions will also **improve public health outcomes** by supporting higher levels of physical activity, improved traffic safety, reduced overall air pollution, reduced noise pollution, enhanced social interactions and improved mental health outcomes. Health conditions, which can be positively influenced

36 Jaccard, M., Failing, L., & Berry, T. (1997) From equipment to infrastructure: community energy management and greenhouse gas emission reduction. Science, 25(13), 1065–1074.

37 IBI Group. (2009) The implications of alternative growth patterns on infrastructure costs. Prepared for the City of Calgary.

by land-use planning, include heart disease, hypertension, stroke, diabetes, obesity, osteoporosis and depression[38].

- The green economy has grown in prominence as **a solution to both the economic slowdown and environmental challenges**. Efforts to reduce GHG emissions stimulate innovation in renewable energy development, manufacturing and installation, energy efficiency retrofits, green building, energy efficient technologies, local agriculture activities, and new infrastructure for public transit and cycling, amongst others.

7.2. GHGProof

Figure 10. Scope of issues addressed within GHGProof

An open source model, GHGProof, was used for this project. GHGProof can be used to analyze past and present land-use patterns, project the impact of future land-use patterns and generate land-use scenarios to achieve a set target. All of the calculations, inputs and assumptions in GHGProof are visible to the user. Key strengths of the model include:

- **Comprehensive**: Seeks to address all major land-use impacts on GHG emissions, and some public and private energy costs.
- **Adaptable:** Can be used for a rigorous analysis of a large city or in a one-day workshop

38 Frank, L., Kavage, S., and Litman, T. (2008) Promoting public health through Smart Growth. Prepared for Smart Growth BC.

for a small community.

- **Affordable**: Free to use for non-profit purposes, open source.
- **Transparent**: All assumptions and calculations are visible and can be altered.
- **Scope:** Can be used at the scale of a large development, a municipal plan and a regional plan.
- **Policy relevant:** Allows local governments to develop or evaluate targets to address provincial legislation.
- **Accessible:** Uses simple Geographic Information Systems (GIS) analysis and an Excel-based calculator; limits number of inputs to those that have greatest potential GHG impacts.

It is important to note that a model cannot determine outcomes with certainty, but rather will illustrate the effects of choosing among various outcomes. Thus it is crucial that both the assumptions and the means of creating and presenting the model be fully transparent. In GHGProof, all of the calculations, inputs and assumptions are visible to the user. The model was developed with support from the Fraser Valley Regional District and Canada Mortgage and Housing Corporation. GHGProof is licensed through Creative Commons as an open-source tool and can be used for free for non-profit purposes. The model is available as a download at www.sustainabilitysolutions.ca/resources/GHGProof.

A scenario is a view of what the future might turn out to be; it is not a forecast, but one possible future outcome. A good set of scenarios is both plausible and surprising, providing insight into a particular challenge. A scenario analysis is designed to enable users to make informed decisions in the context of a complex set of variables.

Here, GHGProof is used to explore:

- Alternatives: variations in housing types, locations and technologies can be expressed using different scenarios in the model.
- Consequences: the immediate and cumulative effects are expressed through the outputs of the analysis and through a GIS mapping exercise.
- Causations: causal bonds between alternatives and consequences are illustrated using transparent equations between assumptions and inputs.
- Time frames: periods of time between implementation of the alternatives and the unfolding of their consequences.
- Geographical footprints: the place-oriented blueprints or alternatives are developed using a GIS methodology.

7.3. Assumptions

GHGProof uses a large number of assumptions, drawing where possible on local studies and otherwise employing provincial or national averages. All of the assumptions are adjustable so users can test different possibilities. A complete list of assumptions as well as sources is available in the Assumptions tab of GHGProof, attached in Appendix 3. Note that these assumptions have evolved since this table was created.

The foremost aim of this analysis is to enable planners, policy- and decision-makers, and communities within local and regional jurisdictions to understand the implications of land-use decisions on greenhouse gas emissions and energy costs. Municipal governments can directly influence key variables as illustrated in Table 6.

Table 6 Key variables under municipal influence

Area of influence	Tools
Transportation	Municipal plans, transit plans, infrastructure provision, tax incentives
Buildings	Supplementary municipal development standards, development management, energy efficiency incentives
Liquid waste	Regional service
Solid waste	Regional service
Agriculture	Municipal plans
Forest area	Municipal plans, municipal services

In these spheres of influence, it has been estimated that municipalities directly or indirectly control between 44 and 52% of greenhouse gas emissions.[39] This estimate does not address the impact of land-use decisions in a systematic manner. The goal is to translate the relationship between land-use and GHG emissions into a methodology that allows the quantitative evaluation of different land-use scenarios, while incorporating the influence of provincial and federal government policies on GHG reductions, for example fuel efficiency regulations.
The total greenhouse gas emissions for a community is defined as:

$$GHG_{landuse} = GHG_{transport} + GHG_{energygen} + GHG_{embody} + GHG_{waste} + GHG_{agriculture} + GHG_{forest} + GHG_{landconvert}$$

Where:

- $GHG_{transport}$ is the movement of goods and people;
- $GHG_{energygen}$ is the generation of heat and electricity;
- GHG_{embody} is the embodied energy in materials;
- GHG_{waste} is liquid and solid waste produced;
- $GHGa_{griculture}$ is the production of food;
- GHG_{forest} is the area of forest land;
- $GHG_{landconvert}$ is the area of land that has been modified (e.g.: farmed)

The analysis does not include GHG emissions from:

- Small engines including ATVs, motorboats, lawnmowers, etc, because of data limitations;
- Planes or boats, even if their travel originates in Halton Hills, because of data limitations and limited control by municipal governments;
- Poultry, pigs and other livestock, excluding cows, because these are considered to be marginal;
- Major industrial sources that are not within the sphere of influence of municipalities;
- Extraction and manufacture of goods consumed by Halton Hills residents (embodied GHG emissions).

The analysis does include emissions associated with the transportation of food (i.e.: food miles). While the concept of food miles has attracted some debate, our analysis indicates that local production and consumption of food can generate significant GHG emissions reductions. For a detailed literature review of SSG's approach, see the paper "Greenhouse gas emissions modelling to build resilient communities."[40] Note that for the purpose of this analysis, locally-produced food is considered to be food that is produced within the Province of Ontario.

39 EnviroEconomics. (2009) Prepared for FCM. Act Locally, The Municipal Role in Fighting Climate Change.

40 SSG. (2010) Greenhouse gas emissions modelling to build resilient communities: A Review of the Literature. Available at:.www.sustainabilitysolutions.ca/sites/default/Ļ les/SSG%20GHG%20Model%20Literature%20review_0.pdf

7.4. Inventory

Following the identification of assumptions, inputs for the 2011 baseline year, including the population of 59,008 in 20,260 households, were entered into GHGProof. A transportation model of Halton Hills was created by identifying all potential destinations using Geographic Information Systems (GIS) data. Institute of Transportation Engineers trip generation factors were then assigned to each destination according to its classification and its area. For example, according to the Institute of Transportation Engineers a 5,000 square foot financial institution is assumed to generate 741 trips each day. Each destination was assigned trip generation numbers and aggregated using GIS to identify the key destination clusters in Halton Hills (Figure 11).

Average trip length was then calculated using GIS by assessing the distance between each key destination cluster and each dwelling. These distances were weighted according to the percentage of total trips to that destination and then added together to generate an average trip length for Halton Hills (Table 7). This average is then calibrated against estimated fuel consumption data to calculate an average trip length for the 2011 baseline.

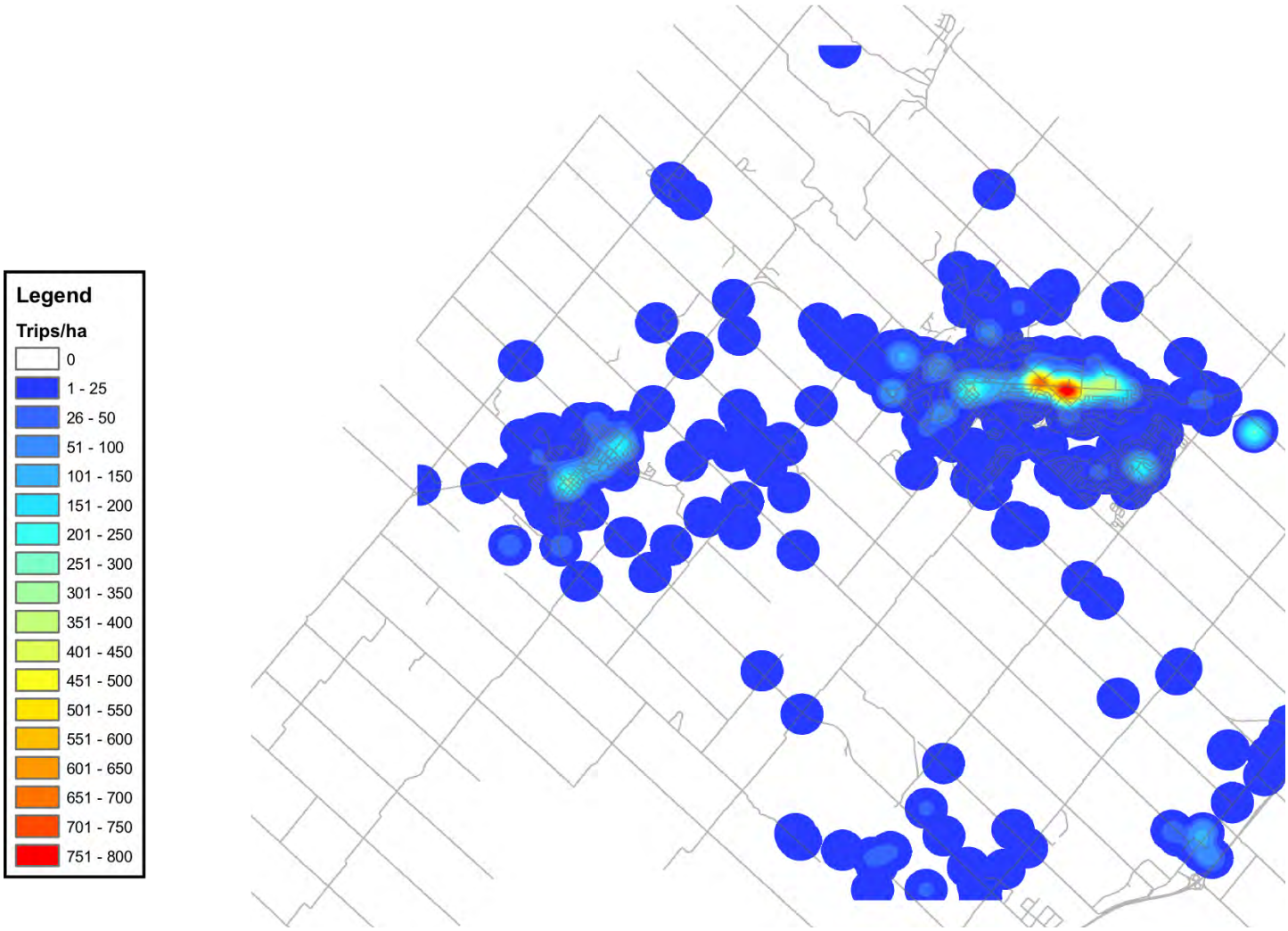


Figure 11. Trip generation (trips per hectare)

Table 7 Destinations by weight and distance[41]

Destinations	Weighting (2011)	Weighting (2031)	Average trip length calculated from all dwellings in Halton Hills (metres)
Acton	6.78%	5.73%	12,537
Brampton (City Centre)	16.04%	13.55%	18,643
Georgetown	22.47%	18.98%	6,280
Mill St.	3.66%	3.09%	5,684
Mississauga (City Centre)	25.91%	21.89%	29,536
Milton (City Centre)	7.40%	6.25%	17,995
Mountainview Rd. S. & Argyll Rd.	2.13%	1.80%	6,340
Steeles Av. & James Snow Pkwy	1.97%	6.35%	14,477
Southwest Georgetown Downtown	0.00%	7.07%	5,610
Union Station (Toronto)	12.34%	10.42%	53,335
Future employment area	0.00%	4.85%	13,628
Toronto Premium Outlets	1.31%	1.11%	12,472

The number of dwellings by type (detached, attached, apartments < 5 storeys, apartments > 5 storeys, mobile homes) was identified from Town of Halton Hills data. GIS was used to calculate the number of dwellings at different levels of density (Figure 12). Solid waste data was provided by the Region of Halton and GIS was used to identify the number of dwellings served by primary or tertiary waste treatment. GIS data was also used to calculate the area of land in the Agricultural Land Reserve and area of forest in the Town of Halton Hills. Data on agricultural practices was provided by the Agricultural Census.

41 For the purposes of this analysis, the destinations in this table are considered commercial cores.

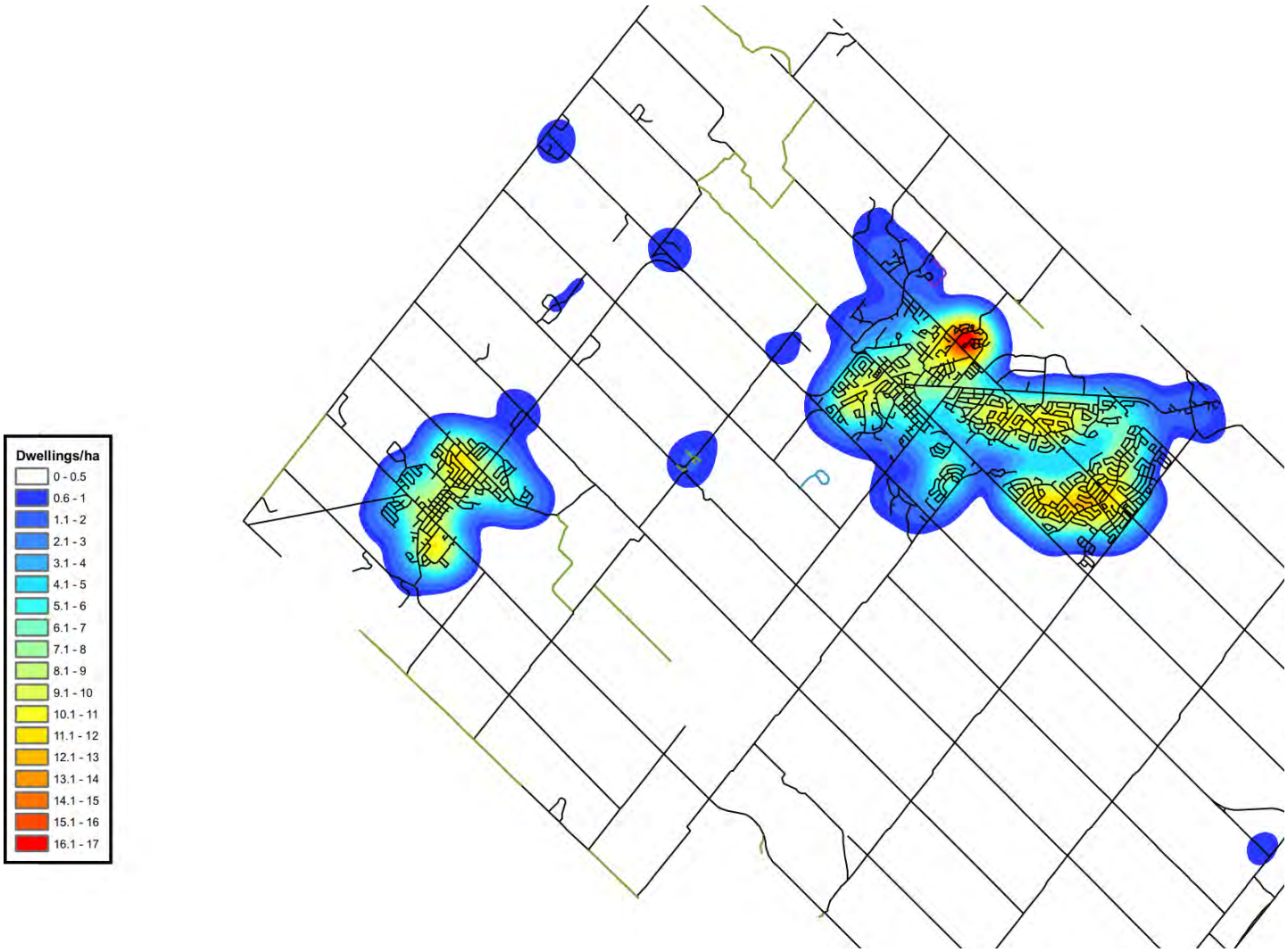


Figure 12. Housing density (dwellings per hectare)

7.4.1. Baseline results

Total GHG emissions for the Town of Halton Hills were calculated to be 623,886 tCO2e.

Table 8 Total GHG emissions for Halton Hills

Category	Result
Total GHG emissions	618,465 tCO2e
GHG emissions/capita	10.5 tCO2e/capita
Energy/capita	168 GJ
VKT/Household	51,094 km

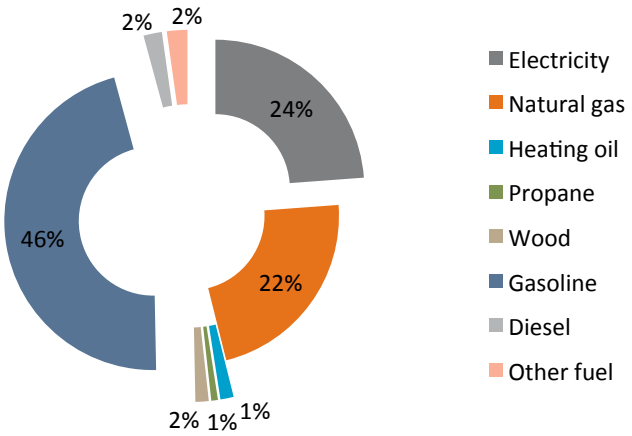


Figure 13. Energy consumption by fuel

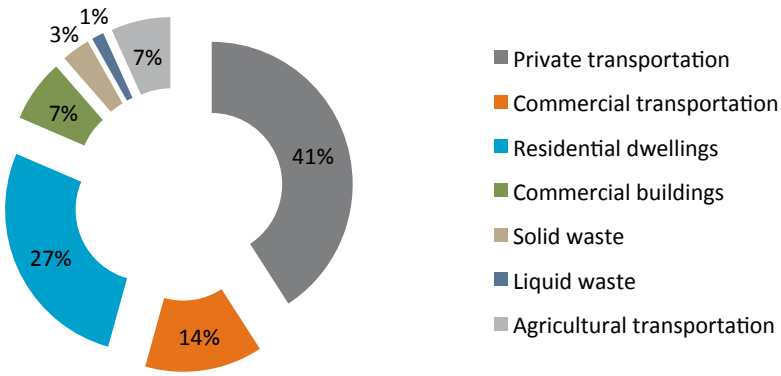


Figure 14. GHG Emissions by theme

7.4.2. Baseline observations

Gasoline accounts for 46% of the energy used in Halton Hills, more than electricity or natural gas, which each having slightly less than a quarter of the remaining pie. Private transportation accounts for just over a third of the total GHG emissions, residential buildings account for a quarter and commercial transportation and ex-situ transportation of food (transportation from outside of Halton Hills) account for just over another quarter of the total emissions. Commercial buildings represent 7% of the emissions and together solid and liquid waste account for just 4%.

7.4.3. Energy and GHG intensity maps

The data produced by the GHGProof model was translated into a GIS analysis, generating "heat maps" of the electricity and natural gas consumption – the warmer the colour, the more significant the energy consumption. These maps are highly effective visual tools to illustrate where energy is being used and the potential for district energy systems, amongst other considerations. Electricity data was available at the building level from Halton Hills Hydro, whereas natural gas was available at the postal code level from Union Gas.

Electricity and natural gas consumption is concentrated in Georgetown and Acton, a result which is what one would anticipate given the concentration of buildings in those locations. Acton shows a horseshoe-like pattern of energy consumption, whereas Georgetown is a slightly distorted shape of a numeral 3. Because of the difference in data resolution, the concentration of energy consumption in the two maps is not directly comparable. In both maps there is a concentration of energy consumption in the southern areas of Georgetown.

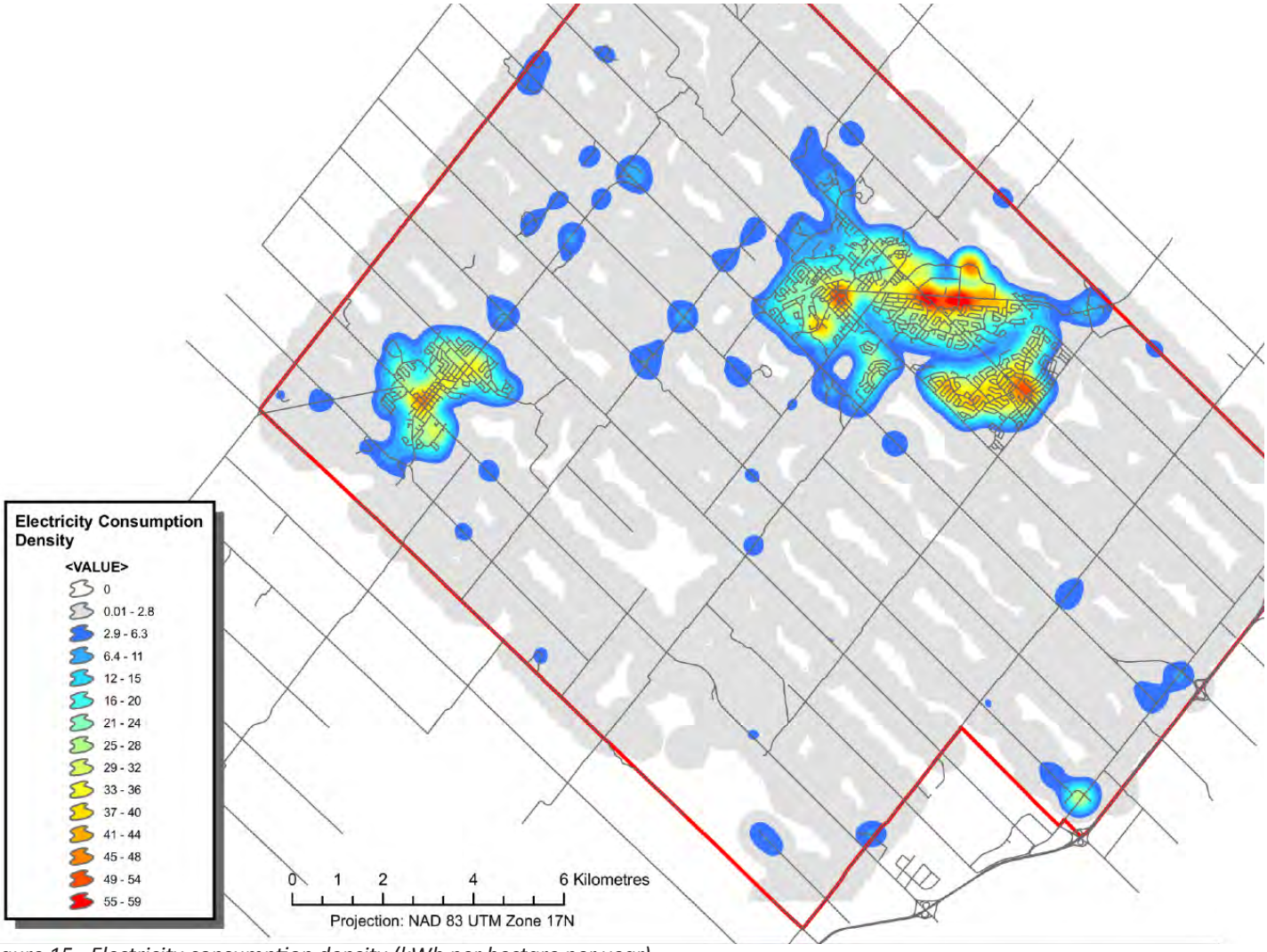


Figure 15. Electricity consumption density (kWh per hectare per year)

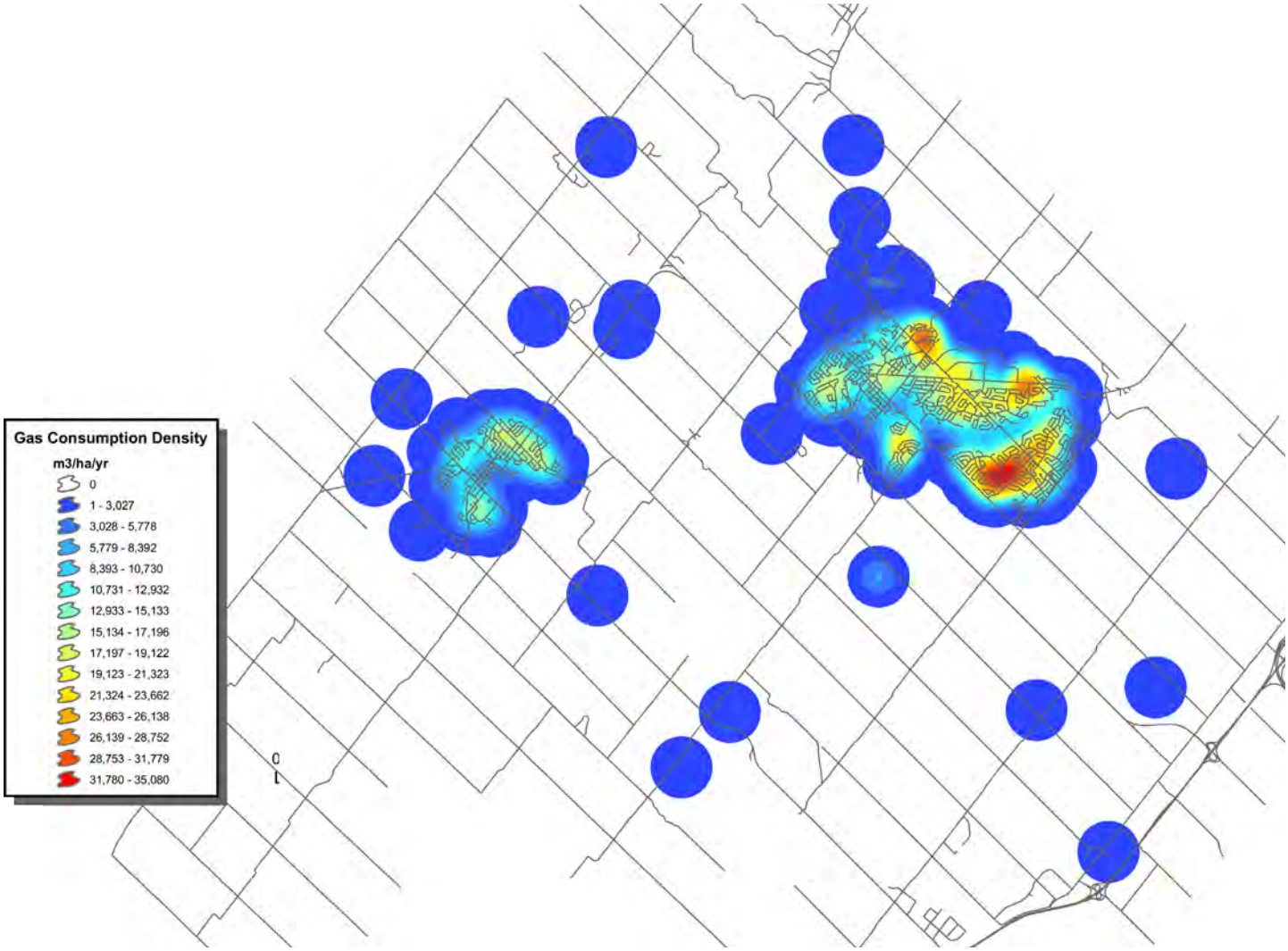


Figure 16. Natural gas consumption density (m3 per hectare per year)

8 Modelled scenarios

8.1. Description of Scenarios

As with other types of modelling, such as economic or demographic, it is critical that the methodology is consistent between the baseline and the scenarios. Because population is a key driver in the model (increased population equals more houses and more transportation and therefore more GHG emissions), the scenarios can only be compared on a per capita basis and not on total energy or GHG emissions. The details of the scenarios were identified in a scenario-planning workshop held with the Town of Halton Hills using a series of questions (Appendix 4). All scenarios cover the period from 2011 to 2031. The land-use aspects of the scenarios were derived from the Halton Hills Intensification Opportunities Study, with Scenario 1 representing a lower level of intensification and Scenarios 2 and 3 representing the numbers approved in the Official Plan amendment. Note that there is a difference in population between Scenario 1 and Scenarios 2 and 3. This difference reflects the population variation in the Intensification Opportunities Study that Scenarios 2 and 3 represent.

The purpose of the scenarios was to explore the impacts of 'pulling different levers' or to explore the 'what ifs' on community energy use and greenhouse gas emissions, rather than to define exactly what will happen by 2031, or to prescribe actions. The assumptions underlying the scenarios are not intended to be interpreted as the actions that will necessarily happen by 2031. Because Halton Hills' planned land-use patterns are already very aggressive in terms of their focus on density and reducing low carbon development, land-use patterns were held constant in Scenarios 2 and 3. Scenario 3 represents a higher degree of ambition in terms of district energy, energy retrofits, uptake of renewable energy, vehicle mode share and other variables.

Local food production, defined as food produced in the Province of Ontario, was assumed to be 5% in the baseline, based on a study in the Province of British Columbia. No comparable information was available in Ontario.

Average trip length was calculated for each of the scenarios by calculating the average distance between dwellings and key destinations, which are either commercial centres or employment centres described in Table 6. The key destinations were identified as the most significant centres of trip generation, following the development of a trip generation model.

Subject to additional in-depth study, areas that may be possible for district energy are identified as those areas that exceed a minimum energy threshold, equivalent to 15-25 units/hectare. This calculation does not indicate district energy feasibility but does provide an indication of areas that merit detailed consideration through feasibility studies. District energy feasibility includes other variables such as the presence of an anchor load, mixed-use character of the area, energy supply opportunities and others.

Key variables for each scenario are described in the subsequent sections.

Scenario 1: Moderate Energy Efficiency

Scenario 1 reflects the conservative scenario in the Intensification Opportunities study, projecting the population growth to 2031 (Figure 17).

Halton Hills projects a total population of 86,646 in 2031 under the conservative intensification used in Scenario 1, an increase of 11,080 households (35%) over 2007. In this scenario, the average vehicle trip length is projected to decrease from 22 km to 19.63 km as additional dwellings are concentrated in the urban areas.

Employment increases in the existing employment lands between Steeles Avenue and Highway 401 to 10,882 jobs by 2031. A new employment area is added north of Steeles Avenue with 8,307 new jobs by 2031. An additional 1,701 jobs are added to Southwest Georgetown. These additions are held constant across all three scenarios.

Average trip length is calculated by identifying key destinations in Halton Hills and calculating the average distance from each dwelling to those destinations. If dwellings are farther away from the destinations, that number will be higher, whereas if the dwellings are closer, the number will be lower. On average there are 2.6 trips per person in Halton Hills each day so even a small reduction in average trip length results in a significant overall GHG emissions reduction from vehicular emissions. GIS was used to identify the number of dwellings within walking distance (500 metres) to transit and the commercial core[42] areas, both of which increased over the Baseline.

[42] A commercial core is defined as an aggregation of different types of commercial uses.

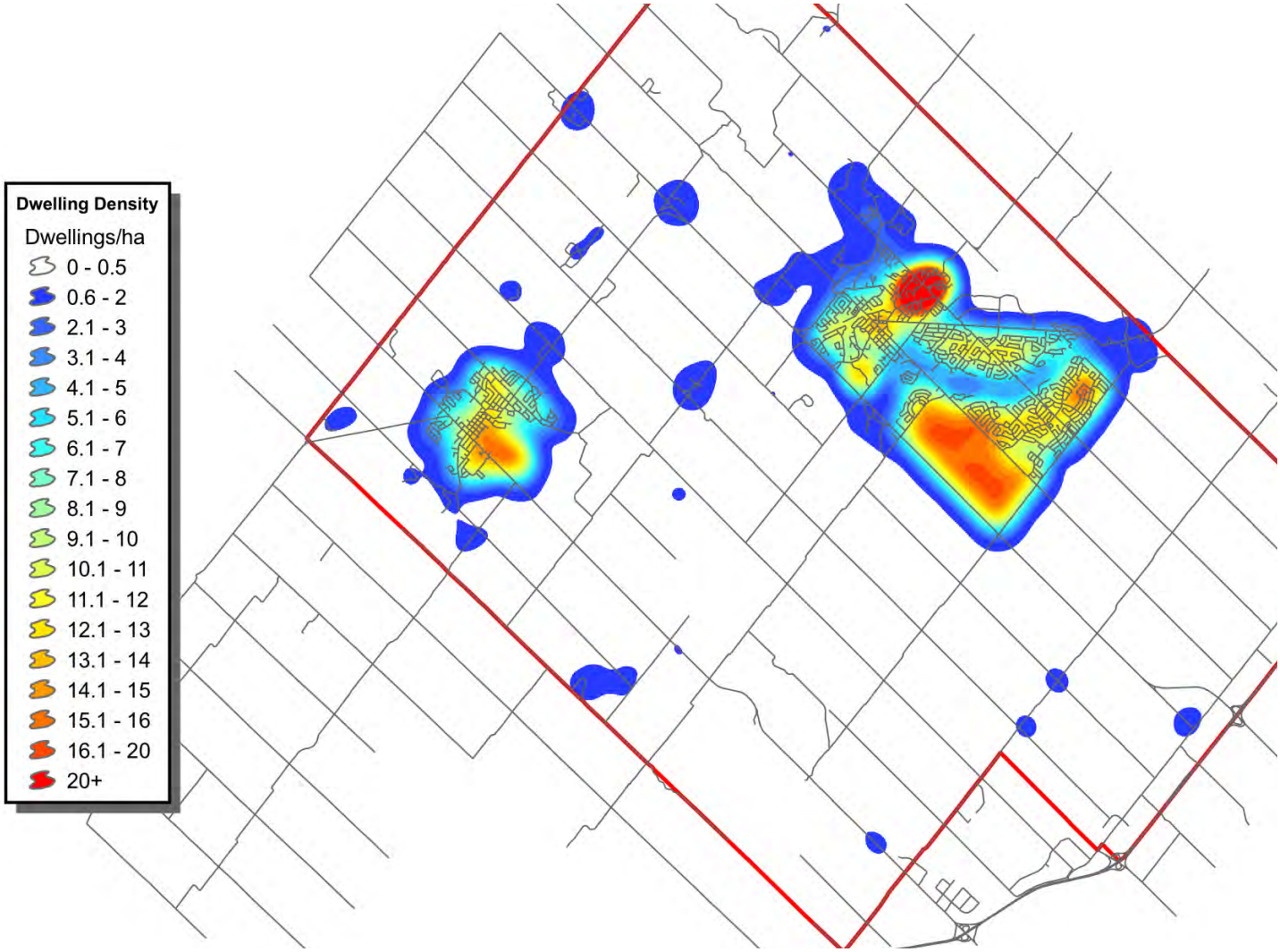


Figure 17. Scenario 1 housing density

The number and density of dwellings increased over the Baseline to the extent that district energy may be a viable possibility. The federal fuel efficiency standard and energy efficiency improvements to the Building Code were included. Accounting for all of these factors, GHG emissions in 2031 in Scenario 1 amount to 720,291 tCO2e, a 16% increase over 2011 levels. Additionally the following changes are modelled between the Baseline and 2031:

- 11,080 additional dwellings are allocated according to the conservative scenario in the Intensification Opportunities study;
- Increasing the dwellings within 500 metres of a commercial core area from 9,200 in the Baseline to 11,071;
- Increasing the dwellings within 500 metres of frequent GO Transit from 0 to 900[43];
- Attaching 502 dwellings to district energy systems by 2031;
- Holding the electricity and gas shares constant for buildings;
- Increasing fleet fuel efficiency from 9.5 to 15.9 km/litre;
- Decreasing vehicular mode share from 84 to 82% of trips and increasing walking and cycling trips;
- Holding the waste diversion rate constant at 58%;
- Increasing the share of locally produced food from 5% in the Baseline to 20%;
- Forest area is constant at 7,857 hectares;
- Decreasing the area farmed from 18,390 to 17,707 hectares;
- Increasing the energy efficiency of new dwellings by 25% over existing building stock; and
- GO station in Georgetown and Acton with increased daily service.

Scenario 2: Towards a Low Carbon Community

This scenario is designed to reflect the best understanding of GHG emission forecasts in Halton Hills according to the existing planning regime (Figure 18). A low carbon community is a community that is trying to minimize its GHG emissions by focusing on the use of renewable energy technologies and reducing fossil fuel consumption.

This scenario was informed by a data review and consultation with Halton Hills staff. The business as usual Scenario projects out to 2031. Halton Hills projects a total population of 94,000 in 2031, an increase of 13,740 households (68%) over 2007. GIS analysis was used to locate new households according to current planning applications, neighbourhood plans and Official Plan projections. In this scenario, the average vehicle trip length is projected to decrease slightly from 22 km to 20 km as additional dwellings are concentrated in the urban areas. GHG emissions in 2031 in Scenario 2 amount to 638,353 tCO2e, a 3% increase over 2011 levels. Additionally the following changes are modelled between the Baseline and 2031:

- 13,740 dwellings are added distributed according to Amendment No.9 (2010) of the Official Plan
- Increasing the dwellings within 500 metres of a commercial core area from 9,200 in the Baseline to 12,230;
- Increasing the dwellings within 500 metres of GO Transit and bus between Georgetown and Acton from 0 to 5,988[44];
- Attaching 2,713 dwellings to district energy systems by 2031;
- Increasing the electricity share from 52 to 61% for residential buildings;

43 For the purposes of the scenarios, current GO service is not considered frequent and while there are dwellings within 500m of the GO Stations, there are no dwellings within 500m of frequent (i.e. at least hourly) GO service.

44 For the purposes of the scenarios, current GO service is not considered frequent and while there are dwellings within 500m of the GO Stations, there are no dwellings within 500m of frequent (i.e. at least hourly) GO service.

- Increasing fleet fuel efficiency from 9.5 to 15.9 km/litre;
- Decreasing vehicular mode share from 84 to 71% of trips and increasing walking and cycling trips;
- Decreasing per capita solid waste production from 0.5 to 0.46 tonnes per capita;
- Increasing the share of locally produced food from 5% in the Baseline to 20%;
- Forest area is constant at 7,857 hectares;
- Decreasing the area farmed from 18,390 to 17,707 hectares;
- Increasing the energy efficiency of new dwellings by 50% over existing building stock;
- Retrofitting 5% of the existing building stock each year, resulting in a 25% energy savings by 2031; and
- GO station in Georgetown and Acton with increased daily service; bus between Georgetown and Acton.

Scenario 3: Low Carbon Community

Scenario 3 takes the recommended Official Plan Amendment for intensification (Figure 20) and further enhances the density where possible as well as seeking more ambitious GHG emissions reductions elsewhere:

- 13,740 dwellings are added distributed according to Amendment No.9 of the Official Plan;
- Increasing the dwellings within 500 metres of a commercial core area from 9,200 in the Baseline to 12,230;
- Increasing the dwellings within 500 metres of frequent GO Transit and the bus from 0 to 9,187[45];
- Attaching 2,713 dwellings to district energy systems by 2031;
- Increasing the electricity share from 52 to 73% for residential buildings;
- Increasing fleet fuel efficiency from 9.5 to 15.9 km/litre;
- Decreasing vehicular mode share from 84 to 54% of trips and increasing walking and cycling trips;
- Decreasing per capita solid waste production from 0.5 to 0.24 tonnes per capita;
- Increasing the share of locally produced food from 5% in the Baseline to 20%;
- Forest area is constant at 7,857 hectares;
- Decreasing the area farmed from 18,390 to 17,707 hectares
- Increasing the energy efficiency of new dwellings by 60% over existing building stock;
- Retrofitting 8% of the existing building stock each year, resulting in a 40% energy savings by 2031;
- GO station in Georgetown and Acton with increased daily service;
- Shuttle from SW Georgetown to Georgetown GO Station; and
- Bus from Acton to Georgetown to Milton.

45 For the purposes of the scenarios, current GO service is not considered frequent and while there are dwellings within 400m of the GO Stations, there are no dwellings within 400m of frequent (i.e. at least hourly) GO service.

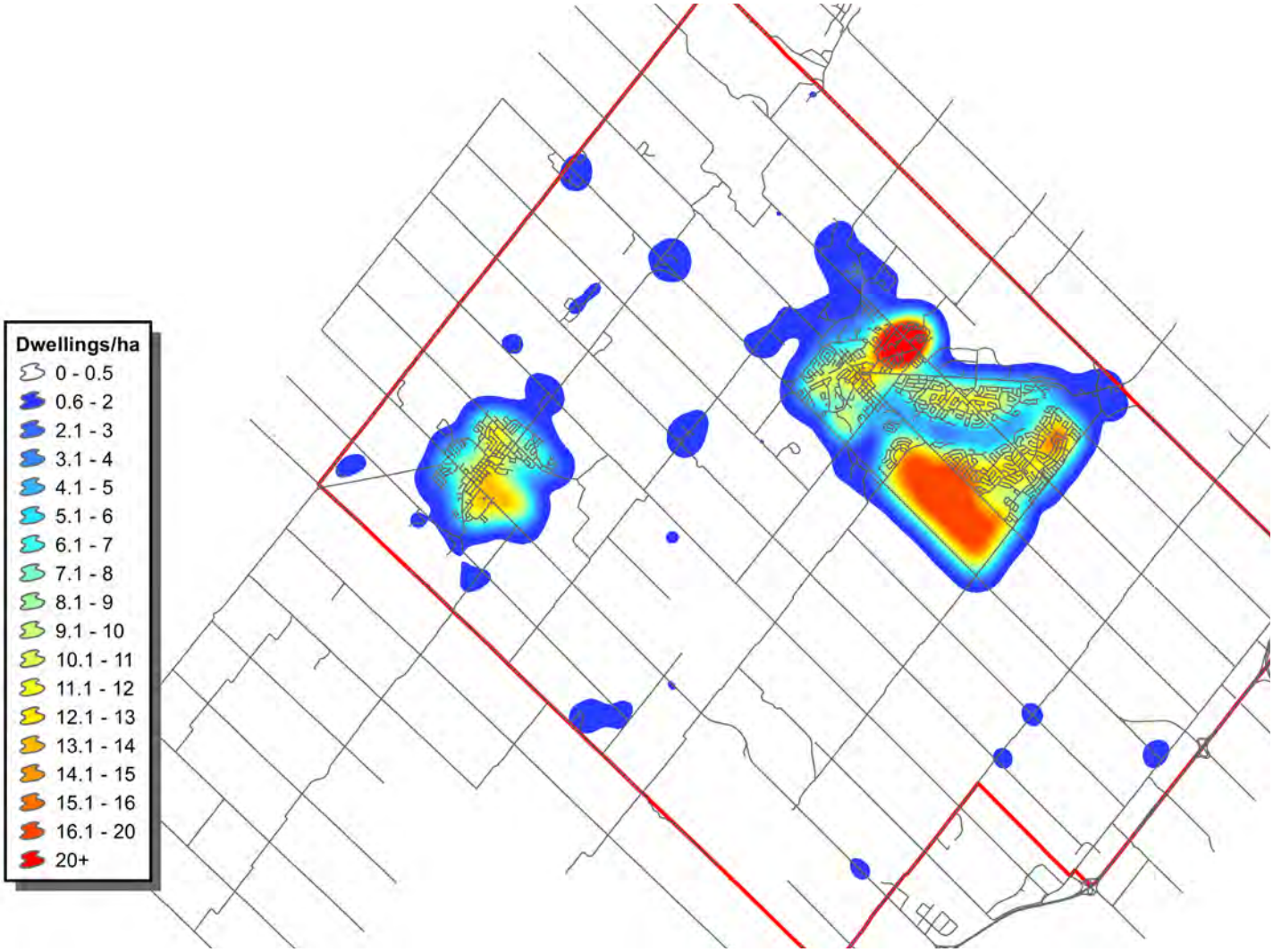


Figure 18. Scenario 2 and Scenario 3 housing density

8.2. Scenario results

8.2.1. GHG emissions

Achieving significant absolute GHG emissions reductions in Halton Hills represents a major challenge, because the population is projected to increase rapidly. This challenge is further exacerbated because the population is broadly distributed over the landscape, and because many key destinations are only accessible by a relatively long vehicular commute. The Official Plan amendment (represented by Scenario 2) is an ambitious plan to reverse existing land use patterns. The projected population increase, with its demand for more dwellings, more vehicles and more food, counters the reductions achieved by federal and provincial policies related to fuel efficiency and low carbon fuels.

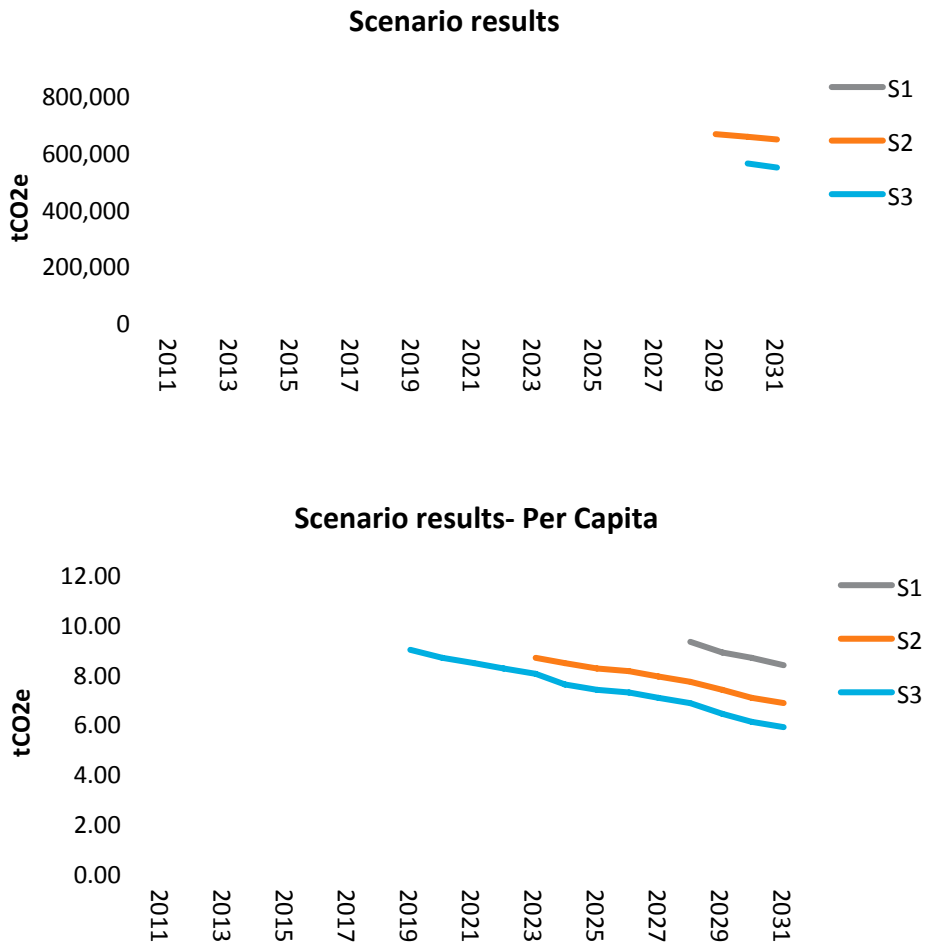


Figure 19. Overall GHG emissions results – absolute and per capita

Absolute GHG emissions continue to climb in Scenarios 1 and 2, while Scenario 3 achieves a small overall reduction. All three scenarios, however, achieve significant per capita GHG reductions, due to the GHG mitigation (Figure 20) efforts across the board (Table 9). The difference between the absolute increases and the per capita reductions illustrates how important the population increase is in driving up GHG emissions.

Table 9 GHG emissions in each scenario

	Total (tCO2e)			Per capita Total (tCO2e)		
Scenario	Baseline (2011)	2031	% change	Baseline (2011)	2031	% change
1	618,465	720,291	+17%	10.5	8.3	-21%
2	618,465	638,353	+3%	10.5	6.8	-35%
3	618,465	542,430	-12%	10.5	5.8	-45%

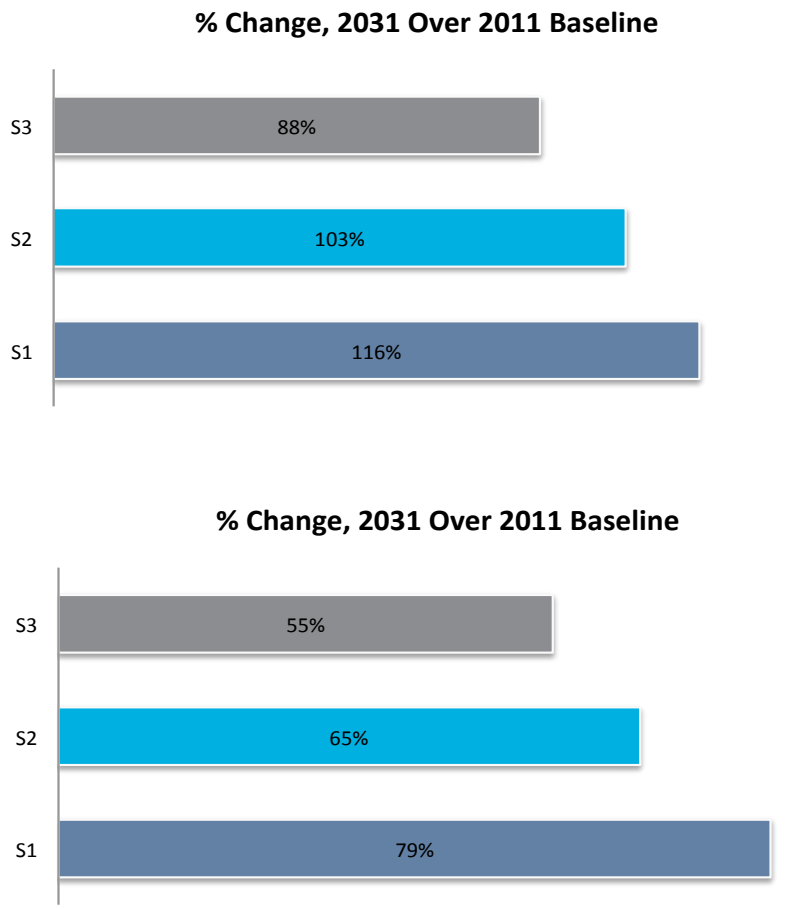


Figure 20. Percent reduction, absolute and per capita

8.2.2. Distribution of Emissions

In Scenario 1, emissions continue to increase in all sectors except for transportation, due to federal policies on fuel efficiency, the introduction of electric vehicles and low carbon fuels. Emissions produced by new homes to accommodate the projected increase in population outweigh the emissions reduced through improved energy efficiency standards in the provincial Building Code. Emissions from liquid and solid waste continue to increase on a per capita basis. The charts in Figure 21 illustrate that the population increases in Scenarios 2 and 3 result in increased emissions from buildings, waste and agriculture and forests in comparison to Scenario 1. The width of the bar reflects the proportion of the total emissions attributed to that sector. Emissions from agriculture refer to emissions associated with transporting and producing food, and emissions from forests refer to the increase or decrease of carbon sequestration by forests in Halton Hills. The significant reductions in GHG emissions in Scenario 3 in particular are achieved in the transportation sector. The peak in emissions in 2028 can be attributed to the point at which per capita emissions reductions overtake emissions increases driven by an increasing population.

Because the emissions reduction strategies, particularly in the transportation sector are more aggressive in Scenario 3, emissions stabilise and decline earlier.

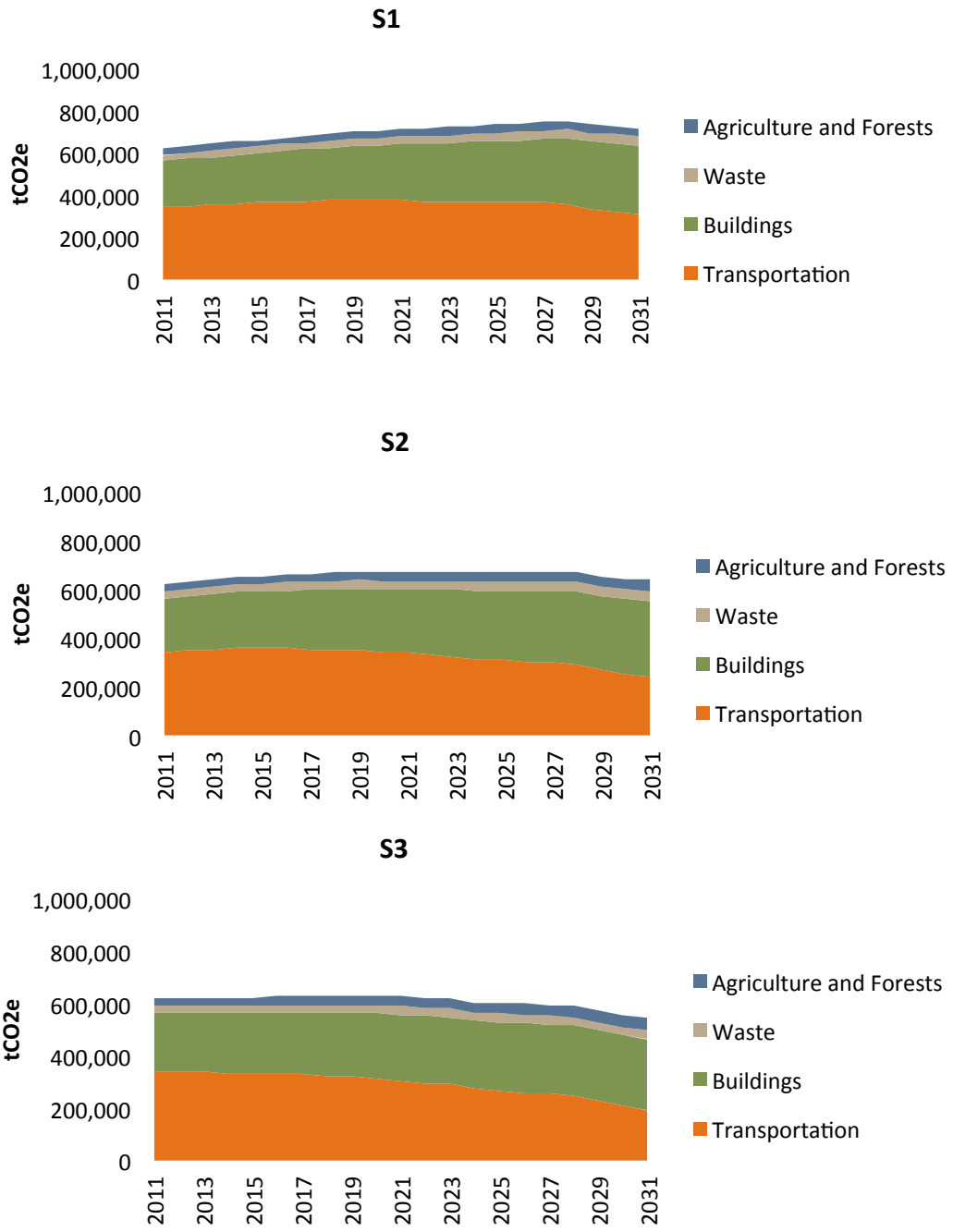


Figure 21. Emissions by theme

8.2.3. Energy consumption

Overall energy consumption decreases by approximately 1 million gigajoules by 2031 in Scenario 3 in comparison to Scenario 1 (Figure 22). A thematic analysis of energy in each of the scenarios reinforces the analysis that the substantial GHG reductions are derived from transportation, as reflected by the reduction in gasoline between Scenario 1 and Scenarios 2 and 3. Scenario 3 also differs from the other two scenarios in that the consumption of natural gas is held more or less consistent, whereas in Scenarios 1 and 2, the consumption of natural gas increases significantly. In Scenario 3, the consumption of electricity increases in comparison with the other two scenarios.

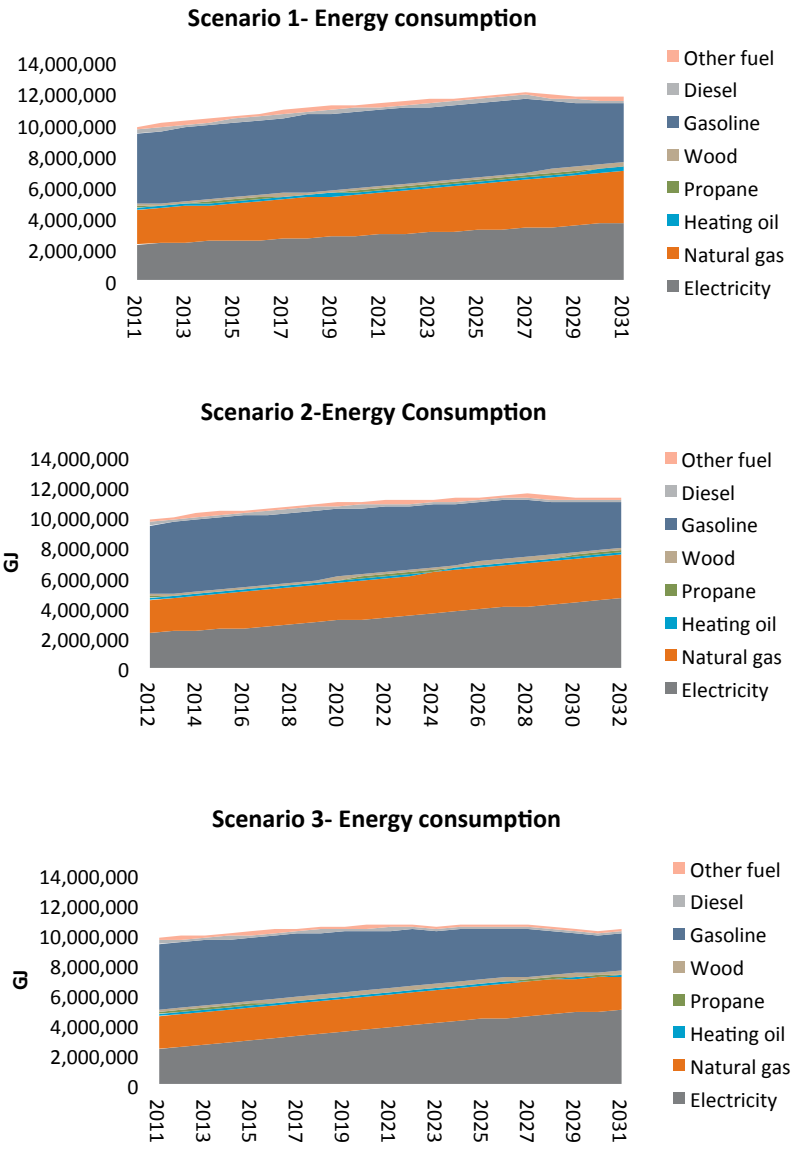


Figure 22. Energy consumption in the Scenarios

8.2.4. Transportation

Transportation emissions are driven by three factors: the distance people drive (vehicle kilometres travelled or VKT), the carbon intensity of the fuel used, and the efficiency of the vehicle. Reducing VKT through land-use planning is the most certain way to reduce transportation emissions. Our transportation modelling indicates there are limited additional opportunities for reducing VKT from redirecting housing development, firstly because the existing intensification plan is ambitious and secondly there is limited ability to adjust this plan. Trip length decreases marginally from 22 km to 20 km. Even with the intensification, people in Halton Hills will continue to travel outside of the community for many services. Providing a full suite of amenities in Halton Hills, where new housing will be concentrated, will encourage people to walk or cycle, resulting in fewer trips and shorter trips, thereby reducing the average VKT. Georgetown Expansion represents a major opportunity here. Scenario 3 assumes a major mode shift in the later part of the run-up to 2031 as people are assumed to be more willing to walk and cycle when destinations are within 500 metres (for walking) and 1,000 metres (for cycling). Overall, the vehicular mode split drops from 83% in 2031 to 54% in Scenario 3 (Figure 23). The mode split is the major factor in reducing overall VKT in a context in which trip length is more or less constant.

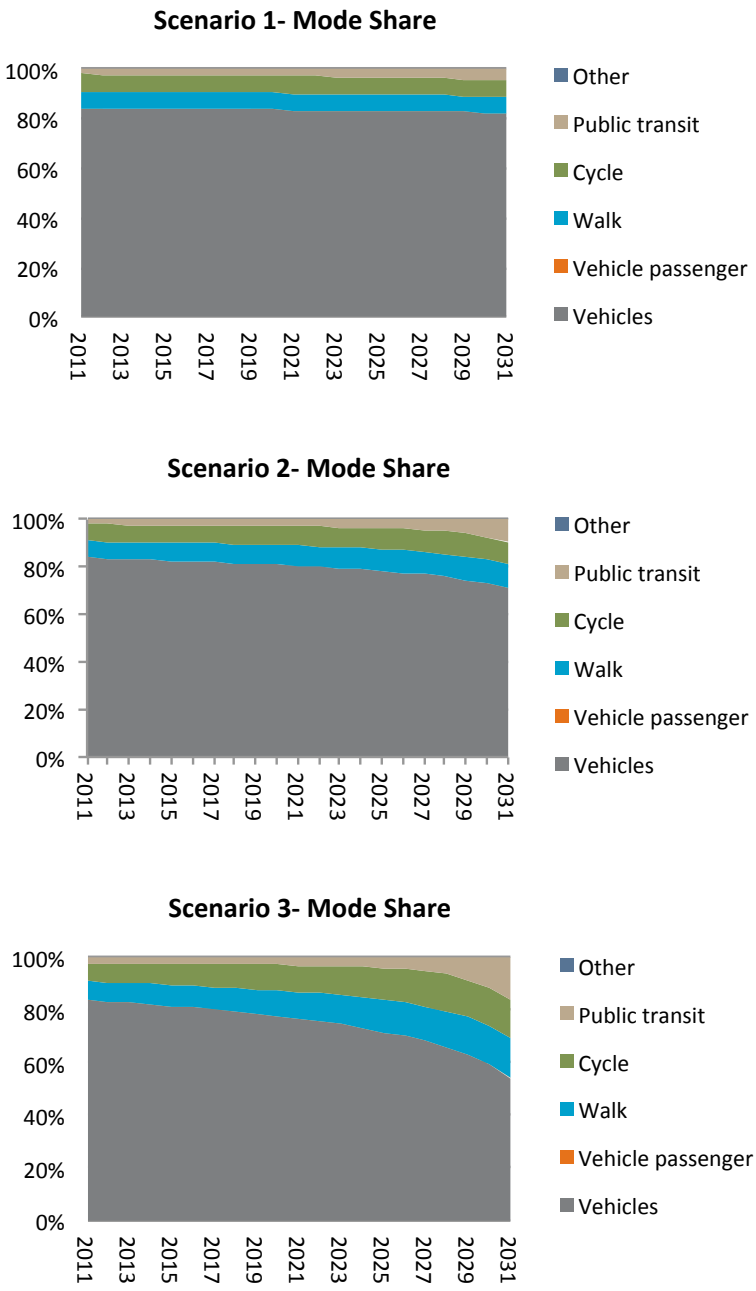


Figure 23. Mode share in the Scenarios

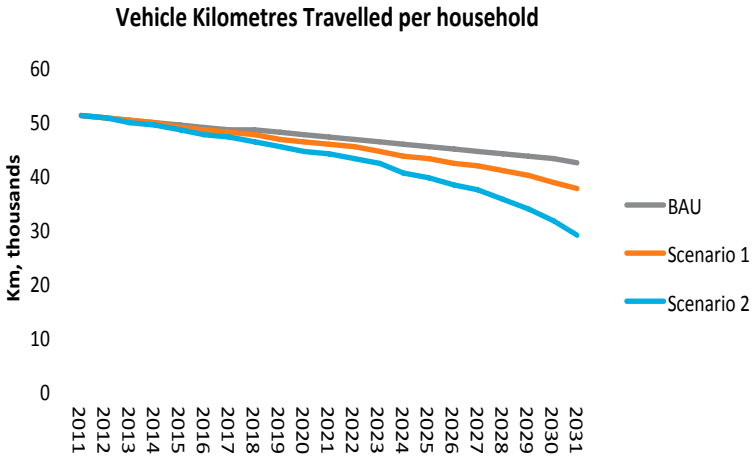


Figure 24. Total VKT in each of the Scenarios.

8.3. Economic impacts

8.3.1. Energy costs

A central focus of the plan is to recommend strategies and actions that have holistic benefits to Halton Hills. The green economy was a focus of the project's public engagement program. This theme is continued here with a general analysis of energy costs, investment required (by the municipality, its partners and the community) and employment generated by the efforts required to achieve the GHG targets, as modelled in the previous section.

Energy costs in 2011 for private and commercial transportation and private and commercial buildings totalled $321 million in 2011, and based on conservative cost per unit increases will climb to $426 million by 2031, a total of $105 million over 20 years, or an average of $5 million per year. Scenario 2 achieves a gross reduction in annual energy costs of $17 million in 2031 over Scenario 1, for total annual community energy costs of $409 million. On a household basis, energy costs fall from $15,846 in 2011 to $12,037 in 2031 in Scenario 2, a savings of $3,809 per year (Figure 25).

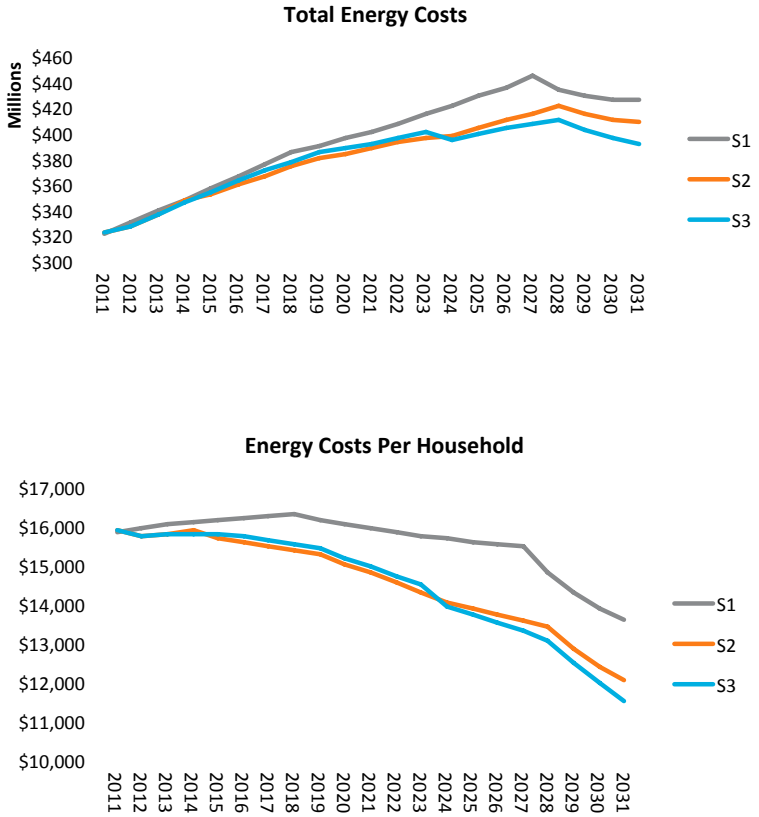


Figure 25. Energy costs and costs per household

8.3.2. Investment

In order to explore what additional effort would be required to generate the energy and GHG savings between Scenario 1 and Scenario 2, we calculated the level of investment involved. Between 2011 and 2031 total investment equals $107 million, generating total savings of $271 million over the same period. By 2031, energy cost savings total $17 million in Scenario 2 over Scenario 1 with an investment of $9.4 million for Scenario 2 in the same year. The annual investments represent investments in renewable energy, waste management, energy retrofits, district energy and so forth, activities that can be implemented by the public and private sectors.

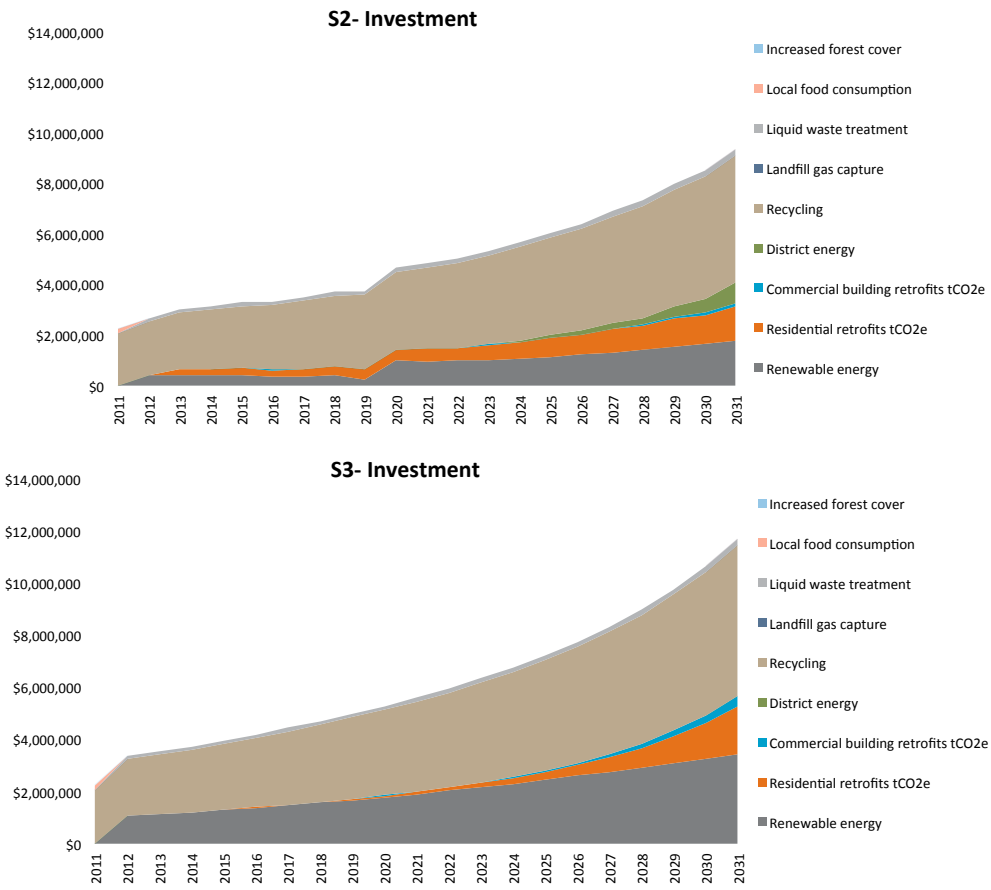


Figure 26. Scenarios 2 and 3 investment efforts versus Scenario 1

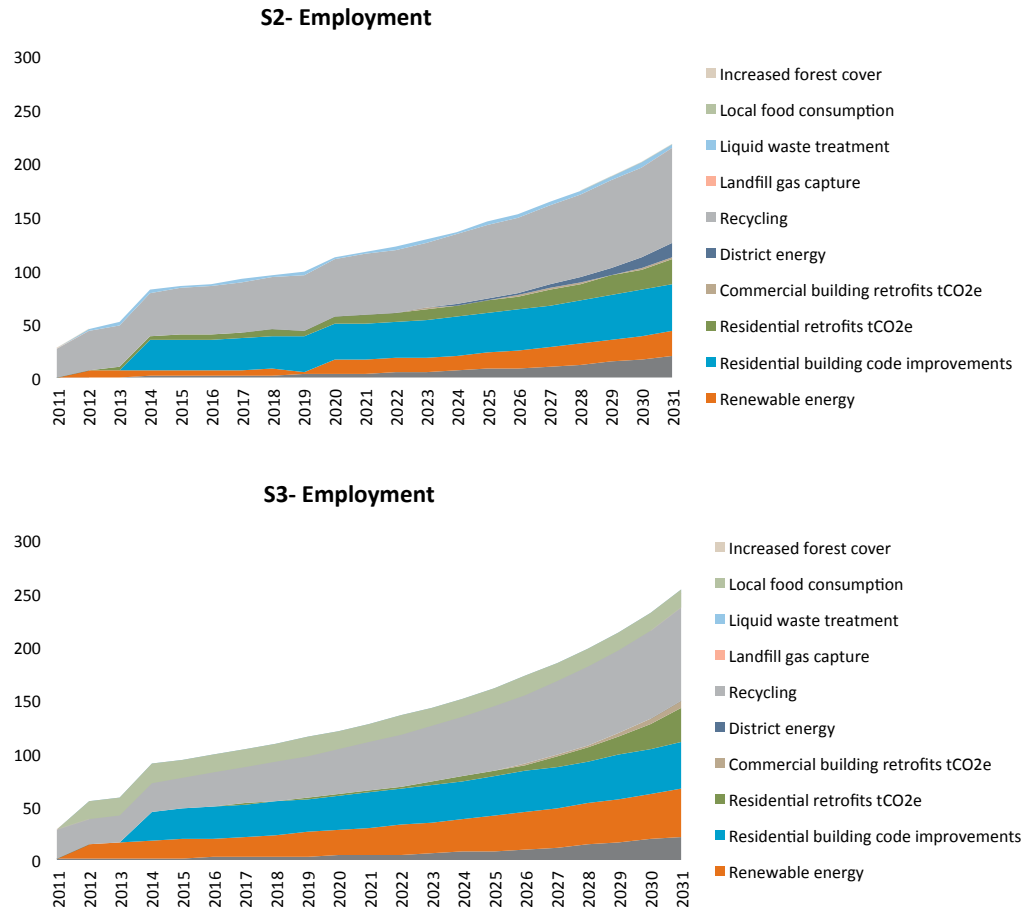


Figure 27. Scenarios 2 and 3 jobs created with reductions in GHG emissions and energy saving

8.3.3. Employment

Investments translate into employment and we estimated the number of new jobs that could be created by saving energy and reducing GHG emissions, beyond the trajectory of Scenario 1. This additional effort would generate approximately 250 new jobs by 2031 in Scenario 3 and slightly less in Scenario 2.

9 Discussion items

9.1. The Social Cost of Carbon

The complexity of the climate system makes it difficult to ascribe a value to future damages brought about by climate change. One economic strategy for expressing these damages is the Social Cost of Carbon (SCC), an estimate of the monetized damages associated with an increase in GHG emissions each year, including impacts on agriculture, human health, and property damage from the increased risk of floods. SCC is typically presented as a range of values, to capture the uncertainty of the estimate, and to incorporate discounting rates, which are used in economic analysis to recognize that people value dollars in hand more than dollars in the future. The SCC increases over time because future emissions are expected to produce larger incremental damages as physical and economic systems become more stressed in response to greater climatic change.

The SCC graphs in Appendix 5 show the four standard discount rate estimates and provide a compelling argument for Halton Hills to work to reduce GHG emissions. By 2031, the annual damages resulting from emissions in Halton Hills are estimated to be between $3 million (5% discount rate) and $74 million (3% discount rate, 95th percentile). These costs reflect the damage caused by climate change anywhere in the world as a result of Halton Hills' GHG emissions. There is no correlation between where the emissions are released and the damage incurred. In other words Halton Hills may suffer damage of greater or lesser value than this amount because of the overall impact of climate change. Halton Hills can use the SCC as a policy tool, requiring that it be calculated and incorporated into the economic decision-making for major projects. This helps to ensure that the economic analysis reflects the damage resulting from climate change and provides an economic case for selecting lower carbon options.

9.2. Different types of inventories

The modelling process is able to accommodate certain types of data. Others are difficult to include for various reasons. Figure 28 describes three different types of community inventories: 1) Pure geographic; 2) Geographic Plus; and 3) Consumption-based. Halton Hills' inventory is a geographic-plus approach in that it includes local emissions from natural gas combustion and transportation emissions, but it also includes off-site emissions from waste, transportation (travel to and from) and electricity production.

9.3. Emissions factors

9.3.1. Electricity

The emissions factor of electricity in Ontario is in flux with its planned phase-out of coal by

the end of 2014[46]. For electricity, emissions factors are determined by the mix of fuels used to generate electricity in a particular jurisdiction. The more renewable fuels in the mix, the fewer greenhouse gas emissions produced per unit of electricity (Figure 29). The fuel mix is complicated by the import and export of electricity from different jurisdictions in Ontario to meet peak demands or production lows. As a starting point, we used the emissions factor reported by the Government of Canada to the United Nations Framework Convention on Climate Change[47]. By phasing out coal, the emissions factor for electricity is likely to decrease, however that depends on the fuel mix of the imported electricity. Driving down the emissions factor for electricity is critical to reducing GHG emissions from electrical loads in households and emerging loads from electric vehicles. A decreasing emissions factor for electricity also supports a strategy of fuel switching from fossil fuels to electricity for buildings and transportation.

We used three different trends for emissions factors in each of the Scenarios (Figure 30). The rate of decline in the emissions factor reflects the composition of electricity generation. Scenario 3 assumes the most aggressive introduction of renewable electricity generation resulting in lower GHG emissions per unit of electricity while Scenario 1 assumes that the fuel mix for electricity generation does not substantially change.

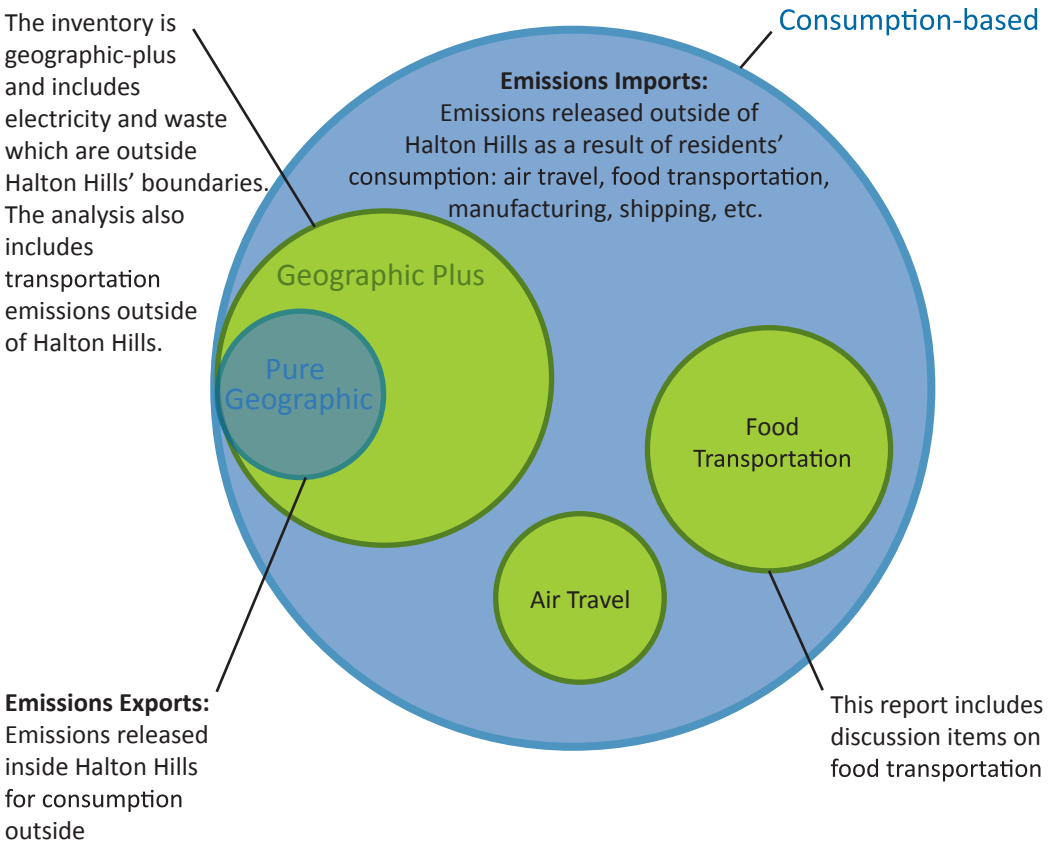


Figure 28. Types of community inventories

46 Government of Ontario. (2013) Ending Coal for Cleaner Air in Ontario. Retrieved January 21, 2014 from: http://news.ontario.ca/ene/en/2013/11/ending-coal-for-cleaner-air-in-ontario.html

47 Environment Canada. (2013) Canada's National Inventory Report. Retrieved January 2014 from: http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/can-2013-nir-15apr.zip

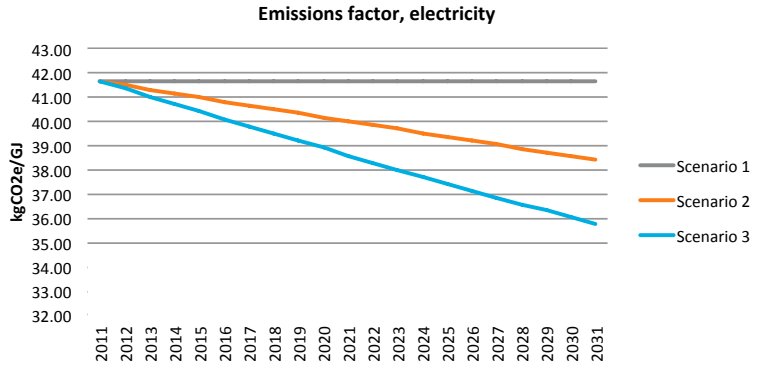


Figure 29. Projected emissions factors used in the modelling

Per unit of energy, electricity is the cleanest source available, meaning that fuel switching is a viable option for reducing GHG emissions.

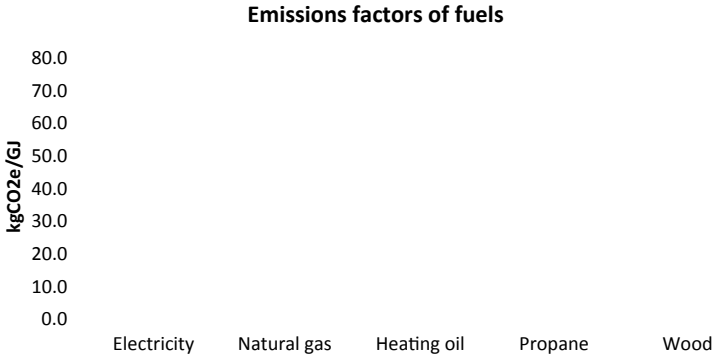


Figure 30. Emissions factors of different fuels, 2011

9.3.2. Natural gas

There is considerable discussion underway with respect to the emissions factor of natural gas. While it is the cleanest fossil fuel at point of combustion, the introduction of new methods to extract natural gas has given rise to a concern about its lifecycle GHG emissions, the emissions associated with production and combustion. One recent study suggests that leaks of methane from hydraulic fracturing mean that the greenhouse gas emissions associated with natural gas may actually be twice as high as coal over a twenty-year period[48z49]. There is considerable debate underway [50] as there are a number of variables, including well type and age, geological formation, and regulatory environment. This report assumes the default natural gas emissions factor and does not account for upstream GHG emissions.

48 Howard, R. et al. (2012) Methane emissions from natural gas systems: Background paper prepared for the National Climate Assessment. Retrieved January 2014 from: http://www.eeb.cornell.edu/howarth/publications/Howarth_et_al_2012_National_Climate_Assessment.pdf

49 Howarth, R. et al. (2011) Methane and the greenhouse-gas footprint of natural gas from shale formations. Climatic Change. Volume 106, Number 4, Pages 679–690.

50 Lovett, R. (2013) Study revises estimate of methane links from US gas fields. Nature: International weekly journal of science. Retrieved January 2014 from: http://www.nature.com/news/study-revises-estimate-of-methane-leaks-from-us-gas-fields-1.13748

9.4. Agricultural production emissions

Emissions associated with transporting food to Halton Hills were considered. Assuming each person in Halton Hills consumes 580 kg of food per year, two Ontario studies' estimates for GHG emissions for transportation from an imported basket of food versus food transported from farmers' markets were analyzed. One study[51] found grocery store food (i.e. imported food) emissions to be 1.0 kg CO2 per kilogram of food while a second study[52] determined grocery store food emissions to be 1.3 kg CO2 per kilogram of food. In comparison GHG emissions from locally-produced food items from the farmers market averaged 0.13 kg CO2 per kilogram of food. Using the 1.3 kg CO2 estimate the total emissions from agricultural production associated with feeding the population of Halton Hills is 63,000 tC02, or 1% of the community's total annual GHG emissions.

9.5. Rebound effect

The rebound effect can reduce the benefits of energy efficiency initiatives[53]. For example, the introduction of energy efficiency measures in the Building Code could result in the construction of larger homes so that the benefit of the efficiency is offset partially or fully by behaviour changes. As vehicles become more efficient in terms of their fuel consumption, there has been an increase in both driving speed and kilometres driven. This impact is not well understood and is controversial[54] but needs to be carefully considered in the design and implementation of energy efficiency projects. The rebound affect was not addressed in this analysis.

9.6. Induced benefits of efficiency

It is important to note that 1 kWh of electricity saved in Halton Hills represents greater savings than 1 kWh in the context of an electricity system. That 1 kWh used for lighting, equipment, heating or cooling requires the generation of more than 1 kWh to account for efficiency losses in the conversion of primary energy into electricity, the distribution of the electricity from the point of conversion to the point of end-use and the efficiency with which the electricity is converted to that end-use. As a result, reduction in demand of electricity in Halton Hills delivers significantly more reductions upstream, however these additions were not accounted for in this analysis.

51 Stephen Bentley (2005) Fighting Global Warming at the Farmer's Market. Retrieved from: www.foodshare.net/files/www/Food_Policy/Fighting_Global_Warming_at_the_Farmers_Market.pdf.

52 Xuereb, M. (2005) Food miles: Environmental implications of food imports to Waterloo Region. Region of Waterloo Public Health.

53 Jenkins, J., Nordhaus, T. and Shellenberger, M. (2011) Energy emergence: Rebound & Backfire as emergent phenomena. Breakthrough Institute. Retrieved January 2014 from: http://thebreakthrough.org/blog/Energy_Emergence.pdf

54 Burns, C. and Potts, M. (2011) The "Rebound Effect": A perennial controversy rises again. Solutions Journal 4(2). Rocky Mountain Institute. Retrieved January 2014 from: http://www.rmi.org/TheReboundEffectAPerennialControversyRisesAgain

10 Corporate plan

This chapter presents the specific actions that can be taken by the Town of Halton Hills on their own facilites and operations to reduce energy consumption and GHG emissions. Section 10.1 presents the results of the Corporate Energy Plan (CEP) to meet the requirements of *Regulation 397/11* of the *Ontario Green Energy Act (2009)* and section 10.2 presents the corporate PCP requirements.

All recommendations related to corporate activities are presented in this chapter.

10.1. Corporate Energy Plan

This section of the Mayor's Community Energy Plan integrates the Corporate Energy Plan (CEP). For more information, the full stand-alone document is available online at http://www.haltonhills.ca/initiatives/pdf/Energyplan/EnergyPlan_FINAL.pdf.

The Town of Halton Hills Corporate Energy Plan (CEP) provides a roadmap for energy management in the corporate Town of Halton Hills. The CEP describes the energy management activities that the Town as a corporation can take over the next 5 years to increase its energy efficiency, reduce its energy costs, and minimize its environmental footprint.

10.1.1. Planning horizon and scope

The CEP for the Town of Halton Hills is a 5-year plan covering the period from July 2014 to July 2019.

The CEP provides a roadmap for energy management at all of the Town's facilities. As can be seen in Figure 31, it addresses the use of electricity and natural gas in Town facilities, as well as some limited reference to fleet vehicle fuel.

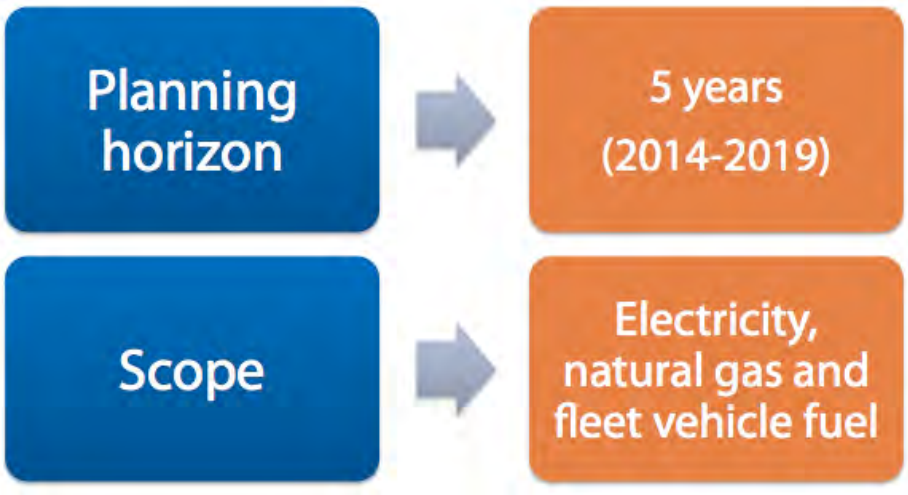


Figure 31. Planning horizon and scope

10.1.2. Planning process

Figure 32 depicts the major steps in the planning process that were used to develop the Town's *Corporate Energy Plan*. Key staff and stakeholders from the Town Technical Advisory Committee and Steering Committee were consulted throughout the planning process and provided valuable input, as referenced in chapter 5. Inputs to the planning process included:

- Analysis of the Town's energy use data
- Review of the Town's existing policies, plans, and past energy efficiency projects
- ASHRAE Level 2 audits of seven Town facilities
- Benchmarking of Town facilities against comparable facilities
- Interviews with Town staff (including department directors, the CAO, and O&M staff)
- Two strategic planning sessions with the Town Technical Advisory Committee and the Steering Committee
- Survey of Town staff regarding energy management and efficiency
- Review of energy management best practices in other jurisdictions

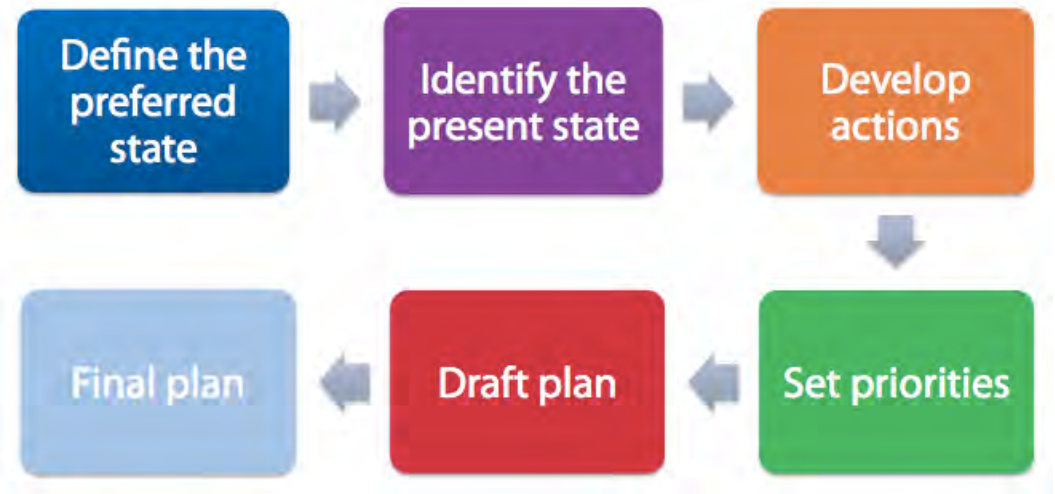


Figure 32. Overview of the planning process

Defining the preferred state involved exploring where the corporate Town of Halton Hills would like to be with respect to energy management. The elements of the preferred state were identified through interviews, a review of jurisdictional best practices, and through two strategic planning sessions. The preferred state informed the CEP's objectives, targets, and actions.

Identifying the present state involved exploring where the Town is now with respect to energy management. Energy data analysis; interviews; seven AHSRAE Level 2 audits; a review of the Town's existing policies, plans, and past energy efficiency projects; and benchmarking were among the inputs that were used to identify the present state. The audited buildings were chosen based on largest consumption, archetype, and above average energy intensity to increase the likelihood of identifying a significant number of cost-effective energy efficiency measures. Separate audit reports were produced for each of the buildings.

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 Town move towards the preferred state. Actions were identified through audits, interviews, strategic planning sessions, and the jurisdictional review of best practices. They were grouped according to the following categories:

- **Organizational commitment** – measures related to policies, targets, and resources required to enable energy management and the other actions
- **Existing buildings and equipment** – measures, both technical and policy based, that impact existing buildings and equipment
- **New buildings and equipment** – measures, both technical and policy based, that impact new buildings and equipment
- **Monitoring and tracking** – measures related to evaluating, monitoring, and verifying energy data
- **Communication and engagement** – measures related to encouraging behavioural modifications to save energy
- **Fleets** – measures related to Town fleet vehicles that reduce energy consumption
- **Procurement and renewables** – measures related to the procurement of energy and renewable technologies.

Setting priorities involved determining the timeframe for implementation of each action in the CEP. Organizational measures were prioritized based on their importance and ease of implementation. Technological measures were prioritized based on their internal rate of return (IRR) with adjustments to group similar measures together for more efficient implementation.

Preparing the Draft and Final Plan involved documenting the results of the planning process. As described in section 10.1.4.4, the CEP will be reviewed annually and updated at the end of the five years.

10.1.3. Framework for planning

The Town's *Corporate Energy Plan* addresses buildings, fleets and technologies – as well as people, processes, and information. As illustrated in Figure 33, the CEP centers on the Town's facilities. It aims to ensure that new and existing facilities are built and operated as efficiently and sustainably as possible. The Town's supporting organizational policies and processes, monitoring and tracking systems, and communication and engagement tools allow this to happen.

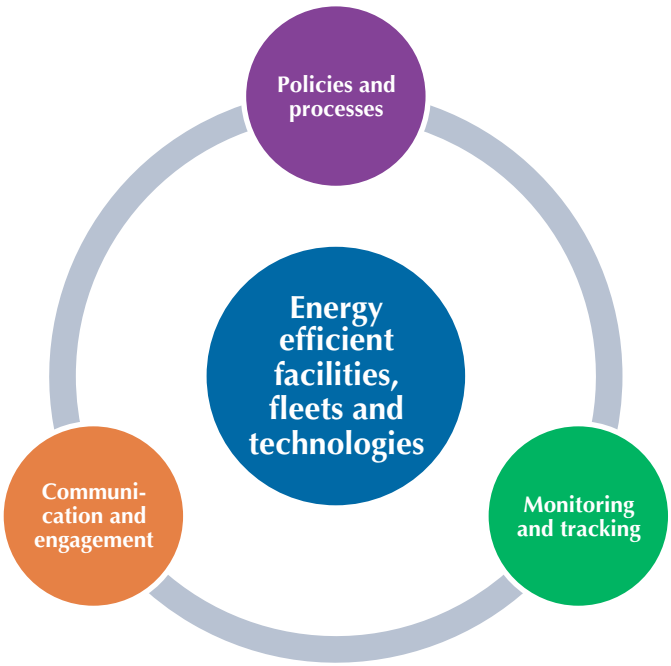


Figure 33. Framework for planning

10.1.4. Objectives and targets

10.1.4.1. Objectives

The primary objectives of the Town's *Corporate Energy Plan* are to achieve the following:

- The Town of Halton Hills is a national leader in the efficient management of energy in its operations.
- The efficient use of energy is part of the day-to-day activities of Town staff.
- The Town's environmental and financial sustainability are improved through energy management initiatives that are Practical, Affordable, Reasonable, Educational, and Enforceable.

10.1.4.2. Targets

Figure 34 illustrates the set of quantitative targets that should guide the Town's efforts on energy management from July 2014 to July 2019.

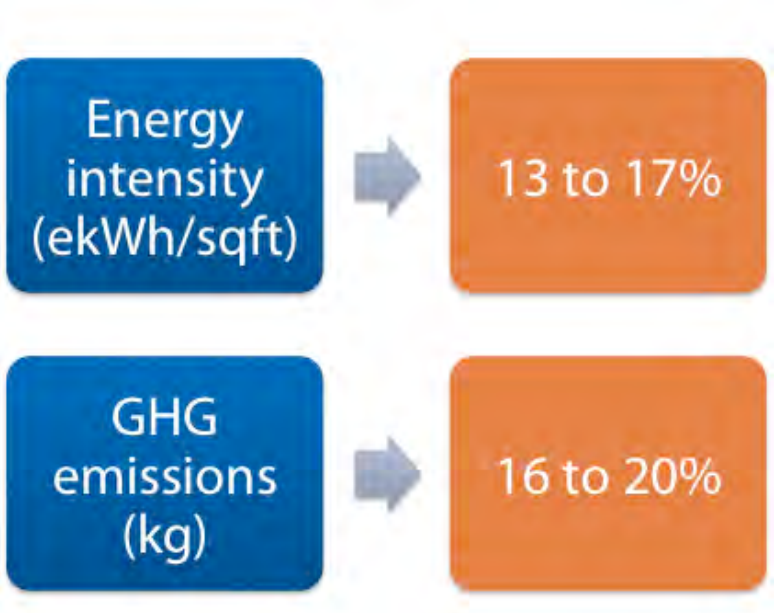


Figure 34. Energy intensity and GHG targets

The results of the ASHRAE Level 2 audits and benchmarking of the Town's buildings suggest that a 13% to 17% improvement in energy intensity and a 16% to 20% reduction in greenhouse gas (GHG) emissions in the existing building stock is very achievable. Halton Hills Hydro also estimates that by converting all streetlights to LED lights, the Town can achieve an additional 30% reduction in streetlight electricity consumption.

Table 10 outlines the break down of the targets over the 5-year term of the CEP based on the prioritization of technical actions discussed in sections 10.1.5.2, 10.1.6.2, and 10.1.7.2.

Table 10 Breakdown of energy intensity and GHG emissions reductions targets by plan phase

	Energy intensity (ekWH/sqft)	GHG emissions (kg)
Year 1	8.3%	11.0%
Years 2-3	6.9%	8.0%
Years 4-5	1.5%	1.4%
Overall	**16.7%**	**20.5%**

The targets were calculated based on the results of the audits completed in seven representative "archetype" buildings (Table 11). The percentage of energy intensity and GHG emissions reductions from the last reported levels (2011) for these buildings was calculated based on all recommended measures being undertaken during the five-year period. The savings were grouped according to facility type with the assumption that similar measures and savings could be achieved in other facilities of the same type. In the case of arenas and community centres, where more than one building was audited, the average weighted by square footage was used. The overall targets were derived by extrapolating the savings based on square footage by facility type to all facilities of the same type. All buildings that the Town of Halton Hills pays the utilities for that remained open beyond 2013 were included in the calculations except for those facilities that were judged to have very limited or no potential for energy savings measures due to the nature of their construction or level of usage.[55]

Due to uncertainty about whether the measures identified in the audited buildings will be transferable to the unaudited buildings, a target range from 80% of the estimated reductions to 100% of estimated reductions has been used. Thus, the energy intensity reduction target is 13% to 17% and the GHG emissions reduction target is 16% to 20%.

The targets are in line with the publicly reported energy intensity and GHG emissions reductions targets found in a sample of other municipalities.

Table 11 Estimated energy intensity and GHG emissions savings from facility audits[56]

Facility	Energy intensity (ekWh/sqft)	GHG emissions (kg)
Mold-Masters Arena	6.0%	6.5%
Acton Arena	9.7%	9.2%
Gellert Community Centre	30.6%	36.5%
Cedarvale Community Centre	9.3%	9.6%
Civic Centre	25.6%	35.6%
Acton Library	28.8%	37.9%
Acton Firehall	12.1%	12.6%

10.1.4.3. Updating and reporting on the plan

The *Corporate Energy Plan* should be reviewed at least once a year. As part of the annual review, the dedicated staff person assigned to oversee the implementation of the CEP (see Action 7, Table 12) should complete the following steps:

- Track the activities that have been implemented, based on a checklist of all of the actions included in the CEP;
- Track quantitative progress towards targets, using the KPIs provided in the action tables;
- Note any updates to the CEP based on new 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 a short report annually describing projects implemented, progress towards targets, updates to the CEP, and priority actions for the upcoming year; and
- In 2019, report on the implementation of the CEP as required under *Regulation 397/11*.

55 Cedarvale Cottage, Prospect Park Pavilion, Central Yard – Office Trailer, Central Yard – Works Garage, Central Yard - Stores Building, Acton Yard - Equipment Depot.

56 Audit of Mold-Masters Arena only included the old section of the arena, as the new section was not complete at the time of the audit. Audit of Acton Library was conducted on the new Acton Library constructed in 2011.

Include detail on: energy and GHG emissions for 2017; current and proposed energy conservation and demand management measures; a report of results achieved; and a revised forecast of the expected results of the current and proposed measures.

10.1.5. Priority actions (Year 1, July 2014 - July 2015)

In the first year of the CEP (July 2014 – July 2015), the Town should implement the high-priority organizational actions presented in Table 12. These actions are very important, as they directly or indirectly impact the Town's energy performance. All of these actions are easy enough to be initiated (and often completed) in Year 1. These actions are grouped by category and are numbered for ease of identification. The numbering is not an indication of importance; however, some actions will need to be completed first as they may directly impact other actions. For instance, it will be imperative at the onset to establish the necessary resources for implementing the CEP, including assigning a dedicated staff person and developing a centralized energy facilities management role.

In the first year of the CEP, the Town should also implement the high-priority technical actions for retrofitting the Town's existing buildings, as presented in Table 13.

The technical actions were based on audits conducted on seven Town facilities of a variety of archetypes and then extrapolated across all Town buildings. The actions were grouped together based on the type of measure so that a single tender could be issued to implement a group of actions in order to reduce cost and administrative burden. The estimated cost for each measure was based on the project costs and incentives in the audit reports[57]. The internal rate of return (IRR) and net present value (NPV)[58] for each measure were calculated from the estimated costs and reduced utility costs. The projected costs and NPV for each group of measures was based on extrapolating the measures in the group for all audited buildings to all applicable Town buildings. The groups of actions are prioritized based on average IRR of the component measures and ease of implementation.

The NPV is a way of assessing the financial benefit of spending the capital funds on an energy conservation measure. The NPV includes all of the cumulative energy cost savings that will be realized by implementing the measure over the lifespan of the measure, taking into account expected increases in energy prices, based on government estimates. The NPV also takes inflation into account by including the value of the original capital cost multiplied by a standard interest rate (in this case, 5%). Thus, if a NPV is positive, it means that the capital cost investment on the energy efficiency measure is better than putting the money into an investment with a 5% rate of return. If the NPV is negative, the energy efficiency measure is not considered a good investment from a financial perspective.

For example, if an energy efficiency measure has an initial cost of $1,000, a lifespan of 20 years

57 The project cost estimates are developed based on Mindscape's experience from other energy audits, project cost from previously implemented projects, and quotes from suppliers that Mindscape has worked with in the past. Project costs include purchase and installation of the measures, but do not include additional resources for project management, procurement, or preparation of specifications, etc. These costs are scaled to fit the subject project at the client's site, but do not account for many of the specific and unique requirements of each client or building. ASHRAE, the regulatory body that determines the requirements for a Level 2 audit, states that the project costing estimate should have an accuracy of +/- 50%. This is a wide range for accuracy, and further indicates that although the energy savings analysis should be accurate, detailed project costing is not within the purview of the audit.

58 The utility rates used to calculate the IRR and NPV were based on the average utility costs from the utility analysis in the audit reports. The electricity rate was adjusted based on the Industrial Price Forecast on page 8 of Ontario's Long-Term Energy Plan (http://www.energy.gov.on.ca/docs/LTEP_2013_English_WEB.pdf). The natural gas rate was adjusted based on the natural gas price reference projections in Natural Resource Canada's report on Canada's Energy Future: Energy Supply and Demand Projections to 2035 - Energy Market Assessment (http://www.neb-one.gc.ca/clf-nsi/rnrgynfmtn/nrgyrprt/nrgyftr/2011/nrgsppldmndprjctn2035-eng.html). A discount rate of 5% was used in calculating the NPV.

and a net present value of $10,000, this means that the value of the $1,000 investment in the measure is $10,000 in current value over the 20 years in comparison to investing the same $1,000 at a 5% interest rate for the same time period. In this example the measure will have cumulative energy cost savings of $10,000 over 20 years over and above the $1,000 multiplied by a compound interest rate of 5% each year for the same 20 years. NPV is a more robust measure of the value of an investment than simply showing the annual return on that investment, as it takes into account the total value of the investment over it's lifetime compared to the standard rate of return available on the same initial investment.

10.1.5.1. Organizational actions

Table 12 Preferred state, priority actions, and metrics for tracking implementation

Preferred state of energy management	Priority actions	Metrics / KPI
Organizational commitment		
The Town's energy management activities are guided by ambitious yet achievable targets.	1. Formally adopt 5-year corporate targets for energy intensity and GHG emissions. 2. Formally adopt long-term corporate GHG emissions targets to align with the community-wide targets. 3. Formally adopt interim targets to assist in tracking progress towards 5-year goals. (See section 10.1.4 for specific objectives and targets).	Targets adopted (y/n)
The Town is progressive in energy management and strives for excellence.	4. Continue to apply to community awards (e.g. OPA Community Conservation Award, QUEST Community Energy Builder award).	Number of award applications submitted Number of awards received
The Town's energy management activities are guided by an up-to-date energy plan.	5. Develop a process for updating the CEP in the interim and after 5 years.	Updating process developed (y/n)
The Town continues to own Halton Hills Hydro and maintains its excellent working relationship with Halton Hills Hydro and Union Gas.	6. Continue to foster an excellent relationship with Halton Hills Hydro and Union Gas.	Number of meetings Number of projects developed
Dedicated staff are available to implement the energy plan.	7. Assign a dedicated staff person to implement the CEP and track energy initiatives. (See section 10.1.10 for more detail).	Staff assigned to implementing the CEP (y/n)

Preferred state of energy management	Priority actions	Metrics / KPI
The Town has a centralized facility management role to ensure a consistent approach to energy management across all buildings.	8. Develop a centralized energy facilities management role within the Town to act as a resource for implementing energy initiatives. (See section 10.1.10 for more detail).	Role developed (y/n) Person assigned to the role (y/n)
Existing buildings and equipment		
The Town strategically implements all cost effective energy efficiency projects in existing buildings.	Implement all retrofit measures identified as priority actions in all applicable buildings: 9. Plumbing – DHW optimization measures in all applicable buildings. 10-11. General and specialized HVAC optimization measures in all applicable buildings. 12. IT plug load measure in all applicable buildings. 13-14. General and specialized construction air sealing measures in all applicable buildings. (See full list in Table 13).	Retrofit projects implemented (y/n) ekWh and m^3 saved $ saved on energy bills
Facilities staff proactively explore new energy efficiency opportunities and new technologies.	15. Consistently set ice temperatures in arenas to 23°F. 16. Develop a formal process for soliciting ideas from O&M staff. (See section 10.1.12 for more detail).	Energy savings achieved (ekWh) Process developed (y/n) Number of ideas brought forward Number of ideas implemented ROI / savings achieved

Preferred state of energy management	Priority actions	Metrics / KPI
Projects are prioritized in a consistent way, using clear criteria and appropriate metrics, and the Town implements retrofit projects that are cost-effective over longer time periods.	17. Formalize the criteria and metrics for prioritizing energy efficiency projects. Criteria should include: life-cycle costing of the project, available incentives, occupant comfort and regulatory requirements, ease of implementation, achievable energy savings, and contribution to demonstrating leadership. Appropriate weighting for these criteria should be developed. (See Appendix 7 for more detail).	Criteria and metrics formalized (y/n)
All buildings operate in an energy efficient manner.	18. Develop consistent guidelines and policies for energy management to be followed at all Town facilities. 19. Develop a corporate re-commissioning plan.	Guidelines and policies developed (y/n) Re-commissioning plan developed (y/n)
New buildings and equipment		
The Town has specific energy efficiency standards for new buildings that are outlined in the Corporate Sustainable Building Policy (CSBP) .	20. Implement the comprehensive CSBP. 21. Develop energy efficiency processes for new construction to be incorporated into the CSBP. 22. Include siting of Town buildings (e.g. close together) as part of the CSBP.	CSBP implemented (y/n) Energy efficiency process for new construction developed (y/n) Process incorporated into CSBP (y/n) Siting of buildings incorporated in CSBP (y/n)
Monitoring and tracking		
The Town uses KPIs to track progress towards targets.	23. Formalize KPIs and tracking mechanisms to monitor and report on progress towards interim and 5-year targets (e.g. ekWh/sqft, kg CO^2eq).	KPIs adopted (y/n)
The Town has real-time building level data for all utilities at an appropriate level of granularity (e.g. daily).	24. Investigate options for an energy management system (EMS) to be used to track and analyze energy use at the building level. (See section 10.1.11 for details).	EMS investigated (y/n) EMS chosen (y/n)

Preferred state of energy management	Priority actions	Metrics / KPI
Project evaluation, monitoring and verification (EM&V) is simple and accurate thanks to energy data and monitoring processes.	25. Develop a process for evaluating the savings achieved from energy efficiency projects.	Evaluation process developed (y/n
Communication and engagement		
Project-specific communication and education helps building occupants (staff and public) appreciate energy efficiency retrofits.	26. Make energy management related information available on the Town's Internet and Intranet websites so that staff and the community are aware of Town's energy initiatives. (See section 10.1.12 for details).	Information on Town websites (y/n) Number of people visiting energy page
All O&M staff are trained and understand how to identify energy saving opportunities.	27. Investigate / develop general training on energy efficiency for all O&M staff. (See section 10.1.12 for details). 28. Ensure that all staff responsible for operation and maintenance of specific buildings are appropriately trained. (See section 10.1.12 for details and audit reports for specific training recommendations).	Training investigated / developed (y/n) Number of staff trained
The Town relays a common and consistent message about energy, greening and sustainability, and this message is communicated succinctly and directly to all staff including O&M staff.	29. Develop a single brand for communicating about energy, greening and sustainability (consider using the new sustainability logo). (See section 10.1.12 for more detail).	Brand established (y/n) Brand utilized (y/n)
O&M staff communicate and share energy efficiency methods and best practices.	30. O&M staff across departments meet quarterly to discuss energy efficiency activities conducted in that quarter.	Meetings set up quarterly (y/n) Number of O&M staff attending meetings

10.1.5.2. Technical actions

Table 13 includes the priority technical actions to be implemented in the first year of the plan. The technical actions are based on recommendations from the audits conducted on seven representative buildings and are prioritized based on their IRRs. Detailed information on each technical action can be found in the accompanying audit reports for each of the facilities.

The actions are grouped together by type in order to facilitate the Town issuing a single tender for similar measures in all applicable buildings. For example, the auditors recommended doing air sealing at Cedarvale Community Centre and the conditioned part of the Acton Fire hall –

these were grouped together and extrapolated to include air sealing in all applicable buildings. "All applicable buildings" refers to buildings where the measures were identified in the audits, in addition to buildings that were not audited where the same or similar measures could be undertaken.

The projected cost and NPV numbers are estimates based on industry average data, research and analysis; they may not match actual costs and savings.

Table 13 Priority technical actions for Year 1

Measures	Buildings	Projected cost (including incentives estimates)	Projected net present value	Internal rate of return
9.Plumbing - DHW optimization	All applicable buildings	$0	$3,454	
DHW recirculation pump on auto	Acton Library	$0	$2,300	N/A
DHW optimization	All unaudited buildings	$0	$1,155	N/A
10. General HVAC optimization	All applicable buildings	$41,961	$533,638	
Inspect RTU economizers, install CO_2 sensors, and reduce exhaust fan operation	Gellert Centre	$10,107	$243,820	176%
Add basic controls to electric baseboard heaters	Civic Centre	$8,868	$38,573	40%
CO_2 sensing	Civic Centre	$7,826	$44,537	48%
Vestibule heater settings	Acton Library	$0	$7,653	N/A
HVAC system controls	Acton Fire hall	$1,134	$20,685	139%
General HVAC optimization	All unaudited buildings	$14,026	$178,371	N/A
11. Specialized HVAC optimization	All applicable buildings	$0	$11,044	
Truck-bay temperature	All applicable buildings	$0	$3,023	N/A
Specialized HVAC optimization	All applicable buildings	$0	$8,021	N/A
12. IT - plug load	All applicable buildings	$0	$19,569	
Workstation and server electrical efficiencies	Civic Centre	$0	$13,028	N/A
IT - plug load	All unaudited buildings	$0	$6,541	N/A

Measures	Buildings	Projected cost (including incentives estimates)	Projected net present value	Internal rate of return
13. General construction air sealing	All applicable buildings	$4,924	$34,136	
Air sealing	Cedarvale Community Centre	$1,200	$6,516	46%
Air sealing of the conditioned building	Acton Fire hall	$2,078	$16,211	109%
General construction air sealing	All unaudited buildings	$1,646	$11,410	N/A
14. Specialized construction air sealing	All applicable buildings	$2,923	$14,429	
Air seal generator room	All applicable buildings	$800	$3,949	74%
Specialized air sealing	All applicable buildings	$2,123	$10,480	N/A
Totals for Year 1		**$49,808**	**$616,270**	

NOTE: THE INTERNAL RATE OF RETURN (IRR) WAS CALCULATED FOR MEASURES THAT WERE IDENTIFIED IN THE AUDITS. THE IRR COULD NOT BE CALCULATED FOR MEASURES WITH NO PROJECTED COSTS AND WERE NOT CALCULATED FOR THE ESTIMATES MADE FOR UNAUDITED BUILDINGS.

10.1.6. Medium term actions (Years 2-3, July 2015 – July 2017)

In Years 2 and 3 of the CEP (July 2015 – July 2017), the Town should ensure that all of the priority actions have been completed, and are being maintained as required. The Town should also pursue the organizational actions presented in Table 14 below, and the technological actions presented in Table 15. These actions are grouped by category and are numbered for ease of identification. The numbering is not an indication of importance.

10.1.6.1. Organizational actions

Table 14 Preferred state, medium-term actions, and metrics for tracking implementation

Preferred state of energy management	Medium-term actions	Metrics / KPI
Organizational commitment		
The Town's energy management activities are guided by ambitious yet achievable targets.	31. Re-affirm commitment to targets.	Targets reaffirmed (y/n)
The Town tracks progress towards targets.	32. Track and assess progress on interim targets and Year 1 actions.	Energy intensity (ekWh/m^2) Total energy use (ekWh, m^3) Percentage of actions implemented

Preferred state of energy management	Medium-term actions	Metrics / KPI
Energy management is highly recognized as a strategic opportunity and priority in all policy and planning activities.	33. Include energy management as an important objective for the Town corporation.	Energy management included as an important objective (y/n)
The Town takes advantage of available incentives from utility companies.	34. Develop a process for continually monitoring available incentives, and applying for incentives.	Number of incentive applications submitted Monetary value ($) of incentives obtained
The Town has a staff committee that keeps track of CEP initiatives.	35.Expand the scope of the Staff Sustainability Team to help champion the CEP's implementation and behaviour change programs, and to provide resources and assistance to the dedicated staff person. (See section 10.1.10 for more detail).	Staff Sustainability Team's scope expanded (y/n)
The Town has a clear and dedicated process to fund energy efficiency projects, and money obtained from energy savings is re-invested into energy projects.	36. Develop a mechanism (e.g. a revolving fund) through which savings from energy projects are re-invested in new energy projects.	Fund and mechanism developed (y/n) Amount of savings re-invested ($)
Existing buildings and equipment		
The Town strategically implements all cost effective energy efficiency projects in existing buildings.	Implement all retrofit measures identified as medium-term actions in all applicable buildings: 37. Plumbing – Domestic Hot Water (DHW) insulation measure in all applicable buildings. 38. Specialized plumbing – Variable Frequency Drive (VFD) measures in both arenas. 39. General plumbing – VDF measures in all applicable buildings. 40. Lighting control measures in all applicable buildings. 41. Specialized HVAC measures in all community centres. 42. Utility analysis measures in all applicable buildings. (See full list in Table 15).	Retrofit projects implemented (y/n) ekWh and m^3 saved $ saved on energy bills

Preferred state of energy management	Medium-term actions	Metrics / KPI
Energy efficiency is considered when conducting large renovations of existing buildings.	43. Develop a standard requiring that energy efficiency be considered in all building renovations.	Standard developed (y/n)
All buildings operate in an energy efficient manner.	44. Implement guidelines and policies that were developed in Year 1 for energy management to be followed at all facilities. 45. Develop and implement a corporate O&M preventative maintenance program in remaining buildings. 46. Implement corporate re-commissioning plan that was developed in Year 1.	O&M preventative maintenance program developed (y/n)
New buildings and equipment		
Strong, formal processes exist to ensure that all new equipment is highly energy efficient and appropriately sized.	47. Identify and adopt energy efficient equipment standards to be followed when replacing equipment (e.g. Energy Star).	Equipment standards adopted (y/n)
Energy is considered at all stages of new building design and development, including so the Town can add renewable energy technologies in the future.	48. Develop formal guidelines for considering energy at all stages of new building development (e.g. budgeting, procurement, design, construction / change management).	Guidelines developed (y/n)
Energy performance of new buildings is always verified after construction.	49. Develop a formal commissioning policy based on current practices for new buildings to verify energy performance after construction. Embed policy in the existing CSBP.	Formal commissioning policy developed and embedded in CSBP (y/n)
Monitoring and tracking		
The Town has real-time building level data for all utilities, at an appropriate level of granularity (e.g. daily).	50. Conduct an assessment of the metering needs of each building. 51. Ensure each building is appropriately metered for each utility (e.g. interval and sub-meters). 52. Implement the EMS chosen in Year 1 to track and analyze energy use at the building level.	Assessment of metering needs conducted (y/n) Required meters purchased and installed (y/n) Energy management system implemented (y/n)

Preferred state of energy management	Medium-term actions	Metrics / KPI
The Town has the capacity to manage, analyze, and use energy data from meters.	53. Develop a plan for analysis and use of energy data. 54. Allocate sufficient and appropriate staff resources to collect and manage energy data.	Data analysis and reporting system developed (y/n) Staff resources allocated (y/n)
Staff have easy and up-to-date access to energy data for each facility.	55. Develop / purchase an energy dashboard that provides operators, management, and the community with appropriate information on energy use utilizing existing resources (e.g. Halton Hills Hydro and Union Gas).	Energy dashboard selected (y/n) Energy dashboard implemented (y/n)
Project EM&V is simple and accurate thanks to energy data and monitoring processes.	56. Develop a process for rolling out successful energy efficiency projects.	Process for rolling out energy projects developed (y/n)
The Town uses KPIs to track progress towards targets.	57. Develop building level KPIs and produce a quarterly evaluation report for each building that is made public and identifies the status of the KPIs (e.g. number of energy efficiency initiatives implemented, energy saved).	Building level KPIs developed (y/n) Building level KPIs reported each quarter (y/n) Energy saved (ekWh and m^3)
Communication and engagement		
Project-specific communication and education helps building occupants (staff and public) appreciate energy efficiency retrofits.	58. Develop standardized education and communication tools (e.g. poster boards, brochures) for retrofit projects (e.g. lighting retrofit) and/or changes in building comfort levels for staff and the public.	Standardized communication tools deployed (y/n) Changes in attitudes and behaviours
All staff have the tools and training to identify energy management opportunities and are actively engaged in submitting ideas.	59. Develop an employee engagement process for all staff based on the O&M pilot program implemented in Year 1. (See section 10.1.12 for more detail).	Employee engagement process developed (y/n) Changes in attitudes and behaviours
All O&M staff are trained and understand energy and energy saving opportunities.	60. Implement general training on energy and energy efficiency for O&M staff identified in Year 1. (See section 10.1.12 for more detail).	Number of staff trained

Preferred state of energy management	Medium-term actions	Metrics / KPI
All O&M staff receive appropriate training on the use of new energy efficiency technologies and equipment.	61. Implement project specific training for O&M staff as needed (e.g. new technology, new piece of equipment). (See section 10.1.12 for more detail).	Number of staff trained
All staff are aware of energy conservation and the actions they can take to save energy within the Town facilities.	62. Develop and implement a corporate Town-wide energy, greening and sustainability behaviour change program for all staff with the assistance of the Staff Sustainability Team. (See section 10.1.12 for more detail).	Behaviour change program developed (y/n) Changes in attitudes and behaviours
The Town's O&M staff work together with other municipalities to share technologies and best practices.	63. Set up regular site visits and meetings with O&M staff from other municipalities to share information and tour facilities. 64. Continue to send O&M staff to conferences for information sharing.	Number of site visits Number of O&M staff attending site visits Number of O&M staff attending conferences
Fleets		
All fleet vehicles are operated in the most energy efficient manner while meeting the needs of their intended use.	65. Develop guidelines to operate vehicles in the most energy efficient manner (e.g. anti-idling). 66. Implement a driver-training program (e.g. Shuttle Challenge). (See section 10.1.12 for more detail). 67. Develop a policy for purchasing the right-sized vehicles.	Guidelines developed (y/n) Number of drivers trained Reduction in annual fuel consumption per vehicle-km Policy for purchasing right-sized vehicles developed (y/n)
Renewables and procurement		
The Town's energy procurement systems consider cost, predictability, and environmental impacts.	68. Ask contracted procurement advisors how to consider environmental impacts in electricity and natural gas purchasing decision (e.g. from renewable sources).	% of energy purchased from environmentally benign sources

Preferred state of energy management	Medium-term actions	Metrics / KPI
All fleet vehicles selected and purchased are the most energy efficient and meet the needs for their intended use. All fleet vehicle fuel purchased is from alternative sources.	69. Develop procurement standards for vehicles to encourage vehicles that include energy efficiency and alternative fuel purchases.	Procurement standards developed (y/n)

59

10.1.6.2. Technical actions

Table 15 includes the medium-term technical actions to be implemented in Years 2 and 3 of the plan. The technical actions are based on recommendations from audits completed on seven representative buildings and are prioritized based on their internal rates of return. Detailed information on each technical action can be found in the accompanying audit reports for each of the facilities.

The actions are grouped together by type in order to facilitate the Town issuing a single tender for similar measures in all applicable buildings. For example, the auditors recommended installing daylighting & occupancy sensor in the Gellert Centre, fixing the daylighting sensors in the Acton Library and installing a motion sensor at the Acton Fire hall. These were grouped together and extrapolated to include retrofits to lighting controls in all applicable buildings. "All applicable buildings" refers to buildings where the measures were identified in the audits, in addition to buildings that were not audited where the same or similar measures could be undertaken.

The projected cost and NPV numbers are estimates based on industry average data, research and analysis; they may not match actual costs and savings.

Table 15 Medium-term technical actions for Years 2-3

Measures	Buildings	Projected cost (including incentives estimates)	Projected net present value	Internal rate of return
15. Plumbing - Domestic Hot Water (DHW) insulation	All applicable buildings	$4,506	$7,387	
Water heaters (insulate)	Mold-Masters	$3,000	$4,918	38%
Plumbing - DHW insulation	All unaudited buildings	$1,506	$2,469	N/A
39. Specialized plumbing – Variable Frequency Drive (VFD)	All arenas	$28,610	$185,636	
VFD on glycol pumps	Mold-Masters	$21,610	$65,132	34%
VFD on circulation pumps	Acton Arena	$7,000	$120,504	147%
40. General plumbing – VFD	All applicable buildings	$11,743	$93,213	

59 For more information on the Shuttle Challenge, refer to: http://www.shuttlechallenge.ca

Measures	Buildings	Projected cost (including incentives estimates)	Projected net present value	Internal rate of return
VFD on glycol circulation pump	Civic Centre	$7,818	$62,056	74%
General plumbing – VFD	All unaudited buildings	$3,925	$31,157	N/A
41. Lighting controls	All applicable buildings	$9,477	$38,317	
Put daylighting & occupancy sensor on Kinsmen room lights	Gellert Centre	$3,301	$7,356	25%
Daylighting sensors over-ridden	Acton Library	$0	$4,145	N/A
Commission outdoor light timer	Acton Library	$2,759	$10,729	37%
Motion sensor for heritage room lights	Acton Fire hall	$250	$3,279	104%
Lighting controls	All unaudited buildings	$3,168	$12,808	N/A
42. Specialized HVAC	All community centres	$37,740	$115,099	
Heat Recovery Ventilation (HRV) on pool area exhaust fan	Gellert Centre	$30,000	$91,493	44%
Specialized HVAC	All unaudited community centres	$7,740	$23,606	N/A
43. Consultant - utility analysis	All applicable buildings	$7,510	$59,143	
Investigate lost hydro	Acton Library	$5,000	$39,374	66%
Consultant - utility analysis	All unaudited buildings	$2,510	$19,769	N/A
Totals for Years 2-3		**$99,587**	**$498,795**	

NOTE: THE INTERNAL RATE OF RETURN (IRR) WAS CALCULATED FOR MEASURES THAT WERE IDENTIFIED IN THE AUDITS. THE IRR COULD NOT BE CALCULATED FOR MEASURES WITH NO PROJECTED COSTS AND WERE NOT CALCULATED FOR THE ESTIMATES MADE FOR UNAUDITED BUILDINGS.

10.1.7. Long term actions (Years 4-5, July 2017 – July 2019)

In Years 4 through 5 of the CEP (July 2017 – July 2019), the Town should ensure that all of the priority and medium-term actions (both organizational and technological) have been completed, and are being maintained as required.

The Town should then pursue the organizational actions presented in Table 16. In addition, the Town should pursue the technical actions provided in Table 17 below. These actions are grouped by category and are numbered for ease of identification. The numbering is not an indication of importance.

10.1.7.1. Organizational actions

Table 16 Preferred state, long-term actions, and metrics for tracking implementation

Preferred state of energy management	Long-term actions	Metrics / KPI
Organizational commitment		
The Town's energy management activities are guided by ambitious yet achievable targets.	70. Re-affirm commitment to targets. 71. Prepare plan update (See section on Updating and reporting on the plan).	Targets re-affirmed (y/n) Plan update prepared (y/n)
The Town tracks progress towards targets.	72. Track and assess progress on interim targets and Years 2-3 actions.	Energy intensity (ekWh/m^2) Total energy use (ekWh, m^3) Percentage of actions implemented
Existing buildings and equipment		
The Town strategically implements all cost effective energy efficiency projects in existing buildings.	Implement all technical measures identified as long-term actions in all applicable buildings: 73. Lighting retrofits in all applicable buildings. (See full list in Table 17)	Retrofit projects implemented (y/n) ekWh and m^3 saved $ saved on energy bills
All buildings operate in an energy efficient manner.	74. Continue to implement and update guidelines and policies for energy management to be followed at all facilities. 75. Continue to implement the corporate O&M preventative maintenance program. 76. Continue to implement the corporate re-commissioning plan.	Guidelines updated (y/n)
Monitoring and tracking		
The Town has real-time building level data for all utilities, at an appropriate level of granularity (e.g. daily).	77. Continue to use the EMS selected in Year 1 to track and analyze energy use at the building level.	EMS utilized (y/n)
The Town has the capacity to manage, analyze, and use energy data from meters.	78. Conduct an assessment to ensure that energy data needs are being met, and that staff resources are adequate to manage and collect the data.	Assessment conducted (y/n)

Preferred state of energy management	Long-term actions	Metrics / KPI
The Town understands how all buildings are performing, relative to other comparable buildings.	79. Identify an appropriate benchmarking system to monitor the energy performance of buildings (e.g. Energy Star) or join an existing benchmarking group (e.g. Mayor's Megawatt Challenge).	Benchmarking system used (y/n) Number of buildings benchmarked
Communication and engagement		
The Town's O&M staff work together with other municipalities to share technologies and best practices.	80. Continue to set up regular site visits and meetings with O&M staff from other municipalities to share information and tour facilities. 81. Continue to send O&M staff to conferences for information sharing.	Number of site visits Number of O&M staff attending site visits Number of O&M staff attending conferences
Fleets		
All fleet vehicles are operated in the most energy efficient manner while meeting the needs of their intended use.	82. Continue to implement the driver-training program (e.g. Shuttle Challenge).	Number of drivers trained
Renewables and procurement		
The Town is pursuing net-zero energy use.	83. Examine the feasibility of installing renewables or other alternative generation (e.g. district energy, combined heat and power).	Number of feasibility studies conducted
The Town has a clear process to guide renewable energy development. This process leads to visible and cost-effective renewable energy projects.	84. Develop a process for identifying, evaluating, and developing renewable energy projects.	Process developed (y/n)
The most energy efficient option for work related travel is selected.	85. Produce guidelines for selecting the most energy efficient travel option for work related travel.	Travel guidelines developed (y/n)

10.1.7.2. Technical actions

Table 17 includes the long-term technical actions to be implemented in the fourth and fifth years of the plan. The technical actions are based on recommendations from audits completed on seven representative buildings and are prioritized based on their internal rates of return. Detailed information on the recommended action can be found in the accompanying audit reports for each of the facilities.

The actions are grouped together by type in order to facilitate the Town issuing a single tender for similar measures in all applicable buildings. In this case, the auditors recommended lighting upgrades in the Mold Masters SportsPlex and Acton Arena as well as an adjustment to lighting

density in the Gellert Community Centre. These were grouped together and extrapolated to include energy saving lighting retrofits in all applicable buildings. “All applicable buildings” refers to buildings where the measures were identified in the audits, in addition to buildings that were not audited where the same or similar measures could be undertaken.

The projected cost and NPV numbers are estimates based on industry average data, research and analysis; they may not match actual costs and savings.

Table 17 Long-term technical actions for Years 4-5

Measures	Buildings	Projected cost (including incentives estimates)	Projected net present value	Internal rate of return
76. Lighting retrofit	All applicable buildings	$101,244	$41,480	
Lighting in rink A	Mold-Masters	$19,400	$7,414	21%
Lighting in both rinks	Acton Arena	$25,400	$13,592	27%
Adjust lighting density	Gellert Centre	$22,603	$6,609	17%
Lighting retrofit	All unaudited buildings	$33,841	$13,865	N/A
Totals for Years 4-5		**$101,244**	**$41,480**	

NOTE: THE INTERNAL RATE OF RETURN (IRR) WAS CALCULATED FOR MEASURES THAT WERE IDENTIFIED IN THE AUDITS. THE IRR COULD NOT BE CALCULATED FOR MEASURES WITH NO PROJECTED COSTS AND WERE NOT CALCULATED FOR THE ESTIMATES MADE FOR UNAUDITED BUILDINGS.

10.1.8. Capital costs and net present values

This section summarizes the extrapolated capital costs and net present values associated with implementing all of the technical actions recommended in the seven audited buildings and the equivalent measures in the appropriate unaudited buildings. The measures are listed in Table 13, Table 15, and Table 17 and include: plumbing upgrades; heating, ventilation, and air conditioning optimization; installing lighting controls; building envelope upgrades, and lighting retrofit measures. The groups of technical actions were allocated across the five years of the plan in order to facilitate an annual net capital cost of approximately $50,100 in each year for budgeting purposes.

Table 18 shows the breakdown of net capital costs and NPVs of the technical measures broken down by the plan phases. This shows that, the Town will realize a total NPV of over $1 million by investing an average of roughly $50,100 each year over the next five years, for a total of $250,639.

The costs listed in the table below only include the costs associated with the technical measures. Additional costs will be required to implement some of the organizational measures, which may include: hiring third party contractors (e.g. to implement training programs and communication and engagement activities), auditing additional facilities, sending staff to conferences, and purchasing an EMS. Other costs associated with organizational actions will be mainly in the form of staff time (e.g. full-time equivalents (FTEs)).

Table 18 Net capital costs and present values for all technical actions

	Net capital cost (all measures)	Net present value (all measures)
Year 1	$49,808	$616,270
Years 2-3	$99,587	$498,795
Years 4-5	$101,244	$41,480
Total	**$250,639**	**$1,156,545**

NOTE: THE PROJECTED COST AND NPV NUMBERS ARE ESTIMATES BASED ON INDUSTRY AVERAGE DATA, RESEARCH AND ANALYSIS, BUT MAY NOT MATCH ACTUAL COSTS AND SAVINGS.

10.1.9. Renewables and alternative energy

The Town of Halton Hills has installed geothermal heat pump units in two of its fire stations (Headquarters and Maple Avenue fire stations in Georgetown), as well as in its Acton and Georgetown libraries. All of these buildings were built in recent years and the geothermal heat pumps were included as part of the construction process. There was no prior energy use for these buildings without geothermal heat pumps to compare current usage. The following annual estimated savings associated with using geothermal heat pumps are provided below in Table 19 for each building. These estimates are based on the Buildings Table of the National Climate Change Program prepared by the Earth Energy Society of Canada for Natural Resource Canada's Renewable & Electrical Energy Division.[60]

Table 19 Energy savings estimates from geothermal heat pumps

Building	Estimated savings (ekWh/a)
District Three Fire Station and HQ	173,697
District Two Fire Station (Georgetown)	203,268
Acton Library Branch (New)	114,812
Georgetown Library Branch & Cultural Centre (both facilities)	644,221

In addition, Town Council has supported an application to the Ontario Power Authority as part of the Feed-in-Tariff program to install a 450 kW (521,000 kWh/a) rooftop mounted solar PV project on the Mold-Masters SportsPlex.

Actions related to renewable and alternative energy have also been included in the CEP as actions to be implemented in the long-term (Years 4 and 5). These actions are listed in Table 20 below. It should be noted that when preparing the annual update of the CEP, these actions may be moved to the medium-term (Years 2 and 3) if new renewable installation opportunities arise.

Table 20 Actions related to renewable and alternative energy

Action number	Action description
83	Examine the feasibility of installing renewables or other alternative generation (e.g. district energy, combined heat and power).
84	Develop a process for identifying, evaluating, and developing renewable energy projects.

10.1.10. Implementation of the plan

Several organizational actions in Table 12, Table 14, and Table 16 identify the need for more staff

60 Global Warming Impacts of Ground-Source Heat Pumps Compared to Other Heating Cooling Systems (http://www.earthenergy.ca/climate.html).

resources to implement the CEP. Having sufficient resources will be imperative to ensuring the success of the Plan and for effectively managing energy use and GHG emissions at the Town.

As a first step, the Town should assign a staff member to be responsible for overseeing and monitoring the implementation of the CEP. This person will be responsible for ensuring the plan is implemented, tracking progress on all the actions, leading the Plan's five-year review and update, taking a lead role in designing and implementing all the actions outlined in the Communication and engagement section, as well as leading the implementation of the broader Mayor's Community Energy Plan and ensuring alignment with the Community Sustainability Strategy. An additional resource may be needed to effectively fulfill this role.

Obtaining a central facilities management role has also been identified as a priority action. Currently, there is no overall or consistent energy management of facilities across all departments. For a description of the responsibilities of this role, see Table 21 below. Funding is available to hire an Embedded Energy Manager from Halton Hills Hydro under the Process and System Upgrade Initiatives of the OPA *saveONenergy* programs. Currently, funding is only available until the end of 2015. Ultimately, it would be most effective to have a person dedicated to the role over the long-term; however, the Town can decide the best course of action. Many municipalities have a dedicated staff person responsible for managing energy, including: the Town of Caledon, the City of Pickering, the Town of Oakville, the City of Brantford, the City of Hamilton, and the City of Burlington.

The following table outlines the key actions related to staff resources and identifies the recommended roles and responsibilities for these positions.

Table 21 Staff roles and responsibilities for implementing the CEP

Role	Responsibilities
Dedicated staff to implement CEP	Taking the lead on overseeing and monitoring the implementation of the CEP and the broader MCEP. This includes ensuring actions are implemented and progress is tracked, as well as designing and implementing the communication, training, and behaviour change programs. This person would work closely with the central facilities management staff person and the Staff Sustainability Team. (See Action 7).
Central facilities management role	Overseeing energy management within all facilities and acting as a central resource and contact for O&M staff from different departments. Other responsibilities include: managing the selected EMS, working with the dedicated staff person responsible for implementing the plan on training programs and employee engagement for O&M staff, and taking the lead on overseeing the implementation of the technical actions. (See Action 8).
O&M staff	Identifying and implementing energy saving opportunities at facilities, and participating in training programs.
Staff Sustainability Team	Assisting the dedicated staff person responsible for implementing the plan in implementing staff behaviour change programs and providing resources where appropriate. (See Action 35).

10.1.11. Energy management systems

As a priority action (Action 24, Table 12) it is recommended that the Town investigate options for an energy management system (EMS) to be used to track and analyze energy use at the building level. Current Town data collection processes are very resource intensive and involve requesting information from multiple sources both internal (departments) and external (Halton Hills Hydro and Union Gas).

There is a range of EMS software available on the market. The selection of a particular system will depend on the specific features being sought, as well as the compatibility with existing IT systems. This includes ensuring buildings or specific equipment or systems have the appropriate meters to collect data at correct levels of granularity (e.g. real-time, hourly, daily, etc.).

This section provides an overview of the system characteristics the Town should be considering, as well as the supporting organizational capacity and processes the Town will need to implement the system.

10.1.11.1. Selecting an energy management system

System characteristics. The Town should look for the following capabilities in an EMS:

- Centralized data logging
- Data normalization
- User-friendly data reporting (automatic and customized report generation for diverse audiences)
- Near real-time display options (for individual buildings and for aggregated buildings)
- "Dashboard" summary options for Town-wide/public display
- Tracking of actual energy performance against expected performance
- Immediate notifications/alerts when monitored systems deviate from usual patterns
- Project evaluation, monitoring and verification capabilities
- Compatibility with the Town's IT systems

The Town may also want to seek the following additional capabilities:

- Electrical load shedding
- Verification of monthly bills
- Prediction of future bills

There are three major types of energy management systems:

1. In-house hardware and software solutions. With this option, the Town would have more control over how the suite of programs is used, but would have to provide permanent staff or assign person-hours to generate and review energy reporting, and to maintain hardware and software systems.

2. Energy accounting as a service. A third party contractor collects and analyzes energy information from the Town's metres and sub-metres, and then delivers the information to the Town via a web-portal. This option typically involves higher monthly cost and less control over the outputs (usually a high degree of customization is available); however, minimal organizational capacity is required.

3. Externally hosted and maintained software solution with a web interface. The software maintenance is outsourced, while monitoring tasks remain in-house. The Town is still responsible

for “making sense” of the data and reports.

Before going to tender, the Town should consider which of the three types of systems it would prefer. Based on our understanding of the Town’s goals and capacity, energy accounting as a service (option 2) is recommended.

Most municipalities that have effectively managed their energy data and have achieved energy and cost savings have purchased and are using an EMS. For example, the Town of Caledon, the City of Pickering, the Town of Oakville, and the City of Burlington all track energy data through an EMS. Some municipalities have developed their own EMS. For example, the Region of York developed an EMS called Energy and Environmental Management System (EEMS), which is also used by other municipalities.

Evaluation criteria. Once the Town has decided which of the three approaches it prefers, the specific EMS can be selected based on:

- Functionality (inclusion of all desired capabilities)
- Ease of use
- Cost (capital and operational/maintenance)
- Staffing requirements
- Integration with other Town systems
- Security and redundancy of information/backups
- Current use by other municipalities.

Next steps. Within the next year, the Town can solicit proposals from different vendors for an EMS. The Town can then select and implement the preferred EMS.

10.1.11.2. Establishing the supporting organizational capacity and processes

Selecting and purchasing an EMS is one step; however, ensuring the appropriate resources are in place to use and manage the EMS is equally, if not more, important. The Town will need additional staff capacity to make use of the information from the EMS. The Town will also need new organizational processes to ensure that:

- The right information reaches the right people in a timely way; and
- These people can use the information to take action on energy efficiency.

Data and information. As part of the selection and implementation of the EMS, the Town will need to develop a reporting system for energy data (energy use, demand, costs, savings, progress, etc.). This reporting system should consider who will be reviewing the data, what they will be looking for, and what user interfaces are needed. For example:

- What information is relevant to O&M staff? What analysis / statistical techniques are needed to transform the data into the information desired?
- What format can best convey this information to O&M staff? How will the outputs be made available to staff (paper copy, e-mail reporting, web-based reporting)? How often should O&M staff receive this information?
- What information is relevant to management staff?
- What format can best convey this information? How often should management staff receive this information?

It is recommended that the Town start with a more limited and manageable set of outputs and reports. Then, as staff become more familiar with the energy management system, the Town can

look to add additional features, based on staff input about what is most useful.

Implementation. The Town will also need to develop a system for acting based on the problems and opportunities identified from the data. This system will enable staff to use the outputs of the EMS to improve energy efficiency. For example:

- How should O&M staff respond to alerts about deviations from normal energy use patterns? How should staff report on the causes of the alert and any remedial action taken to address problems?
- Who should be responsible for analyzing weekly/monthly reports? How can they investigate any irregularities in the data? How can they pursue opportunities identified by the data?
- How should actions taken as a result of information from the energy management system be tracked on an ongoing basis?

All relevant staff should be trained to understand energy management systems. They should also be trained to analyze information from the EMS, and to take action as a result of this information.

Next steps. Within the next year, the Town should determine the desired outputs and reports, and secure the staff resources required to manage the energy management system. It is recommended that the new central Facilities Management (Action 8, Table 17) role take responsibility for managing and overseeing the energy management system.

Alongside deployment of the EMS, the Town can develop a system for translating data and analysis into action (including training for staff).

Once the EMS is deployed, the Town can use it to develop one-year baselines for each building and each utility. These will be the basis for ongoing monitoring and tracking.

10.1.11.3. Taking advantage of utility incentives

As part of the Integrated Energy Management Systems program, Union Gas will fund up to 75% of an energy management system assessment (up to $20,000), and up to 50% for the installation of the energy management system (up to $100,000).

Halton Hills Hydro also offers an Energy Management and Monitoring program under the Process and System Upgrade program. This program offers two types of incentives – one for an embedded Energy Manager and one for a monitoring and targeting system. For more details on incentives offered by Union Gas and Halton Hills Hydro see Appendix 8.

10.1.12. Communication and engagement

This section complements and expands on the overarching communication and engagement actions identified in the *Organizational Actions* listed in Table 12, Table 14, and Table 16.

10.1.12.1. Overview and program management

The communication and engagement section focuses on three areas:

- Employee engagement
- Facilities staff training
- Behaviour change and communication

Each area is expanded upon in more detail below.

10.1.12.2. Employee engagement

In the first year of the CEP, the Town should develop a pilot employee engagement program that encourages O&M staff to identify energy efficiency opportunities across the Town's facilities. Based on the success of this program, the Town should roll-out the program to all staff within Years 2 and 3 of the CEP.

The pilot program should be developed by the new central facilities management role in collaboration with the dedicated staff person assigned to oversee the implementation of the CEP. The program would establish a formal process for O&M staff to submit ideas based on their daily activities in Town facilities, and staff would receive recognition for their ideas. For example, O&M staff might identify opportunities related to:

- Operational inefficiencies (e.g. buildings where night-time setbacks are not in place);
- Equipment maintenance needs (e.g. air handling units requiring maintenance);
- Equipment upgrades (e.g. buildings that would benefit from occupancy sensors); and
- Policy and business process changes.

Staff that submit ideas would be rewarded for their contributions. This will encourage them to identify additional opportunities and submit additional ideas. The central facilities management staff person would review ideas from the employee engagement program, implement them wherever possible, and report on the results. Ideas for the specific components of the employee engagement program include:

- **A system for staff to submit ideas.** The Town should develop a new system for staff to submit ideas for energy efficiency opportunities. For example, creating a process where staff fill out a specific "energy opportunities" form to give to their supervisors, who then submit the form to the central facilities management staff person. The form would include criteria such as: payback, life-cycle costing, ease of implementation, achievable energy savings, available incentives, occupant comfort, regulatory requirements, and contribution to demonstrating leadership.
- **A system for recognizing staff contributions.** Recognition / rewards for staff that contribute ideas should be designed based on culture of the organization. Particularly at the outset, the recognition and rewards system should convey that "any idea is a good idea". The system could involve public recognition of individuals that submit ideas (e.g. contributing staff get their name in newsletter, their picture on the wall, and are eligible for the "opportunity spotter of the month" award). Or, it could involve rewards for group achievement (e.g. pizza lunches each month where over 25 ideas are submitted).
- **Tools for communicating about the program.** Particularly at the outset, the employee engagement program should be continuously promoted (e.g. reminders in meetings, advertised on posters, updates on progress visible on the wall) to encourage staff to submit ideas. Staff should also receive feedback about the implementation of their ideas, to realize that they are making a difference.

The pilot employee engagement program should be limited to O&M staff. Once the program is established, it can be rolled out more broadly across all Town staff in Years 2 and 3. The dedicated staff person assigned to oversee the implementation of the CEP would be responsible for facilitating the program to general staff; whereas, the central facilities management staff person would take the lead for O&M engagement.

Implementing an employee engagement program has many benefits, including: providing a formal system for staff to submit ideas, allowing for opportunities to be captured and not missed,

and encouraging O&M staff to share their ideas and knowledge.

10.1.12.3. Staff training

This section provides further information on two types of training identified as actions in Table 12 and 14:

- General training for O&M staff on energy efficiency (Action 27, Table 12 and Action 60, Table 14); and
- Energy efficiency training for fleet drivers (Action 66, Table 14).

O&M staff training. General energy training should be provided to all O&M staff to ensure that they have the knowledge and skills to contribute to efficient energy management within the Town. Training options should be investigated and developed in Year 1 of the CEP, and then implemented in Years 2 to 3. The training could be provided as a half-day or full-day workshop, or through multiple weekly / monthly sessions.

Training may address:

- Energy basics (cost of energy, how and where energy is used);
- The difference between distribution vs. transmission costs
- Lighting and mechanical equipment basics;
- Building automation systems and re-commissioning;
- Metering, monitoring, and the energy management system;
- How to spot energy saving opportunities;
- The Town's Corporate Sustainable Building Policy, preventative maintenance program, and re-commissioning plan; and
- The Town's employee engagement program (including how to submit ideas and what types of ideas can be submitted).

O&M staff should receive a certificate upon completion of the training, recognizing that they have gained important knowledge and skills.

The Town should provide energy management training to all O&M staff every two to three years (or more often, if staff turnover is high). The content of the training can be updated to reflect "state of the art" knowledge about energy management, and to reflect changes in the Town's buildings, equipment, and practices. This training will provide a "refresher" for veteran staff and an opportunity for new hires to increase their skills and knowledge.

The central facilities management role should take the lead on designing and implementing these training programs in collaboration with the dedicated staff person assigned to oversee the implementation of the CEP. The program(s) may be designed and delivered by in-house staff, trainers may be hired from outside the organization and/or staff could be sent to more generic training (e.g. Natural Resource Canada's "Dollars to $ense" Energy Management Workshops). The Town may also consider speaking with the Town of Oakville, who is partnering with Seneca College to deliver a training program to its staff responsible for operating, maintaining, and designing buildings.

Fleet driver training. All staff that drive Town vehicles should be trained to operate all fleet vehicles in a more fuel-efficient manner. Fuel-efficient driving will not only reduce GHG emissions and other pollutants, but it will also reduce fuel costs and save the Town money. The driver-training program should be implemented in Years 2 to 3 of the CEP. Training could be provided as a half-day or full-day workshop or as an online course with different modules.

Driver-training should include information regarding:

- Vehicle maintenance
- Idling reduction
- Routing optimization
- Vehicle "right-sizing"
- Driving habits (speeds, gear changing, braking, etc.)
- Determining and evaluating fuel saving options
- Analyzing performance

All staff that complete the training should receive a certificate upon completion, recognizing that they have gained important knowledge and skills.

The dedicated staff person assigned to oversee the implementation of the CEP should take the lead on designing and implementing the driver-training program. Training could be designed and delivered by in-house staff, trainers may be hired from outside the organization, and/or staff could be sent to more generic training (e.g. Natural Resource Canada's "Fuel Management 101" Workshop). Natural Resources Canada also has an "Auto$mart Driver Education" program that could be purchased by the Town and incorporated into a workshop delivered by in-house staff.

Another option for the Town could be to sign up for a challenge such as the Shuttle Challenge. This challenge involves measuring the baseline fuel usage and impact, taking the free online "Eco driver training" course, and then pledging to improve fuel impact by 10% over the next two weeks.

New hires. Training for energy management, including fuel-efficient driving, should be built into the training and orientation process for new hires. It could be more or less formal, as appropriate given current training and orientation practices.

10.1.12.4. Behaviour change and communication

Communicating about the CEP and encouraging staff to think about energy efficiency in their day-to-day activities is one of the objectives of this plan and is fundamental to improving the management of energy within the Town. Behaviour change programs are important for raising staff awareness about energy management. Change in behaviour can also lead to up to five percent savings in energy intensity. The Staff Sustainability Team and the dedicated staff person assigned to oversee the implementation of the CEP should work together to develop a behaviour change and communication strategy. This strategy should involve a combination of tools and initiatives to communicate and engage the Town staff. These could include:

- Using a consistent set of high impact tools for corporate Town-wide communication. These may include: visual displays in the lobbies of facilities, dashboard tools on the Town's intranet, e-newsletters, brochures, YouTube videos, event calendars, etc. Staff indicated in the internal survey that they would prefer communication via e-mail updates and e-newsletters, followed by information tips and lunch-n-learn sessions.

- Taking advantage of existing communication tools currently used to promote awareness of sustainability and environmental initiatives. For example, the new sustainability logo could easily be used to communicate about energy as well as greening and sustainability.

- Developing building-specific poster boards and educational materials discussing the building's energy efficient features, technologies, retrofits, etc.

- Promoting the "spot the energy efficiency opportunities" program for staff outlined above in the Employee engagement section. This will help encourage staff to think about energy management in their day-to-day activities, and change their behaviours to include energy efficiency.

Progress on the CEP should also be communicated to the community so they are aware of the energy initiatives being undertaken by the corporation. The Office of Sustainability website is very informative and already has a lot of information about sustainability, the Green Report Card, and other greening initiatives being undertaken by the Town. Updates on the CEP and energy efficiency initiatives should also be included on the website.

10.2. Corporate energy management requirements for the FCM Partners for Climate Protection program

A corporate GHG inventory was completed for the Town of Halton Hills' municipal operations, building on the work of the Corporate Energy Plan. The Corporate Energy Plan addresses energy consumption and greenhouse gas emissions for buildings and the analysis below expands that scope to include the municipal fleet, solid waste and street lighting in line with the requirements for the first three milestones of the Partners for Climate Protection Program from the Federation of Canadian Municipalities. The milestones are as follows:

- Milestone 1: Creating a greenhouse gas emissions inventory and forecast
- Milestone 2: Setting an emissions reduction target
- Milestone 3: Developing a local action plan

10.2.1. Corporate GHG Inventory

GHG emissions, energy consumption and energy costs were analysed from buildings, street lights, fleet and the volume of solid waste generated by staff. Note that the service of solid waste collection for the community and water and waste water utilities are under the purview of the Region of Halton and are therefore outside of the scope of this analysis[61]. Total energy consumption for the Town of Halton Hills was just under 72,000 GJ for transportation, buildings and street lights resulting in 3,280 tCO2e and costing $1.9 million in 2011 (Table 22).

There are numerous strategies to achieve energy efficiencies, categorized as technological improvements or behaviour change. In addition to resulting in reduced energy consumption, these also save money.

Table 22 Annual energy consumption by type, cost and GHG emissions

Fuel Type	Energy Consumption (GJ)	GHG Emissions (tCO2e)	Annual Energy Cost ($)
Electricity	40,779	1,246.0	$1,036,461
Natural gas	25,057	1,260.4	$358,945
Gasoline	6,772	430.9	$241,646
Diesel	9,260	641.3	$265,181
Propane	0	0.0	$0
Total	**71,993**	**3,276.9**	**$1,902,232**

[61] Note that solid and liquid waste are included in the community inventory but are excluded from the corporate inventory according to inventory protocols.

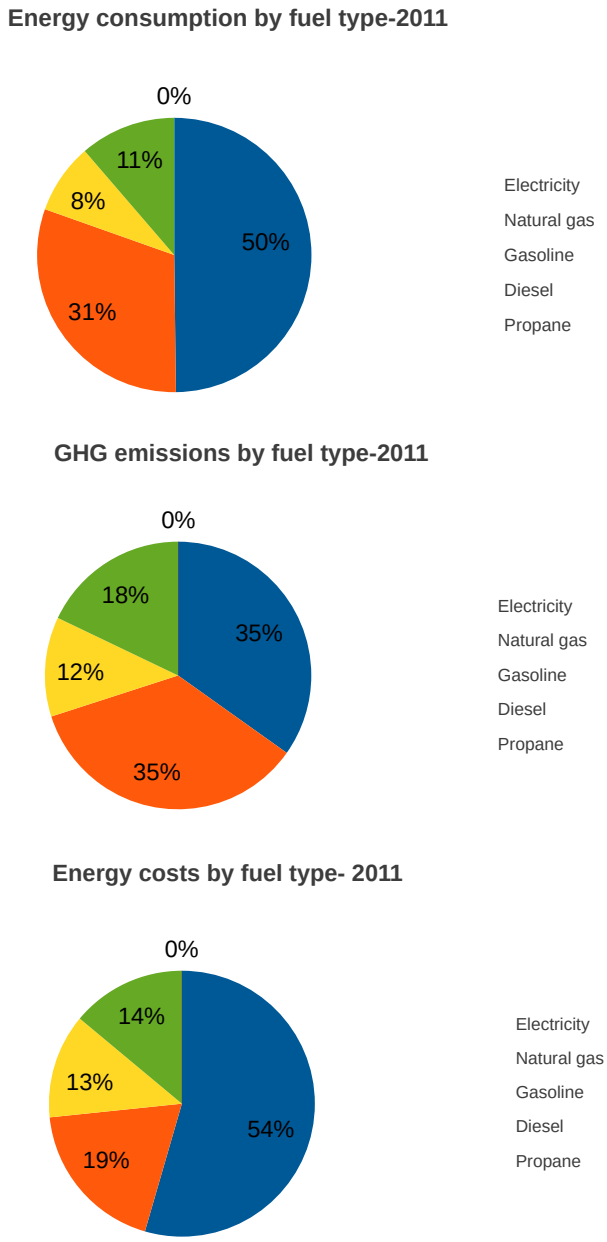


Figure 35. Energy consumption, GHG emissions, and energy costs by fuel type for 2011

Figure 35 shows the breakdown by energy type for energy consumption, GHG emissions and cost. The most notable finding is that while electricity represents 50% of the energy consumed, it represents 35% of the GHG emissions, because electricity results in less GHG emissions per unit of fuel than other fuels.

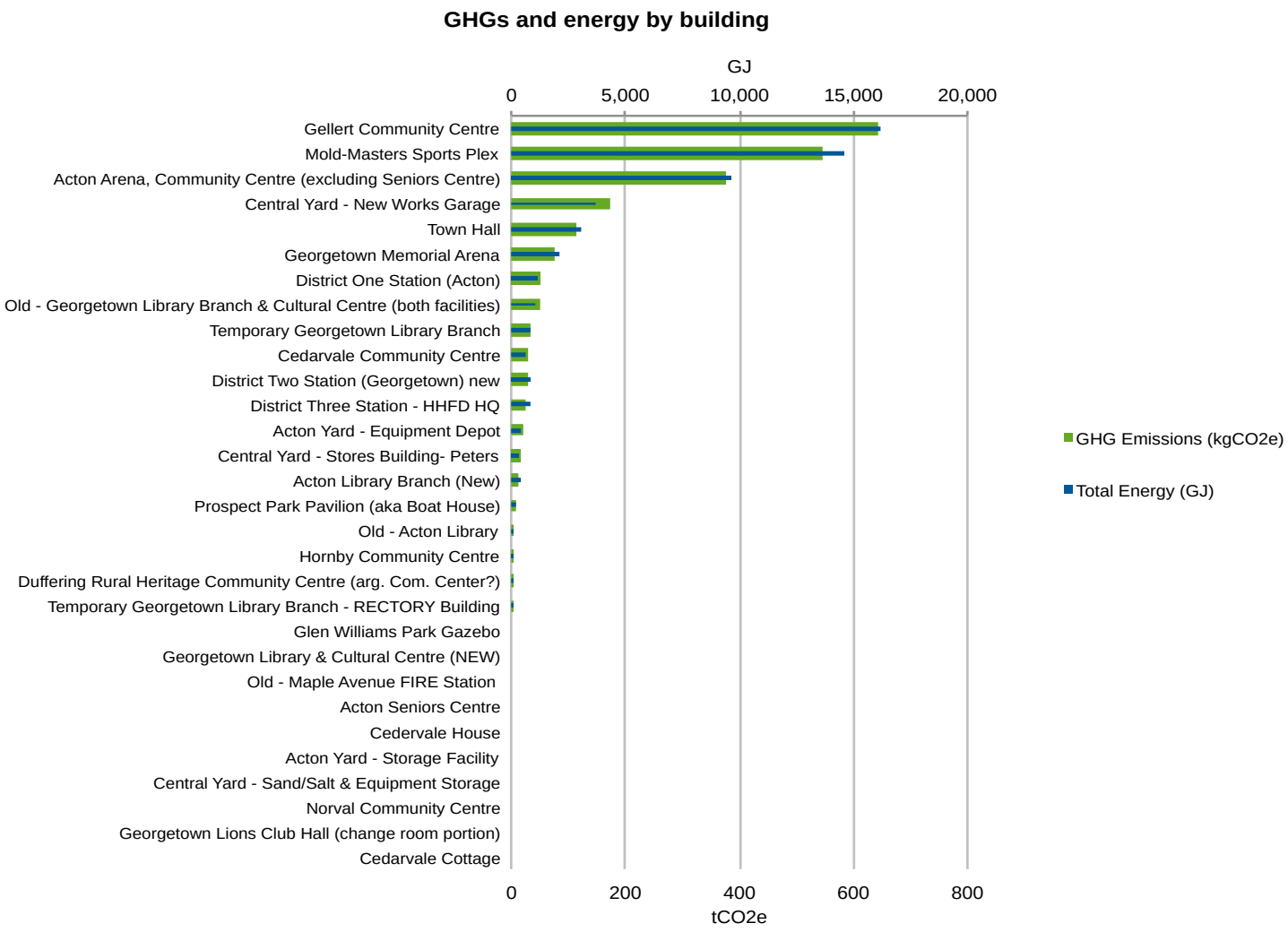


Figure 36. GHGs and energy by building

A comparison of the GHG emissions and energy consumption by building shows small variations according to the mix of natural gas and electricity for each building. The Gellert Community Centre, the Mold-Masters Sports Plex and the Acton Arena represent the major loads in the Town of Halton Hills' building portfolio (Figure 36).

The same three buildings have the highest energy cost but the Central Yard- New Works Garage has the second highest energy intensity per area after the Gellert Community Centre, followed by the Mold-Masters SportsPlex and the Acton Arena (Figure 37).

Nearly two thirds of the energy costs are associated with buildings and just over two thirds of the GHG emissions are associated with buildings.

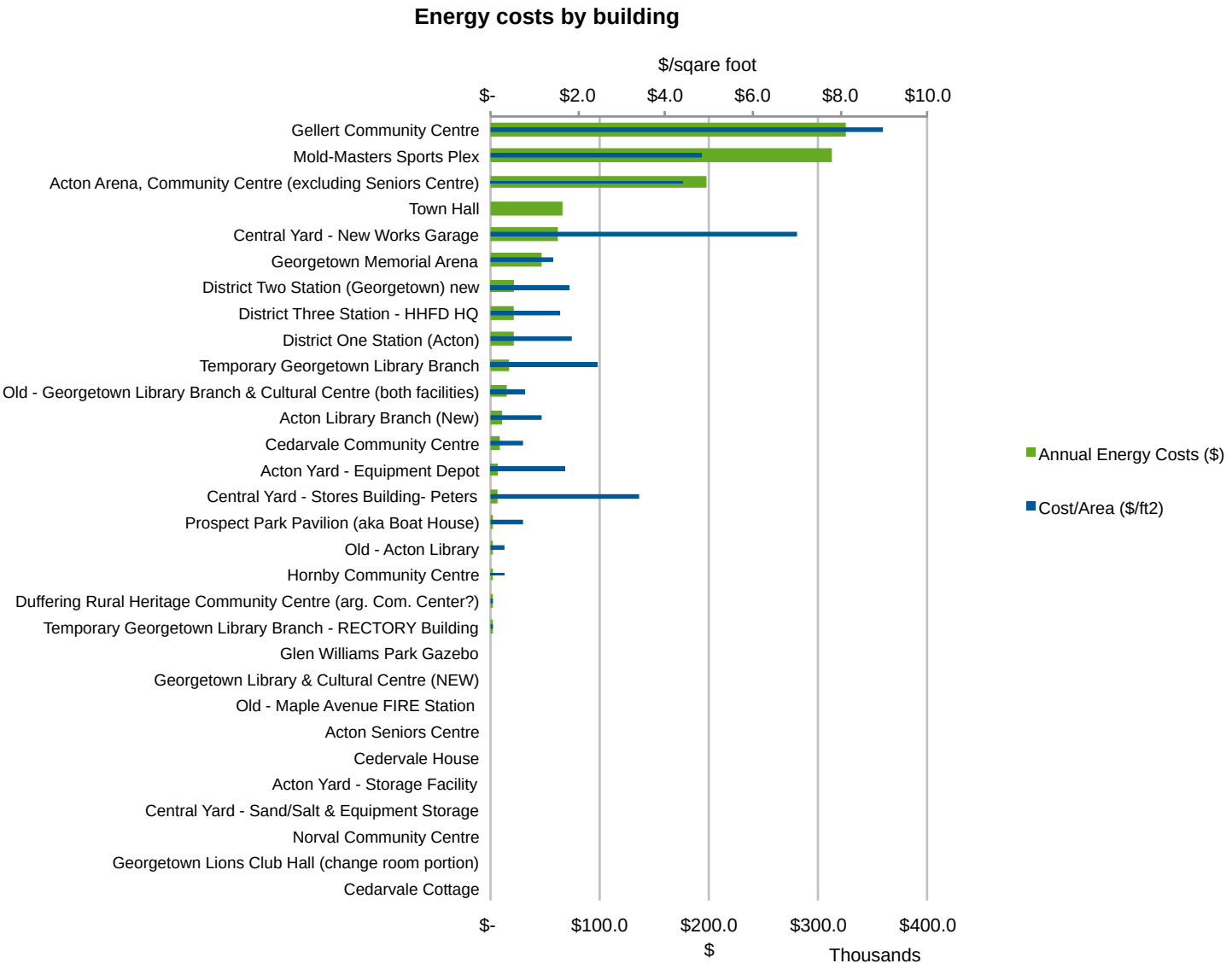


Figure 37. Energy costs by building

Annual energy costs are described by source in Table 23. Annal GHG emissions are described by source in Table 24. In both cases buildings represent the most significant source of cost and emissions.

Table 23 Annual energy costs by source*

Source	Annual Energy Cost
Buildings	$1,144,402
Municipal Fleet	$506,827
Streetlights	$251,003
Total	$1,902,232

* Estimated

Table 24 Annual GHG emissions by source

Source	GHG Emissions (tCO2e)
Buildings	2,204.6
Municipal Fleet	1,072.3
Streetlights	301.8
Solid waste	44*
Total	**3,622.7**
*Estimated	

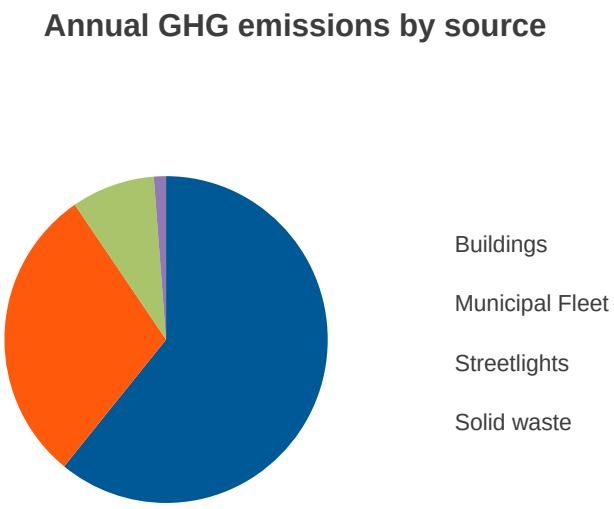


Figure 38. Annual GHG emissions by source

Certain new Town facilities and expansions are planned. New facilities will incorporate appropriate energy efficiency measures, including applying the Town's Corporate Sustainable Building Policy.

10.2.2. Corporate emissions target

The Corporate Energy Plan establishes the following targets between 2014 and 2019 (Table 25).

Table 25 Corporate Energy Plan targets

Area	Category	Target
Buildings	Energy intensity (ekWh/sqft)	-13% to -17%
	GHG emissions	-16% to-20%
Streetlights	Energy consumption	-30%*

*Halton Hills Hydro estimates that 30% reduction in streetlight electricity can be achieved.

The upper end of these targets (-17% in energy intensity for buildings and -30% in energy consumption for streetlights) translates into a 15% reduction in total GHG emissions for Halton Hills. The combination of the targets for buildings and streetlights and a 15% reduction in fuel consumption and GHG emissions from the fleet results in an overall target of 20% reduction in GHG emissions for the corporation operations of Town of Halton Hills by 2019 (Table 26).

Table 26 Summary of proposed targets

Area	Baseline (tCO2e)	Target (tCO2e) 2019	% reduction
Buildings	2,204	1,763	-20
Municipal fleet	1,072	911	-15
Streetlights	302	211	-30
Solid waste	44	44	No change
Total	**3,622.7**	**2,930.4**	**-20**

This target will culminate in between $300,000 and $360,000 each year in energy cost savings by 2019. The targets for buildings and streetlights are aligned with the Corporate Energy Plan.

10.2.3. Corporate plan

A detailed plan including actions and timelines has been prepared in the Corporate Energy Plan to achieve the reductions in the building area (see section 10.1 for details). Additional actions in the areas of streetlights and fleet are described below.

Table 27 Additional actions in the areas of streetlights and fleet

	Measure	Projected cost	Projected annual savings ($)
Streetlights	1. Convert the streetlights to LEDs	Further study required depending on labour, capital cost, rebates, etc.	$75,000
Fleet	2. Preferentially purchase electric or hybrid vehicles where small vehicles are appropriate.	The payback on a Nissan LEAF is 2.5 years and a Mitsubishi i-MiEV is 0.7 years over a Ford Focus with capital costs of $25,000 and $30,000 respectively[51].	~$2,000 per year for each electric small vehicle on a total cost of ownership basis.
	3. Preferentially purchase electric vans .	The payback on a Transit Connect Electric van is 2.5 years on capital costs of $53,750 over the Ford E-250 Van[52].	~$6,000 per year for each electric small vehicle on a total cost of ownership basis.
	4. Join Natural Resources Canada's FleetSmart program[53] and offer the SmartDriver training and the Fuel Management 101 courses.	No cost.	5%-33% reduction in fuel consumption[54].
	5. Conduct an internal review of the fleet and transportation needs to identify vehicles that can be replaced and services that can be offered without requiring driving.	Staff time of 8-12 weeks.	Savings are variable.

62 Pollution Probe (2013). Final report on electric vehicle analysis. Retrieved March, 2014 from: http://www.pwu.ca/issues/Project-EVAN-Final-Report-June-2013.pdf

63 Ibid.

64 NRCan's FleetSmart program can be accessed here: http://fleetsmart.nrcan.gc.ca/index.cfm?fuseaction=fleetsmart.member

65 EPA (2013). Fuel-efficient driving practices and training. Retrieved March, 2014 from: http://www.epa.gov/region9/

11 Recommendations

This chapter provides all recommendations related to community activities. For corporate recommendations, see chapter 10.

11.1. Actions

11.1.1. Process used to identify actions

The process of identifying actions involved the following:

1. Identifying a baseline of activities in the community (green economy mapping).
2. Brainstorming actions in in-person workshops and online (Ideascale and Survey Monkey).
3. Best practices analysis.
4. Community outreach to rate the options.
5. Analysis of the actions using multi-criteria analysis (MCA).
6. Selection of the most effective options according to the MCA analysis.

11.1.2. Multi-criteria analysis (MCA)

MCA is a useful tool to aid decision-making where there is a choice to be made between competing options. It is frequently used for sustainability assessment where a complex range of environmental, social and economic issues must be taken into consideration and where trade-offs are unavoidable. There are basic steps in analysis for all three types of decision-making (Table 28).

Table 28 Steps in a multi-criteria analysis

Step	Response
Identifying and characterizing the option	The options emerged out of the community engagement process.
Identifying relevant criteria	The criteria that were used included preference from the community engagement process (the number of times the idea showed up or was weighted in the dotmocracy), energy reduction, GHG reduction, cost to Halton Hills to implement, cost savings for households, employment generation and health impacts.
Scoring criteria	The criteria were scored on a scale from 1 to 10 based on the results of the community engagement process, the results of the GHGProof modelling and our best judgement.

climatechange/transportation/driving.html

Step	Response
Weighing criteria	Criteria were weighted on a scale from 1 to 10 according to the following: community engagement process- 4, energy reduction- 10, GHG reduction- 10, cost to Halton Hills to implement- 8, cost savings for households- 6, employment generation-4, and health impacts- 4.

At each stage, important value judgements are made – about relevant criteria, about how we define what is 'better' or 'worse', and about the degree to which we can trade off performance on one criteria in favour of performance on another. Figure 39 shows the results of the analysis.

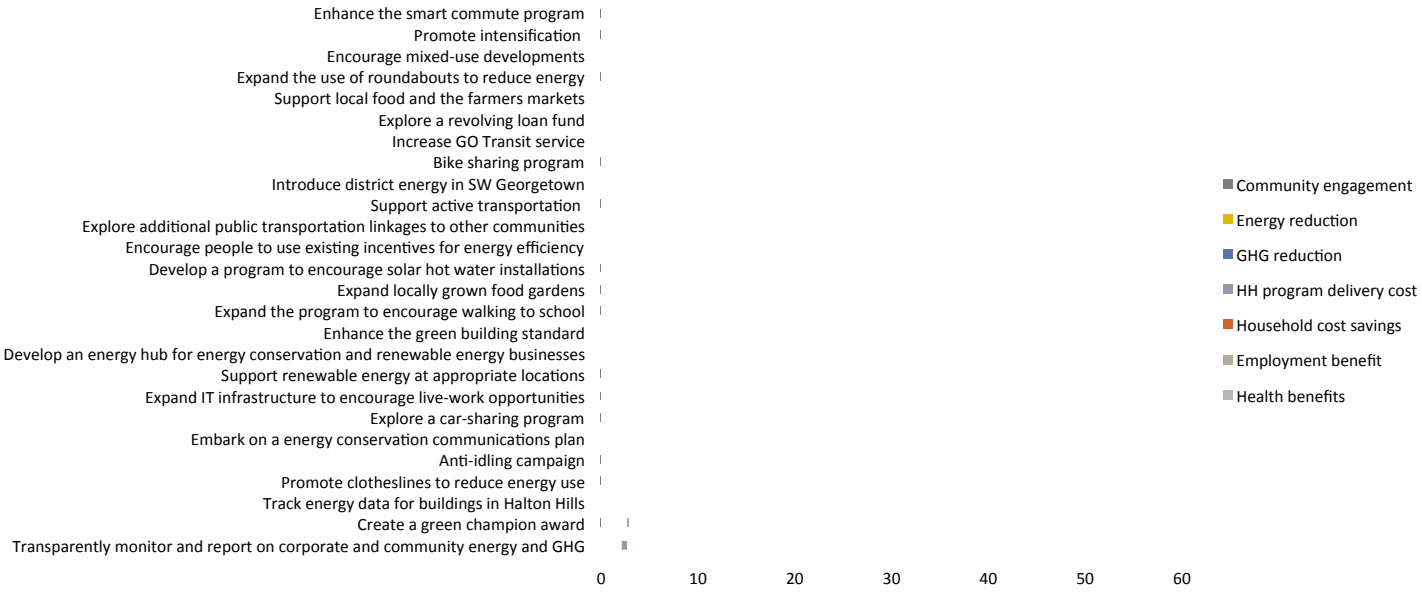


Figure 39. Analysis of actions using Multi-Criteria Analysis

11.2. Modelling GHG reductions

Thematic strategies were modelled in GHGProof to identify the relative contribution of each effort in the Scenarios. The results of Scenarios 2 and 3 were compared against Scenario 1. This analysis helped us understand the GHG savings, energy reductions and cost savings for the proposed actions (Figure 40).

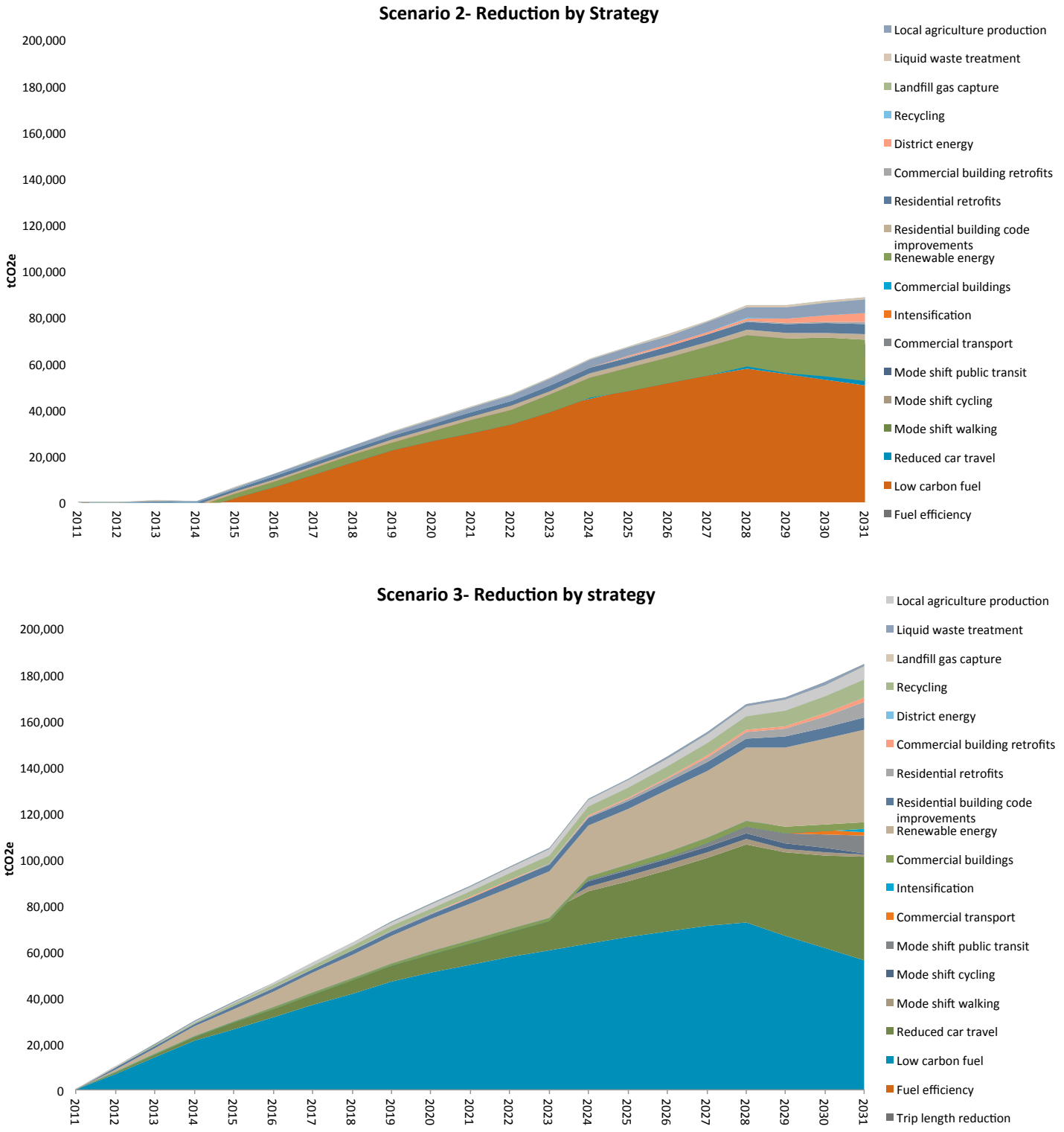


Figure 40. Scenarios 2 and 3 reductions by strategy

11.3. Actions

The top 15 actions are analyzed in more detail in the table that follows.

Table 29 Actions for GHG reductions

	Action	Theme	Relevance	Relevant targets from the modeling	Activities	Year initiated	Estimated cost	Funding sources	Lead Department	Supporting Policies	Partners
1	Continue to promote intensification	Planning	Shifting the land-use pattern in Halton Hills from greenfield development to focus on Acton and Georgetown reduces GHG emissions, and energy and infrastructure costs.	Increase the number of dwellings located within 500 metres of a commercial core area from 9,200 in the Baseline year to 12,230.	1.1) Implement Official Plan Amendment No. 9; 1.2) Account for lifecycle costs (the full cost of the services including design, construction, maintenance and operations) in servicing. agreements for new developments.	Ongoing	Staff time	Town	Planning and Infrastructure	OPA Amendment No. 9; Community Sustainability Strategy; Strategic Plan	Development Industry
2	Continue to encourage mixed-use developments	Planning	Mixed-use developments encourage people to walk and cycle more, buildings use less energy and overall GHG emissions are reduced.	Decrease vehicular mode share from 84% of trips to 71% of trips, and increase walking and cycling trips.	2.1 Provide additional incentives for mixed- use development projects such as prioritized development applications and building permits, and waived or reduced development application fees.	2016	Staff time	Town	Planning and Infrastructure	Official Plan; Community Sustainability Strategy; Cycling Master Plan; Transportation Master Plan	Town Departments Development Industry
3	Develop a program for property assessed payments for energy retrofits (PAPER)	Energy	The PAPER program, recently enabled by new legislation, is a simple and secure way for municipalities to encourage energy-savings retrofits, be cost neutral to the municipality and deliver cost savings to homeowners.	Increasing the energy efficiency of new dwellings by 50% over existing building stock; and retrofitting 5% of the existing building stock each year, resulting in a 25% energy savings by 2031.	3.1 Design and implement a PAPER program for Halton Hills.	2017	$100,000 for program design, legal fees and implementation	FCM Green Municipal Fund	Planning and Infrastructure	Community Sustainability Strategy	Halton Hills Hydro, Union Gas
4	Implement a revolving loan fund	Energy	A revolving loan fund is a mechanism for financing energy efficiency projects and using the savings to fund further projects, hence reducing the overall operating costs.	Increasing the electricity share from 52% to 61% for residential buildings in Halton Hills.	4.1) Design and implement a revolving loan fund for municipal facilities in partnership with local utilities; 4.2) Expand the revolving loan fund to commercial buildings.	2016	Allocate $50,000 per year to create a $200,000 fund.	Town	Planning and Infrastructure	Corporate Energy Plan; Community Sustainability Strategy; Strategic Plan	Town Departments
5	Encourage the uptake of existing energy efficiency incentives and programs	Community Engagement	There are a range of incentives and programs to support energy efficiency currently offered by the utilities. Halton Hills can support the uptake of these activities.	Increasing the energy efficiency of new dwellings by 50% over existing building stock; and retrofitting 5% of the existing building stock each year, resulting in a 25% energy savings by 2031.	5.1 Develop a cooperative community engagement strategy with the utilities.	2015 (Ongoing)	$15,000	Partner with utilities	Planning and Infrastructure	Community Sustainability Strategy; Green Development Standards; Strategic Plan	Halton Hills Hydro, Union Gas
6	Expand the scope of the Green Development Standards	Buildings	The existing Green Development Standards are a mechanism that can be used to advance the energy efficiency of new buildings going forward. A version for major renovations can be used to ensure energy upgrades in the existing building stock.	Increasing the energy efficiency of new dwellings by 50% over existing building stock; and retrofitting 5% of the existing building stock each year, resulting in a 25% energy savings by 2031.	6.1) Introduce mandatory Green Development Standards for major renovations and gradually increase the energy performance requirements; 6.2) Encourage the application of the PassiveHouse standard in the Georgetown Expansion project.	2018/2019	$40,000	Town	Planning and Infrastructure	Green Development Standards; Strategic Plan; Community Sustainability Strategy	Development Industry
7	Introduce district energy in the Vision Georgetown lands, if confirmed to be feasible	Energy	District energy is a system for providing heat to houses that is flexible and potentially carbon neutral. District energy also acts as an attractor, stimulating increased density.	Attach 2,713 dwellings to district energy systems by 2031.	7.1) Complete a feasibility study for district energy as part of the Vision Georgetown Secondary Plan project; 7.2) Engage Halton Hills Community Energy Corporation, landowners, school boards and other appropriate stakeholders to include district energy criteria as part of the Vision Georgetown Secondary Plan exercise to determine if district energy is feasible in all or part of the urban expansion area.	Study in 2015	$70,000 (Part of Vision Georgetown planning project budget)	FCM Green Municipal Fund	Planning and Infrastructure	Vision Georgetown; Community Sustainability Strategy; Mayor's Community Energy Plan	Halton Hills Community Energy Corporation and Union Gas
8	Support active transportation	Transportation	Active transportation encourages people to walk and cycle as opposed to taking the car.	Decrease vehicular mode share from 84% of trips to 71% of trips, and increase walking and cycling trips.	8.1) Implement the Cycling Master Plan; 8.2) Prioritize walking and cycling over vehicles in the plan for the Georgetown Expansion.	Ongoing	Ongoing projects	Town	Planning and Infrastructure	Halton Hills Transportation Master Plan; Trails and Cycling Master Plan; Cycling Master Plan; Community Sustainability Strategy	Schools, businesses, Smart Commute Halton, Share the Road Cycling Coalition

	Action	Theme	Relevance	Relevant targets from the modeling	Activities	Year Initiated	Estimated cost	Funding sources	Department	Supporting Policies	Partners
9	Increase GO Transit service	Transportation	GO Transit is infrequent in Halton Hills. Increasing the frequency of the service as the population increases will enable more people to commute to work and travel to commercial centres without using cars.	Increase the number of dwellings located within 500 metres of frequent GO Transit, and bus service between Georgetown and Acton from 0 to 5,988.	9.1 Continue to advocate for improved GO Transit service for Halton Hills.	Increased service by 2017	Staff time	N/A	Planning and Infrastructure	Strategic Plan; ICSS; Official Plan	Halton Region; Metrolinx
10	Explore additional transport linkages to other communities	Transportation	Explore opportunities for public transportation options. As appropriate, opportunities for enhancing access to public transit should be explored through the upcoming update of the Town's Transportation Master Plan in 2016.	Decrease vehicular mode share from 84% of trips to 71% of trips.		2016		Town	Planning and Infrastructure	Official Plan; ICSS; TMP	Halton Region; Metrolinx
11	Enhance and leverage the Smart Commute Halton program	Transportation	Achieving GHG reductions through behaviour change is difficult. This action is modelled on one successful example in the United Kingdom which generated GHG reductions of between 13% and 20% per capita, and a significant positive cost-benefit ratio. This program involves working with individual people and households over time to alter their transportation patterns using new and existing transportation options and programs over time to successfully achieve mode shifts.	Decrease vehicular mode share from 84% of trips to 71% of trips, and increase walking and cycling trips.	As appropriate, in collaboration with Smart Commute Halton and other stakeholders: 11.1) Deliver custom school and workplace travel plans; 11.2) Offer bicycle training programs; 11.3). Establish car sharing programs; 11.4) Engage employers in transportation planning; 11.5) Offer personalized transportation planning to individuals and households. A similar and highly successful program in the United Kingdom cost about $22/person. Based on this cost, the total for Halton Hills would be about $1.3 million. A pilot project would provide systematic transportation planning for a neighbourhood of 5,000 for two years.	Launch in 2017	$100,000	FCM Green Municipal Fund	Planning and Infrastructure	TMP; Community Sustainability Strategy; Official Plan; Cycling Master Plan	Smart Commute Halton; Halton Region; Metrolinx' schools; BIAs; Chamber of Commerce
12	Expand the program to encourage walking to school	Transportation	Encouraging youth to walk to school reduces vehicular traffic to schools, enlivens the streets, engages parents in walking and educates young people in active transportation.	Decrease vehicular mode share from 84% of trips to 71% of trips, and increase walking and cycling trips.	12.1 Work with the school boards to implement a broad-based walk to school program with maps, appropriate signage and infrastructure.	2015	$10,000	Town	Planning and Infrastructure	Halton Hills Transportation Master Plan	School Boards; Metrolinx; Smart Commute Halton
13	Continue to support local food and farmers' markets	Agriculture	Local production and consumption of food reduces GHG emissions from transportation of food.	Increase local food consumption of locally produced food from 5% in the Baseline to 20%	13.1) Complete a Halton Hills Food Security Plan that aims towards this target; 13.2) Continue to support existing farmers' market operations; 13.3). In partnership with appropriate stakeholders, explore opportunities to offer programs that encourage a new generation of farmers; 13.4) Identify opportunities to partner and support local farming organizations; 13.5) Introduce a local food procurement policy.	2017	$20,000	Town	Planning and Infrastructure	Official Plan; ICSS	Georgetown BIA; Acton BIA; Chamber of Commerce
14	Partner with economic development agencies on a green economic development strategy.	Economic development	Identifying and supporting green business around a 'hub' will support business and social networking and enable the businesses to collaborate and learn from each other.	N/A	14.1 Develop an energy hub for energy conservation and renewable energy businesses.	2018	$60,000 to develop a green economic development strategy	Town	Planning and Infrastructure; Economic Development Office	EDS; ICSS	Georgetown BIA; Acton BIA; Chamber of Commerce
15	Ensure the ongoing protection of the forested areas of Halton Hills	Forests	The forest areas of Halton Hills are an important carbon sink.	Maintain the forest area within Halton Hills.	15.1 Undertake a detailed analysis of the carbon storage capacity of forested areas of Halton Hills.	2017	$45,000 for a detailed carbon inventory	Town	Planning and Infrastructure; Community and Corporate Services	ICSS	Halton Region; CVC; CH; GRCA
16	Continue to monitor progress toward achieving the plan.	Management	Development trends and technologies will evolve, necessitating regular monitoring and reporting.	N/A	16.1) Update the GHG inventory and GHG model for Halton Hills every two years; 16.2) Report on progress of implementing this plan every year; 16.3) Update and revise the plan every five years.	2016	$5-10,000 every two years	Town	Planning and Infrastructure	Mayor's Community Energy Plan; ICSS	N/A
17	Plan and design the Vision Georgetown community to be transit ready	Transportation	Ensure that Vision Georgetown can support transit when it is introduced.	Decrease vehicular mode share from 84% of trips to 71% of trips.		2015	Part of Vision Georgetown planning project budget	Town	Planning and Infrastructure	Vision Georgetown	Stakeholders involved in Vision Georgetown

NOTES:

- GHG = Greenhouse Gas
- ICSS = Integrated Community Sustainability Strategy
- TMP = Transportation Master Plan
- EDS = Economic Development Strategy
- CVC = Credit Valley Conservation
- CH = Conservation Halton
- GRCA = Grand River Conservation Authority
- TBD = To be determined as part of the final Mayor's Community Energy Plan and/or subsequent implementation phase.

11.4. Targets

Careful and detailed consideration was given to the inputs and results of the scenarios by Town staff and the consulting team. Achieving all three scenarios will require changes in human behaviour (especially related to commuting) and increased energy efficiency of new development. Given the current stage of the Town's evolution as a community, Scenarios 2 and 3 will require transformative change. Halton Hills is a relatively low-density community, characterized by travel patterns that are dominated by the car. Although meaningful change is starting to take place as new development becomes more efficient, as more intensification occurs, as alternative modes of transportation become more widely used, and as more people realize the benefits of energy conservation, it will take time and resources over the long-term to achieve significant change.

The conclusion of these deliberations was that in-keeping with the PAREE Principle (Practical, Affordable, Reasonable, Educational and Enforceable), it is recommended that Scenario 2 (Towards a Low Carbon Community) be the basis for establishing greenhouse gas emission reduction targets for Halton Hills. Scenario 2 achieves a 35% reduction in per capita greenhouse gas emissions. Although there is an overall increase in total greenhouse gas emissions over the baseline year (2011), Scenario 2 does achieve a 14% decrease in total emissions compared to Scenario 1.

Basing the targets on Scenario 2 will allow the Town the time needed to start implementing the Plan's recommendations and to assess progress. The outcomes of the recommended district energy feasibility study will be particularly important as all the scenarios, but especially Scenarios 2 and 3, are premised on Halton Hills having a district energy system in place by 2031. Once the results of the feasibility study are known and the Plan's implementation is underway, the greenhouse gas reduction targets can be revisited and adjusted as appropriate. It is recommended that this be done every two years. The two-year review will also take into account development trends and technological improvements.

Table 30 Recommended GHG targets for Halton Hills

	2011 Baseline (tCO2e)	2031 (tCO2e)	%
Absolute	618,465	638,353	+3%
Over S1	720,291	638,353	-14%
Per capita	10.5	6.8	-35%

As referenced in chapter 10, the targets for the corporation are as follows:

Table 31 Corporate Energy Plan targets

Area	Category	Target
Buildings	Energy intensity (ekWh/sqft)	-13% to -17%
	GHG emissions	-16% to-20%
Streetlights	Energy consumption	-30%*

*Halton Hills Hydro estimates that 30% reduction in streetlight electricity can be achieved.

Figure 41. Drawings from a children's sustainability workshop

12 Conclusion

To step back from the detailed analysis, the Town of Halton Hills, as a community, has many of the key ingredients necessary to move towards a low carbon community:

- Established town centres: Acton and Georgetown are two compact town centres with a wide range of amenities.
- Greenspaces: The community has extensive greenspace that reduces sprawl and acts as a significant carbon sink.
- An approved pathway to intensification: The existing planning regime is focused in the direction of supporting more compact growth on existing centres, which translates into more opportunities for cycling, walking, district energy, public transit and mixed-use developments.
- Vision Georgetown: This is a once-in-a-lifetime opportunity to design a community using the best possible strategies to reduce energy and GHG emissions. Few communities receive this kind of opportunity. Done well it will enable infrastructure such as district energy to trickle across into established neighbourhoods and act as an inspiration for the modification and retrofit of existing and new development going forward.
- Halton Hills Hydro: The existence of a subsidiary organization with a deep understanding and commitment to energy is a powerful resource that can advance the Town of Halton Hills' goals and and objectives on energy and GHG emissions.
- Existing efforts: There are many existing initiatives and projects both voluntary and commercial that are already underway that contribute to this effort.

A key challenge that the Town of Halton Hills community faces is the existing dispersed land-use patterns. These are difficult to revise and commit community members to a reliance on private vehicles and to a widely dispersed municipal infrastructure that is costly to maintain. However, the existing plans and policies place the Town of Halton Hills on a trajectory toward carbon reductions and this plan provides additional specificity and detail around the actions and strategies to achieve those reductions.

On the corporate side, there are significant opportunities for the Town of Halton Hills to improve the energy efficiency of its buildings, to reduce utility costs, and to minimize its environmental footprint. From July 2014 to July 2019, the Town will work to reduce its energy intensity between 13% and 17% and to reduce greenhouse gas emissions between 16% and 20%.

The corporate Town of Halton Hills can take advantage of these opportunities by implementing the organizational and technological actions, including:

- Adequate resources to implement the CEP, including a dedicated staff person responsible for the CEP, as well as a centralized facilities management role.
- Systematic and strategic implementation of retrofits in existing buildings;
- Development of a rigorous and effective monitoring and tracking system, through an EMS with supporting organizational capacity;
- Implementation of education, communication, engagement and training initiatives for staff; and

- Organizational policies and processes for implementing the CEP, tracking progress, and updating the CEP.

The Town of Halton Hills has the motivation and expertise to implement all of the actions in the CEP. However, the Town will likely need additional human and financial resources. The Town's investments in energy efficiency will yield significant returns, in the traditional economic sense, and will allow the Town to reduce its GHG emissions. Finally, they will help to establish the Town of Halton Hills as a national leader in the efficient management of energy.

As a whole, both the corporate Town and the entire community of Halton Hills are well positioned to reach their sustainability goals.

Glossary

ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers

baseline: basic level or standard, from which change is measured

biomass: non-fossilized organic matter. As an energy source biomass can be used directly to produce heat, via combustion, or indirectly after converting it to biofuel. Wood is the largest biomass energy source being used today.

CAO: Chief Administrative Officer

cap-and-trade: policy tool whereby a cap or limit is placed on total GHG emissions, and parties (whether nations, municipalities, or businesses) who exceed their quota may purchase unused quota from other parties, in order to meet the target

carbon credit: unit representing one tonne of GHG reductions achieved by one party, available for purchase by another

carbon tax: a GHG emissions reduction incentive in the form of a tax levied on carbon-based fuels

CEEI: The Community Energy and Emissions Inventory tracks energy consumption and GHG emissions stemming from community activities. It was designed to help communities meet their *Climate Action Charter* commitments.

CEP: Corporate Energy Plan

CO_2eq: Carbon dioxide equivalent

CSBP: Corporate Sustainability Building Policy

district energy: a system that centralizes heat and/or cooling for a neighbourhood or community

DHW: Domestic Hot Water

dotmocracy: facilitation method designed to recognize levels of agreement on a set of statements among a group of people. Participants write ideas on paper forms and record their opinion on a scale of strong agreement to strong disagreement, using dot stickers.

EEMS: Environmental and Energy Management System

EM&V: Evaluation, monitoring and verification

embodied energy: sum of the energy required to produce a good or service, including raw material extraction, manufacturing, transportation, etc

emissions factor: coefficient that approximates the emissions related to a measured use of a particular fuel or energy source, for the purpose of inventory and decision-making

EMS: Energy management system

FCM: Federation of Canadian Municipalities

FIT: Feed-in Tariff program. A policy mechanism offering long-term contracts to renewable energy providers, usually based on the cost of generation.

FTE: Full-time equivalent

green economy: economic development model based on sustainable development, natural capital and full-cost accounting, as distinct from other economic regimes

green space: expanse of grass, trees, etc, set apart for recreational or aesthetic purposes, especially in an urban environment. Also used to refer to all of these spaces within a given area.

GHG: green house gas. Any of the various gases that contribute to the greenhouse effect.

GHGProof: an Open Source modelling program designed to evaluate the impacts of land-use decisions on greenhouse gas emissions and energy consumption at the community scale. (Created by Sustainability Solutions Group.)

GIS: A Geographic Information System is a system designed to capture, store, manipulate, analyze, manage and present geographical data for the purpose of informing decision-making.

HRV: Heat Recovery Ventilation

HVAC: Heating, ventilation and air conditioning

hydraulic fracturing: technique used to access seams of oil or gas by injecting pressurized liquid to fracture the surrounding rock

IPCC: The Intergovernmental Panel on Climate Change is a scientific body established by the United Nations in 1988. It produces assessment reports (the fifth to be completed in 2014) to support the work of the UNFCCC.
IRR: Internal rate of return

IT: Information technology

KPI: Key performance indicator

LAP: Local action plan

LED: Light-emitting diode

LEED[R]: Leadership in Energy and Environmental Design is a set of certification programs for the design, construction operation and maintenance of buildings, homes and neighbourhoods. The program was established in the U.S. and has since been adapted for Canada.

MCEP: Mayor's Community Energy Plan

mixed-use housing: A building or development designed to accommodate diverse functions, usually including residential units, work places, etc.

multi-criteria analysis: tool to aid decision-making when there is a choice to be made between competing options. Analysis includes identifying and weighting criteria based on value judgments.

NPV: Net present value

O&M: Operations and maintenance

OPA: Ontario Power Authority

PCP: Partners for Climate Protection

QUEST: Quality Urban Energy Systems of Tomorrow

rebound effect: In energy conservation, refers to the effect of increased use of an energy-efficient technology such that actual energy savings are less than anticipated. Also known as the Jevons Paradox.

retrofit: modify an existing structure with new fixtures (in this context refers to more resource-efficient models)

RTU: Remote terminal unit

SCC: The Social Cost of Carbon is an economic strategy that attempts to express in monetary terms the damage associated with an increase in GHG emissions.

sprawl: the straggling expansion of an urban or industrial area

triple bottom line: concept that attempts to broaden conventional accounting by adding to the traditional bottom line of profit/loss lines to account for social and environmental costs

UNFCCC: The United Nations Framework Convention on Climate Change is an international treaty negotiated at Rio de Janiero in 1992 with the stated objective to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".

vehicular mode split: (also called modal share) percentage of travellers using a particular type of transportation or the number of trips made using this type

VFD: Variable Frequency Drive

VKT: Vehicle Kilometres Travelled

Appendix 1

IndEco Strategic Solutions for a Changing World™ & Sustainability Solutions Group

Mayor's Community Energy Plan Best Practices Report

June 2013

This document was prepared for the Town of Halton Hills by IndEco Strategic Consulting Inc. and Sustainability Solutions Group

Additional information on the Mayor's Community Energy Plan as well as the Town's many other sustainability initiatives is available via:

Sustainability Website: www.haltonhills.ca/sustainability
Project Webpage: www.haltonhills.ca/initiatives/CommunityEnergyPlan.php
Twitter: www.twitter.com/ImagineHH or @ImagineHH
Facebook: www.facebook.com/ImagineHaltonHills
Phone: 905.873.2601 ext. 2289
E-Mail: sustainability@haltonhills.ca

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1. Introduction

The following compilation is a set of best practices that can provide both reassurance and inspiration to the Town of Halton Hills.

The City of London has installed three free electrical vehicle charging stations in the downtown core as a pilot project to promote the use electric vehicles and the accessibility of charging stations in the city. Oshawa's Megawatt Challenge is an innovative mechanism to stimulate energy reductions in municipally-owned buildings. Caledon has developed and implemented a program to reduce energy demand in its facilities. The City of Thunder Bay has improved the public perception of active transportation and has increased the number of bike lanes developed within the city. The City of Hamilton has set energy intensity targets for its municipally owned facilities, and works closely with Horizon Utilities to implement energy efficiency projects. Taxibus is an example of a low cost transit system designed for communities with a distributed population. Halifax Regional Municipality's Solar City Initiative demonstrates how a municipality can advance renewable energy through bulk purchasing and quality assurance. The Modo Car Co-operative illustrates an effective mechanism for sharing vehicles, rather than supporting individual car ownership. Vancouver's Greenest City Action Plan is a comprehensive effort to advance green buildings and reduce GHG emissions using ambitious targets. Intervale Centre in Burlington, Vermont facilitates the development of local farms and local agricultural markets, reducing the GHG emissions from food transportation. Sustainable Travel Towns describes how a concentrated and comprehensive educational effort can significantly reduce vehicular use and increase walking and cycling. Children's trails in Norway describes how an often hidden network of trails can be identified for the benefit of the whole community. The Salix Revolving Loan Fund is a strategy for capturing and recycling the economic benefits of energy efficiency measures. A district energy system owned by the municipality of Boras in Sweden provides district energy and biogas.

These examples are to greater and lesser degrees applicable to the context of Halton Hills; at a minimum, they represent ideas or concepts that can be adjusted and modified to contribute to GHG emission reductions and energy savings in Halton Hills.

2. City of London launches electric vehicle pilot program

Location: London, Ontario

Population: 366,151

Issue addressed: Promoting use of electric vehicles

Description: In March 2013, the City of London announced a one year pilot program to test the use of three Electric Vehicle (EV) Charging Stations in the downtown core. The City will monitor the use and progress of the existing EV charging network in London and Ontario. The new locations added to the EV network include City Hall Lower Level Parking Garage, Covent Garden Market Parking Garage, and Budweiser Gardens Municipal Parking Lot #8. The City of London has partnered with three private sector EV charging station providers which include ChargePoint, Sun Country Highway, and HD Supply Canada Inc - each of the providers has donated a charging station to one of the three locations in London all located in pay parking lots. The pilot period will take place over the course of the year and will offer "free charging" to the public to promote the use and accessibility of the growing EV Charging Station infrastructure in London.

Relevance to Halton Hills: Transportation is the major source of GHG emissions in Halton Hills.

How to translate to the Halton Hills context: Halton Hills could embark on a similar initiative to add to the Ontario EV network and encourage the use of electric vehicles. Halton Hills could take this initiative a step further by requiring dedicated outlets for electric vehicles in new construction. Purchasing electric vehicles for municipal use will serve both to demonstrate the municipality's commitment and as an opportunity for staff to experience the implications of electric vehicle technology. Halton Hills may also consider partnering with Halton Hills Hydro to install public charging stations in Georgetown and Acton.

Source: City of London, Charging London, Pilot Program

3. Mayor's Megawatt Challenge

Location: Oshawa, Ontario

Population: ~152,000

Issue addressed: Reducing energy use & GHG emissions in existing buildings

Description: In 2002, the City of Oshawa signed on to the Mayor's Megawatt Challenge to reduce energy consumption in its municipally owned buildings. The city has 23 buildings involved in the challenge, which represents 80 percent of the city's energy footprint. The challenge allows the city to compare and benchmark its buildings to similar building types in other municipalities. As of 2008, the city had saved 20.7 percent of its energy throughout 16 buildings, and 3,500 tons of greenhouse gas emissions (GHG) compared to 2005. This was the greatest savings out of the nine other municipalities involved in the challenge. In 2011, the City of Oshawa also joined the Town Hall Challenge with 60 other municipalities with the goal to reach an energy intensity target of 20 ekWh/sf by the year 2015. Other Ontario cities that signed on to the Town Hall Challenge include: Caledon, Hamilton, Newmarket, Brampton, Mississauga, Burlington, Toronto, Windsor, Pickering, Richmond Hill, and Ajax, as well as other cities throughout Canada.

To reduce energy consumption, the city has installed solar panel systems that supply energy to the electrical grid on the rooftops of two recreation complexes, and the General Motors Centre. Several buildings are LEED certified, including City Hall, which underwent a retrofit and reduced its energy footprint by half, resulting in savings of $500,000 per year. Oshawa's courthouse is also certified LEED Gold and was built on a brownfield. Staff awareness and training programs have also been initiated, including: education on building automation systems for optimization of HVAC and lighting, manual control of lighting, staff energy awareness training, and identifying the relationship between programming, maintenance, and energy consumption. Training has led to increased energy management understanding and appreciation for staff, and has created a more consistent approach to building operations and management.

Relevance to Halton Hills: Buildings can play a large role in reducing total energy use and GHG emissions for the Town.

How to translate to the Halton Hills context: The Town of Halton Hills could consider joining the Town Hall Challenge to meet the energy intensity target of 20 ekWh/sf by the year 2015. The challenge allows for municipalities across Canada to compare and benchmark energy consumption in their buildings against like buildings in other jurisdictions.

Source: City of Oshawa, Town Hall Challenge

4. Greenest Town in Ontario

Location: Caledon, Ontario

Population: 59,460

Issue addressed: Organizational and management support for energy efficiency; reducing energy use & GHG emissions in existing buildings

Description: The Town of Caledon prides itself is being the "Greenest Town in Ontario". As a corporation, the Town was the first municipality in Ontario to incorporate environmental policies in the Town's Official Plan. Along with this, the Town has a dedicated staff member (Manager of Energy and the Environment) that is responsible for managing energy and sustainability within the corporation. Several plans and standards have been developed through the lead of the Manager of Energy and Environment related to the environment and sustainability including Caledon's *Corporate Energy Management Plan* and the *Corporate Green Building Standards*. The success of sustainability and energy within the Town is the result of continuous support and commitment from the Mayor, Town staff, local businesses, and community members.

Some initiatives the Town has undertaken to increase energy efficiency and reduce energy consumption in Town facilities includes: purchasing green energy for a number of its facilities, implementing a LEED Silver standard for all newly constructed municipal buildings, constructing a natural gas cogeneration unit at the Caledon Centre, installing solar walls at recreational complexes, and retrofitting lights and installing daylight sensor controls in all facilities.

The municipality has also signed up Town Hall to participate in *Race to Reduce*, which is a greening program that encourages tenants to make smart energy usage decisions and change their day-to-day energy operations and behaviour. As part of the challenge, Town Hall will have energy monitoring software soon available so that the public and staff can monitor and track the building's energy use in real time.

Relevance to Halton Hills: Commitment and support from the Mayor, Council, Town staff, and community members are essential if energy management is to continue to have strategic importance in the Town of Halton Hills.

How to translate to the Halton Hills context: Halton Hills can use the Town of Caledon as an example of a town of similar size and available resources to advocate for assigning at least one dedicated staff member to manage energy within the corporation. Halton Hills can also gain ideas from some of the energy initiatives the Town of Caledon has implemented.

Source: Town of Caledon

5. "You know me, I ride a bike" campaign

Location: City of Thunder Bay, Ontario

Population: 108,359

Issue addressed: Marketing active transportation

Description: In the City of Thunder Bay, there was a significant social stigma attached to cycling for transportation. Many drivers labeled cyclists as miscreants, unemployed, drunks, etc. Additionally, two councilors put forward a motion in 2012 to get rid of all bike lanes and have cyclists ride on sidewalks. The City's Health Unit played a leadership role in changing the conversation and public perceptions by:

- Publishing a media release stating that sidewalks are dangerous for cycling, based on City collision data.
- Launching a marketing campaign called "You know me, I ride a bike", with radio, newspaper and billboard advertisements.

The campaign aimed to improve the relationship between motorists and cyclists by educating motorists to view cyclists as a people, not objects, riding on the road. Prominent community members were also displayed on marketing posters to help change the negative perception of cyclists. Very quickly, the discussion shifted to bike lanes and cycling safety, and the public perception of cyclists changed greatly.

Steady municipal funding also contributed to the success of active transportation in the City of Thunder Bay. The active transportation program is provided with a dedicated annual budget for marketing and education programs, for the development of bike lanes, and for the salary of an Active Transportation Coordinator. In some years, the active transportation program has been able to supplement its annual budget, thanks to successful grant applications and funding from the provincial and federal governments. Council is now considering a ~40% increase in the annual active transportation budget.

Relevance to Halton Hills: Halton Hills is working to improve active transportation.

How to translate to Halton Hills context: Halton Hills has already initiated an active transportation campaign to raise money for the hospital. However, more could be done to promote active transportation within the Town, including building on the existing active transportation campaign and providing increased education about the benefits of cycling. One issue is lack of connectivity of bike lane paths throughout the Town, which raises safety concerns. Having a dedicated budget and support from Council and the community will help to connect the paths / lanes and promote the use of alternative transportation to travel between destinations. Looking for grant opportunities and funding sources is also something the Town of Halton Hills should pursue.

Source: City of Thunder Bay

6. Corporate Energy Policy

Location: City of Hamilton, Ontario

Population: 519,949

Issue addressed: Setting corporate energy targets; partnering with utility companies

Description: The City of Hamilton developed a Corporate Energy Policy in 2007 that sets energy reduction targets for the energy intensity of City facilities and operations. The City set the following energy intensity reduction targets:

- 3.0% reduction by 2009
- 7.5% reduction by 2012
- 20% reduction by 2020

As of 2011, the energy intensity of corporate buildings was down 14%, with an accumulated savings of $23 million. Contributing to these savings are various energy efficiency projects including: District Energy (cooling and heating), energy efficiency retrofits to the High Lift Pump Station, energy mapping, lighting retrofits in the arenas and fire halls, solar rooftop PV systems, and biogas projects at the Wastewater Treatment Plant.

The City also works closely with Horizon Utilities to implement energy efficiency projects. The 38 projects the City has implemented with the help of Horizon since 2010 has resulted in 13.5 million kWh in savings, which is equivalent to taking approximately 17,000 homes off the grid.

Relevance to Halton Hills: The relationship between Hamilton and its energy utility parallels that of the Town of Halton Hills with its utility.

How to translate to Halton Hills context: Halton Hills should continue to partner with HHH to implement energy efficiency initiatives. HHH is also a valuable funding source for many projects through the OPA saveONenergy programs. In addition to working with HHH, the Town of Halton Hills should consider developing energy reduction targets in order to demonstrate commitment to energy management.

Source: Community Conservation Awards, City of Hamilton Corporate Energy Policy

7. Taxibus

Location: Rimouski, Quebec

Population: 46,860

Issue addressed: Cost-effective public transportation in low density areas.

Description: After seeking a form of public transit that could serve effectively but within its financial constraints, the City of Rimouski created a successful operation using private taxis. Taxibus and INTER-Taxibus are demand-responsive services operating on weekdays in Rimouski. Taxibus passengers can travel between any two of 350 designated stop points, sharing taxis that are dispatched in a manner to maximize occupancy. INTER-Taxibus passengers can travel within either of two outer service zones, or between them and the Taxibus zone. All trips are made without transfers and leave within 15 minutes of the scheduled time. A non-profit corporation created by the city administers the service and performs registration, reservation and financial functions. Local taxi drivers have formed a cooperative to dispatch and drive the taxis.

In 2004, Taxibus and INTER-Taxibus served 81,000 passenger trips annually with an average occupancy of 2.9 passengers per taxi, an average fare of $0.64 and a revenue/cost ratio of 45%. The services required a municipal subsidy of about $180,000 annually, a lower per-capita rate than conventional transit services in Quebec communities of a similar size. There are now taxibuses in many communities in Quebec and across Canada.

Relevance to Halton Hills: The Taxibus concept is particularly useful for servicing areas of low density that don't warrant regular public transit.

How to translate to the Halton Hills context: The City of Rimouski has created a comprehensive model for the Taxibus concept and has since added taxi-bus plus for longer distances and has integrated the Taxibus with more conventional public transit systems. Halton Hills could explore a similar initiative.

Source: Transport Canada

8. Halifax Regional Municipality (HRM) Solar City

Location: Halifax Regional Municipality

Population: ~400,000

Issue addressed: Barriers to solar hot water installation

Description: HRM identified an opportunity to scale up the installation of solar hot water systems in Halifax through a co-ordinated purchasing and installation effort. The Solar City project was designed to address three issues: complexity of technology options, complexity of financing, and the fragmented solar industry. HRM acts as a financial administrator and contracting agent to install an initial 1,000 to 1,500 panels on 500 to 700 homes within one year. The project will be financed through a low-interest loan through the FCM Green Municipal Fund and residents would be able to repay the cost at a schedule that would match the energy savings on their tax bills. Recognizing that there were only 800 solar hot water installations in Canada last year, this was anticipated to be a difficult target, but in the initial call the City received 2000 names of individuals wishing to participate. The project is expected to generate over 75,000 person hours of employment, 30-40 new green collar jobs, $250-700 in annual savings per resident and annual GHG reductions of 2,000 tonnes. One major challenge was that it was necessary for the Province of Nova Scotia to amend the HRM Charter to enable security of financing of energy conservation via lien authority.

Relevance to Halton Hills: The project illustrates the possibilities of scaling up solutions when key barriers are addressed. Halton Hills also has a better solar resource than Halifax.

How to translate to Halton Hills context: This approach to broad deployment of solar hot water could be investigated for Halton Hills and the opportunity to attach additional payments to municipal taxes now exists in Ontario.

Source: Halifax Regional Municipality

9. Modo – The Car Co-op

Location: Vancouver, BC

Population: 1 million+

Issue addressed: Car-sharing

Description: Modo is a not-for-profit co-operative with about 8,000 members sharing 250 vehicles in Metro Vancouver. Modo has a diverse fleet that includes hatchbacks, hybrids and minivans and the same rate is charted regardless of the type of car that is booked. Booking occurs over a secure website. Modo members typically drive only 1,400 kilometres a year, while the average driver in the Lower Mainland drives 6,000 - 24,000 kilometres a year and produce 0.32 metric tonnes of carbon dioxide equivalents a year, which is 10-36 times less than the average driver. Members purchase a one-time refundable share of $500 to join, and a $20 non-refundable registration fee is also collected to pay for a member binder, a lockbox key and a credit check. In addition, members pay a small monthly administration fee to cover some of the fixed costs of the car, and low hourly and per kilometre usage fees set up in a variety of plans designed to meet the needs of members. Other characteristics of Modo are as follows:

- Modo cars are permitted to park in any Permit Zone in Vancouver. Members are also entitled to use car share parking spaces at a growing number of SkyTrain stations.
- Members do not pay for vehicle maintenance or gas; amounts paid by members to fill up cars are credited on monthly bills.
- All insurance, cleaning, maintenance, BCAA Membership, plus permanent and permit parking are included in the rate plans.
- Modo cars are insured for both work and pleasure use with the co-op holding the insurance under a fleet plan option. As with privately owned vehicles, car costs can be claimed as business expenses when the vehicle is used for work purposes.
- Modo members also have access to reduced public transit costs and other car co-operatives around the world.
- Modo can also be useful for organisations. A Vancouver courier company called Novex uses Modo cars in order to avoid purchasing new vehicles.

Relevance to Halton Hills: The car-sharing option is particularly useful for people who can easily access key destinations without driving and is less appropriate for suburban areas. Car co-op spaces could be allocated for future development projects.

How to translate to Halton Hills context: Halton Hills could explore setting up a co-op to support the development of a car co-operative. Incentives such as free parking, municipal use of the car co-op and other strategies can be used to support the development.

Sources: Modo, Co-operative Secretariat

10. Greenest City 2020 Action Plan

Location: Vancouver, British Columbia

Population: 603,502

Issue addressed: Reducing energy use & GHG emissions in existing buildings; new construction standards

Description: The City of Vancouver wants to become the greenest city in the world and has developed the *Greenest City 2020 Action Plan* to help meet its goal. On the corporate side, the city has reduced emissions from municipal operations to 33% below 1990 levels, with a goal of reaching carbon neutrality by 2012 (it is unclear if this goal has been met). Energy upgrades to municipal facilities and the construction of high performing new buildings have reduced GHG emissions by 22% under 1990 levels on the building side. Upgrades have included: new boilers, improvements to the building automation system, new lighting with instant on/off capability, HVAC upgrades, and energy metering.

For new construction, all new municipal buildings are to be built to LEED Gold. Some features of the City's LEED buildings include: high-efficiency glazing to prevent heat loss, geothermal heating and cooling, light sensors, dual-flush toilets, radiant floor heating, light tubes to provide natural daylight, geo-exchange heating, and solar panels.

Relevance to Halton Hills: Buildings can play a large role in reducing total energy use and GHG emissions for the Town.

How to translate to the Halton Hills context: Halton Hills can use the targets developed by the City of Vancouver as a guideline for developing their own energy and GHG targets. The Town could also consider setting a carbon neutral target for its buildings and operations.

Source: City of Vancouver, Greenest City 2020 Action Plan

11. Intervale

Location: Burlington, Vermont

Population: 42,645

Issue addressed: Support for local agriculture

Description: In 1980s, a river valley on the edge of Burlington that used to be a farm had fallen into disuse. A local entrepreneur, Will Raap started a small garden shop on the edge of the valley and identified the potential to grow 10% of Burlington's fresh food at the Intervale. From this beginning the Intervale has expanded to a web of agriculture-based businesses including the Gardener's Supply, Burlington Electric's McNeil Generating Station, the Sugarsnap Café, and the Stray Cat Flower Farm and Market. The Intervale Center is a non-profit organisation that runs the 350 acres including a dozen farms, Community Supported Agriculture (CSA) programs, a compost project, a conservation nursery, produce and farm product distribution and storage enterprises, and farm consulting services.

The Intervale Center is a non-profit that engages local farmers and eaters at every step of the supply chain of local food, from pre-production planning to post-consumer waste disposal. It has a local food education program for young people, a farm enterprise business incubator for new farmers, business consulting services for established farmers, and a land preservation initiative.

The Farm Incubator Program has provided start up support for emerging and small organic farmers since 1995. Incubator farms get subsidized rates and access to equipment and mentoring. The fees start low and only rise as the farmers' independent businesses expand and they reach enterprise status after three years. The Intervale is a platform for young aspiring farmers to take a risk and launch an enterprise, and when they emerge from incubator status they are prepared to pay market rates to continue.

Relevance to Halton Hills: Local food production is widely supported in Halton Hills, much like Burlington. Halton Hills also has a farming history and the municipality has agricultural land that could support a similar project. In Burlington the municipality played a key role in helping Intervale start, through funding and access to land.

How to translate to Halton Hills context: Halton Hills can explore working with local farmers and to initiate a similar initiative to house a diverse network of farms and businesses, helping to build social capital and increase the production and demand for local organic food.

Source: Intervale Center

12. Sustainable Travel Towns

Location: Darlington, Peterborough and Worcester, UK

Population: 98,000, 173,400 and 94,000

Issue addressed: Transportation in medium-sized communities

Description: Darlington, Peterborough and Worcester are all medium-sized, relatively freestanding towns, located in the north and middle of England. Following a competition, they were designated 'Sustainable Travel Towns', implementing a program of measures from 2004 to 2009, intended to reduce car use. Taken together, they spent £15 million, of which £10 million was special Government funding provided by the Department for Transport. Baseline surveys in each town in 2004 showed that traffic growth was a significant issue of public concern. The same surveys showed strong public support to give more sustainable transport modes (buses, walking and cycling) a priority in transport policy. Each town spent most investments on personal travel planning (from a third to nearly half of revenue spending), followed by travel awareness campaigns, promoting walking and cycling, and public transport marketing. Smaller amounts were spent on workplace and school travel plans. The main data sources for the towns included detailed travel surveys, smaller interim household surveys in some areas, surveys in schools and workplaces, bus passenger counts, automatic and manual counts of cyclists, manual counts of pedestrians and automatic and manual vehicle counts.

Car driver trips by residents fell by 9% per person, and car driver distance by 5% - 7%, according to aggregated household survey results for the three towns. This compares with a fall of about 1% in medium-sized urban areas over the same period. Bus trips per person grew substantially, by 10% - 22%, compared with a national fall of 0.5% in medium-sized towns. The number of cycle trips grew substantially in all three towns by 26% - 30%. Darlington (which was also a Cycling Demonstration Town) showed the greatest growth. Meanwhile, cycle trips declined in medium-sized towns elsewhere. The number of walking trips also grew substantially, by 10% - 13%, compared to a national decline in similar towns.

The number of interventions was substantial and comprehensive, including the following:

Workplace travel planning: Support available to employers included assistance in undertaking surveys, advice on developing a travel plan, access to a travel plan network, employer green travel award, grants for sustainable travel improvements, discounted bus ticket schemes, new bus services (a commuter bus and a shuttle bus to a park-and-ride site), cycle to work promotions, workplace cycle training, cycle loan schemes, a visiting cycle repair service, access to a city-wide car share scheme organised via Liftshare, travel advice sessions, and customised travel guides to key worksites.

School travel planning included assistance with pupil surveys and writing the school travel plan, a school travel plan award scheme, provision of cycle parking, cycle training, cycling promotion (Bike It), Dr. Bike sessions, bikers' breakfasts, cycle loan schemes (for teachers and parent-and-child tandems), pedestrian training, assistance setting up walking buses, promotional activities such as Medal Motion, Walk on Wednesdays, Walk to School Week, Wheelie Wednesdays etc., lesson activities and participation in assemblies, and visiting theatre productions on school travel issues.

Personal travel planning included town-wide and neighbourhood walking, cycling and public transport maps or guides, walking information (e.g. leisure walks leaflets, information about walking groups and events, leaflets on walking for health and setting up a walking bus), cycling information (e.g. cycle maps, guides to neighbourhood cycle routes, information about cycle loans, cycle training, taking a bike on the train, choosing a bike and cycle maintenance), cycling services and equipment (cycle training, cycle loan scheme, bike health check, LED cycle lights, cycle trip computer), public transport information (e.g. bus map, area guides to bus services, bus stop-specific timetables, personal journey plans, rail timetables, information about Text and Go service, information about railcards and concessionary fares), a free bus pass for a limited period, travel information for people with mobility problems (e.g. about Shopmobility and transport to healthcare), information about eco-driving and car-sharing; and loyalty scheme pledge cards and challenges.

Relevance to Halton Hills: Transportation is a major source of GHG emissions in Halton Hills and many people commute to Toronto. While this project took place in the UK, it does provide evidence that a sustained and comprehensive effort to address transportation will yield significant results.

How to translate to Halton Hills context: Halton Hills can consider a comprehensive approach to transportation over ten years with multiple interventions and funding from FCM's Green Municipal Fund, municipal sources and other grants, focusing on strategies to encourage people to cycle, walk and use the GO Train.

Source: UK Department of Transport

13. Children's Trails

Location: Sandes, Norway

Population: 56,000

Issue addressed: Supporting youth and children in non-vehicular modes of travel

Description: Sandnes has a burgeoning population and has adopted a policy of densification to accommodate growth. In order to protect existing local environments, the city made a systematic effort to identify young people's use of urban areas. The Children's Trails program was launched as a way to improve the environment in which children and young people grow up, and to strengthen their interest in city planning. The program is a joint venture between the Department of Culture, Department of Parks and Outdoor Environment and the Department of Education. It is funded by the Ministry of Children and Family Affairs. As part of the initiative, children 8-13 years old at all schools recorded on maps their informal play areas, paths and trails. In all, the children identified 1265 play areas, 550 short cuts, 130 reference areas for schools and 185 reference areas for nurseries. The information was transformed into digital form and made available through the municipal mapping program. Consideration of the Children's Trails report is a permanent routine in all physical planning.

Relevance to Halton Hills: This is a mechanism to broadly engage the community in transportation issues and to ensure safe accessibility for a population that is not served by traditional transportation infrastructure.

How to translate to Halton Hills context: Halton Hills can consider developing a partnership with Halton Hill's Recreation and Parks Department, the Halton District School Board and the Halton Catholic District School Board to undertake this type of project.

Source: Provincial Health Services Authority

14. Salix Revolving Loan Fund

Location: United Kingdom

Population: N/A

Issue addressed: Financing energy efficiency in the public sector

Description: Salix is an independent, not-for-profit company set up by the Carbon Trust in 2004 as an integral part of the UK's Climate Change Programme. It is designed specifically to address the issue of public sector investment capital and annual financing rules. The role of Salix is to help public sector bodies reduce energy costs and carbon emissions and show leadership in tackling climate change by providing funding and expertise. Typically, progress in reducing GHG gas emissions from the public sector has been hampered by lack of investment capital and revenue/capital barriers (the 'annuality' problem). Salix is currently working with the higher education sector, National Health Services, local authorities and UK government departments. Start-up budget for the first two years was £20 million per annum. Salix stimulates investment by establishing ring-fenced, interest-free funds matched by the public sector. The funds are unique in that they recycle savings back to the organisation. Funding typically ranges from between £100k and £500k, targeted at cost-effective projects with a high persistence and CO2 impact. Projects must comply with either of the following criteria:

- A payback period of 5 years or less which costs less than £100 per tonne life-time carbon saved or;
- A payback period of 7.5 years or less with a cost of less than £50 per tonne life-time carbon saved.

Salix also provides expertise and tracking systems to identify savings.

Relevance to Halton Hills: While Salix is the best example of a green revolving loan fund (GRLF) for energy efficiency, other municipalities in Canada have developed GRLFs in various forms including the City of Toronto's Green Revolving Loan Fund, the Toronto Atmospheric Fund and the City of Edmonton's Sustainable Development Fund. Haida Gwaii and Peace River Regional District in BC are also in the process of developing similar funds. Such a fund can be used both to finance energy efficiency retrofits in municipal operations and in the broader community.

How to translate to Halton Hills context: Halton Hills can investigate working with the local credit unions, the Federation of Canadian Municipalities, the Toronto Atmospheric Fund or other local partners to establish a fund initially targeting municipal retrofits. After gaining experience with this effort over several years, Halton Hills could expand the effort to include residential and commercial buildings.

Source: Salix Finance

15. Boras – A medium sized town on a path to carbon neutrality

Location: Borås, Sweden

Population: 64,000

Issue addressed: Production of district heating, cooling and electricity

Description: Borås is Sweden's 13th largest municipally. Around 64,000 people live in Borås City, and over 100,000 throughout the municipality. Borås Energi och Miljö AB (BEM) is a municipally owned company that handles waste and the production of district heating, cooling and electricity in the municipality. The company's vision is a city free from fossil fuels and BEM has established several different district heating plants. The main unit, Ryaverket, is a combined heat and power plant with two biofuel boilers, two waste boilers and two generators. The two Ryaverket generators are driven by steam produced from the combustion of biofuel and waste. Electricity is also generated using four different hydropower plants. The generators were built in 1965, but were rebuilt and renovated in 2008 to obtain a higher electricity/heat ratio. Biodegradable household waste is mixed with biodegradable waste from non-domestic sources in an anaerobic digester to produce biogas. Biogas is distributed at four different filling stations in Borås two of which are open to the public, one is located at the local bus garage and the other is at the Sobacken plant for filling BEM's vehicles.

Relevance to Halton Hills: New developments can be designed to support district energy particularly South-West Georgetown.

How to translate to Halton Hills context: Halton Hills can investigate partnering with Halton Hills Hydro to assess the opportunity for the production of district heating, cooling and electricity in the municipality, identify potential areas for district energy and undertake prefeasibility studies. Identification of sufficient biomass or waste is the next step. Ultimately a service area bylaw could be used to ensure connection to the district energy systems in the relevant locations.

Source: Global District Energy Climate Awards

16. Conclusion

The general trend for GHG emissions and energy in most communities in North America is that of an upward trajectory. Energy and GHG emissions are not the traditional domain of municipalities. For these two reasons, considerable creativity and experimentation are required to identify policies and actions that effectively save energy and reduce GHG emissions. A key strategy to avoid the pitfalls and failures in this process is to draw on the experience of other communities who have already walked this road, or part of it. The 14 profiled stories in this report represent a combination of regional, national and international best practices that can serve as inspiration for the Town of Halton Hills. These best practices do not provide sufficient detail to launch Halton Hills into a new project, but they do provide a taste to discover whether one or more of the profiled initiatives merits further investigation.

Appendix 2

GHGProof Community: Town of Halton Hills

Data, methods and assumptions manual

May 8 2013, updated June, 2014

Version 1

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1. Modelling

Modelling is a useful strategy to clarify what matters and what doesn't in complex systems. A model is defined as:

> . . . a conceptual abstraction of an existing or proposed real system that captures the characteristics of interest of the system. Modelling is the process of building the abstraction (Taylor & Tofts, 2003).

Models may be used for (Johnston & Shabazian, 2003):

1. Analysis of past and present spatial patterns of phenomena (with maps and descriptive statistics);
2. Projection of the most likely future patterns of these conditions; and
3. Prescription of desired future conditions and requisite policies (and testing of these policy sets).

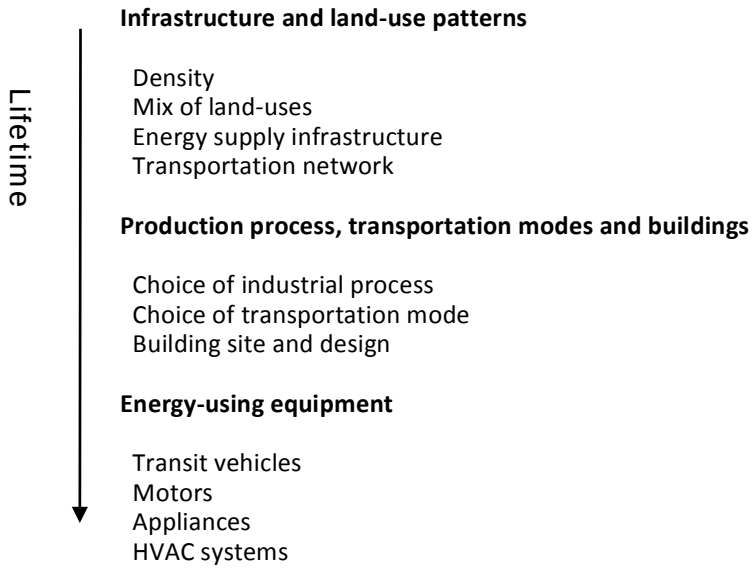
The development of models to assess social and environmental impacts on land-use is currently an area of focus and innovation for many researchers, motivated by the need to assess major transportation investments and their effects on urban development and on the environment. A model can support a community in its efforts to think longer-term, clearly communicate causes and effects, allow planners to rapidly assess the impact of different scenarios without risk and provide an informed context for decision-making.

It is important to note that the map is not the territory; the only model that will behave, in all ways, as the original system is that system itself. In other words, the model will not determine the outcomes but it can illustrate the effects of choosing those outcomes. Thus, for a user to trust a model, both the assumptions and the means of creating and presenting the model need to be fully transparent.

2. Background

Of all the energy-related decisions made at a community level, land-use decisions have implications on the community's consumption of energy for the longest time (See Figure 1). Land-use decisions therefore need to be prioritized in efforts to reduce energy consumption and greenhouse gas emissions, above transportation management, site and building design and energy supply (Jaccard, 1997).

Figure 1: Hierarchy of Energy Related Choices



3. Structure

The total GHG for a community is defined as the sum of the GHG from each of the aspects:

$$GHG_{landuse} = GHG_{transport} + GHG_{energygen} + GHG_{waste} + GHG_{agriculture} + GHG_{forest} + GHG_{landconvert}$$

Where

$GHG_{transport}$ is the movement of goods and people.
$GHG_{energygen}$ is the generation of heat and electricity.
GHG_{waste} is liquid and solid waste produced.
$GHG_{agriculture}$ is the production of food.
GHG_{forest} is the area of forest land.
$GHG_{landconvert}$ is the area of land in natural or modified conditions.

4. GIS analysis

GIS is used to generate inputs into GHGProof including the following aspects:

- **Key destinations**: Destinations in the Town of Halton Hills are identified by assigning trip generation numbers to all commercial and institutional parcels in Halton Hills in GIS. A heat map is used to identify the most important generations and these are weighted based on the number of trips that they generate.
- **Trip length:** Trip length is calculated by aggregating the average distance from every dwelling to all of the weighted destinations.
- **Walking and bicycling**: Walking and bicycling is calculated by assessing the number of people within 400m of key destinations.

- **Transit accessibility**: Transit accessibility is calculated by assessing the number of dwellings within 400m of transit.
- **District energy:** The potential for district energy is calculated by identifying the number of dwellings within a dissemination area that has a density of 55 units per hectare.
- **Forest area**: Forest area is assessed by identifying the area of municipally-controlled forest land.
- **Agricultural area**: Agricultural area is identified from municipal GIS layers.
- **Liquid waste treatment**: Number of dwellings connected to septic systems is calculated by subtracting the number of dwellings connected to a waste treatment system from the total number of dwellings.

For a detailed review of the GIS analysis, please see the GHGProof guidebook on SSG's website.

5. Scenarios development

A model is designed to support the use of scenarios as a mechanism to evaluate potential futures for communities (Bartholomew, 2006) Bartholomew (p. 2) describes a scenario as ''an internally consistent view of what the future might turn out to be—not a forecast, but one possible future outcome". A good set of scenarios is both plausible and surprising (Xiang & Clarke, 2003) but scenarios can also be misleading if, for example, there are too few so that one scenario is ''good'' and the other ''bad". Another consideration is to ensure that the name of the scenario does not bias the audience. And lastly, the scenarios must represent serious considerations defined not only by the planning staff but also by community members (Ibid).

The model seeks to address five aspects of scenarios (Xiang & Clarke, 2003);

1. Alternatives: variations of housing types, locations, technologies can be expressed using scenarios in the model.
2. Consequences: the immediate and cumulative effects (physical, ecological and economical) are expressed through the outputs of the analysis and in the course of a mapping exercise.
3. Causations: causal bonds between alternatives and consequences are illustrated using transparent equations between assumptions and inputs.
4. Time frames- periods of time between implementation of the alternatives and the unfolding of their consequences are indicated in the inputs spreadsheet.
5. Geographical footprints: the place-oriented blueprints or alternatives are developed using a GIS methodology.

Scenarios are generated by identifying population projections into the future, identifying how many additional households are required and then applying those additional households according to existing land-use plans and/or alternative scenarios. We then use a simplified transportation model to evaluate the impact of the new development on transportation behaviour, building types, agricultural and forest land and other variables.

Table 1: Variables

	Variables	Business as usual	Scenario 1- Moderate (2031)	Scenario 2 (2031)
Land-use	Location of dwellings	Reference case, Intensification study	Official Plan, Amendment No. 9	Official Plan, Amendment No. 9
	Location of commercial buildings	Current plan	Current plan	Current plan
Transportation	Mode split	82% vehicles by 2031	71% vehicles by 2031	54% vehicles by 2031
	Fuel efficiency	Government of Canada fuel efficiency regulations	Additional fuel efficiency improvements (5%)	Additional fuel efficiency improvements (10%)
	Access to transit	No additional transit service	Link to Brampton; Connection between Georgetown and Acton	Expanded GO train service in Georgetown; Bus service from Acton to Georgetown
	Emissions factor of fuel	Government of Ontario	10% electric vehicles	30% electric vehicles
Buildings	Mix of dwelling types	75% single family homes	60% single family homes (new homes)	40% single family homes(new homes)
	Rate of and energy reduction from retrofits	No retrofits	5% of buildings per year	7.5% of buildings per year
	Energy reduction from new building codes/incentives	Existing provincial building code updates	50% reduction for new buildings	60% reduction for new buildings
	Connection to district energy	No district energy	District energy in SW Georgetown	District energy in SW Georgetown
Waste	Per capita waste production	1,201 kg	1,000 kg	800 kg
	Diversion rate	65% by 2016	70% by 2031	80% by 2031
	Landfill gas capture	Yes	Yes	Yes
	Level of wastewater treatment	Remain at 2011 levels	No change	No change
Local agricultural production	Area of agricultural land	17,707 ha	17,707 ha	17,707 ha
	Intensity of food production	Remain at 2011 levels	Increase by 5%	Increase by 10%
	% of food consumed locally	Remain at 2011 levels	Increase by 10%	Increase by 40%
Forest	Area of forest	Remain at 2011 levels	Remain at 2011 levels	Remain at 2011 levels
	Area harvested for firewood	Remain at 2011 levels	No change	No change

6. Addressing uncertainty

There is extensive discussion of uncertainty in the models and modelling results. The assumptions underlying a model can be from other locations or large data sets and do not reflect local conditions or behaviours, and even if they did accurately reflect local conditions, it is exceptionally difficult to predict how those conditions and behaviours will respond to broader societal changes and what those broader societal changes will be (the "unknown unknowns").

An analysis of land-use models used to assess climate change impacts for Sydney, Australia, emphasised that the models should be used only for scenario testing and not forecasting because of limits to the possible precision. The importance of this point is demonstrated by the fact that the models considered in this analysis can generate a range of outcomes from the same starting point (Oydell et al., 2007, pg. 10).

We identified four strategies for managing uncertainty applicable to community energy and emissions modelling:

1. Sensitivity analysis: From a methodological perspective, one of the most basic ways of studying complex models is sensitivity analysis, quantifying uncertainty in a model's output. To perform this assessment, each of the model's input parameters is described as being drawn from a statistical distribution in order to capture the uncertainty in the parameter's true value (Keirstead, Jennings, & Sivakumar, 2012).

> Approach: We will increase each of the variables by 10% to illustrate the impact that an error of that magnitude has on the overall total.

2. Calibration: One way to challenge the untested assumptions is the use of 'back-casting' to ensure the model can 'forecast' the past accurately (Keirstead et al., 2012). The model can then be calibrated to generate historical outcomes, which usually refers to "parameter adjustments" that "force" the model to better replicate observed data (Miller, 2004).

> Approach: We will calibrate variables for which there are two independent sources of data. For example, we will be able to calibrate the model against actual electricity data from Halton Hills Hydro.

3. Scenario analysis: Scenarios are used to demonstrate that a range of future outcomes are possible given the current conditions that no one scenario is more likely than another.

> Approach: We will create a business as usual scenario and two alternative scenarios that represent different visions of the community.

4. Transparency: The provision of detailed sources for all assumptions is critical to enabling policy-makers to understand the uncertainty intrinsic in a model.

> Approach: The assumptions and inputs are presented in this report.

7. Conclusion

The modelling process involves thousands of calculations based on these assumptions and involves a significant time commitment to develop. As a result we request that the client take the time to understand the methodology and assumptions up front so we can make any changes necessary at this point and that this document is then signed-off as the basis for the modelling exercise.

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9. Appendix 1: Assumptions detail

Population

			Rationale
Start year	2011	year	Established by Town of Halton Hills
Population, 2011	59,008	#	Statistics Canada 2011 Census
Households	20,260	#	Statistics Canada 2011 Census
Population, 2031	94,000	#	Sustainable Halton Development Phasing Report
End year	2031	year	Established by Town of Halton Hills

Transportation

Daily trips per household 2006	2.60	#	Transportation Tomorrow Survey
Median trip length 2006			
Auto	6.90		Ibid
Auto passenger	3.40		Ibid
Go Train	42.90		Ibid
Mode split, 2006			
Vehicles	84%		Halton Hills Transportation Master Plan Report 2011
Transit	2%		Ibid
School bus	7%		Ibid
Walk/cycle	7%		Ibid
Mode split, 2031			
Vehicles	82%		Ibid
Transit	4%		Ibid
School bus	7%		Ibid
Walk/cycle	7%		Ibid
Commuting trips PM			
Halton Hills	30%		Halton Hills Economic Development Plan- Situation Analysis 2012
Toronto	10%		Ibid
Brampton	13%		Ibid
Mississauga	21%		Ibid
Milton	6%		Ibid
Others	20%		Ibid
Fuel efficiency	9.52	km/l	Average for Ontario in 2008 from Statistics Canada
Fuel cost, 2011	1.24	$	Ontario Ministry of Energy, Fuel Prices
Fuel cost escalation	1.00%	%/year	Assumption
Fuel emissions factor	2.50	kgCO2e/L	Environment Canada National Inventory Report 1990-2011 Greenhouse Gas Sources and Sinks in Canada
Fuel emissions factor, 2050	1.92	kgCO2e/L	Assumption
Annual vehicle replacement	4%	%	Vehicle scrappage in Canada
2016 Fuel efficiency regulation	9.54	km/l	EPA Regulations and Standards for 2016
2025 Fuel efficiency regulation	15.15	km/l	EPA Regulations and Standards for 2025
% of trips within 400 m	24%	%	Access to destinations: How close is close enough?
% of 400m trips willing to walk	21%	%	Trends in walking for transportation in the United States, 1995 and 2001
% of trips within 1000 m	24%	%	Access to destinations: How close is close enough?
% of 1000m trips willing to cycle	21%	%	Ibid
% of trips shifted to transit if <400m	15%	%	Quantifying Greenhouse Gas Emissions Mitigation Measures

Transit efficiency	45.0	passenger km/L	A cost comparison of transportation modes
Transit emissions factor	1.7	kgCO2e/km	Getting to Carbon Neutral: A guide for Canadian Municipalities; assumes diesel buses
Transit cost	0.5	$/passenger km	A cost comparison of transportation modes

Buildings

Emissions factors			
Electricity	352.8	kgCO2e/GJ	Environment Canada National Inventory Report 1990-2011 Greenhouse Gas Sources and Sinks in Canada
Natural gas	49.2	kgCO2e/GJ	Environment Canada National Inventory Report 1990-2011 Greenhouse Gas Sources and Sinks in Canada
Heating Oil	70.3	kgCO2e/GJ	Environment Canada National Inventory Report 1990-2011 Greenhouse Gas Sources and Sinks in Canada
Propane	60.9	kgCO2e/GJ	Environment Canada National Inventory Report 1990-2011 Greenhouse Gas Sources and Sinks in Canada
Wood	0.0	kgCO2e/GJ	Considered biogenic source of energy
Cost of energy			
Electricity	28.9	$/GJ	Ontario Energy Board
Natural gas	2.3	$/GJ	Ontario Energy Board
Heating Oil	31.0	$/GJ	National Energy Board Winter Outlook 2012-2013
Propane	29.1	$/GJ	Natural Resources Canada Energy Sources
Wood	12.2	$/GJ	Estimated
Detached, 2011		#	Halton Hills GIS analysis
Attached, 2011		#	Halton Hills GIS analysis
Apartments ≤ 5 stories, 2011		#	Halton Hills GIS analysis
Apartments > 5 stories, 2011		#	Halton Hills GIS analysis
Mobile homes, 2011		#	Halton Hills GIS analysis
Detached, 2011	0.0		
Energy/area	1.1	GJ/m2	Comprehensive Energy Use Database- Ontario Table 34
Average size		m2	Halton Hills GIS analysis
Attached			
Energy/area	1.0	GJ/m2	Comprehensive Energy Use Database- Ontario Table 36
Average size		m2	Halton Hills GIS analysis
Apartments ≤ 5 stories			
Energy/area	0.8	GJ/m2	Comprehensive Energy Use Database- Ontario Table 38
Average size		m2	Halton Hills GIS analysis
Apartments > 5 stories			
Energy/area	0.8	GJ/m2	Comprehensive Energy Use Database- Ontario Table 38
Average size		m2	Halton Hills GIS analysis
Mobile homes			
Energy/area	1.5	GJ/m2	Comprehensive Energy Use Database- Ontario Table 40
Average size		m2	Halton Hills GIS analysis
Energy reduction for new buildings, 2011 onwards			
BAU	25%	%	Energy efficiency requirements in building codes, energy efficiency policies for new buildings
Scenario 1	50%	%	Assumption
Scenario 2	60%	%	Assumption
% of existing buildings upgraded per year			
BAU	0%	%	Assumption
Scenario 1	5%	%	Assumption
Scenario 2	8%	%	Assumption

Energy savings in existing buildings			
BAU	10%	%	Assumption
Scenario 1	25%	%	Assumption
Scenario 2	40%	%	Assumption
Commercial buildings			
Energy/area	1.5	GJ/m2	Comprehensive Energy Use Database Table 3
Emissions factor, commercial buildings			
BAU	26.12	kgCO2e/GJ	Comprehensive Energy Use Database Table 3
Scenario 1	20.31	kgCO2e/GJ	Assumption
Scenario 2	14.67	kgCO2e/GJ	Assumption
% of existing buildings upgraded, commercial			
BAU	0%	%	Assumption
Scenario 1	5%	%	Assumption
Scenario 2	8%	%	Assumption
Energy savings in existing commercial buildings			
BAU	10%	%	Assumption
Scenario 1	30%	%	Assumption
Scenario 2	40%	%	Assumption

Community energy

Threshold	50.0	kWh/m2/yr	District heating distribution in areas with low heat demand density
Energy savings in existing commercial buildings			
BAU	0%	%	Assumption
Scenario 1	45%	%	Assumption
Scenario 2	45%	%	Assumption

Waste

Emissions factor, solid waste	1,645.1	kgCO2e/t	Environment Canada National Inventory Report 1990-2011 Greenhouse Gas Sources and Sinks in Canada
Landfill gas capture	75%	%	Landfill Gas Management Facilities Design Guidelines
Waste production, per capita, 2010	1,201.0	kg	Halton Solid Waste Management Strategy 2011
Diversion rate 2010			
BAU, 2011	57.9%	%	Ibid
Scenarion 1, 2031	70%	%	Assumption
Scenario 2, 2031	80%	%	Assumption
Emissions factor, liquid waste, tertiary	123.2	kgCO2e/capita	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Emissions factor, liquid waste, secondary	123.0	kgCO2e/capita	Ibid
Emissions factor, liquid waste, primary	123.0	kgCO2e/capita	Ibid
Emissions factor, liquid waste, septic	205.0	kgCO2e/capita	Ibid

Food miles

Emissions factor, imported food	3.6	kgCo2e/kg	Fighting Global Warming at the Farmers Market

Emissions factor, local food	0.1	kgCo2e/kg	Ibid
Land/person	0.2	ha	BC's Food Self- Reliance
Weight of food/year	580.4	kg	Ibid

Agriculture

Emissions factor, perennials	0.3	tCO2e/ha	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Emissions factor, till	1.2	tCO2e/ha	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Emissions factor, no-till	2.0	tCO2e/ha	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Emissions factor, beef	1.8	tCO2e/head	Environment Canada National Inventory Report 1990-2011 Greenhouse Gas Sources and Sinks in Canada
Emissions factor, dairy	2.7	tCO2e/head	Ibid

Forest

Absorption	5.7	tCO2e/ha	Carbon offsets from afforestation and the potential for landowner participation in Ontario
Emissions factor, soil	25.0	tCO2e/ha	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Emissions, proportion	33%	tCO2e/m3	Future carbon storage in harvested wood products from Ontario's Crown forests
Emissions factor, fuel removal	0.0	tCO2e/m3	2006 IPCC Guidelines for National Greenhouse Gas Inventories

Economic variables

Social cost of carbon	150.00	$/tCO2e	OECD Social Cost of Carbon
Carbon tax	0.00	$/tCO2e	
Renewable energy investment cost	3,567.00	$/GJ	Distributed generation renewable energy estimate of costs
Residential retrofit costs	10.00	$/GJ	Energy savings and economics of retrofitting single-family buildings
Commercial retrofit costs	7.00	$/GJ	Energy Management Action Plan for Langara College
District energy investment costs	5,528.00	$/GJ	Distributed generation renewable energy estimate of costs
Recycling-investment	50.00	$/tonne	Green Communities Carbon Neutral Framework: Option 1: Household Organic Waste Composting.
Landfill gas	10.00	$/tCO2e	Cost estimation model for implementing GHG emission reduction rpojects at landfills in BC
Liquid waste upgrade	400.00	$/household	Affordability of wastewater treatment services in Canada
Local food consumption	15,000.00	$/ha	Estimated
Agricultural practices change	6.00	$/ha	Zero tillage: a greener way for Canadian farms.
Reforestation	3,000.00	$/ha	The Carbon sequestration potential from afforestation in Ontario

Employment

	Direct	Indirect	Induced	
Densification	2.2	0.0	0.0	Employment effects of brownfield redevelopment
Residential retrofit costs	4.6	4.9	3.8	Climate justice, green jobs and sustainable production in BC
Commercial retrofit costs	7.0	4.9	4.8	Ibid
Renewable energy	4.6	4.9	3.8	Ibid
Recycling-investment	6.7	3.5	3.2	Ibid
Landfill gas	6.7	3.5	3.2	Ibid
Liquid waste upgrade	6.7	3.5	3.2	Ibid
Local food consumption	0.5	0.0	0.0	Assumption
Reforestation	0.1	0.0	0.0	Assumption

Appendix 3

IMAGINE HALTON HILLS

GREEN MAPPING SESSIONS

Engagement Ideas

July 2013

This June 2013, community members and businesses in the Halton Hills area were asked to come together to map all the pieces of Halton Hill's green economy and identify opportunities to reduce energy/GHG emissions to help inform the Mayor's Community Energy Plan. The participants came together in a world café format (world cafés are an engaging and effective method of drawing out the collective wisdom of a community) and explored the existing green economy capacity, identified gaps and informed the development of GHG/energy scenarios and targets using local knowledge. The ideas that emerged were diverse and explored themes such as energy, transportation, land use, buildings, food, waste, water and education. Below is an overall synopsis of the discussion.

Where Halton Hills is at now…

ENERGY

- Solar panels on poles
- 2 large solar initiatives - 250 kW each
- Greenport also has a solar wall
- Energy drill in elementary schools - school board contributes to a demand response event reducing consumption and load
- Creek cut their power by 20% and peak demand by 17%
- School board schools are eco-schools, engaged in energy conservation
- Municipal street lights are LEDs - 50% reduction
- Town park has a solar panel for one of its signs
- St. Catherine's Catholic school has developed a new energy initiative
- Porch light program - council promoting energy efficient lighting
- Dentist office with solar panels
- Utility funded conservation programs (hydro and gas programs)
- Ontario Power Authority has a range of OPA initiatives
- Halton Hills Hydro will put 6 charging stations at the arena

- Ontario Power Authority has a range of OPA initiatives
- Halton Hills Hydro will put 6 charging stations at the arena

TRANSPORTATION

- GO station in Georgetown and Acton
- Parking lot on Edith street is permeable and has three electric power stations
- Activan
- Car share program in the main towns
- Walking school bus
- Active and safe routes to school program

- Carpool lot at Steels and 401
- More efficient traffic management with roundabouts
- Taxi company using hybrids and electric cars
- Canadian Tire cycling competition
- Bike sharing initiative - riding to GO station
- Smart Commute initiative

LAND USE

- Concentrated green areas in north west of Halton Hills
- Mixed-use development
- Urban densification
- Rural assets - forest at Upper Canada College
- Multi-use paths

- Meadows on the Glenn - low impact development
- Acton and Georgetown are mixed-use and walkable - drive, walk and eat in same spot

BUILDINGS

- Library in Georgetown is LEED certified
- Acton building - LEED Gold
- Devereaux House - retrofit house
- Green developments around the town
- Outlook mall - white roof, steel roofs
- Gardeners public school - LEED certified
- Greening sacred spaces - retrofit churches
- Pre-fabricated homes

- Greening sacred spaces - retrofit churches
- Pre-fabricated homes

FOOD

- Farmers market in Acton and Georgetown
- Large agricultural area in Niagara escarpment
- Whole Circle Farm - organic farm outside of Acton
- Community vegetable garden at St Albans; Georgetown community gardens - 2 new gardens with 10 plots
- Local farms

WATER

- Splashpads recycle water
- Sheraton nurseries water conservation
- Water efficiency - reduces pumping from wells

WASTE

- Greenport environmental building dispose of hazardous waste
- Wastewise for consumer recycling
- Waste management - blue box and green bin
- Adding 80 recycling bins to parks with Wastewise
- Green cart program provided by region for organic material recycling
- Salvation Army
- Recycling facility - enhanced what they are taking
- Community garage sales

Appendix 4

Scenario name:

Scenario questions

A. Identify the top ten destinations in Halton Hills and surrounding area by order of importance.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

B. Identify the top ten destinations in Halton Hills in 2031 in your scenario.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

C. There will be approximately 13,000 additional dwellings in Halton Hills by 2031. Where should these dwellings be located? (Please indicate on the map)

D. Identify any existing areas with the potential for district energy drawing on a significant existing commercial or industrial load and/or areas with high density. (Please indicate on the map)

E. Will there be a transit system by 2031, and if so what would its route be? Please describe the frequency and type of transit you envision?

Supplementary questions

1. In your scenario, electric vehicles will make up what percentage of the fleet and why?

2. Currently more than 75% of dwellings in Halton Hills are single family homes. How will this change in your scenario?

3. Is there a household/commercial energy retrofit program in your scenario? How many buildings would it target per year?

4. Waste diversion is currently at 16.4% in Halton Hills. What will it be by 2031 in your scenario?

2

Scenario name:

5. Will the area of forest area increase or decrease in your scenario?

6. Will the area of agriculture increase or decrease in your scenario?

Appendix 5

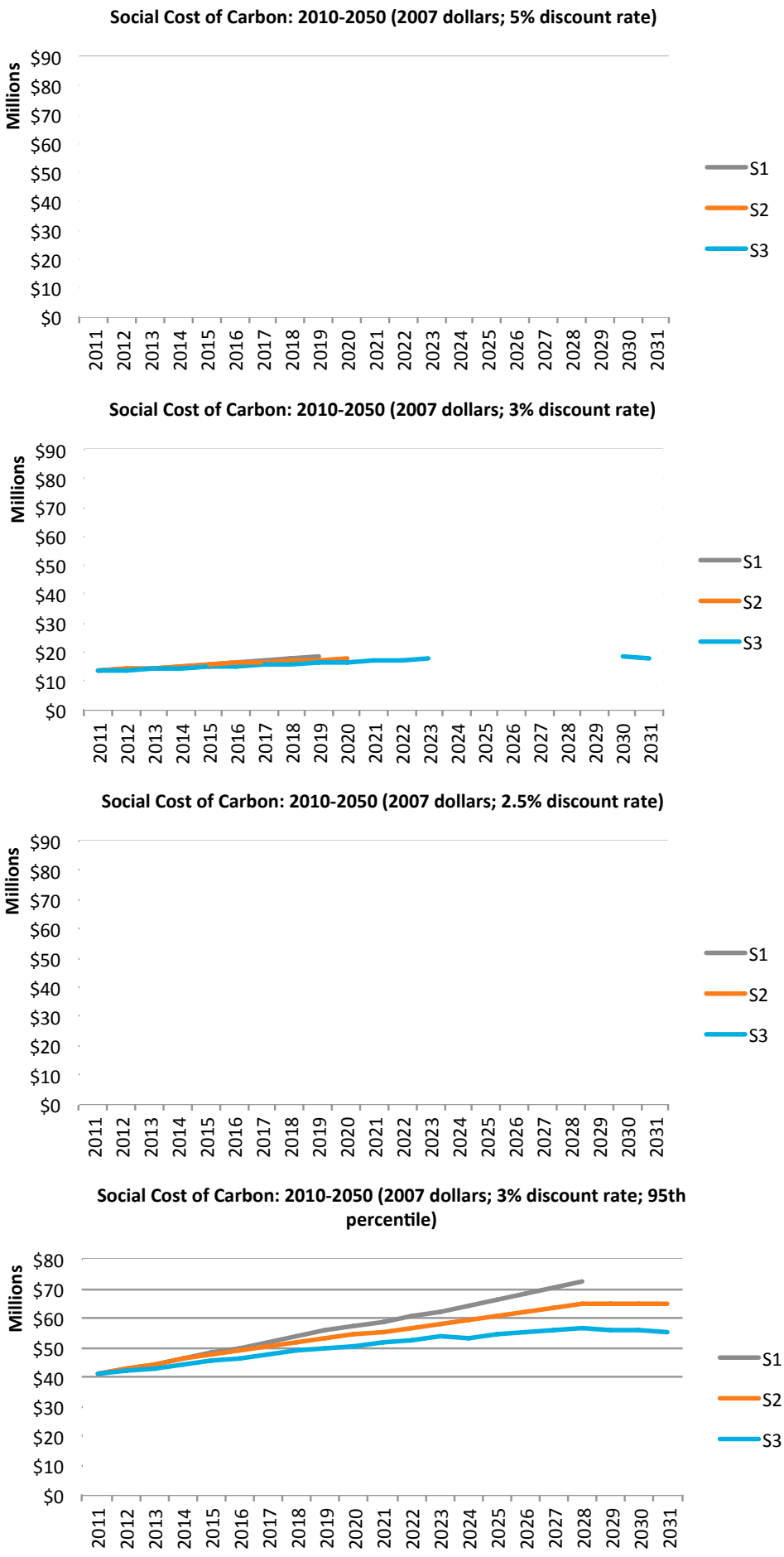
The Social Cost of Carbon

GHG emissions contribute to climate change, which has a wide range of impacts from droughts to floods, from displacing animals from their habitat to increasing the range of diseases. The complexity of the climate system makes it difficult to attribute these impacts and value the damage. One economic strategy for expressing these damages is the Social Cost of Carbon (SCC). The SCC is an estimate of the monetized damages associated with an increase in GHG emissions each year and includes impacts on agriculture, human health, increased floods and ecosystem services. The range of SCC values used by the United States and Canadian governments for cost benefit analysis. The U.S. Government presents a range of numbers to capture the uncertainty of the estimate, in particular by using three different discounting rates. Discounting is used in economic analysis to recognize that people value dollars in hand more than dollars in the future. This practice has been criticized in the context of climate change because it carries the implicit assumption that it will be easier for future generations to solve climate change with new technologies than for the current generation using today's technologies. For this reason, while a range of discount rates is presented (2.5%, 3% and 5%), lower discount rates are favoured as a conservative approach (i.e.: future technologies may have little success in addressing climate change issues). A more conservative estimate is included as a fourth scenario that represents a higher level of damages (95th percentile). The SCC increases over time because future emissions are expected to produce larger incremental damages as physical and economic systems become more stressed in response to greater climatic change.

The SCC graphs provide a compelling argument for Halton Hills to work to reduce GHG emissions. Mitigating emissions will reduce energy costs, create new jobs, and reduce the climate change impact burden on communities around the world. The SCC assigns a value to the damages that will occur globally as a result of emissions produced in the municipality. For some communities in the present these costs can be devastating, while impacts in the future are less certain. Halton Hills can also use the SCC as a policy tool, requiring that it be calculated and incorporated into the economic decision-making for major projects. This helps to ensure that the economic analysis reflects the damage resulting from climate change and provides an economic case for selecting lower carbon options.

By 2031, in Scenario 1, annual damages resulting from emissions in Halton Hills are estimated to be between almost $7.3 million (5% discount rate) and $74 million (3% discount rate, 95th percentile). By contrazzst, Scenario 3 yields an SCC between $5.5 million (5% discount rate) and $56 million (3% discount rate, 95th percentile). The graphs of the four discount rate estimates are presented in Figure 1 on the following pages.

Figure 1: Social cost of carbon at different discount rates



Appendix 6

Present state

This section provides an overview of the present state of energy use in the Town of Halton Hills facilities, including the Town's 2012 utility energy data, a description of existing policies and plans, and the results of the corporate survey.

1.1. Utility data analysis

Table 1 shows the 2012 calendar year utility data, GHG emissions, and energy intensity for the Town of Halton Hills buildings that are required to be reported to the Ministry of Energy under Regulation 397/11 of the Green Energy Act. This list only includes buildings for which the Town pays the utility bills.

Table 1 Town of Halton Hills 2012 energy data for facilities

	Energy Consumption and Greenhouse Gas Emissions Reporting - for 2012							
12-mth period	Jan-2012 to Dec-2012							
					Purchased and Consumed		webform)	
					Electricity	Natural Gas		
Operation Name	Operation Type	Address	Total Floor Area (ft^2)	Avg hrs/wk	Quantity (kWh)	Quantity (m^3)	GHG Emissions (Kg)	Energy Intensity (ekWh/sqft)
Acton Arena	Indoor ice rinks	415 Queen Street	40862	133	763225.889	89423.513	242366.723	41.93625
Acton Community Centre (excluding Seniors Centre)	Community centres	415 Queen Street	2960	133	55287.275	6477.7446	17556.7887	41.93625
Acton Seniors Centre	Community centres	415 Queen Street	2086	40	38962.5864	4565.0592	12372.791	41.93625
Mold-Masters SportsPlex	Indoor ice rinks	221 Guelph Street	60762	133	1236884.47	124388.53	353962.705	42.1128019
Mold-Masters SportsPlex	Community centres	221 Guelph Street	7042	133	143348.481	14415.985	41022.4379	42.1128019
Mold-Masters SportsPlex	Cultural facilities	221 Guelph Street	2196	133	44702.2528	4495.5272	12792.5694	42.1128019
Georgetown Memorial Arena	Indoor ice rinks	42 Mill Street	29378	133	338796.568	14626.946	60192.1218	16.8237624
Georgetown Memorial Arena	Community centres	42 Mill Street	3200	133	36903.4318	1593.2408	6556.42964	16.8237624
Cedarvale Community Centre	Community centres	185 Main Street South	11500	35	52780.99	14832.362	33111.5504	18.2970457
Gellert Community Centre	Indoor swimming pools	10241 Eighth Line	14514	101	368602.572	77476.408	181879.581	82.1279153
Gellert Community Centre	Community centres	10241 Eighth Line	21771	101	552903.858	116214.61	272819.371	82.1279153
Town Hall	Administrative offices and related facilities, including municipal council chambers	1 Halton Hills Drive	40000	65	545938.749	24955.634	99613.7529	20.2790416
Prospect Park Pavilion (aka Boat House)	Community centres	30 Park Avenue	4800	45	13948.5889	2441.91	5956.36345	8.3126383
District One Station (Acton)	Fire stations and associated offices and facilities	21 Churchill Road South	11136	70	108428.716	17693.332	43864.9851	26.6226206
District Two Station (Georgetown) new	Fire stations and associated offices and facilities	53 Maple Avenue	15934	42	213148.772	1629.001	23550.6413	14.4635014
District Three Station - HHFD HQ	Fire stations and associated offices and facilities	14007 10 Side Road	13616	98	233778.162	1002.76	24347.8998	17.9520617
Acton Library Branch (New)	Public libraries	17 River Street	9000	52	137743.921	959.742	15043.4403	16.4382049
Temporary Georgetown Library Branch	Public libraries	224 Maple Avenue	7500	52	26482.7348	32471.138	63934.2121	49.5438331
Temporary Georgetown Library Branch - RECTORY Building	Administrative offices and related facilities, including municipal council chambers	224 Maple Avenue	6000	5	159774.979	90.09	15515.1155	26.7887392
Central Yard - Works Garages and Sand/Salt & Equipment Storage	Storage facilities where equipment or vehicles are maintained, repaired or stored	11620 Trafalgar Road	30000	42.5	171766.311	63017.558	135639.133	28.0500954
Central Yard - Office Trailer	Administrative offices and related facilities, including municipal council chambers	11620 Trafalgar Road	1200	42.5	6870.65245	2520.7023	5425.5653	28.0500954
Central Yard - Stores Building- Peters	Storage facilities where equipment or vehicles are maintained, repaired or stored	11618 Trafalgar Road	1750	22.5	29373.5768	7087.413	16220.6927	59.8268695
Acton Yard - Equipment Depot	Storage facilities where equipment or vehicles are maintained, repaired or stored	3 Commerce Cres.	3700	40	11429.1333	8681.803	17511.7051	28.0263242
				Totals	**5,291,083**	**631,061**	**1,701,257**	**Average**
				Estimated average price (per unit)	**$0.12**	**$0.32**		**34.46529**
				Estimated cost	**$612,254**	**$204,644**		

1.2. Description of existing policies and plans

For the Town of Halton Hills, energy has additional strategic importance. Well before undertaking the *Corporate Energy Plan* and the *Mayor's Community Energy Plan*, the Town has been actively implementing and exploring energy conservation opportunities. In addition, several Town plans and strategies support energy conservation and GHG emissions reduction. These reports demonstrate the Town's commitment to the environment, energy, and sustainability. They establish relevant goals for the Town, as a community and as a corporation. These plans and strategies are briefly described in more detail below.

1.2.1. Town of Halton Hills Strategic Plan

The Halton Hills Strategic Plan identifies a community vision and corporate mission to plan for a "vibrant urban and rural community". The Strategic Plan also includes a comprehensive list of objectives to meet the Town's strategic directions.

The Mayor's Community Energy Plan will advance a number of Strategic Directions, including to:

- Foster a healthy community;
- Preserve, protect and enhance the environment;
- Foster a prosperous economy;
- Achieve sustainable growth;
- Provide sustainable infrastructure & services; and
- Provide responsive, effective municipal government.

The objectives that specifically address energy and GHGs include:

- Developing innovative programs and partnerships related to sustainable design and energy efficiency;
- Encouraging improvements to air quality through facility management, land use planning, transportation management and other programs, and work with other orders of government to address greenhouse gas emissions; and
- Conserving energy through community design, land use planning, transportation planning, and the design/retrofitting of public and private buildings.

Also within the Strategic Plan are actions that support each objective, further demonstrating the Town's commitment to energy conservation and sustainability. Below is a list of key actions:

- Develop a Community Energy Plan, in cooperation with Halton Hills Community Energy Corporation;
- Establish minimum standards for sustainable design and energy efficiency for all new Town funded capital projects;
- Continue to encourage and promote sustainable design and energy efficiency to home and business owners, by way of policy development and/or by Town example of best practice implementation;
- Work with developers to facilitate best practices in sustainable design and energy efficiency objectives;
- Continue to monitor best-practices, and implement energy conservation in municipal buildings and infrastructure;
- Assess alternate fuel for fleet applications;
- Complete a comprehensive review of fleet composition to determine where efficiencies

can be achieved through “right sizing”;
- Implement the Cycling Master Plan and the Active Transportation initiatives identified in the Transportation Master Plan; and
- Design new Facilities to incorporate LEED Strategies.

1.2.2. Integrated Community Sustainability Strategy

The Integrated Community Sustainability Strategy (ICSS) establishes environmental, social, economic, and cultural sustainability goals, and a long-term vision for the Town of Halton Hills to the year 2060. Energy is a main focus area for achieving environmental health, and several energy-related goals provide strategic direction to reach the Town’s vision. These goals include:

- Fostering a culture of conservation by preparing energy plans focusing on efficiency and renewable power generation;
- Demonstrating leadership in local renewable energy generation and conservation;
- Using sustainable building standards for design, construction and operation of new developments and renovations;
- Reducing energy consumption through vehicle technologies;
- Reducing the amount of energy consumed by residential, industrial, commercial, institutional, and business sectors; and
- Maximizing the amount of locally generated thermal and electrical energy from renewable sources.

The ICSS has been endorsed by Council as being the Town’s key document used to position Halton Hills as a leader in sustainability by acting as a blueprint to seamlessly integrate sustainability into the Town’s day-to-day decision making, plans, policies and other initiatives.

1.2.3. Town of Halton Hills Official Plan

The Halton Hills Official Plan, as amended by Official Plan Amendments No. 9 and 10, outlines a long-term vision for the Town and provides direction as to how development should take place to meet the current and future needs of its people to the year 2031. The Plan demonstrates the Town’s commitment to energy conservation by identifying five topics that relate to energy and land use planning. These topics encourage the promotion of:

- Compact urban form in new greenfield areas that is transit supportive;
- Mixed use development in appropriate locations and live-work relationships that reduce automobile use;
- Lot and building design that maximizes direct access to sunlight during the winter;
- The use of vegetation that will reduce energy consumption of buildings; and
- Cycling and walking.

1.2.4. Halton Hills Green Plan

The Halton Hills Green Plan demonstrates the commitment of residents, businesses, and the municipality to “thinking globally and acting locally”. The intent of the Green Plan is to lead the community in a direction that will “preserve, protect and enhance [the] environment” in accordance with the Town’s Strategic Plan.

The Plan lists several energy-related initiatives that the Town has already implemented, including: lighting retrofits and programs, installation of energy efficient features and equipment, use of LEED principles in the design of new buildings, and DSM load reduction, among many others.

The Plan also highlights 70 ways to further engage the community and promote energy conservation at Town facilities. Recommended actions that specifically address energy include:

- Purchasing an Energy and Environmental Management System to track energy performance and costs;
- Meeting with developers and builders to discuss standards for new subdivision development that will reduce energy and water consumption;
- Making bio-diesel available for all Town owned diesel vehicles;
- Sourcing renewable energy for Town facilities; and
- Requiring that energy efficient vehicle quotations be included in vehicle bids.

In 2012, 65 actions were taken which advanced approximately 73% of the Green Plan's 70 recommendations. Some of these actions include:

- Obtaining LEED® Gold certification for the Acton Library and designing the Halton Hills Library and Cultural Centre to LEED® Silver;
- Installing energy-efficiency windows at the Cedarvale Community Centre and reducing heat loss;
- Creating Sustainable Purchasing procedures;
- Participating in "Smart Commute", a transportation demand reduction program, to reduce GHG emissions, vehicle kilometers travelled, and commuting costs;
- Community events and programs such as: Bike it to the Market, Earth Hour, Halton Fresh Food Box program, and the Walking School Bus program;
- Focusing on "complete streets" that allow for pedestrians, bicyclists, motorists, and transit riders of all ages and abilities to move safely along a street; and
- Processing applications under the provincial Feed-in-Tariff program.

1.2.5. Green Development Standards Study

The Town recently completed the Green Development Standards Study. These new Standards put in place more comprehensive 'second-generation' green development requirements for new development, including residential and non-residential uses. The new Standards are an update and enhancement of the Town's existing award-winning Green Development Evaluation Checklist. The new Green Development Standards will allow the Town to maximize the many positive attributes of development while minimizing its potentially negative impacts.

1.2.6. Economic Development Strategy

The Economic Development Strategy was developed to guide the Town over the next 10 years (2013-2023) and assist in creating and retaining jobs and increasing property assessments for the community. Although there are no recommendations specific to energy, it is suggested that many companies are attracted to the area due to the Town's "pro-active energy sustainability model". The Town has demonstrated its commitment to energy by updating and implementing the Green Development Evaluation Checklist to ensure new developments are more energy efficient and by introducing various energy-related programs and policies; continuation of this commitment will contribute to continued economic growth and prosperity in the area.

1.2.7. Transportation Master Plan and Cycling Master Plan

The Transportation Master Plan identifies strategies to meet the transportation challenges facing the Town to the year 2031. The Plan builds upon and supports existing policies and plans including the Strategic Plan, Official Plan and Green Plan. The Cycling Master Plan was developed to guide Halton Hills in the implementation of a Town-wide cycling network over the next ten

years and beyond. Both Plans promote increased use of public transit (i.e. GO Transit) and active transportation, which will reduce energy use and GHG emissions.

1.2.8. Smart Commute Plan

Transportation is a major energy user and greenhouse gas emission generator. Smart Commute is a transportation demand reduction program, focused on reducing traffic congestion, improving air quality, encouraging alternative travel choices, and reducing the environmental, economic and community costs of vehicle travel. In 2012, Metrolinx and Smart Commute Halton recognized the Town with a "Smart Commute Workplace" designation. This designation recognizes the Town's commitment to being an employer that supports sustainable transportation options through its participation in the Smart Commute program. These options include carpooling, cycling, providing sheltered bike lockers, and walking.

1.2.9. Vision Georgetown

Vision Georgetown is a three-year, multi-phase project that will guide the development of future residential/mixed use in the southwest area of Georgetown. The plan is unique in that it addresses sustainable and environmental planning considerations including: broad-based community engagement, community visioning, sub-watershed planning, urban design, heritage conservation, energy management, and development phasing. The new development will align with strategic directions outlined in the Town of Halton Hills Strategic Plan, and will contribute to the sustainability and energy vision of the Town. These new communities will be more people-friendly, community-oriented, cleaner, greener, and more sustainable.

1.2.10. Halton Hills Generating Station

Halton Hills is home to a natural gas-fired combined cycle electricity generating facility capable of producing 641.5 MW of electricity. Located along the 401-407 Industrial Corridor, the facility became operational in 2010 and is under a 20-year power purchase arrangement with the OPA. The generating station uses high efficiency and low emissions technologies, and has the capacity to generate power to meet the needs of 700,000 homes. This generating facility is relevant to the Energy Plan because it is a major local energy producer.

1.3. Corporate survey results

As part of the CEP planning process, Town staff were asked to complete a short survey about energy management at the Town of Halton Hills. In total, 77 out of 340 staff either fully completed or partially completed the survey, representing a response rate of 23%. Responses were very useful and gave a sense of how energy management is perceived presently by staff and suggestions on what can be done moving forward. The responses from the survey fed into the recommendations made in the Communication and engagement section.

When asked how familiar staff were with the Town's corporate energy use and energy management processes, almost half of respondents indicated that they were not familiar (48.7%). Thirty-four percent said they were somewhat familiar. However, when asked how well they think the Town is managing its corporate energy use, half said "well".

The majority of staff (63.5%) indicated that e-mail updates and e-newsletters would be the best way to assist them in better understanding the Town's corporate energy use and management processes, followed by information tips (43.2%) and lunch-n-learn sessions (29.7%). Over two-thirds of Town staff said they were very interested (34.2%) or interested (36.8%) in assisting

the Town in reducing its corporate energy use. A large majority of staff agreed that it is either important (37.8%) or very important (48.6%) that the Town is seen as a leader in corporate energy management.

Staff were also asked what opportunities they have to reduce energy at work on a typical day. Most respondents said that they turn lights off in rooms not being used and make maximum use of natural light when possible; they turn off computers and monitors when not in use and at the end of the day; and they set printers to sleep mode when not used.

Finally, staff were asked what energy conservation measures they would like to see implemented by the Town in its operations. Some of the most common and/or interesting answers were:

- Improve temperature controls (i.e. increase indoor temperatures in the summer and decrease temperatures in the winter)
- Formalize work-at-home arrangements
- Install motion activated light switches in seldom used rooms and washrooms
- Increase budgets for implementing energy saving projects
- Update energy consuming devices to more energy efficient models including installing energy efficient lights and high efficiency toilets
- Install more rooftop solar panels and solar energy lights
- Reduce solar heating of buildings by installing crushed white rock on building roofs
- More fuel efficient fleet vehicles
- Mandatory and enforced turning-off of computers at the end of the day
- Install better reflective glazing on the windows or UV blocking blinds
- Reduce the amount of printing to save paper and energy

Appendix 7

Criteria for prioritizing actions

The Town of Halton Hills can evaluate and prioritize energy management actions identified in the future (e.g. from future ASHRAE Level 2 audits, employee engagement and renewable/alternative energy feasibility studies), based on the following criteria:

1. **Leadership**: Does the action help the Town become a leader in energy management? Does it demonstrate the Town's commitment to improving its energy performance? The Town should implement projects that are not cost-effective if they have high visibility, demonstrate new or emerging technologies, are an established "best practice", etc.).

2. **Cost-effectiveness**: Is the action cost-effective over its lifetime, based on internal rate of return (IRR)? Unlike simple payback, IRR captures lifetime energy savings. IRR conveys that projects with high capital costs (and long paybacks) but long effective lives are a good investment. The Town should plan to implement all projects with IRRs that are higher than the cost of capital, or minimum desired rate of return. The net present value (NPV) of each action is also a useful calculation for decision makers, as it provides a measure of the estimated net financial benefit of each action. A positive NPV for an action should also be used as indicator that the Town should implement that action.

3. **Contribution to day-to-day energy efficiency**: Does the action make energy management visible at Town facilities, change the behaviour of staff, help the Town to publicize its successes, and contribute to the Town's reputation?

These criteria align directly with the three objectives presented in the Objectives and targets section:

1. The Town of Halton Hills is a national leader in the efficient management of energy in their corporation.

2. The efficient use of energy is part of the day-to-day activities of Town staff.

3. The Town's environmental and financial sustainability are improved through energy management initiatives that are Practical, Affordable, Reasonable, Educational, and Enforceable.

In addition, the Town can consider the following criteria:

- **Annual energy savings:** For projects with and acceptable IRR and a positive NPV, the Town should prioritize actions with the highest annual energy savings. Though these larger projects will likely have high capital costs, they will have the most significant impact on the Town's overall energy performance. They will also yield the highest returns per hour of Town staff time devoted to implementation. This is linked to objective 1 and leadership in energy performance.
- **Ease of implementation:** Projects may be accelerated (or decelerated) based on ease of implementation. For example, a project with a lower IRR should be scheduled for immediate implementation if renovations in the building make it very easy to implement. A project with a higher IRR should be delayed if implementation is currently very difficult, and if planned renovations (or other changes) will make it significantly

easier in the future. This is linked to objective 3 and cost-effectiveness (considering the value of staff time).

- **Occupant comfort and regulatory requirements:** Projects that increase comfort, address occupant concerns, or address regulatory requirements will improve the overall experience of Town staff, enhance the Town's reputation, or contribute to the culture of effective energy use (objective 2).
- **Availability of incentives:** The Town should also accelerate implementation of projects that are eligible for funding from electric and gas utilities, or from provincial or federal governments. This is particularly important where incentives are likely to be discontinued in the near future (e.g. end of 2015 for current saveONenergy programs). This is linked to objective 3 and cost-effectiveness.

Appendix 8

Utility incentive programs

This section describes incentives and services that are currently available from the Town's electricity and natural gas utilities. The Town of Halton Hills can take advantage of these incentives to implement some of the measures identified in Table 4, Table 6, and Table 8.

Currently, there is no funding available from Natural Resources Canada (NRCAN) or the Federation for Canadian Municipalities (FCM). However, funding may become available in the future and these incentives should be monitored as per Action 36 "develop a process for continually monitoring available incentives, and applying for incentives".

For the most part, the applicable incentive program for the majority of technical measures related to electricity would fall under the Equipment Replacement Incentives Initiative (ERII) from Halton Hills Hydro. For natural gas, most technical measures would fall under the New and Retrofitted Equipment Incentive program from Union Gas. For specific recommendations on incentives for each of the technical measures please refer to the audit reports. For metering measures, the Process and System Upgrade Initiative would be applicable on the electricity side, and the Meters and Integrated Energy Management System would be applicable for natural gas.

1.1. Halton Hills Hydro / Ontario Power Authority saveONenergy Programs

Full details are available at: www.haltonhillshydro.saveonenergy.ca

Demand Response (DR3) Program
The OPA's Demand Response 3 (DR3) Program offers rebates to voluntary participants in the commercial and industrial sector, of 50 kW or greater, to reduce the amount of power being used during certain periods of the year. Participants are scheduled to be on standby approximately 1,600 hours per calendar year and are notified to reduce their load up to 100 to 200 hours within the year depending on the contract. Payments are made to participants based on their actual energy reduction during the demand response event. Alternatively, participating organizations can sign a contract with an aggregator to reduce the risk of not meeting required load reductions.

Process and System Upgrade Initiatives (PSUI)
The process and systems upgrade program provides support for facilities to identify major energy saving opportunities and continue to take advantage of these savings. The program offers two types of services:

1. Energy efficiency upgrades – includes a three-step feasibility and upgrade process (preliminary engineering study, detailed engineering study and capital incentives).

2. Energy management and monitoring – provides long-term support to increase savings (includes an embedded energy manager and/or a monitoring and targeting plan).

Organizations can receive up to 70 percent funding for major energy-saving upgrade projects.

Equipment Replacement Incentive Initiative (ERII)
This program offers incentives to non-residential customers to reduce electricity demand and consumption by upgrading to more energy-efficient equipment for uses such as, lighting, space cooling, ventilation, elevators, and sub-metering. Upgrades are subject to project measurement and verification (M&V) to confirm the new equipment achieves energy and demand savings. Successful participants are eligible to receive between $10,000 to $25,000 for "basic" upgrades, and more than $25,000 for "enhanced" upgrades.

High Performance New Construction program
The Ontario Power Authority supports up to 100% of the cost of modeling a new energy efficient building (up to $10,000). Approved projects are also eligible for incentives for energy savings through a prescriptive path, an engineered path, or a custom path with incentives based on modelled energy performance. There is no cap on the incentives for energy savings.

Audit funding program
Businesses can receive up to 50% of the cost of an energy audit, or up to a certain dollar amount (whichever is less based on the size of the facility and complexity of the audit). Energy audits can identify ways to save energy through equipment replacement, operational procedures, or participation in Demand Response initiatives.

Existing Building Commissioning
The program provides incentives for large buildings (>50,000ft^2) with chiller water plants. Incentives cover: hiring an expert to analyze the Chilled Water System and make recommendations for increasing its energy efficiency; buying and installing metering equipment; and implementing the recommended upgrades.

The participant incentives are broken down into four project phases:

1. Scoping Study: amount charged, to a maximum of $2,500.
2. Investigation Phase: up to $30,000.
3. Implementation Phase: up to $5,000 plus up to 50% of purchasing and installing equipment costs.
4. Completion Phase: amount charged, to a maximum of $2,500.

1.2. Union Gas EnerSmart Programs

Full details are available at: http://www.uniongas.com/business/savemoneyenergy/index.asp#1

New and Retrofitted Equipment Incentive Program
This program provides 15% of incremental high efficiency upgrade costs, up to $40,000, to implement measures that reduce natural gas consumption. Typical projects include building controls, high efficiency process equipment, and building envelope technologies.

Energy Efficiency Engineering Feasibility Study Program
This program covers 30-50% of costs of an energy audit or engineering analysis study on an existing building or process. Audits and studies aim to determine the changes that would increase the overall energy efficiency of the building or process. Typical projects include thermal surveys, facility air-balances, HVAC audits, energy audits, benchmarking activities and equipment upgrade studies.

Stream Trap Survey Program
This program covers 50% of costs, up to $6,000, to inspect steam traps. The inspection will ensure that steam traps are functioning properly and determine if there is a need for condensate return system improvements.

Process Improvement Study Program
This program provides an incentive of 66% of costs, up to $20,000, for the completion of a study on optimizing the energy use of a specific natural gas process, operation, or piece of equipment. The study identifies opportunities, determines a detailed cost analysis, establishes financial justification and verifies energy savings. Typical projects include steam plant audits, process integration analyses, heat integration studies and process operation improvement studies.

RunSmart Building Optimization
This program provides $0.10/$m^3$, to a maximum of $20,000, for the implementation of low-cost/no-cost energy saving measures and activities that optimize a building's energy use. Examples include: verifying dampers and valves on air handling units, calibrating sensors and instruments, reducing excessive exhaust quantities, and checking insulation integrity. Buildings must use at least 200,000 m^3 of natural gas a year, not have been recommissioned in the past five years, and have natural gas heating.

Demonstration of New Technologies Program
This program offers incentives for the adoption of new technologies that improve energy efficiency and can be used as demonstration sites. The program covers 10% of costs, up to a maximum of $50,000.

Meters and Integrated Energy Management Systems
Union Gas helps fund the installation of natural gas, steam or hot water meters (50% of each meter, up to $5,000 per customer). Union Gas will also fund up to 50% of the assessment and installation of energy management system.

Prescriptive and quasi-prescriptive incentives
Incentives are also offered for boiler tune-ups, and space heating, water-heating, and cooking equipment, including: air curtains, destratification fans, condensing boilers, non-condensing high efficiency boilers, energy and heat recovery ventilators, infrared heaters, condensing rooftop make-up units, condensing gas water heaters, and Energy Star dishwashers.

Customer education
Union Gas will help fund workshops and seminars, and can provide access to technical information.