



City of Cambridge PCP Program Milestone 4 Submission



June 2014

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1.0 Executive Summary

This report meets the requirements for the City of Cambridge's Partners for Climate Protection (PCP) program's Milestone 4 submission: Implementing the Local Action Plan or a set of activities. This plan presents implementation elements for each initiative the City of Cambridge has committed to undertake as part of its efforts to reduce Greenhouse Gas (GHG) emissions and energy. Implementation elements presented in this plan include who is involved in each initiative, key implementation dates, status of completion, funding sources with estimated costs where known, and anticipated results – both quantitative and qualitative in nature.

This plan outlines the City's plans to reduce GHG and energy across corporate operations including buildings, street lighting, sewage collection and pumping, fleet, corporate waste and other – such as tree canopy improvements. It builds on previous PCP submissions (Milestones 1, 2 and 3) prepared by the City and approved by the PCP program.

2.0 Introduction & Background

This report provides the City of Cambridge's submission for Milestone 4 of the ICLEI Partners for Climate Protection (PCP) Program. The City of Cambridge (City) has previously achieved Milestones 1 to 3 (refer to Appendix A for the letters from the PCP Program indicating achievement).

In April 2012, the City voluntarily committed to the PCP Program, joining a network of hundreds of Canadian municipalities that have committed to reducing greenhouse gas (GHG) emissions and mitigating climate change.

The following year, in 2013, the City produced its corporate GHG inventory (Milestone 1), set an emissions reduction target (Milestone 2) and released its Corporate GHG Reduction (Energy Management) Plan (Plan), which was approved by Council on November 4, 2013. Since the development and approval of this Plan, the City has taken significant steps towards its implementation (Milestone 4) and will be monitoring the results of the Plan and reporting on them as part of Milestone 5.

2.1 Overview of the City's GHG Reduction (Energy Management) Plan

For Milestone 3: Developing a Local Action Plan, the City identified 30 previously completed and ongoing measures to reduce energy and GHG emissions across corporate operations, including implementing a LEED Gold policy for all new buildings and major renovations; establishing an energy conservation reserve fund; implementing a tree planting program; hosting green workshops on a variety of salient topics including climate change, sustainable development, peak oil; establishing an anti-idling by-law for corporate fleet; implementing a sustainable procurement policy and implementing software to provide a paperless system for report preparation. Other identified measures include numerous retrofits/equipment replacements in existing corporate buildings including lighting retrofits; furnace, dehumidification system, roofing and cladding replacements.

Through a stakeholder consultation process involving members of the City's GHG Task Force, the City identified several "new" actions/initiatives to be implemented over the short (1 – 5 years), medium (5 – 10 years) and long-term (10+ years) planning horizon. **The City's Council approved goal is to reduce emissions by 6% below baseline emissions by 2019**, which translates into 1400 tonnes of carbon dioxide equivalents (CO₂e) saved, or taking 301 cars off the roads every year. These identified strategies to reduce energy and GHG emissions span corporate operations, including:

- Buildings
- Street lighting
- Sewage Collection and Pumping
- Municipal fleets
- Corporate waste
- Other operations

Table 1 below summarizes the initiatives that were identified by the City for inclusion in its GHG Reduction (Energy Management) Plan.

Table 1 Summary of Energy & GHG Reduction Measures

Proposed Energy / GHG Reduction Measure	Description	Implementation Time Frame		
		Short Term (1 – 5 years)	Medium Term (5 – 10 years)	Long Term (10+ years)
Buildings				
ECMs & WCMs from detailed assessments	Implementation of select ECMs and WCMs identified during detailed energy & water assessments of 24 Corporate Facilities (e.g. installation of programmable thermostats and occupancy sensors; upgrading existing natural gas-fired units with higher efficiency units; upgrading lighting to more energy-efficient alternatives)	✓ (229 measures implemented by 2019)		
Occupancy Policy	Developing an overarching policy and building control standards based upon building occupancy to reduce the heating and cooling of unoccupied areas	✓ (policy & implementation)	✓ (ongoing implementation)	✓ (ongoing implementation)
Street Lighting				
Streetlight Conversion Program & Development of New Streetlighting Standard	Convert existing City-owned street lights to higher efficiency lighting (e.g. LEDs, induction) and developing a street lighting standard for new City developments.	✓		
Sewage Collection and Pumping				
Pumping Station Upgrades	Upgrade pumping stations in accordance with energy conservation measures identified in energy assessment reports (e.g. installation of variable frequency drives VFDs on pumps).	✓		

Proposed Energy / GHG Reduction Measure	Description	Implementation Time Frame		
		Short Term (1 - 5 years)	Medium Term (5 - 10 years)	Long Term (10+ years)
Reduce Operation of Diesel Generators	Reduce pumping station runtimes of diesel generators by half.	✓		
Corporate Waste				
Waste Management	Develop strategies to improve corporate waste management and increase diversion rates across select corporate facilities.	✓		
Fleet				
Fleet Right Sizing and Fleet Pooling	Assess current fleet vehicles and see where efficiencies can be made with purchasing new vehicles based on needs and uses.		✓	
Fuel Cells	Look at fuel cell technology and its applicability in the City's fleet	✓		
Alternative Technologies	Look at a pilot project that would explore the use of alternative technologies including biodiesel, natural gas and propane.	✓		
Eco Driver Training	Provide City staff with the opportunity to take an on-line green driving course that would help to reduce fuel consumption throughout the fleet.	✓ (initiation of training program for existing staff)	✓ (ongoing implementation)	✓ (ongoing implementation)
Other				
Tree Canopy Improvement	Inventory and increase the City's tree canopy.	✓ (completion of existing canopy inventory)	✓ (ongoing implementation over 30 year planting period)	✓ (ongoing implementation over 30 year planting period)

3.0 Milestone 4: Implementing the Corporate GHG Reduction (Energy Management) Plan

The remainder of this report outlines the City's implementation plan to achieve its energy conservation goals and GHG emissions reduction target.

3.1 PCP Program Milestone 4 Requirements

Milestone 4 of the PCP Program requires municipalities to “*look at the local action plan developed in Milestone Three and provide a detailed account of what greenhouse gas reduction measures are being implemented and how they have achieved reductions.*”¹

Milestone 4 specifically requires that municipalities include a description of implementation partners and financing mechanisms for each initiative, and an outline of any variations from the original plan that have occurred since its development.²

3.2 The City's Implementation Plan

3.2.1 Variations from the Original Plan

The original plan submitted in November 2013 under Milestone 3 has since been updated to include recommendations from the detailed energy and water assessments for 24 City owned and managed facilities that were commissioned by the City in December 2013. Originally, the Plan called for four (4) main energy conservation and GHG reduction strategies to be pursued for corporate buildings, including the implementation of an occupancy policy, the installation of programmable thermostats, the installation of occupancy sensors, and upgrading existing natural gas-fired units with higher efficiency models. While programmable thermostats, occupancy sensors, and equipment upgrades were identified for many of the 24 facilities assessed, additional energy and water conservation measures were also identified, and the City has decided to proceed with a wide array of initiatives, as outlined later in this report. Furthermore, the original Plan called for the implementation of eco driver training (providing training to City staff to reduce fuel consumption throughout the fleet). This initiative has been put on hold at this time as the City has decided to concentrate on other measures that will yield better results from an energy conservation and GHG reduction standpoint.

3.2.2 Implementing the Plan: High-level Status Update

The following sections provide an update as to how the City is implementing its GHG and energy reduction initiatives across corporate operations.

3.2.2.1 Buildings

In late 2013, the City commissioned detailed energy assessments of its corporate facilities to identify Energy Conservation Measures (ECMs) and Water Conservation Measures (WCMs) to support its energy and GHG reduction goals. For each measure, cost and savings estimates were produced, and payback periods identified. From the master list of ECMs and WCMs produced as a result of these energy assessments, the City has decided to focus its efforts in these areas:

¹ FCM, ICLEI. (n.d.) PCP Milestone 4 – Implement the Local Action Plan. Received via e-mail from Bahareh Toghiani Rizi, Climate and Energy Planner, ICLEI Canada on February 21, 2014.

² Ibid.

- Programmable Thermostats;
- Building Automation Systems;
- Natural Gas-Fired Equipment Upgrades;
- Lighting Upgrades;
- Development and Implementation of an Occupancy Policy; and
- Assorted measures such as building envelope upgrades, and installation of high efficiency fixtures and boilers.

These measures were previously evaluated and deemed priorities by the City's GHG Task Force and were included in the City's GHG Reduction (Energy Management) Plan.

3.2.2.2 Street Lighting

The City of Cambridge is taking a two-pronged approach to reducing energy consumption and GHG emissions associated with street lighting. Specifically, the City has plans to convert existing City-owned street lights to higher efficiency lighting (e.g. LEDs and/or induction lighting) over a five-year period. Furthermore, the City is planning to implement a street lighting standard for new developments to ensure that any new developments within the City utilize higher-efficiency lighting fixtures in accordance with the new City-wide standard/policy.

3.2.2.3 Sewage Collection and Pumping

In its corporate GHG Reduction (Energy Management) Plan, the City identified two initiatives to reduce energy consumption and GHG emissions associated with pumping station operations. The first initiative calls for pumping station upgrades, and the second focuses on reducing pumping station emergency generator runtimes. Specifically, the City is upgrading all 16 city-owned and operated pumping stations over a 10 year period. At its pumping stations, the City has decided to focus its efforts in these areas:

- Installation of variable frequency drives (VFDs) on pumps; and
- Reducing testing of emergency generators by 50% to reduce diesel use by half.

3.2.2.4 Municipal Fleets

The City owns and operates over 850 pieces of equipment and vehicles. Through a fleet right-sizing initiative, the City is developing a more fuel-efficient fleet, incorporating fuel cell technology where appropriate; and exploring the use of alternative fleet technologies such as biodiesel, hybrid and plug-in vehicles, natural gas and propane vehicles. The City is also implementing an improved fuel-tracking system to improve the City's ability to monitor fuel consumption and link consumption to specific drivers and vehicles.

3.2.2.5 Corporate Waste

The City is developing strategies to improve corporate waste management and increase diversion rates at several City-owned and managed facilities. To start, the City is focusing its efforts on larger facilities, for example, those over 60,000 ft² such as City Hall, Hespeler Memorial Arena, Galt Arena Gardens, and the Transportation & Public Works Service Building.

3.2.2.6 Other

In addition to the proposed actions for buildings, street lighting, wastewater, corporate waste and fleet, the City is implementing a tree canopy improvement program. Specifically, the City is conducting an inventory of the current canopy within the City, and developing an urban forest plan, including a canopy goals and targets which the City will work towards over a 30-year period.

3.2.3 Implementing the Plan: Detailed Status Update

Table 2, presented on the following pages, summarizes the implementation elements for each initiative outlined in the City's GHG Reduction (Energy Management) Plan, including a description of each initiative, who is involved with each (including external partners), key implementation date(s), completion status (e.g. completed, ongoing, scheduled), funding (e.g. funding sources and estimated costs, where known), and, where possible, anticipated results (e.g. reductions in electricity, natural gas, water, GHG emissions, social benefits).

Table 2 City of Cambridge Implementation Plan and Status Update

Milestone 4											
Initiative / Action	Description	Who: Department(s) and Others Involved (E.g. External partners)	When: Key Implementation Date(s)	Status	Funding (Source and \$)	Anticipated Results					
						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits	
CORPORATE SECTOR: BUILDINGS											
A1. Detailed Energy Assessments of Corporate Buildings	The City of Cambridge commissioned detailed energy and water assessments for 24 City owned and operated facilities, including arenas, fire stations, administrative buildings, libraries, pools, and theaters.	<ul style="list-style-type: none"> • Manager of Building Design Construction • Director of Sustainable Design and Development • Efficiency Engineering (external consulting firm) 	Assessments commissioned in December 2013. Completed in early April 2014, with a Master List of Energy Conservation Measures (ECMs) and Water Conservation Measures (WCMs) identified.	Completed	Existing capital budget Cost: 68,890	The reports themselves will not result in electricity, natural gas or water savings, nor will they result in a reduction of GHG emissions. The reports do, however, present a list of measures recommended opportunities for savings in all of these areas.					Identification of a breadth of energy and GHG reduction opportunities across corporate facilities; improved understanding of facilities' energy use and GHG emissions
A2. Implement ECMs and WCMs in Preston Arena	14 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: <ol style="list-style-type: none"> 1. Lighting upgrades: upgrading existing 32W T8 to 25W T8; 2. Installing occupancy sensors; 3. Implementing floating head pressure control, 4. Reviewing compressor staging and improving sequence, 5. Implementing instantaneous flood water boilers, 6. Replacing the domestic hot water boiler with a more energy efficient model, 7. Replacing vinyl curtain separating the rink area from corridors with swing doors, 8. Replacing the banquet hall make up air unit with a more energy efficient model, 9. Scheduling the lobby air handling unit, 10. Installing low flow urinals, 11. Installing timers on exhaust fans, 	<ul style="list-style-type: none"> • Manager of Building Design Construction • Director of Sustainable Design and Development • Facility Manager • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented by August 2014.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 126,998	59,503	23,177	11,482	50.4	Compliance with Ontario Building Code	

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Milestone 4										
Initiative / Action	Description	Who: Department(s) and Others Involved (E.g. External partners)	When: Key Implementation Date(s)	Status	Funding (Source and \$)	Anticipated Results				
						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
	12. Replacing all weather-stripping, 13. Adding a recirculation loop to domestic hot water, and 14. Repairing the sump tank float.									
A3. Implement ECMs and WCMs in Fire Station 4	9 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Install ultra-low flow faucet aerators, 2. Install occupancy sensors, 3. Lighting upgrade – T12 to High Performance T8, 4. Lower temp in ambulance garage, 5. Lighting conversion – install LEDs, 6. Lighting upgrade – Incandescent to CFLs, carbon friendly lighting 7. Lighting upgrade – T12 to T5HO Highbays in Fire Hall Garage, 8. Install high efficiency DHW Heater, 9. Building Envelope – Increase exterior wall insulation, dorm room.	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented by August 2014.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 26,534	33,058	696	3,543	5.3	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A4. Implement Lighting Upgrades in all Fire Stations (including Fire Station 4, as per the above)	At the City's fire stations, the lighting will be upgraded to more energy efficient lighting. The list of lighting upgrades for Fire Stations 1 – 3 and 5 (noting that fire station 4 is documented above) include: Fire Stn 1 1. T12 to high performance T8, 2. LED exit signs, 3. Incandescent and halogen to LED 4. 32WT8 to 25WT8, Install T5HO in Apparatus Room	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	All lighting upgrades at Fire Stations are scheduled to be fully implemented by August 2014.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 60,995	105,990	0	11,102	11.7	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual

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Milestone 4										
Initiative / Action	Description	Who: Department(s) and Others Involved (E.g. External partners)	When: Key Implementation Date(s)	Status	Funding (Source and \$)	Anticipated Results				
						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
	<p>Fire Stn 2</p> <ol style="list-style-type: none"> 5. Lighting upgrade to CFLs 6. T12 to high performance T8 7. 32WT8 to 25WT8 8. Install LEDs <p>Fire Stn 3</p> <ol style="list-style-type: none"> 9. Install LEDs 10. T12 to T5HO Highbays in Firehall Garage 11. T12 to high performance T8 12. Lighting upgrade – install CFLs 13. 32WT8 to 25WT8 <p>Fire Stn 5</p> <ol style="list-style-type: none"> 14. Install CFLs 15. T12 to high performance T8 16. 32WT8 to 25WT8 									inventory.
A5. Implement ECMs and WCMs at David Durward & CFA	<p>18 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including:</p> <ol style="list-style-type: none"> 1. Lighting upgrade – T12 to High Performance T8, 2. Install LEDs, 3. 32WT8 to 25WT8, 4. Install occupancy sensors, 5. Install photocells for Daylighting, 6. Insulate piping, 7. Install low flow water fixtures, 8. Install VFD on P-3, 9. Install thermostatic control in Penthouse rooms, 10. Install VFD on Cooling Tower Fan, 11. Seal boiler vent riser in penthouse, 12. Upgrade temperature control, 13. Replace MUA-1, 14. Replace DHW heater tank, 15. Install de-stratification fan in 	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2015.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 417,737	136,360	23,735	21,881	88.5	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.

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Milestone 4										
Initiative / Action	Description	Who: Department(s) and Others Involved (E.g. External partners)	When: Key Implementation Date(s)	Status	Funding (Source and \$)	Anticipated Results				
						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
	Toyota Room, 16. Replace boiler, 17. Install BAS, 18. Install demand control ventilation.									
A6. Implement ECMs and WCMs at Hespeler Arena	10 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. T12 to High performance T8, 2. 32WT8 to 25WT8, 3. Install LEDs, 4. Install occupancy sensors, 5. Implement floating head pressure control, 6. Low-emissivity ceiling, 7. Install manual spray hose on heat recovery system 8. Lower flood water temperature, 9. Replace rink 2 chiller, 10. Install BAS.	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2015.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 390,055	337,015	21,705	34,521	78.1	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A7. Implement ECMs and WCMs at Cambridge Arts Theatre	13 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Install Fridge timer; 2. Lighting upgrade: LED Exit signs; 3. Lighting upgrade: Incandescent fixtures to CFL; 4. Replace exhaust fans; 5. Insulate water taken and piping; 6. Lighting upgrade: LEDs; 7. Reduce combustion air duct size; 8. Install occupancy sensor thermostats; 9. Lighting upgrade: T12 to High performance T8 10. Install demand control ventilation;	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2015.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 19,7634	35,860	2,058	3,846.24	7.8	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.

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Milestone 4										
Initiative / Action	Description	Who: Department(s) and Others Involved (E.g. External partners)	When: Key Implementation Date(s)	Status	Funding (Source and \$)	Anticipated Results				
						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
	11. Install occupancy sensors; 12. Install door sweeps and weather stripping; 13. Upgrade water fixtures.									
A8. Implement ECMs and WCMs at City Hall	5 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Re-commission S-5 MUA Unit for Adherence to ASHRAE Ventilation standards; 2. Implement optimal start/stop of S-5 MUA; 3. Control vestibule temperature through BAS; 4. Boiler upgrade: install linkageless controls; 5. Building Envelope: adjust vestibule doors, replace weather stripping	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2018.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 50,101	3,128	12,631	3,536	24.2	Educational opportunities: Bldg. tours of sustainable features for visitors from several countries (e.g. Japan, Mexico, Germany, Sweden, US, Canada, etc.) Educational tours for elementary schools, college students
A9. Implement ECMs and WCMs at Dickson Arena	11 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Lighting upgrade: Replace incandescent fixtures with CFL; 2. Lighting upgrade: 32WT8 to 25WT8; 3. Install occupancy sensors; 4. Implement floating head pressure; 5. Raise brine loop temperature; 6. Repair exhaust louver in rink; 7. Insulate DHW piping; 8. Replace DHW heater tanks; 9. Replace furnaces; 10. Install timers on vending machines;	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2015.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 29,685	39,262	3,361	5,916.41	10.7	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.

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Initiative / Action	Description	Who: Department(s) and Others Involved (E.g. External partners)	When: Key Implementation Date(s)	Status	Funding (Source and \$)	Anticipated Results				
						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
	11. Install low flow showerheads									
A10. Implement ECMs and WCMs at Duncan McIntosh Arena	9 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. 32WT8 to 25WT8, 2. Install occupancy sensors, 3. Floating head pressure; 4. VFD on cooling tower fan; 5. Implement instantaneous flood water system; 6. Vending machine timers; 7. Replace furnaces with high efficiency condensing furnaces; 8. Install low-flow showerheads; 9. Install high efficiency condensing heater tank.	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2019.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 83,752	51,610	7,680	8,299	20.2	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A11. Implement ECMs and WCMs at Dunfield Theatre	9 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Install beverage refrigerator timers, 2. Insulate DHW piping, 3. Install LEDs, 4. Install VFD on MAU; 5. Replace weather stripping; 6. Install occupancy sensors, 7. Install split cooling system in control room; 8. Install de-stratification fans in theatre; 9. Seal distribution ducting.	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2018.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 32,351	56,344	7,552	7,348	20.5	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A12. Implement ECMs and WCMs at Fire Station 1 - Main	8 Energy and Water Conservation Measures (ECMs and WCMs) were identified in addition to lighting upgrades (previously documented). The additional 8 ECMs/WCMs include: 1. Install ultra-low flow aerators;	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2014.	Scheduled	Existing capital budget Cost 32,351	36,613	3,817	5,580	11	Demonstrates to the public implementation of leadership in Energy and Environmental design. The

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Initiative / Action	Description	Who: Department(s) and Others Involved (E.g. External partners)	When: Key Implementation Date(s)	Status	Funding (Source and \$)	Anticipated Results				
						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
	<ol style="list-style-type: none"> 2. Operate existing de-stratification fans; 3. Install occupancy sensors; 4. Replace rooftop unit (capital upgrade); 5. Insulate exposed DHW piping in basement; 6. Install automated bay doors; 7. Install high efficiency DHW Heater (basement); 8. Fuel conversion: Install gas fired furnace in maintenance office. 	<ul style="list-style-type: none"> • Facility Managers • Mechanical Contractors 								results will be published in a sustainable report annually as well as posted in an annual inventory.
A13. Implement ECMs and WCMs at Fire Station 2 & Hespeler Centre	<p>7 Energy and Water Conservation Measures (ECMs and WCMs) were identified, in addition to lighting upgrades (previously documented). The additional 7 ECMs and WCMs include:</p> <ol style="list-style-type: none"> 1. Insulate exposed heating hot water piping in boiler room; 2. Building Envelope: install/repair door weather stripping; 3. Install dual flush toilets and ultra-low flow faucet aerators; 4. Install occupancy sensors; 5. Install programmable thermostats; 6. Install a lead condensing boiler; 7. Re-caulk window frames. 	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2017.	Scheduled	Existing capital budget Cost 73,499	6,388	6,111	2,617	12	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A14. Implement ECMs and WCMs at Fire Station 3 & ARC	<p>9 Energy and Water Conservation Measures (ECMs and WCMs) were identified, in addition to lighting upgrades (previously documented). The additional 9 ECMs and WCMs</p>	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2017.	Scheduled	Existing capital budget Cost	39,366	16,465	8,689	35	Demonstrates to the public implementation of leadership in Energy and

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Initiative / Action	Description	Who: Department(s) and Others Involved (E.g. External partners)	When: Key Implementation Date(s)	Status	Funding (Source and \$)	Anticipated Results				
						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
	include: 1. ARC: Unplug chest freezer when not in use; 2. Water conversion: Fix running urinal; 3. Install exhaust fan timers, EF-1, EF-2, ARC; 4. Insulate DHW piping, west basement; 5. Replace rooftop units (capital upgrade); 6. Install occupancy sensors; 7. Replace remaining high-flow tank toilets and 2.2 GPM Aerators; 8. Install high-efficiency boilers and controls; 9. Install programmable thermostats on baseboard heaters in meeting rooms, offices, and workshop).	Design and Development • Facility Managers • Mechanical Contractors			242,499					Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A15. Implement ECMs and WCMs at Fire Station 5	9 Energy and Water Conservation Measures (ECMs and WCMs) were identified, in addition to lighting upgrades (previously documented). The additional 9 ECMs and WCMs include: 1. Install Ultra Low Flow Faucet Aerators 2. Install Occupancy sensors 3. Correct Over Heating Issue in Apparatus Bay 4. Seal and Insulate Operable Window Sections in Kitchen/Lounge 5. Increase insulation on Exterior Walls, Dorm and Lounge Areas	• Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2015.	Scheduled	Existing capital budget Cost: 7,277	9,813	956	1,256	3	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.

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						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
A16. Implement ECMs and WCMs at Galt Arena	11 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Incandescent and Halogen lighting to LED; 2. 32WT8 to 25WT8; 3. Exterior lights to LEDs; 4. Ice Pad LED Lighting with occupancy sensors; 5. Replace change room MUAs with packaged HRV Units; 6. Replace AHU-1 and 2; 7. Replace furnace; 8. Install timer on DHWP-1 Recirculation Pump; 9. Implement full BAS; 10. Convert aerators and low-flow showerheads; 11. Vending machine timers.	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2019.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 379,348	123,184	36,088	23,524	81.8	Cambridge citizens are very proud of having the oldest continuously operating arena in the world and these proposed measures will extend life of the building.
A17. Implement ECMs and WCMs at Historic City Hall	7 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Install LED Exit signs; 2. T12 lighting to high performance T8; 3. Install high efficiency boilers and controls; 4. Install first floor storm windows; 5. Install LEDs; 6. Install demand control ventilation; 7. Install BAS.	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	2018	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 156,910	5,346	9,054	2,865.20	17.6	A lot of meetings and events have been held in the Historic City Hall. Storm windows will improve sound and create better environment for meetings/events. City hosts a lot of tours from other municipalities.
A18. Implement ECMs and WCMs at John Dolson	11 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including:	<ul style="list-style-type: none"> • Manager of Building Construction 	The full slate of ECMs and WCMs are scheduled to be	Scheduled	Existing capital budget	85,726	7,520	13,041	23.7	Demonstrates to the public implementation

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						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
Pool	<ol style="list-style-type: none"> 1. Brick up west windows in Link; 2. 32WT8 to 25WT8; 3. Install VFD on Pool Pump; 4. Insulate heating hot water pipe; 5. Install programmable thermostat in vestibule; 6. Install vending machine motion sensor; 7. Install occupancy sensors; 8. Re-balance pool ventilation; 9. Replace RTU and increase sizing; 10. Re-seal envelope; 11. Install BAS. 	<ul style="list-style-type: none"> • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	fully implemented in 2017.		Municipal reserve & hydro rebates (lighting initiatives) Cost 150,178					of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A19. Implement ECMs and WCMs at Karl Homuth Arena	<p>8 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including:</p> <ol style="list-style-type: none"> 1. 32WT8 to 25WT8; 2. Install occupancy sensors; 3. Implement floating head pressure control; 4. Lower flood water temperature; 5. Insulate flood water and DHW piping; 6. Replace flood water and DHW heater tanks; 7. Lower change room heating set point and install programmable thermostat; 8. Install timer on change room exhaust fan. 9. 	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	2019	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 37,318	19,357	3,788	3,117	9.3	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A20. Implement ECMs and WCMs at Hespeler Library	<p>6 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including:</p> <ol style="list-style-type: none"> 1. Lighting conversion: Halogen to LEDs; 2. Install photocell; 	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2019.	Scheduled	Existing capital budget Municipal reserve &	22,942	5,152	4,035	12.3	Demonstrates to the public implementation of leadership in Energy and Environmental

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	3. Install weather stripping in vestibule; 4. Implement demand control ventilation; 5. Lower space temperatures; 6. Solar glazing on exterior wall windows.	<ul style="list-style-type: none"> Development Facility Managers Mechanical Contractors 			hydro rebates (lighting initiatives) Cost 24,305					design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A21. Implement ECMs and WCMs at Main Library	8 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Lighting upgrade: T12 to high performance T8; 2. Lighting conversion: Incandescent and Halogen to LEDs; 3. Replace rooftop unit (capital upgrade); 4. Install occupancy sensors; 5. Lighting upgrade: Mercury vapor to LEDs; 6. Implement demand control ventilation; 7. Install high efficiency boiler, re-pipe to injection loop; 8. Install a comprehensive BAS.	<ul style="list-style-type: none"> Manager of Building Construction Director of Sustainable Design and Development Facility Managers Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2016.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 460,414	0	20,897	18,615	50.8	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A22. Implement ECMs and WCMs at Preston Library	6 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Lighting upgrade: 32WT8 to 25WT8; 2. Halogen to LEDs; 3. Implement demand control ventilation; 4. Install radiator reflectors; 5. Replace single pane windows; 6. Install ultra-low flow faucet	<ul style="list-style-type: none"> Manager of Building Construction Director of Sustainable Design and Development Facility Managers Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2019.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives)	13,009	4,276	2,478	9.5	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually

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						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
	aerators.				Cost 39,867					as well as posted in an annual inventory.
A23. Implement ECMs and WCMs at Market Building	7 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Lighting upgrade: T12 to high performance T8; 2. Replace unit heaters; 3. Replace thermostats; 4. Insulate DHW tanks and piping; 5. Replace DHW heater tanks; 6. Install LED lighting; 7. Refurbish windows.	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2019.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 71,015	16,829	1,868	2,076	5.4	One of the oldest Farmers Market building in Canada serving as farmers market; measures will extend the life of the building and preserve important historical site
A24. Implement ECMs and WCMs at Old Fire Hall Museum and Education Centre	6 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Insulate DHW Tank and Piping; 2. Incandescent to CFL lighting; 3. Reinsulate attic; 4. Seal/insulate wall joints; 5. Lighting upgrade: T12 to high performance T8; 6. Replace heating and cooling systems.	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers • Mechanical Contractors 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2015.	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 111,228	46,130	-202	4,561	4.7	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A25. Implement ECMs and WCMs at Transportation and Public Works Building	5 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Replace remaining high-flow tank toilers with dual-flush units and install ultra-low flow faucet aerators; 2. Install programmable	<ul style="list-style-type: none"> • Manager of Building Construction • Director of Sustainable Design and Development • Facility Managers 	The full slate of ECMs and WCMs are scheduled to be fully implemented in 2018.	Scheduled	Existing capital budget Municipal reserve & hydro rebates	4,100	23,343	4,289	23.8	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be

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						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
	3. thermostats in welding shop; Replace RTU-54 and RTU-57 (capital upgrade); 4. Replace weather stripping around entrances and service bay doors; 5. Install BAS and implement demand control ventilation.	<ul style="list-style-type: none"> Mechanical Contractors 			(lighting initiatives) Cost 177,801					published in a sustainable report annually as well as posted in an annual inventory.
A26. Implement ECMs and WCMs at WG Johnson Pool	10 Energy and Water Conservation Measures (ECMs and WCMs) were identified, including: 1. Install occupancy sensors; 2. 32WT8 to 25WT8 lighting; 3. Seal and reinsulate fan housing; 4. Replace rooftop equipment; 5. Re-commission BAS; 6. Replace tank toilets; 7. Replace heating boilers; 8. Install de-stratification fans in gym; 9. Install VFD on P-20 and 21; 10. Replace slide pump.	<ul style="list-style-type: none"> Manager of Building Construction Director of Sustainable Design and Development Facility Managers Mechanical Contractors 	2017	Scheduled	Existing capital budget Municipal reserve & hydro rebates (lighting initiatives) Cost 373,109	60,122	24,405	13,737	52.8	Demonstrates to the public implementation of leadership in Energy and Environmental design. The results will be published in a sustainable report annually as well as posted in an annual inventory.
A27. Occupancy Policy	Develop an overarching policy and building control standards based upon building occupancy to reduce the heating and cooling of unoccupied areas.	<ul style="list-style-type: none"> Manager of Building Construction Director of Facilities Management and Development Facility Managers (e.g. public works, libraries, fire departments) 	Fall 2013: Mtg with facility managers Fall 2013 – mid 2014: develop generic policy; modify according to building usage & HVAC characteristics Fall 2014: Develop education & engagement program	In progress	N/A – staff time only (regular ops budget)	N/A (difficult to quantify)	N/A (difficult to quantify)	N/A (difficult to quantify)	N/A (difficult to quantify)	Heightened staff engagement and awareness of ways to conserve energy; changes in behaviour/ corporate culture

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						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
			Fall 2014: Deliver comms materials to Facility Managers Fall 2014 – ongoing: begin tracking results							
CORPORATE SECTOR: STREET LIGHTING										
B1. Streetlight Conversion Program & Development of New Streetlighting Standard	Convert existing City-owned street lights to higher efficiency lighting (e.g. LEDs, induction) and develop a street lighting standard for new City developments.	<ul style="list-style-type: none"> Transportation & Public Works Department Mgr. of Transportation Engineering (PM) Dir. Of Corporate Services Dir. of Engineering Services Commissioner of Transportation and Public Works Dir. of Finance Cambridge and North Dumfries Hydro Inc. Independent Region of Waterloo, other Cities & Townships within Region Consultants & contractor(s) – TBD 	Complete pilot project (Boxwood subdivision LED installation (2013-2015)) Develop business case (2013 – 2014) Terms of Reference for consultant to determine best approach to conversion on Region-wide basis and prequal. of products (2014) Finalize Implementation Plan and procurement for contractors / products 2014 – 2015) Implementation: 2015 – 2020	In progress	TBD by Mgmt Ctee			160,000 – 270,000	305 - 508	Demonstration of corporate leadership More energy efficient future developments Reduced maintenance costs Improved understanding of viable alternative lighting technologies
CORPORATE SECTOR: SEWAGE COLLECTION AND PUMPING										
C1. Pumping	Upgrade all 16 City-owned pumping	<ul style="list-style-type: none"> Compliance 	Energy	In	Capital	234,833		24,423	28	

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						Annual Electricity Savings (kWh)	Annual Natural Gas Savings (m ³)	Annual Energy Savings (\$)	GHG Reductions (t CO ₂ e)	Qualitative Benefits
Station Upgrades	stations over 10 years with energy conservation measures (e.g. variable frequency drives on pumps)	<ul style="list-style-type: none"> Manager – Public Works Director of Asset Management Director and Manager of Public Works Region of Waterloo 	Assessments: 2013 – 2014/2015 Specification written: 2014 Implementation: by 2020	progress	reserves Approx. \$20,000 per station (avg) x 16 facilities \$320,000					
C2. Reduce Pumping Station Emergency Generator Runtimes	Reduce pumping station emergency generator runtimes across all pumping stations (cut runtimes to once per month, two hours per test).	<ul style="list-style-type: none"> Manager of Operations of Wastewater Manager of Operations 	2013: Directive provided to staff & operational schedules updated	Completed	N/A			2,369	5.4	Staff time freed up for other important tasks, behavioural changes and increased awareness that even small actions such as cutting runtimes can have positive impacts on energy and GHG reductions.
CORPORATE SECTOR: WASTE MAGEMENT										
D1. Waste Management	Develop strategies to improve corporate waste management and increase waste diversion rates at select City owned and managed facilities, starting first with facilities over 60,000 square feet (e.g. City Hall, Hespeler Memorial Arena, Galt Arena, Transportation and Public Works Building.	<ul style="list-style-type: none"> Manager of Purchasing Facility Managers 	2014: Prepare tender package for comprehensive waste audits at 4 largest facilities Late 2014 - 2018: Commence initial baseline audit (one facility at a time) 2015 – 2020: conduct annual audits to track	Currently being planned	Capital or operating budgets Cost: TBD	The waste audits themselves will not result in electricity, natural gas or water savings, nor will they result in a reduction of GHG emissions. The audits will, however, present opportunities for savings in some of these areas, as well as other areas such as reduced costs associated with waste collection and disposal.				Leading community by example (demonstration of leadership) Educational opportunities for staff and visitors at chosen facilities

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			diversion rates & measure progress against baseline year.							
CORPORATE SECTOR: FLEET										
E1. Fleet Right-sizing and Fleet Pooling	Over the next 10 years, the City plans to create a more sustainable, fuel-efficient fleet using fleet right-sizing and fleet pooling practices. Use of alternative fuels and vehicles will be explored and implemented, where feasible, as part of this initiative. Fleet pooling optimizes the use of vehicles (reduces “downtime”) and involves a process where vehicles are matched with intended use.	<ul style="list-style-type: none"> Fleet Department Manager of Fleet and Buildings Operations Managers (various departments that use fleet vehicles) Director of Transportation and Public Works Commissioner of Transportation and Public Works Corporate Services 	To be determined. The City is currently hiring a Fleet Manager. This person’s first responsibility will be to further define fleet projects and establish timelines.	Not yet started	Self-funded through equip. reserves Cost: TBD (requires further exploration)				37 - 110	<p>Leading community by example</p> <p>Educational opportunities for staff and community at large</p>
E2. Fuel Cells	Explore the potential use of alternative fuel technology – fuel cell vehicles (FCV) within the City fleet	<ul style="list-style-type: none"> Manager of Fleet and Public Works Director and Commissioner of Public Works Commissioner of Planning Corporate Services 	To be determined. The City is currently hiring a Fleet Manager. This person’s first responsibility will be to further define fleet projects and establish timelines.	Not yet started	TBD					<p>Leading community by example</p> <p>Educational opportunities for staff and community at large</p>
E3. Alternative Fleet & Fuel Technologies	Investigate alternative technologies for fleet vehicles and identify pilot projects to test potentially viable technologies for the City (in addition to FCV as described above). Options the City is considering exploring include: biodiesel (biodiesel fuelled vehicles); electricity (hybrid & plug-in vehicles); Ethanol (flexible fuel vehicles); natural gas (natural gas	<ul style="list-style-type: none"> Manager of Fleet and Buildings Director of Public Works Commissioner of Public Works Corporate Services Director of Buildings 	To be determined. The City is currently hiring a Fleet Manager. This person’s first responsibility will be to further define fleet projects and establish timelines.	Not yet started	TBD	To be determined based on pilot projects pursued.			<p>Leading community by example</p> <p>Educational opportunities for staff and community at large</p>	

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	vehicles); propane (propane vehicles); biobutanol (fuel produced from corn, sugar beets, and other biomass feedstocks); drop-in biofuels (hydrocarbon fuels that are similar to gasoline, diesel and jet fuel made from a variety of biomass feedstocks including crop residues, woody biomass, algae); methanol (wood alcohol); biogas (“swamp gas”, “landfill gas” or “digester gas”).									
CORPORATE SECTOR: OTHER										
F1. Tree Canopy Improvement	Inventory current canopy, develop an urban forest plan with canopy target, and increase canopy over 30 years. The health and size of the urban tree canopy is directly related to cleaner air, reduced greenhouse gas (GHG) emissions and local climate; trees remove GHGs from the atmosphere, lower ambient temperature, and ameliorate flooding and stormwater impacts.	<ul style="list-style-type: none"> Sustainability Planner Manager of Forestry 	2014: Complete inventory and plan Present Urban Forest Plan (December 2014) Increase tree canopy over 30 year period, beginning 2013	Inventory & plan in progress	CSD – Capital maint. Potential partnerships with community, residents, and businesses \$130,000 to develop inventory & plan; 100,00 per year for planting				54 by 2020	Decrease the “urban heat island effect”; More habitat for birds & animals; Attract more industry, residents and commercial activity; Improvement of watershed & forest cover; Reduction of flood risk; Improvement of community aesthetics; Increased property values increase; Health benefits

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