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Corporate energy management plan

Corporate energy management plan

City of Brantford

This document was prepared for the City of Brantford by IndEco Strategic Consulting Inc.

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Context

North American municipalities are increasingly focusing on energy as a strategic priority – to reduce operating costs, prepare for rising utility costs, and to demonstrate their commitment to long-term sustainability. In Ontario, the provincial government is allocating millions of dollars to energy conservation and demand management (CDM) programs, providing energy consumers with significant incentives to upgrade their facilities and equipment. The Government of Ontario has also expressed a commitment to greening public sector buildings, and developed *Regulation 397/11* under the *Green Energy and Green Economy Act (2009)* to advance this goal. Under the regulation, all public agencies – including the City of Brantford – are required to report their energy consumption and greenhouse gas (GHG) emissions on an annual basis starting in 2013, and are required to submit 5-year energy conservation and demand management plans in 2014.

The *Corporate Energy Management Plan* (CEMP) provides a 5-year roadmap for energy management in the City of Brantford. It focuses on the use of electricity and natural gas in City facilities, as well as fleet vehicle fuel. It covers the period from July 2014 to July 2019, and is designed to help the City comply with the energy CDM planning requirements of Ontario *Regulation 397/11* under the *Green Energy Act (2009)*.

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

Objectives and targets

Energy efficiency is a valuable opportunity to reduce or avoid future costs. Investing in energy management and implementing the actions identified in the CEMP will provide valuable opportunities for the City of Brantford. Not only will it result in energy intensity and GHG savings, but it will also provide opportunities for staff engagement, lower risk exposure, and demonstrated leadership by the City.

The objectives of the City of Brantford's 5 year *Corporate Energy Management Plan* are to achieve the following:

1. Energy is used efficiently within the City.
2. A corporate structure is established to manage energy efficiently.
3. The efficient use of energy is a priority for the City in corporate policy and budget decisions.
4. The efficient use of energy is part of the day-to-day activities of City staff.

5. The City meets and exceeds the requirements of *Regulation 397/11*.

The CEMP establishes the following quantitative targets to guide the City's efforts on energy management from 2014 to 2019:

- 4.9% improvement in energy intensity; and
- 5.3% reduction in greenhouse gas emissions.

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

Energy use and benchmarking

The Ontario Ministry of Energy benchmarked the 2011 energy consumption data submitted to the Ministry under *Regulation 397/11*. These benchmarks allow the City of Brantford to compare their building's performance against other similar municipal buildings. As can be seen in Figure 1, on a per square foot basis, the majority of the City of Brantford's building types are more efficient than the provincial average.

Figure 1 City of Brantford facilities benchmarked against other Ontario municipalities

Buildings

Operation Type	Provincial Mean (eWh/HDD/ft2)	Mean for Brantford (eWh/HDD/ft2)	% (Brantford vs Province Average)	
Administration Offices	8.39	5.9	70%	
Ambulance Stations	9.15	6.53	71%	
Community Centres	6.78	5.56	82%	
Cultural Facilities	7.18	5.04	70%	
Fire Stations	6.97	7.41	106%	
Indoor Recreational Facilities	10.19	11.93	117%	
Storage Facilities or Garages	8.19	4.55	56%	
Police Stations	9.67	12.31	127%	
Libraries	7.11	6.97	98%	

Water Processing Facilities

Operation Type	Provincial Mean (eWh/HDD/ft2)	Mean for Brantford (eWh/HDD/ft2)	Mean Variance	
Sewage Pumping Stations	300.3	322	107%	
Water Pumping Stations	659.2	654	99%	
Sewage Treatment	1046.5	597	57%	
Water Treatment	1207.2	711	59%	

The City of Brantford is also doing well when comparing itself year over year. Figure 2, Figure 3, and Figure 4 show the energy intensity and GHG emissions for Brantford facilities for the years 2011 to 2013.

The data for these years have not been weather normalized and some variation can be expected based on the impact of weather (e.g. higher heating energy use during colder winters, higher cooling energy use during hotter summers, and increased water pumping and treatment energy use in years with higher precipitation levels).

The facilities in the figures have been grouped together by type in order to facilitate comparison of facilities with similar energy using equipment. The facilities that have the highest energy intensity per square foot are the Wayne Gretzky Centre and the Market Parkade. The facilities that have the highest energy intensity per mega litre (ML) of water processed are the Water Pumping Station & Reservoir at 5 Kraemers Way, the Water Treatment Plant, and the Waste Water Treatment Plant. The facilities that have the highest GHG emissions are the Wayne Gretzky Centre, the Water Treatment Plant, and the Waste Water Treatment Plant. There are some differences in the rankings, as the GHG emissions values are absolute, while the energy intensity values are based on floor area or volume of water processed.

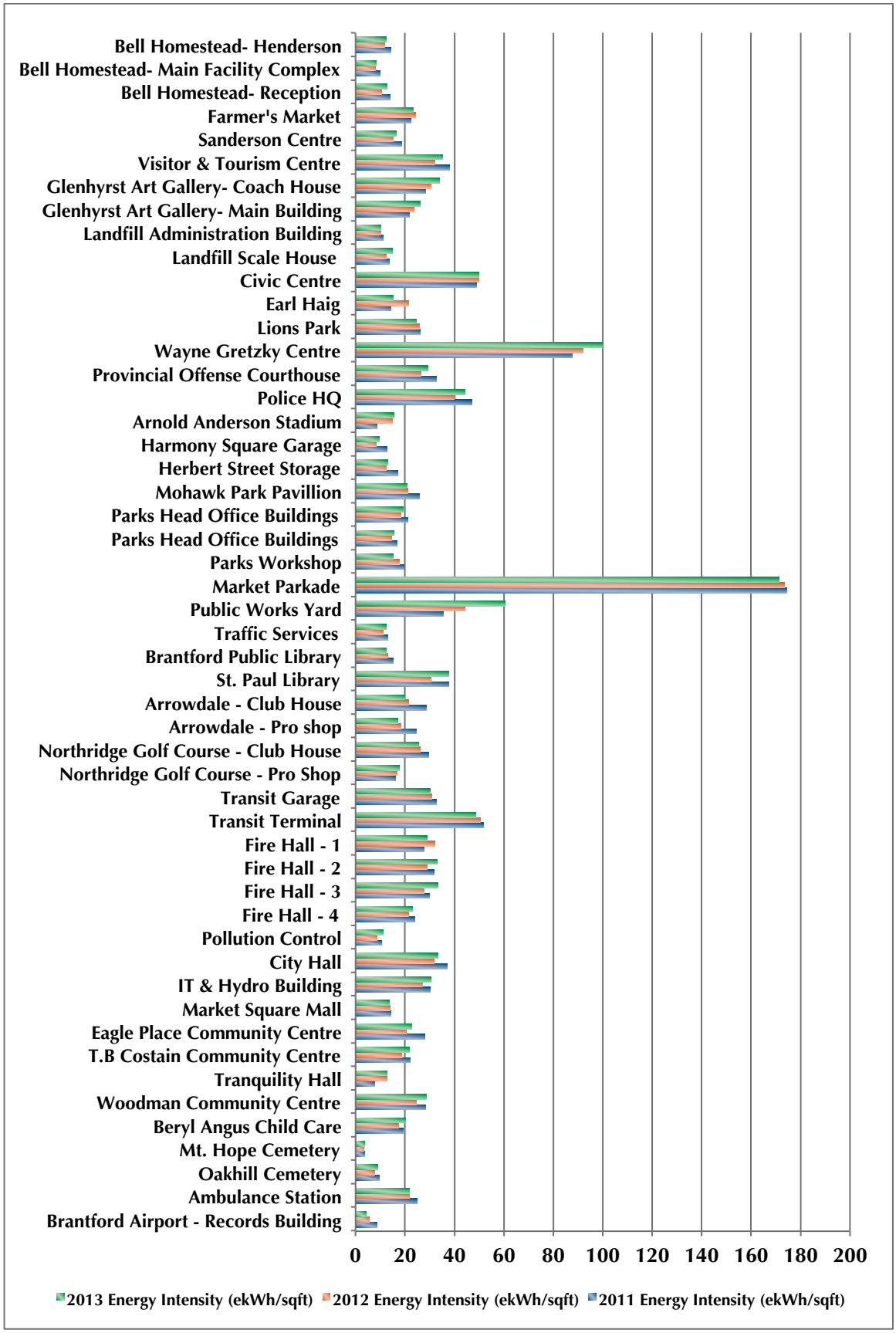

Figure 2 Energy intensity for Brantford facilities for 2011 to 2013

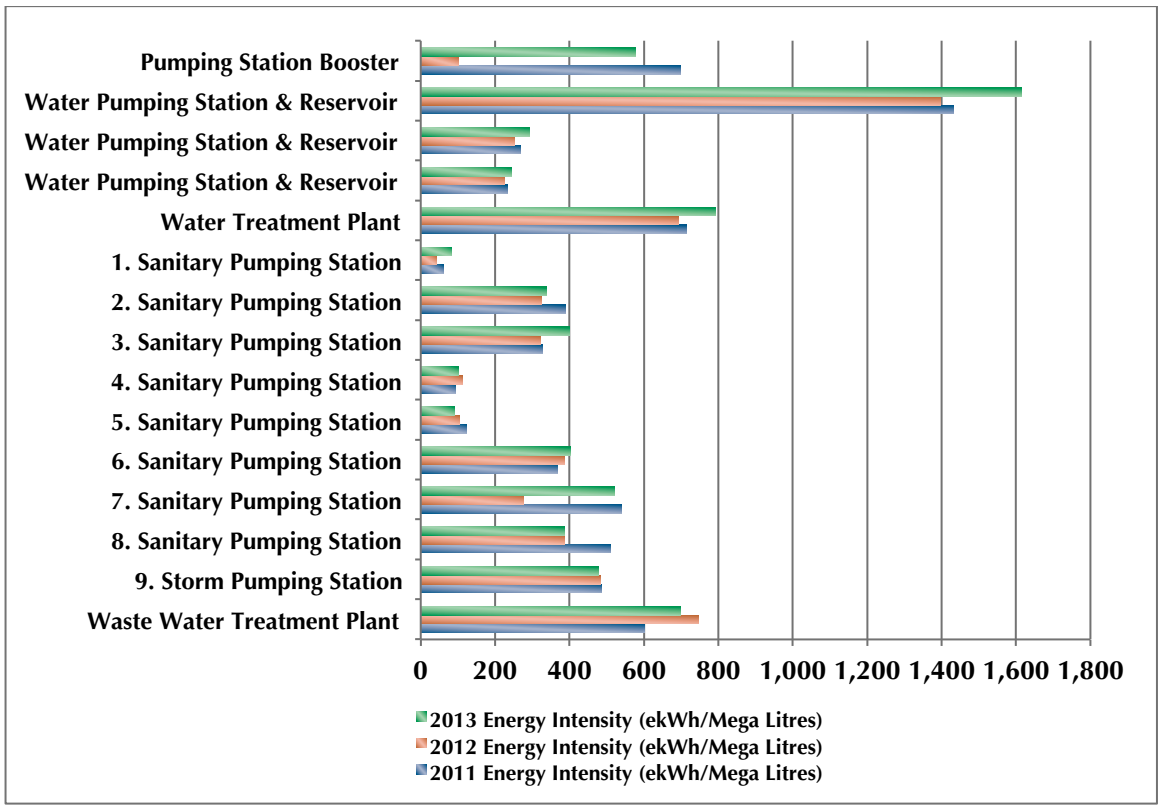

Figure 3 Energy intensity for water and wastewater processing facilities for 2011 to 2013

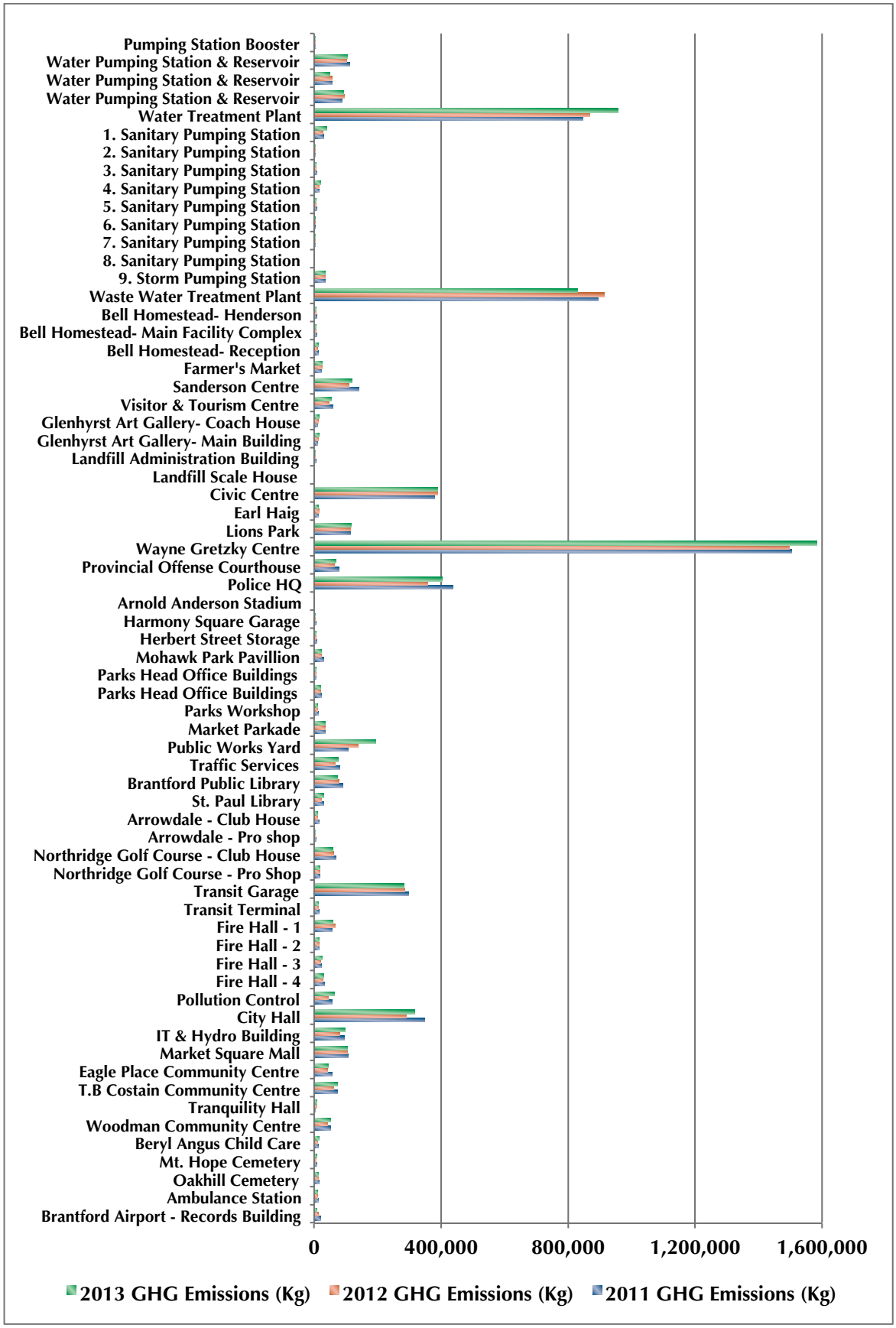

Figure 4 GHG emissions for Brantford facilities for 2011 to 2013

Scope and method

The CEMP addresses buildings, technologies, fleets, and street and traffic lights – as well as people, processes, and information. The plan draws on information from a number of sources: interviews, a corporate-wide survey, and meetings with City staff, specifically the Steering Committee established for the plan; and a review of City policies, plans and programs.

The first step in the process was to identify and define the preferred state / vision of energy management for the City. This was accomplished through nine in-person interviews, one telephone interview, and a strategic planning session held with key City staff.

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

The third step involved developing technical and organizational actions to assist the City in moving from its present to its preferred state of energy management. Technical actions were identified through ASHRAE Level II audits conducted on four of the City's largest energy consuming facilities, which were chosen to capture a variety of archetypes so that measures could be extrapolated across all City buildings. The organizational actions, which relate to corporate processes, were identified through interviews, a strategic planning session, and a corporate-wide survey. The actions are grouped in the CEMP 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 City fleet vehicles that reduce energy consumption;
- **Procurement and renewables** – measures related to the procurement of energy and renewable technologies; and
- **Streetlights and traffic signals** – measures related to installing more energy efficient lighting 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).

Many of the priority actions are foundational and put in place the structures and practices that will facilitate on-going energy efficiency within the City. The technical actions identified through the facility audit reports are grouped according to facility type and were allocated across the five years of the plan in order to facilitate an annual net capital cost of approximately $113,000 in each year for budgeting purposes.[1]

Priority actions

The table below presents all the priority actions that should be implemented in Year 1 of the CEMP (July 2014 – July 2015). These actions are grouped by category and are numbered for ease of identification. The numbering is not an indication of importance; all priority actions should be implemented within the first year.

Organizational commitment
1. Formally adopt 5-year corporate targets for energy intensity and GHG emissions.
2. Formally adopt interim targets to assist in tracking progress towards 5-year goals.
3. Develop a process for updating the CEMP in the interim and after 5 years, and ensure compliance with the *Green Energy Act* reporting requirements.
4. Meet bi-annually with Brantford Power and Union Gas to discuss opportunities to work together on energy efficiency initiatives, including available incentives and credits for streetlights.
5. Meet with new Director of Communications and Conservation at Brantford Power to discuss energy efficiencies opportunities under the new conservation and demand management framework.
6. Develop a process for continually monitoring and applying for available incentives/grants.
7. Assign the Facilities Management Specialist responsibility for championing the energy plan, tracking energy initiatives, and implementing the behaviour change programs to staff.
8. Establish an Energy Technician role responsible for implementing the technical actions of the CEMP.

[1] The City currently budgets $100,000 on an annual basis to projects related to energy conservation. Energy improvements are also completed within other capital and / or operating projects.

9. Reinstate a Corporate Steering Committee with staff from each department to formalize an energy strategy across all City departments, and identify roles and responsibilities.
10. Communicate the energy strategy to all City staff.
11. Conduct an assessment of the needs of building operators with a goal of having an operator identified in each building (where required).
12. Develop a clear and well-publicized process for funding smaller projects from the energy reserve.
Existing buildings and equipment
13. Implement HVAC measures in all applicable buildings, where considered cost effective.
14. Implement general lighting retrofit measures in all applicable buildings.
15. Implement Variable Frequency Drive (VFD) measures in all applicable buildings.
16. Implement behavioural measures in all applicable buildings.
17. Implement lighting control measures in all applicable buildings.
18. Develop a prioritized capital list on an annual basis that includes existing energy audit recommendations. Update list as new audits are completed.
19. Update the criteria and metrics for prioritizing 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.
New buildings and equipment
20. Develop a formal commissioning policy for new buildings, major renovations, and additions to buildings, to verify energy performance after construction.
Monitoring and tracking
21. Formalize key performance indicators (KPIs) and tracking mechanisms to monitor and report on progress towards interim and 5-year targets.
22. Determine if there are sufficient and appropriate staff resources to collect and manage energy data.
23. Develop terms of reference and functional requirements for an energy management system (EMS), including software and other related technology.
24. Develop a process for evaluating and reporting the savings achieved from energy efficiency projects.
25. Continue to develop high-level report card on the annual energy consumption of each building.
Communication and engagement
26. Develop a plan for communicating about the City's energy reduction programs and initiatives to staff.

27. Implement general training on energy and energy efficiency for all staff who operate and maintain buildings.
28. Ensure that all staff who operate and maintain specific buildings are appropriately trained on energy efficiency in their building.
29. Following re-commissioning of buildings, ensure that appropriate staff are trained on modifications made to the building and systems.
30. Include general and facility-specific training on energy and energy efficiency in the training process for new hires related to operating and maintaining buildings
31. Supervisors / managers and building focused staff meet annually to discuss energy consumption and energy efficiency activities conducted throughout the year.
32. Continue to send building staff / Facilities Management staff to conferences and trade shows for information sharing.
Procurement and renewables
33. Work with the Purchasing department to find effective ways of procuring energy efficient technologies (e.g. in situations where only one vendor can offer a particular product).
34. Investigate the installation and leasing of roof space for solar projects.
Streetlights and traffic signals
35. Formalize the plan for replacing and updating City streetlights.
36. Continually communicate with Brantford Power to ensure proper credits for energy savings / reductions from streetlights are applied.
37. Continue to participate in the municipal streetlight working group.
38. Develop a formal process whereby information obtained from participation in the streetlight working group is shared with the appropriate staff at the City (e.g. Director of Engineering Services, Director of Facilities and Asset Management, Energy Technician).
39. Continue to look for opportunities in renewables and new energy efficient technologies for replacing traffic lights and flashers.
40. Make use of the process developed for continually monitoring and applying for available incentives / grants.

Medium-term actions

The table below presents the medium-term actions that should be implemented in Years 2-3 of the CEMP (2015-2017). These actions are grouped by category and are numbered for ease of identification. The numbering is not an indication of importance.

Organizational commitment
41. Re-affirm commitment to targets. Update targets, if required, to reflect progress.

42. Track and assess progress on interim targets and year 1 actions.
43. Include energy management as a strategic priority for the City.
44. Include consideration of energy in relevant corporate plans and policies.
45. Develop a mechanism through which savings from energy projects are re-invested into the relevant reserve account.
46. Develop an operator level energy contact in each division.
47. All operators are assisted by staff within the Facilities Management department as outlined in the formal energy strategy that was developed.
Existing buildings and equipment
48. Implement HVAC settings measures in all applicable buildings.
49. Develop a standard requiring that energy efficiency be considered in all building renovations.
50. Develop consistent guidelines and policies for energy management to be followed at all facilities.
51. Develop and implement a corporate O&M preventative maintenance program.
52. Develop and implement a corporate re-commissioning plan.
New buildings and equipment
53. Identify and adopt energy efficient equipment standards to be followed when replacing equipment (e.g. Energy Star).
54. Develop and adopt an energy efficiency building standard (e.g. LEED® principles, BOMA, etc.)
55. Develop guidelines for considering energy at all stages of new building development (e.g. budgeting, procurement, design, construction / change management).
Monitoring and tracking
56. Conduct an assessment of the metering needs of each building.
57. Ensure each building is appropriately metered for each utility.
58. Establish budgetary and implementation estimate and commence with procurement and implementation of an EMS.
59. Develop a plan for analysis and use of energy data (e.g. Energy Technician collects data centrally and informs staff who operate and maintain buildings of results and anomalies).
60. Develop / purchase an energy dashboard that provides Facilities Managements and operators with appropriate information on energy use.
61. Develop a process for rolling out successful energy efficiency projects / pilots.
62. 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, Ontario Ministry of Energy).

Communication and engagement
63. Implement the staff energy communication plan developed in Year 1.
64. Develop an employee engagement process for all staff who operate and maintain facilities.
65. Include general training on energy and energy efficiency in the training process for all new hires.
66. Implement project specific training for staff as needed (e.g. new technology, new piece of equipment).
67. Set up regular site visits and meetings with O&M staff from other municipalities to share information and tour facilities.
68. Continue to send staff to conferences and trade shows for information sharing.
Fleets
69. Develop guidelines to operate vehicles in the most energy efficient manner (e.g. anti-idling).
70. Include energy efficiency in the driver-training program (e.g. Shuttle Challenge).
71. Develop a formal policy for purchasing the right-sized vehicles that includes considerations other than cost (e.g. life-cycle costs, operational costs).
Renewables and procurement
72. Review the feasibility for installing solar or other renewable and alternative energy technologies on or in City-owned facilities.

Longer-term actions

The table below presents the longer-term actions that should be implemented in Years 4-5 of the CEMP (2017-2019). These actions are grouped by category and are numbered for ease of identification. The numbering is not an indication of importance.

Organizational commitment
73. Re-affirm commitment to targets.
74. Prepare plan update.
75. Establish budget and issue an RFP for preparing the CEMP update.
76. Track and assess progress on interim targets and years 2-3 actions.
77. Apply to energy conservation awards (e.g. OPA Community Conservation Award).
Existing buildings and equipment
78. Implement air sealing measures in all applicable buildings.
79. Implement insulation measures in all applicable buildings.
80. Implement specialized lighting retrofit measures in all applicable arenas.

81. Implement specialized lighting retrofit measures in all applicable pools.
82. Implement compressed air measures in all applicable buildings.
83. Implement guidelines and policies for energy management to be followed at all facilities.
84. Continue to implement the corporate O&M preventative maintenance program.
85. Continue to implement the corporate re-commissioning plan.
New buildings and equipment
86. Develop a process for updating the energy efficiency standards (every 5 years).
Monitoring and tracking
87. Continue to use the EMS to track and analyze energy use at the building level.
88. Conduct an assessment to ensure that energy data needs are being met, and that staff resources are adequate to manage and collect the data.
Communication and engagement
89. Develop a communication and outreach plan for communicating about energy to the community (e.g. soliciting ideas through Crowdsourcing, enhanced website, etc.).
90. Develop an employee engagement process for all staff based on the pilot program implemented in Years 2-3 for staff who operate and maintain facilities.
91. Continue to set up regular site visits and meetings with O&M staff from other municipalities to share information and tour facilities.
92. Continue to send staff to conferences and trade shows for information sharing.
93. Set up regular meetings with applicable staff from Laurier University and the surrounding school boards to discuss opportunities and share best practices.
Fleets
94. Continue to implement the driver-training program.
Renewables and procurement
95. Develop a process for identifying, evaluating, and developing renewable energy projects.
96. Develop procurement standards for vehicles that include energy efficiency and alternative fuel purchases.
97. Ask contracted procurement advisors how to consider environmental impacts in electricity and natural gas purchasing decision.
Streetlights and traffic signals
98. Develop a formal policy for the use of LEDs, timers, photocells, and dimmable settings in the design of any retrofits, renovations, or new projects involving parking lots and / or outdoor field lighting.

Capital costs and savings

To implement the CEMP, the City 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 $566,925 to implement all measures in the four 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 City approximately $113,000 each year over the next five years. The net present value (NPV) of implementing all the measures is $2,340,518.

The estimated energy intensity reductions and GHG savings from implementing the recommended measures in the four facility audit reports are outlined below.

Facility	2012 Energy intensity (ekWh/sqft)	Energy intensity reduction	2012 GHG emissions (Kg)	GHG emissions savings
T.B. Costain Community Centre	18.61	1.7%	61,656	1.9%
Police HQ	39.96	41.8%	357,041	51.0%
Visitor & Tourism Centre	31.96	8.5%	47,802	3.1%
Wayne Gretzky Centre	92.12	3.5%	1,497,261	9.1%

Introduction

The City of Brantford *Corporate energy management plan* (CEMP) provides a roadmap for energy management in the City of Brantford. The CEMP describes the energy management activities that the City as a corporation can take over the next 5 years to increase its energy efficiency, reduce its energy demand, and minimize its environmental footprint. It is also designed to help the City comply with the energy conservation and demand management planning requirements of Ontario *Regulation 397/11* under the *Green Energy Act (2009)*.

The CEMP is organized as follows:

- Section 2 Objectives and targets
- Section 3 Priority actions (Year 1, July 2014 – July 2015)
- Section 4 Medium-term actions (Years 2-3, July 2015 – July 2017)
- Section 5 Long-term actions (Years 4-5, July 2017 – July 2019)
- Section 6 Capital costs and savings
- Section 7 Renewables and alternative energy
- Section 8 Implementation of the plan
- Section 9 Energy management systems
- Section 10 Communication and engagement
- Section 11 Conclusion

The CEMP also has appendices that contain the following:

- Appendix A Present state
- Appendix B Criteria for prioritizing actions
- Appendix C Utility incentive programs
- Appendix D List of acronyms

Planning horizon and scope

The CEMP for the City of Brantford is a 5-year plan covering the period from July 2014 to July 2019.

The CEMP provides a roadmap for energy management at all City facilities.[2] As can be seen in Figure 5, it addresses the use of electricity and natural gas in City facilities, streetlights and traffic lights, as well as fuel for fleets.

[2] Excluding the City of Brantford's Housing portfolio.

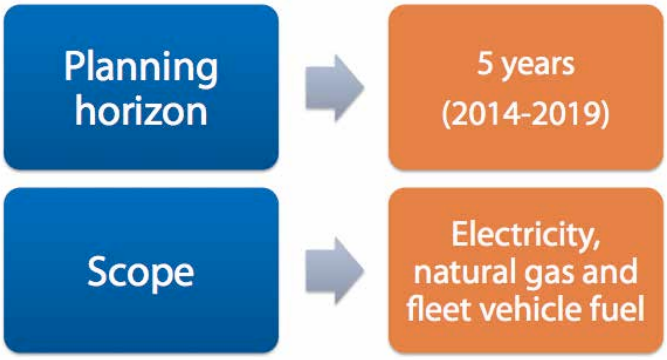

Figure 5 Planning horizon and scope

Planning process

Figure 6 depicts the major steps in the planning process that were used to develop the City's *Corporate energy management plan*. Inputs to the planning process included:

- Review of 2011 and 2012 energy and GHG data for all City facilities, excluding housing and long term care facilities;
- Review of the City's existing policies, plans, and past energy efficiency projects;
- ASHRAE Level II audits of four high consumption City facilities;
- Benchmarking of City facilities against comparable facilities;
- Interviews with City staff (including department directors, managers, and O&M staff);
- A strategic planning sessions with key City staff; and
- A corporate-wide survey for City staff to gather their input into how energy can be managed more efficiently (see Appendix A for a summary of the survey results).

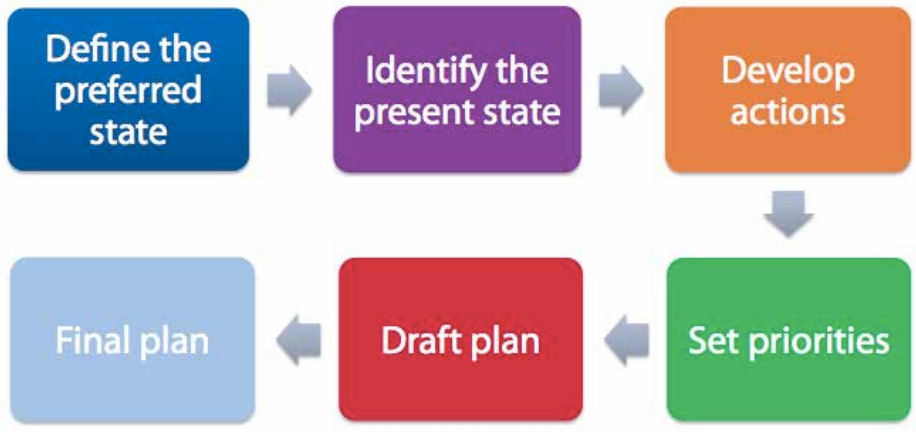

Figure 6 Overview of the planning process

Defining the preferred state involved exploring where the City of Brantford would like to be with respect to energy management. The elements of the preferred state were identified through interviews with staff, a review of jurisdictional best practices, the corporate-wide survey, and during the strategic planning session. The preferred state informed the CEMP's objectives, targets, and actions.

Identifying the present state involved exploring where the City is now with respect to energy management. Energy data analysis; interviews; four AHSRAE Level II audits; a review of the City'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 City move towards the preferred state. Actions were identified through audits, interviews, the strategic planning session, the corporate-wide survey 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 City fleet vehicles that reduce energy consumption;
- **Procurement and renewables** – measures related to the procurement of energy and renewable technologies; and
- **Streetlights and traffic lights** – measures related to installing more energy efficient lighting technologies.

Setting priorities involved determining the timeframe for implementation of each action in the CEMP. 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 the section of this report, *Updating and reporting on the plan*, the CEMP will be reviewed annually and updated at the end of the five years.

Framework for planning

The City's CEMP addresses buildings, fleets, and technologies, including street and traffic lights – as well as people, processes, and information. As illustrated in Figure 7, the CEMP centers on the City's facilities, fleets, and technologies. It aims to ensure that existing and any new facilities are built and operated as efficiently and sustainably as possible. The City's supporting organizational policies and processes, monitoring and tracking systems, and communication and engagement tools allow this to happen.

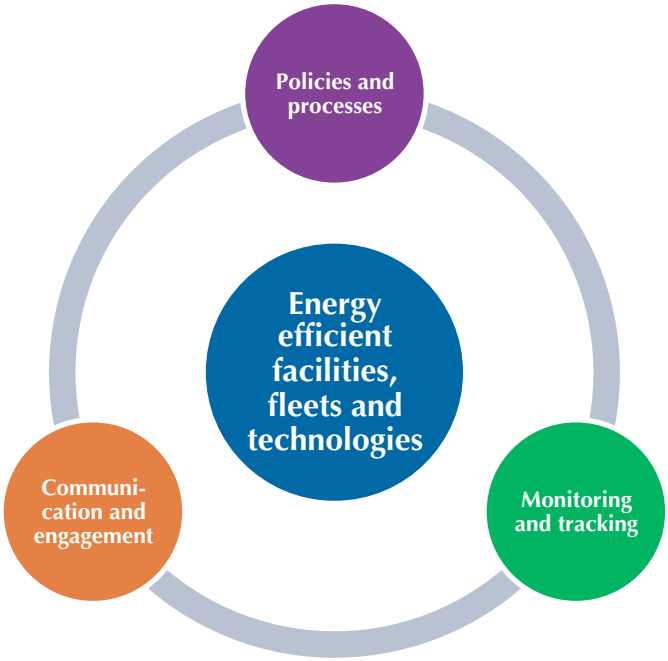

Figure 7 Framework for planning

Objectives and targets

Objectives

The primary objectives of the City of Brantford's 5 year *Corporate energy management plan* are to achieve the following:

1. Energy is used efficiently within the City.
2. A corporate structure and processes are established to manage energy efficiently.
3. The efficient use of energy is a priority for the City in corporate policy and budget decisions.
4. The efficient use of energy is part of the day-to-day activities of City staff.
5. The City meets and exceeds the requirements of *Regulation 397/11*.

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

Targets

Figure 8 illustrates the set of quantitative targets that should guide the City's efforts on energy management from 2014 to 2019.

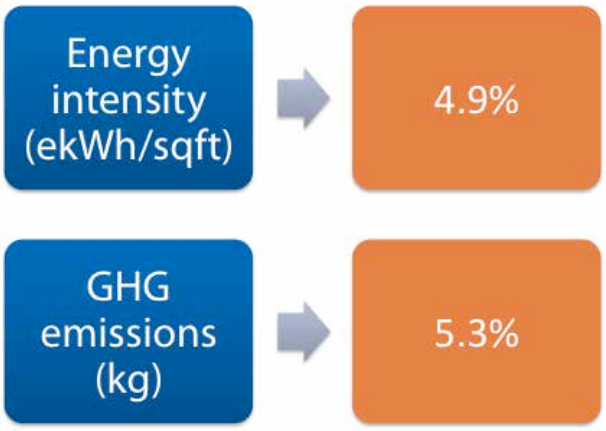

Figure 8 Energy intensity and GHG targets

The results of the ASHRAE Level II audits suggest that a 4.9% improvement in energy intensity and a 5.3% reduction in greenhouse gas (GHG) emissions in the existing building stock is very achievable. In the longer-term (beyond the scope of this plan) the City strives to go beyond these targets and achieve significant energy intensity and GHG reductions.

Table 1 outlines the breakdown of the targets over the 5-year term of the CEMP based on the prioritization of technical actions listed in Table 5, Table 7 and Table 9. Additional savings (typically up to 5 percent) may also be realized from policy and behavioural initiatives outlined in the organizational actions; however, these were not included in the targets breakdown as they are more difficult to accurately measure.

Table 1 Breakdown of energy intensity targets, GHG emissions reductions targets, and annual cost savings by plan phase

	Energy intensity (ekWh/sqft)	GHG emissions (kg)	Annual cost savings
Year 1	1.4%	1.7%	$154,506
Years 2 to 3	3.2%	2.8%	$156,444
Years 4 to 5	0.3%	0.8%	$62,713
Overall	**4.9%**	**5.3%**	**$373,662**

The targets were calculated based on the results of the audits completed in four representative "archetype" buildings (Table 2). The percentage energy intensity and GHG emissions reductions from the last reported levels (2012) 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. The overall targets were derived by extrapolating the savings based on square footage by facility type to all facilities of the same type. The annual cost savings for implementing all of the measures identified in each time period of the plan were calculated based on estimated energy savings and average energy costs for the audited buildings. These estimates were extrapolated by building type in the same manner as the targets. It should be noted that the cost savings estimates do not take into account the variation in energy prices among unaudited buildings and the expected increases in energy costs. All buildings that the City of Brantford reported for under the Ontario Green Energy Act *Regulation 397/11* reporting requirements were included in the calculations. Refer to Appendix A, Table 13 for a complete list of buildings. Refer to the accompanying audit reports for further details on the recommended energy conservation measures.

Table 2 Estimated energy intensity and GHG emissions reductions from recommended measures in the facility audits

Facility	2012 Energy intensity (ekWh/sqft)	Energy intensity reductions	2012 GHG emissions (Kg)	GHG emissions reductions
T.B. Costain Community Centre	18.61	1.7%	61,656	1.9%
Police HQ	39.96	41.8%	357,041	51.0%
Visitor & Tourism Centre	31.96	8.5%	47,802	3.1%
Wayne Gretzky Centre	92.12	3.5%	1,497,261	9.1%

Although the Police HQ has a high estimated potential for energy intensity and GHG emissions reductions, this does not translate directly to higher overall targets for the City's energy plan. As outlined in the audit report, the Police HQ has a number of HVAC-related energy conservation measures that could result in significant savings once they are implemented. This is a unique situation and the Police HQ is the only building of its type within the City's facilities. As such, it is not expected that this level of savings will be directly applicable to any other facility. The Police HQ building contributes to the targets only as part of the average of all audited buildings applied to those buildings within the City's stock that do not fall into the four archetypes that were audited. The buildings associated with the archetype buildings that were audited are shown in Table 3.

Table 3 Audited archetype buildings and the associated unaudited buildings

Archetype buildings	Associated unaudited buildings
T.B. Costain Community Centre	Eagle Place Community Centre
	Tranquility Hall
Police HQ	None
Visitor & Tourism Centre (Administrative)	City Hall
	Farmer's Market
	IT & Hydro Building
	Landfill Administration Building
	Landfill Scale House
	Market Square Mall
	Parks Head Office Buildings
	Parks Head Office Buildings
	Pollution Control / Facilities Group
	Provincial Offense Courthouse
	Public Works Yard

Archetype buildings	Associated unaudited buildings
	Transit Terminal
Wayne Gretzky Centre (Arenas)	Civic Centre
	Lions Park

Updating and reporting on the plan

The *Corporate energy management plan* is a living document and should be reviewed at least once a year. As part of the annual review, the Facilities Management Specialist assigned to oversee the implementation of the CEMP (see Action 7, Table 4) should complete the following steps:

- Track the activities that have been implemented, based on a checklist of all of the actions included in the CEMP;
- Track quantitative progress towards targets, using the KPIs described in this plan;
- Note any updates to the CEMP, 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 an update report annually describing projects implemented, progress towards targets, updates to the CEMP, and priority actions for the upcoming year; and
- Update the City website content to highlight projects completed, status of CEMP, and corporate commitment to energy management;
- In 2019, report on implementation of the CEMP as required under *Regulation 397/11*. 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.

Priority actions (Year 1, July 2014 – July 2015)

In the first year of the CEMP (July 2014 – July 2015), the City should implement the high-priority organizational actions presented in Table 4. These actions are very important, as they directly or indirectly impact the City'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.

In the first year of the CEMP, the City should also implement the high-priority technical actions for retrofitting the City's existing buildings, as presented in Table 5. These actions have been determined to be most cost effective for the City to implement during this time period.

The technical actions were based on audits conducted on four City facilities of a variety of archetypes and then extrapolated across all City buildings (refer to the complete list of buildings in Appendix A, Table 13, and the accompanying audit reports). The technical 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[3]. The internal rate of return (IRR) and net present value (NPV)[4] 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 City buildings. The groups of actions are prioritized based on average IRR of the component measures and ease of implementation.

[3] 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. 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.

[4] 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). Some measures in the audit reports had an estimated lifespan greater than 20 years, but a limit of 20 years was set for the IRR and NPV calculations due to limitations in future energy cost estimates. A discount rate of 5% was used in calculating the NPV.

Organizational actions

Table 4 Preferred state, priority actions, and metrics for tracking implementation

Preferred state of energy management	Priority actions	Metric / KPI
Organizational commitment		
The City'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 interim targets to assist in tracking progress towards 5-year goals. (See section on Objectives and targets for specific objectives and targets).	Targets adopted (y/n)
The City's energy management activities are guided by an up-to-date Energy Plan.	3. Develop a process for updating the CEMP in the interim and after 5 years, and ensure compliance with the *Green Energy Act* reporting requirements.	Updating process developed (y/n)
The City has excellent working relationships with Brantford Power and Union Gas.	4. Meet bi-annually with Brantford Power and Union Gas to discuss opportunities to work together on energy efficiency initiatives, including available incentives and credits for streetlights. 5. Meet with new Director of Communications and Conservation at Brantford Power to discuss energy efficiencies opportunities under the new conservation and demand management framework.	Meetings scheduled (y/n) Number of meetings attended Meetings scheduled with Director Number of opportunities identified
The City takes advantage of available incentives from utility companies.	6. Develop a process for continually monitoring and applying for available incentives / grants.	Number of incentive applications submitted Monetary value ($) of incentives obtained

Preferred state of energy management	Priority actions	Metric / KPI
The City has appropriate staff resources to effectively implement the CEMP.	7. Assign the Facilities Management Specialist responsibility for championing the energy plan, tracking energy initiatives, and implementing the behaviour change programs. 8. Establish an Energy Technician role responsible for implementing the technical actions of the CEMP. (See Implementation of the plan section for more detail).	Responsibilities assigned to the Facilities Management Specialist (y/n) Energy Technician role established (y/n)
The Facilities Management department is widely recognized across the corporation as being responsible for energy management, and staff take advantage of their knowledge and expertise.	9. Reinstate a Corporate Steering Committee with staff from each department to formalize an energy strategy across all City departments, and identify roles and responsibilities. 10. Communicate the energy strategy to all City staff.	Corporate Steering Committee set up (y/n) Roles and responsibilities assigned (y/n) Energy strategy communicated to staff (y/n)
All buildings have designated staff contacts, and where appropriate building operators, to provide guidance and ensure a consistent approach to energy management across all buildings.	11. Conduct an assessment of the needs of building operators with a goal of having an operator identified in each building (where required).	Assessment conducted (y/n)
The City has a clear and dedicated process for tracking energy savings and determining where savings should go.	12. Develop a clear and well-publicized process for funding smaller projects from the energy reserve.	Process developed (y/n) Process communicated to appropriate staff (y/n) Number of project applications

Preferred state of energy management	Priority actions	Metric / KPI
Existing buildings and equipment		
The City strategically implements all high priority, cost effective energy efficiency projects in existing buildings.	Implement all retrofit measures identified as priority actions: 13. HVAC measures in all applicable buildings, where considered cost effective. 14. General lighting retrofit measures in all applicable buildings. 15. VFD measures in all applicable buildings. 16. Behavioural measures in all applicable buildings. 17. Lighting control measures in all applicable buildings. (See full list in Table 5)	Retrofit projects implemented (y/n) ekWh and m^3 saved Money ($) saved on energy bills
Cost effective energy conservation measures identified in audit reports are prioritized and implemented.	18. Develop a prioritized capital list on an annual basis that includes existing energy audit recommendations. Update list as new audits are completed.	List developed (y/n) Number of recommendations implemented
Projects are prioritized in a consistent way, using clear criteria and appropriate metrics, and the City implements retrofit projects that are cost-effective over longer time periods.	19. Update the criteria and metrics for prioritizing 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 B for more detail).	Criteria and metrics formalized (y/n)

Preferred state of energy management	Priority actions	Metric / KPI
New buildings and equipment		
Energy performance of new buildings, major renovations, and additions to buildings is always verified after construction.	20. Develop a formal commissioning policy for new buildings, major renovations, and additions to buildings, to verify energy performance after construction.	Policy developed (y/n)
Monitoring and tracking		
The City uses KPIs to track progress towards targets.	21. Formalize KPIs, benchmarks, and tracking mechanisms to monitor and report on progress towards interim and 5-year targets.	KPIs adopted (y/n)
The City has the capacity to manage, analyze, and use energy data from meters.	22. Determine if there are sufficient and appropriate staff resources to collect and manage energy data. 23. Develop terms of reference and functional requirements for an energy management system (EMS), including software and other related technology. (See section on Energy management systems for more detail).	Review completed on staff resources needed (y/n) EMS terms of reference developed (y/n) EMS functional requirements developed (y/n)
Project evaluation, monitoring and verification (EM&V) is simple and accurate thanks to energy data and monitoring processes.	24. Develop a process for evaluating and reporting the savings achieved from energy efficiency projects.	Evaluation process developed (y/n)
The City understands how all buildings are performing, relative to other comparable buildings.	25. Continue to develop high-level report card on the annual energy consumption of each building.	Report card developed (y/n)

Preferred state of energy management	Priority actions	Metric / KPI
Communication and engagement		
Energy and energy efficiency is effectively communicated across the corporation.	26. Develop a plan for communicating about the City's energy reduction programs and initiatives to staff. (See section on Communication and engagement for more detail).	Plan developed (y/n)
Staff responsible for operating and maintaining buildings are trained and understand energy saving opportunities.	27. Implement general training on energy and energy efficiency for all staff who operate and maintain buildings. 28. Ensure that all staff who operate and maintain specific buildings are appropriately trained on energy efficiency in their building. 29. Following re-commissioning of buildings, ensure that appropriate staff are trained on modifications made to the building and systems. 30. Include general and facility-specific training on energy and energy efficiency in the training process for new hires related to operating and maintaining buildings. (See section on Communication and engagement for more detail).	Training investigated / developed (y/n) Number of staff trained
Supervisors / managers communicate and share energy efficiency methods and best practices.	31. Supervisors / managers and building focused staff meet annually to discuss energy consumption and energy efficiency activities conducted throughout the year.	Meetings set up bi-annually (y/n) Number of staff attending meetings

Preferred state of energy management	Priority actions	Metric / KPI
The City's building and Facilities Management staff work together with other municipalities, school boards, and Laurier University to share technologies and best practices.	32. Continue to send building staff / Facilities Management staff to conferences and trade shows for information sharing.	Number of staff attending conferences
Procurement and renewables		
The City's policies and procedures enable the adoption of state-of-the-art energy management technologies.	33. Work with the Purchasing department to find effective ways of procuring energy efficient technologies (e.g. in situations where only one vendor can offer a particular product).	Meeting set up with Purchasing (y/n) Purchasing requirements modified (y/n)
The City invests in solar technology by leasing out space for solar installations.	34. Investigate the installation and leasing of City roof space for solar projects.	Number of opportunities identified Number of leases awarded
Streetlights and traffic signals		
All City streetlights are LED and are replaced in phases to be less of a financial burden on the City.	35. Formalize the plan for replacing and updating City streetlights. 36. Continually communicate with Brantford Power to ensure proper credits for energy savings / reductions from streetlights are applied.	Plan formalized (y/n) Money ($) saved on electricity bills Policy developed (y/n)

Preferred state of energy management	Priority actions	Metric / KPI
The City continues to have a representative involved in the municipal streetlight working group. Information gathered from the group is shared with the appropriate staff at the City.	37. Continue to participate in the municipal streetlight working group. 38. Develop a formal process whereby information obtained from participation in the streetlight working group is shared with the appropriate staff at the City (e.g. Director of Engineering Services, Director of Facilities and Asset Management, Energy Technician).	Number of events attended Formal process developed (y/n)
Traffic lights are replaced with the most energy efficient and cost effective technologies.	39. Continue to look for opportunities in renewables and new energy efficient technologies for replacing traffic lights and flashers. 40. Make use of the process developed for continually monitoring and applying for available incentives / grants (see Action 6).	Number of incentive applications submitted Monetary value ($) of incentives obtained

Technical actions

Table 5 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 four 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 City issuing a single tender for similar measures in all applicable buildings. For example, the auditors recommended installing variable frequency drives (VFDs) on pumps and motors at the Police HQ and VFD controllers on pump P-8 and the 50 HP filter pump at the Wayne Gretzky Centre. These measures were grouped together and extrapolated to include VFDs 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 may be undertaken.

The projected capital cost and NPV numbers are estimates based on industry average data, research and analysis; they may not match actual costs and savings. Detailed feasibility studies will be required for many of the recommended technical actions, along with confirmation of costing.

Table 5 Priority technical actions for Year 1

Measures	Buildings	Projected cost (including incentives estimate)	Projected net present value	Internal rate of return
11. HVAC	All applicable buildings	$3,302	$42,978	
Seat warmers, and footrest warmers, diffusion zones	Visitor & Tourism Centre	$850	$11,873	183%
HVAC thermostats relocated	Visitor & Tourism Centre	$300	$3,094	139%
HVAC	Applicable unaudited buildings	$2,152	$28,010	N/A
12. General lighting retrofit	All applicable buildings	$43,703	$12,493	
Completion of the lighting retrofit	Police HQ	$15,220	$4,351	13%
General lighting retrofit	Applicable unaudited buildings	$28,483	$8,142	N/A
13. VFDs	All applicable buildings	$56,929	$707,568	
VFDs on pumps and motors	Police HQ	$8,326	$19,833	56%
VFD controller on pump P-8	Wayne Gretzky Centre	$4,000	$42,311	195%
VFD on 50 HP filter pump	Wayne Gretzky Centre	$7,500	$184,274	427%
VFDs	Applicable unaudited buildings	$37,103	$461,151	N/A
14. Behavioural	All applicable buildings	$0	$10,636	
IT energy management program	Police HQ	$0	$3,704	N/A
Behavioural	Applicable unaudited buildings	$0	$6,932	N/A

Measures	Buildings	Projected cost (including incentives estimate)	Projected net present value	Internal rate of return
15. Lighting controls	All applicable buildings	$549	$39,340	
Outside light timing/vanity lights	Visitor & Tourism Centre	$0	$8,992	N/A
Lighting controls in main display area	Visitor & Tourism Centre	$191	$4,709	311%
Lighting controls	Applicable unaudited buildings	$358	$25,639	N/A
Totals for Year 1		**$104,483**	**$813,015**	

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.

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

In Years 2 and 3 of the CEMP (July 2015 – July 2017), the City should ensure that all of the priority actions have been completed, and are being maintained as required. The City should also pursue the organizational actions presented in Table 6 below, and the technological actions presented in Table 7. These actions are grouped by category and are numbered for ease of identification. The numbering is not an indication of importance.

Organizational actions

Table 6 Preferred state, medium-term actions, and metrics for tracking implementation

Preferred state of energy management	Medium-term actions	Metric / KPI
Organizational commitment		
The City's energy management activities are guided by ambitious yet achievable targets.	41. Re-affirm commitment to targets. Update targets, if required, to reflect progress.	Targets re-affirmed (y/n)
The City tracks progress towards targets.	42. 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
Energy management is highly recognized as a strategic opportunity and priority in relevant policy and planning activities.	43. Include energy management as a strategic priority for the City. 44. Include consideration of energy in relevant corporate plans and policies.	Energy management included as a strategic priority (y/n) Number of plans/policies where energy is included
The City has a clear and dedicated process for tracking energy savings and determining where savings should go.	45. Develop a mechanism through which savings from energy projects are re-invested into the relevant reserve account.	Mechanism developed (y/n)

Preferred state of energy management	Medium-term actions	Metric / KPI
All buildings have designated staff contacts, and where appropriate building operators, to provide guidance and ensure a consistent approach to energy management across all buildings.	46. Develop an operator level energy contact in each division. 47. All operators are assisted by staff within the Facilities Management department as outlined in the formal energy strategy that was developed (Action 9).	Assessment conducted (y/n) Energy contact person assigned (y/n)
Existing buildings and equipment		
The City strategically implements all medium-term cost effective energy efficiency projects in existing buildings.	Implement all retrofit measures identified medium-term actions: 48. HVAC settings measures in all applicable buildings.	Retrofit projects implemented (y/n) ekWh and m^3 saved $ saved on energy bills
Energy efficiency is considered when conducting renovations of existing buildings.	49. 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.	50. Develop consistent guidelines and policies for energy management to be followed at all facilities. 51. Develop and implement a corporate O&M preventative maintenance program. 52. Develop and implement a corporate re-commissioning plan.	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.	53. Identify and adopt energy efficient equipment standards to be followed when replacing equipment (e.g. Energy Star).	Equipment standards adopted (y/n)

Preferred state of energy management	Medium-term actions	Metric / KPI
The City has specific energy and efficiency standards for new buildings that considers future operational costs.	54. Develop and adopt an energy efficiency building standard (e.g. LEED® principles, BOMA, etc.).	Updating process developed (y/n)
Energy is considered at all stages of new building design and development, including so the City can add renewable energy technologies in the future.	55. Develop guidelines for considering energy at all stages of new building development (e.g. budgeting, procurement, design, construction / change management).	Guidelines developed (y/n)
Monitoring and tracking		
The City has real-time building level data for all utilities, at an appropriate level of granularity (e.g. daily).	56. Conduct an assessment of the metering needs of each building. 57. Ensure each building is appropriately metered for each utility. 58. Establish budgetary and implementation estimate and commence with procurement and implementation of an EMS.	Assessment of metering needs conducted (y/n) Number of meters identified as beneficial Energy management system procured (y/n) Energy management system implemented (y/n)
The City has the capacity to manage, analyze, and use energy data from meters.	59. Develop a plan for analysis and use of energy data (e.g. Energy Technician collects data centrally and informs staff who operate and maintain buildings of results and anomalies). (See Energy management systems section for more detail).	Data analysis and reporting system developed (y/n)

Preferred state of energy management	Medium-term actions	Metric / KPI
Staff have easy and up-to-date access to energy data for each facility.	60. Develop / purchase an energy dashboard that provides Facilities Managements and operators with appropriate information on energy use. (See section on Energy management systems for more detail).	Energy dashboard chosen (y/n)
Project EM&V is simple and accurate thanks to energy data and monitoring processes.	61. Develop a process for rolling out successful energy efficiency projects / pilots.	Process for rolling out energy projects developed (y/n)
The City understands how all buildings are performing, relative to other comparable buildings.	62. 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, Ontario Ministry of Energy).	Benchmarking system identified (y/n) Benchmarking system utilized (y/n)
Communication and engagement		
Energy and energy efficiency is effectively communicated across the corporation.	63. Implement the staff energy communication plan developed in Year 1. (See section on Communication and engagement for more detail).	Standardized communication tools deployed (y/n) Changes in attitudes and behaviours
Staff have the tools and training to identify energy management opportunities and are actively engaged in submitting ideas.	64. Develop an employee engagement process for all staff who operate and maintain facilities. 65. Include general training on energy and energy efficiency in the training process for all new hires. (See section on Communication and engagement for more detail).	Employee engagement process developed (y/n) Changes in attitudes and behaviours General training included in existing training for all new hires (y/n)

Preferred state of energy management	Medium-term actions	Metric / KPI
All relevant staff receive appropriate training on the use of new energy efficiency technologies and equipment.	66. Implement project specific training for staff as needed (e.g. new technology, new piece of equipment).	Number of staff trained
The City's O&M/Facilities Management staff work together with other municipalities, school boards, and Laurier University to share technologies and best practices.	67. Set up regular site visits and meetings with O&M staff from other municipalities to share information and tour facilities. 68. Continue to send staff to conferences and trade shows for information sharing.	Number of site visits set Number of staff attending site visits Number of staff attending conferences
Fleets		
All fleet vehicles are operated in the most energy efficient manner while meeting the needs of their intended use.	69. Develop guidelines to operate vehicles in the most energy efficient manner (e.g. anti-idling). 70. Include energy efficiency in the driver-training program (e.g. Shuttle Challenge)[5]. (See section on Communication and engagement for more detail). 71. Develop a formal policy for purchasing the right-sized vehicles that includes considerations other than cost (e.g. life-cycle costs, operational costs).	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 City has net-zero energy use.	72. Review the feasibility for installing solar or other renewable and alternative energy technologies on or in City-owned facilities.	Review conducted (y/n)

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

Technical actions

Table 7 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 four representative buildings and are prioritized based on their IRR. Detailed information on each technical action can be found in the accompanying audit reports for each of the facilities. These actions have been determined to be most cost effective for the City to implement during this time period.

The actions are grouped together by type in order to facilitate the City issuing a single tender for similar measures in all applicable buildings. For example, the auditors recommended: upgrading controls on heating, ventilation, and air conditioning (HVAC) equipment, a reduction in fresh air makeup, adjusting HVAC heating and cooling settings, a building automation system (BAS) audit & re-commissioning for data logging at the Police HQ; setting HVAC thermostats to "Fan:Auto" at the Visitor & Tourism Centre; and adjusting the electric heater setpoints at the Wayne Gretzky Centre. These measures were grouped together and extrapolated to include HVAC settings 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. Detailed feasibility studies will be required for many of the recommended technical actions, along with confirmation of costing.

Table 7 Medium-term technical actions for years 2-3

Measures	Buildings	Projected cost (including incentives estimate)	Projected net present value	Internal rate of return
16. HVAC settings	All applicable buildings	$188,157	$1,164,982	
Upgraded controls on HVAC equipment	Police HQ	$11,080	$70,561	92%
Reduction in fresh air makeup	Police HQ	$8,320	$52,662	54%
HVAC heating and cooling settings	Police HQ	$10,000	$167,803	220%
BAS audit & re-commissioning for data logging	Police HQ	$36,128	$17,647	17%
Set HVAC thermostats to fan:auto	Visitor & Tourism Centre	$0	$83,257	N/A

Measures	Buildings	Projected cost (including incentives estimate)	Projected net present value	Internal rate of return
Electric heater set points	Wayne Gretzky Centre	$0	$13,787	N/A
HVAC settings	Applicable unaudited buildings	$122,630	$759,265	N/A
Totals for Years 2 to 3		**$188,157**	**$1,164,982**	

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.

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

In Years 4 and 5 of the CEMP (July 2017 – July 2019), the City 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 City should then pursue the organizational actions presented in Table 8. In addition, the City should pursue the technical actions provided in Table 9 below. These actions are grouped by category and are numbered for ease of identification. The numbering is not an indication of importance.

Organizational actions

Table 8 Preferred state, longer-term actions, and metrics for tracking implementation

Preferred state of energy management	Long-term actions	Metric / KPI
Organizational commitment		
The City's energy management activities are guided by ambitious yet achievable targets.	73. Re-affirm commitment to targets. 74. Prepare plan update. 75. Establish budget and issue an RFP for preparing the CEMP update.	Targets re-affirmed (y/n) Plan update prepared (y/n) Budget established (y/n) RFP prepared (y/n) RFP issued (y/n)
The City tracks progress towards targets.	76. 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.
The City is progressive in energy management and strives for excellence.	77. Apply to energy conservation awards (e.g. OPA Community Conservation Award).	Number of applications submitted Number of awards won

Preferred state of energy management	Long-term actions	Metric / KPI
Existing buildings and equipment		
The City strategically implements all long-term cost effective energy efficiency projects in existing buildings.	Implement all retrofit measures identified as long-term actions: 78. Air sealing measures in all applicable buildings. 79. Insulation measures in all applicable buildings. 80. Lighting retrofit measures in all applicable arenas. 81. Specialized lighting retrofit measures in all applicable pools. 82. Compressed air measures in all applicable buildings. (See full list in Table 9)	Retrofit projects implemented (y/n) ekWh and m^3 saved $ saved on energy bills
All buildings operate in an energy efficient manner.	83. Implement guidelines and policies for energy management to be followed at all facilities. 84. Continue to implement the corporate O&M preventative maintenance program. 85. Continue to implement the corporate re-commissioning plan.	Guidelines updated (y/n)
New buildings and equipment		
The City has specific energy and efficiency standards for new buildings that considers future operational costs.	86. Develop a process for updating the energy efficiency standards (every 5 years).	Process developed (y/n)
Monitoring and tracking		
The City has real-time building level data for all utilities, at an appropriate level of granularity (e.g. daily).	87. Continue to use the EMS to track and analyze energy use at the building level.	EMS utilized (y/n)

Preferred state of energy management	Long-term actions	Metric / KPI
The City has the capacity to manage, analyze, and use energy data from meters.	88. 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)
Communication and engagement		
The community is aware of and supportive of the energy efficiency activities of the City.	89. Develop a communication and outreach plan for communicating about energy to the community (e.g. soliciting ideas through Crowdsourcing, enhanced website, etc.).	Communication and outreach plan developed (y/n) Number of ideas obtained from Crowdsourcing Number of hits to the website
Staff have the tools and training to identify energy management opportunities and are actively engaged in submitting ideas.	90. Develop an employee engagement process for all staff based on the pilot program implemented in Years 2-3 for staff who operate and maintain facilities.	Employee engagement process developed (y/n) Changes in attitudes and behaviours
The City's O&M staff work together with other municipalities to share technologies and best practices.	91. Continue to set up regular site visits and meetings with O&M staff from other municipalities to share information and tour facilities. 92. Continue to send staff to conferences and trade shows for information sharing. 93. Set up regular meetings with applicable staff from Laurier and the surrounding school boards to discuss opportunities and share best practices.	Number of site visits set Number of staff attending site visits Number of staff attending conferences Number of meetings set up with Laurier and school boards

Preferred state of energy management	Long-term actions	Metric / KPI
Fleets		
All fleet vehicles are operated in the most energy efficient manner while meeting the needs of their intended use.	94. Continue to implement the driver-training program.	Number of drivers trained
Renewables and procurement		
The City has a clear process to guide renewable energy development. This process leads to visible and cost-effective renewable energy projects.	95. Develop a process for identifying, evaluating, and developing renewable energy projects.	Process developed (y/n)
All fleet vehicles selected and purchased are the most energy efficient and meet the operational needs. All fleet vehicle fuel purchased is from alternative sources.	96. Develop procurement standards for vehicles that include energy efficiency and alternative fuel purchases.	Procurement standards developed (y/n)
The City's energy procurement systems consider cost, predictability, and environmental impacts.	97. Ask contracted procurement advisors how to consider environmental impacts in electricity and natural gas purchasing decision.	% of energy purchased from environmentally benign sources
Streetlights and traffic signals		
All parking lots and outdoor field lighting use the most energy efficient technologies.	98. Develop a formal policy for the use of LEDs, timers, photocells, and dimmable settings in the design of any retrofits, renovations, or new projects involving parking lots and / or outdoor field lighting.	Policy developed (y/n)

Technical actions

Table 9 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 four representative buildings and are prioritized based on their IRR. Detailed information on the recommended actions can be found in the accompanying audit reports for each of the facilities. These actions have been determined to be most cost effective for the City to implement during this time period.

In the table below, "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. Detailed feasibility studies will be required for many of the recommended technical actions, along with confirmation of costing.

Table 9 Long-term technical actions for years 4-5

Measures	Buildings	Projected cost (including incentives estimate)	Projected net present value	Internal rate of return
79. Construction - air sealing	All applicable buildings	$3,446	$376	
Air Sealing	T.B. Costain Community Centre	$1,200	$131	8%
Construction - air sealing	Applicable unaudited buildings	$2,246	$245	N/A
80. Construction – insulation	All applicable buildings	$14,971	$35,129	
Roof Insulation (already completed)[6]	T.B. Costain Community Centre	N/A	N/A	N/A
Construction – insulation	Applicable unaudited buildings	$14,971	$35,129	N/A
81. Specialized lighting retrofit – arena	All applicable arenas	$190,451	$262,809	
Lighting Above Ice Rinks	Wayne Gretzky Centre	$131,040	$180,826	28%

[6] The roof insulation measure was recommended in the audit report for the T.B. Costain Community Centre, but the auditors found out after the audit that the measure had already been completed. The measure was still recommended in the audit report and should be applied to all applicable unaudited buildings. Extrapolation for this measure only includes unaudited buildings.

Measures	Buildings	Projected cost (including incentives estimate)	Projected net present value	Internal rate of return
Specialized lighting retrofit – arena	Applicable unaudited arenas	$59,411	$81,983	N/A
82. Specialized lighting retrofit - pool	All applicable pools	$48,125	$57,195	
Lighting retrofit in existing 65m pool	Wayne Gretzky Centre	$25,865	$33,538	35%
Lighting retrofit on new 25m pool	Wayne Gretzky Centre	$17,531	$18,036	29%
Specialized lighting retrofit - pool	Applicable unaudited pools	$4,729	$5,621	N/A
82. Compressed air	All applicable buildings	$17,291	$7,012	
Compressed Air Audit	Police HQ	$6,022	$2,442	19%
Compressed air	Applicable unaudited buildings	$11,269	$4,570	N/A
Totals for Years 4 to 5		**$274,284**	**$362,522**	

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.

Capital costs and savings

This section summarizes the extrapolated capital costs and net present values associated with implementing all of the technical actions recommended in the four audited buildings and the equivalent measures in the appropriate unaudited buildings. The measures are listed in Table 5, Table 7, and Table 9, and include: building envelope upgrade; HVAC settings; HVAC retrofit; lighting retrofit; VFD installation; and lighting controls. 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 $113,000 in each year for budgeting purposes. Currently, the City budgets $100,000 on an annual basis to projects related to energy conservation. Energy improvements are also completed within other capital and / or operating projects.

Table 10 shows the breakdown of net capital costs and NPVs of the technical measures broken down by the plan phases. This shows that, the City will realize a total NPV of over $2 million by investing an average of roughly $113,000 each year over the next five years, for a total of $566,925.

The costs listed in Table 10 below only include the capital costs associated with the technical measures in buildings identified through the audits. 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, purchasing an EMS, and installing LED streetlights. Other costs associated with organizational actions will be mainly in the form of staff time (e.g. full-time equivalents (FTEs)). Additional operating budget costs will also be required to implement the technical measures, primarily in the form of staff time.

Table 10 Net capital costs and present values for all technical actions

	Net capital cost (all measures)	Net present value (all measures)
Year 1	$104,483	$813,015
Years 2-3	$188,157	$1,164,982
Years 4-5	$274,284	$362,522
Total	**$566,925**	**$2,340,518**

Renewables and alternative energy

The City of Brantford has no renewable or alternative energy sources installed at this time. However, the City has prepared and will issue a request for proposal in early 2014 that will assess the suitability of roof spaces (over 25,000 m^2) for the installation of solar technology. The intention of this project is to have a third party own and operate the solar system and provide revenue to the City by way of a rooftop lease agreement. Further review of the cost effectiveness of a City owned solar system is required.

Actions described in the CEMP that relate to renewable and alternative energy are listed below in Table 11.

Table 11 Actions related to renewable and alternative energy

Action number	Action description
34	Investigate the installation and leasing of roof space for solar projects.
72	Review the feasibility for installing solar or other renewable and alternative energy technologies on or in City-owned facilities.
95	Develop a process for identifying, evaluating, and developing renewable energy projects.

Implementation of the plan

Several organizational actions in Table 4, Table 6, and Table 8 identify the need for staff resources to implement the CEMP. Having sufficient resources will be imperative to ensuring the success of the Plan and for effectively managing energy use and GHG emissions at the City.

As a first step, the City should assign a staff member to be responsible for implementing the CEMP (see Action 7). This person will be responsible for ensuring the plan is implemented, tracking progress on all the actions, and taking a lead role in designing and implementing all the actions outlined in the Communication and engagement section. The City should review the existing roles and responsibilities of the Facilities Management Specialist to determine if this position has the capacity to take on this proposed role. If not, additional resources should be considered and/or assigned to support the Facilities Management Specialist.

The City should review the roles and responsibilities of existing Technical staff within the Facilities Management Department to determine if an existing staff member has the capacity to take on and receive training for the proposed role of an Energy Technician or if additional resources should be considered (see Action 8). Funding is available to hire an Embedded Energy Manager or a Roving Energy Manager from Brantford Power under the Process and System Upgrade Initiatives of the OPA *saveONenergy* programs (see Appendix C for more detail). 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 City can decide the best course of action.

Other municipalities have a staff resource dedicated to managing energy. For instance, the Town of Caledon has an Energy and Environmental Officer and the City of Pickering has an Energy Management Supervisor.

At the time of the next annual Corporate Budget review the City should evaluate the proposed roles to determine if existing staff resources have the capacity to take on the growing needs and responsibilities, and if necessary, identify the need for additional resources.

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

Table 12 Staff roles and responsibilities for implementing the CEMP

Role	Responsibilities
Dedicated staff to implement CEMP (Facilities Management Specialist)	Taking the lead on managing the implementation of the CEMP. 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 Energy Technician (See Action 7).
Energy Technician	Acting as a central energy resource and contact for all staff who operate and maintain facilities. Other responsibilities include: managing the selected EMS, working with the Facilities Management Specialist on training programs and employee engagement for staff who operate and maintain facilities, taking the lead on overseeing the implementation of the technical actions, and working with utility companies to take advantage of available incentives (See Action 8).
Staff who operate and maintain facilities	Identifying and implementing energy saving opportunities at facilities, and participating in training programs.

Energy management systems

As a priority action (Action 23, Table 4) it is recommended that the City investigate options for an energy management system (EMS) to be used to track and analyze energy use at the building level. There are 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 a high level overview of the system characteristics the City should be considering, as well as the supporting organizational capacity and processes the City will need to implement the system.

Selecting an energy management system

System characteristics. The City 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 City-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 City's IT systems.

The City 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 City 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 City's metres and sub-metres, and

then delivers the information to the City via a web-portal. This option typically involves higher monthly cost and less control over the outputs (usually, though 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 City is still responsible for "making sense" of the data and reports.

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

Evaluation criteria. Once the City 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 City systems
- Security and redundancy of information/backups
- Current use by other municipalities.

Next steps. Within the first year, the City can develop the terms of reference and functional requirements for the EMS. The City can then select and implement the preferred EMS.

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 City may need additional staff capacity to make use of the information from the EMS. The City 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 City will need to develop a reporting system for energy data (energy use, demand, costs, savings, progress, etc.). It is recommended that the Energy Technician collects the data centrally and then informs staff who operate and maintain buildings of results and anomalies (see Action 59). Initial set up of the reporting process is anticipated to take approximately 5 person days (PD), while weekly reporting of data and anomalies is expected to take 0.5 PD per week on average.

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 staff responsible for operating and maintaining buildings? What analysis / statistical techniques are needed to transform the data into the information desired?
- What format can best convey this information to staff responsible for operating and maintaining buildings? How will the outputs be made available to staff (paper copy, e-mail reporting, web-based reporting)? How often should staff responsible for operating and maintaining buildings 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 City start with a more limited and manageable set of outputs and reports. Then, as staff become more familiar with the EMS, the City can look to add additional features, based on staff input about what is most useful.

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

- How should staff responsible for operating and maintaining buildings 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 Year 1, the City should determine if they have sufficient staff resources to collect and manage energy data, and then in Years 2 and 3 develop a plan for the analysis and use of the energy data including the desired outputs and reports. It is recommended that the new Energy Technician take responsibility for managing and overseeing the EMS.

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

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

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).

Brantford Power 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 Brantford Power see Appendix C.

Communication and engagement

This section complements and expands on the high level communication and engagement actions identified in the *Organizational Actions* listed in Table 4, Table 6, and Table 8.

Overview and program management

The communication and engagement section will focus on three areas:

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

Each area is expanded upon in more detail below.

Employee engagement

In the first year of the CEMP, the City should develop a plan for communicating about energy to staff. The plan should include the development of a pilot employee engagement program in Years 2 and 3 that encourages all staff who operate and maintain specific buildings to identify energy efficiency opportunities across the City facilities. Based on the success of this program, the City should role-out the program to all staff within Years 4 and 5 of the CEMP.

The pilot program should be developed by the Facilities Management Specialist in collaboration with the Energy Technician and Facilities Management. The program would establish a formal process for all staff who operate and maintain specific buildings to submit ideas based on their daily activities in City facilities, and staff would receive recognition for their ideas. For example, 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 would encourage them to identify additional opportunities and submit additional ideas. Ideas from the employee engagement program would be reviewed, implemented wherever possible, and results reported. Ideas for the specific components of the employee engagement program include:

- **A system for staff to submit ideas.** The City 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 for review. 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, advertized 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.

Once the program is developed in Year 1, it can be rolled out to all staff who operate and maintain City buildings in Years 2 and 3, including project coordinators/managers, building design staff, building supervisors, caretakers, and other staff that may be able to contribute. Based on the success of the pilot, the program can be implemented more broadly across all staff at the City in Years 4 and 5. The Facilities Management Specialist, in collaboration with the Energy Technician and Facilities Management, would be responsible for developing the programs for staff who operate and maintain specific buildings and general staff.

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 staff responsible for operating and maintaining buildings to share their ideas and knowledge.

Staff training

This section provides further information on six types of training identified as actions in Table 4 and Table 6.

- General training on energy efficiency for all staff responsible for operating and maintaining buildings (Actions 27);
- Facility specific energy training for staff responsible for operating and maintaining specific buildings (Action 28);

- Project specific training for staff responsible for operating and maintaining buildings, as needed (e.g. new technology, new piece of equipment, etc.) (Action 66);
- Energy efficiency training for fleet drivers (Action 70);
- Specific training on energy efficiency for new hires that will be operating and maintaining buildings (Action 30); and
- General energy efficiency training for all new hires (Action 65).

Facilities staff training

General energy training should be provided to all staff who operate and maintain buildings to ensure that they have the knowledge and skills to contribute to efficient energy management within the City. Training options should be investigated and developed in Year 1 of the CEMP, 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.

General training may address:

- Energy basics (cost of energy, how and where energy is used);
- Lighting and mechanical equipment basics;
- Energy audits;
- Building automation systems and re-commissioning;
- Metering, monitoring, and the energy management system;
- How to spot energy saving opportunities;
- The City's building policies, preventative maintenance program, and re-commissioning plan; and
- The City's employee engagement program (including how to submit ideas and what types of ideas can be submitted).

The City should provide general energy management training to all staff who operate and maintain buildings 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 City's buildings, equipment, and practices.

More specific training on energy management and energy efficiency should be provided to all staff who operate and maintain specific buildings (Action 28). This training would be catered toward specific features of the operator's building, allowing the operator to manage energy more effectively within individual buildings. This training should be developed in conjunction with the movement towards having an operator in each building where appropriate.

Additionally, project specific training on energy should be provided to operators, as needed, when new equipment or a new piece of technology is installed. This includes any updates to the building and its systems (e.g. BAS) as indicated in Action 66.

The Facilities Management Specialist should take the lead on designing and implementing these training programs in collaboration with any external agencies and Facilities Management. 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).

Facilities staff should receive a certificate upon completion of any training to recognize that they have gained important knowledge and skills. If in-house training is developed and employed this would be as simple as an internal document produced and signed by a senior manager.

City staff that operate and maintain buildings are only recommended to have basic energy management training as described above rather than a Certified Energy Manager (CEM) designation. When hiring the proposed Energy Technician a candidate with the CEM designation may be considered.

Fleet driver training

All staff that drive City vehicles should be trained to operate 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 City money. Fleet and Transit Services already has a driver training program – energy efficiency training could be incorporated into the existing training program, or could be provided as a half-day or full-day workshop or as an online course with different modules. The driver-training program should be implemented in Years 2 to 3 of the CEMP.

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

The Facilities Management Specialist in collaboration with the Manager of Fleet 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 City and incorporated into a workshop delivered by in-house staff.

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

Another option for the City 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 existing training and orientation process for all new hires. General training on energy efficiency should be provided for all new staff (see Action 65), while more specific training on energy efficiency should be provided to new staff that will be operating and maintaining buildings (see Action 30). Training could be more or less formal, as appropriate given current training and orientation practices.

Behaviour change and communication

Communicating about the CEMP 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 City. Behaviour change programs are important for raising staff awareness about energy management. Change in behaviour may also lead to up to five percent in energy intensity savings. The Facilities Management Specialist should develop a behaviour change and communication strategy with an initial focus on staff working in administration facilities. This strategy should involve a combination of tools and initiatives to communicate and engage the staff. These could include:

- Using a consistent set of high impact tools for corporate City-wide communication. These may include: visual displays in the lobbies of facilities, dashboard tools on the City'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.
- Developing an energy brand (e.g. logo) to promote awareness of energy initiatives. The branding could easily be used to communicate about other related initiatives such 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.

- Implementing a friendly competition between departments focusing on energy efficiency and energy reduction.

Progress on the CEMP should also be communicated to the community so they are aware of the energy initiatives being undertaken by the corporation. The energy management page on the City of Brantford website is very informative and already has a lot of information about facility energy consumption and energy retrofit projects that have been undertaken by the City. Updates on the CEMP and energy efficiency initiatives should also be included on this website.

Conclusion

There are very significant opportunities for the City of Brantford to improve the energy efficiency of its buildings, to reduce utility costs, and to minimize its environmental footprint. From 2014 to 2019, the City will work to reduce its energy intensity by 4.9% and to reduce greenhouse gas emissions by 5.3%. In addition, by spending $113,000 per year over the next five years on energy conservation measures to reach these targets, the City will realize a total NPV of over $2 million.

The City of Brantford can take advantage of these opportunities by implementing the organizational and technological actions of the *Corporate Energy Management Plan,* including:

- Setting up a Corporate Steering Committee with staff from each department, establishing roles and responsibilities, and developing an energy strategy that is communicated to all City staff;
- Systematically and strategically implementing the recommended retrofits in existing buildings;
- Developing a rigorous and effective monitoring and tracking system through an EMS and supporting organizational capacity;
- Implementing the education, communication, engagement and training initiatives for staff; and
- Developing organizational policies and processes for implementing the CEMP, tracking progress, and updating the CEMP.

The City of Brantford has the motivation and expertise to implement all of the actions in the CEMP. The City's investments in energy efficiency will yield significant returns, in the traditional economic sense, and will allow the City to reduce its GHG emissions. Finally, they will help the City of Brantford to manage energy efficiently and ensure it is part of the day-to-day activities of City staff.

Appendix A. Present state

This section provides an overview of the present state of energy use in the City of Brantford facilities, including the City's 2012 utility energy data, a description of existing policies and plans, and a summary of the corporate-wide survey.

A.1. Utility data analysis

Table 13 shows the 2012 calendar year utility data, GHG emissions, and energy intensity for the City of Brantford buildings that are required to be reported to the Ministry of Energy under *Regulation 397/11* of the Green Energy Act.[7] This list only includes buildings for which the City pays the utility bills.

[7] The data presented in Table 13 was compiled by the City of Brantford.

Table 13 City of Brantford 2012 energy data for facilities

CITY OF BRANTFORD - 2012 CORPORATE ENERGY MANAGEMENT																		
PUBLIC WORKS COMMISSION - FACILITIES & ASSET MANAGEMENT - CAPITAL PLANNING																		
Facility Name	Operation Type	Address	City	Postal Code	Total Floor Area of the Indoor Space in which Operation is Conducted		Average # Hours Per Week	Annual Flow (Mega Litres)	*Energy Type and Amount Purchased and Consumed in Natural Units*						GHG Emissions (Kg)	Energy Intensity (ekWh/sqft)	Energy Intensity (ekWh/Mega Litres)
									Electricity		Natural Gas						
City Hall	Administrative offices and related facilities, including municipal council chambers	100 Wellington St.	Brantford	N3T 2M2	60,000	Square feet	62		501,732.00	kWh	131,886.90	Cubic meter			289,487.49	31.72328	
Farmer's Market	Administrative offices and related facilities, including municipal council chambers	79 Icomm Dr.	Brantford	N3S 7N5	10,500	Square feet	17		200,537.00	kWh	5,060.40	Cubic meter			25,610.29	24.22074	
IT & Hydro Building	Administrative offices and related facilities, including municipal council chambers	84 Market St.	Brantford	N3T 2Z8	25,600	Square feet	48		433,860.00	kWh	24,134.60	Cubic meter			80,338.33	26.96708	
Landfill Administration Building	Administrative offices and related facilities, including municipal council chambers	511 Mohawk Rd.	Brantford	N3T 5L9	2,800	Square feet	40		6,504.00	kWh	2,069.60	Cubic meter			4,433.16	10.1783	
Landfill Scale House	Administrative offices and related facilities, including municipal council chambers	20 Morrison Rd.	Brantford	N3T 5L9	400	Square feet	40		4,970.00	kWh	No Gas Service				397.6	12.425	
Market Square Mall	Administrative offices and related facilities, including municipal council chambers	220 Colborne St.	Brantford	N3T 2G8	73,280	Square feet	48		769,698.00	kWh	23,113.00	Cubic meter			105,273.90	13.85559	
Parks Head Office Buildings	Administrative offices and related facilities, including municipal council chambers	3 Sherwood Dr.	Brantford	N3T 1Z5	2,700	Square feet	40		35,533.00	kWh	1,352.70	Cubic meter			5,400.09	18.48489	
Parks Head Office Buildings	Administrative offices and related facilities, including municipal council chambers	1 Sherwood Dr.	Brantford	N3T 1Z5	10,800	Square feet	50		85,544.00	kWh	6,763.50	Cubic meter			19,630.78	14.57639	
Pollution Control / Facilities Group	Administrative offices and related facilities, including municipal council chambers	180 Greenwich Dr.	Brantford	N3S 2X7	34,800	Square feet	50		86,013.00	kWh	20,267.00	Cubic meter			45,198.38	8.6611	
Provincial Offense Courthouse	Administrative offices and related facilities, including municipal council chambers	102 Welington St.	Brantford	N3T 2M2	13,800	Square feet	50		14,507.00	kWh	32,971.70	Cubic meter			63,497.75	26.44369	
Visitor & Tourism Centre	Administrative offices and related facilities, including municipal council chambers	399 Wayne Gretzky Pkwy	Brantford	N3P 1Z7	11,400	Square feet	60		173,770.00	kWh	17,930.70	Cubic meter			47,801.87	31.95908	
Brantford Public Library	Public libraries	173 Colborne St.	Brantford	N3T 2G8	61,000	Square feet	70		652,375.00	kWh	13,572.40	Cubic meter			77,850.35	13.05934	
St. Paul Library	Public libraries	441 St.Paul St.	Brantford	N3R 4N8	5,750	Square feet	50		84,507.00	kWh	8,574.40	Cubic meter			22,971.55	30.54501	
Ambulance Station	Ambulance stations and associated offices and facilities	400 Colborne St.	Brantford	N3T 1M2	3,900	Square feet	168		33,420.30	kWh	4,894.90	Cubic meter			11,928.05	21.90826	
Fire Hall - 1	Fire stations and associated offices and facilities	60 Clarence St.	Brantford	N3T 5M3	15,556	Square feet	168		220,080.00	kWh	26,191.90	Cubic meter			67,125.51	32.04176	
Fire Hall - 2	Fire stations and associated offices and facilities	311 St. Paul Ave.	Brantford	N3R 4M9	3,400	Square feet	168		30,487.00	kWh	6,441.30	Cubic meter			14,617.06	29.10109	
Fire Hall - 3	Fire stations and associated offices and facilities	7 Lynden Rd.	Brantford	N3R 6X3	5,000	Square feet	168		36,586.00	kWh	9,598.80	Cubic meter			21,074.63	27.71998	
Fire Hall - 4	Fire stations and associated offices and facilities	400 Colborne St.	Brantford	N3T 1M3	9,100	Square feet	168		77,980.70	kWh	10,939.60	Cubic meter			26,921.16	21.34553	
Police HQ	Police stations and associated offices and facilities	344 Elgin St.	Brantford	N3S 7P6	65,000	Square feet	168		1,072,320.00	kWh	143,473.60	Cubic meter			357,040.66	39.95578	
Market Parkade	Parking garages	59 Icomm Dr.	Brantford	N3S 7N5	2,500	Square feet	168		43,329.00	kWh	No Gas Service				3,466.32	17.3316	
Brantford Airport - Records Building	Storage facilities where equipment or vehicles are maintained, repaired or stored	51 York Rd.	Brantford	N3T 5L7	14,000	Square feet	40		12,014.00	kWh	6,098.50	Cubic meter			12,491.11	5.48768	
Harmony Square Garage	Storage facilities where equipment or vehicles are maintained, repaired or stored	120 Colborne St.	Brantford	N3T 2G6	2,500	Square feet	75		6,374.00	kWh	1,330.40	Cubic meter			3,025.21	8.20528	
Herbert Street Storage	Storage facilities where equipment or vehicles are maintained, repaired or stored	Herbert St.	Brantford	N3R 2J3	2,700	Square feet	168		1,415.00	kWh	3,007.00	Cubic meter			5,798.32	12.36027	
Parks Workshop	Storage facilities where equipment or vehicles are maintained, repaired or stored	20 Catharine Ave	Brantford	N3T 1X6	3,900	Square feet	168		2,454.00	kWh	6,283.20	Cubic meter			12,075.51	17.7514	
Public Works Yard	Administrative offices and related facilities, including municipal council chambers	100 Earl Ave.	Brantford	N3S 5C6	20,000	Square feet	168		204,619.00	kWh	64,059.60	Cubic meter			137,482.33	44.27151	
Traffic Services	Storage facilities where equipment or vehicles are maintained, repaired or stored	33 Earl Ave.	Brantford	N3S 5C6	40,000	Square feet	168		125,601.00	kWh	29,933.20	Cubic meter			66,640.60	11.09311	
Transit Garage	Storage facilities where equipment or vehicles are maintained, repaired or stored	400 Grand River Ave.	Brantford	N3T 6B6	66,000	Square feet	125		769,121.00	kWh	118,473.40	Cubic meter			285,518.69	30.73076	
Transit Terminal	Administrative offices and related facilities, including municipal council chambers	64 Darling St.	Brantford	N3T 6G6	3,600	Square feet	110		181,199.00	kWh	No Gas Service				14,495.92	50.33306	
Arrowdale - Pro shop	Cultural facilities	282 Stanley St.	Brantford	N3S 6N6	2,000	Square feet	55		16,136.10	kWh	1,940.00	Cubic meter			4,958.70	18.37699	
Arrowdale Club House	Cultural facilities	282 Stanley St.	Brantford	N3S 6N6	4,000	Square feet	55		37,650.90	kWh	4,526.60	Cubic meter			11,570.18	21.43965	
Arnold Anderson Stadium	Cultural facilities	35 Sherwood Drive	Brantford	N3T 1N3	1,200	Square feet	35		17,965.00	kWh	No Gas Service				1,437.20	14.97083	
Bell Homestead-Henderson	Cultural facilities	94 Tutela Heights	Brantford	N3T 1A1	3,600	Square feet	40		14,872.30	kWh	2,569.10	Cubic meter			6,046.99	11.71559	
Bell Homestead-Reception	Cultural facilities	94 Tutela Heights	Brantford	N3T 1A1	6,000	Square feet	40		14,872.30	kWh	4,583.30	Cubic meter			9,855.09	10.5971	
Bell Homestead-Main Facility Complex	Cultural facilities	94 Tutela Heights	Brantford	N3T 1A1	5,400	Square feet	40		14,872.30	kWh	2,666.40	Cubic meter			6,230.95	8.00189	
Beryl Angus Child Care	Cultural facilities	220 Clarence St.	Brantford	N3R 3T5	6,000	Square feet	60		66,523.00	kWh	3,522.50	Cubic meter			11,981.57	17.32656	
Civic Centre	Indoor sports arenas	69 Market St. S.	Brantford	N3S 2E4	55,000	Square feet	76		1,020,111.00	kWh	162,582.50	Cubic meter			388,991.74	49.96366	

Facility Name	Operation Type	Address	City	Postal Code	Total Floor Area of the Indoor Space in which Operation is Conducted		Average # Hours Per Week	Annual Flow (Mega Litres)	*Energy Type and Amount Purchased and Consumed in Natural Units*						
									Electricity		Natural Gas		GHG Emissions (Kg)	Energy Intensity (ekWh/sqft)	Energy Intensity (ekWh/Mega Litres)
Eagle Place Community Centre	Community centres	333 Erie Ave.	Brantford	N3S 2H7	11,760	Square feet	76		13,261.00	kWh	21,423.40	Cubic meter	41,564.54	20.48845	
Earl Haig	Cultural facilities	101 Market St. S	Brantford	N3S 2E4	8,100	Square feet	23		141,535.00	kWh	3,000.60	Cubic meter	16,995.82	21.41046	
Glenhyrst Art Gallery- Coach House	Art galleries	12 Ava Rd.	Brantford	N3T 5G9	3,000	Square feet	30		37,111.50	kWh	5,157.80	Cubic meter	12,720.40	30.64248	
Glenhyrst Art Gallery- Main Building	Art galleries	20 Ava Rd.	Brantford	N3T 5G9	3,900	Square feet	30		37,111.50	kWh	5,157.80	Cubic meter	12,720.40	23.57114	
Kanata Village	Cultural facilities	440 Mohawk St.	Brantford	N3T 5L9	6,732	Square feet	40		39,817.00	kWh	10,412.80	Cubic meter	22,872.08	22.35323	
Lions Park	Indoor sports arenas	20 Edge St.	Brantford	N3T 6H1	36,400	Square feet	76		545,447.00	kWh	36,919.10	Cubic meter	113,436.01	25.76415	
Mohawk Park Pavillion	Cultural facilities	51 Lynnwood Dr.	Brantford	N3L 3E1	8,500	Square feet	70		90,520.00	kWh	8,507.00	Cubic meter	23,325.16	21.28594	
Mt. Hope Cemetery	Cultural facilities	169 Charing Cross St.	Brantford	N3R 2J3	13,500	Square feet	38		8,332.00	kWh	3,358.60	Cubic meter	7,016.42	3.26122	
Northridge Golf Course - Pro Shop	Cultural facilities	320 Balmoral Dr.	Brantford	N3R 7S2	7,000	Square feet	65		34,962.00	kWh	7,699.40	Cubic meter	17,353.65	16.68422	
Northridge Golf Course - Club House	Cultural facilities	320 Balmoral Dr.	Brantford	N3R 7S2	18,000	Square feet	65		223,462.00	kWh	23,098.30	Cubic meter	61,547.23	26.05253	
Oakhill Cemetery	Cultural facilities	17 Jennings Rd.	Brantford	N3T 5L7	10,500	Square feet	38		16,846.30	kWh	6,067.70	Cubic meter	12,819.46	7.74595	
Sanderson Centre	Performing arts facilities	88 Dalhousie St.	Brantford	N3T 2J2	53,112	Square feet	60		342,796.00	kWh	44,059.20	Cubic meter	110,723.19	15.27051	
T.B Costain Community Centre	Community centres	16 Morrel St.	Brantford	N3T 4J2	21,000	Square feet	60		80,400.00	kWh	29,209.10	Cubic meter	61,655.51	18.61085	
Tranquility Hall	Community centres	135 Francis St.	Brantford	N3R 5P1	4,400	Square feet	25		13,768.00	kWh	4,003.10	Cubic meter	8,669.81	12.79819	
Wayne Gretzky Centre	Indoor recreational facilities	254 North park St.	Brantford	N3R 4L1	130,760	Square feet	110		6,594,037.00	kWh	512,918.80	Cubic meter	1,497,261.09	92.11704	
Woodman Community Centre	Community centres	491 Grey St.	Brantford	N3S 7L7	12,500	Square feet	65		116,936.00	kWh	17,904.40	Cubic meter	43,205.42	24.5776	
1. Sanitary Pumping Station	Facilities related to the pumping of sewage	33 Empey St.	Brantford	N3S 7P9			168	8213.167	353,340.00	kWh	No Gas Service		28,267.20		43.02116
2. Sanitary Pumping Station	Facilities related to the pumping of sewage	85 Woodlawn Rd.	Brantford	N3V 1A6			168	148.069	48,000.00	kWh	No Gas Service		3,840.00		324.17319
3. Sanitary Pumping Station	Facilities related to the pumping of sewage	87 Somerset Rd.	Brantford	N3R 5A3			168	274.48	88,320.00	kWh	No Gas Service		7,065.60		321.77208
4. Sanitary Pumping Station	Facilities related to the pumping of sewage	215 Greenwich St.	Brantford	N3S 7X7			168	1863.2208	209,160.00	kWh	No Gas Service		16,732.80		112.25723
5. Sanitary Pumping Station	Facilities related to the pumping of sewage	25 Fifth Ave.	Brantford	N3S 1A1			168	699.026	73,260.00	kWh	No Gas Service		5,860.80		104.80297
6. Sanitary Pumping Station	Facilities related to the pumping of sewage	119 St. Andrews Dr.	Brantford	N3T 6H4			168	88.33	34,108.00	kWh	No Gas Service		2,728.64		386.14287
7. Sanitary Pumping Station	Facilities related to the pumping of sewage	8-14 Lawren S. Harris	Brantford	N3R 7Z6			168	148.069	40,953.00	kWh	No Gas Service		3,276.24		276.58051
8. Sanitary Pumping Station	Facilities related to the pumping of sewage	4 Hansford Dr.	Brantford	N3S 0B6			168	63.795	24,720.00	kWh	No Gas Service		1,977.60		387.49118
9. Storm Pumping Station	Facilities related to the pumping of sewage	59 Icomm Dr.	Brantford	N3S 7N5			168	895.3255	433,290.00	kWh	No Gas Service		34,663.20		483.9469
Waste Water Treatment Plant	Facilities related to the treatment of sewage	385 Mohawk Rd.	Brantford	N3T 5L9			168	12025.9	6956992	kWh	189,356.80	Cubic meter	914,562.44		745.84304
Pumping Station Booster	Facilities related to the pumping of water	182 Albion St.	Brantford	N3T 3N2			168	549.73	55,200.00	kWh	No Gas Service		4,416.00		100.41293
Water Pumping Station & Reservoir	Facilities related to the pumping of water	310 Campbell St.	Brantford	N3S 5B6			168	2631.46	620,150.00	kWh	4,332.80	Cubic meter	57,803.71		253.1667
Water Pumping Station & Reservoir	Facilities related to the pumping of water	5 kraemers Way.	Brantford	N3T 2M2			168	732.37	803,571.00	kWh	20,561.70	Cubic meter	103,160.19		1,395.60
Water Pumping Station & Reservoir	Facilities related to the pumping of water	106 Tollgate Rd.	Brantford	N3R 4Z6			168	5266.25	1,185,314.00	kWh	No Gas Service		94,825.12		225.07743
Water Treatment Plant	Facilities related to the treatment of water	324 Grand River Ave.	Brantford	N3T 4Y8			168	13113.96	7,629,923.00	kWh	136,707.70	Cubic meter	868,857.11		692.60711

The Ontario Ministry of Energy benchmarked the 2011 energy consumption data submitted to the Ministry under *Regulation 397/11*. These benchmarks allow the City of Brantford to compare their building's performance against other similar municipal buildings. As can be seen in Figure 9, on a per square foot basis, the majority of the City of Brantford's building types are more efficient than the provincial average.

Figure 9 City of Brantford facilities benchmarked against other Ontario municipalities

Buildings

Operation Type	Provincial Mean (eWh/HDD/ft2)	Mean for Brantford (eWh/HDD/ft2)	% (Brantford vs Province Average)	
Administration Offices	8.39	5.9	70%	
Ambulance Stations	9.15	6.53	71%	
Community Centres	6.78	5.56	82%	
Cultural Facilities	7.18	5.04	70%	
Fire Stations	6.97	7.41	106%	
Indoor Recreational Facilities	10.19	11.93	117%	
Storage Facilities or Garages	8.19	4.55	56%	
Police Stations	9.67	12.31	127%	
Libraries	7.11	6.97	98%	

Water Processing Facilities

Operation Type	Provincial Mean (eWh/HDD/ft2)	Mean for Brantford (eWh/HDD/ft2)	Mean Variance	
Sewage Pumping Stations	300.3	322	107%	
Water Pumping Stations	659.2	654	99%	
Sewage Treatment	1046.5	597	57%	
Water Treatment	1207.2	711	59%	

The City of Brantford is also doing well when comparing itself year over year. Figure 10, Figure 11, and Figure 12 show the energy intensity and GHG emissions for Brantford facilities for the years 2011 to 2013. The data for these years have not been weather normalized and some variation can be expected based on the impact of weather (e.g. higher heating energy use during colder winters, higher cooling energy use during hotter summers, and increased water pumping and treatment energy use in years with higher precipitation levels).

The facilities have been grouped together by type in order to facilitate comparison of facilities with similar energy using equipment. The facilities that have the highest energy intensity per square foot are the Wayne Gretzky Centre and the Market Parkade. The facilities that have the highest energy intensity per mega litre of water processed are the Water Pumping Station & Reservoir at 5 Kraemers Way, the Water Treatment Plant, and the Waste Water Treatment Plant. The facilities that have the highest GHG emissions are the Wayne Gretzky Centre, the Water Treatment Plant, and the Waste Water Treatment Plant. There are some differences in the rankings, as the GHG emissions values are absolute, while the energy intensity values are based on floor area or volume of water processed.

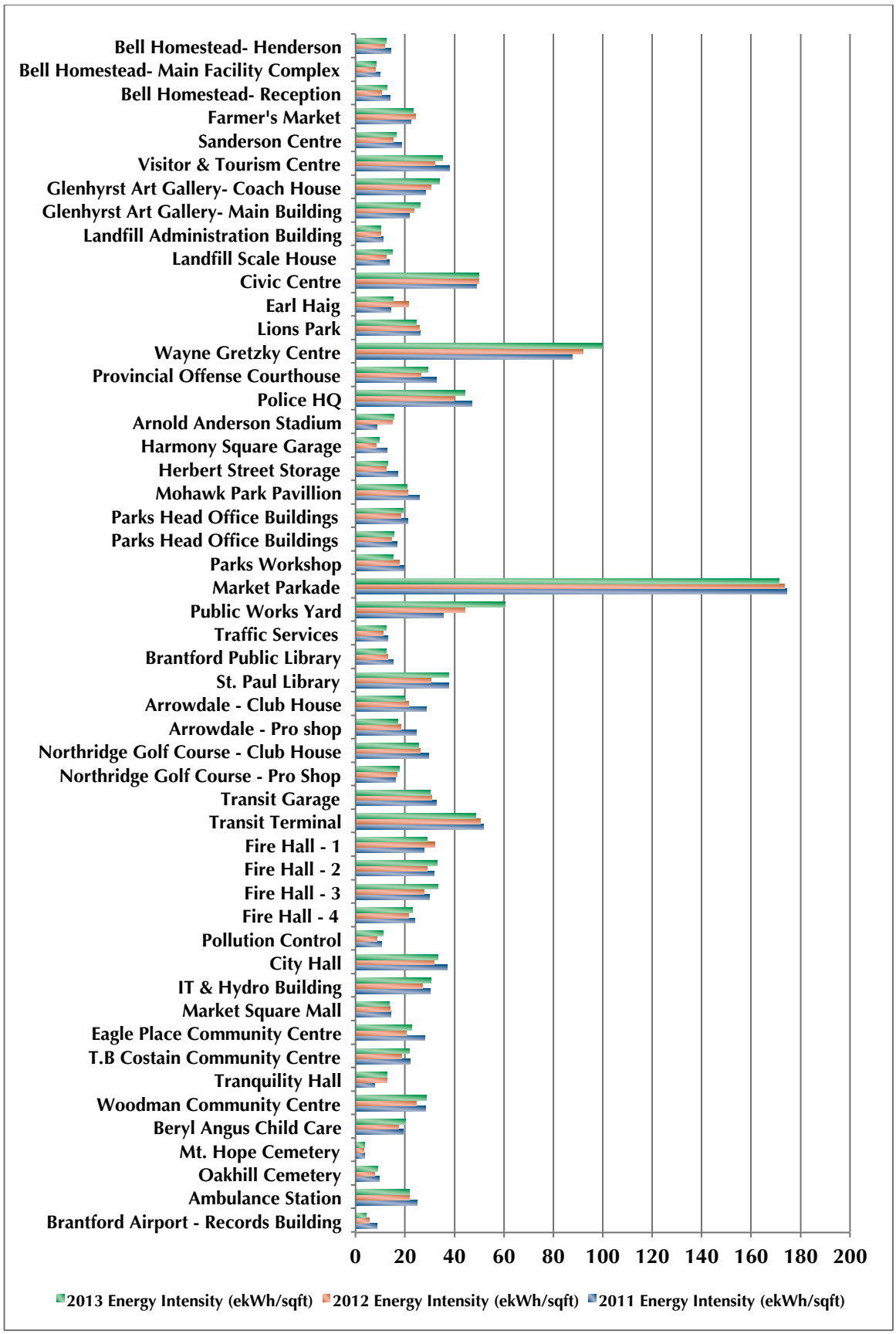

Figure 10 Energy intensity for Brantford facilities for 2011 to 2013

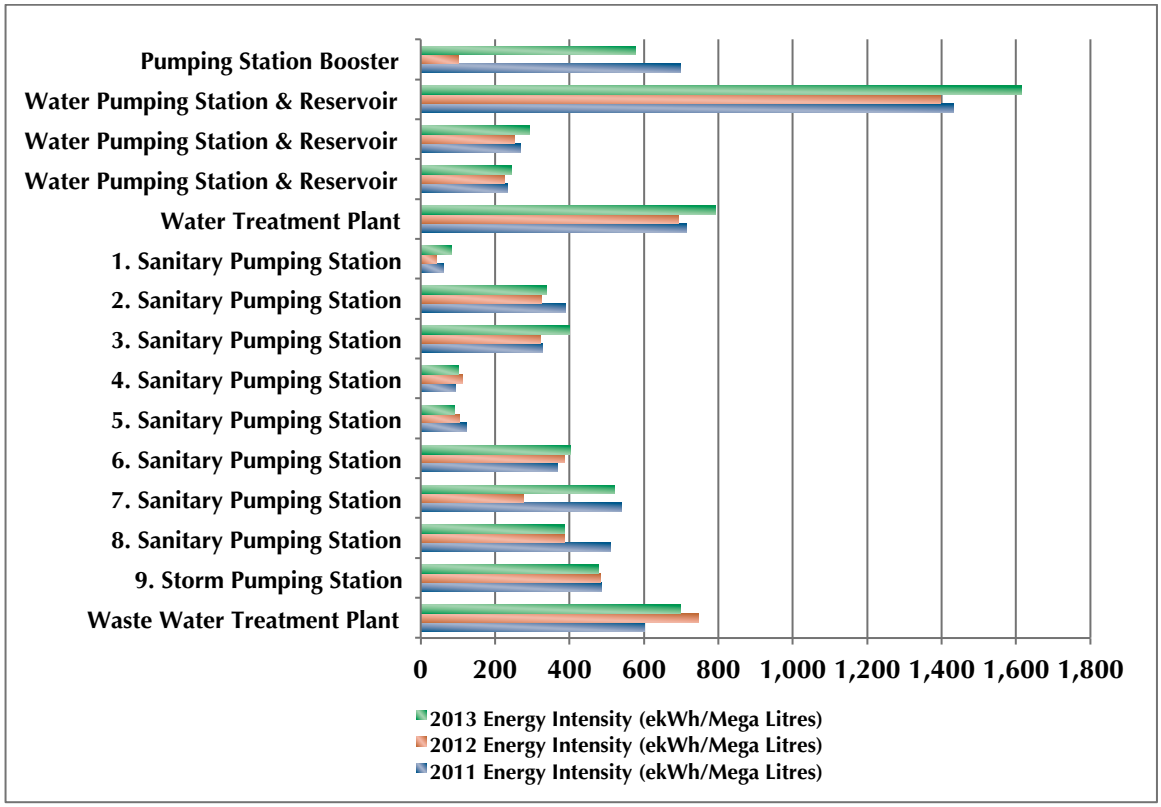

Figure 11 Energy intensity for water and wastewater processing facilities for 2011 to 2013

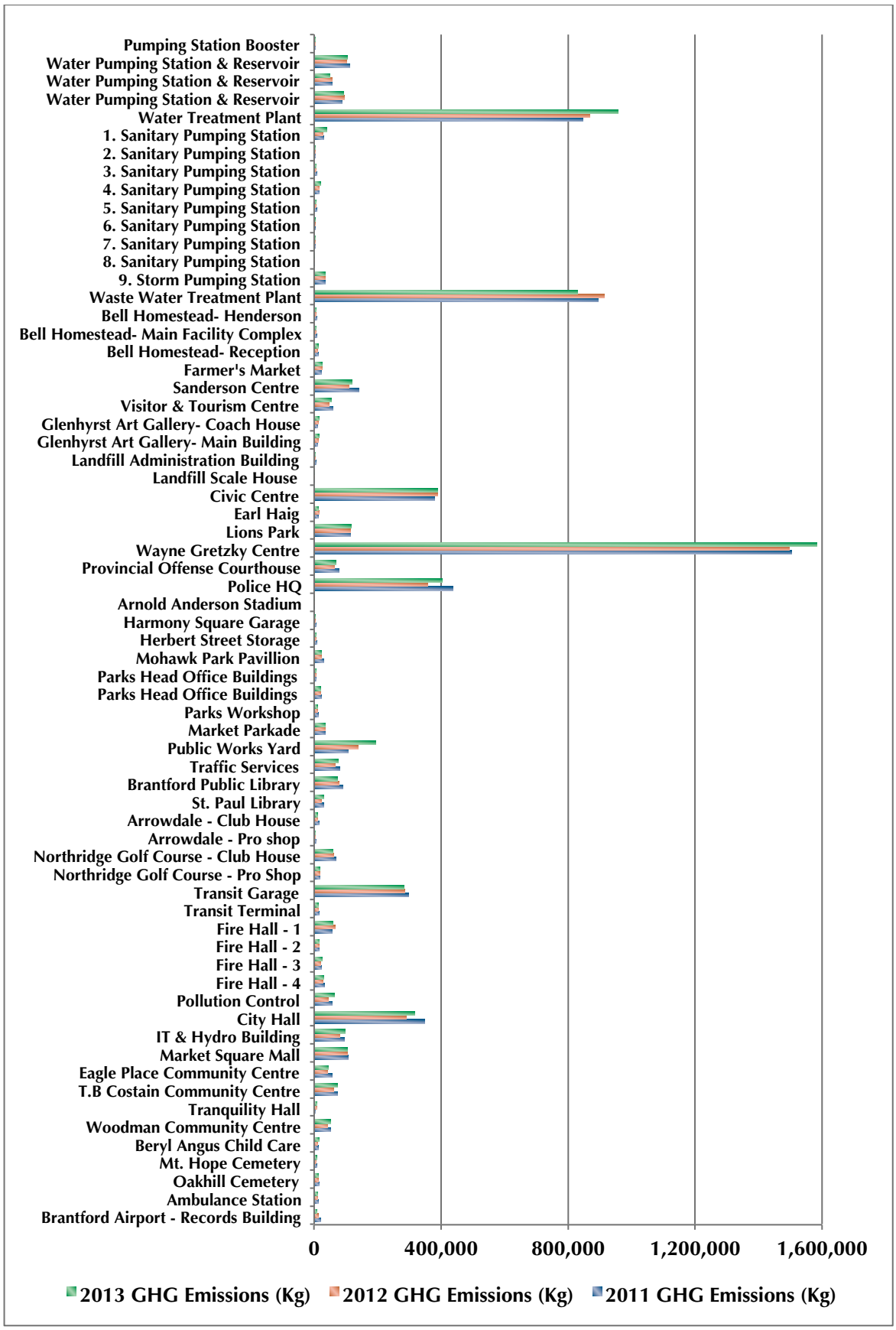

Figure 12 GHG emissions for Brantford facilities for 2011 to 2013

A.2. Description of existing energy initiatives and policies

Energy initiatives

Since 2010, a number of initiatives have been completed or are underway at the City relating to energy/demand management and the reduction of GHGs:

- ASHRAE Level I audits of 14 Corporate and Housing properties.
- Building Condition Assessments for 111 properties in the Housing portfolio.
- ASHRAE Level I audits of 15 multi-residential buildings in the Housing portfolio.
- Lighting retrofit projects, including: LED parking lot lighting, 48 LED light installation in one neighbourhood, all traffic lights converted to LEDs, five solar powered traffic flashers, and T12 to T8/T5 interior lighting retrofits at various facilities.
- Mechanical retrofit projects, including: expanded BAS, more efficient rooftop HVAC and air handling units with heat recovery, high efficiency boilers, efficient compressors, high efficiency furnace units, on demand water heaters, set back controls, and new efficient equipment at various facilities.
- Building retrofits with energy efficiency components, including: increased levels of insulation, improved ventilation, weather stripped exterior doors, high-performance glazing, high-efficiency lighting with occupancy sensors, low-flow shower heads, air curtains, and heat pumps at various facilities.
- Rooftop solar panels on Richard Beckett Building (Housing)
- Grounded mounted solar installation at Trillium Way Housing.
- Energy conservation initiatives through Fleet Services, including: reduction in the average age of the fleet from 18.5 years in 2001 to 4.2 years in 2010; cleaner engines; right sizing of buses to service areas with lower demand; tinted bus windows; onboard air-conditioning and auxiliary heating systems; automatic greasers; recycling bus wash system; and a driver education program, among others.

Policies and plans

In 2006, the City of Brantford undertook a community-based consultation process to provide input into the development of Brantford's Community Strategic Plan for 2006-2010. The Plan has since been reviewed and updated to reflect goals and priorities for 2010-2014. The development and implementation of a *Corporate energy management plan* supports the City's Strategic Plan's vision elements of "Managed Growth and Environmental Leadership" and "Excellent in Governance and Municipal Management".

The following Strategic Actions are relevant to the CEMP and have an impact on energy consumption:

- Undertake a new Transportation Master Plan.
- Maintain the Infrastructure Management Strategy including roads, sewers, water and municipal buildings.
- Develop a Green Infrastructure Strategy.
- Review and update the Growth Management Plan.
- Brantford will be recognized as a fiscally responsible and well-managed city that provides efficient and effective government services.

In addition to the Strategic Plan, in December 2012 and February 2013 City Council endorsed Resolutions that support the review and inclusion of renewable energies such as solar and the advancement of energy management within the City.

A.3. Corporate survey results

As part of the CEMP planning process, City staff were asked to complete a short survey about energy management at the City of Brantford. In total, 107 staff either fully completed or partially completed the survey. 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 City's corporate energy use and energy management processes, over half of respondents indicated that they were not familiar (68.9%). Twenty-two percent said they were somewhat familiar. When asked how well they think the City is managing its corporate energy use, 39.3% said "adequate"; however, 31.8% said "unknown" and no respondents replied with "very well".

The majority of staff (66%) indicated that e-mail updates and e-newsletters would be the best way to assist them in better understanding the City's corporate energy use and management processes, followed by information tips (34%) and lunch-n-learn sessions (23.3%). Over two-thirds of City staff said they were very interested (27.4%) or interested (43.4%) in assisting the City in reducing its corporate energy use. A large majority of staff agreed that it is either important (38.3%) or very important (49.5%) that the City 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; they adjust thermostats in rooms that are not being used; and they unplug heaters, coffee makers, and other appliances when not in use.

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

- Amalgamation of facilities for better use of space.
- Replace electric heating systems with more energy efficient systems (e.g. natural gas).
- Tint windows on vehicles so they operate cooler in the heat.
- Motion sensors on lights in rooms and in parking areas.
- More energy efficient windows or window coverings in some areas.
- Improve temperature controls (i.e. increase indoor temperatures in the summer and decrease temperatures in the winter).
- Enforce lights being turned off when not using rooms.
- Develop an anti-idling policy.
- More efficient heating and cooling systems with improved air flow, particularly at the Visitor and Tourism Centre and Police Headquarters.
- Use of laptops and the option to work from home.
- Energy competitions between departments.
- Create a cross-departmental Energy Steering Committee and Corporate Energy Policy.
- Vehicle right-sizing for staff who drive City vehicles.
- Re-arrangement of office furniture to make use of natural daylight.
- Energy efficient equipment upgrades and better weather stripping.
- Green purchasing policy.
- Renewable energy installation – solar panels, wind turbines, and geothermal.
- Replace corporate vehicles with hybrid models.
- Eliminate use of personal heaters or fans.
- Staff education and behaviour change programs to promote a change in corporate culture.
- LED lighting in facilities.

Appendix B. Criteria for prioritizing actions

The City of Brantford can evaluate and prioritize energy management actions identified in the future (e.g. from future Level 2 audits, staff ideas, and renewable/alternative energy feasibility studies), based on the following criteria presented below. Appropriate weighting should be developed and assigned to these criteria.

- **Leadership:** Does the action help the City become a leader in energy management? Does it demonstrate the City's commitment to improving its energy performance? The City should implement projects that are not cost-effective if they have high visibility, demonstrate new or emerging technologies, are an established "best practice", etc.
- **Cost-effectiveness:** Is the action cost-effective over its lifespan? The City should employ a lifecycle approach to determine the cost effectiveness of proposed actions. Two criteria employed in this plan that can be used to evaluate capital and operating costs and savings over the lifespan of future actions are the internal rate of return (IRR) and net present value (NPV). IRR captures lifetime energy savings and conveys that projects with high capital costs (and long paybacks), but long effective lives are a good investment. The NPV of an action is also a useful calculation, as it provides a measure of the estimated net financial benefit of each action. To consider true lifecycle costs, the City should also take into account the maintenance and disposal costs and savings associated with implementing an action.
- **Contribution to day-to-day energy efficiency:** Does the action make energy management visible at City facilities, change the behaviour of staff, help the City to publicize its successes, and contribute to the City's reputation?

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

1. Energy is used efficiently within the City.
2. A corporate structure is established to manage energy efficiently.
3. The efficient use of energy is a priority for the City in corporate policy and budget decisions.
4. The efficient use of energy is part of the day-to-day activities of City staff.
5. The City meets and exceeds the requirements of *Regulation 397/11*.

In addition, the City can consider the following criteria:

- **Annual energy savings:** For projects with good NPV, the City 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 City's overall energy performance. They will also yield the highest returns per hour of City staff time devoted to implementation.

- **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.
- **Occupant comfort and regulatory requirements:** Projects that increase comfort, address occupant concerns, or address regulatory requirements will improve the overall experience of City staff, enhance the City's reputation, or contribute to the culture of effective energy use.
- **Availability of incentives:** The City 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. in 2015 for current saveONenergy programs).

Appendix C. Utility incentive programs

This section describes incentives and services that are currently available from the City's electricity and natural gas utilities. The City of Brantford can take advantage of these incentives to implement some of the measures identified in Tables 1, 2 and 3.

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 Brantford Power. 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.

Brantford Power / Ontario Power Authority saveONenergy Programs

Full details are available at: http://brantfordpower.com/energy-savings-conservation/business-programs/

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

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).

An Embedded Energy Manager can be obtained through the PSUI program where the utility company will fund up to 80% of the Embedded Manager's annual salary. The Embedded Energy Manager must:

- Be hired by the municipality;
- Implement 0.3MW of peak demand savings and 0.3MW x Facility Load Factor x 8,760 hours of energy savings each year;
- Enrol in energy management related training programs;
- Develop an energy management plan and provide quarterly reporting; and
- Commit to implementing projects with a less than one-year payback.

Another option is to hire a Roving Energy Manager if hiring a full time Embedded Energy Manager is not warranted. A Roving Energy Manager is shared between multiple municipalities and is available for a short-term stay. For further information, contact Brantford Power.

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.

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 instrumentation, 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.

Appendix D. List of acronyms

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

BAS – Building automation system

CDM – Conservation and demand management

CEMP – Corporate Energy Management Plan

CO_2eq – Carbon dioxide equivalent

EEMS – Environmental and Energy Management System

EM&V – Evaluation, monitoring and verification

EMS – Energy management system

FTE – Full-time equivalent

GHG – Greenhouse gas

HQ – Headquarters

HVAC – Heating, ventilation and air conditioning

IRR – Internal rate of return

IT – Information technology

KPI – Key performance indicator

LED – Light-emitting diode

NPV – Net present value

O&M – Operations and maintenance

OPA – Ontario Power Authority

PD – Person days (1 PD = 7.5 hours)

VFD – Variable frequency drive

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