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Energy Management Plan for the City of Barrie

This document was prepared for the City of Barrie by IndEco Strategic Consulting Inc. and Finn Projects.

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Acknowledgments

The project team would like to acknowledge the contribution of the staff of the City of Barrie. Staff members were active participants in the consultation process and development of the Energy Management Plan.

The team for this project consisted of David Heeney, Sabrina Boulkheir, Deborah Lightman and Eric Buan of IndEco Strategic Consulting, Inc. and Logan Harris and Derrick Finn of Finn Projects.

Executive summary

Purpose of the report

The City of Barrie's energy management plan (EMP) is a six-year strategic plan (2012-2017) that aims to provide a basis for the City to move forward on implementing improvements to its facilities and operations that reduce energy and water use, their associated costs as well as the environmental effects of the City's activities.

It will also assist Barrie in complying with the *Energy Conservation and Demand Management Plans regulation 397/11 under the Green Energy Act (2009)* and the *New Construction and Performance Standards (Model National Energy Code for Buildings, MNECB)* that came into effect on January 1, 2012. Under these new regulations, public agencies are required to report annually on energy use and greenhouse gas emissions, they are required to develop and implement energy management plans, and they are required to report on results. They also have to comply with minimum standards of construction for their building components and features.

Scope and method

Our team followed a "systems approach" that aimed to address the City's issues and challenges comprehensively, and holistically, considering multiple dimensions including technological, economic, financial and market-based; behavioural, regulatory and organizational; and ecological dimensions.

First, we defined the preferred state/vision of energy in the City of Barrie. This was achieved through ten face-to-face interviews and the organization of a half-day strategic planning workshop with key City staff. Staff at various levels of the organization were consulted from key General Managers and Directors to Managers, Supervisors and Coordinators. They included in particular: the General Managers of Community Operations and Infrastructure, Development & Culture, the Director of Communications and Intergovernmental Affairs, the Director of Leisure, Transit & Facilities, the Manager of Facility Operations, the Financial Analyst Leisure, Transit & Facilities, Recreation Facilities Coordinators (from Community Operations), a Corporate Facility Coordinator, a Corporate Facilities Supervisor, a Facility Supervisor (from Environmental Facilities) and Managers of ICT.

Second, we identified the present state of energy use in Barrie. This involved reviewing Barrie's energy profile by building on the results of the audits (performed in Phase 1 of the project), and by benchmarking the City's key facilities against comparable facilities in other jurisdictions. Our work also involved analyzing Barrie's energy management practices. Information was obtained through interviews with staff and the review of Barrie's key energy policies, plans, programs and projects implemented to date. Recent regulatory changes,

effective since January 2012 and that will affect the City of Barrie's energy actions, such as the *Energy Conservation and Demand Management Plans regulation 397/11 under the Green Energy Act (2009)* and the *New Construction and Performance Standards (Model National Energy Code for Buildings, MNECB)* were also reported upon.

Third, we developed an action plan to assist the City of Barrie in moving from its present to its preferred state of energy. In concert with key City staff and decision makers, we formulated energy management goals, measures and actions to be achieved by the City within the next six years (2012-2017).

The action plan includes management/organizational measures and technological actions.

Management/organizational measures were prioritized based on their level of importance and ease of implementation.

Technological actions refer to the retrofit opportunities identified by Finn Projects during its audits of eleven City buildings (results from Phase 1 of the project). A cumulative energy savings target of 55 GWh over the six-year timeframe was developed for the City that considers estimated energy savings from retrofits identified during the aforementioned audits, savings from water treatment facility retrofits, and energy savings from retrofits in buildings that did not undergo an energy audit.[1] The retrofits are ranked by order of priority across the six-year plan. A higher priority was given to retrofits with a greater internal rate of return (IRR). The retrofit schedule is front-loaded with retrofits that deliver high savings relative to their cost. The grouping of ranked options was also designed to distribute expenditures evenly across each year.

In addition, we assessed the capital and human resources required in order to successfully implement the plan. Capital resources requirements were determined based on the price of the retrofits that we recommended. Human resources requirements were calculated based on the specific positions we suggest creating.

Finally, we investigated the key components of a monitoring, verification and updating process that would help the City of Barrie better measure and analyze its energy use and cost. We built on our expertise in energy management system solutions, conducted research and reviewed existing monitoring and verification practices in ten other jurisdictions. These were used to develop a list of potential energy management systems that the City of Barrie could use.

[1] Buildings that did not undergo an audit are the Barrie Arena, fire stations 1-4, and properties on Parkview, Southshore and Sunnidale.

Figure 1 below illustrates our scope of work and method.

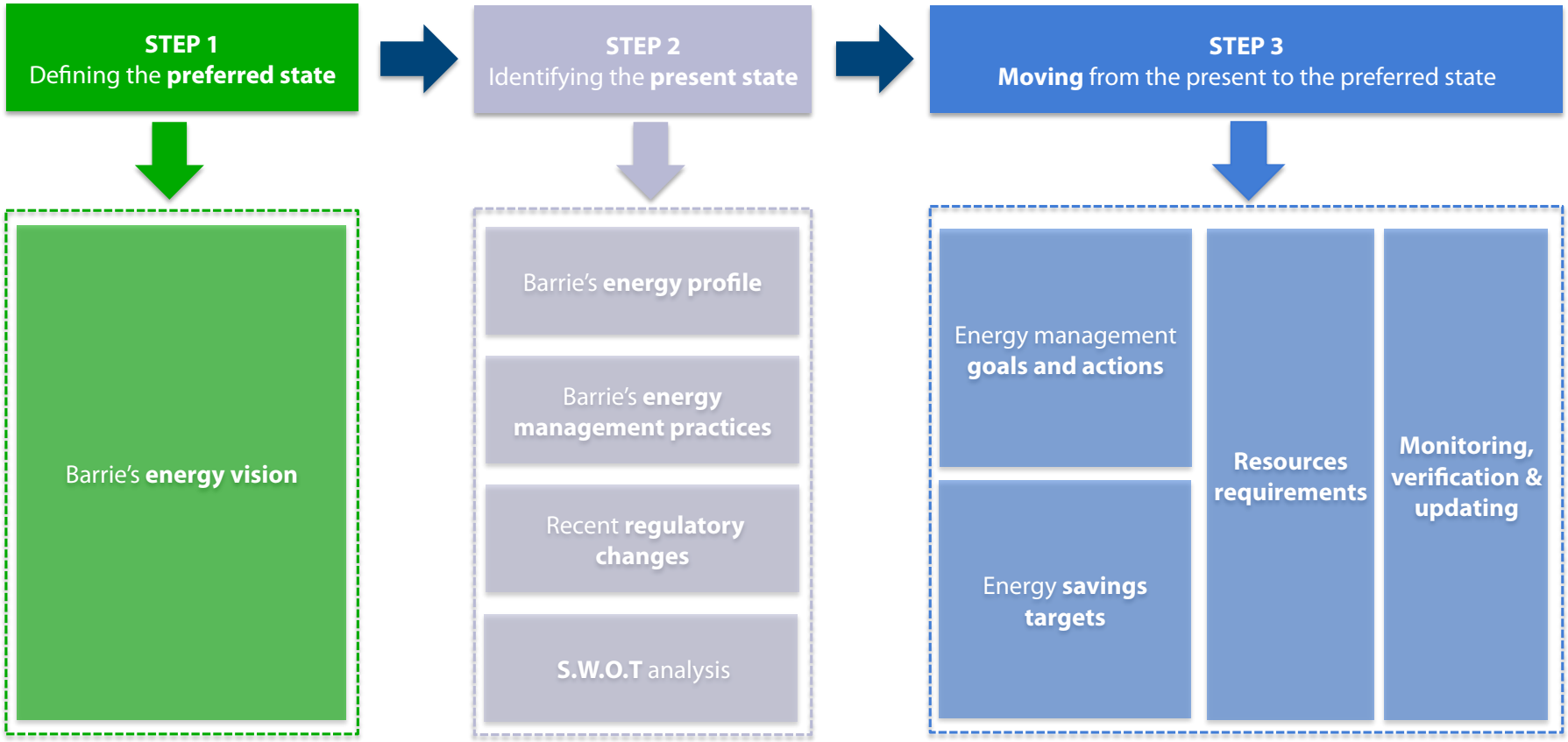


Figure 1 Scope of work and method

Status of data

The City of Barrie's vision is founded on existing City goals, targets and objectives as well as on the opinions and priorities expressed by the key City staff and decision makers that were consulted throughout the project.

The picture of its present state was drawn from our review of City policies, programs and initiatives, and most importantly, from the results of the on-site audits in eleven facilities, the lessons learned from staff consultation and the findings of the City facilities' benchmarking against comparable Ontario average and 'best in class' facilities.

The action plan outlined in this report, along with our assessment of the resources required and the monitoring, verification and updating process to establish, were all obtained from one/several of the following sources: ongoing consultation with the Project Management Team and key City staff, and thorough research and analysis of energy and sustainability best practices in various municipalities in Ontario, in Canada and in the US.

Main findings

The City of Barrie aspires to use energy efficiently to reduce the economic burden on taxpayers, and to protect the environment, in accordance with its Strategic Plan. It wishes to obtain internal support from its staff and external support from the Council and the Community at large. Broad-based awareness and commitment to the wise use of energy, integrated and coordinated approach, optimized processes to encourage innovation and improved energy and environmental performance are the key goals the City is seeking to accomplish.

Despite its efforts to support energy efficiency and sustainability, energy is still not seen as a priority within the organization. Most energy projects undertaken at this time are *ad hoc*. The funding and organizational processes in place sometimes discourage effective action and innovation. The benchmarked City of Barrie facilities vary within each division, with some facilities having higher than average energy intensities and some facilities having better than average or even "best-in-class" type intensities. Addressing these challenges is becoming even more crucial since the City of Barrie, like other Ontario municipalities, will have to comply with the new energy regulations that came into effect in January 2012, and energy prices are rising.

The experiences of many Ontario municipalities demonstrate the benefits of aggressive action on energy management plans. These include tremendous energy and cost savings. Significant energy and cost savings can be realized in Barrie, when the City implements the management/organizational as well as the technological actions (retrofits) outlined in this report.

The City of Barrie has to allocate capital, human and technical resources to energy if it wants to successfully implement the outlined

energy management plan, and to position itself as a leader in the energy field.

The capital costs associated with the recommended retrofits (including retrofits of water treatment facilities) are $4.5M over 6 years. These will be almost completely offset by bill savings and incentives at the end of the six-year plan.

Energy savings will continue beyond the six-year plan and will lead to significant annual financial savings into the next decade. Bill savings over a fifteen-year timeframe are expected to be in the range of $10.6M.

Many municipalities have a distinct sustainability/energy management structure within their organization. However, leaders in energy and sustainability share some common characteristics: they all have a strong organizational structure that has been specifically designed to increase the visibility of energy issues, to facilitate cost-effective investments in energy efficiency and to enable effective tracking of energy and cost savings from energy efficiency improvements. They all rely on a Sustainability Office and/or an Energy Management Office and have at least one full-time staff person dedicated to energy and sustainability actions. The bill savings achieved from less than one year of energy efficiency retrofits would be sufficient to cover the annual costs of an Energy Management Office or a Sustainability Office in Barrie.

Many municipalities also use energy management systems (EMS) that allow them to successfully track their energy use and identify potential areas of energy efficiency improvements. There is no single EMS that is used by municipalities. They select such a system based on their unique needs.

Conclusions and recommendations

Drawing on our main findings, we are recommending a series of prioritized energy management goals, measures and actions (high, medium and low priority). They consist of management/organizational measures and technological actions (retrofits).

Actions and measures that are rated as “low priority” should not be ignored until the end of the six-year period. Starting in 2012, City staff can think ahead and plan to implement the actions in all time periods. They should also be prepared to implement measures and actions ahead of this schedule if relevant opportunities arise.

Key management/organizational recommendations

The City of Barrie should encourage energy efficiency actions within its organization and ensure energy efficiency consistency across buildings. Communicating around energy successes internally, strengthening partnerships with external stakeholders (e.g. PowerStream and Enbridge) should be sought simultaneously.

To achieve its objectives, we recommend that the City of Barrie creates a Sustainability Office with at least one full-time staff member responsible for corporate energy management. It would also enable the City of Barrie to remain on par with other municipalities, to implement more cost-effective energy efficiency projects and to undertake them in an organized and systematic way.

The Sustainability Office would be managed by a Director of Sustainability. The Director would report directly to the Chief Administrative Officer. He or she would be assisted by a Corporate Energy Manager and a Sustainability Coordinator. Their mission would consist of coordinating new and existing energy and sustainability initiatives, and of giving strategic significance to energy and sustainability projects across the entire organization. The City of Barrie could start by creating a Corporate Energy Management Office as an interim option, until the resources required for the Sustainability Office can be secured. The Energy Management Office would be staffed by one full-time Corporate Energy Manager and would aim to increase the visibility of energy within the Corporation, and to ensure that energy is systematically considered as part of all City activities.

The City of Barrie should establish a process in order to better analyze energy use and costs within its facilities and operations and verify savings obtained through energy efficiency improvements. This requires the adoption of an energy management system (EMS) adapted to its needs. Although we provide a few example of EMSs used by other municipalities, we believe that the City of Barrie should consider issuing a request for proposal to select its EMS. This should provide the City with a variety of potentially suitable EMSs. Concurrently, the City of Barrie should work closely with PowerStream and Enbridge to ensure that real-time electricity data and (at least) daily gas data are available to populate the EMS.

The City of Barrie should also look for funding sources. It should seek to take advantage of all available resources and funding options to undertake energy projects (e.g. grants from NRCan, Federation of Canadian Municipalities Green Fund, incentives from PowerStream and Enbridge, etc.). It should investigate the feasibility of creating a revolving fund that would re-invest some or all money obtained through energy savings into new energy projects.

Finally, City staff should continue to develop a compelling business case in order to help Council understand the importance of energy in Barrie and to justify funding for energy projects.

Key technological recommendations

The City of Barrie should focus on implementing retrofits in the order suggested in the retrofit implementation schedule. By following this schedule, the City will be able to focus efforts on retrofits that have the most favourable internal rate of return. Adhering to this schedule will also ensure that the City improves the energy intensity of its facilities in comparison to best-in-class Ontario facilities in the quickest manner possible.

We are confident that the energy management plan outlined in this report will help the City of Barrie achieve its energy goals and targets and position itself as a leader in energy.

Undertaking the recommended actions will be crucial in this process. Another key to success will be to ensure that the 2012-2017 plan remains relevant over the years. The energy management plan should be reviewed at least once a year and progress towards goals and targets should be tracked.

Background to the project

Barrie is a city in Southern Ontario, Canada, located 90 km north of Toronto on Lake Simcoe. Its population has been growing at an annual rate of 5.5% since the mid-1980s, and Barrie now has approximately 140,000 residents. Data released from the 2006 census indicate that the Barrie metropolitan area, with 177,061 residents, is the 21st largest, and one of the fastest growing census metropolitan areas in Canada.

Barrie's energy use has grown along with its population and its own facilities and operations. In particular, the Corporation has twenty-six large facilities and several small facilities and parks whose energy bills (electricity, gas and water) total almost 6.5 M$ per year (in 2008). Further recent additions to the City's building inventory (e.g. a 60,000 m^3 capacity water treatment plant, etc.) impact its energy use, hence its financial position. Decoupling economic growth from energy use (i.e. enhancing economic prosperity while reducing energy costs) is now a requirement if Barrie wants to keep its costs down and build a sustainable future for its Community.

In 2001, Barrie joined the Partners for Climate Protection program (PCP), a partnership between the Federation of Canadian Municipalities (FCM) and ICLEI, Local Governments for Sustainability. In the Spring of 2002, the City started working on its commitment to the PCP by:

- Performing an energy inventory;
- Setting reduction targets;
- Developing a community energy plan.

Those tasks were completed in 2006 and the report on these outlined Barrie's strategies to cut greenhouse gas emissions.

In July 2009, as a next step forward, the City of Barrie retained Finn Projects and IndEco Strategic Consulting Inc. (IndEco) to develop an energy management plan for the City Corporation. The goal of the energy management plan is to reduce energy use in City-owned facilities. The first phase of the project consisted of a series of energy audits and a peer review of past energy audits. The second phase, described in the present report, outlines the City of Barrie's energy management plan for 2012-2017. This six-year plan provides a comprehensive framework for the City to move from its current state of energy management to its preferred state of energy sustainability.

This plan has been designed with the express objective of being useful and practical to successfully guide the City's departments' energy initiatives over the coming years. It will be kept current through annual updates.

It will also assist the City of Barrie in complying with the recent energy regulations that came into effect on January 1, 2012 i.e. The *Energy Conservation and Demand Management Regulation* under the *Green*

Energy Act (2009) and the *New Construction and Performance Standards (Model National Energy Code for Buildings, MNECB)*.

Energy management plan development process

Purpose

The City of Barrie's energy management plan (EMP) is a strategic plan that aims to provide a basis for the City to move forward on implementing improvements to its facilities and operations that reduce energy (and water) use, their associated costs as well as the environmental effects of the City's activities.

The plan aims to give Barrie a leading edge in energy while enhancing its economic vitality. Therefore, it goes beyond the short-term, "least financial cost" objective and considers the City's long-term economic, environmental and social well-being.

Overall approach

The EMP was developed using Barrie's existing requirements and institutional settings as a framework.

Our team followed a "systems approach" that aimed to address the City of Barrie's issues and challenges comprehensively, and holistically, considering multiple dimensions including technological, economic, financial and market-based; behavioural, regulatory and organizational; and ecological dimensions.

A healthy environment, a caring society and economic prosperity are common objectives that were sought simultaneously.

Some of the key principles that guided our approach:

- The City of Barrie and its Community, the Environment and the Economy are intimately connected; hence were dealt with in an integrated way;
- Making real progress on energy efficiency and sustainability requires strategic planning. Our effort was not about setting out elaborate blueprints for Sustainability nor establishing an array of expensive programs. Rather this was about identifying key energy efficiency and sustainability goals, measures and actions that would help the City of Barrie move from where it is today (present state) to where it would like to be with respect to energy and sustainability in the future (preferred state);
- The EMP must be both innovative and practical;
- Leveraging the City of Barrie's existing energy plans/policies, commitments, and projects was as crucial as building on the key lessons learned from and best practices in other jurisdictions that have already developed successful energy management plans;
- The EMP must be engaging and inclusive. The City of Barrie's key staff were engaged from day one of the project through

participation in individual interviews and in a collaborative strategic planning workshop;

- The EMP must recognize the unique situation and aspirations of the City of Barrie and must deal with both physical resources and human values;
- Planning is an iterative, not a linear, process. A key for Barrie to move forward is to successfully evaluate energy-related projects and actions, measure progress and establish adequate reporting mechanisms that staff (e.g. operators, facility supervisors) will have to comply with;
- The EMP has been designed in order to be flexible enough to adapt to The City of Barrie's departments and their differences and allow incorporation of any changes in the City of Barrie desires that may happen in the future;
- Data collection and analysis is expensive and must be done strategically to ensure adequate decision making. The key recommendations proposed in this report have been developed based on understanding and evidence, not speculation.

Planning process

Our team has developed a unique strategic planning process in order to help the City of Barrie identify and implement key improvements in its facilities and operations that reduce energy use and the associated financial and environmental costs.

Defining the plan

Our planning process is comprised of a sequence of several key components. Figure 2 below illustrates how these components are connected throughout the development and implementation of a plan.

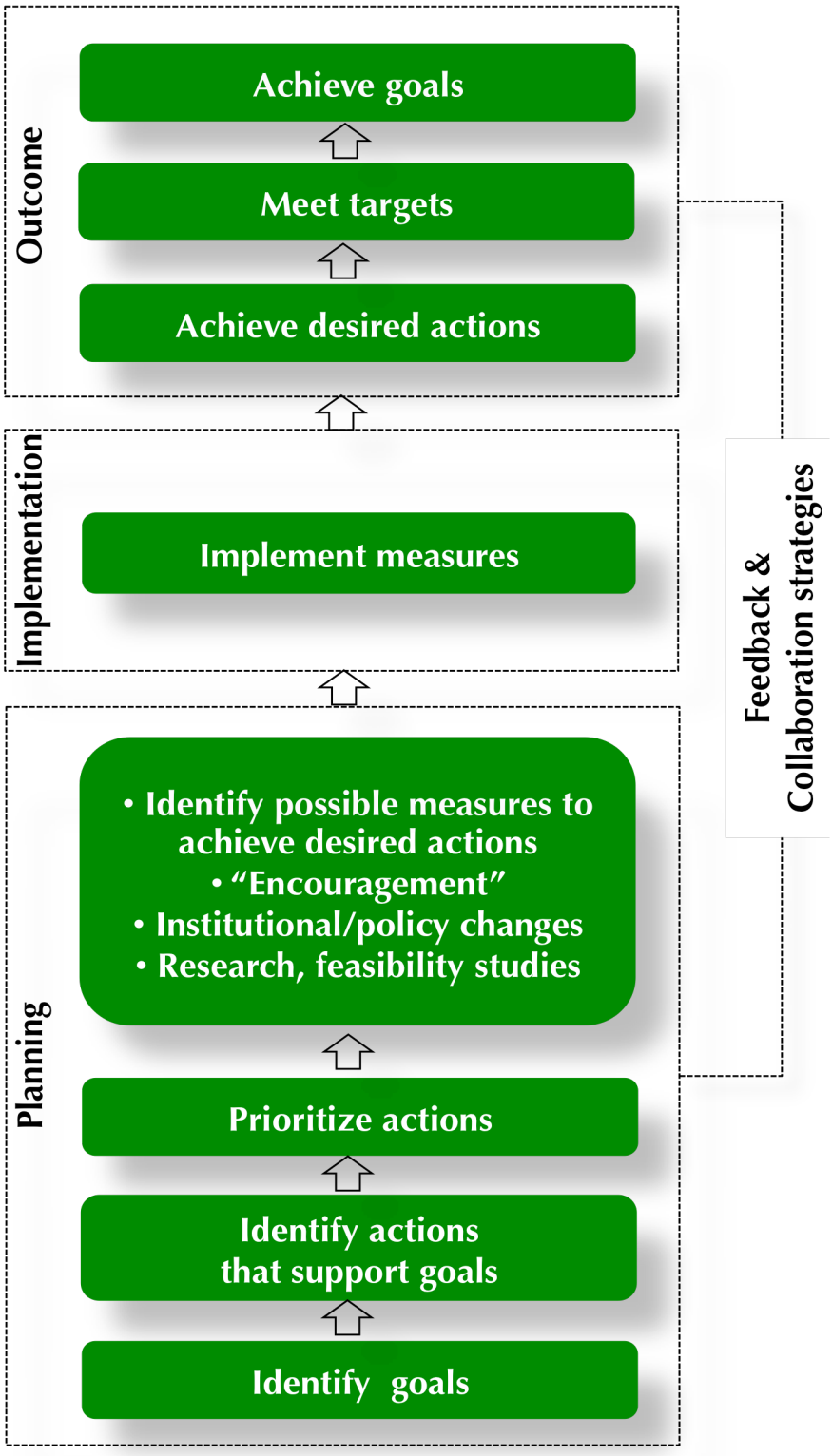


Figure 2 Strategic planning process

According to this model, a comprehensive plan outlines a series of actions and measures that lead to the achievement of goals and targets.

Understanding how the plan components work together is crucial when developing a plan.

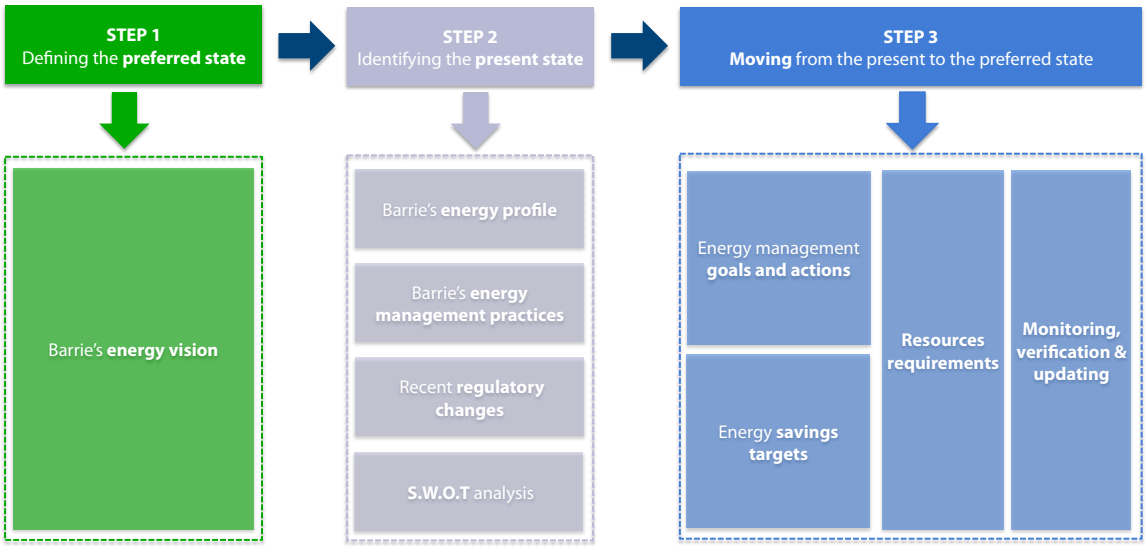
Table 1 below outlines clear and concise definitions of the key components of a plan:

Table 1 Key components of a plan

Definitions of key components of a plan	
Goals	Broad, policy-level statements concerning a preferred state or process.
Actions	Concrete, measurable initiatives to support the goals.
Targets	Specific quantitative objectives related to a particular action.
Measures	Regulations (plans, policies), economic and financial incentives (grants, tax credit, etc.) and other mechanisms that encourage actions.

Developing the plan

Our team went through the 3 following key steps to develop the proposed EMP:



- **Defining the preferred state** – Where the City of Barrie wants to be. The first step in our strategic planning process was the preferred state. The purpose of this step was to encourage Barrie to make its vision of energy explicit. It was the first step of the entire process because there is a common tendency to get bogged down by present circumstances. By focusing first on where Barrie wants to go and how to get there, we were able to go beyond some obstacles that sometimes seemed insurmountable.
- **Identifying the present state** – Where the City of Barrie is today. The second step in our strategic planning process was the identification of the present state. Identifying the present state gave us an indication of how far away the City of Barrie's present state of energy is from where it wants to be. Our work involved reviewing the City of Barrie's energy profile, its energy management practices, identifying the recent energy-related regulatory changes and conducting a S.W.O.T analysis.
- **Moving from the present to the preferred state** – How The City of Barrie can get to where it wants to be. The third step in our strategic planning process was to develop options that would help the City of Barrie move from the present to the preferred state. Options include actions and measures. We developed energy savings targets for the City to achieve. Part of our work also included assessing the resources required to implement the plan and investigating the key components of a monitoring,

verification and updating process that would help the City of Barrie better measure and analyze its energy use and costs.

Stakeholder consultation

Throughout the planning process, consultation was carried out with key City staff to build on their own knowledge of the City facilities and operations and discuss possible opportunities to give strategic significance to energy within their organization.

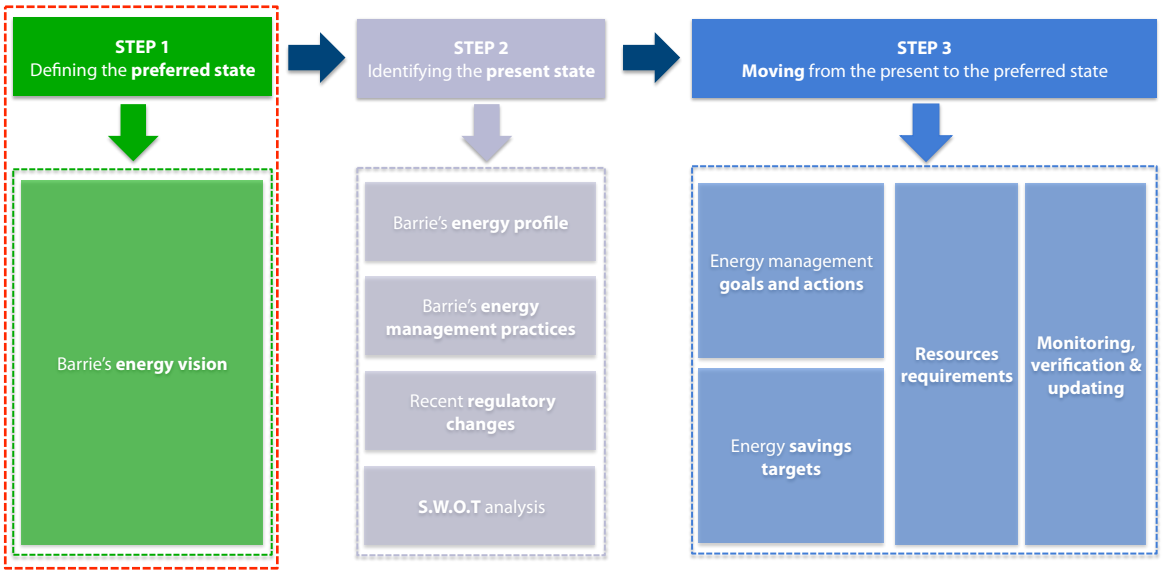
The consultation process with key City staff was comprised of individual interviews and a strategic planning workshop.

Outcomes

Our unique step-by step strategic planning process contributed to:

- Stimulating communication;
- Enhancing cross-departmental cooperation;
- Building a common vision with respect to energy;
- Identifying practical steps, do-able actions and targets that will lead to results;
- Identifying the financial, human and technical support needed to implement the plan.

Defining the preferred state



Defining the preferred state of energy use in the City of Barrie was the very first step in our planning process. It involved the identification of the City of Barrie's vision for energy sustainability through a series of interviews with key City staff and the organization of a strategic planning workshop. The vision is founded on existing City goals, targets and objectives.

"Defining the preferred state" aimed to translate Barrie's values and goals into a description of an ideal situation.

The results obtained during this step have been refined over time as the work on the energy management plan progressed, to ensure that the City's desires were fully and properly captured.

The preferred state was used as a guide for the development of the different options measures and actions for the EMP.

City of Barrie's energy vision and goals

Table 2 below outlines the preferred state of energy/vision for the City of Barrie.

Table 2 Summary of the preferred state of energy management in the City of Barrie

Goal: Broad-based awareness and commitment
• Energy is a municipal priority: Council advocates its importance, the Mayor takes a leadership role and energy communication and improvement efforts extend into the Community.

- Energy use and expenditures (electricity, gas and water costs) are visible and their significance is recognized by Council when analyzing and setting the City's budget.
- There is broad understanding of energy's long-term importance, both for its importance to the economy, and because of rising energy prices.
- The City is seen as "leading the change" in energy and has support of the Community.
- The City of Barrie has a culture of energy awareness and innovation: broad employee awareness and buy-in. Energy is seen as a daily business activity within the organization and investments across the organization consider energy.
- City employees and departments are recognized for their commitment to energy.

Goal: Integrated and coordinated approach

- Energy is considered as part of "sustainability" and is linked to economic development and greenhouse gas reduction.
- The City of Barrie's EMP addresses all types of energy use: it focuses primarily on facilities while also taking into consideration other initiatives that are needed within other parts of the organization.
- The EMP has clear links to all major departments, hence is able to seize any energy efficiency opportunities.
- The City has a coherent energy/sustainability unit (group) that includes representation from all major energy consumers within the City.
- The City takes advantage of all available resources and funding for energy projects (e.g. by strengthening partnerships with utilities and other outside partners).

Goal: Optimized processes to encourage innovation

- Council has approved a Policy that provides ongoing resources and support for energy; hence energy projects do not have to compete with other infrastructure investments.
- The organizational structure and processes for energy management enable effective action:
    - The City has the data and processes in place to easily monitor and analyze energy use and costs.
    - The City has sufficient staff resources for energy planning, monitoring and

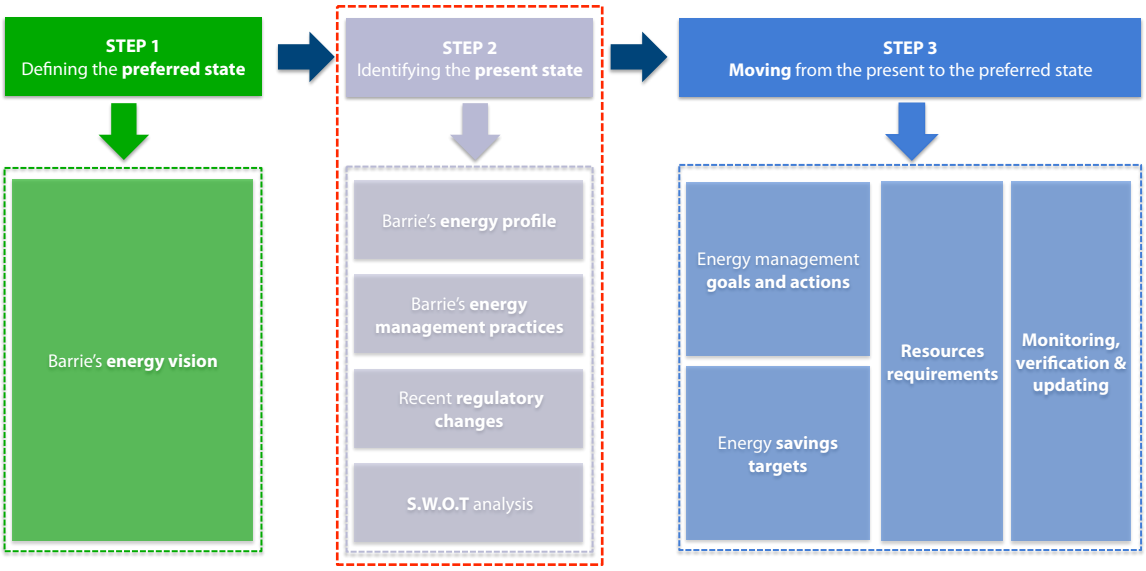
project facilitation.

- The EMP is revenue generating, hence self-sustaining.

Goal: Improved energy and environmental performance

- New and existing buildings are more and more energy efficient.
- The City has specific GHG reduction targets.
- The EMP has appropriate links to greenhouse gas reduction initiatives.

Identifying the present state



Identifying the present state of energy management in Barrie was the second step in our planning process. The present state gives us an indication of how far the City is from where it wants to be (the preferred state).

To understand the City of Barrie's present state, our team:

- Analyzed Barrie's energy profile;
- Investigated energy management practices in Barrie including, but not limited to, action taken on energy efficiency and organizational/management factors related to the preferred state;
- Identified the recent energy-related regulatory changes that will affect the City of Barrie's energy actions;
- Conducted a S.W.O.T analysis in order to assess, not only Barrie's strengths and opportunities with respect to energy management, but also, the key weaknesses and threats that hinder effective action.

City of Barrie's energy profile

Facility Benchmarking

Our team reviewed the energy intensities of major City of Barrie facilities and land holdings in order to benchmark these facilities against average and best-in-class energy intensities of similar facility types in Ontario.

The City provided data for its facilities for a number of years and 2007 was selected as the base representative year. Within the 2007 data set there are 21 buildings or facilities that have associated energy costs, plus an additional 35 facilities used to either treat or pump water.

Energy benchmarking analyzes and reports on a facility's energy performance per unit area or unit of physical production (energy intensity) and focuses on a comparative analysis of energy use. The City of Barrie facilities were benchmarked using data from the Local Authority Service's Energy Performance Benchmarking of Ontario's Municipal Sector Report. This report compares data from nearly 400 municipal facilities across Ontario and created energy benchmarks for various municipal facilities, split into categories.

Similar facilities in the City were categorized, in order to allow for energy benchmarking. Where the floor areas of the buildings were missing, they were estimated. Some energy uses, such as street lighting, did not allow for benchmarking. Also, facilities that did not have recorded energy use data were excluded from the benchmarking exercise. For the water pumping and water treatment facilities, the average and "best-in-class" intensities were estimated, based on our experience.

The facilities were grouped into the following categories:

- Arts & culture;
- Community centre;
- Fire;
- Library;
- Multi-use recreation complex;
- Office;
- Police;
- Public works;
- Single pad ice rink;
- Booster station;
- Treatment pumping;
- Treatment plant;
- Well station.

The "best-in-class" intensity identifies the energy intensity corresponding to the top 25% performers in each division. For the benchmarking, all applicable types of energy were converted into equivalent kWh (ekWh) per square metre (or in the case of the Booster Stations, Treatment Pumping, Treatment Plant and Well Station divisions, ekWh/m^3 water supplied or treated).

The City of Barrie facilities within each division were examined individually and their pre- and post-retrofit intensities were plotted against both the average intensity benchmark and the best-in-class

intensity benchmark. The retrofits are those identified in the audits performed by Finn Projects and described in Step 3: "Moving from the present to the preferred state of energy" - Technological actions section of the report[2].

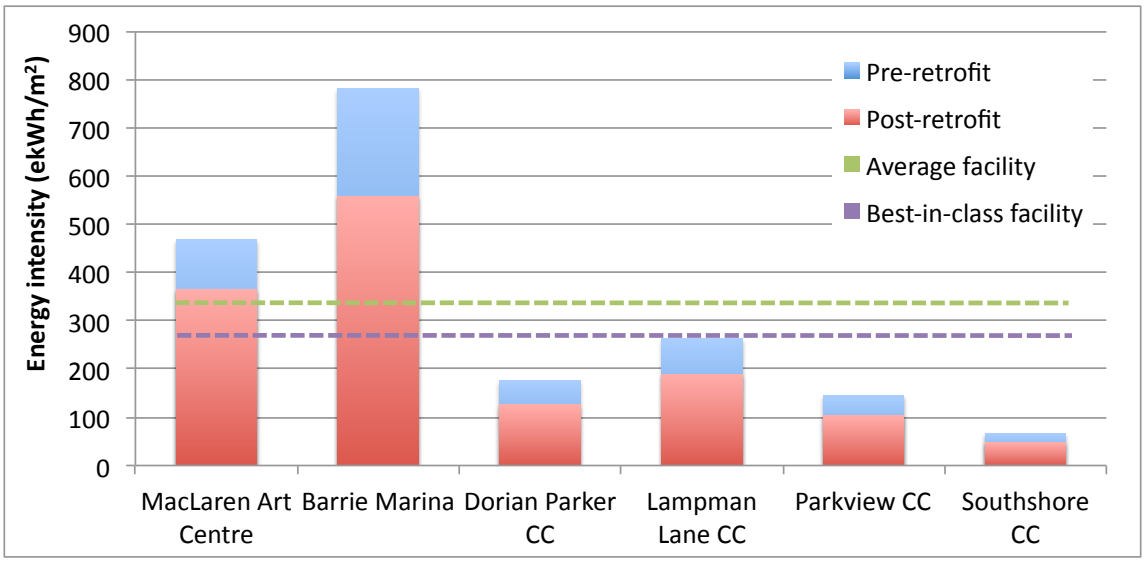


Figure 3. Benchmarking for Arts & Culture, and Community Centre facilities

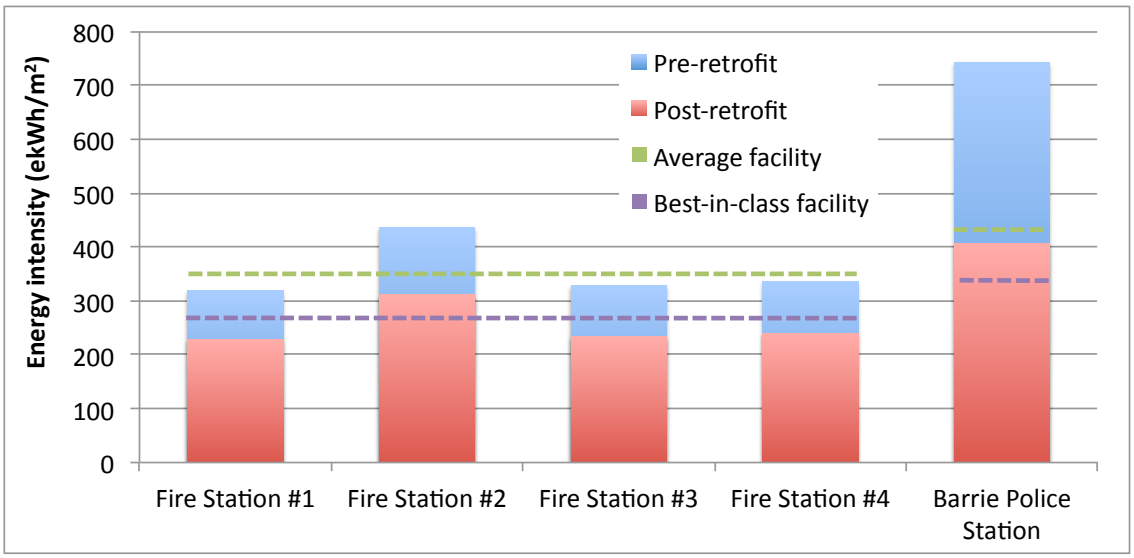


Figure 4. Benchmarking for fire and police stations

[2] Post-retrofit intensities for non-audited facilities were determined by subtracting out energy savings proportional to energy savings estimated for audited facilities.

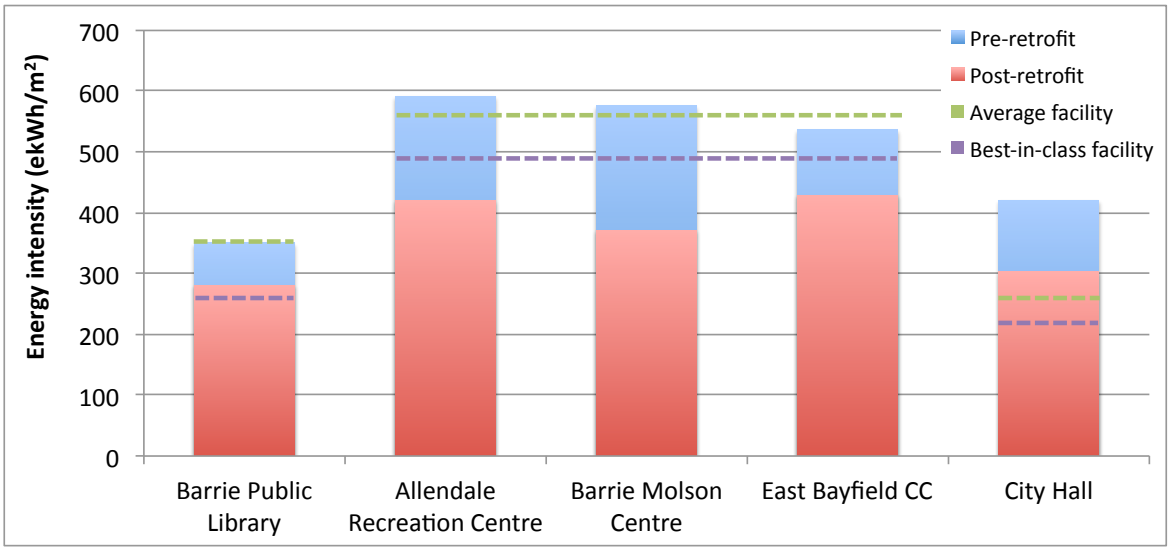


Figure 5. Benchmarking for libraries, multi-use rec. centers, and city hall

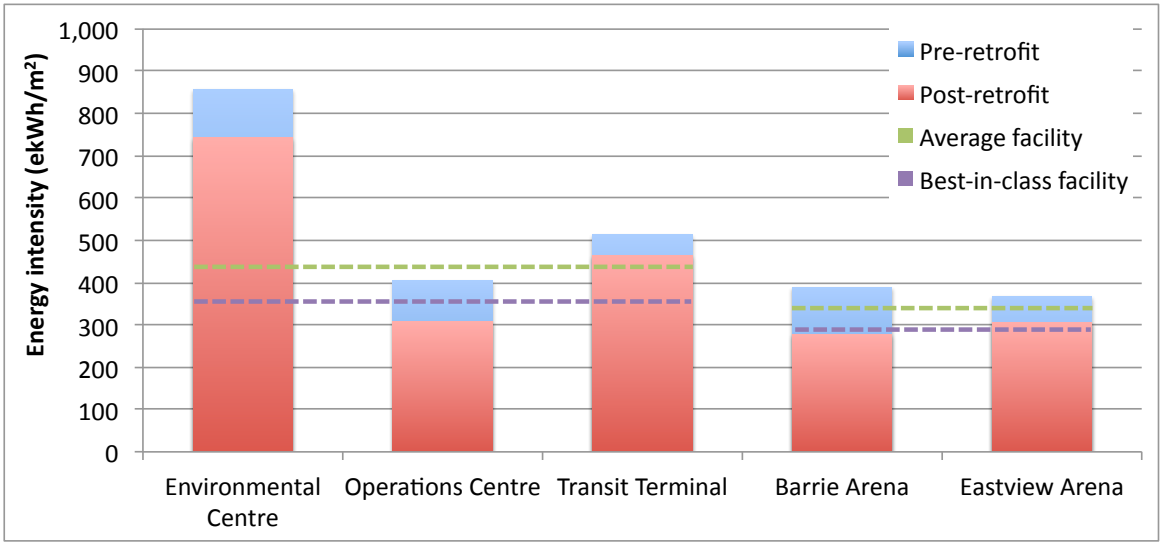


Figure 6. Benchmarking for public works and single pad ice rinks

Retrofits for the water treatment system were only identified in aggregate, and not for specific sites or land holdings. As such, Figure 7 to Figure 10 report on pre-retrofit energy intensities only.

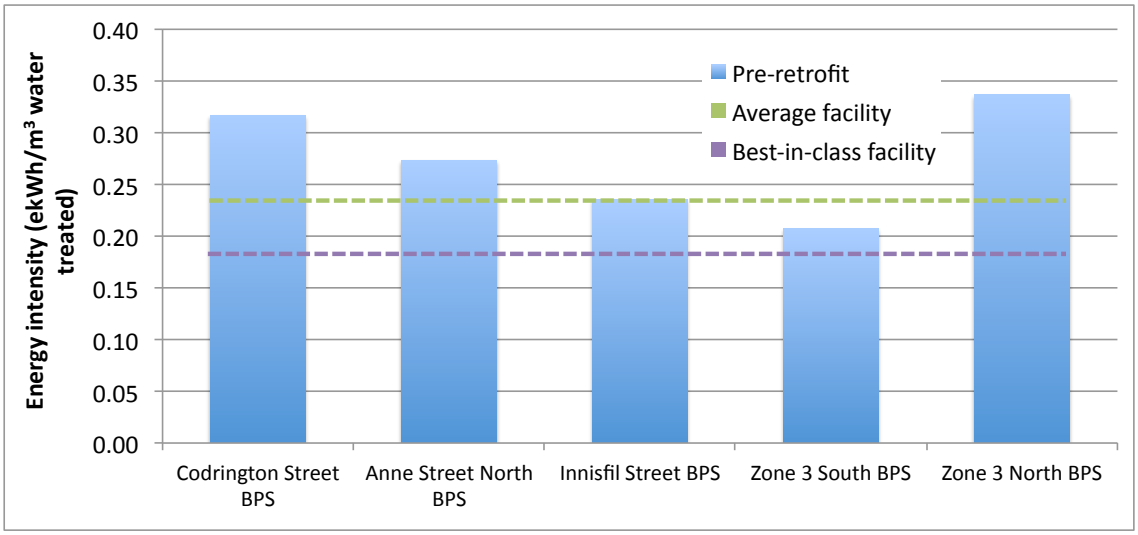


Figure 7. Benchmarking for booster stations

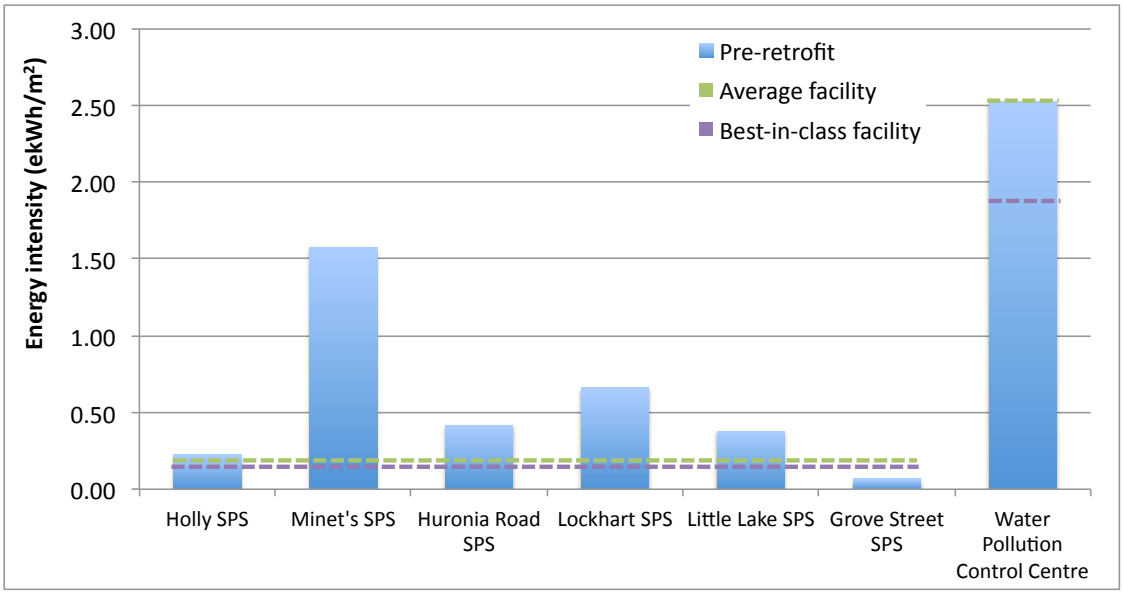


Figure 8 Benchmarking for treatment pumping and the treatment plant

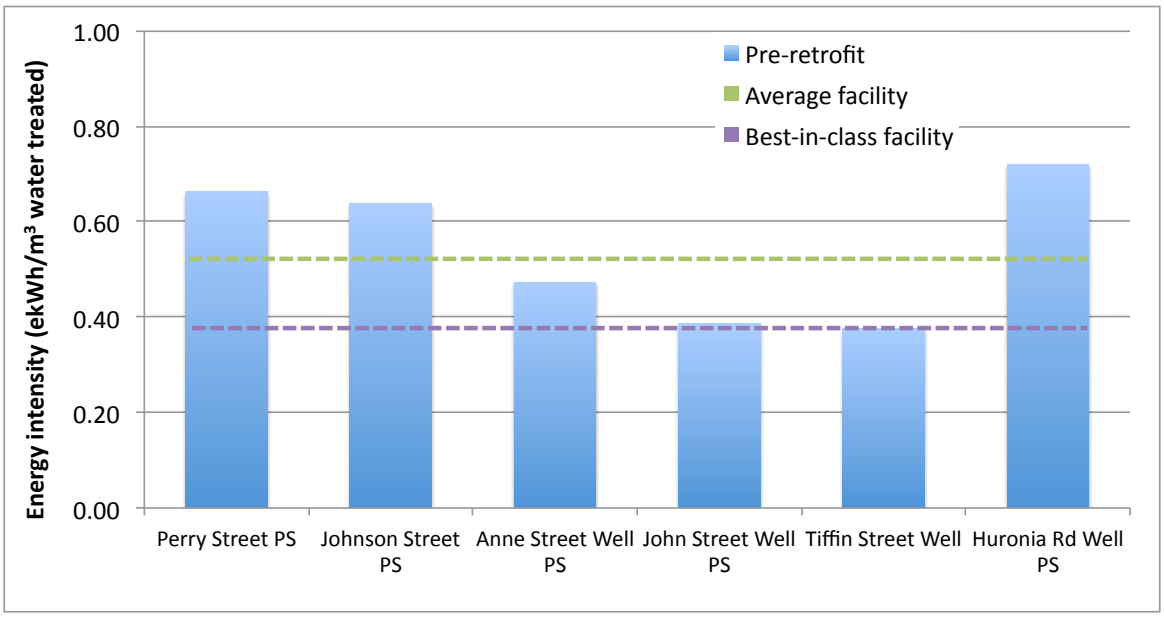


Figure 9. Benchmarking for well stations (1)

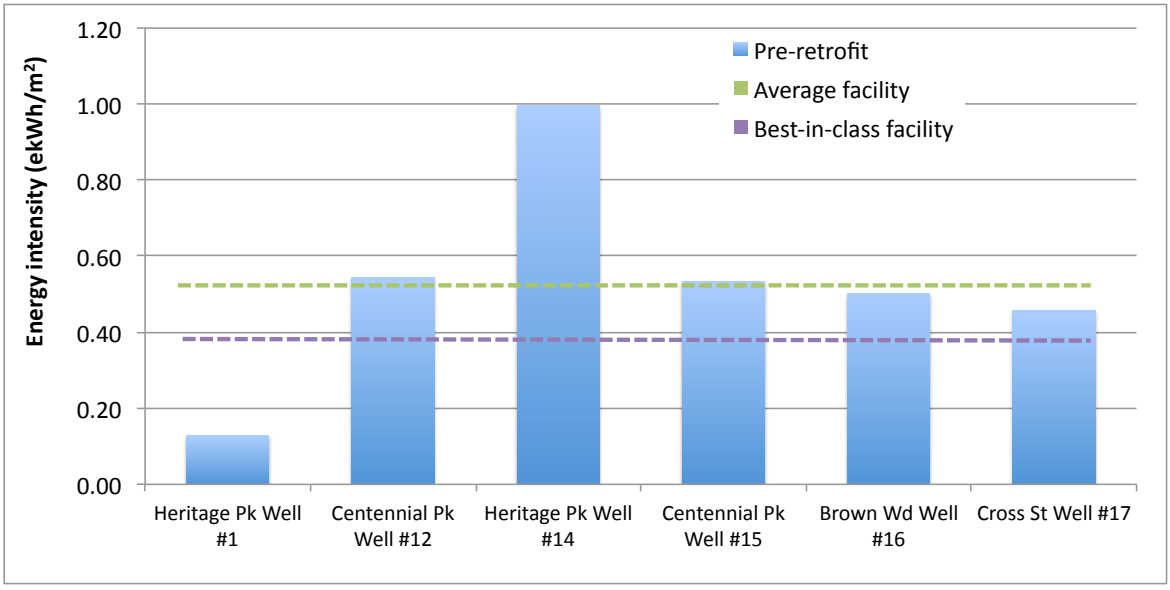


Figure 10. Benchmarking for well stations (2)

Findings

The benchmarking of City facilities and land holdings has shown that retrofits identified by the facility audits will enable many facilities to reach best-in-class energy performance. While some facilities have energy intensities that are above their comparable Ontario average benchmarked intensity, two issues must be considered. The first is that average and best-in-class intensities are general by nature and may not

should not necessarily be targeted first. The most efficient means of retrofitting the City facilities is to implement measures that achieve the greatest bill savings in relation to the capital cost of implementation. Step 3: "Moving from the present to the preferred state of energy" - Technological actions section of the report provides a schedule that prioritizes retrofits (based on IRR) for achieving the post-retrofit intensities identified in the benchmarking figures.

Energy procurement and use

Our team investigated energy procurement in the City of Barrie. The Corporation purchases the vast majority of its electricity and natural gas from PowerStream and Enbridge Gas Distribution, respectively. In addition, one local generation system provides a very small fraction of the City's energy. The 0.5 MW co-generation system at the City's Water Pollution Control Centre runs on bio gas and produces 2,000 MWh of energy per year.

The City has recently developed an energy procurement strategy to better manage energy costs.

Energy management practices in Barrie

Overview

An overview of the energy management practices in Barrie is provided in Table 3 below.

We expand on the City's plans, policies and strategies, on energy projects, and on regulatory changes that will affect energy management in Barrie in the sections that follow and in Appendix A.

Table 3 Overview of the energy management practices in the City of Barrie as they relate to the goals identified in the preferred state

Goal: Broad-based awareness and commitment
Awareness of energy use and commitment to energy efficiency are low among City staff. • Energy costs and energy use have increased, and are forecasted to increase further. The City has recently developed an energy procurement strategy to better manage energy costs. • Energy is not visible to City decision makers such as Council, senior City staff, general staff and the public. This leads to a lack of understanding of the costs of energy and opportunities for energy efficiency. • The City does not communicate around energy, although it already benefits from various existing communication channels/ media and key contacts. • Occasional efforts are made to raise general staff awareness about energy. However, this has had very little impact so far (e.g. electric heaters under desk,

computers on 24/7, etc.).

- The City has access to many media venues (advertising in local newspapers, radio spots, etc.).

Goal: Integrated and coordinated approach

Several City plans and strategies support energy efficiency and sustainability.

- The Community Energy Plan, Official Plan and participation in the Partnership for Climate Protection program lead to a number of energy and sustainability goals.
- The City has adopted LEED silver as a standard for new buildings.

The City's organizational structure complicates the coordination and facilitation of energy action.

- There is limited collaboration between departments/knowledge sharing around energy conservation.
- There are not clear roles and responsibilities within the City to manage energy.
- There is no Energy Management Group to highlight the importance of energy to Senior Management and City staff and encourage action.
- There is a number of different energy cost centers within the Corporation (e.g. street light, traffic lighting, etc.) which makes it harder to coordinate action.
- The City has developed mechanisms to increase the profile and significance of various strategic initiatives that can serve as a model for energy and sustainability (e.g. culture).
- Utility incentive (grant) programs are occasionally used, but not consistently.

Goal: Optimized processes to encourage innovation

Existing project approval and funding lacks rigour, transparency and efficiency.

- There is a need to justify each small expenditure on energy efficiency because there is not an overall business case or energy retrofit plan.
- The City lacks an implementation plan to accompany audits and an evaluation plan to measure energy savings.
- Project justification form goes to Supervisor and then through Manager of Facility Operations who selects projects for the capital budget request.
- There are no formal project evaluation criteria. This results in having projects competing against one another and taking a longer time to get funded.
- Small projects can benefit from operating budget and do not have to go through the capital budget process.
- There is a limited time between approval from purchasing and end of the window for implementing projects. Delays often occur in the purchasing department and also in issuing RfPs.

Energy data availability is insufficient to allow sound planning, decision making and evaluation.

- The City does not have an energy management system (EMS) at this time.
- The City has little access to sub-metering data, though it has created a webpage for Community Operations and Facilities Coordinators to see energy use. It is still rarely used (building operators are not always sure how to use it).
- The City has recently activated Powerview that shows hourly usage, 2-day delay (September 2011) but no training has been offered to staff yet.
- Staff do not have access to energy use in the facilities they manage. They never see the invoices, bills or usage information. It makes it hard to identify energy savings opportunities.
- Finance tracks energy cost but not energy use.

Facilities staff have energy expertise, but are not yet encouraged or rewarded for their efforts.

- Facilities Supervisors and Coordinators understand the energy dimensions of their building(s) and are interested in improving operational energy efficiency. They have also made efforts to learn from successful experiments.
- There is no venue for City staff to share their ideas.
- Savings from energy efficiency projects do not go back to the departments that implemented them.
- Energy efficiency is not a performance metric for City staff.
- Facilities staff often have to focus on more immediate matters than planning or monitoring energy use.

Goal: Improved energy and environmental performance

A number of energy projects have been successfully implemented, though few are large scale.

- Some staff have taken the lead to design and implement energy efficiency projects and have ideas for further improvements.
- Large projects are generally the first cut during capital budgeting, regardless of return on investment (ROI).
- The City has been looking at a 3-year payback to decide which energy projects to fund.

- The maximum expenditure on an energy efficiency project is relatively low and is forcing staff to find some money "ad hoc". This leads to inconsistency of upgrades within buildings and across buildings.
- The City has not yet developed any renewable energy projects. It has implemented a landfill gas facility.

Energy policies, plans and programs

Our team reviewed the City of Barrie's existing energy-related policies, plans and programs in order to ensure integration with the EMP.

Several City plans and strategies support energy efficiency and sustainability. These plans and strategies are briefly described below.

City Council Strategic Plan 2010-2014

Several strategic priorities included in the 2010-2014 Strategic Plan support an enhanced focus on energy management. These include:

- Manage growth and protect the environment;
- Strengthen Barrie's financial condition;
- Improve and expand Community involvement and City interactions.

Investing in energy efficiency and sustainability is a key aspect of protecting the environment.

Investing in energy efficiency also presents opportunities to reduce City expenditures on energy. Saving money on energy is particularly important given the City's budgetary strains. According to the 2011-2020 capital plan, the City of Barrie is struggling to maintain current services at desired levels and to provide additional services in response to growth.

Finally, energy sustainability can provide the basis for increased engagement with the public and demonstration of City leadership.

Greenhouse Gas Inventory and Community Energy Plan (Partnership for Climate Protection)

Energy use is a prime contributor to greenhouse gas emissions, and energy efficiency is a significant opportunity for reducing greenhouse gas emissions. In 2001, the City joined the Partnership for Climate Protection program (PCP).[3] As a PCP member, the City of Barrie has committed to reducing greenhouse gas emissions and taking action on climate change by:

1 Creating a greenhouse gas inventory and forecast;
2 Establishing an emissions reduction target;
3 Developing a local action plan;
4 Implementing the local action plan;
5 Monitoring progress and reporting results.

In 2006, the City completed a greenhouse gas inventory for both:

- The corporate entity - including city-owned facilities, fleets and street lights;
- The Community – including residences, businesses, solid waste and transportation (baseline year: 1994).

Barrie's City Council endorsed the goal of reducing community emissions to 6% below the 2001 baseline by 2012. This would lower emissions to 1994 levels. Council also adopted the Community Energy Plan report and formed a Community Energy Steering Committee (no longer active). Council has not yet adopted a corporate greenhouse gas emissions reduction goal.

The recommendations of the 2006 Community Energy Plan report are included in Appendix B.

LEED Corporate Facilities Standards

In 2008, Barrie City Council approved a recommendation to apply LEED (Leadership in Energy and Environmental Design) standards in construction and major renovations of City-owned buildings.[4] All new corporate facilities with a footprint of more than 5,400 ft^2 are now designed, delivered and certified by the Canadian Green Building Council at a minimum of LEED Silver. LEED standards also apply to major additions to existing buildings.

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[3] PCP is a partnership between the Federation of Canadian Municipalities (FCM) and ICLEI – Local Governments for Sustainability.

[4] LEED Standards: Leadership in Energy and Environmental Design (LEED) is an internationally recognized green building certification system. Developed by the U.S. Green Building Council (USGBC), the LEED rating system promotes a whole-building approach to sustainability. To achieve LEED certification, new buildings must gain points in key areas including: water efficiency, energy and atmosphere, and materials and resources. For more information, see: http://www.usgbc.org/DisplayPage.aspx?CategoryID=19

Integrated Energy Mapping Strategy

In 2011, the City of Barrie partnered with the Canadian Urban Institute (CUI), PowerStream and Enbridge Gas to evaluate Community and corporate energy reduction strategies as part of the Integrated Mapping Project for Ontario Communities.

The Mapping Project works with cities to analyze the relationship of population growth, employment growth, land-use and transportation to energy use and supply. For the City of Barrie in particular, it provided an energy use baseline and included:

1. An evaluation of the energy reduction opportunities for new and existing buildings;
2. A review of opportunities to use alternative and renewable energy technologies;
3. Tools for monitoring and evaluating progress toward energy and greenhouse gas objectives.

The recommendations of the 2011 Integrated Energy Mapping report are included in Appendix B.

Energy efficiency and renewable energy projects

Our team reviewed the City of Barrie's completed and planned energy efficiency projects. These projects stem from a series of facility audits. Our team also investigated the City's renewable energy efforts.

Energy efficiency projects

The City of Barrie has developed and implemented a number of energy efficiency projects based on recommendations from audits.

Its project database[5] includes 21 planned and 7 completed energy projects (excluding water) in a variety of public facilities.

Lighting retrofits and heating and cooling control systems, in particular, dominate the list, accounting for more than 60% of all the projects. Completed and planned efficiency projects generally target one aspect of a particular facility's energy use. Individual measures to improve this aspect of energy use are assessed primarily based on payback periods identified through audits.

Completed projects: completed projects are estimated to be achieving total annual savings exceeding $45,000, 397,000 kWh/year of electricity savings and 14,500 cubic metres of natural gas/year. Together, they cost approximately $155,000. Their payback period did not exceed 4 years.

[5] "Energy conservation measures" database document provided by the City of Barrie, July 5, 2011.

While the City of Barrie's current efforts are promising, many opportunities to reduce energy use remain untapped. "Deep" efficiency projects have not been undertaken for reasons that include:

- The City has been looking at a 3-year payback to decide to fund energy projects, even though savings from some of these projects will persist far longer;
- Large projects are generally the first cut during capital budgeting.

Furthermore, the City has not evaluated the real energy and cost savings from completed projects.

Details of completed projects (savings, costs, payback periods) are included in Appendix A.

Planned projects: the City of Barrie is planning to undertake several projects in 2012 and 2013 that are more significant than those already achieved with projected annual savings totalling almost $300,000, more than 2 million kilowatt-hours per year of electricity and 150,000 cubic metres of gas. Together, they will cost approximately $1.2 million. Their costs will range from $1,000 to $232,000.

Details of planned projects are included in Appendix A.

Renewable energy projects

The City of Barrie explored the economic feasibility of various renewable and alternative energy technologies within the Integrated Energy Mapping project.

The City is also leasing the roof of one of the City buildings to the PowerStream Solar program. The program offers commercial, industrial and institutional building owners the opportunity to lease their rooftops for large-scale solar PV installation that will be connected to the grid under the Feed-In-Tariff program.

However, the City has not yet developed any renewable energy projects.

Recent regulatory changes

Energy Conservation and Demand Management Plans regulation

On January 1, 2012, the *Energy Conservation and Demand Management Plans* regulation 397/11 under the *Green Energy Act (2009)* came into effect, requiring public agencies to report annually on energy use and greenhouse gas emissions beginning July 1, 2013. In addition to reporting total energy used and greenhouse gas emissions, municipalities will report greenhouse gas *intensity* (per square foot) and energy *intensity* (per square foot), by facility and by "operation type" (listed below).

Starting July 1, 2014, public agencies will also be required to develop and implement five-year energy conservation and demand management plans. Plans must include, among other things:

- Goals and objectives for conserving energy, reducing energy use and managing energy demand;
- Proposed measures, and the associated cost and saving estimates;
- Timeframes associated with the energy conservation and demand management measures;
- Confirmation that the plan has been approved by City's senior management.

Measures implemented before July 1, 2014 can also be included in municipalities' first plans. At the end of the five-year plan period (by July 1, 2019), the City must report on results achieved, current and proposed measures with a revised forecast of expected results, and other proposed changes to assist in reaching targets.

Municipal operation "types" covered by the regulation include:

- Administrative offices;
- Public libraries;
- Cultural and recreational facilities;
- Ambulance stations and facilities;
- Fire stations and facilities;
- Police stations and facilities;
- Storage facilities;
- Water and sewage treatment/pumping;
- Parking garages.

New construction and performance standards

The National Research Council Canada (NRCC) published the Model National Energy Code for Buildings (MNECB) 1997. This is a model energy efficiency code that sets minimum standards of construction for building components and features that affect a building's energy efficiency.

Effective January 1, 2012 the new energy efficiency requirements of the Ontario Building Code (OBC) came into effect, so that any new construction projects must be at least 25% greater than the energy efficiency levels attained by compliance to the MNECB. An energy and sustainable building consultant would be required to demonstrate a building's ability to reduce energy use by 25 % using an energy modelling software to compare the new building to a similar building designed according to MNECB standards.

Whereas buildings codes are designed first and foremost to meet health and safety requirements, the MNECB sets the minimum standards for energy efficiency. Like all other codes, the MNECB requirements do not necessarily represent optimized energy efficiency levels; the technology to achieve greater energy savings is currently available.

S.W.O.T analysis

Based on the review and analysis of the key components mentioned above and the lessons learned from the interviews with City staff, our team identified the key strengths, weaknesses, opportunities and threats of the present state of energy use in the City of Barrie.

This type of analysis helps to identify not only areas for improvement (weaknesses) and potential risks (threats). It also highlights key strengths and opportunities that can be used to move forward.

As illustrated below, the City of Barrie can rely on key strengths including but not limited to strong in-house technical expertise and achievement of successful energy reduction projects in the past. Strengths can lead to opportunities. For example, the City of Barrie can build on its dedicated and skilled team to identify further areas of energy efficiency improvements.

Like many organizations, the City also has weaknesses that could lead to threats if those were not to be addressed. The City of Barrie has already made efforts to become more energy efficient. Unfortunately, energy is still not visible enough to decision makers such as senior City staff and Council, who authorize funds for energy projects in a very constrained environment. The existing organizational structure, project approval and funding process do not lead to energy being a strategic priority within the organization.

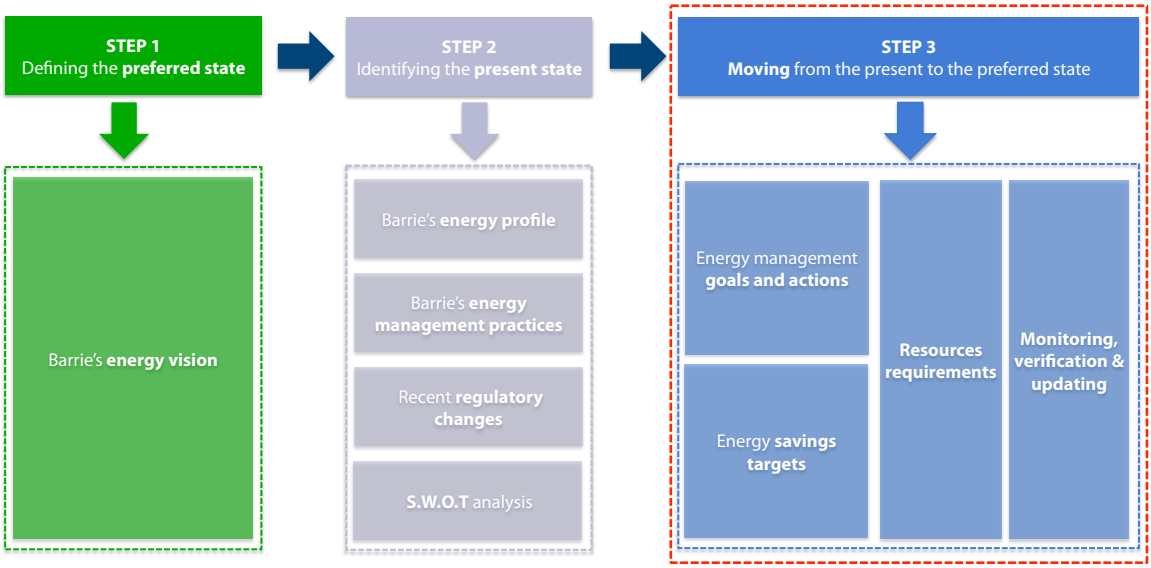
The key elements of the S.W.O.T are described in greater detail in Table 4 below. Feedback on the S.W.O.T was obtained during the strategic planning workshop with City staff.

Table 4 S.W.O.T Analysis of the City of Barrie's present state of energy use

Strengths	Weaknesses
• Successful implementation of some energy efficiency projects in existing facilities • Adoption of ambitious environmental standards for new buildings (e.g. LEED Silver) • Support for energy efficiency expressed by some senior staff members • Innovative, creative team eager to increase energy efficiency • In-house technical expertise	• No large energy efficiency projects to date • Organizational structure and processes that hinder a focus on energy • Limited financial and staff resources for energy efficiency planning and implementation • Minimal access to energy use data • Slow project approval and funding process that lacks transparency • No formal energy efficiency project evaluation, measurement and verification protocols • No incentives/rewards to encourage staff or departments to pursue energy efficiency • Low visibility of energy in the Corporation • Minimal energy awareness, commitment and communication among most staff and Council • Weak coordination with utilities • New building standards that do not consistently deliver the best energy efficiency outcomes

Opportunities	Threats
• Audits that have already identified further energy efficiency improvements • Lessons learned from previous re-organization initiatives (e.g. Culture Department) that can be leveraged to create a sustainability/energy management group and give energy a strategic significance within the organization • Existing communication channels/tools that can be easily leveraged for energy-related purposes • New and strengthened partnerships with utilities and Community organizations • A new regulation that requires municipal energy and GHG monitoring, planning, target-setting and reporting starting 2013 • New construction and performance standards effective since January 1, 2012 (MNECB)	• Lack of clear energy roles and responsibilities that result in a lack of coordination across City departments • Increasing budget constraints that increase hesitance to devote money to energy projects • Addition of new energy efficiency projects that stretch limited resources

Moving from the present state to the preferred state



Moving from the present state to the preferred state represented the third step in our planning process.

In this step, we developed an action plan to assist the City of Barrie in moving from its present to its preferred state of energy. In concert with key City staff and decision makers, we formulated energy management goals and actions to be achieved by the City between 2012 and 2017.

We developed energy savings targets over the six-year timeframe.

We assessed the financial and human resources required in order to successfully implement the plan.

Finally, we investigated the key components of a monitoring, verification and updating process that would help the City of Barrie better measure and analyze its energy use and cost.

Details on each of these topics are provided in the following sections.

Energy management goals, measures and actions

Our team has identified two major types of initiatives:

- Management/organizational measures;
- Technological actions.

Each of those were divided into one of the following stream:

- High priority initiatives – To be achieved in the first year (2012);
- Medium priority initiatives – To be achieved in the second and third year (2013 and 2014);

- Low priority initiatives – To be achieved in the final three years (2015, 2016 and 2017).

Initiatives that are rated as "low priority" should not be ignored until the end of the six-year period. Starting in 2012, City staff can think ahead and plan to implement the measures and actions in all time periods. They should also be prepared to implement measures and actions ahead of this schedule if relevant opportunities arise.

Management/organizational measures

Management/organizational measures were rated as high, medium and low priority based on their importance and relative ease of implementation. The process for developing management/organizational options and establishing their priority level is described in Appendix E.

High priority measures

We recommend that the City of Barrie implements the six measures listed in Table 5 below. They stem from our consultation with key City staff as well as recommendations made in previous plans/ strategies. All of these measures were rated as both highly important and relatively easy to implement. They should be implemented in the first year of the plan (2012).

Table 5 High priority measures (2012)

Goal: Broad awareness and commitment
Primary measure: Reach out to Council and facilitate its understanding of energy significance through the development of a compelling business case (including anticipated results and cost avoidance). **Supporting measures** • Develop an energy policy document outlining long-term targets, savings and associated resources and budget requirements.
Goal: Improved energy and environmental performance
Primary measure: Ensure energy efficiency consistency across City buildings. **Supporting measures** • Design an implementation plan that systematically accompanies audits. • Design an evaluation plan that measures the energy savings generated by the energy retrofits implemented. • Systematically include GHG metrics in the implementation and evaluation plan.

Goal: Integrated and coordinated approach

Primary measure: Create a sustainability/energy management structure.[6]

Supporting measures

- Nominate a key energy champion responsible for encouraging the creation of the energy/sustainability group.
- Find and allocate appropriate resources (with direct links to General Managers) to the energy group.

Goal: Optimized processes to encourage innovation

Primary measure: Take advantage of all available resources and funding options to successfully undertake energy projects.

Supporting measures

- Establish an efficient process for energy project evaluation (selection and approval) and funding.
- Investigate alternative or supportive funding options: e.g. energy efficiency grants from NRCan, Federation of Canadian Municipalities Green Fund, incentives from utilities (PowerStream and Enbridge).
- Investigate the feasibility of creating a revolving fund.

Primary measure: Monitor and verify ROI or IRR to enable re-investment.

Supporting measures

- Establish verification processes that enable demonstrated savings to be reinvested.

Primary measure: Better analyze energy use and costs within City facilities and operations.

Supporting measures

- Acquire and implement an energy management system (EMS) that brings together all information on energy and water use into one place i.e. portal that enables trending analysis, monitoring and presenting the information on a dashboard.
- Ensure that Facility staff review, record and report meter readings, for gas especially (until the EMS is acquired and implemented).
- Develop clear, understandable reports on energy use for Facility Managers.
- Work with PowerStream and Enbridge to ensure that real-time electricity data and (at least) daily gas data are available to populate the EMS. E.g. Discuss with Enbridge the possibility of preparing custom reports, separate from bills.

[6] See "Resource requirements" – Human resources section on P44-52 for greater details.

Medium priority measures

The four measures listed below were assigned a medium priority rating. This rating suggests that these measures should be implemented in the second and third year of the plan (2013 and 2014). Of course, if resources are available to implement these measures earlier, the benefits they lead to will be realized earlier.

Table 6 Medium priority measures (2013, 2014)

Goal: Broad awareness and commitment
Primary measure: Communicate energy successes regularly and effectively to both internal and external City stakeholders (including Council). **Supporting measures** • Include energy considerations in the City's Communication Policy/Plan (e.g. energy related communication: frequency, type of content, party responsible, etc.). • Make energy a dedicated focus within the Communications and Intergovernmental Affairs Department and ensure support of someone from the energy/sustainability group. • Leverage free and existing communication tools to get media's attention on City's energy efficiency efforts. E.g. The Communication and Intergovernmental Affairs Department could incorporate energy matters in both the e-newsletter that is issued to any member of public registered on the City of Barrie's website (around 9,000 people) and its internal city e-newsletter that every employee gets. • Use key contacts to promote energy. E.g. The Communication and Intergovernmental Affairs Department has good relationships with the Mayor. It could use those to help promote energy internally (staff) and externally (Community).
Goal: Integrated and coordinated approach
Primary measure: Strengthen partnerships with external stakeholders (e.g. utilities). **Supporting measures** • Meet with PowerStream and Enbridge to discuss potential areas of collaboration. • Explore collaboration opportunities with private firms and Community institutions to undertake energy projects (e.g. demonstration projects).
Goal: Improved energy and environmental performance
Primary measure: Encourage energy efficiency actions in new and existing City buildings. **Supporting measures** • Develop/modify job descriptions to specifically allocate time to energy efficiency activities and to include energy performance benchmarks. • Evaluate energy efficiency as part of performance metrics/requirements for Facility

Operators.

- Develop incentives that reward energy efficient departments.
- Develop new building design standards that specifically include an energy efficiency metric.
- Develop energy performance standards approved by Council.
- Develop/amend Purchasing Policy/Guidelines to include energy considerations.

Goal: Optimized processes to encourage innovation

Primary measure: Re-invest the money obtained through energy savings into energy projects.

Supporting measures

- Create a separate fund (revolving fund) enabling money saved through energy improvements to be reinvested into energy projects (See appendix D).
- Design a policy to obtain Council's approval to authorize a separate fund.

Low priority measures

The two measures described below were given a low priority rating because they are either very difficult to implement, or are less critical than the other measures. This rating does not mean that they should be ignored, but should be completed in 2015, 2016 and 2017. Planning and implementation should begin earlier, if feasible.

Table 7 Low priority measures (2015, 2016, 2017)

Goal: Broad awareness and commitment

Primary measure: Raise City staff awareness around energy efficiency.

Supporting measures

- Organize regular energy training/information/ education sessions.
- Develop an "energy ambassador"(education) program for all City staff, with appropriate recognition/reinforcement/communication (e.g. "energy awareness week").

Goal: Improved energy and environmental performance

Primary measure: Identify and seize renewable energy opportunities.

Supporting measures

- Build on the opportunities identified as part of the Integrated Energy Mapping Strategy.
- Take advantage of government funding and mechanisms to help develop renewables.

Technological actions

Our team built on the audits performed in City facilities and operations in Phase 1 of the project in order to recommend retrofits for the City of Barrie to implement.

These retrofits were ranked on the basis of their bill savings in relation to their capital costs of implementation. This metric was quantified with an internal rate of return (IRR).

A prioritized list of recommended retrofits along with their IRR are provided in Table 8 below. Retrofits were divided across years in a manner that front loads those with high IRR in the early years but maintains an even distribution of capital expenditures across all six years. A review of the internal rates of return of the retrofits indicates that they represent an incredible investment opportunity for the City.

A description of some of the categories of retrofits described in Table 8 can be found in Appendix F.

Table 8 Schedule of retrofits

Building	Measure	Implementation year	Cost of retrofit	Annual savings (ekWh)	Possible incentives	IRR
Operations Ctr	Monitoring & Tracking, Training & Education	2012	$2,000	77,778	$0	287%
Transit terminal	Reduce the Hours of Operation for the Rooftop Units Serving the Second Floor	2012	$700	26,667	$0	256%
Public library	Tighten the Operating Schedules to Match Operating Hours	2012	$3,000	73,056	$0	246%
Police station	Monitoring & Tracking, Training & Education	2012	$2,000	68,889	$0	243%
East Bayfield CC	Monitoring & Tracking, Training & Education	2012	$5,000	146,390	$0	223%
East Bayfield CC	Control the Fresh Air Supply to the Pool Area Based on the Air Quality in the Area	2012	$7,500	162,779	$0	220%
Public library	Install Low Flow Aerators	2012	$400	5,278	$49	206%
East Bayfield CC	Introduce Tighter Scheduling in the Building	2012	$4,300	84,167	$0	198%
Allendale Ctr	Pushbutton Override Installation	2012	$1,840	59,445	$559	193%
Allendale Ctr	Arena Lighting Controls	2012	$1,380	12,222	$616	164%
Molson Centre	Monitoring & Tracking, Training & Education	2012	$5,000	111,668	$0	160%
Molson Centre	Introduce New Controls for the Refrigeration Equipment	2012	$30,500	172,501	$17,256	133%
Allendale Ctr	Arena Redesign	2012	$22,994	127,501	$12,763	127%
City hall	Monitoring & Tracking, Training & Education	2012	$5,000	76,945	$0	127%
Police station	Install Low Flow Showerheads & Aerators	2012	$1,400	14,167	$134	125%
MacLaren Art Ctr	Install Low Flow Aerators	2012	$200	1,389	$14	115%
MacLaren Art Ctr	Schedule the Operation of the RTU-1 to Match Facility Operation	2012	$9,200	123,612	$0	110%
Public library	Monitoring & Tracking, Training & Education	2012	$2,000	25,834	$0	102%
Operations Ctr	Install Low-Flow Showerheads & Aerators	2012	$1,000	7,222	$67	99%
Police station	Lighting Retrofit	2012	$85,700	191,113	$27,968	99%
Transit terminal	Install Central Control for the Baseboard Heaters Operation	2012	$2,500	11,945	$1,195	94%
Eastview arena	Monitoring & Tracking, Training & Education	2012	$1,250	15,278	$0	92%
Operations Ctr	Introduce Night Setback for the Office Area	2012	$2,900	38,889	$0	85%

Building	Measure	Implementation year	Cost of retrofit	Annual savings (ekWh)	Possible incentives	IRR
MacLaren Art Ctr	Monitoring & Tracking, Training & Education	2012	$2,000	21,667	$0	85%
Eastview arena	Building Envelope Upgrades	2012	$1,800	7,778	$790	80%
Allendale Ctr	Ice Plant Controls	2012	$25,300	108,056	$10,812	77%
Enviro Ctr	Monitoring & Tracking, Training & Education	2012	$2,000	20,000	$0	74%
Enviro Ctr	Introduce Night Setback & Scheduling for Equipment Operation	2012	$3,700	49,167	$0	58%
Water treatment	VFD installation on pumps	2012	$354,500	1,267,000	$126,700	58%
City hall	Building Envelope Upgrades	2012	$1,000	11,945	$115	57%
East Bayfield CC	Install Vending Machine Controls	2012	$1,100	3,611	$375	54%
Operations Ctr	Building Envelope Improvements	2012	$2,300	26,389	$249	53%
Transit terminal	Monitoring & Tracking, Training & Education	2012	$2,500	18,333	$0	52%
Molson Centre	Install Vending Machine Controls	2012	$1,700	5,556	$555	50%
Operations Ctr	Install Controls for the Electric Block Heaters for the Diesel Trucks	2012	$21,200	66,389	$6,650	48%
Enviro Ctr	Install Low Flow Showerheads & Aerators	2012	$500	1,667	$17	47%
Allendale Ctr	BAS Upgrade & TOD Scheduling	2012	$9,200	76,390	$1,313	45%
Molson Centre	Introduce/increase scheduling for Supply Fans SF-1, SF-2 and SF-3 and replace their gas-fired heating sections with glycol heating coils	2012	$205,300	1,138,342	$40,698	42%
Eastview arena	Install Vending Machine Controls	2012	$500	1,389	$140	41%
Enviro Ctr	Eliminate the Use of the Hot Water Storage Tank	2012	$300	2,500	$0	35%
City hall	Lighting Retrofit	2013	$121,700	415,837	$20,790	54%
Allendale Ctr	Domestic Water Retrofit	2013	$64,400	150,835	$1,420	52%
Public library	Control the Fresh Air Flow to the Building based on Occupancy & Air Quality, Recommission the Building Mechanical Systems Operation, and Lower the Boilers' Primary Loop Temperature	2013	$18,100	76,390	$4,022	47%
Allendale Ctr	Insulate Brine Header	2013	$25,990	65,001	$6,512	42%

Building	Measure	Implementation year	Cost of retrofit	Annual savings (ekWh)	Possible incentives	IRR
City hall	Install Controls for the Refrigeration Equipment Serving the Ice Rink	2013	$22,600	56,389	$5,629	42%
Eastview arena	Install Controls System for the Refrigeration Equipment	2013	$22,600	55,556	$5,559	41%
Operations Ctr	Install Controls for the Electric Heaters based on Building Occupancy	2013	$11,700	28,334	$2,830	40%
Operations Ctr	Install Vending Machine Controls	2013	$600	1,389	$140	38%
Transit terminal	Lighting Retrofit	2013	$11,200	29,445	$1,478	38%
Allendale Ctr	Low E Ceiling for Blue Arena	2013	$32,200	75,001	$7,500	38%
East Bayfield CC	Lighting Retrofit	2013	$97,100	252,502	$12,625	37%
Molson Centre	Lighting Retrofit	2013	$58,000	148,335	$7,413	36%
East Bayfield CC	Install Low-E Ceilings in Both Arenas	2013	$105,300	238,613	$23,868	36%
Public library	Install Vending Machine Controls	2013	$1,000	2,222	$225	36%
MacLaren Art Ctr	Install an Interface between the Existing Siemens Control Panels for System Access	2013	$19,700	66,112	$3,372	33%
Transit terminal	Building Envelope Upgrades	2013	$3,200	20,556	$195	32%
Allendale Ctr	Programmable Thermostat Installation	2013	$920	1,944	$189	31%
Allendale Ctr	Occupancy Sensors	2013	$8,970	18,333	$1,824	31%
Eastview arena	Introduce Night Setback for the Lobby Heaters	2013	$5,600	10,556	$1,068	28%
Molson Centre	Install VFDs on Supply Fans SF-1 & SF-2 to Modulate Air Flow Based on Occupancy	2013	$37,300	118,890	$5,214	28%
Transit terminal	Install a Timer for the Split Systems in the Store & Drivers' Lounge	2013	$1,100	1,944	$192	25%
Operations Ctr	Replace the Existing Lunchroom Fridge with an Energy Efficient Model	2013	$500	833	$80	22%
Allendale Ctr	VSD on Cooling Tower Fan Motors	2013	$23,000	33,889	$3,388	20%
Allendale Ctr	Pool Redesign with 320W Metal Halide Pulse Start	2013	$9,200	12,222	$1,226	17%
Molson Centre	Install a New BAS System including the Main Equipment on Site	2014	$96,100	279,169	$15,223	29%
East Bayfield CC	Modulate the Air Flow from the HRU-1 & HRU-2 to Match Occupancy in the Building	2014	$81,400	299,447	$7,890	24%

Building	Measure	Implementation year	Cost of retrofit	Annual savings (ekWh)	Possible incentives	IRR
Allendale Ctr	Lighting Retrofit & Redesign	2014	$69,000	120,557	$6,022	22%
Police station	Retrofit the System to Variable Air Volume from Constant Volume with Terminal Reheats	2014	$259,500	905,007	$21,628	21%
Public library	Lighting Retrofit	2014	$47,900	74,167	$3,710	19%
Allendale Ctr	Ice Plant Heat Recovery - Blue Rink	2014	$101,200	412,226	$3,880	18%
Operations Ctr	Lighting Retrofit	2015	$232,400	365,281	$18,270	20%
Allendale Ctr	Pool Wastewater Heat Recovery System	2015	$27,600	105,556	$993	17%
Allendale Ctr	Building Envelope Sealing	2015	$18,170	72,778	$686	17%
Eastview arena	Lighting Retrofit	2015	$24,700	33,334	$1,670	16%
Allendale Ctr	Pool Redesign with T5HO Lamps	2015	$19,550	23,889	$2,394	15%
East Bayfield CC	Install Desiccant Dehumidification	2015	$83,000	76,112	$10,742	14%
MacLaren Art Ctr	Lighting Retrofit	2015	$30,700	37,500	$1,875	14%
Enviro Ctr	Lighting Retrofit	2015	$20,200	24,167	$1,208	14%
Transit terminal	Install a VAV Box for the Ticket Office to Reduce the Electric Heating Coil Operation	2015	$3,400	3,611	$351	13%
Molson Centre	Replace Existing Lead Boiler with a New High Efficiency Boiler	2015	$50,200	126,390	$1,206	10%
Eastview arena	Insulate the DHW Piping & Control DHW Recirculating Pumps	2015	$900	2,500	$30	10%
Operations Ctr	Replace the Existing Heaters in the Greenhouses with New Models	2015	$31,200	75,278	$712	10%
MacLaren Art Ctr	Convert the Electric Heating Coil in RTU-1 to Hydronic	2015	$31,000	-7,500	$4,175	8%
Allendale Ctr	Pool Cover	2015	$16,675	46,667	$440	6%
Operations Ctr	Introduce Night Setback for the Garage/Storage Areas	2015	$10,000	22,778	$0	5%
Enviro Ctr	Install Additional Temperature Sensors in the Outside Offices for Improved Unit Control	2015	$5,300	-2,500	$539	5%
Enviro Ctr	Replace the Gas-Fired Section of the Enmar Unit with a Glycol Heating Coil & a Condensing Boiler	2015	$28,100	42,223	$398	2%

Building	Measure	Implementation year	Cost of retrofit	Annual savings (ekWh)	Possible incentives	IRR
City hall	Replace the Existing Heating Boilers with New High Efficiency Equipment	2016	$136,300	334,725	$3,198	10%
Police station	Install a Direct Digital Control Building Automation System	2016	$179,100	216,113	$12,673	8%
Allendale Ctr	Ice Plant Heat Recovery - Red Rink	2016	$173,650	362,781	$3,415	6%
Operations Ctr	Install Circulation Fans for the Garage Area	2016	$113,000	226,113	$2,137	6%
Allendale Ctr	Demand Control Ventilation	2016	$4,600	3,333	$32	-2%
Allendale Ctr	Optimum Start/Stop	2016	$2,990	2,500	$23	-8%
East Bayfield CC	Install a Gas-Fired Condensing Boiler for HRU-1 & HRU-2 in place of the Gas-Fired Heating Burners	2017	$131,200	256,669	$2,452	6%
City hall	Install a New BAS which will allow for Full Control of the Existing Mechanical Equipment	2017	$293,900	215,557	$18,391	5%
Police station	Replace the Existing Hot Water Heating Boilers with New High Efficiency Boilers	2017	$146,500	166,668	$1,574	1%
MacLaren Art Ctr	Convert the Electric Humidifiers to Gas-Fired Humidifiers	2017	$32,900	-3,889	$2,160	0%

Energy savings targets

An energy savings target of 55 eGWh over the six-year timeframe was developed for the City of Barrie that considers energy savings (electricity, and natural gas) from retrofits identified in Table 8 as well as estimated energy savings from retrofits in buildings that did not undergo an energy audit.[7] The six-year energy target is detailed in Table 9.

Table 9 Six-year energy savings targets

	2012	2013	2014	2015	2016	2017	Total
Incremental energy saved from audited building retrofits (eMWh)	4,461	1,881	2,091	1,048	1,146	635	
Incremental energy saved from unaudited building retrofits (eMWh)[1]	346	204	227	114	124	69	
Percent of energy savings target achieved	40%	56%	75%	84%	94%	100%	
Total energy savings (eMWh)	**4,807**	**6,892**	**9,210**	**10,372**	**11,642**	**12,346**	**55,268**

1. Incremental energy savings refer to the savings achieved from retrofits being performed in the indicated year.
2. Total energy savings refers to the sum of the savings in the indicated year achieved from retrofits being performed in the indicated year and persisting savings from retrofits performed in previous years.

The net target across all facility divisions is a reduction in energy intensity of 20% below the 2007 levels by 2017, even with an estimated annual load growth of 0.38%.

Adapting to new regulatory changes

The actions, measures and targets recommended above should allow the City of Barrie to successfully adapt to the *Energy Conservation and Demand Management Plans regulation 397/11* under the *Green Energy Act* and the *New Construction and Performance Standards (MNECB)* described in the "Identifying the present state" - Recent regulatory changes section of this report.

In addition to these actions, the City of Barrie should continue having all new facilities constructed to achieve a minimum of LEED Silver designation.

There are also operational efficiencies that could be defined in order to manage energy use within the new and existing buildings. For example, the standardized temperature settings should be applied to all City

[7] Buildings that did not undergo an audit are the Barrie Arena, fire stations 1-4, and properties on Parkview, Southshore and Sunnidale. The energy savings from buildings that did not undergo an audit were estimated by comparing the audited and unaudited buildings' energy usage during a 2007 baseline year.

Facilities (unless a deviation from the standard is required due to mechanical or system limitations):

- Indoor temperature settings in all spaces during occupied periods should be 22°C (72°F) during the winter and 24°C (75°F) during the summer. Where available, occupants should be given the temporary capability of varying temperature +/- 1°C (2°F), resulting in 21-23°C (70-73°F) for heating and 23-25°C (74-77°F) for cooling;
- Indoor temperature settings in all spaces during unoccupied periods should be 18°C (64° F) during the winter and 27°C (81° F) during the summer. The exception is for pre-heating or pre-cooling periods necessary to maintain building system performance during occupied periods, especially during adverse weather conditions.

Occupants who control their own thermostats should also be required to adhere to these temperature standards.

In addition performance standards, which must be measurable and quantifiable, could also be instituted for new and existing buildings. The following are examples of potential standards of performance that the City of Barrie could implement:

- Minimum light levels in offices, hallways, storage areas, etc.;
- Maximum CO_2 level in offices, resident spaces, etc.;
- Fan operation: when outdoor air temperature > 12°C.

These definitions of the performance standards should not be arbitrary, and they would provide useful guidelines and checks when new energy efficiency measures are being considered (e.g. lighting retrofits, control of fresh air volume using CO_2, etc.). The performance standards must reflect building code requirements, good O&M practices, and occupant needs.

Resource requirements

This section aims to provide an initial indication of capital and human resources required for implementing the 2012-2017 energy management plan.

Capital resources

Requirements

The capital resources that would be required to implement the retrofits (recommended in the previous section), as well as the associated savings (both from reductions in energy use and from possible incentives) are provided in Table 10.

Table 10 Cost and savings associated with six-year energy savings plan

	2012	2013	2014	2015	2016	2017	*Total*
Estimated capital cost of retrofits	$923,000	$778,000	$726,000	$702,000	$676,000	$670,000	*$4,475,000*
Estimated retrofit incentives[1]	$276,000	$129,000	$65,000	$51,000	$24,000	$27,000	*$572,000*
Capital required	*$647,000*	*$649,000*	*$661,000*	*$651,000*	*$652,000*	*$643,000*	*$3,903,000*
Estimated bill savings[2]	**$0**	**$484,000**	**$712,000**	**$824,000**	**$916,000**	**$938,000**	***$3,874,000***

1. Estimated incentives are those from Enbridge's commercial incentive program, which offers $0.10/m3 of natural gas saved and the OPA ERII incentive program, which offers $0.10/kWh for non-lighting retrofits and $0.05/kWh for lighting retrofits.
2. Estimated bill savings are reported only for the six-year plan. However, bill savings are expected far beyond this timeframe. Estimated bill savings use current and forecasted electricity, natural gas and water rates reported by the Ontario Integrated Power Systems Plan (IPSP)

As shown in Table 10, the $4.5M in capital costs associated with implementing the retrofits will be almost completely offset by the $570k in available incentives and $3.9M in bill savings over the six-year plan. Energy savings will continue beyond 2017 and will lead to significant annual financial savings into the next decade. Bill savings over a fifteen-year timeframe are expected to be in the range of $10.6M.

Figure 11 shows Business as Usual (BAU) and with-retrofit scenarios for both energy use and energy costs. The business as usual (BAU) scenario was established for the period 2008 to 2017 by using the 2007 baseline energy use and cost information, and then applying an assumed load growth factor of 0.38% per year for the City. As well, unit price escalation of 3% was applied for all energy sources including electricity and natural gas.

The with-retrofit scenario was established for the same period using the factors detailed in the BAU above together with the target energy and bill reductions outlined in Table 10.

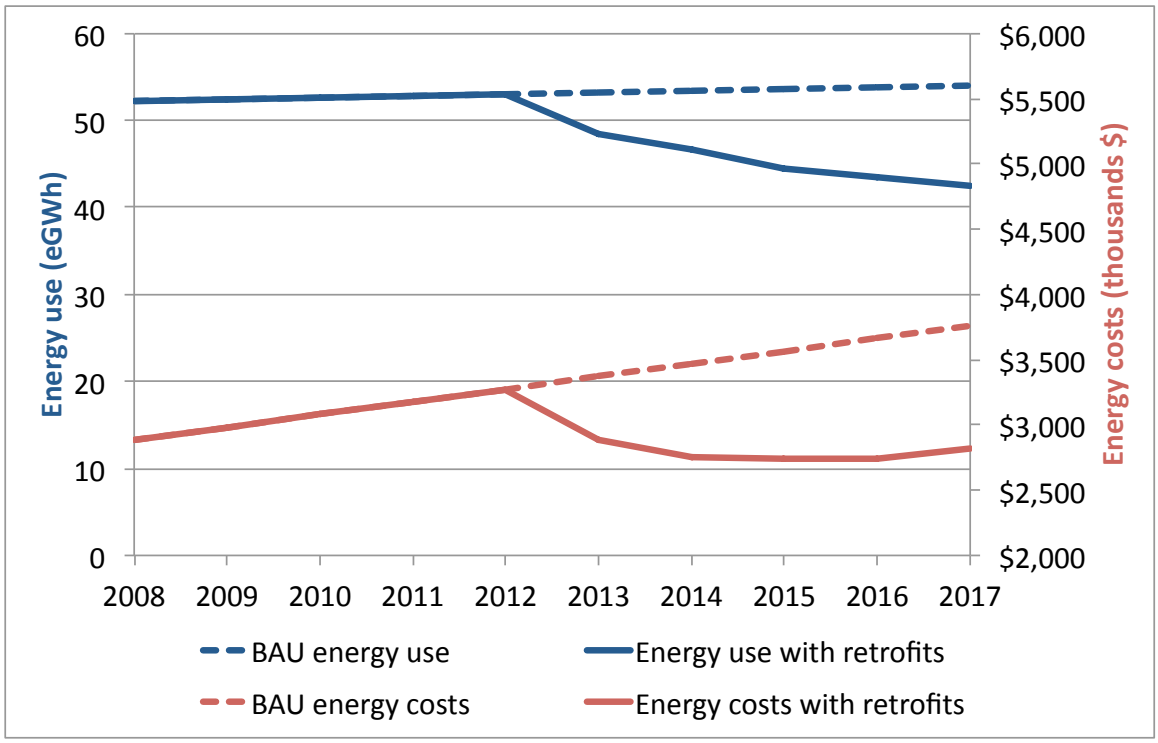


Figure 11 Energy use and costs forecasts

As can be seen in Figure 11, if the City of Barrie does nothing (BAU scenario) the 2008 annual energy cost of $2.9 million would escalate to $3.8 million by 2017. However, if the targets detailed in this energy management plan are implemented, the annual energy costs by 2017 would be $2.8 million, or $930 thousand below the BAU scenario. The City would achieve a total energy cost savings of $3.8 million dollars over six years. These savings would continue into the next decade.

Anticipated outcome

As outlined in Table 10 above, we anticipate significant energy and cost savings in Barrie, when the measures are implemented.

The experiences of other Ontario municipalities demonstrate the tremendous energy and cost savings associated with aggressive action on energy management plans.

The City of Hamilton's 2007 *Corporate Energy Policy* identified aggressive energy reduction targets, and strategies for achieving these targets: energy conservation and demand management in new and existing buildings, energy procurement, and purchasing policies.

Between 2007 and the end of 2011, the City of Hamilton's total cumulative energy savings exceeded $23 million. Energy conservation accounted for $9.1 million of these savings – operational savings totalled $5.1 million and incentives totalled $4 million.

The City's 2011 Energy Intensity (ekWh/ft^2) is 14% lower than 2005. The City's 2011 Energy Cost Utilization Index ($/ft^2) is 17% lower than 2005[8].

The Town of Richmond Hill reduced energy use by 8% and saved over $7 million in energy costs between 1992 and 2009, through over 20 building energy efficiency retrofits: lighting retrofits, energy efficient equipment upgrades, building automation systems, solar hot water heating, and geothermal heating and cooling.[9]

The Town's 2009 Energy Intensity is over 20% lower than 1990 (22% lower for electricity - kWh/ ft^2, and 33% lower for natural gas - m^3/ft^2)[10].

The 2009 *Energy Management Plan* identifies additional projects and other actions to further reduce energy use and greenhouse gas emissions.

The Region of Peel has realized 44 million dollars of savings total through all its energy management actions and practices undertaken since 2003.

Human resources

A key step in successfully implementing energy efficiency measures within the City of Barrie's municipal operations is to ensure that the organizational structure enables successful implementation of the EMP.

In order to develop organizational recommendations for the City of Barrie, our team reviewed a wide range of energy management plans (lessons learned and best practices) in ten other jurisdictions in North America. Details are provided in Appendix C.

We also researched, in particular, the sustainability and energy management groups of other Ontario municipalities that are similar in size to the City of Barrie. The full results of the benchmarking analysis are included in Table 13 Benchmarking sustainability practices with other Canadian municipalities. The overall findings of the benchmarking analysis are as follows:

- All municipalities reviewed have a distinct sustainability or energy management structure within their organization;
- All municipalities reviewed have at least one full-time staff member devoted to corporate energy management;
- The existence of distinct sustainability or energy management structures increases the visibility of energy issues and facilitates cost-effective investments in energy efficiency. These structures also enable effective tracking of energy and cost savings from energy efficiency improvements.

[8] City of Hamilton Public Works Department. *Overview of Energy Initiatives*. Presentation March, 2012

[9] Town of Richmond Hill. *Clean Air Local Action Plan Corporate Update*. 2011.

[10] Town of Richmond Hill. *Energy Management Plan*. 2009.

Based on these findings, we recommend that the City of Barrie establish a Sustainability Office with at least one full-time staff member responsible for corporate energy management. This will enable the City of Barrie to remain on par with other municipalities, and to implement cost-effective energy efficiency projects.

In the section below, we:

- Draw on the models of individual municipalities to identify the structure, responsibilities and resources required for the Sustainability Office;
- Describe the option of creating a Corporate Energy Management Office as an interim option, until the resources required for the Sustainability Office can be secured;
- Analyze the total resources required for these staff members.

The City of Barrie Sustainability Office

To achieve maximum success improving energy management and sustainability, the City of Barrie should create a Sustainability Office, managed by a Director of Sustainability. The Sustainability Office would coordinate new and existing energy and sustainability initiatives, and would give strategic significance to energy and sustainability projects across the City of Barrie.

In municipalities such as Markham, Pickering, Burlington and Oakville, sustainability offices work with corporate and community stakeholders to coordinate projects and programs that increase environmental, social and economic sustainability. Their work involve:

- Overseeing the development and implementation of energy and sustainability master plans;
- Coordinating the development, implementation and ongoing management of sustainability programs targeting energy, water, waste, habitat and greenhouse gas emissions;
- Assisting various departments with their energy and environmental challenges.

Thus, they are seen as providing valuable services to the organization.[11]

Resources and responsibilities

The Sustainability Office would include three full-time staff members, for a total annual cost of approximately $480,000, assuming that total costs (including operational costs) are two times the salary costs. This could be reduced to as little as $416,000 if the City takes advantage of

[11] This point was emphasized by the Sustainability Office in the Town of Markham.

OPA funding for an Energy Manager position.[12] The table below highlights their titles, primary responsibilities and approximate salaries.

Table 11 The City of Barrie Sustainability Office - team

Sustainability Office positions	Primary responsibilities	Salary
Director of Sustainability	Leads corporate and community energy and sustainability planning. Leads sustainability monitoring, reporting & communication. Coordinates sustainability program development and implementation in all City departments.	~$100,000
Corporate Energy Manager	Leads monitoring and reporting on energy use and greenhouse gas emissions within municipal operations. Leads planning and implementation of energy projects in: • Administrative offices, including Council chambers • Public libraries, cultural and recreational facilities • Ambulance, fire and police stations and facilities • Storage facilities and parking garages • Water and sewage treatment / pumping facilities. Coordinates development of energy policies and programs related to new buildings, purchasing, procurement, employee engagement, renewable energy, etc.	~$80,000
Sustainability Coordinator	Supports energy and sustainability programs and projects in all City departments. Manages community and corporate sustainability inquiries and day-to-day communication.	~$60,000

[12] Up to 80% of the Energy Manager's salary could be funded through the Ontario Power Authority's *Industrial Energy Managers and Training Opportunities* program.

Position within the organization

The Director of Sustainability would report directly to the Chief Administrative Officer (i.e. they would be located at the same level as the Director of Strategy & Economic Development, Director of Communications & Intergovernmental Affairs). This placement has proven to be efficient in the cities we reviewed. In almost all of them, (Markham, Burlington, and Pickering), the director of the sustainability office / group reports to the City Manager or Chief Administrative Officer. In all of the cities reviewed, sustainability groups also assume responsibility for corporate energy.

It will indicate its strategic importance and enable staff within this Office to build relationships with staff in other departments, and to share responsibility for project planning, implementation and communication. It will also facilitate coordination across the organization, to enable compliance with the regulations under the Green Energy Act.

The organizational chart below illustrates the location of the Sustainability Office within the City of Barrie's organizational structure.

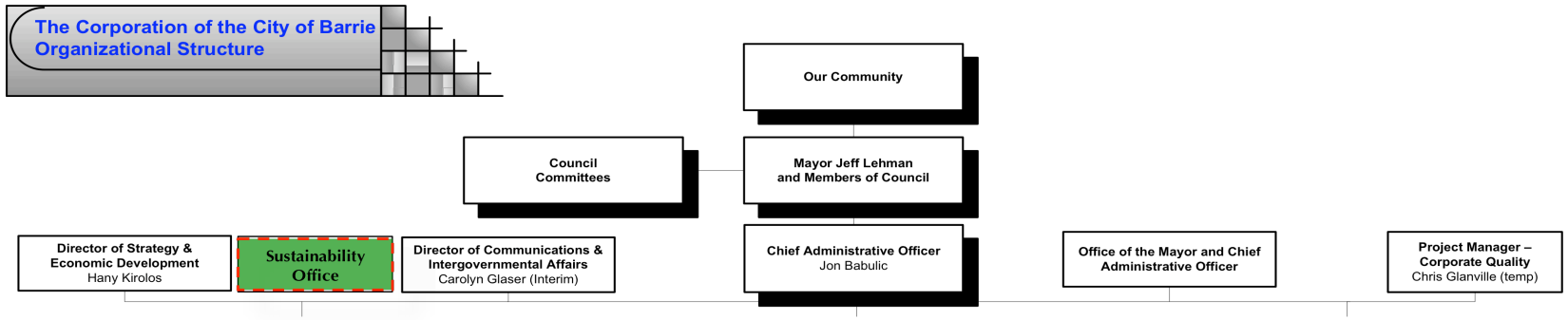


Figure 12 Sustainability Office in the Corporation

The City of Barrie Energy Management Office

Until the Sustainability Office can be created, the City of Barrie should create an Energy Management Office to increase the visibility of energy within the Corporation, and to ensure that energy is systematically considered as part of all City activities.

In the City of Hamilton and the Region of Peel, among other municipalities, energy management offices track energy indicators, oversee energy efficiency projects and report on progress. Their work also involve:

- Coordinating audits;
- Evaluating and prioritizing projects;
- Allocating funding to energy efficiency upgrades;
- Managing energy procurement, researching new energy technologies, and leading public communication on energy issues (in some cities).

Resources and responsibilities

The Energy Management Office would be staffed by a full-time Corporate Energy Manager, for a total annual cost of approximately $180,000, again using total costs as double salary costs. This could be reduced to as little as $108,000 if the City takes advantage of OPA funding for an Energy Manager position.[13]

The Energy Manager's responsibilities within the Energy Management Office are similar to those within the Sustainability Office. However, the Corporate Energy Manager would have additional responsibility for managing overall energy planning, and internal and external communication. The Energy Manager would therefore have less time to develop and implement innovative energy projects, programs and policies. The table below highlights the responsibilities and approximate salary of the Corporate Energy Manager.

[13] Up to 80% of the Energy Manager's salary could be funded through the Ontario Power Authority's *Industrial Energy Managers and Training Opportunities* program

Table 12 The City of Barrie Energy Management Office

Title	Primary responsibilities	Salary
Corporate Energy Manager	Leads corporate and community energy and greenhouse gas emissions planning. Leads monitoring and reporting on energy use and greenhouse gas emissions within municipal operations. Leads planning and implementation of energy projects in: • Administrative offices, including Council chambers • Public libraries, cultural and recreational facilities • Ambulance, fire and police stations and facilities • Storage facilities and parking garages • Water and sewage treatment / pumping facilities. Coordinates development of energy policies and programs related to new buildings, purchasing, procurement, employee engagement, renewable energy, etc. Manages internal and external communication around energy issues.	~$90,000

Position within the organization

The Corporate Energy Manager would report directly to the Director of Leisure, Transit and Facilities. This location would convey that energy is a priority. With the help of the Director of Leisure Transit and Facilities, the Energy Manager would be able to reach all municipal operations that are included within the new regulation. The Energy Manager would work closely with relevant staff within fire and emergency planning, environmental services, and roads, parks and fleets given that the regulation covers ambulance, fire and police facilities, water and sewage treatment / pumping, and parking garages. This placement has proven to be efficient in the cities we reviewed. In all of them, corporate energy managers are positioned to work closely with managers and directors, and to work closely with operational staff.

The Corporate Energy Manager would also have relationships and responsibilities beyond Community Operations. In order to perform the activities required under the new regulation, he or she would need to develop close relationships with the appropriate individuals in Finance

and in each of the types of operations. In addition, he or she would need to develop relationships with individuals across the organization to work on different types of projects, including:

- New building standards (e.g. in coordination with Planning);
- Employee engagement programs (e.g. with Human Resources);
- Procurement policies (e.g. with Finance);
- Community outreach and reporting under the Regulation (e.g. with Intergovernmental Affairs);
- Renewable energy (e.g. with Engineering);
- Energy efficiency programs (e.g. with partners outside the organization such as Enbridge and PowerStream).

The organizational chart below illustrates the location of the Energy Management Office within the City of Barrie's organizational structure.

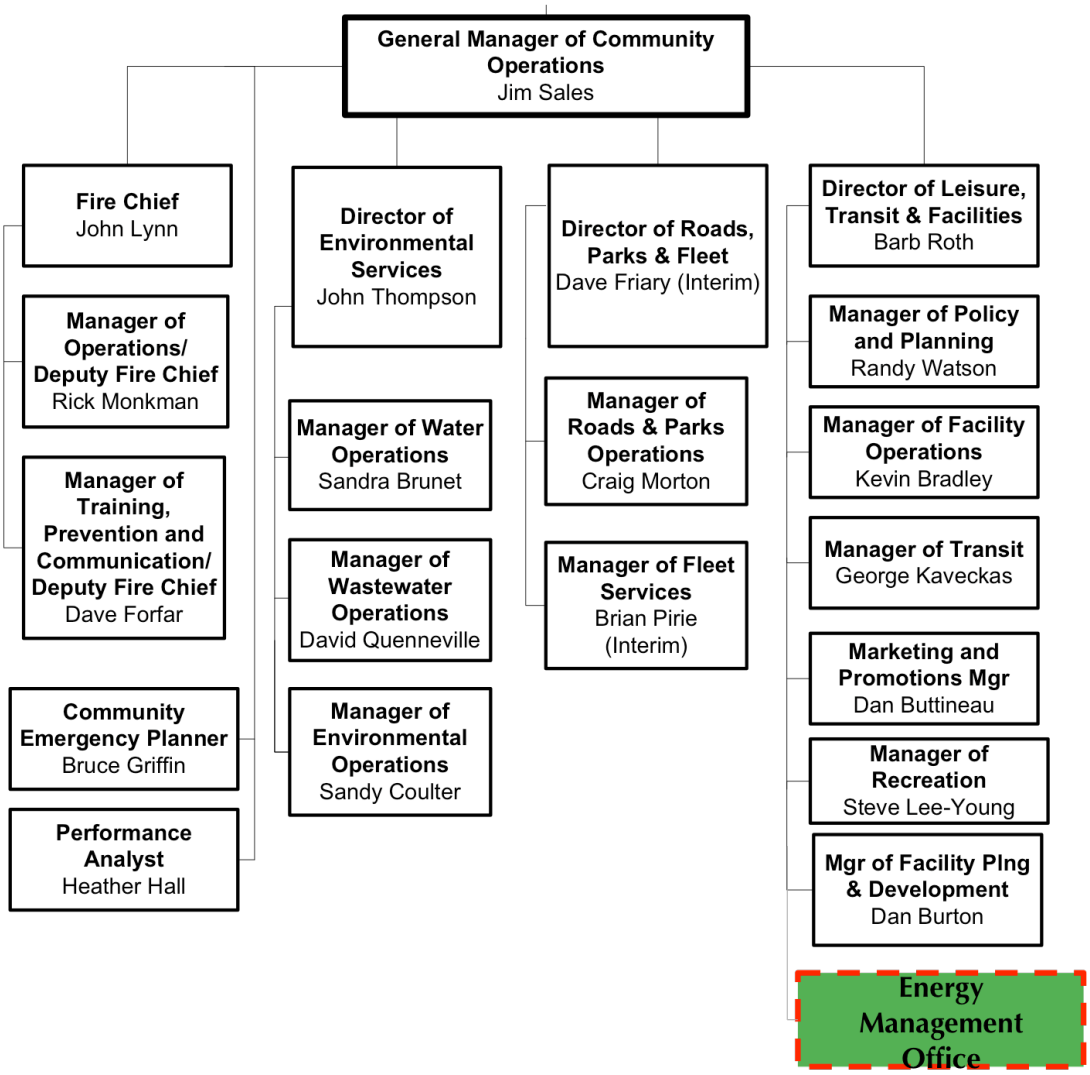


Figure 13 Energy Management Office in the Corporation

Establishing and funding the new structures

The bill savings achieved from less than one year of energy efficiency retrofits would be sufficient to cover the annual costs of the Sustainability Office or the Energy Management Office.

The City should consult all relevant managers, directors, and Executive Management Team members when creating the Sustainability Office and/or Energy Management Office. Ideally, these stakeholders will all understand and support these structures. Any concerns regarding their staffing and activities can be identified and addressed as part of this consultation.

If the City of Barrie begins by establishing an Energy Manager position within Leisure, Transit and Facilities, then the transition to the

Sustainability Office will require a degree of planning. The General Managers and Directors – particularly those within Community Operations – should understand the implications of the organizational change, and should support the change. Despite the strategically significant location of the Sustainability Office, the Energy Manager's responsibilities will change very little. The Energy Manager will continue to work closely with Directors and staff within Community Operations. Though the Energy Manager will officially report to the Director of Sustainability, they will continue to communicate with and report on progress to all relevant City staff.

Benchmarking analysis

Table 13 outlines how some Canadian municipalities, recognized for their sustainability efforts and their effective management of energy, in particular, succeeded in promoting sustainability.

Table 13 Benchmarking sustainability practices with other Canadian municipalities

Name	Mandate	Location within the organization	Staffing levels
Markham Sustainability Office[14]	• Prepares and implements Markham's Integrated Community Sustainability Plan; • Provides energy and environmental services to Town staff; • Leads a wide range of energy conservation programs (e.g. retrofit projects, new facility standards, and employee awareness); • Manages climate change mitigation and adaptation efforts; • Develops and implements corporate energy management projects; • Partners with businesses and the Community to deliver sustainability programs to residents, businesses and developers.	Within the Chief Administrative Office	3 full-time equivalent staff, 1 full-time energy staff

[14] Source: Phone conversation with the Sustainability Office.

Name	Mandate	Location within the organization	Staffing levels
Burlington Corporate Strategic Initiatives Department[15]	• Environment and Energy; • Corporate Facilities Asset Management; • Major Projects; • Strategic Planning.	Department Director reports to the City Manager	15 full-time equivalent staff
Pickering Office of Sustainability	• Promotes and coordinates the Sustainable Pickering initiative; • Directs corporate energy management and GHG reduction; • Identifies and monitors sustainability targets; • Develops and delivers sustainability programs /projects; • Promotes corporate and community sustainable development buildings and projects; • Is responsible for the day-to-day operation of the economic development program.	Director reports to the Chief Administrative Officer	2 full-time equivalent sustainability staff, 5 staff in total
Town of Oakville Environmental Policy Department	• Coordinates all corporate and community sustainability strategies and initiatives; • Coordinates implementation of the Corporate Energy Management Plan, the Corporate Environmental Strategic Plan, and the Community Sustainability Plan; • Develops environmental programs and resources related to land, water, energy, stewardship, air, climate change,	Environmental Policy Director reports to Commissioner of Infrastructure and Transportation Services	4 full time staff + 1 contract position, 1 full time energy staff

[15] Sources: City of Burlington website; Corporate Organizational structure cms.burlington.ca/AssetFactory.aspx?did=16636

Name	Mandate	Location within the organization	Staffing levels
	and biodiversity.		
Office of Energy Initiatives,[16] City of Hamilton	Created in 2006. Over $5M in energy cost savings and avoided costs (and significant reduction in GHG emissions) since then. • Coordinates energy project development and implementation; • Tracks and reports on energy results based on key performance indicators.	Office of Energy Initiatives Manager reports to Director of Energy, Fleet, Facilities and Traffic within Public Works Department	7 full-time energy staff (Manager, Specifications Clerk, Energy Engineers) + 5 Utilities staff + 10 Operations staff
Clean Air and Energy Efficiency Initiatives,	• Coordinates implementation of the Energy Management Plan and Clean Air Local Action Plan; • Coordinates renewable energy projects, building automation projects, and energy efficiency events; • Develops and implements programs and initiatives: staff commuting options, energy and GHG awareness programs.	Environment and Infrastructure Services Department, Environment Services Division	Not available
Energy Management Division, City of Waterloo	• Coordinates implementation of the corporate energy management plan; • Manages energy efficiency audits and retrofit projects; • Develops and implements energy efficiency programs and initiatives: training and awareness, EcoAction Teams, Energy Conservation Week.	Reports to Director of Asset Management, within Corporate Services Department	1 full-time Energy Manager (in the near future)

[16] Sources: Local Authority Services Ltd (LAS); 2010 Corporate Energy Report.

Name	Mandate	Location within the organization	Staffing levels
Corporate Energy Management, [17] Region of Peel	Created in 2003. Result of a structural reorganization a few years back to enhance information sharing among staff. **Key tasks:** • Energy procurement; • Energy services[18]; • Advisory services[19]; • Utility bill validation and payment for regional facilities; • Research & Development[20]; • Public outreach.	Section of the Real Property Asset Management with 2 major tiers: energy projects and energy services (e.g. billing information, etc.)	15-16 employees including 5 in energy projects and the rest in energy services.
City Implementation Team,[21] City of Guelph	Energy Consortium[22] created in 2004 to develop the Community Energy Plan[23] (CEP). Long-term CEP formalized in 2006. This led to the creation of the Mayor's Task Force on Community Energy[24] with four subcommittees[25], one of which is the City Implementation Team.	City Implementation Team: representation of all city departments and major energy budget holders[26].	City Implementation Team: 1 full time Corporate Energy Manager (appointed in May

[17] Sources: Local Authority Services Ltd (LAS) – Municipal Offices; phone conversation with the Corporate Energy Management group.
[18] Use of a real-time energy tracking technology: ITRON management software.
[19] To provide fellow regional departments with up-to-date information about energy efficiency practices, renewable energy technology, etc. (for new and existing buildings).
[20] Investigation of new technologies and developments to give the Region of Peel more ways to reduce energy cost and build sustainable communities.
[21] Sources: City of Guelph's website; Community Energy Plan; phone discussion with Corporate Manager of Community Energy.
[22] The Energy Consortium is a somewhat informal group that came together during the planning process of the CEP. Members: the City (chair), local utilities (co-chair)
[23] Sponsored by the City and Guelph Hydro (that used part of its CDM budget for it).
[24] It is one-year old now and has the same members as the Energy Consortium. It is the oversight body for the CEP.
[25] Four subcommittees: Intergovernmental, Communication & Stakeholder Engagement, Governance & Finance and City Implementation Team.
[26] i.e. Managers who oversee significant energy budgets such as Large Building, Fleet, etc.

Name	Mandate	Location within the organization	Staffing levels
	Key tasks: • Oversees energy management within the City's facilities and operations; • Coordinates energy programs and strategic initiatives (e.g. priority setting); • Develops corporate energy policies and standards.	Located in the CAO office Energy Consortium: representation of city administration, academia, business, gas and electric utilities, and community groups.	2011) – Around 15 members from other city departments[27].

[27] Details to be presented to Council soon.

Monitoring, verification and updating

As highlighted in the previous sections, planning is necessary but it is not sufficient. The City of Barrie needs to pay great attention to implementation too.

An important part of the outlined EMP is the inclusion of monitoring mechanisms that address progress on both:

- The tasks to be carried out to realize the plan. This can be achieved through the establishment of adequate reporting mechanisms that staff (e.g. operators, facility supervisors) will have to comply with. This will make it easier to follow up on the energy actions' status (already implemented, in progress, not started).
- The results of the plan (energy use reductions). This can be achieved through the acquisition and use of an energy management system (EMS). An EMS will enable a regular analysis of energy use, allow for easier identification of opportunities for improvement, and thus, limit the need for expensive studies. It will also make it possible for the City of Barrie to remotely monitor resulting changes in use and to calculate energy benefits derived from these improvements.

Measurement and verification

Process overview

Measurement and verification (M&V) is the process of using measurement to reliably determine actual savings created within an individual facility by an energy conservation measure (ECM). Savings are determined by comparing measured use before and after implementation, making appropriate adjustments for changes in conditions.

The mostly widely accepted M&V process is based on the International Performance Measurement and Verification Protocol (IPMVP). IPMVP provides two basic methods to determine energy savings under the IPMVP guideline, namely Retrofit Isolation and Whole Facility. Each method has two options to allow for flexibility in various situations. For Retrofit Isolation, the two options include Key Parameter Measurement (Option A) and All Parameter Measurement (Option B); for Whole Facility, the two options include Whole Building (Option C) and Calibrated Simulation (Option D).

The table below from the IPMVP Concepts and Options for Determining Energy and Water Savings, Volume 1 report outlines the IPMVP options for determining savings.

Table 14 IPMVP options for determining savings

IPMVP Option	How Savings are Calculated	Typical Applications
A. Partially Measured Retrofit Isolation Savings are determined by partial field measurement of the energy use of the system(s) to which an ECM was applied, separate from the energy use of the rest of the facility. Measurements may be either short-term or continuous. Partial measurement means that some but not all parameter(s) may be stipulated, if the total impact of possible stipulation error(s) is not significant to the resultant savings. Careful review of ECM design and installation will ensure that stipulated values fairly represent the probable actual value. Stipulations should be shown in the M&V Plan along with analysis of the significance of the error they may introduce.	Engineering calculations using short term or continuous post-retrofit measurements and stipulations.	Lighting retrofit where power draw is measured periodically. Operating hours of the lights are assumed to be one half hour per day longer than store open hours.
B. Retrofit Isolation Savings are determined by field measurement of the energy use of the systems to which the ECM was applied, separate from the energy use of the rest of the facility. Short-term or continuous measurements are taken throughout the post-retrofit period.	Engineering calculations using short term or continuous measurements	Application of controls to vary the load on a constant speed pump using a variable speed drive. Electricity use is measured by a kWh meter installed on the electrical supply to the pump motor. In the base year this meter is in place for a week to verify constant loading. The meter is in place throughout the post-retrofit period to track variations in energy use.
C. Whole Facility Savings are determined by measuring energy use at the whole facility level. Short-term or continuous measurements are taken throughout the post-retrofit	Analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis.	Multifaceted energy management program affecting many systems in a building. Energy use is measured by the gas and electric utility meters for a twelve month base year period and throughout the post-retrofit

IPMVP Option	How Savings are Calculated	Typical Applications
period.		period.
D. Calibrated Simulation Savings are determined through simulation of the energy use of components or the whole facility. Simulation routines must be demonstrated to adequately model actual energy performance measured in the facility. This option usually requires considerable skill in calibrated simulation.	Energy use simulation, calibrated with hourly or monthly utility billing data and/or end-use metering.	Multifaceted energy management program affecting many systems in a building but where no base year data are available. Post-retrofit period energy use is measured by the gas and electric utility meters. Base year energy use is determined by simulation using a model calibrated by the post-retrofit period utility data.

Selection of the IPMVP method for determining savings will depend on the energy conservation measure implemented.

Energy management system (EMS)

There are a number of different systems used to monitor energy use, to verify savings realized through energy efficient measures and to establish energy baselines for facilities; the energy use baseline for a building is the energy that would be used under normal circumstances.

The benefits of an EMS include tracking and monitoring of utility costs; verification of energy savings from implemented projects; and validation of billing charges. With proper management and maintenance, the implementation of an EMS program should generate savings in the range of 2-5% of the City's energy bills, or approximately $80,000 - $200,000 per year.

The sections below aim to provide useful information to assist the City of Barrie in selecting an appropriate EMS.

Criteria for EMS selection

When going through the process of selecting a vendor and an EMS, the City of Barrie should consider the criteria listed below.

- **Determine the purpose of the EMS**. An EMS can be either "out of the box" or customisable to specific needs. A vendor can help select specific elements that the EMS will cover. While customizable software can prove to be more costly, it is not always the case. If the scope of the EMS can be effectively narrowed, then fewer unneeded elements will be included.
- **Identify the required user interfaces**. In selecting an EMS and what information it displays, consideration should be given

towards who will be reviewing the data. Different levels of management within the City of Barrie, from facility engineers to executives might have access to the EMS but each will need to extract different types of information. A vendor will be able to help tailor the EMS to meet the data interface needs of the City.

- **Identify what external interfaces are needed**. The EMS interacts and connects many external data sources including facility metering data, energy budgets, city financial software, weather data and facility operating data. When selecting an EMS, it is important to ensure that the vendor is aware of all external data sources and that the EMS is capable of linking to them in an appropriate manner.
- **Identify required performance of the system**. While the EMS can have all of the appropriate content and interfaces, its performance is also vital. Consideration should be given towards its response time to user inputs, the speed, quality and bandwidth of its operating network, its ability to scale from a pilot phase to use across the City, and its reliability and how it deals with data redundancy, backups of hardware/software and data loss.

It is important, regardless of the type of EMS selected, that the system uses multi-linear regression analysis, allowing for the simultaneous adjustment of multiple variables, such as weather, occupancy and production.

Vendor selection

To select an appropriate EMS, the City of Barrie should consider issuing a request for proposal. This should provide the City with a variety of potentially suitable EMSs. Along with the criteria listed above regarding the content and performance of the EMS, the City should select a vendor based on price per deliverables, which can include the number of interface dashboards, EMS hardware requirements, number of data points, the requirements of the City's IT department, and other specifics related to the installation and operation of the EMS.

EMSs used in other jurisdictions

In order to assist the City of Barrie in choosing the right EMS, our team researched the types and names of EMSs used in ten other jurisdictions including: York Region, Waterloo Region and City of Waterloo, Halton Region, Town of Markham, Town of Oakville, Region of Peel, City of Guelph, City of Mississauga and Association of Municipalities in Ontario (AMO). Our literature review was complemented by phone discussions, wherever possible.

Our overall findings are as follows:

- EMS can be generally classified into three **major types**:
    - Control-based systems: they use data obtained from the control systems i.e. hardware/ technical systems in place in the facilities. Itron (now known as Mckinstry), Honeywell EMS, for example, belong to this category;
    - Stand-alone systems: they convert raw billing data into a wide assortment of standard and user-specified reports. The monthly data in tabular and graphic format enable highly efficient analysis of usage trends and the tracking of the effects of such events as energy efficiency measures, occupancy changes and building additions. They include applications such as Metrix™, Managing energy.com, Energy Cap, Energy Lense and Pulse Energy;
    - 'Hybrid' systems: they are a mix between a control-based and a stand-alone system.
- **Web-based systems are becoming popular among municipalities.** They offer access to the entire internal City group and allow building capacity within the entire organization.
- **Choosing the right EMS is not easy**. Not every municipality has chosen its energy management system yet. The City of Waterloo, for example, does not currently have such a system but believes it will purchase one in 2012. The City of Hamilton is looking to upgrade its current EMS. Also, even after opting for a given EMS, it is important to make it more efficient wherever possible. The Region of Peel, for example, is satisfied with its current EMS but is going through software upgrades at this time.
- **Every municipality is different**. It will use the product that best suits its needs. A small municipality may not have the financial ability to invest in an EMS; therefore other options may need to be considered.
- **There is no general rule for staffing requirements to manage an EMS**. These differ from one municipality to another. It depends on the size and number of facilities the municipality is monitoring. The Region of Peel, for example, has two full-time coordinators. They are responsible for managing the EMS (1,200 accounts total): they start by reviewing the region's utility energy bills (to ensure the correct billing and payment) and then enter the information into the system.
- **Cost is often a driving-factor when opting for an EMS**. Many municipalities are considering getting an EMS but they are often reluctant to invest in the first place.

We provide greater details on the most popular EMS that are used by municipalities below:

- **Metrix™.**
    - Is considered as the industry standard for energy savings projects is Metrix™.
    - Can be used to develop energy and water baselines and benchmarking, and for the monitoring and verification of energy savings and greenhouse gas reductions.
    - Allows adjustments for up to four variables, such as weather and occupancy, simultaneously.

  A cost effective alternative to purchasing software, data entry, analysis and reporting would be contract out for a third party energy monitoring and verification service.

- **Energy and Environmental Management System (EEMS)**.
    - Was developed by York Region.
    - Is a versatile web based application designed to specifically address the unique organizational structure and business requirements of municipalities.
    - Has the capability to track and report electricity, water and natural gas utility accounts as well as fuel usage for heating, power generation and fleet vehicles.
    - Tracks and provides reporting on environmental emissions generated through energy use by municipal facilities.
    - Tracks and reports on electricity, water, natural gas consumption and related costs, fuel usage for heating, power generation and fleet vehicles.
    - Has the ability to track and report greenhouse gas and criteria air contaminant emissions generated through energy consumed by buildings, street and traffic lighting, water and wastewater operations, power generation and fleet transportation.
    - Is used by a wide range of municipalities including York Region, Waterloo Region, Halton Region, Town of Markham, and the Town of Oakville.
    - Has a purchase price of $20,000 and there is an additional (optional) Annual Enhancement Program, which costs $2,000.

- **Utility Gateway Systems (UGS) Profiler**.
    - Is a real-time web-based utility monitoring system. It provides monitoring, reporting, energy analysis, energy use forecasting, alarming and load control capabilities.
    - Monitors real-time load, energy usage, and costs in five minute increments to help identify savings opportunities.
    - Provides the information necessary to help make timely data-driven decisions and to develop a long-term energy strategy.
    - Offers reports with diagnostics, reporting and strategy services based on their detailed analysis of the energy usage and costs.
    - Is used by Commercial and Industrial customers, including hospitals, schools, government institutions, utilities and co-generators.
    - Has an installation cost in the order of $500-$1000 for existing pulse meters; the system requires dedicated communication lines for the monitored meters. Monthly monitoring fees vary depending on the number of meters monitored, but would be in the range of $50-75 per meter. This fee would include all monthly reports and no data entry would be required since the data are pulled from the meters in real-time.

- **Itron, now known as Mckinstry.**
    - Is a control-based software.
    - Is used by the Region of Peel to track billing and energy use. Is also used by other municipalities such as the City of Mississauga.

  The Region of Peel reported beginning the energy management software evaluation in 2003. This followed an RFP process. Itron (now known as Mckinstry) scored the highest by far in the evaluation matrix which was guided by its business needs and requirements. Although there are other products on the market today that may offer other options such as Power Quality measurement, the Region of Peel is confident that the Mckinstry system is a powerful tool that enables its teams to manage the Region's energy efficiently and effectively.

- **PowerLogic® ION EEM.**
    - Is a unifying application that complements and extends the benefits of existing energy-related data resources. These can include power monitoring and control systems, metering systems, substation automation and SCADA systems, EMSs, building and process automation systems, utility billing systems, weather services, spot-market energy pricing feeds, and enterprise business

applications. Data is automatically acquired, cleansed and warehoused.
    - Has personalized, browser-based dashboards and visualization and modeling tools that help monitor, validate, predict and ultimately control all energy-related expenses and risks to reliability.
    - Is used by the Association of Municipalities in Ontario (AMO).

- **Managingenergy.com.**
    - Is a web-based stand-alone system.
    - Is used by the City of Guelph.

  The Energy Manager at the City of Guelph reported switching from Metrix™ to Managingenergy.com. Some of the advantages include: no need to buy a licence, access to all City staff, etc.

Updating the plan

Ensuring that the 2012-2017 plan remains relevant over the years is crucial. The energy management plan should be reviewed at least once a year and progress towards goals and targets should be tracked.

Appendix A. Overview of Barrie's energy projects

Completed projects

Table 15 below outlines the energy efficiency projects undertaken by the City of Barrie.

Table 15 Completed energy efficiency projects

	Number of projects	Electricity savings (kWh/a)	Gas savings (m^3/yr)	Total annual savings	Totals costs	Simple payback (years)
Lighting	2	282,057		$27,875	$108,300	3.9
Controls, heat	4	108,600	7,957	$14,890	$37,640	2.5
Building Automation Systems	1	6,541	6,585	$2,820	$9,200	3.3
Total	**7**	**397,198**	**14,542**	**$45,585**	**$155,140**	**3.4**

Two projects are of particular importance:

- A $97,000 lighting retrofit for the East Bayfield Community Centre that will yield almost $25,000 in annual savings.
- A $21,000 upgrade to improve controls for electric / truck block heaters that will yield over $7,000 / year in electricity savings.

Completed projects with very short payback periods include:

- The installation of programmable thermostats in office areas. The thermostats cost $2,900 and will yield approximately $2,500 / year in electricity savings.
- The installation of a pushbutton system to facilitate heating of the Allandale Recreation Centre for short time periods. The installation cost $1,840 and will yield $1,990 / year in electricity savings.

Planned projects

Table 16 below outlines the energy efficiency projects that the City of Barrie is planning on undertaking.

Table 16 Planned energy efficiency projects

Type of project	Number of projects	Electricity savings (kWh/a)	Gas savings (m^3/a)	Total annual savings	Totals costs	Simple payback (years)
Lighting	5	1,241,095	0	$116,030	$530,800	4.6
Controls, HVAC	4	439,199	81,005	$81,898	$226,620	2.8
Controls, refrigeration	1	172,559	0	$17,800	$30,500	1.7
Controls, heat	2	13,397	4,510	$3,311	$6,200	1.9
Building Automation Systems	1	138,825	13,400	$20,269	$96,100	4.7
Building envelope	4	0	12,451	$5,426	$26,170	4.8
Other	4	378,802	38,800	$47,450	$264,690	5.6
Total	**21**	**2,383,877**	**150,166**	**$292,184**	**$1,181,080**	**4.0**

The largest projects were:

- A $205,000 project to install high efficiency boilers and heaters and to improve refrigeration scheduling in the Barrie Molson Centre. It will yield almost $70,000 in annual savings.
- A $232,000 lighting upgrade for the Operations Centre that will yield $40,000 in annual savings.

Planned projects with very short payback periods include:

- Tightening HVAC operating schedules in the Barrie Public Library. The $3,200 cost will quickly be offset by the estimated $8,000 in annual savings.
- Introducing new controls for the Barrie Molson Centre's refrigeration system. The project will cost $30,5000 but will yield an estimated $17,800 in annual savings.
- Weather stripping City Hall door sweeps. The project will cost $2,500 and will yield $1,000 in annual savings.

Appendix B. Recommendations of previous plans and strategies for Barrie

This appendix contains a summary of recommendations from two key energy-related plans and strategies adopted by the City of Barrie: the Greenhouse Gas Inventory and Community Energy Plan (2006), and the Integrated Energy Mapping Strategy (2011).

Greenhouse Gas Inventory and Community Energy Plan

The 2006 Community Energy Plan Report recommended the reduction targets under the PCP program: 20% reduction in corporate emissions and 6% in community emissions by 2011 (baseline year: 1994). Based on the review of Barrie's corporate assets, the study outlined key potential initiatives to help meet the targets. These ranged from the installation of dimmer controls and motion sensors in city buildings to the replacement of incandescent traffic signals with LEDs. In particular, the study concluded that recovering landfill gas could singlehandedly reduce corporate greenhouse gas emissions by 20%. The study outlined a community energy plan to encourage citizens and businesses to reduce energy use and foster the development of a green economy in Barrie. Some suggested energy efficiency projects for the City to undertake include: improvement of public transit and the revision of building codes among others.

Finally, in an "Environmental and Activity Based Cost Accounting" audit, the report highlighted management and cultural issues that are key to achieving long-term GHG reduction goals. It emphasized opportunities to improve energy awareness, accountability, and coordination through changes in metering, software, performance metrics, reward systems and reporting structures.

Specific organizational recommendations included:

- **Improving energy use metering**: Equipping facility meters with remote communication modules to enable real-time energy monitoring; and retrofitting meters to enable digital outputs and installing sub-meters on large energy consuming systems.
- **Adopting metering data acquisition software**: Purchasing and installing a data management software system to generate short- and long-term energy use information.
- **Benchmarking and performance metrics of energy use**: Developing dynamic benchmark energy indices for each facility that account for changes in building use and other key parameters. These indices can be used to compare facilities to other facilities in the City and in Ontario.
- **Management performance metrics**: Implementing energy-based performance metrics for Operations Staff, including a formal reward system for meeting or exceeding energy targets.
- **Communication:** Communicating energy efficiency goals to operators and end-users of facilities.
- **Integration with financial measures and rewards systems**: Developing a network-based financial tracking system that allows real-time access to billing and energy performance information.

Integrated Energy Mapping Strategy

As part of the Integrated Mapping Strategy developed by the City of Barrie in 2011, a number of immediate strategic actions were recommended to advance energy efficiency within the organization:

- Building relationships with local utilities and other key stakeholders;
- Using the Environmental Advisory Committee and/or local champions to advance the energy agenda and catalyze actions;
- Developing a corporate energy efficiency action plan with specific actions and timeframes for policies, programs or partnerships;
- Confirming the natural gas demand side management and electricity conservation demand management programs offered by utilities in Barrie;
- Adopting progress indicators for energy use and greenhouse gas emissions;
- Enhancing communication with utilities about energy management programs;
- Creating an energy management position within the City to coordinate, develop and implement policies and initiatives;
- Exploring opportunities for district energy and for electric vehicles.

Appendix C. Best energy management practices: jurisdictional review

Table 17 Energy Management Plan in ten jurisdictions in North America

	Energy Management Program – York Region (Canada)
Plan key features	**Energy data management:** • Creation of a new subdivision, Corporate Energy Services[28] responsible for setting up a utility consumption monitoring and tracking system; and undertaking energy reduction initiatives • Development of an energy data management system ("Energy and Environmental Management System, EEMS[29]") to track the energy and environmental performance of a number of regional operations. Currently being licensed to other municipalities in Southern Ontario (e.g. Region of Waterloo, Halton region, the Town of Oakville, the town of Markham and Richmond Hill) • Collaboration with utilities (PowerStream and Hydro One) to set the system up to electronically collect monthly utility bill data[30] **Energy supply management:** • Strategic procurements of natural gas and electricity to cut costs: o Participation in a bulk natural gas purchasing program administered by the AMO[31] o New electricity procurement strategy: combination of Regulated Price Plans or Fixed Price Contracts to the Spot Market (expected to save money not energy per se)

[28] It is part of the Property Services Division, in charge of the region's properties.

[29] Assistance of a software developer: Mission Systems Development Corporation

[30] The system allows the Region to compare the performance parameters of its facilities and target specific buildings for retrofit

[31] Association of Municipalities of Ontario

	○ Purchase of EcoLogo-certified green power for 2 facilities (2008) and media campaign to increase public awareness and benefits of green power **Energy demand management:** • Conduct of building energy feasibility studies • Energy audits and energy savings retrofits performed by the Region's Housing provider at its housing facilities • 2 DR initiatives **Sustainable buildings program:** • Minimum standard of LEED Silver for new facilities with a floor area>500 m^2 **Organizational integration:** • Commitment to develop a SEP that will encompass the activities of all regional departments, setting short, medium and long-term energy management objectives
Partnerships	• Other sections of the Property Service Division: e.g. Capital Projects[32] and Facilities Management[33] • Housing York • PowerStream, Hydro One and Newmarket Hydro • Other municipalities that have licensed EEMS • Lower and upper-tier municipalities

[32] It is responsible for the construction of new buildings and major renovations of existing buildings

[33] It is responsible for equipment upgrades ad maintenance

Energy Management Program – York Region (Canada)	
Financial aspects	**Main expenses:** • Development of EEMS: $82,500 + $5,000 to $6,000 / year for support cost[34] • Buildings Energy Feasibility Studies and the resulting energy efficiency upgrades to the region's administrative buildings ($ 1.6 M to date) • Ongoing human resources related expenses **Funding through:** • Region's general fund • Variety of external funding sources: almost $500,000 from various energy efficiency grants provided by Natural Resources Canada, the Federation of Canadian Municipalities Green Fund, Enbridge Gas Distribution, Environmental Careers organization • Capital funding from PowerStream's CDM program (>$400,000)
Human Resources	**5 permanent EMP staff:** • A Program Manager - Oversees all aspects of the EMP • A Housing Sustainable Building Engineer - Oversees energy management projects in region-owned housing • A Sustainable Building Engineer- Oversees energy management projects in properties other than housing • An EEMS coordinator- Oversees all systems related to tracking energy use data • An Energy Analyst - Monitors energy use in the region's water and waste water facilities

[34] Part of those costs are recovered through licensing fees collected from other municipalities

Energy Management Program – York Region (Canada)	
Key success factors	• A supportive regional Council • Strong support of senior Management • Development of a comprehensive, strategic energy plan to address overall energy management objectives and identify the resources needed to achieve them[35] • Identification of energy savings during the detailed design phase to avoid potential delays in EE retrofits implementation • Implementation of an energy monitoring and tracking system • Continuous feedback from the municipalities that have licensed the EEMS: it has helped Corporate Energy Services improve its system • Adoption of a widely accepted minimum standard for new buildings such as LEED
Major challenges	• Limited availability of local expertise and resources in energy management and green building design
Limits	• Little visibility outside the regional administration: o EMP largely unknown to the general public o No public awareness or marketing campaign associated with the program (except regular updates on the program's progress to the media provided by the Region's Corporate Communications Department)

[35] This is something that York Region did not do but would have done, in retrospect

Municipal Energy Efficiency Program (MEEP)- St John's, New Brunswick (Canada)	
Plan key features	**Improving Energy Efficiency:** • Evaluation of all City building envelopes for possible efficiency upgrades • Retrofit projects • Adoption of an innovative software tool, The "Energy Management Control System, EMCS[36]" to [1] Test new efficiency measures [2] remotely monitor resulting changes in consumption patterns [3] Track and calculate energy benefits derived from energy efficiency measures (cost effectiveness). System linked to the City's internal network, hence allowing access to City staff from any workstation and managers from other departments to monitor energy performance **Promoting renewable energy generating capacity:** • Geo-exchange project consisting of using water from the Bay of Fundy to provide district heating/cooling to buildings in the City's core, including buildings owned by City affiliated agencies **Reducing transportation level emissions:** • New procurement policy to purchase smaller-sized vehicles • Traffic lights upgrade • Park and ride facilities and ridesharing programs
Partnerships	• City Board and Commissions, Leisure Services, Municipal Operations and Fire Department • Industrial partners: e.g. Saint John Energy, Enbridge Gas and NB Power and suppliers of energy equipment and commodities such as Irving Oil Ltd

[36] Administered by the Office of the Energy Manager.

Municipal Energy Efficiency Program (MEEP)- St John's, New Brunswick (Canada)	
	• FCM[37] • Province of New Brunswick • PCP[38] • Provincial and Federal: collaborative work on a building labeling system
Financial aspects	• Grants from the FCM, New Brunswick Environmental Trust Fund • Financial and technical support from Enbridge Gas • Funding from Provincial Government to hire an Energy Manager • From 1996 to 2007: 2.5 M$ total (for building retrofits, creation of EMCS, Geo-exchange distribution loop and administrative costs) • $200,000/ year allocated for energy management projects (from the City's capital projects budget) • Administrative costs (one full time salary and other expenses): around $70,000 / year covered through the City's operating budget
Human Resources	**Energy Manager:** • Works within the Department of Facility Management • Is in charge of analyzing energy use throughout municipal government and affiliated agencies, to establish benchmarks for energy reductions, and to outline strategies for meeting these benchmarks • Identifies financing needs • Cooperates with department managers to establish energy efficiency requirements for equipment to

[37] Federation of Canadian Municipalities

[38] Partner for Climate Protection

Municipal Energy Efficiency Program (MEEP)- St John's, New Brunswick (Canada)	
	provide employee training and to raise awareness about the program (e.g. energy awareness program for staff)
Key success factors	• Establishment of a reasonable timetable to achieve energy savings • Creation of an Energy Management position to oversee the program • Development of a comprehensive monitoring system to help ensure full compliance throughout municipal departments and agencies
Major challenges	• Slow emergence of a public outreach and communication strategy: major obstacle to expanding the MEEP (e.g. no webpage dedicated to the program) • Greater political support will be required to encourage DSM programs and renewable energy production in cooperation with local utility companies • Investors do not invest in wind/biomass at current electricity rates • Electricity utility not willing to increase the rates to help finance renewable energy
Limits	• No public consultation process associated with the development of the MEEP, although the City plans to consult citizens through MEEP-related community wide programs • Absence of website and Public Relations strategy dedicated to the program that prevents participation of local experts in the development of the MEEP • Staff members not aware of Saint John's MEEP • No measures to develop community energy efficiency programs • The City has not investigated alternative financing schemes to help foster a switch to clean energy

Corporate Action Plan "For Preserving the Climate", Montreal, Quebec (Canada)

Plan key features

12 key actions to reduce gas emissions from municipal buildings and vehicles:

- Passive solar heating, renewable energy project development, anti-idling campaign, use of gasoline blended with 5% ethanol, energy efficient vehicles, etc.

3 performance indicators to help measure progress and hold participating municipal departments[39] accountable to the City Council:

- Energy efficiency in municipal buildings
- Buildings temperatures
- CO_2 emissions per volume of potable water processed by the City's filtration plants

Energy fund:

- 1st municipal energy fund in Quebec to help finance energy efficiency projects within the municipal corporation[40].

Internal energy website:

- Aimed to encourage capacity building and information sharing[41].

Training program:

- Training on Climate Change and how individual actions can help mitigate climate change - provided to 3,000 municipal workers (mainly blue collar workers)

[39] Boroughs and divisions of the central administration

[40] Self sustained through returns from energy efficiency investments and subsidies from external sources

[41] E.g. Purpose: to share experiences with respect to managing energy use, to help identify and locate expertise on specific matters within the administration, to be kept fully appraised on tendering calls on upcoming projects and technical/financial reports on energy-related initiatives, etc.

Corporate Action Plan "For Preserving the Climate", Montreal, Quebec (Canada)	
Partnerships	• Internal stakeholders such as the police and the fire department, the wastewater treatment plant • Various agencies and departments • Member of Partners for Climate Protection program
Financial aspects	• Estimated municipal investment over 6 year-period: 10.7 M$ assuming 5 M$ from different federal and provincial programs[42] • 5M$ savings in energy costs would be generated per year. • 2M$ invested in the Fund so far • Federation of Canadian Municipalities (PCP program): financed 50% of the installation of passive solar heating project
Human Resources	• 1.5 staff members at SITE[43] worked 2 years to produce both the GHG inventory and the Action Plan • SITE responsible for developing the Action Plan • The plan's actions are carried out by the relevant departments/services with SITE acting as a facilitator in most cases • ¼ of a staff position today to administer and coordinate the plan
Key success factors	• Strong support from the City Council to help legitimize and provide a considerable impetus for the whole Action Plan process • Centralized energy audit to allow energy use comparison across buildings and identify progress • Dissemination of information to motivate "stragglers" to reinforce their energy saving efforts

[42] EcoEnergy (NRC), Energy Efficiency Fund (Gaz Metro), etc.

[43] SITE: Infrastructure, Transport and Environment Service

Corporate Action Plan "For Preserving the Climate", Montreal, Quebec (Canada)	
	• Optimized internal consultation processes[44] during the plan preparation phase: group certain stakeholders together, where applicable, when consulting them • Inter-departmental coordination • Cooperation with external stakeholders • Productive partnerships
Major challenges	• Fragmented and decentralized nature of the municipal administration
Limits	• Limited public awareness of the plan • No public consultation; corporate initiative affecting only internal operations of the City

Integrated Energy, Air Quality and Greenhouse Gas Management Plan, Resort Municipality of Whistler – British Columbia (Canada)	
Plan key features	**Integrated approach:** • Integration of energy, air quality and GHG emissions into one single management plan **A new position:** • Creation of a full time position – Manager of Sustainability Initiatives **Energy use and emissions inventory (2000):** • Inventory in 6 different sectors: residential buildings, passenger vehicle transportation, commercial and

[44] This helps ensure involvement towards achieving the plan's goals

	institutional industrial, solid waste, and municipal operations • Forecasts of energy use and emissions to the year 2020: 7 measures were recommended including renewables, energy efficiency for new and existing residential and commercial buildings, diversion of 70% of solid waste, improvement of the transportation strategy, etc.
	Stakeholder consultation: • In-depth consultation process with stakeholders from municipality, business community and public - 16 sustainability task forces responsible for recommending actions
Partnerships	• Member of the FCM's Partners for Climate Protection • Provincial and federal support (policies) • Gas and electricity companies
Financial aspects	• Subsidies from the FCM's GMF[45] for energy efficient building • Incentives from BC Hydro for the development of small scale renewable energy projects
Human Resources	• Plan overseen by the General Manager of Environmental Services (champion) • No staff specifically hired for the implementation of the plan • Public Works Department - Responsible for providing ongoing management, monitoring and data collection as well as tracking outcomes and coordinating public awareness activities • Manager of Sustainability Initiatives **-** Dedicating 40-50% of his/her time to complete the annual energy use and emissions inventories • 12 people in the Environmental Services Department but no staff dedicated full time on the

[45] GMF: Green Municipal Fund

Integrated Energy, Air Quality and Greenhouse Gas Management Plan, Resort Municipality of Whistler – British Columbia (Canada)	
	implementation of the plan (4 of them dedicate at least a portion of their time)
Key success factors	• Support from municipal and community stakeholders • Integrative approach that avoids duplicating initiatives • Use of the plan as a "guiding principals" document to reduce energy use • Involvement of BC Hydro and Terasen Gas. • Community consultation and partnerships that help provide an adaptive management framework, where priorities are redefined on an annual basis • Creation of a full time position – Manager of Sustainability Initiatives
Major challenges	• Availability of staff and financial resources • Municipality's level of control on some measures. Some measures are beyond the municipality's direct control (e.g. switch from a propane grid to natural gas)
Limits	• Timeline for implementation, monitoring and reporting not met

Climate Action Plan, Burlington, Vermont (United States)	
Plan key features	**Energy Efficiency in municipal buildings and operations:** • Retrofits • Legacy project: a public consultation process aimed to develop a comprehensive action plan to promote economic, environmental and social well-being. This has facilitated retrofits on buildings in the

community

Residential and business energy efficiency programs:

- Energy efficiency programs and construction of new, high performance buildings

Public education and outreach:

- 10% challenge in 2002 to help citizens and businesses make sustainable consumption decisions with regards to heating, electricity and transportation while implementing quantifiable actions to reduce emissions. Interactive website in place to estimate participants' GHG emissions and provide information on possibilities to reduce emissions

Biomass district energy and alternative fuel development:

- Cogeneration at Burlington's wood burning facility (not yet implemented)
- Other renewable energy project (under development)

Transportation:

- Development of a more balanced and efficient use of existing transportation facilities, coordination of land use and transportation decisions, enhancement of pedestrian, bicycle and public transit opportunities, etc.

Partnerships

Joint programs with external partners such as:

- The Institute for Sustainable Communities
- The University of Vermont
- The Fletcher Allen Hospital Complex

Climate Action Plan, Burlington, Vermont (United States)	
	• The Local Chamber of Commerce • Local businesses and individual citizens • Chittenden County regional Planning Commission • Chittenden County Solid Waste District • Chittenden County Transportation Authority (CCTA)
Financial aspects	• Environmental Protection Agency (EPA) grants • Donations from local entities (University, Hospital, Chamber of Commerce): 6M$ allocated to programs for increasing energy efficiency in homes and businesses since the plan was adopted in 2000 • Staffing expenses for the Legacy project partly covered by the University of Vermont in the form of research support from students and faculty
Human Resources	**Involvement of several partners within the municipal corporation:** • The Burlington Electric Department - Oversees the implementation of energy efficiency measures and oversees sustainable building design and construction • The Department of Public Works - Responsible for implementing climate friendly transportation measures and supporting state and regional actions • The Community and Economic Development Office (CEDO) - Responsible for managing the overall direction of the plan through the Legacy project
Key success factors	• Support and involvement of community stakeholders: strong public turnout in consultation process showing public's interest in curbing emissions • Commitment of local politicians, City officials, representatives of community organizations, local institutions, businesses and citizens to sustainability goals is an essential component of Burlington's

Climate Action Plan, Burlington, Vermont (United States)	
	emissions reduction strategy • Public outreach programs: they can play an important role in channelling environmental awareness and concern towards action among businesses and residents, as it was the case for Burlington • Regular communication with citizens via bill messages, newsletters, phone messages, community events and web updates. This plays an important role in raising public awareness about climate action • Participation in campaigns (e.g. "Cities for Climate Protection", "New England Cities") can facilitate information sharing and the development and implementation of new GHG reduction practices and programs, as it was the case for Burlington
Major challenges	Not available
Limits	• Adequate reporting mechanisms have been slow to emerge: no city-wide mechanism for tracking energy use • No structure in place to coordinate community involvement and ensure accountability throughout municipal operations • Revolving energy fund not yet created

Energy Use Partnership – Partnership for a Green City, Louisville, Kentucky (United States)	
Plan key features	**7 main objectives including:** • To develop funding proposals for energy efficiency projects and energy education programs • To perform energy efficiency audits in buildings of all 3 organizations

Energy Use Partnership – Partnership for a Green City, Louisville, Kentucky (United States)	
	• To develop low cost energy efficiency technologies, etc.
	8 different committees[46]:
	• Each of them working on a different aspect of environmental sustainability: waste management, green purchasing, energy use partnership, environmental education, outdoor classroom, environmental health, interagency coordinating, principles and standard committee
	Example of actions:
	• University and high school students were trained to perform audits, learn how to use an energy data management software, etc. • Several workshops for facilities managers and personnel were organized and facilities managers received training on green standard
Partnerships	**3 partners:**
	• Local government (Louisville-Jefferson County Metro Government) • University of Louisville • Public school system (the Jefferson County Public School District)
Financial aspects	• Main grant obtained via the US Department of Energy • Funding from the Federal Government and other institutions • Fund from the Kentucky Division of Energy

[46] The committee members from within the municipal corporation come from a variety of agencies (e.g. facilities management department, mayor's office, etc.)

Energy Use Partnership – Partnership for a Green City, Louisville, Kentucky (United States)	
Human Resources	• HR contributed by each partner (redirection of existing resources) • Partnership first managed at the Committee level, relying on 1 staff full time director for the Partnership since 2007 • ~100 employees total
Key success factors	• Decentralized committee framework • Political leadership • Knowledge sharing: public institutions can learn a lot from sharing their knowledge and experience • Full time employee to coordinate and motivate the various committees and sustain and renew collaborative efforts • Structure that allows peer pressure rather than top down decision making
Major challenges	• Time constraints - Difficulty for the Steering Committee - composed of volunteers who already had full-time jobs within the partner agencies - to effectively coordinate the various committees and monitor their progress
Limits	• No systematic accounting of outcome across the various committees and projects undertaken • Uneven follow-up across committees on their own recommendations for action • No systematic energy awareness training programs in place

PlaNYC Energy, New York City, New York (United States)

Plan key features	**25-year sustainability plan:** • Purpose: to address NYC's 3 major concerns: ongoing population growth, aging infrastructure, and increasing environmental risks due to pollution and global warming. Energy is one chapter within this plan. **14 energy related initiatives:** • 4 basic themes: improving energy planning, reducing NYC's energy use, expanding the City's clean power supply and modernizing electricity delivery infrastructure • An extensive 4-month long public consultation process • A 10-point vision presented to community leaders, public organizations, advocacy groups and to City's residents at large to obtain feedback and ideas in the implementation of the vision (e.g. town hall, neighbourhood leader meetings, etc.) **A new branch within the Mayor's Office of Operations (the OLTPS[47]):** • Purpose: to devise a new, long-term sustainability plan for the City i.e. to oversee the implementation of PlaNYC with dedicated staff including some for the Energy Chapter
Partnerships	**NYC internal (Government) partners:** • OLTPS • NYC Economic Development Corporation (NYCEDC) • Department of Citywide Administrative Services (DCAS): administers all city-owned properties

[47] The Office of Long-Term Planning and Sustainability

PlaNYC Energy, New York City, New York (United States)	
	• Department of Buildings (DOB): enforces the building code and regulates the construction industry
	External partners (outside NYC Government):
	• New York State Public Service Commission • Regulator of the state's electric, gas, steam, telecommunications and water utilities • Electric utilities: Con Edison and National Grid
Financial aspects	• Internal funding and in particular, through SBC[48] • Variety of state and federal grants • Expenses set to: 199 M$ of which 42% dedicated to energy initiatives
Human Resources	• 17 staff members from OLTPS dedicated to energy (versus 9 at start) • 2 staff members from NYECD Energy and Telecommunication Division - Administer the PlayNYC-related energy initiatives with frequent support from 7-8 other staff members.
Key success factors	• Comprehensive long-term energy plan • Creation of a municipal body such as the NYC Energy Planning Board to oversee plan implementation • Regulatory approach versus legislative approach to set up new administrative mechanisms in the energy sector
Major challenges	• Huge diversity and complexity of residential ownership • Equitable distribution of the costs and benefits entailed by energy initiatives

[48] Systems Benefit Charge: surcharge paid by electricity consumers state-wide

PlaNYC Energy, New York City, New York (United States)

Limits

- 2 supervisory bodies with some new administrative capacity proposed in the energy chapter and not set up yet (an *Energy Planning Board*[49] & an *Energy Efficiency Authority*[50])
- Little coordination of energy-related efforts among the many cities in the New York Metropolitan area
- Insufficient promotion of renewables for electricity generation resigning the City to build new fossil fuel-fired plants
- Lack of a clear implementation table, beyond the establishment of some broad goals to be achieved

Climate Action Plan and Carbon Tax, Boulder – Colorado (United States)

Plan key features

Purpose:

- To reduce GHG emissions in both municipal operations and the wider community to meet Boulder's emission reduction goal of 7% below the 1990 levels by 2012

Different strategies:

- For residential, commercial industrial, institutional, transportation and solid waste sources

Measures:

- Energy audits for households and businesses

[49] With staff from the City, from the State and the 2 utilities

[50] With staff from the City and New York State Energy Research and Development Authority and the 2 utilities

- Incentives for better building practices
- Rebates for environmental renovations and support for renewable energy development

GHG inventory tracking software:

- Creation of a GHG inventory tracking software to enable regular updates on the effectiveness of emission reduction policy measures

Carbon tax:

- Creation of a carbon tax

Franchise agreements:

- Renegotiation of franchise agreements with Xcel Energy to encourage greater energy efficiency and a shift towards RE sources

Partnerships

- Cooperation with local partners: Xcel Energy[51], local contractors (conducting energy efficiency audits and renovations)
- Networking programs and partnerships to increase the private sector's involvement
- Collaborative institutional relationship with Boulder County
- Participation in the Energy Freedom Challenge[52]
- Member of the Chicago Climate Exchange (CCX)[53]

[51] Electric utility

[52] A campaign to encourage cities across the US to obtain their supply of energy from local and renewable energy - wind, solar and bio-energy sources

[53] A voluntary cap-and-trade program, which calculates emission reductions credits for firms and organizations (including municipal governments) which may be sold to offset emissions elsewhere

	Climate Action Plan and Carbon Tax, Boulder – Colorado (United States)
	• Participation in the federal EPA[54] Energy Star rating system - Basis of several local initiatives to improve energy efficiency in homes and businesses • Work with the BREEE[55] replaced now by CAPAG[56] • Work with Boulder Green Building Guild and E –star Colorado to encourage knowledge sharing networks for residential and commercial building contractors
Financial aspects	• Local trash tax: it generated $258,000 to support climate change measures (2005, 2006). It was then replaced by the CAP tax[57] on electricity consumption (2006) from which the City expected to generate approximately 1M$ annually • Procurement expenses and operating and administrative costs covered by revenue from CAP tax
Human Resources	• 5 full staff in Office of Environmental Affairs (2007) versus 2 (2006)
Key success factors	• Highly innovative climate plan and funding strategy. Favourable conditions in Boulder that contributed to this: high level of technological sophistication and environmental awareness • Extensive consultation process with citizens, research institutions, and industries with climate change or energy efficiency expertise. In Boulder, it benefited the adoption of climate action policies • Collaborative network - Strong working relationship with local energy experts, firms, organizations, laboratories and academic institutes specializing in RE, economics and environmental policy
Major challenges	• Finding the right balance between addressing Council and Policy experts with technical information and

[54] The Environmental Protection Agency

[55] Boulder Renewable Energy and energy Efficiency group

[56] CAP Advisory group: has a municipal mandate to provide technical and professional expertise in helping the City meet or exceed CAP goals

[57] Carbon tax aimed to fund transportation and residential energy efficiency measures

	Climate Action Plan and Carbon Tax, Boulder – Colorado (United States)
Limits	reaching out to the public with more accessible materials • Limited availability of technological expertise and limited public awareness might result in an unwillingness to accept taxation of energy use • Absence of a detailed communications strategy resulting in opposition to the tax, thereby putting the City on the defensive in the local media

	Energy Management Program, Eugene – Oregon (United States)
Plan key features	**Background:** • EMP launch in 1995 – Internal initiative of the City's Facility Management Division interested in energy efficiency measures as a means to keep operating costs down in the face of rising energy prices. • Scope: City-owned and occupied buildings • Resolution passed by Council in 2000 making the EMP become an official City Policy **4 pillars:** • Implementing energy efficiency measures (design and construction of new buildings and retrofit of existing buildings • Rigorous building management and maintenance practices • Use of energy management tools • Education of City's employees

Energy Management Program, Eugene – Oregon (United States)	
	A new position:
	• Creation of an Energy Analyst position
	Energy management:
	• Use of a computerized energy management system • Utility accounting = electronic tracking of electricity and fuel consumption across all City-owned and operated buildings
	Achievements:
	• Over 50 energy efficiency projects carried out since launch
Partnerships	• Ongoing technical assistance from EWEB [58] • Ongoing support from federal and state agencies (e.g. Oregon's Department of Energy, etc.)

Financial aspects	• Combination of loans and government incentives to fund energy efficiency measures
	  o 2M$ loan from the City's Fleet Fund[59]
	  o Grant from Bonneville Power Administration[60]
	• Use of state's Business Energy Tax Credit Pass-through program to fund upgrades to city-owned buildings
	• Low-interest loans and tax incentives from Oregon's Department of Energy
	• Pro bono technical assistance from the EWEB. Savings used to repay loans, hence energy efficiency

[58] Eugene Water and Electric Board. It is the City's public-owned water and electricity utility

[59] These were mostly spent on design and implementation of energy efficiency measures

[60] Bonneville Power Administration is a branch of the US Department of Energy

	Energy Management Program, Eugene – Oregon (United States)
	measures are selected upon their ability to pay for themselves within 10 years of their implementation

Human Resources	• Manager of Operations & Maintenance (O&M)[61]
	• 3 key administrative entities responsible for the EMP:
	  o Facility Management - Coordinates the program
	  o Operations & Maintenance Department (~10 certified Operations & Maintenance staff members) – Responsible for the installation and maintenance of energy-efficient equipment
	  o Design & Construction section[62] - Oversees the design and construction of new buildings and major renovations in existing buildings
	• An Energy Analyst - Responsible for maintaining a database and tracking the implementation of energy efficiency measures by monitoring energy use in City facilities on an ongoing basis, assessing the effectiveness of energy efficiency measures and identifying problems or weaknesses in energy management

Key success factors	• Energy management tool • Rigorous tracking of energy use. This allows for easy identification of opportunities for improvement, limited the need for expensive studies • Solid building operations and maintenance procedures • Targeted retrofits and equipment upgrades • Involvement of departments that are part of the same division • Proper training of staff

[61] Section of the Facility Management Division

[62] Section of the Facility Management Division

Energy Management Program, Eugene – Oregon (United States)	
	• Inventory-wide approach (versus building by building)
Major challenges	• Employee behaviour- It was found to be one of the greatest barriers to further improving energy efficiency in City facilities • Lack of political support - City's politicians unaware and seemingly uninterested in the program during the first year of its existence • Limited funding
Limits	• Attempts to modify workplace practices and to instill more energy efficient behaviours among employees have not been very fruitful so far (employee "push back" to energy efficient workplace practices)

Energy Management program – City of Phoenix, Arizona (United States)	
Plan key features	**Background:** • EMP: part of the Public Works Department i.e. integrally tied to the City's Facilities Management department **5 basic tenets:** • Commitment to eliminate wasteful and inefficient energy usage • Development of cost effective alternatives • Development of employee awareness • Promotion of the use of renewable energy resources

Energy Management program – City of Phoenix, Arizona (United States)	
	• Role model/Leadership example for the Community
	Energy management:
	• Focus on low-cost opportunities that could be spotted by simple walk through audits in City-owned facilities first and then conduct of advanced energy management measures. At first: investment in projects with a payback of ≤2 years. Now: 6-8 years • Use of energy management systems for the City's largest facilities (20) and establishment of a chronological list of all completed retrofits on Lotus spreadsheet. This has been replaced with an annual projects and savings summary. • Monitoring of pre and post retrofit use for major buildings where retrofits recently occurred
Partnerships	• Involvement in the energy Task Force of The Urban Consortium • Cooperation with Arizona State University Energy Management
Financial aspects	• Grants from The Urban Consortium • Outside support from the US Department of Energy (<0.5M$ over the years) • Annual dollar savings: 10% of utility bill ($4M)
Human Resources	• 7 positions within the Phoenix Energy Management Section[63] • Energy Management Team - Has the lead role • Participation of other departments (e.g.: the Downtown Facilities Management Team, the Water and Waste Water team

[63] Those include in particular: 1 superintendent, 2 engineers, 1 project manager and 1 account clerk. Use of staff from the Public Works Department talent pool too (e.g. electricians, etc.)

	Energy Management program – City of Phoenix, Arizona (United States)
Key success factors	• Energy Management Team. "Utilities Monitor": one of the most cost effective role of the Energy Management Team: assessment of bills to check errors, early warning / detection of unusual energy use patterns • Savings reinvestment mechanism[64] • Residents' involvement • Simplicity of EMP Keep the EMP simple[65] • Combination of Energy Management and Facilities Management in the same division. In Phoenix, this has helped to further enhance efficiency initiatives • Rotating staff within Public Works. This has bolstered the skill sets in the department and fostered closer communication between program emphases • Support of upper management for reinvestment funds
Major challenges	• Difficulty to sort out basic information (e.g. how many buildings and square feet of properties the City owns) • Difficulty to encourage Fire stations and police stations to undertake energy efficiency projects. An option is not to push measures that restrict their services but some that promote other means of garnering efficiency in fire stations (e.g. energy efficient lighting)
Limits	• Savings reinvestment mechanism in jeopardy in times of budget restrictions • No substantial private sector initiatives

Source of the tables above: Best Energy Management Practices in 13 North American Cities – www.cec.org/municipalenergy

[64] Mechanism where each year, a portion of documented energy savings are reinvested in further energy efficiency improvements

[65] E.g. begin with clear winners i.e. relatively simple retrofits

Appendix D.Revolving energy funds

To establish a Revolving Energy Fund, the City of Barrie will be required to:

- Locate initial funding
- Develop a fund management and project approval process
- Establish repayment terms to the Fund

We provide suggestions on these topics and present ideas from other jurisdictions.

Seed funding. The City of Barrie should look for "creative" funding sources - for example, investing the first 10 years of savings from improved energy procurement into a revolving fund.

- The City of Edmonton has access to $30 million in project financing from the Alberta Municipal Finance Corporation at a very competitive rate.
- The City of Ann Arbor, MI, paid off of a 10-year bond in 1997. Rather than discontinuing the budget line item, they reduced it by 50% for 5 years and directed the $500,000 into the new Municipal Energy Fund.
- The City of Homer, AK, capitalized the fund through a one-time transfer of $315,000 from facility depreciation accounts.

Project approval process. The City of Barrie should develop transparent project approval criteria, using information from audits to determine payback and/or ROI.

- In Edmonton, projects generally have payback periods of 8 years or less. In Montreal, the average payback is 7 years.
- In Homer, only facilities that have been audited and have developed an Energy Conservation Plan are eligible for funding.
- In Ann Arbor, project screening considers improvement of facility environment and educational / demonstrational value as well as energy savings.

Repayment terms. The City of Barrie should ensure that the savings achieved through energy efficiency improvements return to the fund in order to allow other energy efficiency projects to be funded.

Table 18 on the next page provides additional details on the funds established in five cities including: seed funding, project screening, fund repayment and broader municipal context of the fund

Table 18 Summary of Revolving Funds in five other jurisdictions

City	Seed funding	Project screening	Repayment	Broader context
Edmonton, AB **(pop. 780,000)** **Energy Management Revolving Fund**	• Started at $1 million in 1995, increased to up to $30 million in 2002. • Financed from the Alberta Municipal Finance Corporation at a very competitive rate. • Little impact on tax levy (short-term borrowing).	• Standard payback: 8 years or less, though longer-term projects are considered. • Projects are brought forward by the operating areas. • The Facility Energy Management Revolving Fund Review Committee provides technical feedback. • The Environmental Policy Coordinating Committee (Branch Manager level) issues approval.	• The operating area repays the fund over a fixed five-year period. • The repayment stream is in place (utility budgets).	• The Fund is part of the City's Energy Management Program (includes initiatives in fleets, streetlights and wastewater treatment). • The Program is part of the Municipal Operations Climate Change Strategy, a high priority topic in the Environmental Strategic Plan.

City	Seed funding	Project screening	Repayment	Broader context
Ann Arbor, MI **(pop. 114,000)** **Municipal Energy Fund**	• City Council approved a $500,000 allocation over 5 years after a 10-year energy efficiency bond was paid off in 1997. • Instead of discontinuing the budget line item, the City reduced it by 50% to $100,000 for 5 years. • The initial $500,00 has allowed the Fund to be self-sustaining.	• Standard payback: 3-6 years. • Screening considers: energy savings, improvement of facility environment *and* education / demonstration value. • Facility managers submit applications. • The City's Energy Office compiles audit information and applications for the Fund's Board. • The three-person Board approves funding and implements projects.	• Facilities pay back 80% of the projected energy savings for five years after project implementation. • Projects with a shorter payback support projects with payback > 5 years. • The extra 20% can be used for other purposes or facility budgets can be reduced.	• Energy Plan adopted in 1981 led to the 10-year Energy Bond. • U.S. EPA Green Lights program further stimulated the City.

City	Seed funding	Project screening	Repayment	Broader context
Montreal, QC **(pop. 1,620,000)** **Fonds Énergie**	• $10.7 million initial investment over 6 years. • Total investment goal including reinvestment: $24 million over 6 years. • Assumes 20% in grants.	• Average payback period: 7 years.	• Payback rate of up to 80% of annual ROI until the principal is repaid. • Project promoter keeps remaining 20% annually.	• The Fund is part of the Climate Protection - Corporate Action Plan. • Corporate emissions reduction goal of 20% by 2012.
Homer, AK **(pop. 5,364)** **Revolving Energy Fund**	• Capitalized by a one-time transfer of $315,000 from 13 facility depreciation accounts.	• Facilities must have an Energy Conservation Plan to be eligible for loans. • Loans are approved by City Council.	• Loans are repaid over time based on estimated energy costs savings from audits / in the facility's Energy Conservation Plan.	• 2007 Climate Action Plan and Implementation Report led to the establishment of the Fund.

City	Seed funding	Project screening	Repayment	Broader context
Knox, Australia **(pop. 156,000)** **Proposed Revolving Energy Fund**	• TBD	• Executive Management Team (EMT) receives details of: estimated costs, annual financial savings and crediting period. • EMT issues approval.	• Operational Improvements (e.g. adjusting thermostats and operating hours) – savings credited for 1 year. • Mechanical, Lighting or Equipment Improvements – savings credited for 4 years. • Other measures (e.g. solar panels, co-generation, pool covers) – savings credited for 10 years.	• GHG reduction is a key objective of Knox Sustainable City Plan. • Community and Council Plan includes energy efficiency and environmental leadership as part of a *Vibrant and connected community*.

Appendix E. Developing options and setting priorities

The energy management plan builds upon the existing energy related-work of the City (policies/programs, energy projects, etc.). It includes, in particular, key management/organizational measures. These measures were developed in consultation with key City staff during the strategic planning workshop.

Our team rated the measures according to their "importance" and "ease of implementation" in order to facilitate action.

Importance of management/organizational measures

The importance of measures was rated using the following scale:

4 - Top level importance, priority

3 - Important but not the most important

2 – It would be nice

1 – Low importance

This was based on whether it helps:

- Meet the City's goals, actions and targets;
- Give strategic significance to energy in the organization;
- Encourage innovation and implementation of energy efficiency projects.

Ease of implementation

The ease of implementation of measures was rated according to the following scale:

4 - Well set up or easy to get, resource requirements small or easy to get

3 – Resources can probably be found

2 – A challenge, but not impossible

1 – It seems impossible at that time

This was based on whether it:

- Can be implemented with existing staff resources;
- Has support from Council;
- Can be implemented with existing financial resources.

For each management/organizational measure, the importance and ease of implementation ratings were combined to give an overall priority rating for implementation (Table 19). Based on their overall score, measures were integrated into the Energy Management Plan for 2012-2017.

Overall priority of 7 or 8

Measures that received a cumulative score of 7 or above were deemed to be high priorities for implementation.

Overall priority of 6

Measures that received a cumulative score of 6 were deemed to be medium priorities for implementation.

Overall priority of 5 or below

Measures that received a cumulative score of 5 or below were deemed to be low priorities for implementation.

Table 19 List of management/organizational measures and their level of priority

Measures	Importance (1-4; 4=most important)	Ease of implementation (1-4; 4 =easiest)	Overall priority (sum)
Goal: Broad-based awareness and commitment			
Communicate energy successes regularly and effectively to both internal and external City stakeholders (including Council)	2	4	6
Reach out to Council and facilitate its understanding of energy significance through the development of a compelling business case (including anticipated results and cost avoidance).	4	4	8
Raise City staff awareness around energy efficiency	3	2	5
Goal: Integrated and coordinated approach			
Create a sustainability/energy management structure	4	3	7
Strengthen partnerships with external stakeholders (e.g. utilities)	2	4	6
Goal: Improved energy and environmental performance			
Encourage energy efficiency actions in new and existing City buildings	4	2	6
Ensure energy efficiency consistency across City buildings	4	3	7
Identify and seize renewable energy opportunities	2	1	3

Measures	Importance (1-4; 4=most important)	Ease of implementation (1-4; 4 =easiest)	Overall priority (sum)
Goal: Optimized processes to encourage innovation			
Take advantage of all available resources and funding options to successfully undertake energy projects	4	3	7
Re-invest the money obtained through energy savings into energy projects	4	2	6
Monitor and verify ROI or IRR to enable re-investment	4	3	7
Better analyze energy use and costs within City facilities and operations	4	3	7

Appendix F.Potential high level energy savings opportunities

There are good opportunities for energy savings at the facilities in the City of Barrie's portfolio. The potential energy savings that could be realized through a comprehensive suite of capital energy efficiency measures, as well as renewables, recommissioning, and education, awareness and training programs is generally in the 30% to 40% range.

Below is a list of actions/technologies that should be implemented in order for the City of Barrie to meet the targets.

Table 20 High Level Energy Savings Actions/Technologies

Action/ Technology	Rationale
Recommissioning	Should be done to identify low-cost opportunities and bring the buildings up to the design intentions of their current use.
Energy Audits	Should be carried out for each of the facilities to assess individual energy efficiency measure opportunities.
Water Audits	Should be carried out for each of the facilities to assess individual water efficiency measure opportunities.
HVAC & Control Measures	Replacement and upgrading of the HVAC is very important and control systems must be installed to maximize the energy savings.
Lighting	New technologies for energy efficiency lighting should be explored and installed.
Plug Load	Once the audits identify the opportunities, measures should be implemented to reduce plug load.
LEED-EB	All buildings should be retrofitted to meet the LEED-EB standard while energy efficiency retrofits are being implemented.
Renewable Energy	Once the audits identify the opportunities, renewable measures should be implemented to maximize the buildings efficiencies.
Education, Training & Awareness	A comprehensive program should be implemented or existing programs should be expanded on in all of the buildings.
Energy Monitoring	After the retrofits are complete, monitoring is imperative to ensure the energy savings are realized.

The actions/technologies listed above are expanded in the section below.

Recommissioning

Recommissioning (RCx) is a re-optimization process for existing buildings that have already been either commissioned or retrocommissioned and ensures equipment and systems are operating optimally to meet current occupant needs. RCx focuses on mechanical equipment, lighting and related controls. RCx optimizes existing system performance, rather than relying on major equipment replacement.

Recommissioning should be carried out in existing buildings to identify low-cost operational and maintenance improvements, in a systematic process, and bring the buildings up to the design intentions of its current use. RCx would include the review of the building automation systems (BAS) to ensure that the proper ventilation levels are provided to each discrete area and that programmed temperature settings are appropriate. Supplied ventilation may be able to be switched off or cut back to 50% during unoccupied times.

The operation of the air handling units should also be reviewed to make sure all equipment is fully operational and is not causing additional energy usage. Examples include valves passing hot water, or dampers that are not operational allowing additional amounts of fresh air to flow to the facility, or variable frequency drives (VFDs) that are not operating properly.

Energy audits

Energy audits should be carried out for each of the facilities to assess individual energy savings opportunities. The reports should include the estimated capital costs, energy savings, cost savings and paybacks and operational impacts. The goal, of course, is to lower the operating cost without sacrificing occupational comfort

Water audits

A water consumption audit should be conducted at each of the facilities to assess opportunities for reducing water use at each of the individual facilities. The opportunities to reduce the amount of water consumed would include the installation of low-flow toilets and urinals, and low-flow showerheads. Aerators should be considered in areas where infection control is not a concern. Other areas of potential water savings would be cooling towers.

In addition to the water cost savings that could be achieved through the implementation of the water conservation measures suggest above, the associated energy costs to heat the water would also be reduced.

Heating, ventilation and air conditioning (HVAC) & controls

Boilers, used for both heating and domestic hot water purposes, should be replaced with new high efficiency or condensing boilers (depending on the particular needs of the building) equipped with fully modulating burners.

The existing chillers should be replaced with new high efficiency chillers equipped with variable frequency drives (VFDs), together with energy efficiency cooling towers with VFDs.

100% fresh air units could be used to produce free cooling during the winter months; the make-up air units could be used to provide cooling for the chilled water in the building for equipment cooling, fan coils and other winter uses.

Heat recovery measures should be explored, including heat recovery from the exhaust air to transfer to the incoming fresh air stream.

Variable frequency drives should be considered for pumping systems and for the air handling units wherever possible. The VFD savings are very significant, for example running a fan at 80% of its speed would reduce the energy use by 50%.

The building automation system (BAS) should be used to optimize the chiller and chilled water system to provide very tight control of the chilled water production, distribution and usage in the facility.

The air-systems should be properly insulated and sealed and all hot water piping, where accessible, should be properly insulated.

Boiler combustion analyses should be carried out and the corrections that are identified should be implemented.

Lighting

While most fluorescent lighting has been changed from T-12 to T-8 there are still some opportunities to upgrade the magnetic ballasts to electronic ballasts, switch to T-5 or use LED technologies. Compact fluorescent lighting or LEDs should replace all incandescent lights. Occupancy sensors should be installed in public areas where permitted and in areas such as washrooms, storage rooms, mechanical and electrical rooms. LED exit lights should be installed.

Street lights should be upgraded to energy efficient technologies, including LEDs or induction lamps. Dimmable technologies should be looked at as a method to further reduce demand and electricity consumption.

Lighting levels throughout the building should be measured. Corridors and rooms are often over lit and there is an opportunity to reduce the number of lamps in the fixtures, which could significantly reduce electricity consumption.

Night audits should take place to ensure that the lighting control shut off all lighting in unoccupied areas, except the emergency exit lighting.

Plug load

The City should consider the following measures to reduce plug load consumption:

- Computers and monitors should be shut down when the staff leave for the evening or weekend; software updates could be carried out during regular business hours. New computer software is available which is designed to apply power savings options to unused computers. Power schemes can be applied to groups of computers.
- Printers and copy machines should be also switched off if possible.
- Vending Misers monitor both occupancy levels in the area around the vending machine and ambient temperate changes, allowing only enough power to keep the cooled product inside at the right temperature and have it ready to dispense

when someone is in the vicinity, powering down costly heat generating lighting and denying compressor cycles to run when they are not required.

LEED-EB

The LEED Green Building Rating System for Existing Buildings (EB) is a set of performance standards for the sustainable operation of existing buildings. The LEED-EB criteria cover building operations and systems upgrades in existing buildings where the majority of interior or exterior surfaces remain unchanged. The LEED Canada EB: O&M 2009 rating system helps building owners and operators measure operations, improvements and maintenance on a consistent scale, with the goal of maximizing operational efficiency while minimizing environmental impacts.

The City should consider a plan to rate their buildings under LEED-EB. The LEED Rating System for Existing Buildings addresses:

- Whole-building cleaning and maintenance issues including chemical use
- Ongoing indoor air quality
- Energy efficiency
- Water efficiency
- Recycling programs and facilities
- Exterior maintenance programs, and
- Systems upgrades to meet green building energy, water, IAQ, and lighting performance standards

Municipalities that have adopted LEED-EB standards include: Miami Beach City, Florida; Portland, Oregon; and Los Angeles, California.

Renewable energy and distributed generation (DG)

Renewable energy is energy which comes from natural resources such as sunlight, wind, and geothermal heat, which are naturally replenished. Utilizing renewable energy can significantly reduce the energy requirements of a building along with the associated greenhouse gas emissions.

The City should consider renewable technologies to reduce the overall energy use of their facilities. Renewable technologies includes photovoltaics; wind; geothermal; small biomass; combined small cogeneration (or combined heat and power, known as CHP); combined cooling, heat and power (CCHP); non-CHP systems; and gas fired CHeP systems. These systems can range from several kWs to several MWs in size.

Education, training and awareness

Education, training and awareness, including employee engagement and social marketing, is an integral part of the project plan and is critical to the success of the project in terms of achieving and sustaining the proposed savings. The overall intent of the training program is to complement the technological and organization changes proposed in the plan and maximize the energy savings resulting from the project. Training on building systems and energy efficiency will allow the building staff to modify operations to increase efficiencies, identify opportunities for energy savings measures

and raise awareness of energy efficiency among the non-technical staff. Case studies have shown that energy training and education for operators and staff can lead to greater energy savings than many building retrofits.

Energy monitoring

Monitoring of energy use should be integrated as part of the operation for the facilities. The daily hydro use profiles will be available from the interval meters at each building, either through the BAS or a web-based monitoring system. The monthly energy use should be regularly compared to the weather and occupancy corrected baselines.

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