

# Corporate Energy Business Plan – 2013 to 2018

Faced with exponentially-increasing energy prices, Corporate Energy has developed a transformative strategic business plan, positioning the Corporation to:

- Realize immediate bottom-line energy reductions and future avoided costs from rapidly escalating energy prices (Risk Mitigation)
- Build internal capacity to pursue deeper operational (non-capital) energy reductions
- Enable best practice service-based energy accounting
- Assist Departments to achieve their departmental CEI goals.
- Support broader corporate asset renewal through retrofit activity
- Leverage corporate assets for revenue – leasing rooftops for solar photovoltaic generation, tying facility boilers to district energy systems.
- Establish the City's corporate leadership role in the Community Energy Initiative.

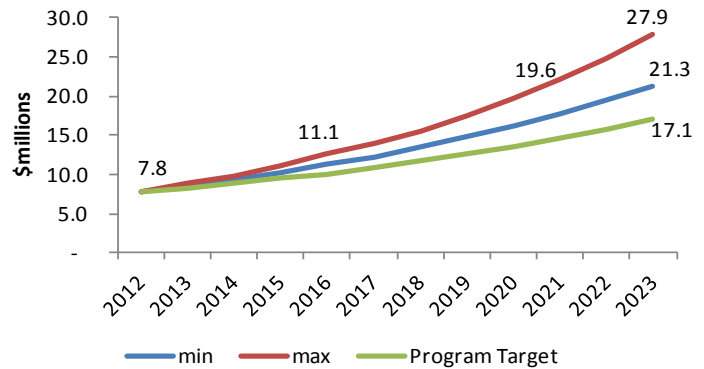
## Energy Price Increases

Municipalities are currently faced with energy price increases in excess of four times the current cost of living index.

Next to salaries, the largest year-on-year impact to the City's operational budget is double-digit electricity rate increases.

In 2011, the City's hydro bill was over \$7.7M which, according to predictions, could double in the next 7-8 years with continued exponential growth thereafter.

**Predicted Corporate Utility Costs Business As Usual (BAU) Scenario**



## The Corporate Energy Program is closely aligned with City strategic initiatives

- Closely supports the objectives of Guelph's 2012-2016 Corporate Strategic Plan
- Showcases innovative approaches and alternative financing as part of the new Finance & Enterprise Division
- Leadership role in support of the Community Energy Plan
- Aligned with Guelph Municipal Holding Company governance directive
- Chosen as a pilot for development of the Corporate Business Planning Framework.

## Corporate Energy Division Scorecard and Strategic Framework

Used to define and benchmark the Corporation with regards to best practice energy management and establish targets for achievement in 2012/2013.

Four Focus Areas of Best Practice:

1. Energy Management
2. Financial Management
3. Awareness & Information
4. Technical

## Corporate Energy Program Scorecard

### Energy management

Scores		Targets	
2010	2011	2012	2013
0.7	1.3	2.2	2.8

### Awareness and information

Scores		Targets	
2010	2011	2012	2013
0.3	1.2	1.8	2.5

### Financial management

Scores		Targets	
2010	2011	2012	2013
1.2	1.3	2.8	3.7

### Technical

Scores		Targets	
2010	2011	2012	2013
0.7	0.8	1.3	2.0

**Program Scorecard colour-coded greener the better (up to 4 points max)**

## Financial

The plan covers both operational (program) and capital (project) aspects to demonstrate that energy management is more than just energy conservation, encompassing the technical aspects of facility and process operation, organizational management, and human behaviour. The Plan is essentially a risk mitigation strategy.

### Capital (Project)

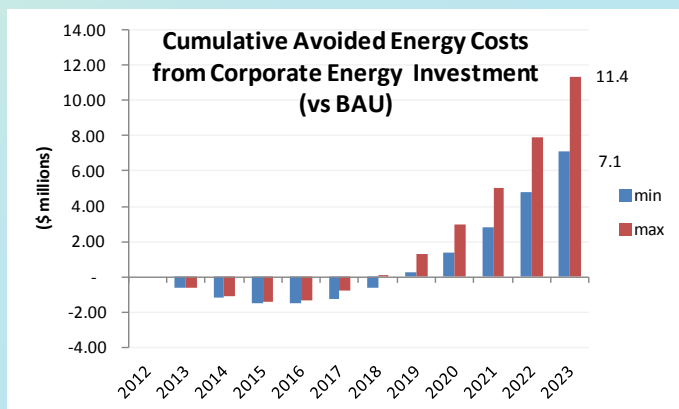
#### Capital (Project) Budget Request

for energy reduction projects:

2013	\$1.25M	<i>Payback: meets institutional-grade payback of 9-10 yrs</i>
2014	\$985kM	
2015	\$1.09M/yr	
2016 -2022	~\$1M/yr	

#### Avoided future costs

Avoided costs estimated at **\$2.3 to 3.5M/yr** in 2023, representing **\$7.1-11.4M** in net cumulative avoided costs over 10 years and **\$86M** over 20 years



### Operational (Program)

#### Energy/GHG Accounting and Reporting

Facility optimization function	\$80k
Subscription to Managing Energy data management software	\$35k
energy data management functional role	\$40k

#### Energy Projects

Project Manager (included as part of energy retrofit projects)	Within Capital Budget
Additional energy auditing using an outside consultant	\$75K
Continuous facility commissioning using a hired commissioning team	\$50K

#### Capacity Building

Energy Management training	\$5k
----------------------------	------

**Total \$288k**

### Alternative Funding Opportunities

The positioning of Corporate Energy within the new Enterprise Division, together with the program's alignment with the "Doing Business Differently" committee, provides an opportunity to identify and better assess alternate delivery and funding models.

Some alternatives being investigated include mobilizing City-owned assets into community-based energy activity, ie revenue generation from facility roof space leased to Envida for solar panels. We are also investigating third party bridge financing - including funding through Guelph Hydro via its unregulated arm, Envida. We will also be pursuing grants including FCM and Utility subsidies.

### Corporate Energy Excellence – Demonstrating Innovation and Best Practice

The goal of Corporate Energy program is to operationalize the steps to becoming a best practice energy managing organization in order to avoid future costs and risks associated with exponentially increasing energy prices. Through this, the City also demonstrates leadership in implementing the Community Energy Plan under the banner of the Community Energy Initiative.

# **Corporate Energy Strategic Business Plan**

**Community Energy Division  
Finance and Enterprise  
City of Guelph**

**September 21, 2012**

**City Hall**  
1 Carden St  
Guelph, ON  
Canada  
N1H 3A1

T 519-822-1260  
TTY 519-826-9771

[guelph.ca](http://guelph.ca)

# Table of Contents

Introduction .....	4
Business Plan Purpose and scope .....	4
Corporate Energy Program Backgrounder .....	5
The Imperative of Energy Rate Escalation .....	7
Electricity Price Predictions.....	8
Natural Gas Price Predictions .....	9
Overall Corporate Utility Increases.....	10
Benefits of Corporate Energy Management .....	10
Best Practice Energy Management Framework .....	11
Scoring for the City’s Corporate Energy Program.....	12
Implementation Plan - Turning Direction into Action.....	13
Energy management.....	13
a) Energy policy.....	13
b) Organising .....	14
c) Motivation.....	15
d) Information systems .....	15
e) Marketing.....	16
f) Investment.....	17
Financial management.....	17
a) Identifying opportunities .....	17
b) Exploiting opportunities.....	18
c) Management information.....	19
d) Appraisal methods .....	19
e) Human Resources .....	20
f) Project funding.....	20
Awareness and information.....	20
a) Energy management responsibilities.....	20
b) Energy efficiency awareness (Communications) .....	21
c) Reporting procedures .....	21
d) Review of energy performance.....	22
e) Ongoing training (Capacity Building) .....	23

# Table of Contents

f) Market awareness.....	24
Technical .....	24
a) Existing plant and equipment .....	24
b) Plant and equipment replacement .....	25
c) Maintenance procedures.....	25
d) Operational knowledge.....	26
e) Documentation and record keeping.....	26
f) Operational methods .....	27
Operational Resource Needs .....	29
Capital Resource Needs .....	30
Relationship between Operational and Capital Resource Needs.....	31
Financial Benefits to the Corporation.....	31
Discussion of Funding Alternatives.....	35
Traditional Funding Sources .....	35
Leveraging existing approved capital.....	35
Tax-supported debt (debenture, mortgage), funded via reserves .....	35
Alternative Funding Opportunities .....	36
Grants and Top-ups.....	36
Re-allocation of Federal Gas Tax money.....	36
Grants / Incentives.....	36
Summary .....	37
Appendix 1 - Corporate Energy Program Performance Metrics .....	39
Appendix 2 - Cost/Benefit Analysis – Capital Projects .....	39

## Introduction

Outside of labour costs, energy is the largest aggregated expense to the Corporation of the City of Guelph. It is also arguably the Corporate expense with the largest inflationary pressure. In 2012, the City's utility bills are predicted to top \$7.7M and this expenditure, if left unchecked, is expected to double in the next 7 years. On the positive side, energy is one of the more manageable expenses for the Corporation.

This Business Plan includes the business case for \$3.3M investment in energy efficiency projects over the next three years, resulting in 5.9% savings below Business-As-Usual utility expenditure. These savings will not decrease overall utility budgets, which will continue to rise under the pressure of double-digit utility rate escalation. However, investing in energy efficiency will help mitigate the exponential increase, paying dividends in future avoided costs. The concept of avoided costs, rather than absolute savings, is core to the business case presented here. Double-digit utility rate escalation for the foreseeable future, and increasing Corporate energy budgets, are the new reality but, by investing in energy management, the City achieves a level of risk management. That, together with the need to show leadership on energy matters in support of the Community Energy Initiative, both dictate that the Corporation needs to take immediate and significant action to manage its energy consumption.

The impact and timeline of the energy challenge is not a new issue – it is the reason the previous Council ratified the ambitious Community Energy Plan in 2007. The Community Energy Division is looking to minimize the Corporation's exposure to year-on-year exponential rate increases through best practice energy management programs, including seeking portfolio-wide energy conservation opportunities.

The Corporate Energy strategy is the overall strategy covering all matters related to energy and utility use within City operations. While spearheaded through the Community Energy Department, strategy success relies on an expanded, cooperative effort across all Departments, leveraging capital and operational Department budgets for investments into energy saving initiatives, as well allocation of Department staff resources during planning and implementation of these initiatives.

The Business Plan described here includes recommendations that are transformative rather than incremental in nature, positioning the Corporation to increase resilience, mitigate future risks and meet goals dictated by the Community Energy Plan and Corporate Strategic Plan. Benefits will accrue to all Departments through bottom-line energy avoided costs, internal capacity building and adoption of best practice service-based accounting.

## Business Plan Purpose and scope

This business plan was developed in support of the following items:

- Inform on corporate risk posed by exponentially escalating energy costs;
- Outline Corporate Energy's strategic approach to energy management;

- Describe strategic framework and key performance indicators to assess program success;
- Present business case for 2013 Capital Budget request for energy conservation projects to be conducted by the Corporate Energy Program in 2013 and beyond;
- Present business case for Operational Budget request for the Corporate Energy Program for 2013 and beyond; and,
- As part of Corporate Energy's involvement in the Business Development Framework Pilot.

The plan covers both operational/program and capital/project aspects to demonstrate that energy management is more than just implementing energy conservation retrofits. Energy management is instead multi-dimensional, encompassing the technical aspects of facility and process operation, organizational management, and human behaviour. The Corporate Energy Plan presented below addresses these three dimensions in a strategic approach to energy planning.

While Corporate Energy is not a new program for the City, there has not been an over-arching Corporate Energy strategic business plan, to date, nor has the program been funded to a large degree, both in terms of capital and operating budget. Because of this, and because Corporate Energy is an initiative that closely supports the objectives of Guelph's 2012-2016 Corporate Strategic Plan, it was chosen as a pilot for development of the Corporate Business Planning Framework.

This business plan outlines a forward-looking strategy for the Corporate Energy program together with an aggressive implementation plan that will turn direction into action. The Plan outlines a series of goals, objectives, and initiatives designed to support the strategic directions of the City. The plan is used to guide decision making, resource allocation, and prioritization. The Plan includes a preliminary implementation plan with timelines, costs, resources, requirements, impacts, and risks.

The Corporate Program Manager, Energy is responsible for delivering the Corporate Energy Program and for developing this business plan. Programmatic oversight is provided by the Corporate Manager, Corporate Energy.

## **Corporate Energy Program Backgrounder**

The Corporate energy management function has existed since 2008. In early 2011, the work was re-structured to be more strategically and organizationally linked with the broader Community Energy program. In April of 2011, the position of Program Manager, Energy was filled after being vacant for nearly a year. Previously, the responsibility of corporate energy management was overseen by the Energy Conservation Project Manager within the Corporate Services department and focussed primarily on energy reduction projects, including electricity and gas procurement. While these are still a core priority, in addition to energy reduction projects, the new Corporate Energy Program Manager is now also responsible for operationalizing the steps to becoming a best practice energy managing organization, a longer-term and ultimately a more sustainable and effective model.

Since 2011, the Community Energy Division has been seeking opportunities in regard to energy conservation within City facilities as well as energy reductions that help mitigate ever-escalating Department energy budgets. Examples include various energy efficiency upgrades such as energy efficient lighting systems, solar domestic hot water systems, new HVAC units and high efficiency boilers. These measures have been financed from Departmental capital and operating budgets, Infrastructure Stimulus Fund (ISF) grants, and 3rd party grants from sources such as the Ontario Power Authority, Guelph Hydro and Union Gas.

Following are a few examples of energy-related initiatives since 2011:

Leveraging a grant of over \$118k from the Continuous Improvement Fund (CIF) through Waste Diversion Ontario (WDO), the Materials Recovery Facility implemented six energy reduction projects including energy efficient lighting and controls, power factor correction, and HVAC upgrades, all controlled by a new state-of-the-art building management system. Avoided Costs are estimated at approximately \$100k/year, or 25% of total annual energy costs, with a payback of less than 1.5 years on the City-funded portion of the total project costs.

At Exhibition Rink, induction lights replaced the old metal halide lighting and will result in over 60% energy reduction and \$5,400 in avoided costs annually, equating to \$100k avoided over 10 years. The lighting retrofit qualified for \$6,336 in incentives from the Ontario Power Authority (OPA) saveONenergy Retrofit Program, or 25% of fixture cost. Smaller scale lighting retrofits were conducted at an additional 10 facilities, replacing inefficient bulbs and fixtures with lower wattage T8 fluorescent units and resulting in \$13k avoided costs per year in electricity and a 1.3 year payback.

An ISF grant was used to initiate several energy initiatives at the River Run Centre, including solar panels and a “tankless” or “on-demand” high efficiency boiler for domestic hot water, new heating boilers, and lighting controls integration. ISF money also helped sponsor conversion of HVAC units at Evergreen Seniors Community Centre to more efficient units. Guelph Transit also added solar panels as part of refurbishment work in 2011, with additional plans to retrofit garage lighting in 2012.

Avoided operational costs will be realised from the new cogeneration plant at West End Community Centre, which was commissioned in summer 2012, and awaiting Ministry approval for continuous operation.

Finally, not to be overlooked, are avoided energy costs as a result of water savings achieved by the Water Department’s conservation demand management (CDM) group. These include retrofit of low-flow showerheads, rainwater harvesting (Lyon’s Pool), and recovery/reuse of bus wash water at the Watson Road Transit Facility to be commissioned in 2012. The link between water and energy reductions provide doubled savings while meeting multiple corporate goals.

Since 2011, the City has secured over \$1.9M worth of incentives for energy-related initiatives from various levels of government agencies. This is in addition to what the City will realize in energy reductions and avoided energy costs.



This business plan envisions an expansion of the program in 2013, with the Corporate Energy Program Manager extending into a managerial role with the addition of a direct report (Project Manager - PM). This PM will oversee implementation of energy reduction projects, additional energy audits and other projects such as rooftop solar installations etc. The Corporate Energy Program Manager would also guide the work of a new resource that would be responsible for optimizing facility utility consumption on a day-to-day basis. Oversight for this function would remain with Corporate Building Maintenance.

Investment in corporate energy management pays dividends through improved service-based accounting, energy cost avoidance, and risk mitigation; all the while demonstrating leadership in implementing the Community Energy Plan under the banner of the Community Energy Initiative.

Avoided costs present an opportunity to leverage innovative, alternative financing and are one of the reasons that the Corporate Energy program has now been repositioned under the new Finance & Enterprise (F&E) Division. The Corporate Energy Program is also closely aligned with a number of City strategic initiatives including Guelph's 2012-2016 Corporate Strategic Plan. The program also directly supports the objectives of the Community Energy Initiative (CEI), a key strategic initiative for the Corporation.

Beyond corporate boundaries, Corporate Energy is responsible for legislative reporting including development of annual energy reports as well as a 5 year Energy Conservation Plan, as required under new regulation OReg 397/11, Section 6, part of the Green Energy Act (2009).

At the national level, Corporate Energy will spearhead the City of Guelph's participation in ICLEI's Partners for Climate Protection (PCP) program, including annual reporting and participation in meetings.

Over the coming year, Community Energy will be exploring and assessing alternatives to the current management and administrative oversight of Corporate Energy, including the use of available tools at our disposal such as the Guelph Municipal Holding Company (GMHI).

## **The Imperative of Energy Rate Escalation**

Municipalities are currently faced with energy price increases in excess of four times the current cost of living index, as measured by the Consumer Price Index (CPI) and Municipal Price Index (MPI). This challenge is exacerbated by the pressure to increase services while maintaining or reducing tax-based operating and capital budgets. These pressures, together with a desire to demonstrate a leadership role under the Community Energy Initiative, require that the Corporation aggressively pursue energy management and energy efficiency.

There is a Corporate "Insurance and Risk Management Policy" which states that "It is the responsibility of each department to identify the potential perils, factors and types of risk to which their assets, program activities and interests are exposed." Next to salaries, the largest year-on-year impact to the

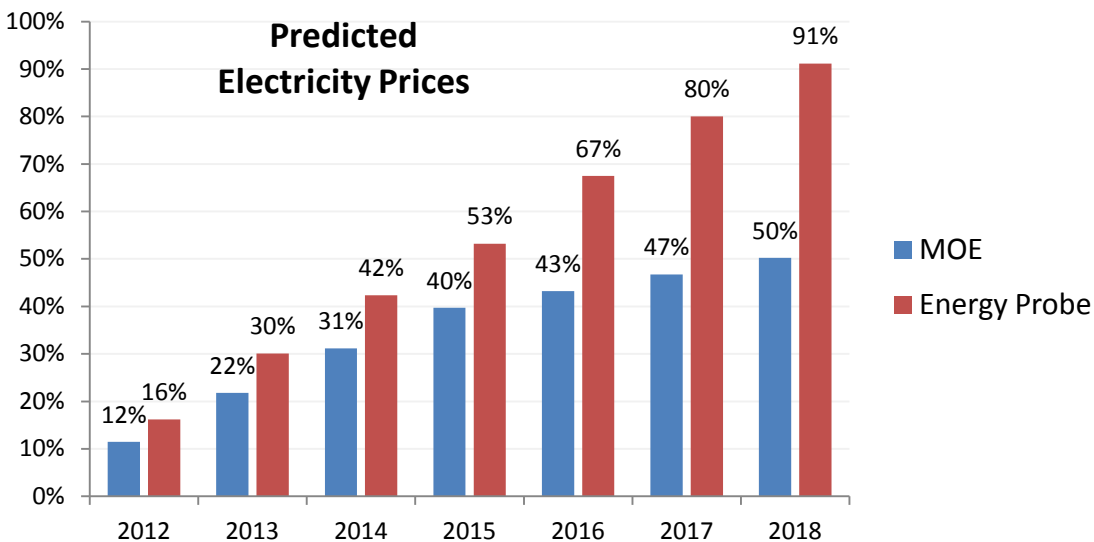
City's operational budget is double-digit electricity rate increases. Natural gas prices, while currently stable, are also expected to significantly rise as natural gas reserves decline over the next decade.

## Electricity Price Predictions

Electricity price increases in excess of cost of living are a result of upward pressure from:

- Increasing cost of developing new fossil fuel reserves
- Carbon pricing/taxation
- Cost recovery following electricity market deregulation as well as the need to pay for new energy infrastructure (Province's planned investments of over \$87 Billion in energy infrastructure to replace coal by 2015).

There are two sources for electricity cost predictions in Ontario. The Ministry of Energy Long Term Energy Plan (LTEP) predicts 46% increase by 2015, or between 9 and 12% per year. Energy Probe, a respected industry think tank, went further by taking into account infrastructure renewal costs and new energy sources (nuclear and renewable energy) that will be required to replace coal generation plants and is considered a more reliable prediction of true energy prices. Predictions by Energy Probe are 16.2% electricity increase in 2012, 53.2% by 2015 and 91% by 2018. This represents an annual exponential increase of 13% per year. These cost increase predictions are depicted in Figure 1 below.



**Figure 1 – Predicted Electricity Rate Increases**

In 2011, the City's hydro bill was over \$6M which, according to the above predictions, could double in the next 7-8 years with continued exponential growth thereafter. Based on the predictions, for the average ratepayer, an annual electricity bill would escalate from \$1,700 per year to over \$4,000/yr in 2018.

## Natural Gas Price Predictions

For the last four years, natural gas prices have continued to trend downwards for the following reasons:

1. Reduced industrial demand the recession beginning in mid-2008
2. record high seasonally adjusted storage levels due to an unusually warm winter weather season across North America
3. record production levels due to discovery of large formations of shale oil and gas

Current low price levels are not expected to last beyond the next 3-5 years:

- Recent shale gas finds are coming under more and more environmental scrutiny.
- Exporting of liquid natural gas will decrease local supply and expose N.America to global gas prices.
- Conversion of coal facilities to natural gas will also increase demand.

While debate will continue as to when fossil fuel production will peak, what we do know is that the timing is imminent (within a decade). Also debatable is the price impact, but municipalities such as Guelph can reasonably expect exponential price increases together with price volatility as the supply-demand balance shifts.

Despite the uncertainty, Figure 2 shows price increases that can reasonably be expected for natural gas prices to 2023 (Source: Envida). The prediction indicates a 50% increase by 2017, doubling of gas price by 2022 and a three-fold increase by 2030.

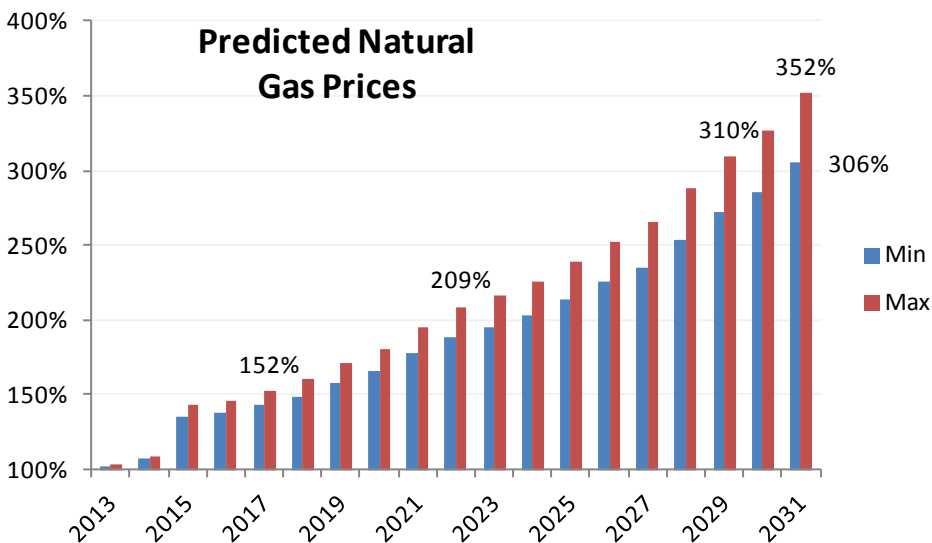
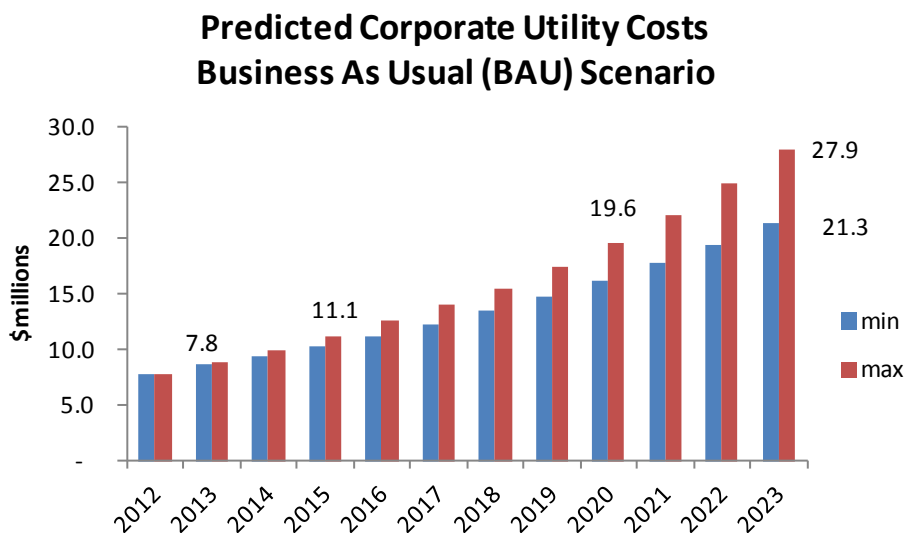


Figure 2 Predicted Natural Gas Rate Increases

## Overall Corporate Utility Increases

Exponentially increasing utility costs amplify the corporate risk posed by energy. In 2012, the City's utility bill is predicted to top \$7.7M. Under a Business-As-Usual scenario, assuming 1% growth in corporate energy usage and year-on-year rate escalations shown in Figures 1 & 2, the City utility cost is expected to reach \$21-28M by 2023 (Figure 3). Left unmanaged, this would represent an approximate increase of 13%-18% over the current net tax levy (2012).



**Figure 3 Predicted utility costs for the Corporation under Business-As-Usual Scenario**

## Benefits of Corporate Energy Management

Managing the Corporation's energy consumption will reduce the Corporation's exposure to increases due to growth and energy rate escalation. The business case analysis presented in this Plan demonstrates that investment in corporate energy management can not only be recovered, but will realize significant avoided energy costs. However, the business case for building a robust Corporate Energy program is not simply a financial one, and can only be assessed based on integrated benefits of ongoing energy management, both fiscal and institutional. Beyond identifiable energy reductions and future cost avoidance, energy reduction has the following non quantifiable benefits:

- Mitigate the longer term risk of rapidly escalating energy prices
- Lowers CO2 Emissions (carbon footprint)
- Reduces Global Warming
- Build capacity to pursue deeper energy reduction
- Support broader corporate asset renewal through retrofit activity
- Demonstrates the City as a sustainable-minded organization and a corporate leadership role in the Community Energy Initiative

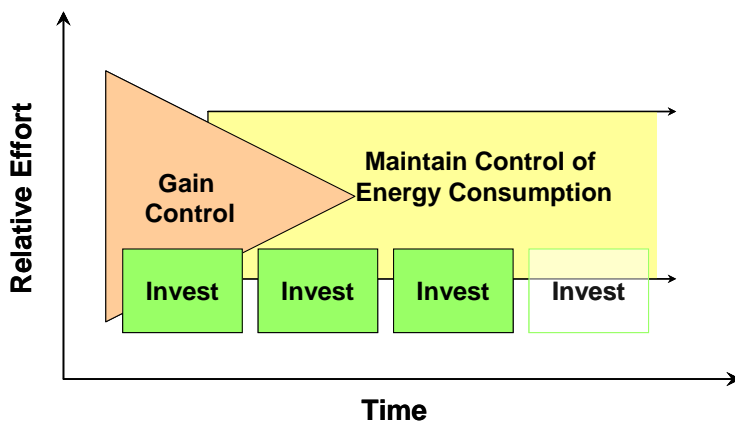
The Corporate Energy Program delivers value to the corporation by facilitating outcomes that various city departments want to achieve, specifically energy operating budget control and department responsibilities with respect to achieving their CEI goals.

## Best Practice Energy Management Framework

Energy management is more than just energy reduction – holistically encompassing technical, organizational, and human behavioural aspects. Energy management can be seen as a three-phase process:

1. gaining control of energy use
2. maintaining control as a continuous business process
3. investing in measures to improve energy performance

Effort and resources expended on these phases vary over time (see Figure 4 below).



**Figure 4 Strategic Phases of Energy Management**

The Corporate Energy program is still in start-up mode and, while it will be an ongoing program, the rapid expansion envisioned in this business plan over the next few years is considered necessary to gain a basic level of control over the Organization's energy consumption.

In 2011, Corporate Energy implemented a strategic framework to define best practice energy management, to benchmark where the Corporation is at using both quantitative and qualitative metrics, and also establish targets for achievement in 2013 and beyond.

This criteria is based in large measure on techniques and tools developed in the UK under the Best Practice Program of the Department of Environment. The framework includes clearly defined success criteria for the Corporate Energy Program as a whole to be able to measure the success and progress against the plan goals in four focus areas:

1. Energy Management
2. Financial Management
3. Awareness & Information

#### 4. Technical

Each of the above four focus areas (Level 1 Matrix) contains several sub-categories (Level 2 Matrix). The four focus areas and Level 2 Matrix sub-categories are further described in Appendix 1.

The Corporate Energy program strategy is in response to a desire to improve the program across all performance metric categories. For each of these categories, a score was derived for past years (2010 & 2011) and targets established for achievement in 2013 and 2014. Performance of the program against these metrics will be assessed at key junctures to see if anticipated outcomes are in fact being realized or if additional effort is required.

### Scoring for the City's Corporate Energy Program

The "Dashboard" summary in Figure 5 shows corporate scoring goals established for 2012 and 2013, colour-coded to indicate how well we're doing (the greener the better with 4 being the maximum score). The focus areas requiring more effort correspond to the areas of focus for this business plan.

The "Investment" category refers to investments in both the energy management program as well as energy reduction projects. This category is shown as "on track" with the assumption that 2013 capital and operating budget requests are approved by Council.

#### Corporate Energy Program Dashboard 2012/2013 Target Scoring

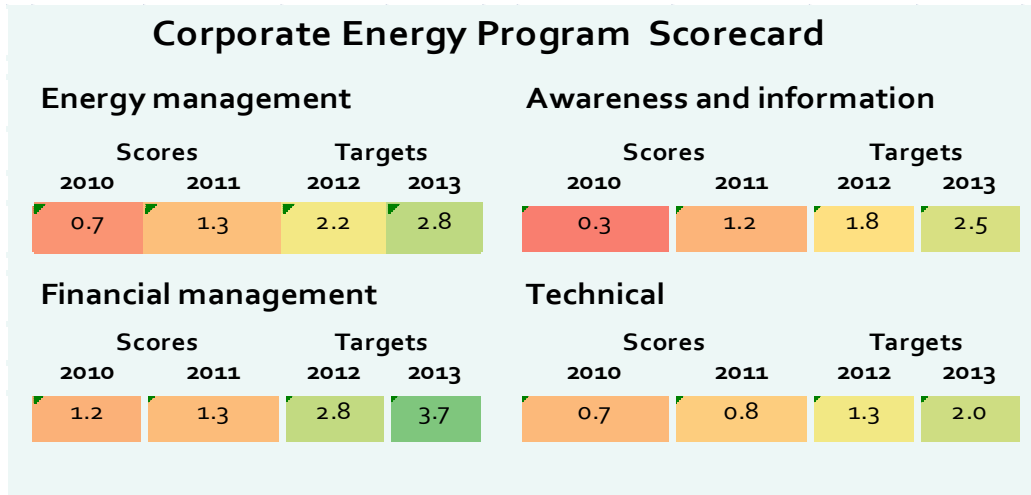
<u>Energy management</u>	2012	2013	<u>Awareness and information</u>	2012	2013
Energy policy	2.0	4.0	Energy management	2.0	3.0
Organising	2.0	3.0	Energy efficiency awareness	2.0	3.0
Motivation	2.0	2.0	Reporting procedures	2.0	2.0
Information systems	2.0	2.0	Review of energy performance	2.0	3.0
Marketing	2.0	3.0	Ongoing training	1.0	2.0
Investment	3.0	3.0	Market awareness	2.0	2.0
Average score	2.2	2.8	Average score	1.8	2.5

<u>Financial management</u>	2012	2013	<u>Technical</u>	2012	2013
Identifying opportunities	3.0	3.0	Existing plant and equipment	1.0	2.0
Exploiting opportunities	3.0	3.0	Plant and equipment	1.0	2.0
Management information	3.0	4.0	Maintenance procedures	1.0	2.0
Appraisal methods	3.0	4.0	Operational knowledge	1.0	2.0
Human resources	3.0	4.0	Documentation and records	2.0	2.0
Project funding	2.0	4.0	Operational methods	2.0	2.0
Average score	2.8	3.7	Average score	1.3	2.0

**Figure 5 Corporate Energy Program Dashboard showing goals for 2012 and 2013**

Figure 6 shows Corporate Energy Program scores for 2010/2011 together with goals for 2012 and 2013 (the greener the better with 4 being the maximum score). The graph shows the general progression towards best practice, while also highlighting areas that require more effort. The objectives for each focus area, together with specific actions and resource requirements, are outlined in the section following entitled “Discussion of Program Focus Areas for 2012/2013.”\



**Figure 6 Corporate Energy Program scores for 2010/2011 & goals for 2012/2013.**

## Implementation Plan - Turning Direction into Action

A key objective of the Corporate Energy Program is to define best practice energy management and operationalize within corporate management structure so that it is “Business as Usual”. Below is further discussion on the Corporate Energy strategy in the four key areas of focus:

1. Energy Management
2. Financial Management
3. Awareness & Information
4. Technical

Each section describes where the Corporate Energy Program is currently plus future objectives, proposed actions, and new resource requirements that are considered necessary for achieving these actions.

### Energy management

#### a) Energy policy

Current situation: No explicit corporate energy-related policies

Objective(s):

- Generate energy-related policies covering operations, capital replacement and procurement.

- Energy policy, action plan and regular review have commitment of top management as part of an environmental strategy.

Action:

- Program Manager to assist Procurement, including:
  - Specifying lower energy products through Procurement (non-capital replacement)
  - Utility procurement strategy for gas and electricity to reduce costs &/or risks

Resource needs:

No additional resource needs. The existing Program Manager will be responsible for generating energy-related policies.

Objective 2: Support Planning Division initiatives

Action:

- Program Manager to assist Procurement, including:
  - Integration of CEI goals into City Planning Activities (Official and Secondary Plans)
  - Analyzing and developing planning incentive tools such as Community Improvement Plans (CIPS) and Local Improvement Charges (LICs).

Resource needs:

No additional resource needs. The existing Program Manager will be responsible for providing assistance as needed.

## **b) Organising**

Current situation:

- Energy manager reports infrequently to the Corporate Implementation Sub-Committee of the Mayor's Task Force on Community Energy. This sub-committee has not been utilized to maximum effect.
- There is a disconnect between energy budgets, which are a departmental responsibility, and responsibility for corporate energy efficiency, which is the responsibility of the Energy Program Manager.

Objective(s):

- Corporate Implementation Sub-Committee to be placed as a Sub-Committee of the Direct Report Leadership Team (DRLT). Membership of this sub-committee changed to represent energy budget holders and other key department stakeholders, including Finance.
- Energy Manager to report quarterly to this sub-committee.



- Improve & formalize communication between Energy Manager and departmental energy budget holders (i.e. regarding variance, budgets etc).

Action:

- Energy Program Manager to work with Corporate Manager to establish DRLT sub-committee.
- Energy Manager to develop formal Departmental communication/reporting plan.

Resource needs: No additional resource needs, covered by the existing Program Manager and Corporate Manager.

### **c) Motivation**

Current situation: channels of communication regarding energy efficiency rely on Informal contact between Energy Program Manager and engineer/technical staff and users. Energy management is only just starting to be seen as important, mainly as one of only a few areas available to business units for controlling operational budgets.

Objective(s): Both formal and informal channels of communication regularly exploited by energy manager and energy staff at all levels.

Action:

Per 1b) “Organizing” above:

- Energy Program Manager to work with Corporate Manager to establish DRLT sub-committee.
- Energy Manager to develop formal Departmental communication/reporting plan.

Resource needs: No additional resource needs, covered by the existing Program Manager.

### **d) Information systems**

Current situation: we are only just beginning to monitor and report on energy consumption (\$) based on utility invoicing. Energy unit has ad hoc involvement in budget setting.

Objective(s): Improve corporate energy accounting functions and related reporting and communication strategies. This strategy centres on subscription to ManagingEnergy energy data management software that includes monitoring, tracking and reporting (M,T&R) capabilities to enable:

- Improved data flow from gas and electric utilities
- Centralized automatic collection of facility energy data
- Analysis of facility consumption to discover operational anomalies and to identify the worst performing facilities
- Analysis of utility invoices to uncover billing errors
- Streamlined reporting to front-line energy budget holders and financial analysts responsible for energy budget tracking.
- Streamline procedures for public energy and greenhouse gas reporting, customized to audience (targeted stakeholders / public).

Action:

- Implement ManagingEnergy energy web-based data management software
- Add a “*Facility Optimization Coordinator*” function to work with the Energy Program Manager, maintenance staff and facility managers in the monitoring, optimization, and trouble shooting of existing and planned building automation systems.
- Add an “Energy Data Management” resource to provide liaison between Finance and the energy accounting functional role of the “*Facility Optimization Coordinator*”.
- Train energy budget holders and accounting staff on software

Resource needs:

- Subscription to Managing Energy energy data management software \$32,328 total:
  - \$12,648 for Utility Bill Entry (82 electrical and 42 natural gas meters).
  - \$19,680 for ManagingEnergy Subscription (Energy Accounting Module: \$20.00/facility/month x 82 facilities).
- The *Facility Optimization Coordinator* function is a critical support role involved in following tasks:
  - Optimize facility utility consumption (gas, hydro, water) through monitoring of ManagingEnergy utility data management software, existing Building Management Systems (BMS) and collected facility data.
  - Identify utility use anomalies and liaise with Corporate Building Maintenance to trouble-shoot and rectify
  - lead with respect to maintenance, installation, and set up of building automation systems
  - Oversee commissioning of mechanical and electrical systems in our new facilities and supporting retro-commissioning of existing buildings.
- For the “*Energy Data Management*” resource, it is envisioned that this part-time (50%) role could either be staffed using existing Finance resources or, alternatively, could be a contract position. Utility accounting will be streamlined through implementation of the ManagingEnergy energy management software, so current Accounts Payable staff may be able to be dedicated to this role without need for additional resourcing. In case this is not possible, \$40k has been allocated in Corporate Energy’s operational budget request to cover this function.
- Energy Program Manager to implement ManagingEnergy software and train energy budget holders
- Budget holders already have responsibility for tracking their utility expenditures.

**e) Marketing**

Current situation: Informal contacts used to promote energy efficiency.

Objective(s): improve internal communication and training around energy efficiency

Action:

- 2013 – Introduce ad hoc staff awareness training.

- 2014 – Implement program of staff awareness and regular publicity campaigns.

Resource needs:

No additional resource needs, covered by the existing Program Manager with assistance from Communications Dept.

#### **f) Investment**

Current situation: no tacit consideration of energy efficiency when deciding on investments (lifecycle replacement and procurement). Where energy is considered, analysis is based on short-term payback criteria only.

Objective(s): Utilize same payback criteria employed as for all other lifecycle-related investments/purchases.

Action: Energy Program Manager to work with CSS and Procurement to incorporate lifecycle costing into decision-making around investments/purchases. This includes Net Present Value (NPV) and other long-term cost/benefit tools.

Resource needs: No additional resource needs, covered by the existing Program Manager.

### **Financial management**

#### **a) Identifying opportunities**

Current situation: in 2012, Corporate Energy conducted the first of a series of energy audits by outside consultants for thirteen buildings likely to yield largest savings.

Objective(s): to continue energy audits for other facilities, tax-based and enterprise.

Action:

- Additional energy auditing beyond the 13 facility energy audits conducted in 2012. This work will be conducted using an outside consultant in conjunction with a hired commissioning team. Estimated fee for this work is \$75k. Scope includes:
  - Conduct facility energy audits
  - Identify energy reduction opportunities, complete with cost/benefit analysis.

Resource needs:

- Energy audits will be managed on behalf of the Corporation PM by an Energy Project Manager function funded as part of the capital budget request for energy reduction projects. In addition to overseeing the energy audits, this Energy Project Manager will be responsible for project management of Energy reduction projects identified in the 2012 energy audits (see item b , below).
- Contract for additional energy auditing using an outside consultant in conjunction with a hired commissioning team (\$75k)

## b) Exploiting opportunities

### Current situation:

- Formal energy audits in 2012 have identified \$3.3M of energy conservation measures at thirteen buildings likely to yield largest future avoided costs. These projects will be accomplished over the next three years (based on funding approval). Details of this capital request are included later in this report. The business case for the recommended measures, including full breakout by facility, is included in Appendix 2.
- Included in the energy audit recommended measures are a number of “operational” or “low hanging fruit” measures with quick paybacks and low capital. The Energy Program Manager is exploring implementation options with Corporate Properties Maintenance and Building Operations staff, with the hope of completing these in 2012/early 2013. The Energy Program Manager uses informal contacts to identify additional projects to reduce energy consumption.
- The Energy Program Manager is also invited to comment on most large-scale new-build, refurbishment and plant replacement projects.

### Objective(s):

- Fund and Implement cost-effective energy reduction measures identified in energy audits.
- Move towards “continuous commissioning” of facilities in partnership with Corporate Buildings.
- Require that energy staff be invited to comment on all new-build, refurbishment and plant replacement projects.

### Action:

- Implement energy reduction measures identified in audits conducted in 2012 at 13 tax-based facilities.
- Oversee continuous commissioning of facilities in partnership with Corporate Buildings. This work will be conducted using a hired commissioning team. Estimated fee for this work is \$50k.
- Internal consulting to maximize energy performance of capital replacement & life cycle projects having an energy component
- Promotion and project Management of renewable energy generation projects on city property in conjunction with Envida (Guelph Hydro), i.e. solar photovoltaic on city rooftops.

### Resource needs:

- Energy Project Manager to manage following projects on behalf of the City:
  - \$3.3M in energy reduction opportunities identified in 2012 facility energy audits. Includes managing incentive applications.
  - Renewable energy generation projects on city property in conjunction with Envida (Guelph Hydro), i.e. solar photovoltaic on city rooftops.
  - Additional energy auditing using an outside consultant in conjunction with a hired commissioning team (\$75k)
  - Continuous facility commissioning using a hired commissioning team (\$50k).

Notes on Energy Project Manager function:

- since this position is a resource need associated with the \$3.3M capital project request for 2013-2015, costs are included within the 2013-2015 Capital funding request although the plan envisions the possibility of continuing this function as an operationally funded FTE in future years as a resource for ongoing energy-related projects.
- Oversight of Energy Project Manager provided by the existing Corporate Energy Program Manager.
- Design and construction contracts to implement energy conservation measures at thirteen buildings

### c) Management information

Current situation: *ManagingEnergy* energy data management system was implemented in July 2012 that will allow tracking of utility expenditures for all significant utility accounts. The system will also enable verification of utility bills and variance analysis. Without discreet sub-metering at facilities, however, it is still difficult to demonstrate the effectiveness of investment in energy efficiency except on a macro facility-wide basis.

Objective(s):

Full management information system enabling identification of past savings and further opportunities for investment meeting organisation's financial parameters.

Action:

- fully populate and test *ManagingEnergy* energy data management system
- provide training to budget holders, operations staff and Finance on *ManagingEnergy* energy data management system

Resource needs:

No additional resource needs, covered by the existing energy audit contract, with oversight by the Energy Program Manager.

### d) Appraisal methods

Current situation: Traditionally, simple payback criteria are applied for evaluation of energy projects. No account taken of lifetime of the investment. For all measures as part of the 2012 energy audits have evaluated based on lifecycle costs using the organisation's specified discount rates.

Objective(s): Full discounting methods using internal rate of return and ranking priority projects as part of an ongoing investment strategy.

Action: As part of the energy audits, identified energy reduction recommendations will have associated lifecycle business case.

Resource needs: No additional resource needs, covered by planned energy audits with coordination by the existing Energy Program Manager.

#### **e) Human Resources**

Current situation: Energy manager working well with accounts/finance department to present well-argued cases to decision makers.

Objective(s): City Council to take a proactive approach to a long-term investment in Energy Management Program.

Action: Council approval of business plan and capital & operational budget requests

Resource needs:

No additional resource needs, covered by the existing Energy Program Manager, who is responsible for developing the business plan and business case and participating in the Business Development Framework Pilot.

#### **f) Project funding**

Current situation: Energy projects not formally considered for funding from capital budget, except when very short-term returns are evident.

Objective(s): Projects compete equally for funding with other core business investment opportunities. Full account taken of benefits which do not have direct cost benefit, e.g. improved service-based accounting, capacity building, marketing opportunities, environmental factors.

Action:

- Populate 10 year budgeting cycle with energy projects.
- Demonstrate prioritization of energy projects in alignment with corporate strategic goals.
- Investigate and secure third party financial support (i.e. Envida & other potential sources)
- Work with Financial Analysts to seek third party financial support through incentive programs (for audits, retrofits) and partnerships

Resource needs:

- Seeking funding will be covered by existing Energy Program Manager and Corporate Manager with assistance from Financial Analyst assigned to Corporate Energy Department.

### **Awareness and information**

#### **a) Energy management responsibilities**

Current situation: Energy Management is centralized under the Energy Program Manager. Within other Departments or Divisions, there are no formal assigned staff responsibilities for energy efficiency.

Objective(s): Move responsibility for energy efficiency to departmental level.

Action:

- Formalize staff responsibility for energy efficiency. Develop lists of responsibilities for key energy staff and all departments.
- Program Manager to establish Corporate Energy Committee with representatives from all energy account holders.

Resource needs:

No additional resource needs, the existing Program Manager will work with departments establish Corporate Energy Committee and develop lists of responsibilities.

### **b) Energy efficiency awareness (Communications)**

Current situation: No Corporate Energy communications strategy for corporate or CEI initiatives, either internal (Corporate) or external (public). Energy performance has only been occasionally reported and only to a limited audience. No general promotion of energy-saving measures.

Objective(s):

- Develop and implement a formal Corporate Energy communications strategy for corporate energy and CEI initiatives.
- Actively seek ideas from staff.

Action:

- Work with Communications Division to design Corporate Energy communications strategy for Corporate Energy and CEI initiatives; leveraging existing and new media tools (web 2.0).
- Develop specific communication pieces.
- For all communications or any media-related inquiries relating to Corporate Energy, provide assistance to the primary spokespersons; namely the Task Force Manager and Chair of the City Implementation Committee of the Mayor's Task Force on Community Energy
- Share knowledge & experience with other municipalities.

Resource needs: No additional resource needs. The existing Program Manager will be responsible for generating Corporate Energy communications strategy with assistance from Communications Division.

### **C) Reporting procedures**

Current situation:

- Internal energy status reports have only been generated in response to specific requests (i.e. Council).
- Up until now, there has been no requirement to publicly report the Corporation's energy consumption or greenhouse gas footprint. The City is now required to develop and report on its Energy Conservation Plan, as required under new regulation OReg 397/11, Section 6, part of the Green Energy Act (2009). This includes annual reports and a strategic plan updated every 5 years.

Objective(s):

- Increase frequency of corporate energy efficiency reporting and review.
- Performance compared against internal and external references or benchmarks.
- Meet regulatory reporting requirements

Action:

- Publish energy and greenhouse gas reports, customized to audience (targeted stakeholders / public).
  - Energy Conservation Plan, as required under new regulation OReg 397/11, Section 6, part of the Green Energy Act (2009). This includes annual reports and a strategic plan updated every 5 years.
  - ICLEI Partners for Climate Protection (PCP) program, annual reporting and meetings.
  - Council Report on Energy Achievements
  - Internal and external communications

Resource needs:

No additional resource needs, covered by the existing Program Manager.

#### **d) Review of energy performance**

Current situation:

- We are only just beginning to monitor and report on energy consumption. This has focused on utility costs rather than energy consumption, in keeping with the focus on energy budgeting and variance analysis.
- Baseline energy use has been established for thirteen audited facilities, representing 90% of energy total corporate expenditure on the tax-base side (streetlights excluded).

Objective(s):

- Utilize ManagingEnergy energy data management software and other existing business systems for frequent:
  - Review of energy efficiency performance compared against internal and external references or benchmarks.
  - Analysis of facility consumption to discover operational anomalies and to identify the worst performing facilities
  - Analysis of utility invoices to uncover billing errors

Action:

- Establish schedule for regular energy efficiency performance reviews.
- Implement ManagingEnergy energy web-based data management software
- Train energy budget holders and accounting staff on software



Resource needs:

- Implementation covered by the existing Program Manager.
- Staff and Council will have reports to review.
- Budget holders and accounting staff will need to be trained on energy software

#### e) Ongoing training (Capacity Building)

Current situation: Staff energy efficiency awareness generally low. A few staff have knowledge of energy efficiency techniques and facts. Little, if any, training in energy efficiency for staff. The Program Manager, Energy is a Professional Engineer but does not have certification as a Certified Energy Manager (CEM). Another item related to corporate capacity-building includes the support that the Energy Program Manager provides on Planning Department initiatives, including:

- Integration of CEI goals into City Planning Activities (Official and Secondary Plans, analyzing and developing planning incentive tools like CIPs, LICs).
- Assistance to Building Services to incorporate/promote CEI goals and regulations like the 2012 Ontario building code (OBC), including the Assist in development of 2012 OBC checklist

Objective(s):

- Developing general staff awareness is covered by item *b) Energy efficiency awareness (Communications)*.
- Technical and premises staff development mainly via professional and technical journals.
- Occasional initiatives to train staff in energy efficiency.

Action:

- Energy Program Manager to work with Departments to identify training needs, develop framework and facilitate staff training and information sessions.
- Depending on training, Energy Program Manager to deliver or sub-contract to outside consultant/agency.
- Energy Program Manager to receive training as Certified Energy Manager (CEM).

Resource needs:

- Certified Energy Manager (CEM) training for Energy Program Manager \$3k
- Energy Management training \$5k
- Depending on level of training required, can be delivered by Energy Program Manager or sub-contracted to outside consultant/agency.
- Department staff to dedicate time/resources to training
- Remaining capacity building action items covered by existing Program Manager

## f) **Market awareness**

Current situation: Trade journals, literature and other sources scanned by Energy Program Manager on an ad hoc basis for information on the latest developments relating to energy efficiency. Energy Program Manager attends 1 to 2 targeted conferences per year.

Objective(s):

- To understand Best Practice and industry trends
- Develop network of other energy managers in other jurisdictions.

Action:

- Energy Program Manager to
  - Accommodate time to review trade information on Best Practice and industry trends.
  - Continue to develop network of other energy managers in other jurisdictions.
  - attend following two annual conferences, including Energy Matters (Peel Region) and AMO/LAS Connections Energy Symposium

Resource needs:

- Conferences - 2 events x \$1.5k = \$3k
- No additional resource needs, covered by the existing Program Manager.

## **Technical**

### a) **Existing plant and equipment**

Current situation: Equipment is not energy efficient, but has been commissioned for economy and undergoes periodic maintenance.

Objective(s): Equipment and plant is appropriately selected, energy efficient, commissioned for low energy consumption and well maintained. Over time, this would be extended from fixed plant to portable appliances.

Action:

- Energy Program Manager to
  - Work with Departments and Purchasing to ensure that major energy-consuming equipment and plant is appropriately selected for energy efficiency.
  - Assist in commissioning and Measurement & Verification activities.
  - Implement and oversee continuous commissioning of facilities to optimize efficiency.

Resource needs:

No additional resource needs, covered by the existing Program Manager with assistance from Departments.

## b) Plant and equipment replacement

Current situation: Apart from isolated purchases and consumables such as light bulbs, there is no wide-spread consideration of energy efficiency in product selection.

Objective(s):

- Equipment selected to be fit for purpose, bearing in mind likely life cycle costs and energy efficiency factors.

Action:

- Energy Program Manager to work with staff purchasing major energy-consuming equipment to ensure that life cycle costs and energy efficiency are factored into decision making, including assessing power efficiency data on products as part of selection process.

Resource needs:

No additional resource needs, covered by the existing Program Manager and cooperation from Departments.

## c) Maintenance procedures

Current situation: Condition surveys and occasional activity, often prompted by plant failure or safety considerations. Remedial work only carried out on major defects.

Objective(s): Move from *reactive* trouble-shooting to *proactive* preventative maintenance and optimization.

Action:

The 2013 budget request includes an additional *Facility Optimization Coordinator* function responsible for optimizing facility utility consumption on a day-to-day basis. This functional role would be funded for the first year or two through the Corporate Energy Program, although oversight would remain with Corporate Building Maintenance. The Plan envisions this functional role as being incorporated within Corporate Maintenance in future.

Having this additional staff resource would enable closer oversight of energy usage to identify anomalies as they occur, allowing maintenance to optimize operation or provide timely maintenance as appropriate.

Resource needs:

- Additional functional role covered under 1d) above.
- No additional resource needs, covered by the existing Program Manager.

#### **d) Operational knowledge**

Current situation: Staff is only marginally aware of how they affect energy use. Operational improvements that save energy are only implemented where they can be easily accommodated within traditional working practices.

Objective(s):

- Immediate (1-2 yr goal)
  - Improve operations and housekeeping practices in an attempt to reduce energy usage.
  - Help all staff understand their role with respect to corporate energy use.
- Longer term (3-5 yr goal) – staff taking positive steps to minimize energy use.

Action:

- General training to help all staff understand how their roles impact on energy efficiency and how they can take positive steps to minimize energy use will be part of awareness training covered by 3b), above.
- Specific training to facility operational and maintenance staff will need to be customized based on equipment and controls that staff encounter in their work.

Resource needs:

The existing Energy Program Manager will be responsible for delivering general energy awareness training.

The Energy Program Manager will work with Departments to identify specific training needs. It is envisioned that these training needs will be funded through Department training budgets.

#### **e) Documentation and record keeping**

Current situation: Documentation exists for most of the larger facilities, including basic descriptions of major building systems (i.e. HVAC plant) and instrumentation and control schedules. Asset data was last updated a few years back but the data is not consistently maintained.

As part of the audits conducted in 2012 on thirteen tax-based facilities, asset details were inventoried for all major equipment including:

- Fans and pumps > 5 hp (3.75 kW)
- Boilers > 100,000 BTU/Hr
- Building Systems that consume energy or affect energy consumption > 2 kilowatts (7000 BTU/Hr)
- All building systems that consume water or affect water consumption

This information has yet to be incorporated into the City's existing Operations and Maintenance WAM asset management database.

Objective(s):

- Improved asset documentation of major equipment and details for plant instrumentation and controls.
- Improved operational record-keeping (i.e. baseline power consumption etc)

Action:

- Program Manager to coordinate with CSS to
  - Integrate asset inventory for 13 audited facilities into existing WAM asset management system (or its replacement).
  - Continue collecting inventory information for other facilities
- Program Manager to coordinate with other Departments for asset inventory of other facilities.

Resource needs:

Existing Program Manager with Departmental assistance.

## f) Operational methods

Current situation:

Corporate Energy has implemented an energy data management system called *ManagingEnergy* that will enable more accurate energy accounting. The software generates baseline energy equations that are normalized to weather and other factors like occupancy. This will improve our ability to assess facility performance against established targets.

Estimating annual energy operating budgets has been made difficult by:

- Poor understanding of facility energy use
- Poor understanding of method of utility rate calculations by utilities
- Complicated allocation of facility budgets across multiple internal business accounts
- Uncertainty regarding energy rate increases in a volatile market

The above have created variances in year-on-year energy budgets. Some of this uncertainty and variability can be reduced with more sophisticated understanding of energy use and what avoided costs can be realistically achieved. Other variables, such as energy rate increases, will continue to have uncertainty.

Objective(s):

Develop robust methodology for establishing realistic annual energy budgets, setting realistic energy reduction targets, and assessing performance at a service (facility) level.

Action:

- Develop robust energy baselines for all major facilities.

- Develop a standard methodology for establishing realistic annual energy budgets based on facility energy baselines and calculated avoided energy costs from energy conservation measures (through audits).
- Streamline accounting to better align internal account codes to facilities as opposed to business units. This will help with move towards service-based accounting.
- Improve energy and financial accounting procedures to better enable assessment of performance to targets, including regular variance reporting.

Resource needs:

No additional resource needs, covered by the existing Program Manager with assistance from Finance and business account holders.

## Summary of Corporate Energy Program Resource Needs

The expanded Corporate Energy Program envisioned in this Business Plan includes requests for resourcing at both the program (operational) and project (capital) level. Both components are integrated and integral to an effective Corporate Energy program.

### Operational Resource Needs

Figure 7 below summarizes the additional **operational** resource needs for the Corporate Energy program in 2013. That is, additional to current staff and operational budgets.

**Figure 7: Summary of 2013 Corporate Energy Program operational resource needs:**

Area of Focus	Resource Requirements	Estimated Cost
Energy Management / Information Systems	Facility Optimization Coordinator functional role	<b>\$80k</b>
	Subscription to Managing Energy data management software	<b>\$35k</b>
	Energy data management resource (see Note 1)	<b>\$40k</b>
Exploiting Opportunities (Energy Projects)	Project Manager	<b>(see Note 2 at bottom)</b>
	Additional energy auditing using an outside consultant in conjunction with a hired commissioning team	<b>\$75K</b>
	Continuous facility commissioning using a hired commissioning team	<b>\$50K</b>
Awareness & Information (Capacity Building)	Energy Management training labour for management of training program - covered by existing Program Manager and HR staff	<b>\$8k</b>
<b>Total</b>		<b>\$288k</b>

Note 1) for the “Energy Data Management” resource, it is envisioned that this part-time (50%) role could either be staffed using existing Finance resources or, alternatively, could be a contract position. Utility accounting will be streamlined through implementation of the ManagingEnergy energy management software, so current Accounts Payable staff may be

able to be dedicated to this role without need for additional resourcing. In case this is not possible, \$40k has been allocated in Corporate Energy's operational budget request to cover this function.

Note 2) Since the Project Manager position is a resource need associated with the \$3.3M capital project request for 2013-2015, costs are included within the 2013-2015 Capital funding request although the plan envisions the possibility of continuing this function as an operationally funded FTE in future years as a resource for ongoing energy-related projects.

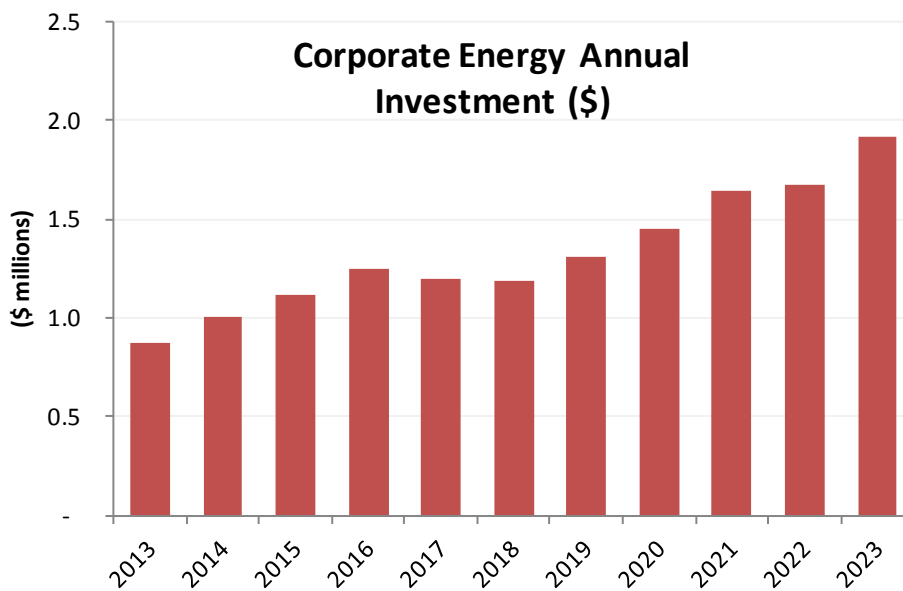
## Capital Resource Needs

In addition to recommending areas of development for the Corporate Energy program, listed above, the business plan also includes a plan for implementing significant energy reduction measures, with a long-term goal of 28% reduction in absolute energy use (gas & electricity) across the City's portfolio by 2031.

Significant energy-related investments in 2010 and 2011, including City funds and matching grants, enabled the City to maintain 2011 energy expenditure at the 2010 level, despite the addition of new facilities and despite 9% increase in hydro consumption rates in 2011. This proves that energy management is an effective tool for mitigating hyperinflationary energy price increases. We are looking to renew this strategy of investing in energy conservation, beginning with an ambitious energy reduction program starting in 2013.

Formal energy audits in 2012 have identified \$3.3M of energy conservation measures at thirteen buildings, representing 90% of energy total corporate expenditure on the tax-base side (streetlights excluded). These energy reduction retrofits have been split into \$1.25M capital request for energy reduction projects in 2013, \$985k in 2014 and \$1.09M in 2015. This is followed by continued annual investment over the next 20 years as the list of projects and facilities is expanded following future energy audits (Figure 8). This future investment increases based on decreasing Return-on-investment (ROI) for future retrofits that have higher paybacks. The business case for the 2013-2015 capital request, with specific measures broken out by facility, is included in Appendix 2.





**Figure 8** Corporate Energy Investment (\$/year)

### Relationship between Operational and Capital Resource Needs

While application for the \$288k 2013 operational budget request is separate from the \$3.3M 2013-2015 capital budget request for energy conservation measures, operational and capital aspects are very much intertwined. The capital energy retrofits will require internal project management resources, which will depend on approval of operational expansions. Conversely, an Energy Management Program without funding for retrofits will be ineffective at delivering on real avoided energy costs, thus undermining the goal. For this reason, supporting both program (operational) and project (capital) components of the business plan in an integrated way is crucial to an effective Corporate Energy program.

### Financial Benefits to the Corporation

The business case for building a robust Corporate Energy program is not simply a financial one. It should be assessed based on integrated benefits of ongoing energy management, both fiscal and institutional which, together, will reduce the Corporation’s exposure to increases due to growth and energy rate escalation. However, assessing the business case based on quantifiable avoided costs is significant enough by itself to justify the program expansion and continued funding.

The energy reduction projects alone are expected to produce 8.3% energy reduction across all tax-based energy accounts. Additional avoided costs are expected from finding errors on utility bills and cost saving utility procurement strategies. An expected energy reduction of \$156k in 2013 has been incorporated into the 2013 budget, which will help mitigate expected double-digit utility rate escalation. This increases to \$376k/yr in 2014 and \$423k/yr in 2015, equating to 5% of overall utility spend (See Figure 9). Achieving these annual avoided costs is dependent on approval of the 2013, 2014 and 2015 capital budget requests.

Energy Saving Measure		Avoided costs (\$)
2013	Bill Verification	\$25,000
	Utility Procurement strategy	\$25,000
	<b>2013 Energy Reduction Projects (Capital)</b>	<b>\$106,000</b>
	• Operating efficiencies	\$30,000
	• Re-commissioning (2 yr payback)	\$20,000
	• Capital Energy Reduction Projects	\$56,000
	<b>2013 Total Avoided costs (2%)</b>	<b>\$156,000</b>
2014	2014 Energy Reduction Projects	\$114,000
2015	2015 Energy Reduction Projects	\$47,000
2013 - 2015	All measures (5.9%)	\$423,000

**Figure 9 Anticipated Avoided costs from Proposed Energy 2013/2014 Reduction Measures**

While the payback on individual energy efficiency investments can be shown to meet typical institutional-grade payback of 9-10 years or lower, the real benefits are realized when we look at future avoided costs.

Investment in energy efficiency now will continue to save money indefinitely and, importantly, future avoided costs will compound in lock-step with exponentially-increasing energy prices. Thus energy management equals risk management.

The magnitude of the Corporation’s risk exposure to energy price escalation can be significantly mitigated by investment in energy conservation today, resulting in significant future avoided costs, estimated at over **\$2M/yr** by 2018 and **\$4.2-5.4M/yr** in 2023 (Figure 10).

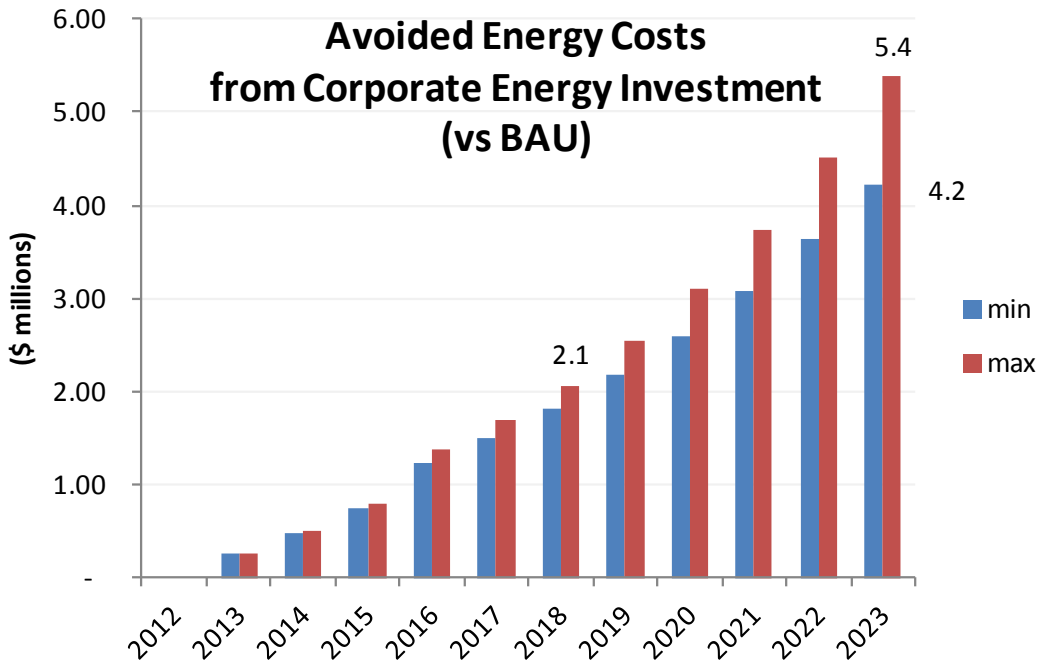


Figure 10 future avoided energy costs from energy investments (annual)

This represents \$21-26M in cumulative avoided costs over 10 years (Figure 11).

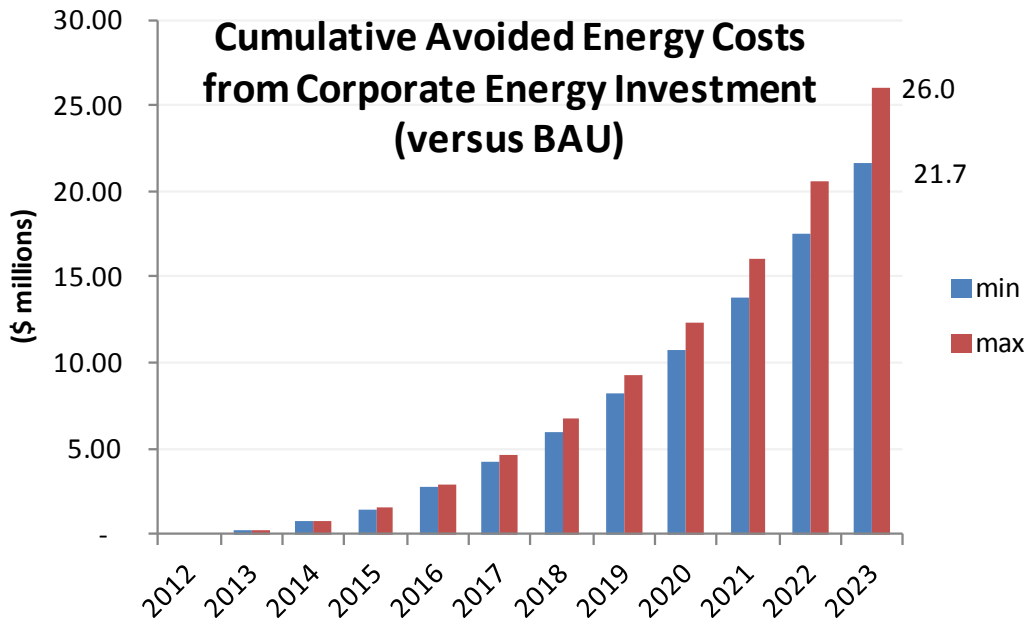
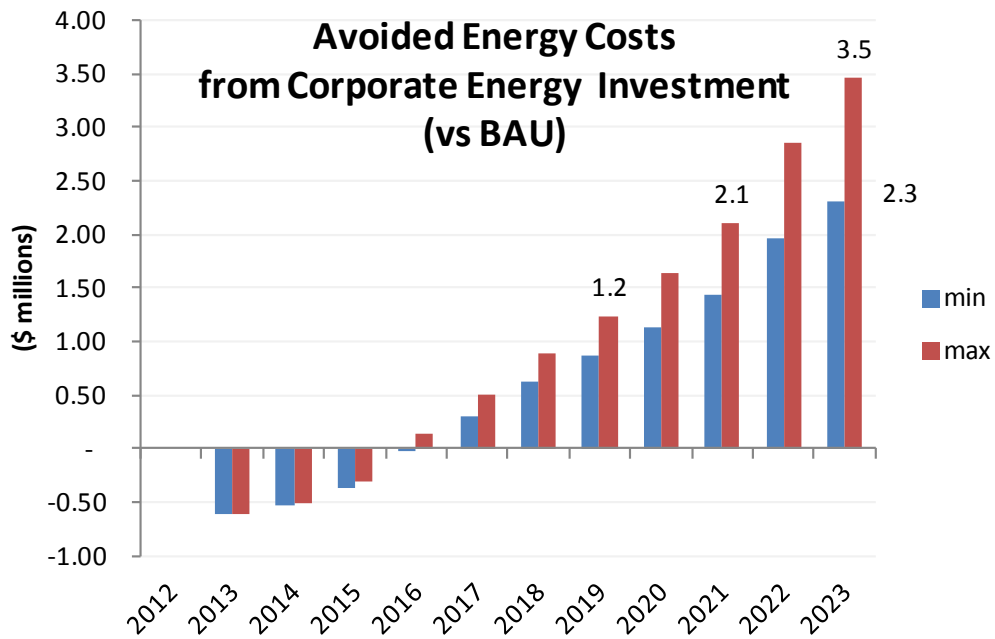


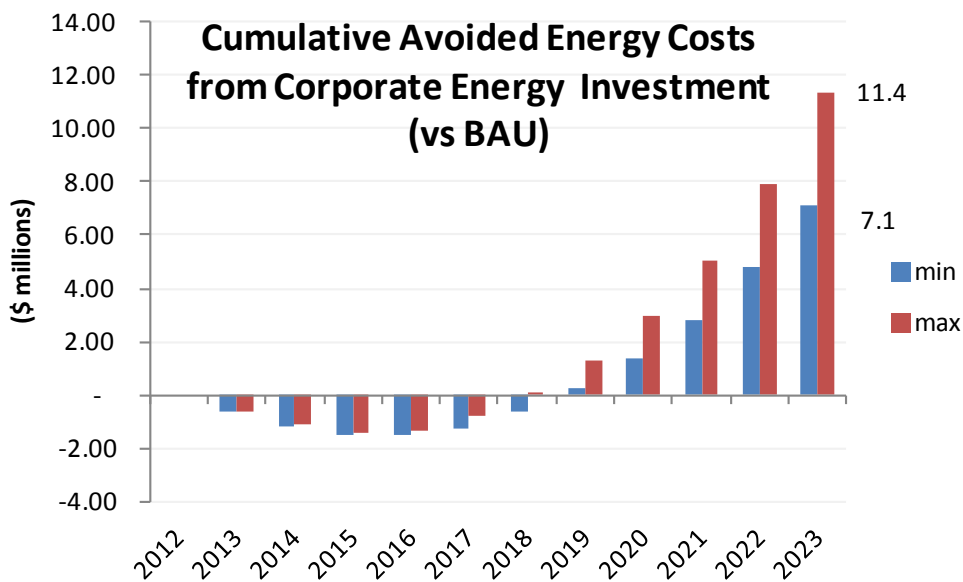
Figure 11 future avoided energy costs from energy investments (cumulative)

Factoring in Corporate Energy Program investments, the net avoided costs are \$1.2M/yr in 2018 and \$2.3-3.5M per year in 2023 (Figure 12).



**Figure 12** future net avoided energy costs from energy investments

This represents **\$7.1-11.4 M** in net cumulative avoided costs over 10 years and **\$86M** over 20 years (Figure 13).



**Figure 13** future net avoided energy costs from energy investments (cumulative)

Without significant energy investment, the City is fully exposed to increases due to growth and energy rate escalation. The business case analysis presented in this Plan demonstrates that invested capital will not only be recovered, but significant savings will be realized in avoided costs.

## **Discussion of Funding Alternatives**

This Business Plan envisions a significant program expansion and annual capital budget requests spanning 10 years. A number of strategies are being assessed to fund this expansion, including the traditional possible funding sources that have been identified are:

### **Traditional Funding Sources**

The traditional possible funding sources that have been identified include:

- Leveraging existing approved capital
- Tax-supported debt (debenture, mortgage), funded via reserves

#### **Leveraging existing approved capital**

Opportunities to fund energy efficiency projects through existing capital budgets, such as Corporate Maintenance Lifecycle capital replacement budget, have been investigated. Over two dozen projects with energy-related components are being implemented as part of Lifecycle capital replacement budget in 2013/2014 and the Energy Program Manager will continue to liaise on leveraging this budget to realize energy efficiencies wherever feasible.

The Energy Program Manager is participating in scoping discussions for major facility retrofits, including the Police Headquarters and planned renovations at Victoria Road Recreation Centre starting in 2013. It is envisioned that avoided energy costs can be realized through these funded projects.

#### **Tax-supported debt (debenture, mortgage), funded via reserves**

On July 23, 2012, Council approved use of the \$13M Capital Renewal Reserve Fund (aka Hydro Note) for measures that will “mitigate tax rate increases”. We foresee that energy reduction measures could be funded through this reserve since these measures result in avoided costs, thus mitigating tax burden. Council also approved increasing capital funding to 20%, which would provide room to accommodate unfunded Corporate Strategic Plan initiatives like Community Energy.

Corporate Energy is also looking to gain funding access to the 2012 \$1.5M Hydro Dividend in 2012. This will enable design and procurement to begin immediately (in 2012) so that savings can accrue as early as possible in 2013. Approval of this Plan and early funding via the Hydro Dividend would also enable staff to proceed with organizing for FTE expansions required in early 2013.

## Alternative Funding Opportunities

Given the City's fiscal constraints, it will be necessary to look at alternative and innovative ways to mobilize available resources, both internal and external. The positioning of Corporate Energy within the new Enterprise Division, together with the program's alignment with the "Doing Business Differently" committee, provides an opportunity to identify and better assess alternate delivery and funding models.

Opportunities to mobilize City-owned assets into community-based energy activity need to be explored. One existing example already implemented is revenue generation from facility roof space leased to Envida for solar panels. Another example is exploring using facility heating and cooling infrastructure as part of a District Energy System, likely in coordination with GHMI and utilities (Guelph Hydro, Union Gas).

Also, avoided energy costs that can be mobilized towards various alternative resourcing strategies that don't require access to traditional operating or capital budgets. This includes investigating third party bridge financing - including funding through Guelph Hydro via its unregulated arm, Envida.

These are just some of the innovative ways that Corporate Energy program can bring benefit to the Corporation.

## Grants and Top-ups

The need for internal funding &/or third party bridge financing can be significantly reduced through grants and outside "top-up" money that is currently available for energy reduction initiatives. The possible sources that have been identified include:

- Federal Gas Tax money
- Grants/Incentives

## Re-allocation of Federal Gas Tax money

The City of Guelph currently receives \$7M per year in Federal Gas Tax (FGT). Current policy is to allocate FGT to roads & infrastructure. Other jurisdictions - including Waterloo/Kitchener/Ajax - are applying FGT to energy projects. Approximately \$100M of FGT money was utilized for energy efficiency projects between 2005 and 2011 (227 projects). Corporate Energy would like to investigate with staff and Council, the possibility of allocating funds from the FGT to energy conservation projects.

## Grants / Incentives

Corporate Energy has begun exploring avenues for incentive funding for energy conservation projects. Application will be submitted for an FCM Green Municipal Fund (GMF) that could provide up to 50% matching grant.

Corporate Energy is also being considered as part of a coordinated corporate application for funding under the Federal [Community Infrastructure Improvement Fund](#). Like the FCM Green Municipal Fund, this retrofit fund contributes 50% of the cost.

We have also begun the process of applying for audit and retrofit incentives provided through Union Gas and Guelph Hydro utilities.

## Summary

Escalating fossil fuel costs are a financial risk and a service risk for the City since many of its services are highly reliant on energy (e.g. facility operation, pumping water to homes). A properly resourced Corporate Energy program can reduce the Corporation's risk exposure to escalating energy costs, through best practice, and increase resilience to future price volatility. Thus energy management equals risk management.

Energy management is more than just implementing energy conservation retrofits. A robust energy management strategy covers both program and project aspects. Energy management is multi-dimensional, encompassing the technical aspects of facility and process operation, organizational management, and human behaviour. Beyond specific energy reduction capital projects, a holistic approach leverages existing staff and budgets to build energy resilience from within.

If we just consider financially quantifiable benefits, investment in a corporate energy management program pays for itself ten-fold in avoided energy costs/risk. The magnitude of avoided costs resulting from deep energy reduction demonstrates that the business case for conservation is strongest when viewed from a risk management context rather than just in simple payback terms. Investment in energy conservation today will result in net avoided costs of \$1.2M/yr by 2018 and \$2.3 to 3.5M/yr in 2023, representing \$11.4 M in net cumulative avoided costs over 10 years and \$86M over 20 years. These avoided costs are contingent on approval of the following operational and capital budget requests:

- \$1.25M capital request for energy reduction projects in 2013, \$985k in 2014 and \$1.09M in 2015, followed by continued future annual investment as the list of projects and facilities is expanded following future energy audits.
- \$288k 2013 operational budget request for program expansion to deliver best practice energy management.

Expansion of the corporate energy management program will require significant continued investment. But investing to reduce utility expenditure is the one of the few palatable options the City has to reducing the tax burden posed by Corporate operational costs (versus service reductions, freeze on hiring, increased user fees etc).

While application for the Corporate Energy Program operational budget request is separate from the 2013/2014 capital budget request for energy conservation measures, it is important to remember that the operational and capital aspects are very much intertwined. The capital energy retrofits are dependent on elements of the operational resourcing request, for instance a Project Manager to oversee the retrofit projects on behalf of the Corporation. Conversely, an Energy Management Program without funding for retrofits will be ineffective at delivering on real avoided energy costs, thus

undermining the goal. For this reason, supporting both program (operational) and project (capital) components of the business plan in an integrated way is crucial to an effective Corporate Energy program.

Support for the Corporate Energy Program aligns with corporate goals, based on commitment to the Community Energy Initiative and directives of the 2012-2016 Corporate Strategic Plan, and a need to retain a leadership position in the community and amongst municipal peers.

There is always a concern that an ambitious undertaking, such as the one outlined in this business plan, will fall short of expectations. The rigorous performance metrics developed for validating achievement of the Corporate Energy program on many fronts will ensure that performance can be monitored, and that interventions can be made to rectify shortfalls as they occur. The energy management best practice measures being implemented, including state-of-the art data management software, together with sufficient staff resourcing, will ensure that energy avoided costs are managed and tracked and that year-to-year goals are achieved.

This plan outlines the corporate risk posed by exponentially escalating energy costs and how we can mitigate that risk through Best Practice energy management based on a robust internationally-accepted framework.



# Appendices

**Appendix 1 - Corporate Energy Program Performance Metrics**

**Appendix 2 - Cost/Benefit Analysis – Capital Projects**

## Appendix 1 Corporate Energy Program Performance Metrics

### Background

In 2011, Corporate Energy embarked on a capacity assessment to better understand where the City is at with regards to energy management. The capacity assessment utilized a UK Department of Environment guide which helps organizations understand its current position with respect to a range of energy management issues and identify which areas should be improved. The performance metrics within this methodology have been adopted by Corporate Energy as a tool to assess program development towards the goal of best practice corporate energy management.

Below is a summary of Corporate Energy program scoring for 2010, 2011 together with goals for 2012 and 2013. Performance of the program against these metrics will be assessed at key junctures to see if anticipated outcomes are in fact being realized or if additional effort is required.

### Capacity Assessment Framework

The capacity assessment utilized a UK Department of Environment guide which helps organizations understand its current position with respect to a range of energy management issues and identify which areas should be improved. Further details of this assessment methodology can be found in the attached Appendices. The approach is based on two levels of scoring matrices covering four main categories:

Level 1 Matrix →	1) Energy management
Level 2 Matrix {	a) Energy policy
	b) Organising
	c) Motivation
	d) Information systems
	e) Marketing
	f) Investment
	2) Financial management
	a) Identifying opportunities
	b) Exploiting opportunities
	c) Management information
	d) Appraisal methods
	e) Human resources
	f) Project funding
	3) Awareness and information
	a) Energy management responsibilities
	b) Energy efficiency awareness
	c) Reporting procedures
	d) Review of energy performance
	e) Ongoing training
	f) Market awareness
	4) Technical
	a) Existing plant and equipment
	b) Plant and equipment replacement
	c) Maintenance procedures
	d) Operational knowledge
	e) Documentation and record keeping
	f) Operational methods

## **Summary of Scores - Corporate-Level Energy Management Capacity Assessment**

Using this capacity assessment as a benchmark, we have established a baseline scores for 2010 and 2011 as well as corporate-level goals for 2012 and 2013. **Table 1** summarizes the scoring. Figures 1 through 4 provide more information of what these scores mean.

# Corporate Energy Program Scorecard (greener the better, Max score is 4)

## Energy management

Scores		Targets		
2010	2011	2012	2013	
0	0	2	4	Energy management responsibilities
0	2	2	3	Energy efficiency awareness
1	1	2	2	Reporting procedures
0	2	2	2	Review of energy performance
1	1	2	3	Ongoing training
2	2	3	3	Market awareness
0.7	1.3	2.2	2.8	Average score

## Awareness and information

Scores		Targets		
2010	2011	2012	2013	
1	1	2	3	Energy management responsibilities
0	1	2	3	Energy efficiency awareness
0	1	2	2	Reporting procedures
0	1	2	3	Review of energy performance
1	1	1	2	Ongoing training
0	2	2	2	Market awareness
0.3	1.2	1.8	2.5	Average score

## Financial management

Scores		Targets		
2010	2011	2012	2013	
0	1	3	3	Existing plant and equipment
1	1	3	3	Plant and equipment replacement
1	1	3	4	Maintenance procedures
1	1	3	4	Operational knowledge
2	2	3	4	Documentation and record keeping
2	2	2	4	Operational methods
1.2	1.3	2.8	3.7	Average score

## Technical

Scores		Targets		
2010	2011	2012	2013	
0	1	1	2	Existing plant and equipment
0	0	1	2	Plant and equipment replacement
1	1	1	2	Maintenance procedures
1	1	1	2	Operational knowledge
1	1	2	2	Documentation and record keeping
1	1	2	2	Operational methods
0.7	0.8	1.3	2.0	Average score

**Figure 1 - ENERGY MANAGEMENT SECOND-LEVEL MATRIX**

Level	Energy policy	Organising	Motivation	Information systems*	Marketing	Investment
4	Energy policy, action plan and regular review have commitment of top management as part of an environmental strategy.	Energy management fully integrated into management structure. Clear delegation of responsibility for energy consumption. Energy Committee chaired by board member.	Formal and informal channels of communication regularly exploited by energy manager and energy staff at all levels.	Comprehensive systems set targets, monitor consumption, identify faults, quantify savings and provide budget tracking.	Marketing the value of energy efficiency and the performance of energy management both within the organisation and outside it.	Positive discrimination in favour of 'green' schemes with detailed investment appraisal of all new-build and refurbishment opportunities.
3	Formal energy policy, but no active commitment from top management.	Energy manager accountable to energy committee representing all users.	Energy committee used as main channel together with direct contact with major users.	M&T reports for individual premises are based on sub-metering. Achieved performance against targets reported effectively to users.	Programme of staff awareness and regular publicity campaigns.	Same payback criteria employed as for all other investment.

Level	Energy policy	Organising	Motivation	Information systems*	Marketing	Investment
2	Unadopted energy policy set by energy manager or senior departmental manager.	Energy manager in post, reporting to ad hoc committee, but line management and authority are unclear.	Contact with major users through ad hoc committee chaired by senior departmental manager.	Monitoring and targeting reports based on supply meter data. Energy unit has ad hoc involvement in budget setting.	Some ad hoc staff awareness training.	Investment using short-term payback criteria only.
1	An unwritten or uncoordinated set of guidelines.	Energy management is the part-time responsibility of someone with limited authority or influence.	Informal contacts between engineer/technical staff and a few users.	Cost reporting based on invoice detail. Engineer compiles reports for internal use within technical department.	Informal contacts used to promote energy efficiency.	Only low-cost measures taken.
0	No explicit policy.	No energy management or any formal delegation of responsibility for energy consumption.	No contact with users.	No information system. No accounting for energy consumption.	No promotion of energy efficiency.	No investment in increasing energy efficiency in premises.

**Figure 2 - FINANCIAL MANAGEMENT SECOND-LEVEL MATRIX**

Level	Identifying opportunities	Exploiting opportunities	Management information	Appraisal methods	Human resources	Project funding
4	Detailed energy surveys are regularly updated. Lists of high- and low-cost opportunities already costed and ready to proceed immediately.	Formal requirement to identify the most energy-efficient option in all new-build, refurbishment and plant replacement projects. Decisions made on the basis of life cycle costs.	Full management information system enabling identification of past savings and further opportunities for investment meeting organisation's financial parameters.	Full discounting methods using internal rate of return and ranking priority projects as part of an ongoing investment strategy.	Board take a proactive approach to a long-term investment programme as part of a detailed environmental strategy in full support of the energy management team.	Projects compete equally for funding with other core business investment opportunities. Full account taken of benefits which do not have direct cost benefit, eg marketing opportunities, environmental factors.
3	Energy surveys conducted by experienced staff or consultants for buildings likely to yield largest savings.	Energy staff are required to comment on all new-build, refurbishment and plant replacement projects. Energy efficiency options often approved but no account is taken of life cycle costs.	Promising proposals are presented to decision-makers but insufficient information (eg sensitivity or risk analysis) results in delays or rejections.	Discounting methods using the organisation's specified discount rates.	Energy manager working well with accounts/finance department to present well-argued cases to decision makers.	Projects compete for capital funding along with other business opportunities, but have to meet more stringent requirements for return on investment.

Level	Identifying opportunities	Exploiting opportunities	Management information	Appraisal methods	Human resources	Project funding
2	Regular energy monitoring/analysis identifies possible areas for saving.	Energy staff are notified of all project proposals with obvious energy implications. Proposals for energy savings are vulnerable when capital costs are reduced.	Adequate management information available, but not in the correct format or easily accessed in support of energy-saving proposals.	Undiscounted appraisal methods – eg gross return on capital.	Occasional proposals to decision makers by energy managers with limited success and only marginal interest from decision makers.	Energy projects not formally considered for funding from capital budget, except when very short-term returns are evident.
1	Informal ad hoc energy walkabouts conducted by staff with checklists to identify energy-saving measures.	Energy staff use informal contacts to identify projects where energy efficiency can be improved at marginal cost.	Insufficient information to demonstrate whether previous investment in energy efficiency has been worthwhile.	Simple payback criteria are applied. No account taken of lifetime of the investment.	Responsibility unclear and those involved lack time, expertise and resources to identify projects and prepare proposals.	Funding only available from revenue on low-risk projects with paybacks of less than one year.
0	No mechanism or resources to identify energy-saving opportunities.	Energy efficiency not considered in new-build, refurbishment or plant replacement decisions.	Little or no information available to develop a case for funding.	No method used irrespective of the attractiveness of a project.	No-one in organisation promoting investment in energy efficiency.	No funding available for energy projects. No funding in the past.



**Figure 3 - AWARENESS AND INFORMATION SECOND-LEVEL MATRIX**

Level	Energy management responsibilities	Energy efficiency awareness	Reporting procedures	Review of energy performance	Ongoing training	Market awareness
4	Lists of responsibilities and their assignment exist and are comprehensive and regularly reviewed. All staff have responsibilities.	Energy efficiency performance regularly presented to all staff. Full use made of publicity. Advantage taken of all available dissemination routes for promoting new measures for saving energy.	Comprehensive reporting of current status compared with best practice, on regular basis and geared at a variety of audiences. Full support to public statements.	Energy and water efficiency regularly reviewed. Performance compared against internal and external references or benchmarks. Ideas actively sought.	Continuous professional development properly resourced for technical and premises staff. Active technical library. All staff have ready access to domestic and non-domestic energy efficiency information.	Keep abreast of technological developments by ongoing monitoring of trade journals, literature and other sources on issues affecting energy efficiency.
3	Lists of responsibilities and their assignment exist for key energy staff and all departments.	Energy efficiency status presented to all staff at least annually. Occasional but widespread use of publicity to promote energy-saving measures.	Current status reports issued annually to shareholders and staff. Impartial reporting of performance to staff and departments on a regular basis.	Frequent energy efficiency reviews using monitored consumption and cost data. Analysis is regular, wide-ranging but ritualistic.	Continuous professional development for technical and premises staff. All staff are aware of and have access to an energy efficiency library.	Regular studies carried out on trade journals, literature and other sources to assess current developments impacting on energy efficiency.

Level	Energy management responsibilities	Energy efficiency awareness	Reporting procedures	Review of energy performance	Ongoing training	Market awareness
2	Some staff and departments have written responsibilities.	Energy performance presented to staff on a regular basis. Occasional use of publicity for promoting energy-saving measures.	Occasional issues of energy efficiency status reports. Concentrates on good news.	Occasional technical energy efficiency reviews. Regular cost checks with exception reporting. Analysis of limited scope.	Technical and premises staff development mainly via professional and technical journals. Occasional initiatives to train staff in energy efficiency.	Trade journals, literature and other sources scanned on an ad hoc basis for information on the latest developments relating to energy efficiency.
1	Unwritten set of responsibility assignments.	Energy performance occasionally reported and known to very few staff. Energy-saving measures are rarely promoted.	Reports only issued if prompted by a business need. Most reports will contain only good news.	Energy review activity based on revenue costs. Limited exception reporting only.	Energy efficiency awareness generally low. A few staff have knowledge of energy efficiency techniques and facts. Little, if any, training in energy efficiency for staff.	Trade journals, literature and other sources studied for energy implications when a purchase is imminent.
0	No evidence of assignment of energy efficiency tasks and duties.	No staff have explicit responsibilities or duties.	No reporting.	No monitoring activity to underpin review processes.	Little, if any, knowledge of energy efficiency amongst staff. No attempt made to inform staff of techniques and benefits of energy efficiency.	Energy efficiency not a consideration when keeping up to date on products or technology.

**Figure 4 - TECHNICAL SECOND-LEVEL MATRIX**

Level	Existing plant and equipment*	Plant and equipment replacement	Maintenance procedures	Operational knowledge	Documentation and record keeping	Operational methods
4	The majority of existing equipment (fixed plant and portable appliances) incorporates best practice energy-efficient features, is correctly commissioned for energy efficiency and well maintained.	Equipment is selected to be the most appropriate to the application. Life cycle costs and energy efficiency are taken into account. Energy saving is a major consideration in product selection.	Maintenance is based on needs, with formal condition appraisal methods being performed for all equipment and fabric elements affecting energy efficiency. Results acted upon where necessary.	All staff understand how their roles impact on energy efficiency and take positive steps to minimise energy use. Staff receive targeted training in energy efficiency.	Fully detailed descriptions of system concepts, plant control and operation. Detailed schedules of all plant, instrumentation and controls.	Operation methods and settings for energy efficiency defined and implemented. Full utilisation of feedback from monitoring.
3	Equipment and plant is appropriately selected, energy efficient, commissioned for low energy consumption and well maintained.	Equipment is selected to be appropriate to the application with energy-saving features taken into consideration. Life cycle costs and energy efficiency are evaluated.	Condition surveys carried out regularly on equipment and fabric elements affecting energy efficiency. Action undertaken for most defects identified.	Staff are aware of how they affect energy use and take all good housekeeping measures to save energy. Further training received on a regular basis.	Detailed descriptions of plant control and operation, and outline system concepts. Reasonably detailed schedules of all plant instrumentation and controls.	Delivered conditions and operating methods for energy efficiency defined and implemented. Informal use of information from monitoring.

Level	Existing plant and equipment*	Plant and equipment replacement	Maintenance procedures	Operational knowledge	Documentation and record keeping	Operational methods
2	Most equipment is not specifically energy efficient, but either was commissioned or is being regularly maintained for low energy consumption.	Equipment selected to be fit for purpose, bearing in mind likely life cycle costs and energy efficiency factors.	Condition surveys carried out regularly on all equipment and fabric elements affecting energy efficiency. Remedial work constrained by budgets.	Most good housekeeping practices are adhered to in an attempt to reduce energy usage. Occasional energy efficiency training received.	Basic descriptions of plant control and operation. Basic plant instrumentation and control schedules for most control systems.	Targets set against realistic budgets, and maintained through financial procedures.
1	Equipment is not energy efficient, but has been commissioned for economy and undergoes periodic maintenance.	Power efficiency data on products obtained as part of selection process.	Condition surveys and occasional activity, often prompted by plant failure or safety considerations. Remedial work only carried out on major defects.	Energy-saving techniques are only adopted where they can be easily accommodated within traditional working practices.	Minimal, or poor plant control and operation. Plant instrumentation and control schedules for only some of the plant and control systems.	Targets set by default through budget setting procedures.
0	Energy performance has not been considered during the procurement, commissioning or maintenance of existing plant and equipment.	No consideration of energy efficiency in product selection.	No regular surveys or maintenance carried out.	No consideration is given to energy efficiency during working operations.	None available.	No targets set.



## Appendix 2 Cost/Benefit Analysis – Capital Projects

Summary of Community Energy Capital Request  
 PL0029 9900-8204 ENERGY CONSERVATION INITIATIVE

	2013	2014	2015	2016	2017	Next 5
Total	2,197,653	1,032,145	1,000,000	1,000,000	1,000,000	5,000,000
HST (1.76%)	38,679	18,166	17,600	17,600	17,600	88,000
Total	2,236,332	1,050,311	1,017,600	1,017,600	1,017,600	5,088,000

### Capital Cost summary for 2013 Energy Reduction Measures

<i>Measure</i>	<i>Annual Total Energy Savings (\$)</i>	<i>Annual Tonnes CO2 Avoided</i>	<i>Price Estimate (Mat'l &amp; Lab)</i>	<i>Engineering &amp; Proj Mgmt</i>	<i>Total Implementation Cost (\$)</i>	<i>NPV</i>
Centennial Arena	7,282	52	83,345	6,322	89,667	213,716
Centennial Pool	335	3	1,979	0	1,979	12,939
City Hall	23,601	213	206,673	26,992	233,665	728,402
Evergreen	16,509	64	117,349	28,000	145,349	568,336
Exhibition Arena	6,492	59	95,410	14,545	109,953	187,589
Main Library	14,994	108	152,741	9,100	161,841	644,214
River Run	46,907	274	303,582	40,000	338,974	1,707,340
Sleeman	51,229	374	419,568	51,394	470,962	1,822,915
Transit Garage	57,495	458	272,366	44,500	316,866	2,178,544
VRRC	15,552	115	87,037	0	87,037	604,381
WERC	33,866	266	208,598	32,761	241,359	1,183,956
45 Municipal	0	0	0	0	0	0
50 Municipal	0	0	0	0	0	0
Total	274,263	1,985	1,948,649	253,615	2,197,653	9,852,331
HST (1.76%)	4,827		34,296	4,464	38,679	
Total	279,090		1,982,946	258,078	2,236,332	

## Capital Cost summary for 2014 Energy Reduction Measures

<i>Measure</i>	<i>Annual Total Energy Savings (kWh)</i>	<i>Annual Tonnes CO2 Avoided</i>	<i>Price Estimate (Mat'l &amp; Lab)</i>	<i>Engineering &amp; Proj Mgmt</i>	<i>Total Implementation Cost (\$)</i>	<i>NPV</i>
Centennial Arena	3,077	28	17,732	3,224	20,956	116,073
Centennial Pool	0	0	0	0	0	0
City Hall	0	0	0	0	0	0
Evergreen	1,348	8	20,902	5,000	25,902	16,093
Exhibition Arena	0	0	0	0	0	0
Main Library	5,801	45	169,012	23,650	192,662	99,407
River Run	3,745	34	58,316	11,500	69,816	73,792
Sleeman	14,161	130	22,052	4,382	26,434	599,636
Transit Garage	0	0	0	0	0	0
VRRC	12,251	97	154,029	18,049	172,078	371,813
WERC	20,011	134	339,910	44,098	378,878	247,013
45 Municipal	7,365	42	108,749	13,511	122,260	115,164
50 Municipal	5,886	36	23,160	0	23,160	217,480
Sub-total	73,643	554	913,860	123,414	1,032,145	1,856,470
HST (1.76%)	1,296		16,084	2,172	18,166	
Total	74,940		929,944	125,586	1,050,311	

## Centennial Arena

Energy Savings		Utility Savings (\$)					Emissions Reduction	Financials				
Measure	Electricity	Electricity	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV	
	demand (kW)	Consumption (kWh)										
1	Lighting Upgrade: T8, 32W to 25W	\$ 72	\$ 254	\$ -	\$ -	\$327	2.3	\$2,756	\$0	\$2,756	5.3	\$11,750
	Lighting Upgrade: Incandescent to CFL	\$ 117	\$ 932	\$ -	\$ -	\$1,050	8.3	\$258	\$0	\$258	0.2	\$46,027
	Lighting Upgrade: Parabolic Incandescent to LED	\$ 18	\$ 75	\$ -	\$ -	\$93	0.7	\$211	\$0	\$211	1.8	\$3,919
	Lighting Upgrade: LED Exit Signs	\$ 18	\$ 119	\$ -	\$ -	\$137	1.1	\$722	\$0	\$722	3.7	\$5,382
2	HVAC Upgrade: Control Unit Heaters with Programmable Thermostats	\$ -	\$ 320	\$ 1,532	\$ -	\$1,852	10.9	\$7,864	\$0	\$7,864	3.3	\$53,547
3	HVAC Upgrade: Insulate Piping	\$ -	\$ -	\$ 496	\$ -	\$496	2.6	\$863	\$0	\$863	1.5	\$14,323
4	Control Upgrade: Install Vending Machine Timers	\$ -	\$ 206	\$ -	\$ -	\$206	1.8	\$939	\$0	\$939	3.3	\$8,207
5	Water Upgrade: Ultra Low Flow Aerators	\$ -	\$ -	\$ 227	\$ 345	\$572	1.2	\$495	\$0	\$495	0.8	\$17,335
6	Arena Upgrade: Interlock Ice Resurfacing Machine Garage Heater to Overhead Door	\$ -	\$ 149	\$ -	\$ -	\$149	1.3	\$738	\$0	\$738	3.5	\$5,883
7	Arena Upgrade: Install Variable Frequency Drive on Evaporative Condenser	\$ -	\$ 2,006	\$ -	\$ -	\$2,006	17.9	\$6,461	\$1,468	\$7,930	3.0	\$81,025
8	Arena Upgrade: Implement Floating Head Pressure with Infrared Sensor	\$ -	\$ 3,077	\$ -	\$ -	\$3,077	27.5	\$17,732	\$3,224	\$20,956	4.5	\$116,073
9	HVAC Upgrade: Install Weather Stripping and Door Closers for Interior and Exterior Doors	\$ -	\$ 76	\$ 442	\$ -	\$518	3.0	\$3,682	\$0	\$3,682	5.0	\$13,397
10	HVAC Upgrade: Install High Efficiency Domestic Hot Water Tank	\$ -	\$ -	\$ 553	\$ -	\$553	2.9	\$22,067	\$4,012	\$26,079	13.3	\$2,652
11	HVAC Upgrade: Block in Old Concession Booth Window	\$ -	\$ 35	\$ -	\$ -	\$35	0.3	\$1,156	\$0	\$1,156	11.8	\$465
12	Arena Upgrade: Install Separate High Efficiency Heater Tanks for Fixtures and Flood Water	\$ -	\$ -	\$ 1,885	\$ -	\$1,885	9.9	\$46,362	\$6,322	\$52,684	6.8	\$31,072



## Centennial Arena

Energy Savings		Utility Savings (\$)					Emissions Reduction	Financials				
		Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)		Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)
13	Arena Upgrade: Install Low-E Ceilings	\$ -	\$ 3,361	\$ -	\$ -	\$3,361	30.0	\$27,225	\$0	\$27,225	5.1	\$122,749
14	Arena Upgrade: Instal New Laser Level on Ice Resurfacing Machine	\$ -	\$ 154	\$ -	\$ -	\$154	1.4	\$16,500	\$0	\$16,500	19.2	-\$8,633
15	Arena Upgrade: New Refrigeration Compressor and Motors	\$ -	\$ 2,461	\$ -	\$ -	\$2,461	22.0	\$44,953	\$6,130	\$51,083	9.3	\$60,815
16	Arena Upgrade: Soft Starter on Compressors and Brine Pump Motors	\$ -	\$ 246	\$ -	\$ -	\$246	2.2	\$7,826	\$1,779	\$9,605	12.8	\$1,883
<b>Total</b>		<b>\$ 226</b>	<b>\$ 13,471</b>	<b>\$ 5,134</b>	<b>\$ 345</b>	<b>\$19,176</b>	<b>147.3</b>	<b>\$208,810</b>	<b>\$22,935</b>	<b>\$231,746</b>	<b>6.0</b>	<b>\$587,871</b>

Marginal Rate	\$ 9.0300	\$ 0.0840	\$ 0.3510	\$ 2.5000	
Utility Savings	\$ 226	\$ 13,471	\$ 5,134	\$ 345	\$ 19,176

2012 Operational Measures	226	1,663	938	0	2,826	20	9,431	0	9,431	21	103,005
2013	0	3,546	1,532	0	5,078	40	26,334	3,224	29,558	11	175,503
2014	0	3,361	1,885	0	5,245	40	73,587	6,322	79,909	12	153,821
2015	0	35	553	0	588	3	23,223	4,012	27,235	25	3,117
All Pursued Measures	226	8,604	4,908	0	13,737	103	132,575	13,558	146,133		435,446

## Centennial Pool

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
		Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water		Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)
1a	Lighting Upgrade: T12 to T8, 32W T8 to 25W T8, CFL's	81	517	0	0	\$599	4.7	\$2,538	\$0	\$2,538	3.1	\$24,096
1b	Lighting Upgrade: Induction	569	2,545	0	0	\$3,114	23.0	\$26,987	\$0	\$26,987	5.4	\$112,152
2	Lighting Controls: Install Occupancy Sensors	47	287	0	0	\$334	2.6	\$1,979	\$0	\$1,979	4.1	\$12,939
3	HVAC Upgrade: Install Weather Stripping	0	0	180	0	\$180	0.9	\$1,024	\$0	\$1,024	4.2	\$4,545
4	HVAC Upgrade: Replace Pool Mechanical Room Exhaust Fan	0	82	0	0	\$82	0.7	\$1,790	\$0	\$1,790	9.5	1,964
5	HVAC Upgrade: Install a Dehumidifier and a HRV	0	1,300	7,101	0	\$8,401	46.5	\$320,005	\$29,091	\$349,097	14.6	-51,872
<b>Total</b>		<b>697</b>	<b>4,732</b>	<b>7,281</b>	<b>0</b>	<b>\$12,710</b>	<b>78.4</b>	<b>\$354,323</b>	<b>\$29,091</b>	<b>\$383,415</b>	<b>6.8</b>	<b>103,824</b>

<b>Revised Total with Sam's items removed</b>		<b>697</b>	<b>3,350</b>	<b>180</b>	<b>0</b>	<b>4,227</b>	<b>31</b>	<b>32,528</b>	<b>0</b>	<b>32,528</b>		<b>\$153,732</b>
	Marginal Rate	\$ 6.7700	\$ 0.0830	\$ 0.3767	\$ 2.3936							
	Utility Savings	\$ 697	\$ 4,732	\$ 7,281	\$ -	\$ 12,710						
	2012 Operational Measures	81	517	180	0	779	6	3,562	0	3,562	7	28,641
	2013	47	287	0	0	334	3	1,979	0	1,979	4	12,939
	2014	0	0	0	0	0	0	0	0	0	0	0
	2015	569	2,545	0	0	3,114	23	26,987	0	26,987	5	112,152
	All Pursued Measures	697	3,350	180	0	4,227	31	32,528	0	32,528		153,732

City Hall

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure	Electricity	Electricity	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV	
	demand (kW)	Consumption (kWh)										
1	Lighting Controls GCAC Occupancy Sensors	0	6,808	0	0	\$6,808	61.6	\$39,338	\$5,364	\$44,702	4.8	\$258,767
2	Lighting Controls GCAC-Occupancy/photocell Sensors	0	4,733	0	0	\$4,733	42.8	\$16,741	\$2,283	\$19,024	3.3	\$191,165
3	Lighting Controls GCAC- Photosensor	0	130	0	0	\$130	1.2	\$825	\$142	\$967	4.8	\$4,855
4	Lighting Controls POA- Occupancy Sensors	0	2,426	0	0	\$2,426	22.0	\$11,381	\$1,552	\$12,933	3.8	\$95,020
5	Lighting Upgrade GCAC- LEDs	37	348	0	0	\$385	3.1	\$633	\$0	\$633	1.8	\$16,407
7	Lighting Upgrade POA-LEDs	198	894	0	0	\$1,092	8.1	\$4,222	\$0	\$4,222	3.5	\$44,248
8	Schedule AH-C05	0	885	357	0	\$1,242	11.2	\$1,375	\$0	\$1,375	1.0	\$48,693
9	Install A Lead Condensing Boiler	0	0	3,157	0	\$3,157	28.1	\$73,910	\$10,079	\$83,988	12.0	\$18,044
10	Recommission FCU-3: Basement Storage Room	0	305	0	0	\$305	2.8	\$868	\$0	\$868	2.3	\$12,656
11	Living Wall Timer	0	426	0	0	\$426	3.9	\$78	\$0	\$78	0.3	\$18,716
12	ReCommission AH-C06 Chiller Mech Room	0	839	902	0	\$1,741	15.6	\$7,601	\$2,036	\$9,637	2.5	\$55,590
13	Replaces Bypass Enforcement In Annual Billing	0	4,260	2,715	0	\$6,975	62.7	\$66,910	\$9,124	\$76,035	6.5	\$200,016
14	Reprogram AHU Ventilation Schedules: 5pm-11pm	0	2,305	2,405	0	\$4,710	42.3	\$5,948	\$1,190	\$7,137	1.5	\$168,569
16	Optimize Start Stop of AHU's to Precool Building	0	467	0	0	\$467	4.2	\$1,869	\$0	\$1,869	3.3	\$18,875
17	Verify Thermostat Control of Electrical Room Exhaust Fans	0	661	1,137	0	\$1,798	16.1	\$8,949	\$0	\$8,949	3.3	\$55,556
18	0	0	0	0	0	\$0	0.0	\$0	\$0	\$0	0.0	\$0
19	0	0	0	0	0	\$0	0.0	\$0	\$0	\$0	0.0	\$0
20	0	0	0	0	0	\$0	0.0	\$0	\$0	\$0	0.0	\$0
21	0	0	0	0	0	\$0	0.0	\$0	\$0	\$0	0.0	\$0
22	0	0	0	0	0	\$0	0.0	\$0	\$0	\$0	0.0	\$0
23	0	0	0	0	0	\$0	0.0	\$0	\$0	\$0	0.0	\$0
24	Water Conservation: Install Dual Flush Flush Valves and Ultra Low Flow Urinals	0	0	0	702	\$1,706	0.0	\$34,801	\$4,034	\$38,835	10.8	\$17,546

## City Hall

Energy Savings  Measure	Utility Savings (\$)				Emissions Reduction  Annual Tonnes CO2 Avoided	Financials					
	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water		Total Annual Savings (\$)	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementat ion Cost (\$)	Payback (years)	NPV
<b>Total</b>	<b>235</b>	<b>25,489</b>	<b>10,671</b>	<b>702</b>	<b>\$38,101</b>	<b>325.6</b>	<b>\$275,450</b>	<b>\$35,804</b>	<b>\$311,254</b>	<b>2.7</b>	<b>1,224,723</b>

Marginal Rate	\$ 6.4415	\$ 0.0830	\$ 0.2070	\$ 2.4300	
Utility Savings	\$ 235	\$ 25,489	\$ 10,671	\$ 1,706	\$ 38,101

2012 Operational Measures	37	5,397	3,898	0	9,333	84	19,720	1,190	20,910	13	339,473
2013	198	15,831	902	0	16,931	151	80,108	11,378	91,486	23	649,644
2014	0	0	0	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	0	0
All Pursued Measures	235	21,229	4,800	0	26,263	235	99,828	12,568	112,396		989,118

## Evergreen Seniors Centre

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV	
	1	Lighting Controls- Install Occupancy Sensors	289	1,464	0							0
2	Install New Shower Heads	0	0	0	170	\$170	0	\$648	\$0	\$648	3	\$4,761
3	Install Day Lighting Control	36	184	0	0	\$220	1	\$990	\$0	\$990	3	\$8,785
4	Install VSD's on AC-1,2,4,5	0	6,643	0	0	\$6,643	25	\$30,191	\$10,000	\$40,191	4	\$255,360
5	Install Window Film on South Sky Windows	0	909	781	0	\$1,690	8	\$12,715	\$0	\$12,715	5	\$52,054
6	Lighting Upgrade- T5HO, CFLs	225	1,126	0	0	\$1,351	4	\$10,665	\$0	\$10,665	5	\$49,602
7	Install Advanced RTU Compressor Controls	63	1,528	0	0	\$1,590	6	\$15,581	\$0	\$15,581	6	\$55,570
8	Re-Commission DHW Room	0	29	62	0	\$91	0	\$1,022	\$0	\$1,022	7	\$2,229
9	Continuous Commissioning	0	183	107	0	\$290	1	\$3,895	\$0	\$3,895	8	\$7,682
10	Install Occupancy Sensors in Select Rooms	0	300	591	0	\$892	5	\$8,476	\$4,000	\$12,476	8	\$19,646
11	Install Demand Control Ventilation	0	364	546	0	\$910	5	\$9,509	\$6,500	\$16,009	9	\$17,788
12	Install De-Stratification Fans in Gym	0	29	522	0	\$551	3	\$9,713	\$0	\$9,713	9	\$8,160
13	Duct Solar Hot Air from Behind PV Panels to RTU	0	-92	888	0	\$796	5	\$11,189	\$5,000	\$16,189	11	\$7,933
14	Install Demand Controlled Kitchen Ventilation	0	1,169	0	0	\$1,169	4	\$19,885	\$7,500	\$27,385	9	\$29,633
15	Install Air Curtain over Front Entrance	0	428	0	0	\$428	2	\$12,067	\$4,000	\$16,067	13	\$3,847
<b>Total</b>		<b>613</b>	<b>14,265</b>	<b>3,498</b>	<b>170</b>	<b>\$18,545</b>	<b>73.8</b>	<b>\$151,988</b>	<b>\$37,000</b>	<b>\$188,988</b>	<b>6.7</b>	<b>\$95,265</b>

## Evergreen Seniors Centre

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials				
Measure	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV
	Marginal Rate	\$ 6.7659	\$ 0.0840	\$ 0.3119	\$ 2.4300						
Utility Savings	\$ 4,146	\$ 1,198	\$ 1,091	\$ 413	\$ 6,849						
<b>2012 Operational Measures</b>											
	0	29	62	170	261	0	1,670	0	1,670	10	6,990
2013	550	3,866	887	0	5,304	20	33,707	0	33,707	23	190,339
2014	63	10,005	1,137	0	11,205	44	83,642	28,000	111,642	36	377,997

## Exhibition Arena

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure		Electricity	Electricity	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV
		demand (kW)	Consumption (kWh)									
1	Lighting Upgrade: T12 to T8, 32W to 25W T8, Incandescent to CFL, LED Exit Signs	144	544	0	0	\$689	4.8	\$4,521	\$0	\$4,521	4.4	\$26,127
	Lighting Upgrade: LEDs	9	18	0	0	\$27	6.2	\$106	\$0	\$106	3.1	\$990
2	Lighting Controls: Install Occupancy Sensors	63	167	0	0	\$230	1.5	\$1,979	\$0	\$1,979	5.3	\$8,391
3	HVAC Upgrade: Install Weather Stripping for Interior and Exterior Doors	0	448	93	0	\$541	4.5	\$2,890	\$0	\$2,890	3.8	\$19,885
4	HVAC Upgrade: Insulate Piping	0	0	136	0	\$136	0.7	\$427	\$0	\$427	2.6	\$3,737
5	HVAC Upgrade: Install High Efficiency Furnaces	0	0	1,001	0	\$1,001	5.4	\$6,766	\$1,538	\$8,304	5.6	\$22,804
6	Control Upgrade: Install Vending Machine Timers	0	108	0	0	\$108	1.0	\$626	\$0	\$626	4.0	\$4,162
7	Water Upgrade: Ultra Low Flow Aerators	0	0	141	248	\$389	0.8	\$536	\$0	\$536	1.2	\$11,605
8	Arena Upgrade: Interlock Ice Resurfacing Machine Room Heater to Overhead Door	0	167	0	0	\$167	1.5	\$738	\$0	\$738	3.2	\$6,660
9	Arena Upgrade: Implement Floating Head Pressure with Infrared Sensor over Ice Sheet	0	2,996	0	0	\$2,996	26.9	\$17,732	\$3,224	\$20,956	4.6	\$112,532
10	HVAC Upgrade: Install High Efficiency Domestic Hot Water Tanks (Upper and Lower Mechanical Rooms)	0	0	102	0	\$102	0.6	\$37,338	\$6,789	\$44,126	25.5	-\$28,696
11	HVAC Upgrade: Install Natural Gas Fired Heaters with Thermostats	0	757	-297	0	\$461	5.2	\$7,360	\$1,673	\$9,032	8.5	\$15,886
12	Arena Upgrade: Install High Efficiency Domestic Hot Water Tank for Flood Water	0	0	770	0	\$770	4.2	\$29,160	\$5,302	\$34,461	15.6	-\$8,686
13	Arena Upgrade: Install Low-E Ceilings	0	2,276	0	0	\$2,276	20.4	\$27,225	\$0	\$27,225	6.7	\$74,902
14	Arena Upgrade: Instal New Laser Level on Ice Resurfacing Machine	0	209	0	0	\$209	1.9	\$16,500	\$0	\$16,500	17.1	-\$6,173
15	Arena Upgrade: New Refrigeration Compressor and Motors	0	2,397	0	0	\$2,397	21.5	\$58,151	\$7,930	\$66,080	10.8	\$43,979

## Exhibition Arena

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV	
	16	0	240	0	0							\$240
17	0	-183	-835	0	-\$1,018	-6.2	\$21,160	\$3,847	\$25,007	N/A	-\$56,895	
<b>Total</b>		<b>217</b>	<b>10,144</b>	<b>1,111</b>	<b>248</b>	<b>\$11,719</b>	<b>103.0</b>	<b>\$242,665</b>	<b>\$32,021</b>	<b>\$274,682</b>	<b>8.0</b>	<b>\$251,351</b>

Marginal Rate	\$ 9.0263	\$ 0.0838	\$ 0.3390	\$ 2.5000	
Utility Savings	\$ 217	\$ 10,144	\$ 1,111	\$ 248	\$ 11,719

2012 Operational Measures	153	1,118	228	0	1,500	17	8,570	0	8,570	18	54,901
2013	63	334	0	0	397	3	2,717	0	2,717	9	15,051
2014	0	2,996	0	0	2,996	27	17,732	3,224	20,956	5	112,532
2015	0	3,394	-297	0	3,097	29	74,961	11,321	86,280	33	60,006
All Pursued Measures	217	7,842	-68	0	7,990	76	103,980	14,545	118,523		242,490



Main Library - Norfolk

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)		Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV
1a	Lighting Upgrade - T12 to Reduced wattage T8, LED exit, CFLs	2,410	9,849	0	0	12,258	88	66,463	0	66,463	3	578,471
1b	Lighting Upgrade- Parabolic Incandescent to LED	37	134	0	0	170	1	1,199	0	1,199	5	6,396
2	Controls - Install Thermostatic Valves on All Perimeter Radiators	0	0	877	0	877	5	3,734	1,425	5,159	4	21,949
3	Install Low Flow Water Fixtures	0	1,033	0	748	1,781	9	13,120	0	13,120	5	56,888
4	Lighting Controls- Install Occupancy Sensors	109	410	0	0	519	4	4,216	0	4,216	5	19,073
5	Install Lead Condensing Boiler	0	0	1,225	0	1,225	7	25,228	4,750	29,978	11	9,392
6	Convert Multi-Zone AHU-1 to VAV System	0	2,757	0	0	2,757	25	47,980	9,450	57,430	9	67,929
7	Install New Direct Expansion Cooling System for AHU-1	54	1,468	0	297	1,819	13	95,804	9,450	105,254	10	22,086
8	Controls - New Building Automation System	0	928	389	0	1,316	11	77,287	7,675	84,962	5	24,648
9	Schedule DHW Recirculation Pump	0	24	0	0	24	0	1,042	0	1,042	14	73
10	Install Regenerative Braking Elevator	0	37	0	0	37	0	144,634	0	144,634	5	10
M-OPP1	Turn off AHU-1 During Unoccupied Hours	0	3,330	0	0	3,330	30	1,752	0	1,752	1	145,178
<b>Total</b>		<b>2,609</b>	<b>19,968</b>	<b>2,490</b>	<b>1,046</b>	<b>\$26,113</b>	<b>194.4</b>	<b>\$482,458</b>	<b>\$32,750</b>	<b>\$515,208</b>	<b>6.3</b>	<b>952,092</b>

Marginal Rate	\$ 6.7659	\$ 0.0836	\$ 0.3052	\$ 2.4300	
Utility Savings	\$ 2,609	\$ 19,968	\$ 2,490	\$ 1,046	\$ 26,113

## Main Library - Norfolk

Energy Savings  Measure	Utility Savings (\$)				Emissions Reduction  Annual Tonnes CO2 Avoided	Financials					
	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water		Total Annual Savings (\$)	Price Estimate (Mat'l & Lab)	Engineer ing & Proj Mgmt	Total Implementat ion Cost (\$)	Payback (years)	NPV
2012 Operational Measures	37	4,497	0	748	5,282	40	16,071	0	16,071	10	208,462
2013	2,519	10,258	0	0	12,777	92	70,679	0	70,679	8	597,544
2014	0	951	1,266	0	2,217	16	82,062	9,100	91,162	23	46,670
2015	54	4,225	1,225	297	5,801	45	169,012	23,650	192,662	30	99,407
All Pursued Measures	2,609	19,931	2,490	1,046	26,076	194	337,824	32,750	370,574		952,082

## River Run Centre

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure		Electricity	Electricity	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & PM	Total Implementation Cost	Payback (Years)	Net Present Value
		demand (kW)	Consumption (kWh)									
1	Install Demand Control Ventilation on AHU's	12,670	0	66	0	\$12,736	1	\$27,525	\$10,000	\$37,525	2	\$525,563
2	Lighting Upgrade: LEDs	2,114	6,104	0	0	\$8,218	56	\$35,948	\$0	\$35,948	3	\$329,678
3	Lighting Upgrade: 32W to 25W T8, CFLs and LED Exit Signs	165	1,004	0	0	\$1,169	9	\$5,457	\$0	\$5,457	4	\$46,535
4	Install Motion Sensors in Small Rooms	0	4,178	1,847	0	\$6,026	55	\$22,198	\$10,000	\$32,198	4	\$211,218
5	Install De-Stratification Fan in CCH	0	70	313	0	\$383	3	\$3,318	\$0	\$3,318	6	\$3,070
6	Install VFD's on Air Handler Fans	0	5,668	0	0	\$5,668	52	\$55,819	\$7,500	\$63,319	6	\$194,214
7	Re-Duct Rm 231 S/A to SF-5 Duct	0	2,108	597	0	\$2,705	25	\$19,810	\$5,000	\$24,810	6	\$88,336
8	Lighting Controls: Install Occupancy Sensors	95	422	0	0	\$517	4	\$2,304	\$7,500	\$5,196	6	\$18,008
9	Re-Commission Building Automation System	1,832	5,622	1,591	0	\$9,045	66	\$107,225	\$0	\$107,225	7	\$277,867
10	Install VFD's on HHW Pumps	0	1,216	0	0	\$1,216	11	\$20,020	\$6,500	\$26,520	10	\$29,057
11	Install Film on CCH South Windows	0	596	1,466	0	\$2,062	19	\$31,568	\$0	\$31,568	8	\$41,665
12	Install Reflective Barrier Behind Radiators	0	0	459	0	\$459	4	\$6,728	\$5,000	\$11,728	12	\$3,070
13	Combine Scheduling Resouces with Events Planning	0	85	269	0	\$354	3	\$23,978	\$0	\$23,978	9	\$12,851
14	Replace Chiller	0	1,109	0	0	\$1,109	10	\$302,801	\$12,000	\$314,801	9	(\$86,849)
<b>Total</b>		<b>16,875</b>	<b>28,183</b>	<b>6,609</b>	<b>0</b>	<b>\$51,667</b>	<b>318</b>	<b>\$664,699</b>	<b>\$63,500</b>	<b>\$723,591</b>	<b>6.4</b>	<b>\$1,694,283</b>

	Electricity	Electricity	Natural Gas	Water
Marginal Rate	\$ 6.8857	\$ 0.0816	\$ 0.2069	\$ 2.4300

## River Run Centre

Energy Savings  Measure	Utility Savings (\$)					Emissions Reduction  Annual Tonnes CO2 Avoided	Financials				
	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)		Price Estimate (Mat'l & Lab)	Engineerin g & PM	Total Implementa tion Cost	Payback (Years)	Net Present Value
Utility Savings	\$ 16,875	\$ 28,183	\$ 6,609	\$ -	\$ 51,667						
2012 Operational Measures	0	0	0	0	0	0	0	0	0	0	0
2013	4,206	17,330	3,439	0	24,975	190	173,132	17,500	186,024	23	883,306
2014	12,670	7,931	1,245	0	21,845	84	130,450	22,500	152,950	29	824,034
2015	0	1,812	1,926	0	3,738	34	58,316	11,500	69,816	30	73,792
All Pursued Measures	16,875	27,073	6,609	0	50,558	308	361,898	51,500	408,790		1,781,132

## Sleeman Centre

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure	Electricity	Electricity	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV	
	demand (kW)	Consumption (kWh)										
1	Lighting Upgrade - Program start Electronic Ballast 25 w lamp	924	5,529	0	0	6,452	51	75,509	10,297	85,805	5	239,067
2	Lighting Upgrade: Dimmable Ballasts & Lighting Controls	48	338	0	0	386	3	5,608	765	6,373	6	13,179
3	Lighting Upgrade: Program start Existing u-tube lamps	62	342	0	0	404	3	6,027	822	6,849	5	14,389
4	Lighting Upgrade: Incandescent to LED	896	3,312	0	0	4,209	30	33,846	0	33,846	5	165,739
5	Lighting Upgrade: Induction Lighting over Ice Pad	1,767	6,747	0	0	8,515	62	89,193	12,163	101,355	6	305,217
6	Lighting Controls: Stand Alone Occupancy Sensors	388	2,057	0	0	2,445	19	17,561	0	17,561	5	89,159
7	Lighting Controls: Full Lighting Control System	4,349	19,042	0	0	23,392	175	157,036	21,414	178,450	5	864,679
8	HVAC Upgrade: ReBalance and ReCommission Arena HVAC Units and Exhaust Fans	0	1,263	3,822	0	5,086	35	10,693	1,458	12,151	2	161,040
9	HVAC Upgrade: Install Temperature Sensor for Kitchen Exhaust Fan	0	233	625	0	858	6	2,384	325	2,710	3	26,805
10	HVAC Upgrade: Review Scheduling of Restaurant Rooftop Units	0	209	214	0	423	3	330	0	330	1	15,430
11	Arena Upgrade: Refurbish Mechanical Refrigeration Equipment	0	26,172	0	0	\$26,172	240.9	\$195,639	\$26,678	\$222,317	5.3	\$1,004,433
12	Arena Upgrade: Optimize Compressor Operation	0	4,169	0	0	\$4,169	38.4	\$8,200	\$1,864	\$10,064	1.9	\$174,402
13	Arena Upgrade: Replace Snow Melt Pit Heat Exchanger	0	0	1,142	1,021	\$2,163	6.9	\$16,616	\$3,021	\$19,637	6.0	\$48,720
14	Arena Upgrade: Reinstate Desuperheater for Flood Water Pre-Heat	0	0	2,293	0	\$2,293	13.9	\$15,425	\$2,805	\$18,230	5.4	\$52,965
15	Arena Upgrade: Install Floating Head Pressure Controls	0	6,887	0	0	\$6,887	63.4	\$13,852	\$2,518	\$16,370	1.9	\$288,366

## Sleeman Centre

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure	Electricity	Electricity	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV	
	demand (kW)	Consumption (kWh)										
16	Install Vending Machine Controls	0	743	0	0	\$743	6.8	\$3,625	\$0	\$3,625	3.5	\$29,379
17	Lighting Upgrade: Retrofit 2ft T12 lamps and ballasts	6	14	0	0	\$20	0.1	\$1,554	\$0	\$1,554	12.6	\$3
18	Lighting Upgrade: Exterior Induction Lighting	15	8	0	0	\$22	0.1	\$1,287	\$0	\$1,287	16.0	-\$382
19	Arena Upgrade: Install Instantaneous Condensing Flood Water Heaters	0	0	754	0	\$754	4.6	\$31,539	\$5,734	\$37,274	12.6	-1,880
20	HVAC Upgrade: Install a Lead Condensing Heating Boiler	0	0	3,764	0	\$3,764	22.8	\$54,649	\$7,452	\$62,102	9.0	67,740
21	HVAC Upgrade: Install High Efficiency Domestic Hot Water Heater Tanks	0	0	2,853	0	\$2,853	17.3	\$72,018	\$9,821	\$81,839	12.1	21,508
22	Water Conservation - Install Dual Flush Valves, 1/8 gpf Urinals and Ultra Low Flow Faucet Aerators	0	0	0	1,361	\$1,361	0.0	\$81,651	\$11,134	\$92,785	17.5	-33,316
<b>Total</b>		<b>8,456</b>	<b>77,065</b>	<b>15,468</b>	<b>2,381</b>	<b>103,370</b>	<b>\$803</b>	<b>\$894,241</b>	<b>\$118,270</b>	<b>\$1,012,511</b>	<b>6.6</b>	<b>\$3,546,643</b>

Marginal Rate	\$	6.9257	\$	0.0816	\$	0.3047	\$	2.4300		
Utility Savings	\$	8,456	\$	77,065	\$	15,468	\$	2,381	\$	103,370

2012 Operational Measures	0	1,705	4,662	0	6,366	44	13,408	1,783	15,191	5	203,275
2013	4,092	25,969	0	0	30,062	239	246,773	26,564	273,337	49	1,144,498
2014	4,349	19,042	3,435	1,021	27,847	196	189,077	27,240	216,316	16	966,364
2015	15	8	0	0	22	0	1,287	0	1,287	16	-382
2015	0	4,169	7,372	1,361	12,902	83	248,058	36,005	284,063	53	228,454
All Pursued Measures	8,456	50,893	15,468	2,381	77,199	562	698,602	91,592	790,194		2,542,210

## Transit Garage

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
		Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water		Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)
1	Re-Program Barn Unit Heaters	0	0	496	0	496	3	510	0	510	1	14,658
2	Utilize Maintenance De-Stratification Fans	0	206	358	0	564	4	283	0	283	1	19,733
3	Lighting Controls - Install Occupancy Sensors	1,720	15,400	0	0	17,120	139	30,922	0	30,922	2	725,936
4	Continuous Commissioning	166	909	728	159	1,962	13	11,330	0	11,330	4	64,053
5	Lock Out Bay Doors	0	0	292	0	292	2	1,788	0	1,788	5	7,246
6	Install Induction Lighting in Barn	3,483	31,181	0	0	34,664	281	164,497	35,000	199,497	4	1,342,028
7	Replace 32W T8's with 25W T8's	99	894	0	0	993	8	11,540	0	11,540	7	33,010
8	Install Air Curtains on Fueling Bay Doors	-426	-219	3,304	0	2,659	18	42,691	5,500	48,191	10	27,440
9	Install New Bus Wash Boiler	0	0	1,089	0	1,089	7	22,926	4,000	26,926	7	19,087
10	Increase SDHW Storage	0	0	215	0	215	1	7,075	0	7,075	14	-56
<b>Total</b>		<b>5,043</b>	<b>48,371</b>	<b>6,482</b>	<b>159</b>	<b>\$60,054</b>	<b>475.7</b>	<b>\$293,563</b>	<b>\$44,500</b>	<b>\$338,063</b>	<b>5.2</b>	<b>2,253,134</b>
Marginal Rate		\$ 6.7659	\$ 0.0832	\$ 0.3052	\$ 2.4300							
Utility Savings		\$ 5,043	\$ 48,371	\$ 6,482	\$ 159	\$ 60,054						
2012 Operational Measures		99	1,100	1,146	0	2,345	17	14,122	0	14,122	13	74,647
2013		3,649	32,090	728	159	36,626	294	175,827	35,000	210,827	8	1,406,081
2014		1,294	15,181	4,394	0	20,869	164	96,540	9,500	106,040	18	772,463
2015		0	0	0	0	0	0	0	0	0	0	0
2015		0	0	0	0	0	0	0	0	0	0	0
All Pursued Measures		5,043	48,371	6,268	159	59,840	474	286,488	44,500	330,988		2,253,190

Victoria Road Rec Centre

Energy Savings		Utility Savings (\$)					Emissions Reduction	Financials				
		Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)		Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)
1	Lighting Upgrade: T8, 32W to 25W	424	1,864	0	0	\$2,288	16.7	\$10,950	\$0	\$10,950	3.4	\$90,756
	Lighting Upgrade: CFLs	9	46	0	0	\$55	0.4	\$41	\$0	\$41	0.6	\$2,527
	Lighting Upgrade: Install Induction Lighting	2,681	12,868	0	0	\$15,548	115.0	\$87,037	\$0	\$87,037	3.9	\$604,381
2	Lighting Controls: Install Occupancy Sensors	424	2,155	0	0	\$2,579	19.3	\$11,876	\$0	\$11,876	3.3	\$102,632
3	Control Upgrade: Install Vending Machine Timers	0	98	0	0	\$98	0.9	\$313	\$0	\$313	2.5	\$4,033
4	HVAC Upgrade: Install Weather Stripping for Interior and Exterior Doors	0	294	236	0	\$530	3.9	\$2,890	\$0	\$2,890	3.9	\$17,485
5	Arena Upgrade: Install Variable Frequency Drive on Evaporative Condenser	0	1,133	0	0	\$1,133	10.1	\$5,099	\$1,159	\$6,257	3.9	\$44,126
6	Arena Upgrade: Install High Efficiency Domestic Hot Water Tank for Flood Water	0	0	1,082	0	\$1,082	5.9	\$27,358	\$4,974	\$32,332	12.7	\$10,722
7	HVAC Upgrade: Replace Electric Domestic Hot Water Tank in Family Change Room with a Gas-Fired High Efficiency Domestic Hot Water Tank	0	1,866	-811	0	\$1,055	12.3	\$14,751	\$2,682	\$17,434	7.7	\$41,228
8	HVAC Upgrade: Install High Efficiency Domestic Hot Water Tank in Mechanical Room Penthouse	0	0	2,372	0	\$2,372	12.9	\$67,720	\$9,234	\$76,954	9.8	\$20,861
9	Arena Upgrade: Install New Dehumidifier	0	5,679	-3,258	0	\$2,421	33.1	\$48,667	\$6,636	\$55,303	8.8	\$99,307
10	Arena Upgrade: Install Low-E Ceilings	0	4,030	0	0	\$4,030	36.0	\$27,225	\$0	\$27,225	4.5	\$152,244
11	Arena Upgrade: Install New Laser Level on Ice Resurfacing Machine	0	184	0	0	\$184	1.6	\$16,500	\$0	\$16,500	18.0	-\$7,284
12	Arena Upgrade: New Refrigeration Compressor and Motors	0	3,005	0	0	\$3,005	26.9	\$55,291	\$10,053	\$65,344	9.5	\$71,477
13	Arena Upgrade: Soft Starter on Compressors and Brine Pump Motors	0	300	0	0	\$300	2.7	\$9,639	\$1,752	\$11,391	12.6	\$2,613
14	Pool Upgrade: Install Dehumidifier	0	-3,555	12,421	0	\$8,866	35.7	\$482,438	\$43,858	\$526,296	19.5	-\$268,971
<b>Total</b>		<b>3,538</b>	<b>29,968</b>	<b>12,043</b>	<b>0</b>	<b>\$45,548</b>	<b>333.4</b>	<b>\$867,795</b>	<b>\$80,348</b>	<b>\$948,143</b>	<b>7.8</b>	<b>\$988,137</b>



## Victoria Road Rec Centre

Energy Savings	Utility Savings (\$)				Emissions Reduction	Financials				
	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water		Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)

Marginal Rate	\$ 9.0263	\$ 0.0840	\$ 0.3390	\$ 2.5000							
Utility Savings	\$ 3,538	\$ 29,968	\$ 12,043	\$ -	\$ 45,548						

2012 Operational Measures	433	2,302	236	0	2,972	22	14,194	0	14,194	10	114,801
2013	2,681	12,868	0	0	15,548	115	87,037	0	87,037	4	604,381
2014	0	0	0	0	0	0	0	0	0	0	0
2015	0	1,133	3,454	0	4,587	29	100,177	15,367	115,543	26	75,709
All Pursued Measures	3,114	16,303	3,690	0	23,107	166	201,408	15,367	216,774		794,891

West End Community Centre (figures still assume Cogen plant operational)

Energy Savings	Utility Savings (\$)					Emissions Reduction	Financials				
Measure	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Implementation Cost (\$)	Payback (Years)	Net Present Value
Operational: Turn Off Flood Water Preheat Pump	0	101	0	0	\$101	1	\$44	\$0	\$44	0.3	\$4,466
Operational: Schedule Change Room MAU	0	134	939	0	\$1,073	7	\$313	\$0	\$313	0.3	\$34,314
Operational: Lower/Control Temperature in Olympia Room	0	0	75	0	\$75	0	\$156	\$0	\$156	1.8	\$2,175
Operational: Replace or Repair Hot Water Storage Tank Insulation	0	0	812	0	\$812	5	\$5,035	\$0	\$5,035	4.5	\$20,111
Operational: Condenser Coil Cleaning	0	3,320	0	0	\$3,320	30	\$6,380	\$0	\$6,380	2.0	\$140,652
1a Lighting Upgrades: 32W to 25W T8	101	460	0	0	\$562	4	\$5,020	\$0	\$5,020	5.0	\$21,122
1b Lighting Upgrade: Incandescent to LED Conversion	151	564	0	0	\$715	5	\$4,405	\$0	\$4,405	4.0	\$3,425
2 Install Lighting Controls: Common Area Photo Cells	565	2,996	0	0	\$3,561	27	\$4,866	\$0	\$4,866	1.0	\$152,703
3 Arena Upgrade: Implement Floating Head Pressure	0	4,241	0	0	\$4,241	39	\$27,104	\$3,696	\$30,800	4.8	\$158,515
4 Arena Upgrade: Replace De-Super Heater to Preheat Flood Water	0	0	6,100	0	\$6,100	37	\$15,110	\$2,419	\$17,529	2.5	\$170,038
5 Arena Upgrade: Raise Secondary Refrigerant Temperature	0	2,082	0	0	\$2,082	19	\$3,771	\$655	\$4,426	1.8	\$87,830
6 Arena Upgrade: Install VFD on Evaporative Condenser Fan	0	1,974	0	0	\$1,974	18	\$11,182	\$1,942	\$13,124	4.0	\$76,180
7 Arena Upgrade: Install Window Film on Exterior Windows	0	453	0	0	\$453	4	\$2,320	\$0	\$2,320	3.7	\$17,836
8 HVAC Upgrade: Operate Co-Gen Plant to Heat Hot Water Plant	6,347	56,997	-33,250	0	\$30,094	320	\$57,639	\$7,860	\$65,499	2.0	\$1,720,046
9 HVAC Upgrade: Implement, Review and Optimize Night Setback on All AHU's	0	0	1,724	0	\$1,724	10	\$3,991	\$760	\$4,751	2.3	\$48,259
10 HVAC Upgrade: Recommission BAS Control of AHU's	0	1,016	1,585	0	\$2,601	19	\$5,440	\$9,520	\$14,960	4.0	\$79,326

West End Community Centre (figures still assume Cogen plant operational)

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Implementation Cost (\$)	Payback (Years)	Net Present Value	
	11	0	4,528	0								0
12	0	476	0	0	\$476	4	\$3,074	\$0	\$3,074	3.8	\$18,512	
13	1,944	9,072	0	0	\$11,016	83	\$106,544	\$14,529	\$121,073	5.8	\$398,634	
14	0	270	602	0	\$872	6	\$6,034	\$0	\$6,034	4.8	\$24,670	
15	0	885	2,931	0	\$3,816	25	\$408,926	\$48,486	\$457,411	14.0	-\$73,258	
16	0	0	2,232	0	\$2,232	13	\$23,171	\$3,709	\$26,880	7.3	\$54,450	
17	0	4,830	0	0	\$4,830	44	\$46,506	\$5,514	\$52,020	6.3	\$164,745	
18	0	0	8,144	0	\$8,144	49	\$197,509	\$23,418	\$220,927	8.0	\$8	
19	0	0	1,284	0	\$1,284	8	\$21,539	\$5,000	\$21,410	16.0	-\$32,345	
20	0	-503	4,024	0	\$3,521	20	\$51,185	\$6,456	\$57,641	7.5	\$60,155	
21	0	0	0	1,282	\$1,282	0	\$46,486	\$0	\$46,486	14.0	-\$2,973	
<b>Total</b>		<b>9,108</b>	<b>93,897</b>	<b>-2,799</b>	<b>1,282</b>	<b>\$101,488</b>	<b>841</b>	<b>\$1,094,843</b>	<b>\$133,964</b>	<b>\$1,223,678</b>	<b>5.0</b>	<b>\$3,520,522</b>

Marginal Rate	\$ 6.6495	\$ 0.0821	\$ 0.3047	\$ 2.7100	
Utility Savings	\$ 9,108	\$ 93,897	\$ (2,799)	\$ 1,282	\$ 101,488

Year	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Implementation Cost (\$)	Payback (Years)	Net Present Value
2012 Operational Measures	817	4,731	3,550	0	9,099	65	26,904	760	27,664	23	305,087
2013	1,944	10,357	2,187	0	14,488	108	118,018	24,049	142,067	15	502,630
2014	0	13,278	6,100	0	19,378	158	90,580	8,712	99,293	21	681,326
2015	0	4,328	14,399	0	18,727	127	318,370	39,098	357,468	29	279,358
All Pursued Measures	2,761	32,694	26,236	0	61,691	458	553,872	72,619	626,491		1,768,401

## 45 Municipal Works Yard

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure	Electricity demand (kW)	Electricity Consumption (kWh)	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV	
1	Lighting Controls: Install Occupancy Sensors	63	192	0	0	255	2	1,732	0	1,732	4.8	9,618
2	Controls: Commission BAS	0	3,827	0	0	3,827	35	20,563	0	20,563	3.8	149,732
3	Controls Upgrade: Install Occupancy Sensors to Control Office Unit Heaters	0	0	573	0	573	3	3,681	0	3,681	4.9	14,065
4	Install Condensing Unit Heaters in Repair Service Shop	0	0	3,141	0	3,141	19	33,098	5,110	38,208	5.4	69,161
5	Install Heat Recovery Unit Ventilator in Repair and Service Bay	0	-594	3,644	0	3,050	16	36,959	8,401	45,360	8.8	42,794
6	Install High Speed Bay Door	0	0	347	0	347	2	33,278	0	33,278	22.5	-20,474
7	Water Conservation: Install Dual Flush Valves, 1/8 GPM Urinals and Ultra Low Flow Faucet Aerators	0	0	0	759	759	0	12,352	0	12,352	8.9	12,401
<b>Total</b>		<b>63</b>	<b>3,425</b>	<b>7,704</b>	<b>759</b>	<b>\$11,951</b>	<b>76.5</b>	<b>\$141,664</b>	<b>\$13,511</b>	<b>\$155,175</b>	<b>8.4</b>	<b>277,297</b>

Marginal Rate	\$ 6.7659	\$ 0.0830	\$ 0.3119	\$ 2.7100	
Utility Savings	\$ 63	\$ 3,425	\$ 7,704	\$ 759	\$ 11,951

2012 Operational Measures	0	3,827	0	0	3,827	35	20,563	0	20,563	4	149,732
2013	0	0	0	0	0	0	0	0	0	0	0
2014	63	192	573	0	827	5	5,413	0	5,413	10	23,683
2015	0	-594	6,785	0	6,191	35	70,057	13,511	83,568	14	111,955
All Pursued Measures	63	3,425	7,357	0	10,845	74	96,033	13,511	109,544		285,370

## 50 Municipal

Energy Savings		Utility Savings (\$)				Emissions Reduction	Financials					
Measure		Electricity	Electricity	Natural Gas	Water	Total Annual Savings (\$)	Annual Tonnes CO2 Avoided	Price Estimate (Mat'l & Lab)	Engineering & Proj Mgmt	Total Implementation Cost (\$)	Payback (years)	NPV
		demand (kW)	Consumption (kWh)									
1	Lighting Upgrade - T12 to T8, LED Exit Signs	0	1,515	0	0	1,515	9	9,886	0	9,886	5	57,562
2	Lighting Controls- Install occupancy Sensors	0	2,868	0	0	2,868	18	8,412	0	8,412	2	118,583
3	Use Unoccupied Setback Temperatures	0	694	0	0	694	4	1,439	0	1,439	2	29,247
4	Control Infrared Heaters with Outdoor Air Temperature	0	0	1,503	0	1,503	9	4,861	0	4,861	3	41,334
5	Install Low Flow Water Fixtures	0	0	0	190	190	0	5,272	0	5,272	12	1,082
6	Capture Rain Water for Brine Tanks	0	0	0	2,453	2,453	0	27,636	0	27,636	7	51,521
<b>Total</b>		<b>0</b>	<b>5,077</b>	<b>1,503</b>	<b>2,642</b>	<b>\$9,222</b>	<b>40.4</b>	<b>\$57,506</b>	<b>\$0</b>	<b>\$57,506</b>	<b>5.2</b>	<b>299,329</b>

Marginal Rate	\$ -	\$ 0.1209	\$ 0.3119	\$ 2.7100	
Utility Savings	\$ -	\$ 5,077	\$ 1,503	\$ 2,642	\$ 9,222

2012 Operational Measures	0	694	0	0	694	4	1,439	0	1,439	2	29,247
2013	0	4,383	0	0	4,383	27	18,298	0	18,298	7	176,146
2014	0	0	1,503	0	1,503	9	4,861	0	4,861	3	41,334
2015	0	0	0	0	0	0	0	0	0	0	0
All Pursued Measures	0	5,077	1,503	0	6,579	40	24,598	0	24,598		246,727

## Financial Analysis for Energy Audit Measures

Each energy saving opportunity undergoes a detailed financial analysis and includes all relevant costs to provide a clear picture of which energy saving opportunities should be implemented.

The business case financial analysis includes capital cost estimates for Total Implementation Cost with a breakout by Material & Labour as well as Engineering & Project Mgmt.

The Cost/benefit analysis uses two measures - Payback (years) and Net Present Value (NPV).

For Payback, the analysis goes well beyond "Simple Payback", incorporating utility savings, inflation, projected utility rates, avoided capital costs, changes in maintenance costs and bank rates. The NPV estimates include the total value of all cash streams discounted to present day dollars. figures used for the life cycle costing analysis include:

- MARRR 5.0%
- Inflation 2.0%
- MARRA (as a product of MARRR and Inflation) 7.1%
- Electricity Escalation 13.0% (note 1)
- Natural Gas Escalation 9.7% (note 2)
- Water & Sewer Escalation 10.0% (note 3)
- Corporate Tax Rate - 11% Ontario (effective July1/12)
- Inflation rate – use 2%
- Interest Rate - 4% 10 yr term, 4.8% 20 yr term
- Depreciation schedules for specific asset classes and their respective Life in years is shown below.

### Notes:

1. The electricity escalation rate was drawn from a published Energy Probe Report and is the average escalation rate for the provided timeframe (2012-2018). Below is a summary that I prepared for Electricity Escalation from the MOE Long-Term Energy Plan (LTEP) and also Energy Probe.
2. The escalation rate for natural gas assumes minimal escalation over the next five year period (2% for distribution) and then predicts that the escalation will closely match that of electricity. This results in an average natural gas escalation of 9.7% over the 20 year timeframe for the calculations.
3. The water and sewer escalation rate was provided from the City's Long Term Water/WasteWater Financial Plan.

***Financial Calculations:***

$$\text{MARR}_A = (1 + \text{MARR}_R) \times (1 + \text{Inflation})$$

$$\text{NPV} = \sum [(\text{Annual Cash Balance}) / (1 + \text{MARR}_A)^n]$$

The estimates are based on Class C Cost Estimates for the most part, using measured quantities from preliminary design, as defined by PWGSC (Public Works and Government Services Canada). This cost estimate will be improved following project approval. In some instances, ie lighting opportunities, the cost estimate is closer to Class B.