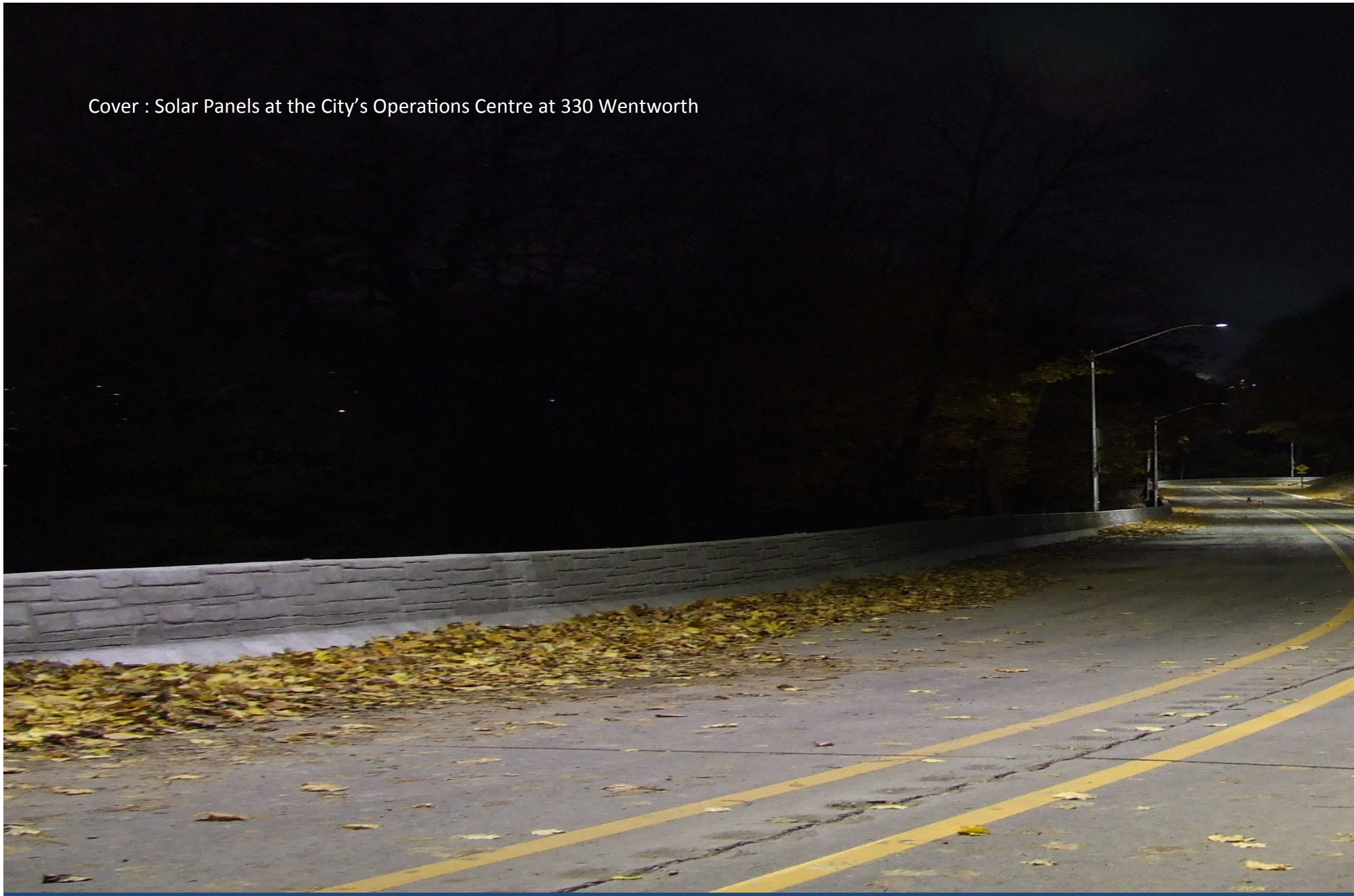
Hamilton

City of Hamilton

2013 Annual Energy Report



Cover : Solar Panels at the City's Operations Centre at 330 Wentworth

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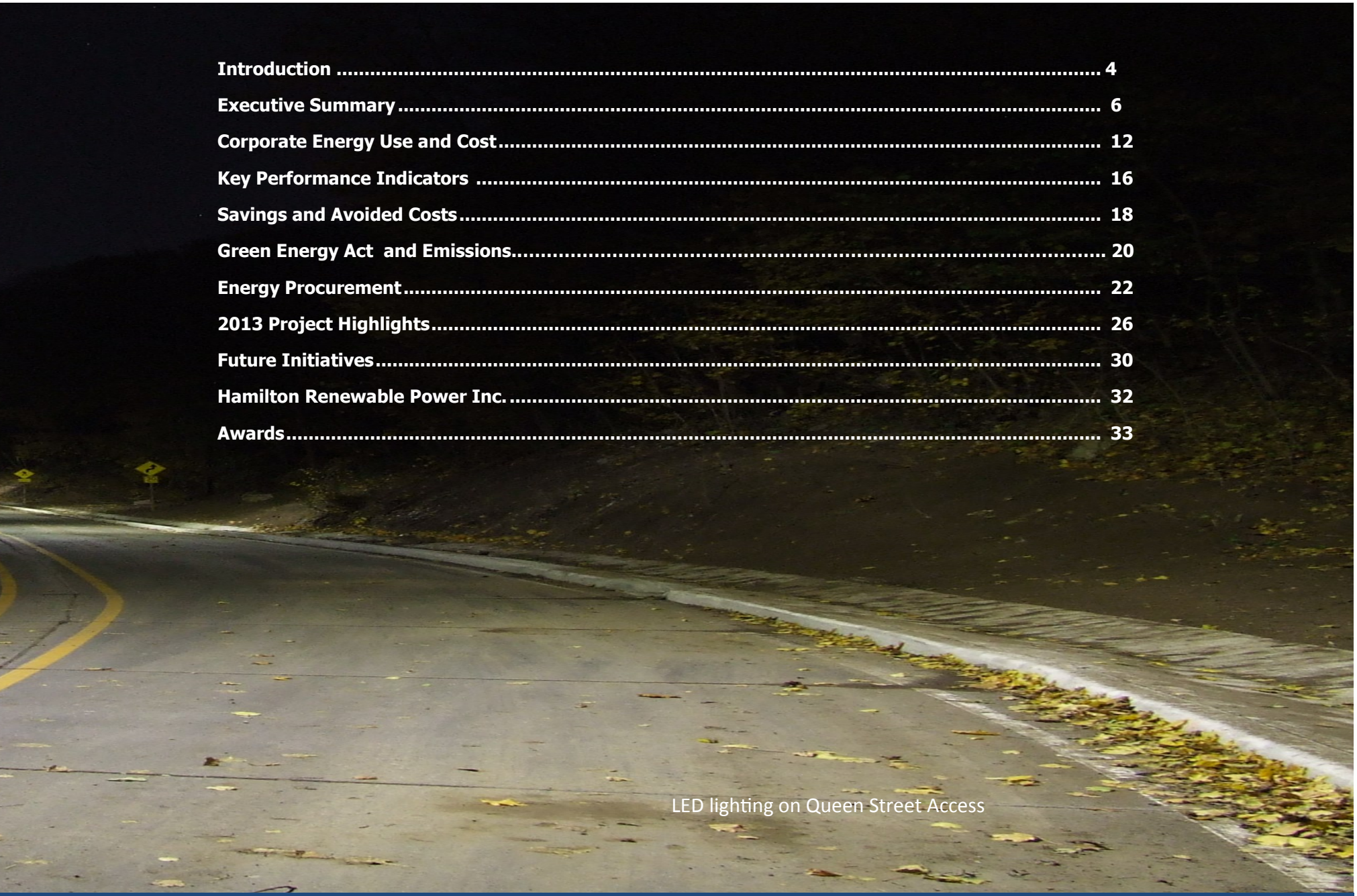


LED lighting on Queen Street Access

Introduction

The City of Hamilton continues to be a municipal leader in energy conservation and demand management as the year 2013 proved to be another successful year for achieving the City's energy conservation and demand management goals.

This year marks the eighth consecutive year of success as energy intensity for Corporate facilities recorded a 20% reduction over the 2005 base year levels of energy use. These results take us to our energy reduction target of 20% as set out in the 2007 Corporate Energy Policy, seven years ahead of schedule. The efforts of City staff from Public Works and all other departments once again demonstrate the commitment and cooperation required to achieve this success.

In the years ahead the City of Hamilton will continue to move forward with energy targets striving for more energy reduction, more energy cost reduction and more emission reductions.

Following the direction of Ontario's *Conservation First: A renewed Vision for Energy Conservation in Ontario,* The City of Hamilton will continue to improve on its energy intensity results and will expand the scope of the energy intensity measurement to include Hamilton Water, Fleet, Transit and Street Lighting

This year the accumulated combination of avoided costs and direct cost savings total more than $32.8 million and a year to year benefit of $5.2 million when comparing 2013 to 2012.

Avoided costs are calculated on the basis of what additional energy costs would have been incurred if no corrective or remedial action was taken to eliminate energy waste or to procure energy cost effectively. Direct cost savings are the result of measures taken to reduce energy consumption using more efficient equipment or processes.

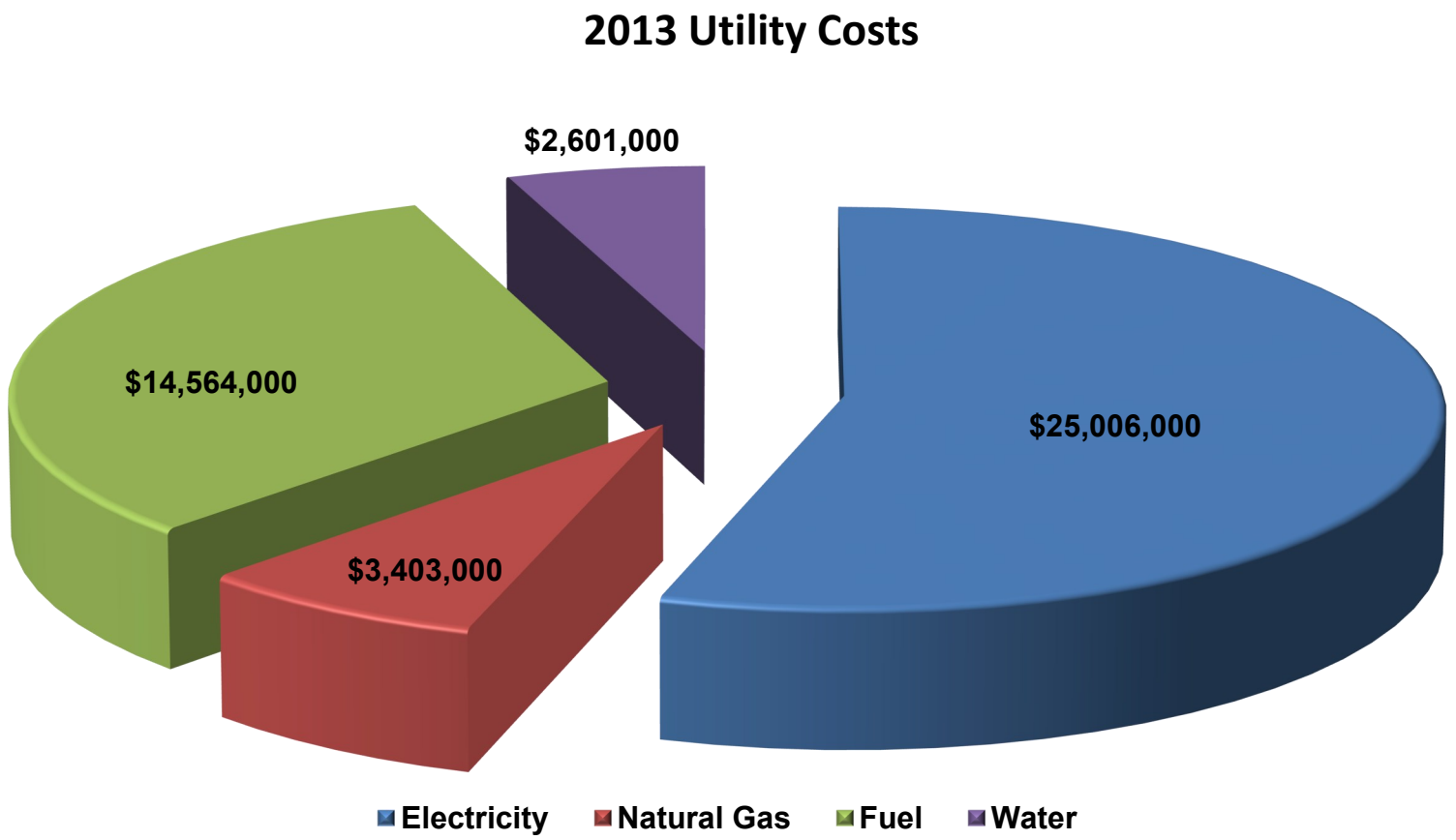
Variable Speed Drives on hot water pumps at Lister Building

2013 was the inaugural year for reporting of the City's energy use as required by the Provincial Green Energy Act (397/11). In addition to recording energy consumption, the report also sets out the City's emissions generated by the energy it consumes. As such, this year's report incorporates changes to the facilities included in the energy intensity measurement in order to be consistent with the guidelines of the Act.

According to the Green Energy Act reporting formula, the City's Corporate facilities are responsible for emitting 93,783 tonnes of Carbon Dioxide equivalent (CO_2e) which is comparable to having 18,000 cars on the road each day.

Utility costs for electricity, fuel, natural gas and water totaled more than $45 million for 2013 reflecting an increase of 6%. These costs include Hamilton Water operations, Street Lighting, Fleet, Transit as well as all Corporate facilities, Recreation facilities and Community Services facilities.

With the onset of colder than normal winter conditions that began earlier than recent years, consumption levels for electricity and natural gas combined were higher in 2013 by 8% from the previous year. Unit prices for electricity were 6% higher than 2012 however unit prices for natural gas were 12% lower than 2012. Diesel fuel unit prices were 1% higher than 2012



Executive Summary

The City of Hamilton is often challenged to address the need to provide increased service offerings while working with a constrained operating and capital expenditure budget. These conditions emphasizes the efforts to reduce energy use and cost through strategic energy procurement, eliminating waste, using more efficient equipment or by optimizing energy intense operations. If energy use were left unchecked or uncontrolled a 2.5% increase in energy costs would increase the City's operating budget by more than $1 million.

With this in mind, the City continues to manage costs and use through an organized procurement strategy for natural gas, fuel and electricity. This entails an ongoing review of the City's demand for energy and the market conditions that impact procurement decisions with the goal to secure the best and lest volatile price for the various energy commodities and services.

Conservation and system optimization is fundamental in managing the City's energy costs. Using energy efficient lighting, variable speed drives and building automation systems continues to benefit the City with reduced energy consumption. Regular review and analysis of our operations keeps energy use in check and helps identify opportunities for improving efficiencies.

In the years ahead, a revised Corporate Energy Policy will be used as the frame work for future energy management plans as the efforts to conserve energy involve further energy intensity reduction targets for City owned facilities as well as Hamilton Water, Fleet, Transit and other operations such as Traffic and Street Lighting.

Hamilton City Hall

Energy Savings and Avoided Costs

The efforts to reduce energy consumed by the various City departments and to mitigate and control their associated costs have demonstrated success in the following major categories of energy management activities.

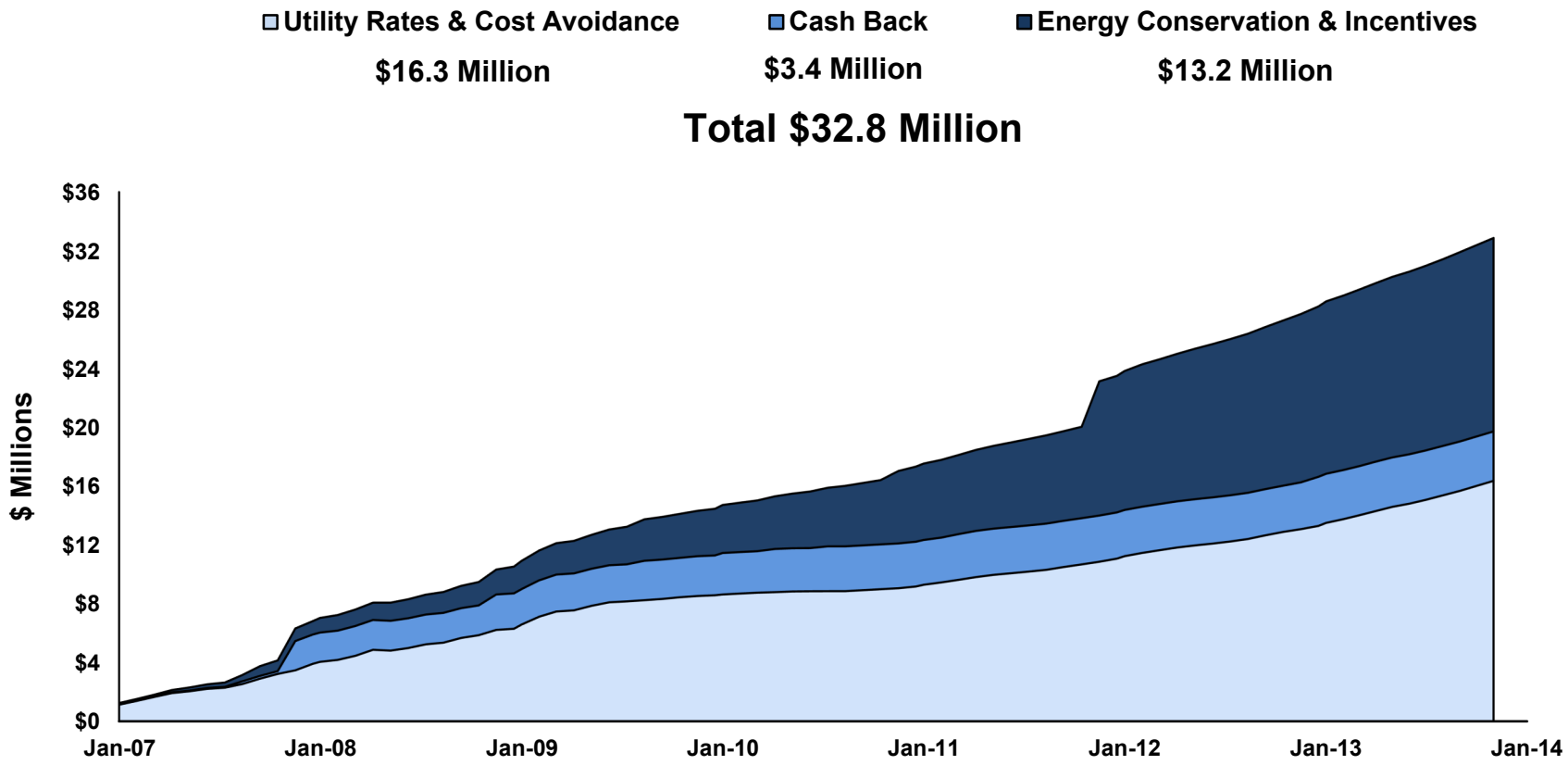
Utility Rates and Cost Avoidance: With a strategic plan for mitigating the financial risk associated with in the commodity portion or regulated portion of the energy markets the City of Hamilton has benefited from costs that are lower than other municipalities. This procurement strategy assists in the creation and control of various energy budgets and yields an avoidance of some costs that would have been incurred if a default to no action was the norm.

Cost Recovery : Over time the City's energy management program has established and expanded a process to monitor and analyze the more than 2000 City of Hamilton utility accounts. This process results in a recovery of costs stemming from corrections or adjustments made to billing errors, billing anomalies and rate analysis.

Energy Conservation & Incentives: Implementing energy efficient measures or equipment leads to lower energy consumption which in turn results in energy costs being lower than what they would be by not implementing. Many of these projects that involve capital spending are also eligible for financial incentives from various energy programs that are delivered by our utility providers Hydro One, Horizon Utilities and Union Gas.

The cumulative total for cost savings and avoided costs from 2005 to the end of 2013 amounts to $32.8 million dollars.

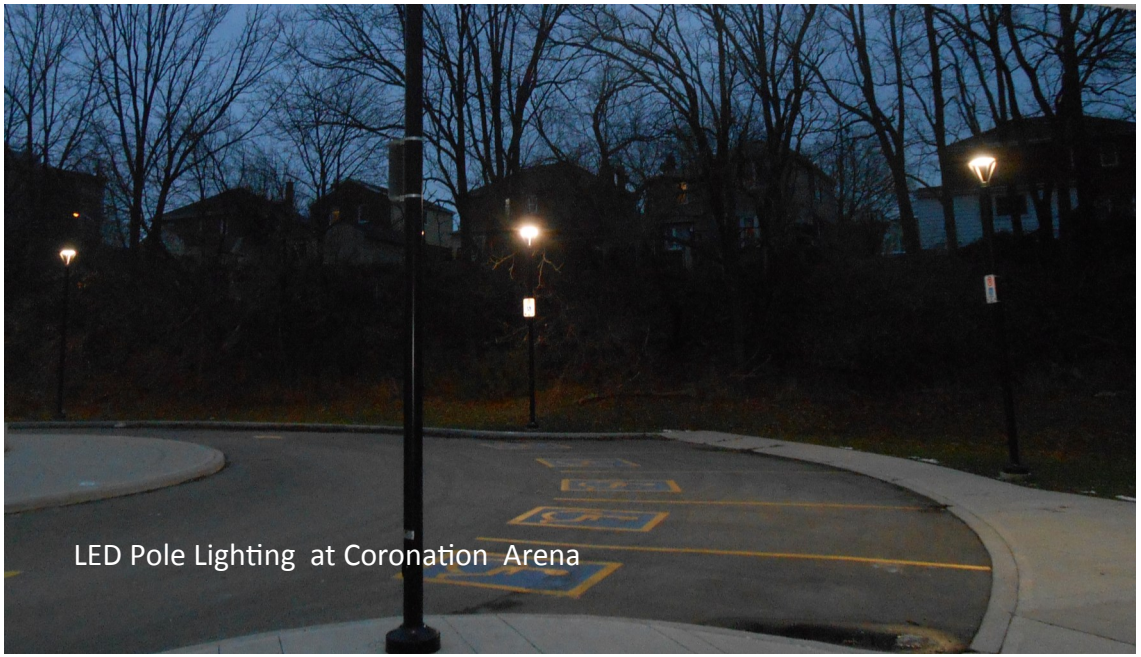
City of Hamilton's Cumulative Energy Savings & Avoided Costs (2006 - 2013)



Energy Targets

Energy intensity is a measure of the amount of total energy a facility uses per square foot of useable space. The buildings used in this measurement are selected from the City's portfolio of corporate buildings and includes buildings with functions such as City and Town Halls, Community Centers, Corporate Facilities and Recreation Centers.

Starting in 2005 with a few measures to reduce energy, City owned and operated facilities now operate at an energy intensity level that is 20% lower. Reaching this goal of a 20% reduction in energy intensity for Corporate facilities has been achieved through a combination of implementing energy efficient capital works projects, optimizing energy use and monitoring energy consumption to mitigate energy waste.



LED Pole Lighting at Coronation Arena

With the targets set out in the 2007 Corporate Energy Policy now realized, new targets , goals and objectives for the City of Hamilton's energy management program will be proposed for the years ahead. As in previous years, targets will be set for energy reduction in Corporate facilities and in addition targets will be established for Fleet and Transportation activities and Hamilton Water operations.

Energy Intensity	2013
Target	9%
Actual	20%

Some of the measures that were implemented in 2013 to reduce City energy use include

- Energy efficient LED lighting for Fire Halls exterior lighting
- Variable Speed Drives for Hamilton Place and Hamilton Convention Center Air handling systems
- Thermal energy transfer system for Copps Coliseum


LED Exterior Lighting at Fire Station No.1

Financially, the cumulative savings from all energy management activities that includes efficiency projects, cost controls, monitoring and optimizing now exceeds $32 million from 2006 to the end of 2013. Breaking down the dollars into three key areas success was achieved through $13.2 million in reduced energy by installing more efficient systems and received incentives, $16.3 million through management of utility rates and cost avoidance and $3.4 million in recovered energy expenditures.

The Office of Energy Initiatives (OEI) continues to work with all City departments to advance and promote the activities that have lead to these results and the cumulative staffing cost of the OEI since it's inception in 2006 through to 2013 is $4.1 million.

These figures are based on the revised building classification square footages as per the Green Energy Act and are not weather corrected.

Energy Consumption

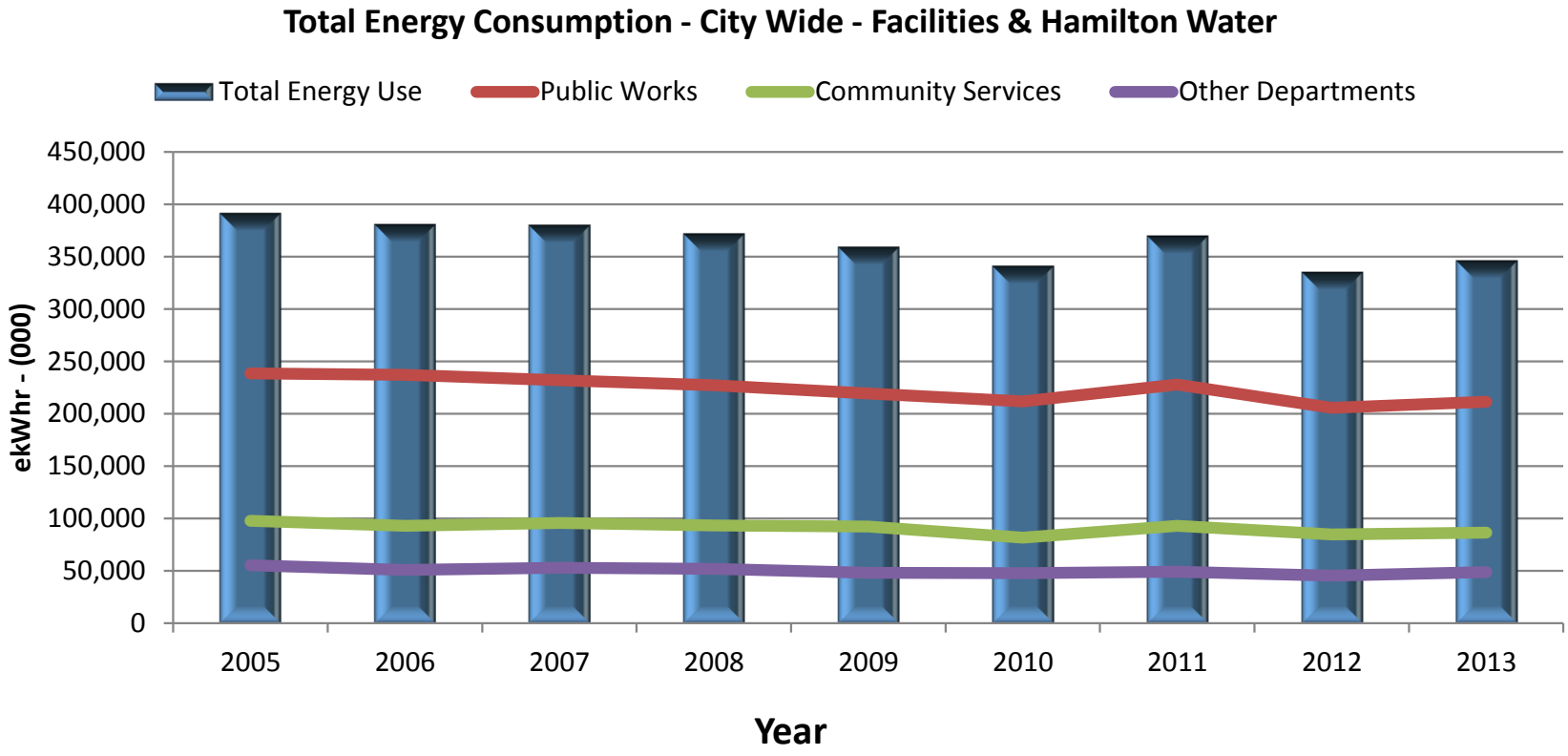
Tracking of the City's corporate energy use and cost centres include Public Works, Community Services and other city departments such as Fire, Emergency Services, Police and Libraries. The table below shows the total consumption numbers for the electricity and natural gas for the 2013 year compared to the base year (2005). The total numbers report on consumption of process oriented energy use such as water and wastewater operations. As with previous reports, the areas excluded are housing, traffic and street lighting.

	2005	2013	% Change
Electricity (kWh)	239,308,000	221,162,000	-7.6%
Natural Gas (m3)	14,279,000	11,983,000	-16.1%
Total Energy (ekWh *)	391,664,000	346,626,000	-11.5%

* kWh = kilowatt - hours
* m3 = cubic meters
* ekWh = equivalent kilowatt hours

Corporate Energy Use and Costs

Total Annual Energy Consumption



Energy Costs

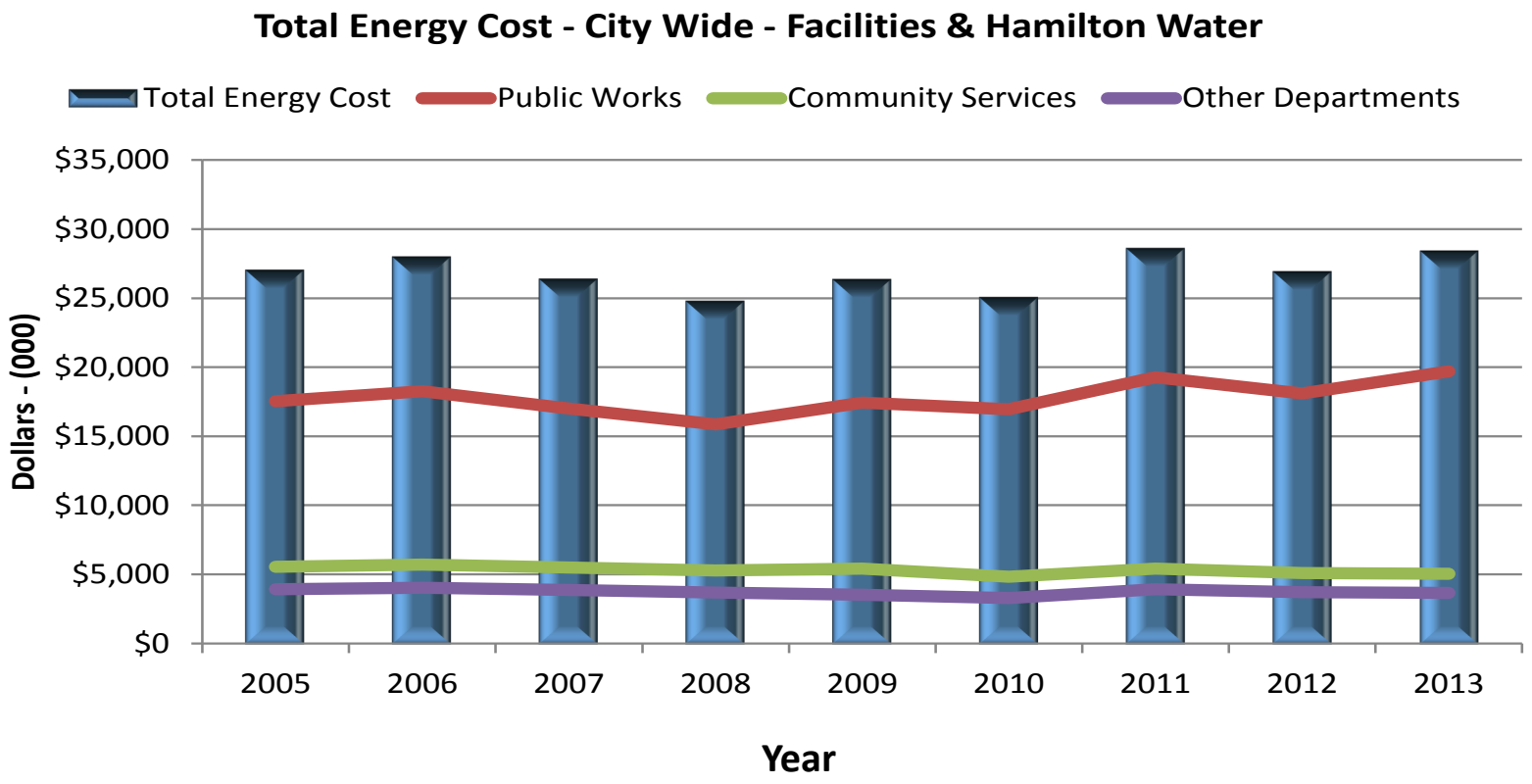
As conditions and drivers change in Ontario's energy markets, so too does the City's cost factors. In 2013, the expenditure for electricity is 19.4% higher than the 2005 baseline year while consumption was down by 7.6%. If electricity consumption levels had remained the same, the spend for electricity in 2013 would have been almost $2 million more. In contrast, the cost for natural gas decreased by 44.1% relative to 2005 and the consumption levels were also down by 16.1%. If natural gas consumption levels had remained at 2005 levels, costs for natural gas would have been higher by roughly $550,000.

The combined costs for both energy streams yields a net increase of 5.1% relative to 2005 energy costs.

	2005	2013	% Change
Electricity Cost	$20,941,000	$25,006,000	19.4%
Natural Gas Cost	$6,088,000	$3,403,000	-44.1%
Total Energy Cost	$27,029,000	$28,409,000	5.1.%

Corporate Energy Use and Costs

Total Annual Energy Cost



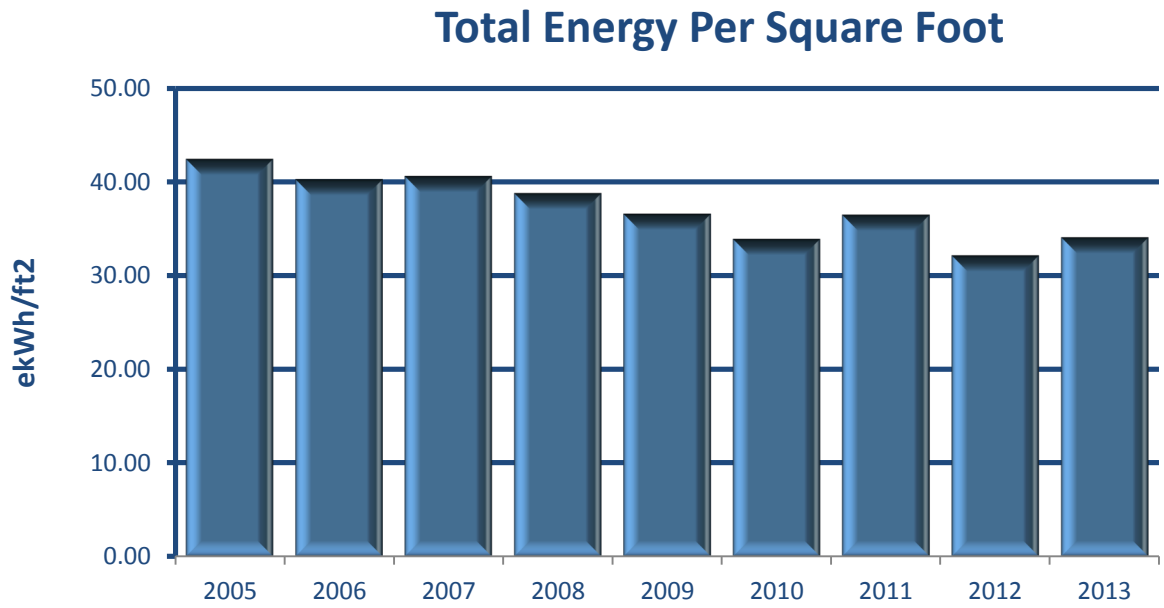
Key Performance Indicators

Total Energy per Square Foot (ekWh/ft^2)

Measurement of the overall energy intensity per square foot of a building is calculated every year relative to the 2005 base year and is reported against the target set out tin the Corporate Energy Policy. These KPI's is net of energy use from Hamilton Water, Operations and Maintenance, street lighting and traffic operations.

Comparing this years energy intensity figures to the 2005 base year intensity levels:

- Electricity consumed per square foot was lower by 12.9%
- Natural Gas consumed per square foot was lower by 22.7%
- Combined energy intensity per square foot was lower by 20.0%

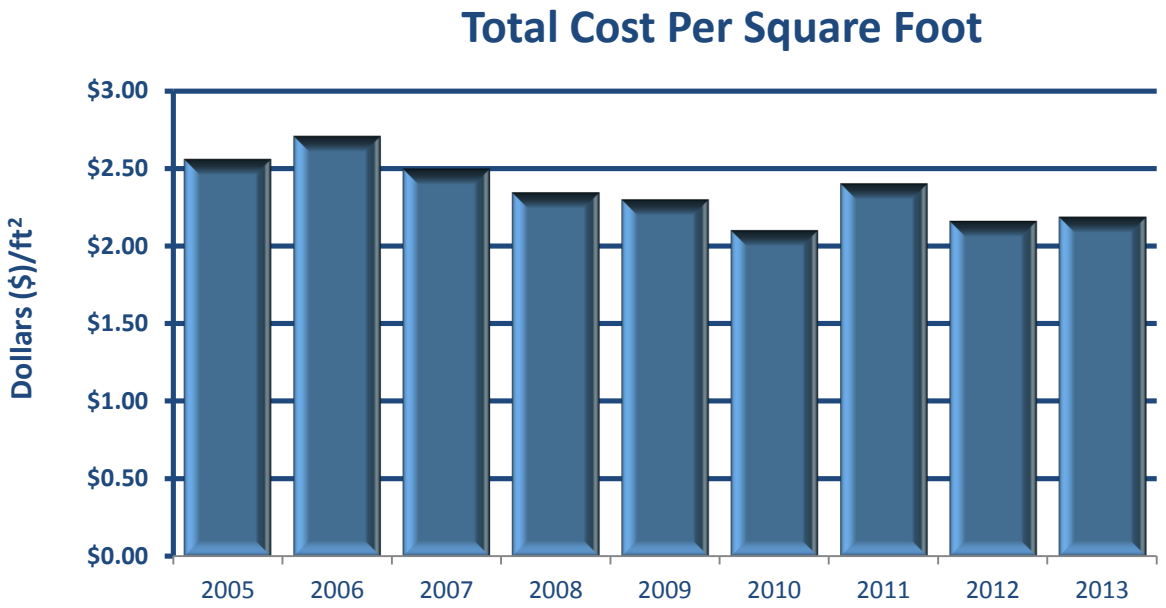


Total Cost per Square Foot ($/ft^2)

Measurement of the overall energy cost per square foot of a building is calculated every year relative to the 2005 base year. This metric takes into account changes due to energy intensity as well as changes in commodity prices.

Comparing this years energy intensity figures to the 2005 base year intensity levels:

- Electricity cost per square foot increased by 6.7%
- Natural Gas cost per square foot was lower by 46.8%
- Combined energy unit cost per square foot was lower by 14.5%



These figures are based on the revised building classification square footages as per the Green Energy Act.

Savings and Avoided Costs

In order to deliver the various services the City provides the means to recover the associated operating costs are applied through Rates and Levy charges. This year the accumulated combination of avoided costs and direct cost savings total more than $32.8 million and a year to year benefit of $5.2 million when comparing 2013 to 2012.

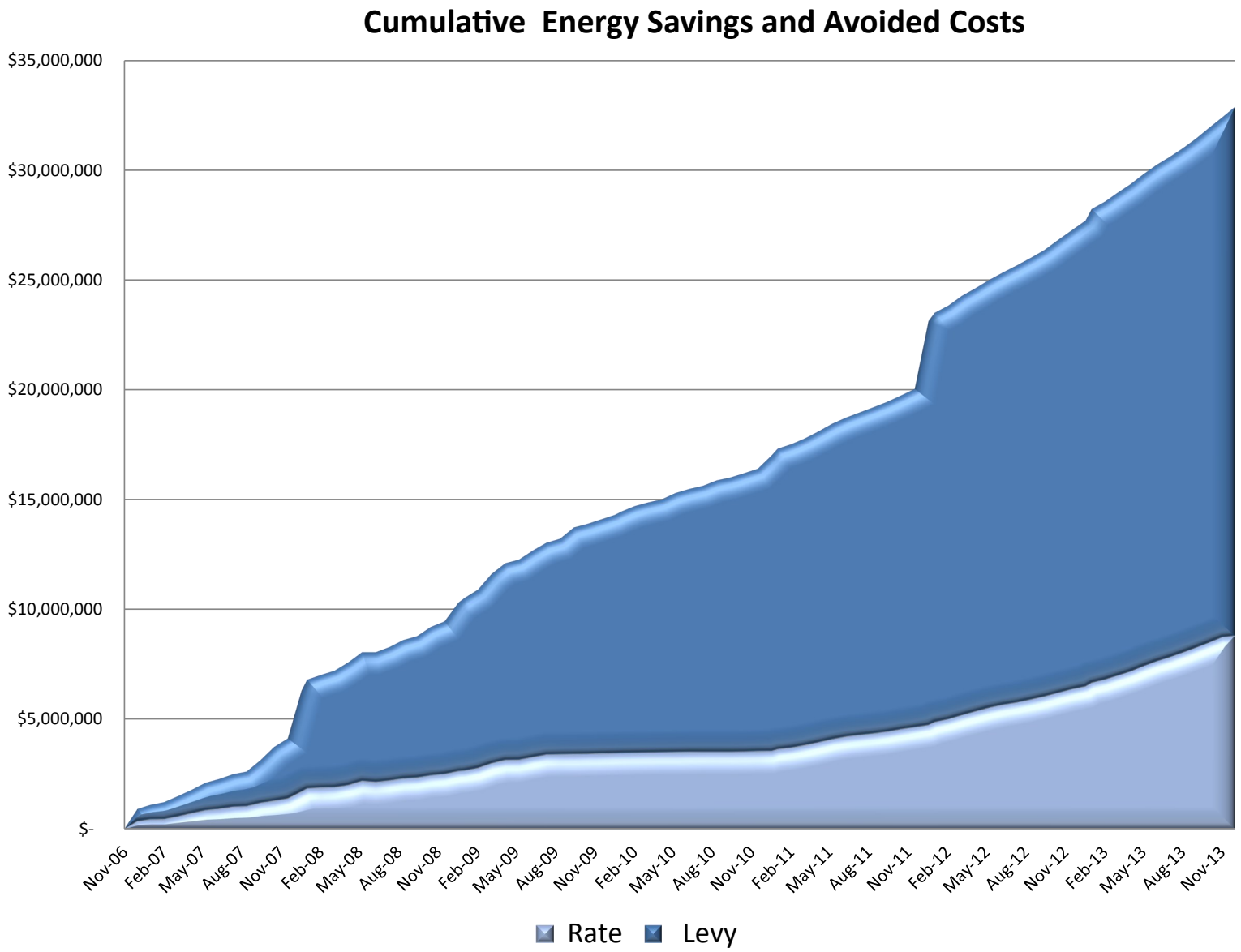
Avoided costs are calculated on the basis of what additional energy costs would have been incurred if no corrective or remedial action was taken to eliminate energy waste or to procure energy cost effectively. An example among several instances of this type of action in 2013 is the recovery of $44,000 in a Union Gas billing error that was detected through the routine vetting of the City's energy invoices.

Direct cost savings are the result of measures taken to reduce energy consumption using more efficient equipment or processes such as LED lighting or variable frequency drives on motors.

This savings below excludes the revenue generated from Hamilton Renewable Power Inc. and the sale of methane from the Hamilton Water Biogas Plant.

Savings/Avoided Costs	Levy Benefits (Tax Base)	Rate Benefits (Water Rates)	Corporate Total ($)
Avoided Costs	$16,056,000	$7,617,000	$23,673,000
Direct Savings	$8,030,000	$1,175,000	$9,205,000
Total Savings	$24,086,000	$8,792,000	$32,878,000

Savings and Avoided Costs


Cumulative Energy Savings and Avoided Costs
$35,000,000
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$-
Nov-06
Feb-07
May-07
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Rate
Levy

District Energy Heat Exchanger for Lister Building

Green Energy Act (GEA)

The GEA became legislation in 2009 as a means to promote and develop green energy industries within the province. It also provides a framework for all municipalities to adhere to for reporting energy consumption and the associated emissions as well as obligates municipalities to create and publish a plan for managing energy.

2013 was the first year reporting had to be submitted to the Ministry of Energy using their report format and protocol and the information was compiled and posted on the City of Hamilton web site as per GEA instructions. This report establishes 2011 as the base year for reporting this information whereas the City of Hamilton has been using 2005 as a base year for energy and emissions reporting.

Green Energy Act and Emissions

Green House Gas Emissions

The amount of reduced CO_2e (Carbon Dioxide equivalent) has over the years been routinely increasing as the energy program continues to be successful and while the pace at which we have reduced energy use has been consistent with other years, the associated GHG emission reductions has leveled out. This is due to the fact that the amounts of CO_2 embedded in the emission factor for electricity generated in Ontario has steadily decreased as the Ontario Government's mandate to eliminate coal fired electrical generation has progressed.

Within the City of Hamilton we have implemented technologies and systems that capture emissions that were previously released into the atmosphere from our Waste water and landfill operations and are today utilizing more energy from waste which has a direct impact on lowering our emissions.

The Biogas purification unit at the Woodward waste water treatment facility captured over 1,000 tonnes of CO_2e in 2013 and produced roughly $65,000 in revenue from the sale of natural gas produced by this system.

Greenhouse Gas Emission Reductions (Tonnes CO_2e)

2,551	6,970	12,493	18,589	24,685	27,220	30,000
2007	2008	2009	2010	2011	2012	2013

Energy Procurement

The City of Hamilton consumed over $45 million of energy in 2013. Electricity, Fuel and Natural gas are the predominate forms of energy used by City facilities, operations and services and are energy commodities that are managed and secured through a strategic procurement plan.

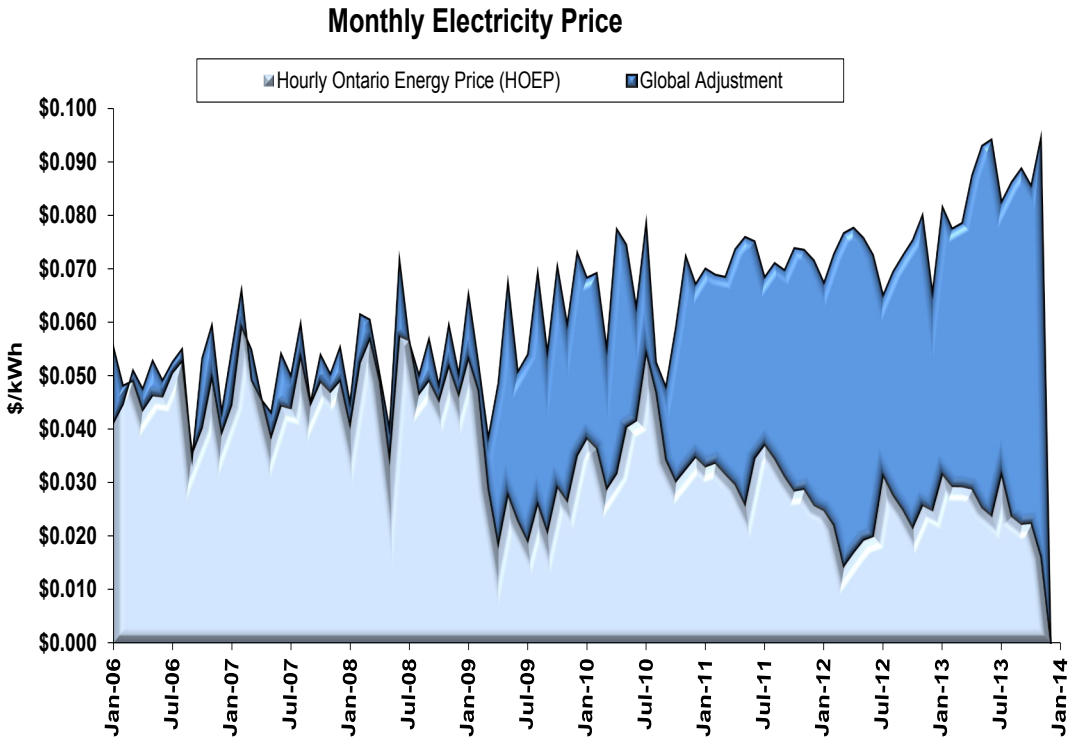
The City's electrical needs are supplied by Horizon Utilities and Hydro One on a floating price basis. Ontario's electricity system is largely represented by Ontario Power Generation for generation, Hydro One for transmission and the IESO for market administration and price setting. These services are monitored and overseen by the Ontario Energy Board and the Ministry of Energy.

Electricity

The cost of electricity is made up of the energy charges which is partially deregulated and the transmission and delivery charges which are regulated by the government through the Ontario Energy Board (OEB).

The regulated charges for all City of Hamilton electricity accounts represent the operating costs incurred by Horizon Utilities and Hydro One to provide the City electricity. These rates undergo scrutiny and review by the OEB which affords consumers the benefit of knowing what utility companies are expecting in future revenues for upcoming years. In the case of Horizon Utilities, the rates for 2013 were roughly 6% higher than the year previous.

The price for electrical energy is a combination of the Hourly Ontario Energy Price (HOEP) and the Global Adjustment (GA). For 2013, the HOEP annual average price was higher by 7.2% and the GA annual average was 21.6% higher resulting in a 19% overall increase in the unit cost per kilowatt-hour of electricity.



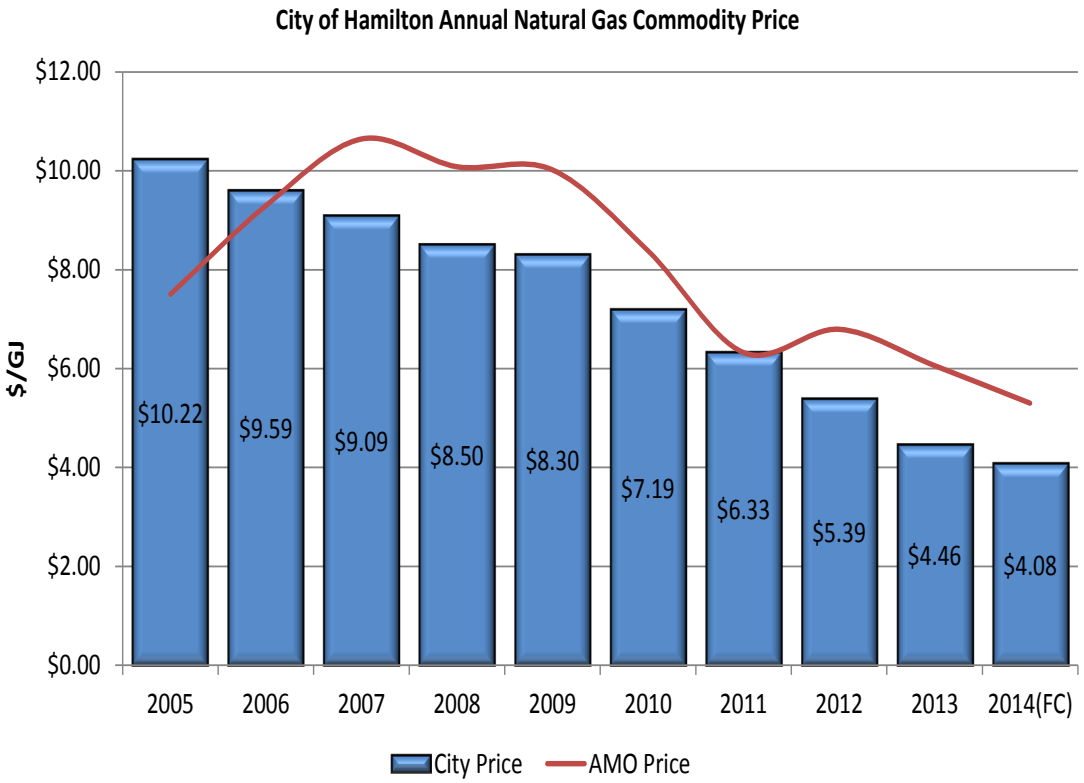
Energy Procurement

Natural Gas

Energy procurement strategies continue to be an effective way for the City of Hamilton to manage and control natural gas costs. By way of direct purchase agreements with Union Gas and supply agreements with large wholesale suppliers, the City has been able to consistently secure forward pricing which contributes to a degree of budget reliability. The pricing secured for 2013 was reflected as a reduction of 10% in the gas commodity price over that in 2012. Going forward into 2014 expectations are for an additional 10% reduction attributed to favorable forward purchases . In addition to commodity cost, regulated costs, such as delivery and storage also appear on Union Gas bills. Those are approved by the Ontario Energy Board (OEB) on a quarterly basis.

Purchasing strategies help to mitigate price fluctuations that can occur in the market place. Current market conditions for natural gas have shown a lot of volatility in the last part of 2013 and the early part of 2014, due mainly to extreme cold weather conditions in much of the high-demand areas in North America. Weather is the largest driver for the natural gas usage of facilities within the City. While the market is expected to correct itself as the weather warms, there is always a risk of upward pressure on prices due to reduced storage levels, drawn out during the winter and an imbalance of supply and demand.

Historically, The City of Hamilton has benchmarked its Natural Gas procurement program against that of the Association of Municipalities - Local Authority Services program. For 2013 the unit cost for natural gas for the City is again in a favorable position relative to that of the AMO Price.



Fuel

The City of Hamilton purchases fuel for its fleet of vehicles for all users including Fleet, Transit, Police, Fire and EMS. The majority of the expenditure is for traditional petroleum based fuel products (diesel and unleaded gasoline).

In an effort to control costs, the City purchases its fuel directly from large suppliers, and secures discounts through those wholesale contracts. In 2013, the City purchased just over 17 million litres of petroleum fuels. That was a 6% increase in consumption over 2012, due mainly to usage in the colder winter. The unit costs of fuel showed a modest increase of 2% in 2013, $1.02 from $1.00 in 2012.

The City has received a fuel tax rebate of $20,200 for 2013.

There is currently a small portion of the Transit fleet that are compressed natural gas vehicles (CNG). Recognizing that the North American natural gas markets have changed significantly with the advancement of shale gas recovery, the City has initiated an evaluation of the conversion of more transit vehicles from diesel fuels to CNG fuels. Implementing such a program will have a significant impact on reducing operating costs and have a favorable impact on GHG emissions as well.

Energy Procurement

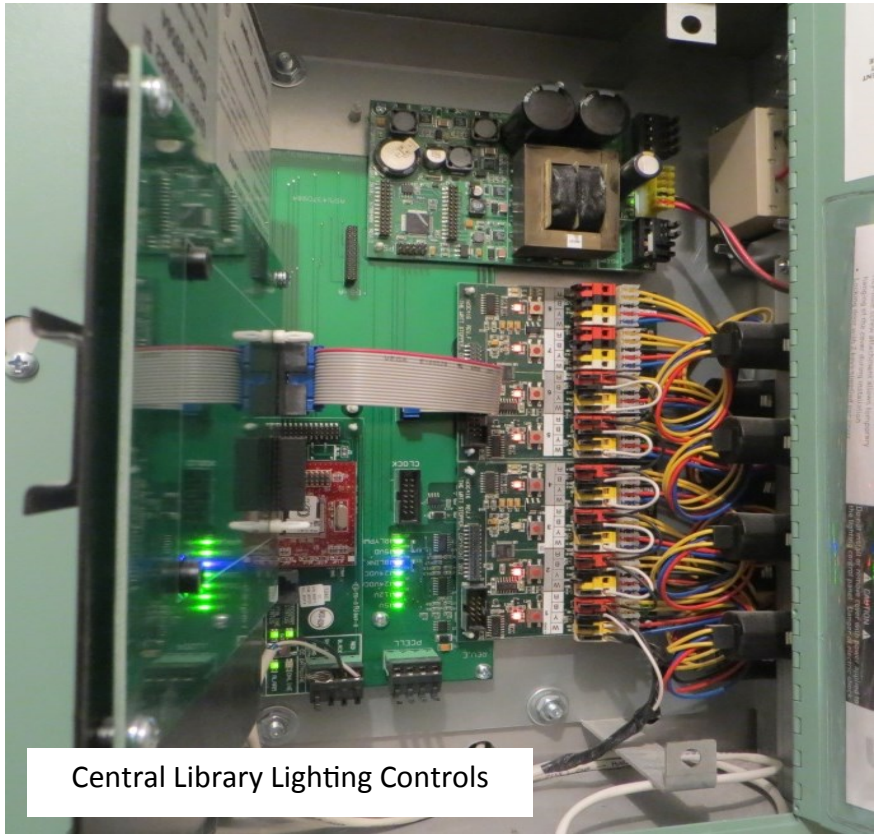
2013 Project Highlights

Fire Stations Exterior LED Lighting

Lighting within City Fire Stations was retrofitted in 2011. At that time, the exterior lighting was not included as it was not economically feasible. Since then however, with advances in LED lighting technology and lower costs, the initiative was revisited and found to be feasible. Exterior Lighting at 25 Fire Stations was converted to LED providing a much better, whiter light, which is very energy efficient and lasts a very long time compared to other light sources previously being used.

Central Library Lighting Controls

When the Central Library lighting was retrofitted in 2011, it was discovered that better lighting zone control could provide for even more energy savings. When the Central Library was built in 1980, zone switches had been installed in a central area on each floor and were controlled manually since that time. Manually switched lighting was typically turned on earlier and left on longer than required. In 2013 a computerized lighting control system was installed to turn on and off zone lighting more effectively reducing energy consumption. Daylight harvesting was also implemented to turn off the lighting in certain areas when natural lighting from outside is sufficient.



Central Library Lighting Controls

2013 Project Highlights

Central Composting Facility Lighting and Controls

In early 2013 the City's Central Composting Facility (CCF), which receives and processes green bin material, contacted the Office of Energy Initiatives looking for ways to improve light levels for better safety within the facility. Green bin compost is delivered to the CCF daily by truck, and is moved around the plant with large front end loaders. Good light levels are necessary to ensure a safe and hazard free environment throughout the plant. The old high intensity discharge (HID) lighting, which operated 24/7, was replaced with new energy efficient T5 fluorescent fixtures and occupancy controls. The new lighting brought light levels way up to ensure safety within the plant and the occupancy controls turned off the lighting when not required. Not only were light levels much improved, occupancy controls provided for energy savings as well.

Central Composting Facility Lighting

Solar PV Project

As a part of the City's commitment to renewable energy, our first Solar PV System was commissioned in the fall of 2013. In partnership with Horizon Energy Solutions, a 250 kW Solar Photo Voltaic System was installed on the roof of the City's Operations Centre at 330 Wentworth Street North. Capturing the sun's rays, over 1200 solar panels send renewable, clean, green energy back to the electrical grid. This system generates enough electricity to power approximately 34 homes.

2013 Project Highlights

Street Lighting

The ten most deficiently lit roadways in the Downtown of Hamilton were upgraded through street lighting retrofits in 2013. The upgrades consisted of the replacement of nearly 300 existing high pressure sodium street lights with LED street lights. Emphasis was placed on the lighting of sidewalks to coordinate with the objectives of the recently approved Pedestrian Mobility Plan. Due to the efficiency and long life of LED street lighting, energy consumption has been reduced by 57% and overall annual operating costs are expected to be reduced by $26,000.

Downtown Hamilton Street Lighting Upgrades

Chiller Optimization Pilot

To reduce power consumption, a clear picture of how a system is working is required. Good analytical tools and methods are the basis for optimising the operation and minimising the downtown of equipment. In an effort to achieve this on chiller systems owned and operated by the City, the City is trialling the installation of chiller performance analyser.

The system monitors real-time performance of a refrigeration system and its components allowing wear and pending failure to be detected in advance for pre-emptive action to be taken. This allows for repairs to be conducted in a planned and cost effective manner thus reducing the risk of downtime and loss of functionality associated with an unexpected failure of the refrigeration system. The system is a real time monitoring system for the evaluation, re-commissioning and maximization of energy efficiency essentially functioning as a 'continuous commissioning' tool with the capability to alert and alarm when conditions vary from optimum set points ensuring maximum energy efficiency is maintained.

The system has been installed at two City Ice Rinks – Mountain Arena and Valley Park Arena, and at Macassa Lodge, a long-term care non-profit organization owned and operated by the City of Hamilton. The systems have been operating successfully and data has been collected and analysed providing major findings and recommended efficiency measures to optimise the systems. These recommendations and measures will be implemented and energy savings will be quantified. The system will be rolled out to other locations in the City to provide further energy reductions and ongoing savings where warranted.

Future Initiatives

Stoney Creek City Hall Building Automation

When Stoney Creek became a part of Hamilton, the new multi-million dollar Stoney Creek City Hall, now referred to as the Stoney Creek City Centre, became a Hamilton Public Library and a Stoney Creek Municipal Service Centre.

In order to optimize the energy performance of the building, the City has invested in a design upgrade of the BAS (Building Automation System) which will simultaneously identify and define savings attached to the optimized control strategy. Systems that are typically controlled by a BAS are HVAC, lighting, air ventilation, heating and cooling systems. A system provides benefits through smarter scheduling, equipment sequencing and coordination and alarming to maintain operation at optimized set points.

There are many immediate benefits of an optimized BAS. The BAS system allows you to manage the real costs of building operation which include both direct and hidden costs. The primary benefit is lowered utility costs which results in an increased net operating income enhancing property value.

Stoney Creek Town Hall Lobby

Hamilton Renewable Power Inc.

The City is the sole shareholder of the private company called Hamilton Renewable Power Inc. (HRPI). This firm owns and operates three 1.6MW Cogen units – two are located at the Glanbrook landfill site and one is located at the Woodward site. These Cogen units all use the available methane as a fuel source to produce electricity under long term contracts with the province. The landfill uses vertical and horizontal wells to extract the methane.

The wastewater plant at Woodward produces methane through the digestion process. Methane captured from the digesters is then compressed and stored in the sphere at the Woodward site. The HRPI operation at Woodward also recovers the heat from the Cogen which is then delivered back to the digestion process to offset natural gas usage. This additional benefit makes the entire process more efficient and sustainable.

The 2013 revenue from all HRPI operations generated annual revenue of $1.7M. Annual emission reduction of over 100,000 tonnes CO2 comes from these Cogen units producing electricity that would otherwise be provided from the grid. Since it began operation in 2006 Hamilton Renewable Power has generated $10 million in incremental net benefit to the City that is above and beyond the contributions made from the energy reduction and cost avoidance savings stated in this report

Hamilton Renewable Power Inc.

Biogas Purification Unit

Association of Energy Engineers (AEE)

The City of Hamilton received an award from the Association of Energy Engineers (AEE) for the operation of the City's Biogas Purification unit. The unit purifies raw biogas and injects the final product (bio-methane) into the local utility's natural gas distribution network. The AEE has a membership base of over 16,000 professionals in 89 countries and is widely recognized for its energy certification programs. Awards were presented for several different categories from regions all over the world. The City of Hamilton was selected as the recipient of the Renewable Energy Project of the Year