

CITY OF VAUGHAN

EXTRACT FROM COUNCIL MEETING MINUTES OF JUNE 24, 2014

Item 41, Report No. 30, of the Committee of the Whole, which was adopted without amendment by the Council of the City of Vaughan on June 24, 2014.

41

ENERGY CONSERVATION DEMAND MANAGEMENT PLAN

The Committee of the Whole recommends approval of the recommendation contained in the following report of the Commissioner of Strategic and Corporate Services and Manager of Environmental Sustainability, dated June 17, 2014:

Recommendation

The Commissioner of Strategic and Corporate Services and Manager of Environmental Sustainability, in consultation with the Director of Building and Facilities recommends:

1. That the City of Vaughan approve the Energy Conservation Demand Plan as per the requirement of Ontario Regulation 397/11- Energy Conservation and Management Plans; and
2. That the Environmental Sustainability Office, in partnership with the Building and Facilities Department and Purchasing Services Department, undertake a pre-qualification process for energy performance contract service providers.

Contribution to Sustainability

This report is consistent with the priorities previously set by Council in *Green Directions Vaughan*, the Community Sustainability and Environmental Master Plan:

- Objective 1.1 to reduce greenhouse gas emissions and move towards carbon neutrality for the City of Vaughan's facilities and infrastructure
- Objective 5.1 to share sustainable best practices and ideas between and among municipal staff and the community

Economic Impact

To be successful, the Energy Conservation and Demand Management Planning process must take into account the City of Vaughan's financial constraints and operational need to continue delivering services. As a result, the initial economic impact of implementing the Energy Conservation and Demand Management Plan will be absorbed in existing budgets where possible. A budget of \$600,000 was established and approved by Council in April 2009 for high priority actions resulting from the energy audit when approval was provided to undertake these audits at major facilities managed by the Building and Facilities department. Should components of the Plan require funding above and beyond existing operational and capital budgets, these components will proceed only when additional external funding resources have been secured. Any proposed capital improvements will be vetted through the regular business planning process.

Communications Plan

As per Ontario Regulation 397/11, the Energy Conservation and Demand Management Plan will be posted on the City's website by the Environmental Sustainability Office. As implementation of the Energy Conservation and Demand Management Plan continues it would be advantageous to provide progress updates via a News Release and/or other means of communication. The Environmental Sustainability Office would work directly with Corporate Communications staff to determine how best to highlight the implementation progress and achievements. This is consistent with Goal 5 of Green Directions Vaughan "To be leaders in advocacy and education on sustainability issues" where "Vaughan is committed to sharing its successes with the community".

CITY OF VAUGHAN

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Purpose

The purpose of this report is to seek Committee approval of the Energy Conservation Demand Management Plan as required under Ontario Regulation 397/11 and outline an approach to explore energy performance contracts.

Background - Analysis and Options

The City of Vaughan is committed to reducing greenhouse gas (GHG) emissions that contribute to climate change and which adversely affect local air quality. To this end, the City of Vaughan joined the Partners for Climate Protection (PCP) program - a voluntary five-milestone framework used to guide municipalities to reduce greenhouse gas emissions. Demonstrating leadership in climate change mitigation at the municipal level is vital as it raises the importance of this global environmental issue within the community and works to encourage local climate action. The Energy Conservation Demand Management Plan focuses on energy use within our community facilities and buildings and complements the Greenhouse Gas Emission Community Action Plan (CAP) approved by Council in April 2014. Completion of the Energy Conservation Demand Management Plan would fulfill the third milestone of the PCP program.

Under the *Ontario Energy Conservation Leadership Act*, municipalities and other public institutions are required to prepare and submit a five year energy management plan to the Ontario Ministry of Energy on July 1, 2104. Energy management plans must include an overview of energy consumption and greenhouse gas emissions for all corporate facilities as well as a description of previous, current and proposed energy conservation projects. Forecasted energy consumption and estimated energy savings must also be reported on an annual basis.

Energy Conservation Demand Management Plan

For the City of Vaughan to efficiently meet the legislated requirements of the *Ontario Energy Conservation Leadership Act*, the Environmental Sustainability Office, in coordination with Building and Facilities Department, will develop the initial Plan and prepare an annual report on the City's energy consumption and progress towards energy conservation targets. It will provide a site-by-site breakdown of the energy consumption of every City of Vaughan owned facilities.

One of the cornerstones of the Energy Conservation Demand Management Plan was the energy audit that was completed in Q4, 2013. An external auditor compiled a detailed inventory of possible energy efficiency upgrades, including payback scenarios, timelines and associated costs versus savings estimates. The audit documented approximately \$4,000,000 of capital projects resulting in a payback of 6.3 years and an estimated annual savings of 3,798,050 kWh of electricity and 328,410 m³ of natural gas.

The Energy Conservation Demand Management Plan was developed over a six month period by an internal team of Building & Facilities Department staff and the Environmental Sustainability Office supported by PowerStream's Roving Energy Manager. Highlights of the Plan include developing a reduction objective/target and an outline of 11 actions.

The emissions reduction target is expressed as a percentage reduction below the quantity of emissions released in the baseline year. The City of Vaughan established a corporate greenhouse gas inventory baseline in 2008 and updated it again in 2011. **The internal team has proposed a 10% overall reduction of energy consumption for facilities on per person served basis below the 2011 baseline year by 2020.**

The 11 actions within the Energy Conservation Demand Management Plan (Attachment 1) cover areas such as information systems, energy communications, facility operations, corporate energy conservation culture, demand response and new construction

CITY OF VAUGHAN

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Energy Performance Contract

Energy performance contracting is a mechanism to implement resource efficiency improvements, upgrade facilities and utility infrastructure and reduce operating costs. It uses guaranteed energy and operational savings resulting from the efficiency project to pay for the improvements over time. An energy performance contract is a contract between the energy user and the energy services company for evaluation, recommendation, implementation and measurement/verification of energy efficiency measures.

The Energy Services Association of Canada consists of eight independent energy service companies. These companies represent over 90% of \$450 million per year market for guaranteed energy performance contracts in Canada. Energy performance contracts were a product of the 1980's and were prevalent in federal government, institutional, and health care sectors.

Many municipalities including Newmarket, London, Orangeville, Timmins, Toronto and Windsor have completed energy performance contracts ranging from \$1.2m to \$3.7m predominantly for facility upgrades.

Relationship to Vaughan Vision 2020/Strategic Plan

This report is consistent with the Vaughan Vision 20/20 strategic goal of providing service excellence to citizens and the strategic objective to lead and promote environmental sustainability. This report is consistent with the priorities previously set by Council and the necessary resources have been allocated and approved. The Energy Conservation Demand Management Plan demonstrates leadership on energy efficiency and climate change while striving to reduce facility operating costs maintain high standards of service delivery.

Regional Implications

There are no Regional implications resulting from the adoption of this report.

Conclusion

Energy conservation is increasing in importance with new Provincial regulatory requirements for energy conservation planning and reporting. Energy conservation planning and reporting dovetails well with the actions identified under *Green Directions Vaughan*, the Community Sustainability and Environmental Master Plan, that commit to reducing greenhouse gas emissions from City owned facilities as well as the early efforts on implementing corporate wide energy efficiency initiatives. The Energy Conservation Demand Management Plan, developed by an internal team, targets a 10% overall reduction of energy consumption for facilities on per person served basis below the 2011 baseline year by 2020. The Plan includes eleven core actions in a variety of areas that will be closely monitored through four performance indicators. Energy performance contracting will be further evaluated to determine if the \$4 million of capital improvements, identified in the energy audit could be pursued through this mechanism.

Attachment

1. Energy Conservation Demand Management Plan

Report prepared by

Chris Wolnik, Manager, Environmental Sustainability

(A copy of the attachments referred to in the foregoing have been forwarded to each Member of Council and a copy thereof is also on file in the office of the City Clerk.)

COMMITTEE OF THE WHOLE – JUNE 17, 2014

ENERGY CONSERVATION DEMAND MANAGEMENT PLAN

Recommendation

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Report prepared by

Chris Wolnik, Manager, Environmental Sustainability

Respectfully submitted,

Joseph Pittari, MSc
Commissioner, Strategic and Corporate Services

Chris Wolnik, MA
Manager, Environmental Sustainability

ENERGY CONSERVATION AND DEMAND MANAGEMENT PLAN

1. INTRODUCTION

Energy costs related to the operation of our facilities and infrastructure continue to be a significant component of our overall operating costs. Energy management is necessary to mitigate the impact these costs potentially could have on the delivery of programs and services.

In April 2009, Council approved *Green Directions Vaughan* (GDV), our Community Sustainability and Environmental Master Plan, which contained a framework of initiatives to improve the City's operational and regulatory functions. Within the Plan was a commitment to reduce use of natural resources, develop a corporate as well as community action plan to reduce greenhouse gases as well as demonstrate leadership on sustainability issues.

In 2009, Ontario Regulation 397/11 directed all public agencies in Ontario to prepare, publicly report, and implement energy conservation and demand management plans. It also mandates annual reporting of energy consumption and greenhouse gas emissions starting on July 1, 2013. Energy conservation and demand management reports are required by July 1, 2014 and every fifth anniversary thereafter.

1.1 Purpose of the Energy Management Plan

The Energy Conservation and Demand Management Plan (CDM) is a document that structures resources and methodologies utilized in improving energy efficiency and energy management effectiveness. It is intended to be a road map for best practice energy management to deliver energy savings in an effective and flexible manner.

Energy management includes electricity, natural gas and corporate fuel consumption, as well as water commodity management. The CDM Plan defines actions in the following key areas:

- Energy management information system
- Energy training and awareness
- Facility operations
- Energy conservation in existing facilities
- New construction
- Renewable energy
- On-site generation and demand response
- Street and traffic lighting
- Development of culture of energy conservation
- Financial considerations

2. OUR ORGANIZATION

This section provides additional context relating to energy management pertinent to the organization as a whole.

2.1 City of Vaughan Profile

This section provides an overview of size and type of buildings operated by the City as well as an overview of streetlights.

2.1.1 Facilities Summary

Table 2.1 presents a summary of all City of Vaughan corporate facilities per category highlighting the significant gross floor area and unique types of facilities being operated.

Table 2.1 Overview of corporate facilities

Building Category	Total Gross Floor Area (ft ²)	Number of Facilities
Administrative	601,414	18
Community Centres	761,128	11
Cultural Facilities	30,327	15
Indoor Recreational Facilities	10,013	3
Public Libraries	270,313	8
Totals	1,673,195	55

2.1.2 Street Light Summary

Street lighting fixtures in the City of Vaughan currently utilize a mix of high pressure sodium and Light emitting Diode (LED) bulbs. In 2010, the City implemented a pilot project installing 1,800 LED streetlights in industrial areas. There are approximately 33,000 street lighting assets.

Public Works and Engineering staff will be compiling a detailed inventory of our streetlights as part of the retrofit project.

Table 2.3 below depicts total street light and traffic light energy consumption in kWh and the associated energy costs. It illustrates the significant energy consumption of streetlights within the City of Vaughan.

Table 2.3 Street light energy consumption and costs

Lighting Category	2008 Energy Consumption (kWh)	2008 Cost
Street light	12,962,214	\$1,327,383.60
Traffic light	718,491	\$77,933.85
Totals	13,680,705	\$1,405,317.45

2.2 Current Energy Consumption

The regular collection and analysis of energy use information establishes the basis for energy management, and energy use and cost control. Quantifying the City's corporate energy consumption and costs allow staff to identify where energy consumption deviates from established patterns and targets and where corrective action is required.

In 2013, the City of Vaughan, working with Finn Projects, conducted ASHRAE Level II energy audits on 15 City of Vaughan facilities. Information garnered from this energy audit is already being used to help identify and develop measures that can reduce energy consumption and related greenhouse gas (GHG) emissions, as well as reduce energy and operating costs. Additionally, as part of the City's reporting requirements to meet Energy Conservation and Demand Management Plans Regulation (O.Reg. 397/11), the City of Vaughan also compiled energy consumption data and costs for all 55 City facilities. Table 3 highlights energy costs from various areas of operation.

Table 3 Corporate energy consumption and costs

Commodity	Quantity		Cost	Rate per Unit	
Electricity (kWh)					
Street Lights*	12,962,214	kWh	\$1,327,383	0.10	\$/kWh
Traffic Lights*	718,491	kWh	\$77,934	0.11	\$/kWh
Facilities*	33,352,607	kWh	\$ 3,335,260	0.10	\$/kWh
Natural Gas (m³)					
Facilities	5,139,397	m³	\$ 1,541,819	0.30	\$/m³
Total Cost			\$ 6,282,396		

***Note: Street Light and Traffic Light data from 2008. Facilities and Natural Gas data from 2011 including estimated cost**

2.3 Greenhouse Gas (GHG) Emissions

Under *Green Directions Vaughan*, the City of Vaughan is committed to reducing greenhouse gas (GHG) emissions that contribute to climate change and which adversely affect local air quality. To this end, the City of Vaughan has joined the Partners for Climate Protection (PCP) program - a voluntary five-milestone framework used to guide municipalities to reduce greenhouse gas emissions. The PCP framework is widely used throughout Canada to audit GHG emissions, identify how GHG emissions can be reduced and demonstrate measurable results for GHG emission reductions.

Under the City's commitments to the PCP program and in compliance with the Energy Conservation and Demand Management Plans Regulation (O.Reg. 397/11), the City of Vaughan reports on its annual energy use and greenhouse gas (GHG) emissions. Table 4 highlights equivalent carbon dioxide emissions, a measure of greenhouse gas warming potential, for our largest operational sources.

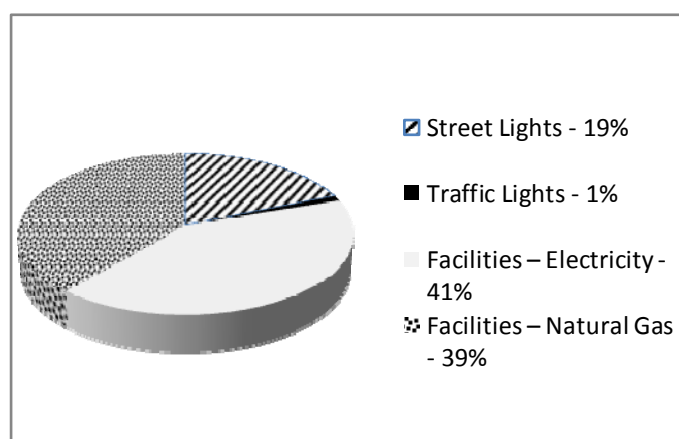
Table 4 - Corporate eCO₂ emissions by source

Source Category	Total eCO ₂ (t) ¹ 2008	Total eCO ₂ (t) ² 2011
Street Lights*	2,204	2,204
Traffic Lights*	122	122
Facilities – Electricity	4,810	4,336
Facilities – Natural Gas	4,501	9,719
Totals	11,637	16,381

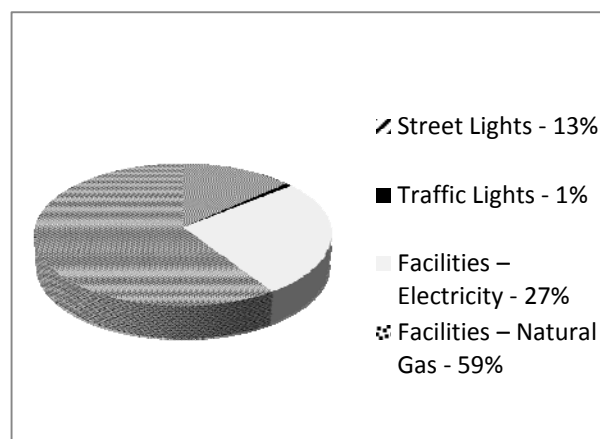
***Note: Street Light and Traffic Light data is only available for 2008. While Facilities and Natural Gas data is available for both 2008 and 2011.**

Figure 1 Corporate GHG emissions by source for 2008 and 2011

2008



2011



All GHG values are CO₂e values in metric tonnes and are estimated based on best practices. . *

Note: Street Light and Traffic Light data is only available for 2008. While Facilities and Natural Gas data is available for both 2008 and 2011

¹ e CO₂ emissions for 2008 were calculated using the emission coefficient rates (0.000170 for kWh/electricity and 0.001891 for m³/natural gas) for Ontario for 2008 as reported by ICLEI as part of the Partners for Climate Protection Milestone program.

² e CO₂ emissions for 2011 were calculated using the emission coefficient rates (0.000130 for kWh/electricity and 0.001891 for m³/natural gas) for Ontario for 2011 the Partners for Climate Protection Milestone Tool developed by ICLEI Canada, <http://www.icleicanada.org/pcptool>. The decline in the emission coefficient for kWh/electricity from 2008 to 2011 is due to the gradual decommissioning of the coal-fired power plants in Ontario. This decline will also be reflected in data from 2011 to the present year.

Figure 1 illustrates that the GHG values for corporate operations have not changed over the 2008-2011 time period.

2.4 Key Stakeholders

This section notes the stakeholders who have an interest in the Energy Conservation and Demand Management Plan.

2.4.1 Vaughan City Council

City Council comprised of the Mayor and City Councillors have a crucial role to play in setting the political framework for the Conservation Demand Management plan. Demonstrating the City's commitment to environmental sustainability and sustainable development, Council approved *Green Directions Vaughan*, the City's Community Sustainability and Environmental Master Plan as presented in Section 2.2 of this plan.

2.4.2 Senior Management Team

The senior management team is responsible for creating the administrative framework and for providing leadership to City staff in the development and implementation of the energy initiatives resulting from the CDM Plan.

2.4.3 Vaughan City Staff

Many City staff and multiple City departments were involved in developing this CDM plan and will be instrumental in working to initiate and implement the associated energy management initiatives across the organization.

The internal Energy Conservation & Demand Management Team will consist of the following key team members:

Role	Department
Manager, Environmental Sustainability	Environmental Sustainability Office
Sustainability Coordinator	Environmental Sustainability Office
Electrical Supervisor	Building and Facilities
Mechanical Supervisor	Building and Facilities
Manager of Facilities	Building and Facilities
Roving Energy Manager	PowerStream

2.4.4 Ontario Ministry of Energy

In compliance with the Energy Conservation and Demand Management Plans Regulation (O.Reg. 397/11), and as part of the *Green Energy Act*, the City of Vaughan is committed to reporting on its annual energy use and greenhouse gas (GHG) emissions. Under these reporting requirements, the Ontario Ministry of Energy will be a key stakeholder in this CDM initiative.

3. GOALS AND OBJECTIVES

This section outlines the goals, objectives and targets for the Energy Conservation and Demand Management Plan.

3.1 Goals

The City of Vaughan Energy Conservation and Demand Management (CDM) Plan is guided by the same ethic established in GDV which speaks to determining the impact of decisions on the environment, weighing the social/cultural consequences and understanding financial implications.

Green Directions Vaughan actions 1.1.3 and 1.1.5, under the goal of significantly reducing use of the City's use of natural resources, make reference to the need to develop a corporate greenhouse gas emission reduction plan that move towards carbon neutrality for the City of Vaughan's facilities and infrastructure.

Commitment towards these ethics and goals will guide the City of Vaughan to comply with Ontario Regulation 397/11 under the *Green Energy Act* that requires public agencies to prepare, make available and implement energy conservation and demand management plans.

3.2 Objectives

Implementation of the Energy Conservation and Demand Management Plan will strive to achieve the following objectives aligned with the above goals and ethics.

- To continue to create a sustainability culture that embraces energy efficiency;
- To promote sustainable resource use through energy conservation, energy efficiency and support of renewable energy initiatives;
- To reduce energy operating and maintenance costs through implementation of best practices and advanced technologies; and
- To continue to enhance the comfort and safety of users of city facilities.

3.3 Targets

As the City of Vaughan continues to grow, the usage of our city facilities will continue to rise to meet the service needs of the community. As a result, we may see an absolute increase in the energy usage. Through implementation of the actions outlined in this Plan, corporate emissions are targeted to be reduced by 10% per person below the 2011 baseline year by 2020. Using 2011 as baseline, the following targets are established within this five year CDM Plan:

- 10% overall reduction of energy consumption for facilities on per person served basis (ekWh/ft²)
- 10% reduction of water consumption for facilities on per person served basis (m³/ft²)³
- 10% reduction of energy cost for facilities (adjusted for utility escalation rate) (\$/ft²)⁴
- 20% reduction of electricity consumption for street lighting (kWh)⁵

³ This water reduction target does not include water consumption for parks irrigation and road side horticulture.

⁴ The cost reduction target is greater than the above energy consumption target as a result of shifting consumption from higher cost energy (electricity) to lower cost energy (natural gas) as well as implementing demand response and load shifting from higher cost peak hours to lower cost off peak hours for electrical consumption.

4. INFORMATION SYSTEM INTEGRATION

This section highlights the role information plays in the Energy Conservation and Demand Management Plan.

4.1 Energy Metering

For a large user of energy, an important first step is to develop a thorough understanding of all energy consumption and associated costs. This can be accomplished with comprehensive metering, measurement and an Energy Management Information System (EMIS).

Real time management requires real time consumption data to be collected by the EMIS for analysis. This allows senior facility staff to react and respond to higher priced times of the day by managing energy in concert with the market. Therefore an ultimate goal would be to have meters and an EMIS that have the ability to transmit and receive real time energy data. The energy data reports and subsequent analysis and reports created by the EMIS would provide opportunities for improvement, reduce energy consumption, control energy costs, mitigate risk, and optimize conservation and demand management.

Action	Improve energy tracking through implementation of Energy Management Information System
Status	Utility Trac®, an energy tracking tool, was acquired in Q2, 2014 and is being populated with historical electricity and natural gas consumption data.
Next Steps	Develop a system to add monthly utility data to Utility trac® as well as review and analyze on a regular basis.
Timeframe	2014-15

Action	Enhance energy metering
Status	Interval meters measuring electricity use were installed at the 10 largest electric demand facilities in Q1, 2013. Staff training on meter usage occurred Q2, 2014.
Next Steps	Explore the feasibility of integrating real time meters with Utility trac system, more granular monitoring and adding natural gas meters.
Timeframe	2016-17

4.2 Smart Buildings

A smart or intelligent building integrates building systems (Heating Ventilation Air Conditioning, Lighting, Security, EMIS, etc.) in order to reduce energy consumption and environmental impact. These systems provide increased efficiency while leading to energy cost savings.

The Energy Conservation and Demand Management Plan recommends a comprehensive system integration for all new facilities and major retrofit projects. Energy related systems such as building automation systems, lighting controls, ice plant controls, pool equipment controls should be included as part of a smart building system.

Action	The City of Vaughan is continuing to implement integration of building systems. Some examples include lighting system controls for City Hall with the Building Automation System.
Status	Other opportunities will be continued to be evaluated.

⁵ Assumes a street light retrofit program is initiated in years 4/5 of the plan subject to satisfactory business case.

Next Steps	Define integration specifications for new buildings or major retrofit projects
Timeframe	Ongoing

4.3 Performance Indicators

The City of Vaughan, through the implementation of *Green Directions Vaughan*, our Community Sustainability and Environmental Master Plan, and development of departmental business plans include performance indicators. These indicators help to monitor progress in achieving various corporate and departmental goals.

The following performance indicators will be used to help monitor progress in the implementation of the Energy Conservation and Demand Management Plan.

- Corporate Greenhouse gas emissions per resident served (eCO₂-equivalent carbon dioxide/pp);
- Energy Utilisation Index (EUI) (ekWh/ft², ekW/ft²,ekWh/user/y);
- Total Energy Cost Intensity (\$/ft²/yr);and
- Employee Awareness Index (Hours of training/employee/year)

These performance indicators will be reviewed annually to evaluate their effectiveness in advancing the key objectives and modified accordingly.

5. FACILITY OPERATIONS

This section highlights the facility operation activities that have an impact on achieving energy savings.

5.1 Operations Procedures

Standard operation procedures will continue to be developed for major electrical and mechanical systems in similar facilities (arenas, pool, libraries, etc.). These operation procedures will allow the optimization of building systems and easy transfer of knowledge between facility operation personnel.

5.2 Maintenance Program

Monitoring energy use through the Energy Management Information System (EMIS) will assist with identifying anomalies in building performance. Individual meter testing on equipment can also assist with equipment diagnostics and troubleshooting.

By recording energy use for equipment parameters, the EMIS can identify hydro peaks and abnormal energy consumption. Regular maintenance work orders can be issued to monitor and correct the performance of the equipment before the equipment fails, increasing reliability and flexibility in planning for replacement. At the same time, maintenance work orders can trigger the implementation of energy conservation measures.

Action	Integrate energy monitoring with maintenance activities.
Status	Evaluating opportunities to align monitoring activities with maintenance.
Next Steps	Determine approaches which could be implemented to ensure monitoring activities closely aligned with maintenance.
Timeframe	Ongoing

6. ENERGY CONSERVATION IN EXISTING FACILITIES

This section highlights benchmarking measures and potential energy conservation measures warranting further evaluation.

6.1 ENERGY STAR® Portfolio Manager

Portfolio Manager is an interactive energy management tool that allows you to track and assess energy and water consumption across an entire portfolio of buildings in a secure online environment. Whether an organization owns, manages, or holds properties for investment, Portfolio Manager can help set investment priorities, identify under-performing buildings, verify efficiency improvements, and receive recognition for superior energy performance. The ENERGY STAR® tool will offer a starting point in benchmarking City facilities until enough data is collected by the EMIS.

Action	Benchmarking
Status	Further research required to determine
Next Steps	Upload utility data on ENERGY STAR® Portfolio Manager for a select number of community centres on a trial basis. Supported through Environmental Sustainability Office staff resources.
Timeframe	2014-2015

6.2 Building Retrofit Actions

As part of the energy management process, energy audits were completed in 15 city facilities in Q4, 2013. The audit reports identified energy conservation measures grouped in the following categories:

- Building envelope
- Lighting systems and controls
- Mechanical systems
- Electrical systems
- Building automation
- Water systems
- Training and awareness

Utility savings for electricity, natural gas and water are presented in Table 5.

Table 5: Utilities saving from energy savings measures

Energy Savings Measure	Total Energy Savings	Total Cost Savings (\$)	Net capital costs (\$)	Ave Payback (years)
Building envelope	25, 830 m ³	9,750	22,150	3.1
Controls	36,700 kWh 300 m ³	3,900	10,200	3.2
Cooling Tower fan	25,750 kWh	2,850	22,300	8.6
Domestic Hot Water	41,800 kWh 118,540 kWh	40,700	\$ 405,650	11.1
Fuel Switch	308,250 kWh - 28,850 m ³	23,600	\$ 219,700	10.7
Heat rejection	48,850 kWh	5,150	51,550	10.7
Heating	484,400 kWh 57,710 m ³	69,400	789,800	10.2
Lighting Retrofit	2,017,800 kWh	214,600	1,308,600	6.0
Monitoring, Tracking, Training	434,250 kWh 53,690 m ³	76,450	228,050	4.4
Pumps	112,200 kWh	11,750	100,950	10.1
Ventilation	288,250 kWh 12,300 m ³	35,200	225,000	7.0
Water conservation	82,040 m ³ (gas) 40, 800 m ³ (water savings)	131,550	510,150	4.2
Total	3,798,050 kWh 328,410 m ³	627,700	3,935,900	

Action	Energy Conservation measures
Status	Implementing energy conservation measures identified within the energy audits is a key element of the CDM Plan implementation.
Next Steps	Schedule energy retrofit measures implementation according to building priority and funding available for each year of the CDM Plan implementation Coordinate capital retrofit measures recommended in the CDM Plan with the corporate facility capital improvements funding available for each year of the CDM Plan. Initiatives will be reviewed and presented as part of the Capital Budget process annually.
Timeframe	Timeline based on approved funding

6.3 Continuous commissioning

Continuous commissioning involves applying the systematic commissioning process to existing buildings in order to improve performance of building systems. In order to select which facilities should be considered the following criterion should be considered:

- High Energy Utilisation Index (EUI) (ekWh/ft², ekW/ft²,ekWh/user/y)
- Chronic failure of equipment and/or control systems
- Complaints related to building performance

Continuous-commissioning is a cost-effective method of improving building energy efficiency, as it relies less on new equipment that requires capital costs and more on returning equipment operation to the initial performance. Continuous-commissioning projects could be considered in situations where mechanical and building automation system upgrades are targeted for improvements.

Action	Continuous-commissioning
Status	Continue to collect energy data to support the tracking of performance indicators such as the Energy Utilisation Index.
Next Steps	Identify potential opportunities for -commissioning particularly those facilities that show an increasing energy consumption trend over time and consider future utilization plans. Utilize the corporate energy team to help plan the retro-commissioning process.
Timeframe	2016

7. NEW CONSTRUCTION

The City of Vaughan's has developed and implemented a Vaughan green building policy, which will ensure that all new and existing municipal buildings perform to the highest environmental standards that are practical taking into account such considerations as energy efficiency, greenhouse gas emissions. The policy is to build new facilities to LEED Silver where practical.

Action	New construction
Status	Continue to cite LEED Silver for new municipal buildings.
Next Steps	Continue to document the energy savings achieved from LEED Silver building standard.
Timeframe	Ongoing

8. DEMAND RESPONSE

The energy usage of municipal facilities is mainly attributable to electricity and natural gas for the purposes of heating, cooling and addressing power loads.

The Province has developed a demand response program for large industrial, commercial and institutional organizations to receive economic incentives to reduce consumption. The program pays participants for turning down their electricity by a specified amount when Ontario's electricity system reaches certain pre-established targets. There are several potential ways for municipalities to be involved in demand response including using stand-by generators, thermal and load shifting.

Action	Demand response
Status	Work with one of three aggregators, approved by the Ontario Power Authority, to determine what potential opportunities exist to participate in the Demand response program.
Next Steps	Monitor available technology and market conditions to investigate the economic feasibility of on-site generation projects, thermal storage initiatives and load shifting opportunities.
Timeframe	Ongoing

9. STREET LIGHTING

Significant energy reduction in street lighting is possible through the conversion of the City's existing High Pressure Sodium (HPS) street lights to LED technology. Street lighting in the city currently accounts for approximately 12% of energy used from the City.

LED technology can deliver energy savings of 50 to 70% when compared with the consumption of the city's existing HPS lights. The LED fixtures also have a much longer life reducing maintenance costs on bulb replacement cycles. Total annual operating cost savings for converting to LED technology would be significant however the capital cost of a replacement program is also very high.

Additional analysis will be required in the preparation of a business case to support a replacement program. There are also design issues that will need to be addressed due to the different nature of the light from these two sources. The city's Engineering department is currently undertaking a review of the city's street light design standards including an assessment of LED technology. Alternative financing arrangements for implementation may also be possible through energy performance contracting and will need to be evaluated further prior to any decision to proceed

Action	Explore the feasibility of a large scale LED street light retrofit.
Status	Continuing to update inventory of street lighting assets with additional details (i.e lighting levels, watts, etc)
Next Steps	Prepare business case including financing alternative for retrofit program
Timeframe	Q2-2017

10. CORPORATE ENERGY CONSERVATION CULTURE AND COMMUNICATIONS PLAN

Culture is often referred to as shared assumptions and values as well as expected behaviours and symbols. If the City of Vaughan expects to build on the sustainability culture it started to establish in the implementation of *Green Directions Vaughan*, then inclusion of an energy conservation culture should be natural inclusion. An organization's culture guides the decisions of its members by establishing and reinforcing expectations about what is valued and how things should be done. In order for the CDM Plan to succeed it will be dependent on the commitment to building a culture of energy conservation that will modify building occupants' behaviour towards energy conservation.

10.1 Energy Training

Training programs for staff will help them to understand the importance of energy management while providing them with the technical knowledge and skills required to make informed energy decisions. Employee feedback and program evaluation can also be gathered in these staff training sessions.

Staff training will be employed to achieve:

1. Sensitivity to energy management, energy efficiency and energy cost issues.
2. Familiarity with new energy technology, equipment, process, and operational methods.
3. Staff training will be performed at the following levels:
 - Management
 - Engineering/Technical/Supervisory
 - Operators

The following matrix depicts the training and objectives at each level.

Table 6: Training approach

Organizational Level	Type of Training	Training Objectives
Management	<ul style="list-style-type: none">- Sensitivity to energy management, energy efficiency and energy cost issues- Familiarity with information and data reporting- Familiarity with evaluation of process and CDM plan	<ul style="list-style-type: none">- Acquire insight into energy cost drivers and energy efficiency- Provide support to the CDM plan implementation- Provide program guidance, motivation, leadership, and encouragement to staff
Engineering, Technical, Supervisory	<ul style="list-style-type: none">- Familiarity with new technology, equipment, processes and operational methods- Awareness of energy	<ul style="list-style-type: none">- Increased familiarity with new energy efficient technologies, equipment, processes, and operational methods

Organizational Level	Type of Training	Training Objectives
	conservation opportunities <ul style="list-style-type: none"> - Familiarity with information and data reporting - Familiarity with evaluation of process and CDM plan 	<ul style="list-style-type: none"> - Provide operator training and guidance - Train and encourage staff to recommend/initiate energy conservation projects and proposals to senior management
Operators	<ul style="list-style-type: none"> - Technical knowledge of systems and equipment - Technical knowledge of maintenance and reduction of loss/waste - Familiarity with operating procedures for energy efficiency - Awareness of energy conservation opportunities 	<ul style="list-style-type: none"> - Operate systems and equipment more efficiently - Reduce energy usage and operating costs - Initiate effective preventative maintenance plans - Champion the culture of energy efficiency and energy cost reduction

As the training program is implemented, energy performance and management measures and metrics will be included in the performance evaluations for facility operations staff.

10.2 Energy Awareness

Front line staff and visitors must be supportive of the building operators as champions in order for an energy conservation culture to materialize. An employee engagement initiative on energy conservation along with a communication plan provides a good foundation to create an energy conservation culture. Community based social marketing strategies can be utilized as a component of the employee engagement efforts. Providing information on performance indicators, outlining expectations from City staff and visitors and sharing information on energy efficiency measures can also help raise awareness towards energy efficiency.

In order to ensure a supportive system for the implementation of the Conservation Demand Management Plan, an effort must first be made to expand the organizational awareness of energy efficiency and conservation and to establish a strong understanding of the connection between energy conservation and energy cost-effectiveness. Embedding this awareness and understanding within the broader organizational culture will require ongoing communication and staff training.

This ongoing communication and staff training will need to address why the program exists and what its goals and objectives are; how the program will impact day-to-day roles, responsibilities and workplace activities; senior management support and participation; and general expectations of staff.

With increased energy awareness, staff behaviours will begin to change which will work to help the organization reduce overall energy use and energy-related costs over time.

Action	Energy training & awareness
Status	Building operators attend technical training related to new systems and on-line energy tracking. The Employee Environmental Education Internal Advisory team continues to provide input on programs and initiatives to integrate sustainability into the core culture of the organization.
Next Steps	Continue to determine, and offer, training relevant to building operations staff. Continue to communicate to staff, visitors and residents on energy management and performance. Determine opportunities to reinforce a culture of energy conservation at the City of Vaughan.
Timeframe	Ongoing

10.3 Energy Communication Plan

Successful implementation of the Conservation Demand Management Plan will require a strategic and staged energy awareness supported by a cohesive internal communications plan. This communications plan will highlight the steps that municipal staff can take to contribute towards energy conservation while working to help foster an organization-wide culture of energy efficiency, energy cost-effectiveness and environmental stewardship.

10.3.1 Foster Senior Management Support Energy Leadership

One of the most important elements for the successful implementation of the Conservation Demand Management Plan and associated energy awareness and internal communications plan is commitment to the program by senior management and middle management. Top managers must not only be made aware of the need for increased energy efficiency and energy cost-effectiveness but also must be afforded the opportunity to take actions to champion energy efficiency at the top levels of the organization, thereby setting an energy leadership example for the broader staff base to follow.

10.3.2 Create an internal Energy Conservation & Demand Management Team

Not all the talent and expertise necessary for a successful Conservation Demand Management program will reside with one person or one discipline. As such, a successful CDM plan and program will require the technical knowledge and expertise of a variety of individuals from a variety of departments working together as part of an internal Energy Conservation & Demand Management Team. This team will provide the necessary technical energy management expertise. The team will also work to guide the activities of the CDM plan, integrate energy management policies and initiatives into various City departments, and communicate the City's energy initiatives, energy use, and energy cost savings to all organizational levels.

The members of the internal Energy Conservation & Demand Management (CDM) Team, as outlined in 2.4.3 will work with the Employee Environmental Education Internal Advisory Team, with respect to initiatives targeting employees.

10.3.3 Design and implement the Energy Communications Plan

Communicating the CDM plan and program to staff will involve the joint efforts of the City's senior management and the internal CDM Team. The internal CDM team will seek the advice and insights of the Corporate Communications Team and leverage the existing mechanisms (Jostle, internal newsletters such as the Environmental Sustainability Office's quarterly newsletter). The design and implementation of the Energy Communications Plan will involve:

- Consulting staff to help develop program content
- Developing key messages
- Identifying and highlighting desired behaviour changes
- Leveraging motivational incentives and award programs
- Leveraging all existing internal communications channels
- Identifying and trialing new, creative communications and engagement tactics
- Developing a timeline or schedule for the development and implementation of the communications plan
- Producing appropriate and targeted promotional materials and visuals (including real-time energy data displays) and conducting engagement activities

10.4 Highlight and Evaluate the Achieved Results

The program's achievements and effectiveness will be evaluated based on feedback gathered through staff surveys, results analysis, and ongoing dialogues with City staff. Pilot project successes, actions and achievements will be highlighted and catalogued as best practices. Energy use and cost savings will be documented and results will be reported and built upon.

10.5 Review and Revise to Improve the Process

The program will be reviewed and revised as part of a cyclical and ongoing effort for continuous improvement. Upon tracking and analyzing data and measuring progress, actions will be reviewed and revised as necessary to achieve the desired program results. If the achieved results are not as expected, new ideas and opportunities will be sought to enhance the strengths and minimize the weaknesses of the CDM program. New suggestions will be sought and the most promising ideas and opportunities will be implemented. Goals will be revised as necessary to achieve the desired outcomes. When needed, new staff talent and skill sets will be fostered.

10.6 Measurement and Verification

The energy management efforts under the Conservation Demand Management plan would not be complete without monitoring, measurement and verification to validate the staff time, internal efforts and budget invested to achieve energy use reductions and energy cost savings. Such monitoring and measurement will help to determine which energy management initiatives were effective in contributing towards the organizational goals and therefore should be replicated; which initiatives were counterproductive or ineffective and therefore should be avoided; which goals and objectives were overly ambitious; and which ones could be improved upon and strengthened.

This measurement and verification will be achieved through regular monitoring of energy usage and energy cost savings generated from energy management projects, including significant renovations, retrofits, and other facility or process improvements, and tracking observed operational and behavioural changes and improvements.

The measurement and verification of the CDM plan will be based upon the scope of each corresponding energy management and efficiency project. It will rely on the energy metering efforts discussed in section 4.1.

10.7 Reporting and Feedback

Upon tracking energy usage and energy cost savings through the measurement and verification process outlined in section 10.6, final reporting and feedback will be required to close the project loop by putting the energy management information into a form that will enable ongoing control of energy use, the achievement of energy reduction progress and targets, and the verification of energy use and cost savings.

Energy reports and project feedback will be provided to the necessary stakeholder groups both internally and externally on a regular basis.

The following reports may be generated:

Report	Timeframe
Summary of annual energy consumption and GHG emissions as required by O.Reg 397/11	July 2014 and every year thereafter
Energy conservation and demand management measures as required by O.Reg 397/11	July 2014 and every 5 years thereafter
Council update reports	Annually – ongoing
Energy dashboard / performance indicators	Annually – ongoing
Stakeholder level custom reports	As required

11. FINANCIAL CONSIDERATIONS

This section provides an overview of the incentives currently available to support the implementation of energy conservation activities.

11.1 Incentives

Several external incentive programs exist to support the implementation of energy conservation and efficiency measures. Ontario Power Authority (SaveOnEnergy), Enbridge and NRCan (ecoEnergy) all have various forms of incentives;

SaveOnEnergy.

	Prescriptive	Measures Engineered and Custom Measures
Lighting	Per unit incentives	The greater of either, \$400/kW of demand savings or \$0.05/kWh of first year electricity savings
Non-lighting Including Lighting Controls	Per unit incentives	The greater of either, \$800/kW or \$0.10/kWh of first year electricity savings

Enbridge- Enbridge helps fund workshops and seminars and provides access to technical information that can help consumers improve their energy efficiency and save natural gas. In addition, rebates and incentives are available for space heating, water heating and engineering projects.

NRCan- At this time, NRCan does not offer any grants or incentives directly related to energy savings. However, a portfolio of information tools and training are available to further support energy efficiency efforts. This can be a useful asset for the operations staff training component.

11.2 Funding of Energy Projects

If all the energy retrofit measures identified for City facilities through the energy audit process were implemented, the total 2013 estimated cost would be \$4,173,900.

12. ENERGY CONSERVATION AND DEMAND MANAGEMENT PLAN IMPLEMENTATION

The Energy Conservation and Demand Management Plan identifies actions to support the City of Vaughan towards achieving its vision, goals, objectives and targets over the next five years. Implementing the CDM Plan requires organizational commitment, as well as responsibility regarding managing the implementation process.

The City of Vaughan's Conservation Demand Management Team will take responsibility in the CDM Plan implementation and revision.

As a living document, the CDM Plan will be periodically reviewed by the Conservation Demand Management Team to consider several external and internal factors. We propose scheduling annual periodic reviews, as well as any time when relevant changes require it, in order to effectively address continuous improvement opportunities. These actions will be inserted into various Work Plans and Business Plans.