

Air Quality and Climate Change Management Plan 2014 – City of Ottawa

The following documents were released on the City of Ottawa website on May 13 in advance of the May 20 Environment Committee meeting at which they will be considered. At time of this writing (May 13, 2014) these documents have not been approved by City Council.

The version posted on the city website was in 13 parts (plus 3 in French). Ecology Ottawa has here brought those parts together into one document. The parts are as follows:

1. A report to the Environment Committee introducing the main documents (page 2 of this PDF)
2. The 2014 Air Quality and Climate Change Management Plan itself (page 9 of this PDF)
3. Taking Action: a short-list of recommended actions based upon Roundtable results, subsequent research and assessment, and one-on-one consultations with key stakeholders (page 43 of this PDF)
4. Appendix A - GHG Inventory (page 48 of this PDF)
5. Appendix B - 2005 Air Quality and Climate Change Management Plan Progress Report (page 63 of this PDF)
6. Appendix C - Trends in Municipal Climate Change Action Plans (page 71 of this PDF)
7. Appendix D - Existing Energy Incentive and Funding Programs (page 79 of this PDF)
8. Appendix E - Energy Supply and Demand in Ottawa (page 93 of this PDF)
9. Appendix F - Assessment of the Local Improvement Charge Mechanism (page 109 of this PDF)
10. Appendix G - Risk Mitigation through the Protection of Natural Areas (page 123 of this PDF)
11. Appendix H - Public Health Implications of Climate Change in Ottawa (page 131 of this PDF)
12. Appendix I - Managing Risk through Adaptation (page 142 of this PDF)
13. Appendix J – Bibliography (page 156 of this PDF)

Original documents can be found at the city website here

http://app05.ottawa.ca/sirepub/agendaminutes/index_en.aspx

**Report to
Rapport au:**

**Environment Committee
Comité de l'environnement**

**and Council
et au Conseil**

**May 20, 2014
20 mai 2014**

**Submitted by
Soumis par:**

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Ward: CITY WIDE / À L'ÉCHELLE DE LA VILLE File Number: ACS2014-COS-ESD-0011

SUBJECT: Update of the Air Quality and Climate Change Management Plan

**OBJET: Mise à jour du Plan de gestion de la qualité de l'air et des
changements climatiques**

REPORT RECOMMENDATIONS

That Environment Committee recommend that Council:

- 1. Approve the 2014 Update of the Air Quality Climate Change Management Plan attached as Document 1 and as outlined in this report; and**
- 2. Direct staff to report to the appropriate Standing Committee and Council in 2015 with the proposed Action Plan, attached as Document 2, for Council's**

consideration as part of the 2014-2018 Term of Council priority and budget processes.

RECOMMANDATIONS DU RAPPORT

Le Comité sur l'environnement recommande que le Conseil :

- 1. Approuve la mise à jour 2014 du Plan de gestion de la qualité de l'air et des changements climatiques (document 1 ci-joint) comme présenté dans ce rapport;**
- 2. Demande au personnel de soumettre au comité permanent concerné et au Conseil en 2015 le plan d'action proposé (document 2 ci-joint) aux fins d'examen par le Conseil dans le cadre du processus d'établissement des priorités pour le mandat du Conseil de 2014-2018 et du processus budgétaire.**

EXECUTIVE SUMMARY

In 2005, Council approved the *Air Quality & Climate Change Management Plan* (AQCCMP) including emissions targets for the community and the Corporation of the City of Ottawa, and eighteen implementation measures. The purpose of this report is to document progress made since 2005, and to set the course for the next twenty years. Specifically, the updated AQCCMP (Document 1) outlines the following:

- Changes in GHG emissions since 2004 (adjusted base year);
- Actions completed by the City since 2005; and
- A new target, goals, and objectives.

Document 2 recommends a new set of projects which will be brought forward for consideration in the next Term of Council.

All of the actions set out in the 2005 AQCCMP were either completed or are on-going, with key accomplishments including the following:

- GHG inventories were completed for 2004, 2008, and 2012.
- The Anti-idling by-law was adopted and an awareness campaign carried out.
- The City's *Energy Management and Investment Strategy* has invested over \$14M since 2004 to reduce utility costs, resulting in a significant drop in the corporation's environmental footprint, while also realizing total savings of approximately \$12.6M.

- The City built and commissioned a power generation plant at Trail Waste Facility that uses landfill gas to generate electricity.
- A *Green Procurement Guideline* was adopted by the City.

Between 2004 and 2012, greenhouse gas (GHG) emissions declined by 12% at the community level, and by 6% at the Corporate level. These results fell short of the community (20%) and corporate (30%) targets set in the 2005 AQCCMP, but are significant when viewed in the context of the growth of the City (86,000 new residents, a 10% increase) during that period. On a per capita basis, emissions per person dropped from 7.3 to 5.8 equivalent tonnes of carbon dioxide (tCO_{2e}) per person, a 20% reduction.

The 2014 updated AQCCMP focuses on the need for the City to work with community partners to reduce air pollution and make Ottawa more resilient. The report proposes a new per capita emissions metric that recognizes the complexity and interplay between community and corporate roles and responsibilities. Accordingly, the updated AQCCMP sets a new overall target of a 20% reduction in per capita emissions (from 5.8 to 4.6 tCO_{2e} per person) between 2012 and 2024. This global target reflects the realities of population growth and the fact that corporate and community activities are inherently intertwined. For example, increases in the City's environmental footprint with respect to mass transit are expected to be balanced with a reduction in the community footprint as residents shift their mode of transportation. Stage two of the light-rail transit project is expected to provide almost 70% of the population easy access to transit by 2023.

Achieving the revised targets would allow Ottawa to reduce community GHG emissions by a further 12% despite growing in population by over 10%. A target that focuses on per capita emissions reflects the reality that Ottawa will continue to grow while working to reduce air pollution from emissions. Furthermore, the Action Plan speaks to the risks to Ottawa's property and economy from more frequent and intense weather events; with an emphasis on improved building resiliency, land and infrastructure management, and emergency preparedness.

Financial Implications

There are no financial requests in this report. The recommended actions and any costs will be considered as part of the 2014-2018 Term of Council priority and budget processes.

Public Consultation/Input

The GHG Roundtable provided a number of suggestions and ideas regarding Climate Change. Staff built on this input, consulted with other municipalities and consulted internally, across most City departments, to develop the Action Plan. A short-list of community actions will be tabled early in the new Term of Council.

BACKGROUND

Action is needed by individuals, organizations, and all level of governments in order that communities are prepared to manage the following risks:

- Increasing frequency of high intensity and duration wet weather, heat wave, and wind storm events;
- Increasing variability in winter and summer temperatures;
- Increasing populations of warm climate pests and invasive species; and
- Increasing energy costs, expanding fuel transmission corridors and use, and longer-term vulnerability in supply.

Ottawa's 2014 AQCCMP Update was developed through the following process:

- *A Review of the 2005 Air Quality and Climate Change Management Plan* – A summary of all progress and outstanding recommendations since 2004. See Appendix B.
- *Best Practice Review* – a comparative analysis of several U.S. and Canadian municipalities with climate change plans and programs. See Appendix C.
- *GHG Inventory and Trends Analysis* – the City completed its 2012 GHG inventory, complementing the previous 2004 and 2008 inventories. Based on the baseline and two subsequent benchmark data sets, a trends analysis was undertaken. See Appendix A.
- *Corporate Working Group and Community Consultations* – building on input from the 2013 GHG Roundtable, meetings with various community stakeholders were held. In addition, an internal corporate/cross-departmental working group was formed to review the GHG inventory results, the draft report and action plan. See Document 2: Taking Action.

Inventory results show that, despite population growth, GHG emissions dropped between 2004 and 2012: corporate emissions were reduced by 6% and community emissions by 12%. Emissions per person dropped by 20% from 7.3 to 5.8 tCO_{2e} per person. While this reduction is positive, much of the drop is attributable to the province's move away from coal-fired electricity generation. Going forward, with predicted

population growth, efforts will be needed from all levels of government, organizations, and individuals if we are to continue to see a reduction in emissions.

DISCUSSION

The following Guiding Principles inform the 2014 Update of the AQCCMP:

- Everyone has a responsibility to manage energy consumption and to mitigate risks.
- Collaboration is needed amongst various levels of government, utilities, stakeholders, and the broader community to effect change.
- Municipal leadership is needed to ensure an integrated and comprehensive approach across the corporation and the community.

The Goals of the proposed update identify the scope of the issues to be addressed. The objectives further illustrate the complexity of the challenge and the need to disaggregate the problem, tackling it from several angles. The full report and details can be found in Document 1.

While much has and is being done, moving forward, it is recommended that the City actions over the next five years focus on the following:

1. Continuing to implement cost effective improvements across City operations.
2. Working with partners to provide people with the information and tools they need to make informed decisions.
3. Working with partners to give assistance to those who want to make their homes, businesses, and investment properties more energy efficient and resilient.
4. Working with partners to provide direction and certainty to the design and construction industry for the creation of sustainable urban spaces and structures.
5. Developing a stewardship program to manage and secure land to serve as natural water reservoirs, windbreaks, air filters, and carbon sinks.

The proposed actions are focused around item 1 above and detailed in Document 2, with some community actions identified that can be completed within existing budgets.

The updated 2014 Plan is also recommending a new GHG target of 4.6 tCO₂e per capita by 2024, representing a 20% reduction from 2012 per capita emissions.

RURAL IMPLICATIONS

The report applies to all of Ottawa, urban and rural. The updated AQCCMP recognises the need for a targeted approach to reflect the different needs and realities of urban,

suburban and rural residents. For example, the lower availability of public transit options in rural areas is often offset by increased waste diversion and increased use of renewable energy sources (e.g. geothermal and solar PV) by these residents.

CONSULTATION

The update of the AQCCMP was initiated with the GHG Roundtable held in March 2013. Over 200 participants attended and provided ideas and input regarding potential actions to mitigate and adapt to Climate Change.

Corporate Working Group – the corporate working group was established with representatives from 7 City departments and 16 branches, to develop the corporate targets and actions and ensure community actions taken by various departments were captured.

Community Stakeholders – Input was also received from a variety of agencies and individuals. (See Document 1 for Acknowledgements)

COMMENTS BY THE WARD COUNCILLOR(S)

Not applicable, citywide project.

LEGAL IMPLICATIONS

There are no legal impediments to implementing any of the recommendations in this report.

RISK MANAGEMENT IMPLICATIONS

The Update to the AQCCMP includes implementation of the Hazard Identification and Mitigation Program and Plan which are integral to protecting people and property in Ottawa.

FINANCIAL IMPLICATIONS

There are no financial implications associated with this report. The action plan and associated costs will be considered as part of the 2014-2018 Term of Council priority, and future budget needs will be identified in future draft budgets.

ACCESSIBILITY IMPACTS

This report will address accessibility impacts as the actions are prioritized and implemented.

ENVIRONMENTAL IMPLICATIONS

This report is integral to environmental stewardship and sustainability.

TECHNOLOGY IMPLICATIONS

There are no technical implications associated with receiving this report.

TERM OF COUNCIL PRIORITIES

The update of the AQCCMP was a Term of Council deliverable under the Environmental Stewardship Strategic Priority.

SUPPORTING DOCUMENTATION

Document 1 AQCCMP Full Report (including Appendices A through K)

Document 2 Action Table

DISPOSITION

Environmental Services will coordinate the 2014 AQCCMP going forward through the budget and prioritization process of the 2014-2018 Term of Council.

Air Quality & Climate Change Management Plan

City of Ottawa

2014

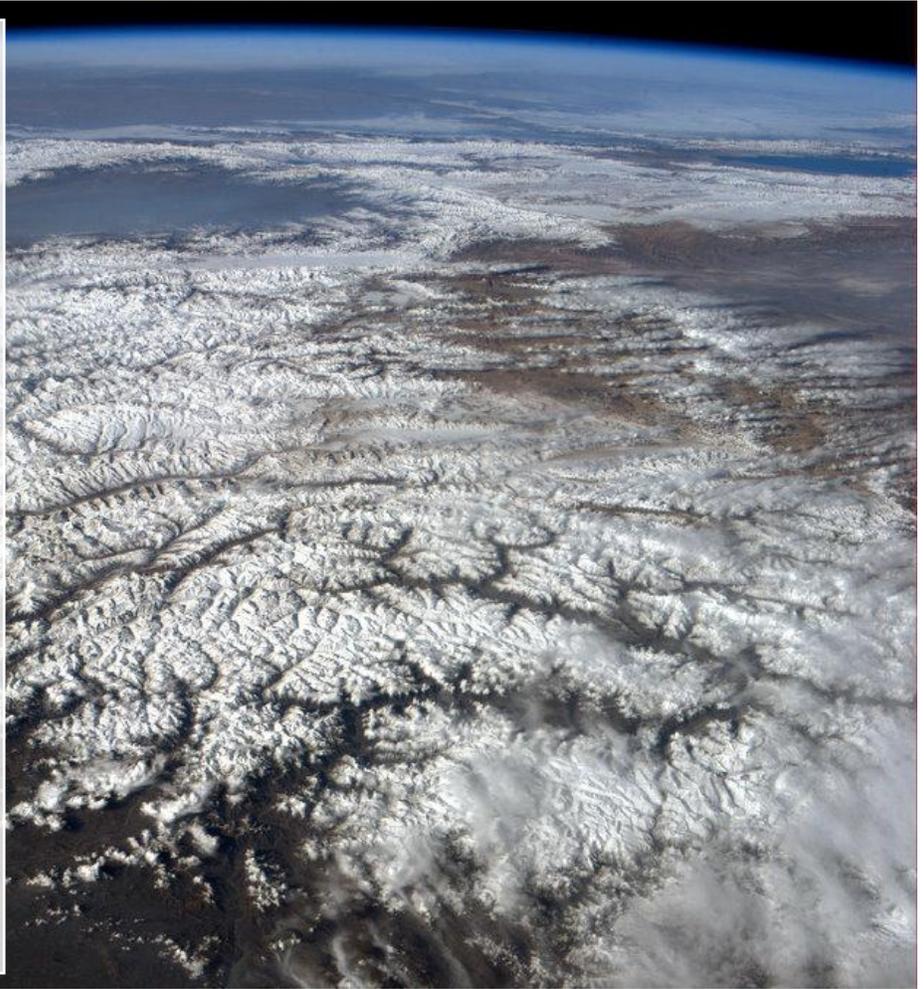


Photo courtesy of NASA and Chris Hadfield; a view from space of earth and its atmosphere

City of Ottawa
Environmental Services Department
May 2014

 **Information**
ottawa.ca
Services **3-1-1**
municipaux
ATS 613-580-2401

This plan is a review and update of the City of Ottawa's 2005 Air Quality and Climate Change Management Plan and builds on recent work with the ville de Gatineau and National Capital Commission on the 2012 Energy & Emissions Plan for Canada's Capital Region. It sets goals, objectives, and a new target, and recommends a variety of actions. This is a 20-year plan, with actions recommended for the first 5-year period. Not all objectives will be achieved within this timeframe, and it is anticipated that the plan will be updated at regular intervals.



Mayor of Ottawa Jim Watson

Twenty-three years ago, the City of Ottawa was one of the first municipalities in Canada to join the Partners for Climate Protection (PCP) program and to commit to reducing corporate greenhouse gas (GHG) emissions. As a newly elected councilor in 1991, and Mayor of the amalgamated City of Ottawa today, I am proud to say that we are moving in the right direction. And, in 2013, we were recognized as one of just 21 municipalities in Canada to achieve Milestone 5 in the PCP program.

Building on the success of the 2005 Air Quality & Climate Change Management Plan, this updated plan sets a target that challenges each of us to reduce our carbon footprint. It embraces the concepts of leading by example, and working in partnership for change. The Plan is ambitious yet realistic, and I am

confident that together we can fulfill its goals.

I look forward to working with members of the community in the years ahead to manage our energy use responsibly while responding to changes in weather patterns that are affecting us all.

Jim Watson, Mayor
City of Ottawa

Ottawa's City Council is committed to preserving and enhancing the natural beauty of our National Capital. The City of Ottawa has embraced innovation and new practices to reduce pollution, improve energy efficiency and decrease our impact on the local environment. Individuals and all levels of governments must continue to work together to protect the quality of the air we breathe. This update to our City's Air Quality and Climate Change Management Plan sets a strong foundation to keep Canada's Capital healthy and clean for future generations.



Maria McRae, Chair
Environment Committee

Councillor Maria McRae
Chair of the Environment Committee

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Document 2: Taking Action

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B	2005 Air Quality and Climate Change Management Plan, Status Update
C	Trends in Municipal Climate Change Action Plans
D	Existing Energy Incentive and Funding Programs
E	Energy Supply and Demand in Ottawa and Program Options
F	Assessment of the Local Improvement Charge Mechanism
G	Risk Mitigation through the Protection of Natural Areas
H	Public Health Implications of Climate Change in the City of Ottawa
I	Managing Risks through Adaptation
J	Bibliography
K	Accessible format figures, tables and end notes

ACKNOWLEDGEMENTS

The City wishes to thank the following people and organizations for the time and consideration they gave to this subject by meeting with the project team during development of the Plan:

- 2013 GHG Roundtable participants
- ANF Energy Solutions
- BioRegional North America
- Bullfrog Power
- Canadian Standards Association
- Cities of London, Toronto, and Hamilton, Vancouver and Halifax staff
- City of Ottawa staff
- Climate Action Network
- Delphi Group
- Ecology Ottawa
- Enbridge Gas
- Energy Ottawa
- EnviroCentre
- Federation of Canadian Municipalities
- Hydro One
- Hydro Ottawa
- Invest Ottawa
- National Resources Canada
- Ottawa Chamber of Commerce, Environment Committee
- Ottawa Centre EcoDistrict
- Ottawa Community Housing
- Ottawa Regional Chapter of the Canadian Green Building Council
- Public Works and Government Services Canada

- Region of Durham and Waterloo staff
- University of Ottawa
- Windmill Developments



March 2013 GHG Roundtable

THE CHALLENGE

Over the past thirty years, all levels of government in Canada have been working to combat air pollution and, more recently, to adapt to its impacts.¹

Ottawa was one of the first Canadian municipalities to address this issue, setting targets and identifying actions as early as 1991. In 2005, the City adopted its first *Air Quality & Climate Change Action Plan (AQCCMP)*, and since then has completed or initiated all of the 18 recommended actions. In 2013, Ottawa was recognized by the Federation of Canadian Municipalities as one of just 21 municipalities to have completed all five steps in its municipal Partners for Climate Protection (PCP) program.

Ottawa's 2005 AQCCMP reconfirmed the 1991 targets², however, as this update will show, the targets have proven to be challenging for three key reasons:

- Ottawa has a growing economy, and growing communities will consume more energy and generate more emissions unless per capita energy use declines.
- Emission generation models hold Ottawa to account for *how* the electricity it uses is generated. The phase-out of coal fired power generation in Ontario did much to reduce emissions across the province, but will not help reduce future emissions.
- Ottawa's municipal government generates a relatively small percentage of emissions in the community. Actions, large and small, are needed by all organizations and individuals in the community to reduce emissions.

Therefore, the challenge moving forward is to build awareness and facilitate action throughout the community, while encouraging other levels of government to show leadership on this issue.

PROGRESS TOWARDS THE 2005 EMISSIONS TARGET

In 2005, Council set the following emissions **TARGET** for Ottawa:

By 2012, reduce corporate GHG emissions by 30% and community GHG emissions by 20% from 1990 levels

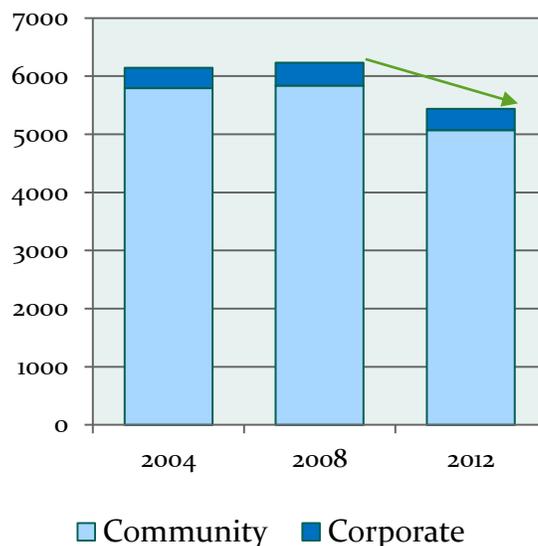
Determining 1990 corporate and community emissions has proven very difficult due to inadequate data sources. However, as shown in **Figure 1**, Ottawa's emissions have dropped from an estimated 6,160 kilotonnes equivalent carbon dioxide (kt eCO₂) in 2004 to 5,420 kt eCO₂ in 2012, or by approximately 12%.

Between 2004 and 2012, Ottawa grew by approximately 86,000 people, yet Hydro Ottawa sales remained relatively static at around 7,500 Giga Watt hours (GWh) per year. In short, per capita consumption of electricity is declining.

However, Ottawa's other energy demands grew over this same period: more roads, cars, and homes and buildings to heat. Why have total emissions not increased?

- ✓ Emissions per kWh electricity produced declined significantly.
- ✓ Reduced emissions from electricity generation offset emissions growth in other areas such as heating and transportation.

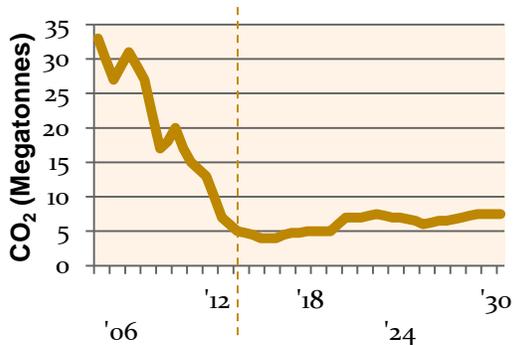
Figure 1: Ottawa's GHG Emissions Estimates³ (Kt CO₂e)



The calculation of community and corporate emissions is based upon numerous variables including *how* Ottawa's electricity was generated. Between 2003 and 2014, Ontario Power Generation (OPG) closed 19 coal-fired power generating stations thereby reducing emissions of NO_x and SO_x across the province by over 80%⁴.

Much of the drop in Ottawa's emissions is attributable to this change in power generation. As shown in **Figure 2**, the province forecasts that such significant GHG reductions will cease in 2015, and that emissions will increase with growth in generating capacity and electricity use.

Figure 2: Ontario's GHG Emissions from Power Generation – Historical and Projected⁵



MANAGING COMPLEXITY

The discussion of Ottawa's 2012 target illustrates the scope of the challenge. Actions taken at home have a consequence at distant power plants. Ottawa is held to account for those emissions when we conduct our inventories.

Achieving broad-scale improvements in energy efficiency and GHG emissions while adapting to the changing environment will require changes by all levels of government, as well as by individuals, businesses and other organizations.

Local governments and utilities have a role to play in helping communities to prepare for and adapt to changing climates, but they cannot eliminate all risks.

Accordingly, the **Guiding Principles** of this Plan are the following:

- Everyone has a responsibility to manage energy consumption and to mitigate risks.
- Collaboration is needed amongst various levels of government, utilities, stakeholders, and the broader community to effect change.
- Municipal leadership is needed to ensure an integrated and comprehensive approach across the corporation and the community.

This Plan sets out Goals and Objectives to mitigate and adapt to Ottawa's changing environment. By comparison, the list of actions contained in Document 1 reflects the scope of powers of the City to address this issue, and the need to work in partnership with others.

Protecting air quality and adapting to climate change will require changes in habits, lifestyles and daily behaviours. Most transactions and energy use in Ottawa fall outside the direct and indirect control of the City. However, the municipality is well positioned to educate, promote, incent, and facilitate changes in community behaviours.

The following goals and objectives apply to Ottawa residents, businesses, and institutions, as well as the corporation of the City of Ottawa.



Transit and bicycle use reduces GHG emissions

The following **Goals** identify the scope of issues to be addressed. That Ottawa:

Mitigates climate change and protects air quality by:

1. Reducing energy demand.
2. Reducing dependence on fossil fuels.
3. Reducing other sources of GHG emissions (e.g. landfills and sewage treatment plants.)
4. Reducing other sources of air borne pollution.
5. Improving carbon capture and storage (e.g. protecting forests and wetlands that capture carbon.)

Adapts to climate change and protects people and property by:

6. Reducing the risks to public health (e.g. through West Nile and Lyme disease monitoring and prevention programs.)
7. Increasing infrastructure resiliency (e.g. back-up power systems and flood protection.)
8. Reducing risks to structures (e.g. modify roofing standards to improve wind resistance.)
9. Ensuring effective emergency management.

The following **Objectives** further illustrate the complexity of the challenge, and the need to disaggregate the problem and tackle it from various angles:

1. Reducing energy demand will require:

- Increasing awareness and understanding amongst Ottawa residents of the impacts of energy consumption; and of the benefits and opportunities to reduce energy consumption.
- Increasing the availability and affordability of energy saving measures and alternatives.
- Increasing the adoption of energy saving measures, alternatives, and behaviours.

2. Reducing dependence on fossil fuels will require the above, and:

- Implementation of programs that encourage renewable energy generation (e.g. FIT and microFIT).
- Greater adoption of renewable energy technologies.
- Greater support to individuals and organizations using or researching renewable energy technologies.
- Strengthening Ottawa's clean-technology sector.

What you can do:

Track your monthly energy bills to see how much you are using. Taking simple steps such as lowering your thermostat, and turning off lights and unused electronics can save your household money and reduce your environmental impact over time.

3. Reducing other GHG emissions will require the above, and:

- Continued landfill gas (LFG) management enhancements.
- Continued methane capture from the agriculture sector and wastewater treatment systems.



Agricultural Biogeneration Facility

What you can do:

Travel efficiently. Use public transit, park and rides and carpooling where feasible. Consider walking or biking for trips around your neighbourhood. Reducing the number of cars on the road gets everyone to their destination faster and reduces pollution.

When you renovate, think energy savings (CMHC Renovating for Energy Savings research series) and alternative forms of energy (e.g. geothermal and solar PV.)

4. Reducing other sources of air borne pollution will require the above, and:

- Design and operation of buildings to mitigate mould growth and promote air quality.
- Construction methods and materials that minimize particulate dispersion and off-gassing.
- Continued maintenance practices to minimize road dust.
- Phase-out of inefficient heating systems.



Canadian War Museum green roof
(Courtesy of Canadian Aerial Photo Corporation)

5. Improving carbon capture and storage will require:

- No net loss of wetlands, forests, and grasslands.
- Continued technological advancements in fossil fuel combustion and emission controls.
- Implementation of carbon sequestration methods.

6. Reducing the risks to public health will require the above, and:

- Identification and communication of health risks to Ottawa residents and businesses.
- Continued surveillance, education and prevention programs for vector-borne diseases such as West Nile Virus and Lyme Disease
- Increasing the ratio of vegetated to impermeable surfaces, thereby reducing the urban 'Heat Island' effect.

What you can do:

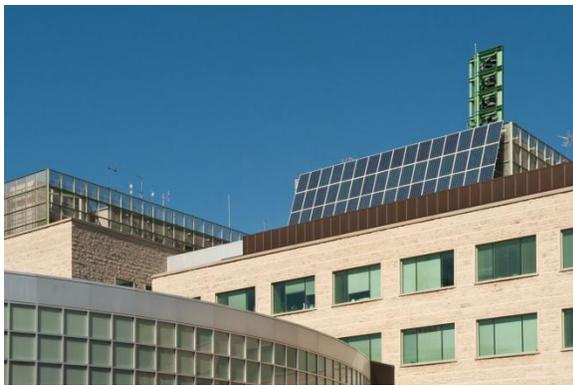
Landscape your property to create more shade, slow stormwater runoff, and prevent ponding near your foundation.



Lyme disease is transmitted by the black legged tick in Ontario

7. Increasing infrastructure resiliency will require:

- Identification of the scope and scale of risks to municipal and utility infrastructure.
- Clear definition of infrastructure performance standards.
- Adjusting infrastructure design standards and specifications to meet performance standards.
- Building infrastructure redundancy and back-up systems where needed.
- Improving construction protocols.



City Hall solar photovoltaic system

8. Reducing risks to structures will require:

- Amendments to the *Ontario Building Code*.
- Amendments to zoning and site plan requirements.
- Increased public awareness of the limits of municipal infrastructure and the behaviours and actions needed to mitigate impacts to private property.
- Increased adoption of lot level stormwater management controls e.g. downspout extensions, shrub plantings, permeable pavement.



Grass Swale

9. Ensuring effective emergency management will require:

- Implementing an Emergency Management System (EMS)
- Increased public awareness on emergency preparedness such as the City of Ottawa's 'Are You Ready?' campaign.
- Establishing partnerships with other agencies, organizations and levels of government.

The City cannot direct changes in all of these areas, but identifies them as matters requiring attention by the broader community and other levels of government.

What you can do:

Discuss emergency management with your family, develop a plan, and have an emergency kit in your car and home.

CHANGES SINCE 2005

The community and regulatory environment in Ottawa have changed significantly and many accomplishments have been made since 2005. The following are highlights of the last decade. Where noted, more details are available in appendices.

Growth

Land Use & Population

Between 2005 and 2011, Ottawa's population grew by approximately 61,570 people and 34,794 households, and approximately 1,325 net hectares of land in the urban settlement areas was consumed for residential, commercial and institutional land uses, including 334,301m² in commercial office space.⁶ More people, infrastructure and a larger developed area mean more energy is consumed for travelling, and for heating and cooling buildings.

Transportation

Between 2005 and 2011, private vehicle ownership increased by approximately 14%⁷, and private vehicle trips rose by approximately 5%.⁸ Currently, approximately 57% of workers commute by themselves in a private vehicle.⁹



Vehicle emissions continue to rise

Between 2005 and 2012, OC Transpo introduced 228 new busses, 179 of which are a hybrid vehicle. The Transitway was expanded by 9.3 kilometres (km) to help increase transit use. At the same time approximately 205 km of roads were constructed and Hwy 7 was expanded between Terry Fox and Carleton Place, and Hwy 417 to Arnprior.

Buildings

Between 2005 and 2011, the City saw 40,313 new housing starts, with about 24% inside the Greenbelt and 76% in outside the Greenbelt.¹⁰ While intensification is occurring, much of Ottawa's growth has been in suburban communities. Seventeen new private sector developments met LEED silver or better design and construction standards.



Housing construction

City of Ottawa Policy & Programs

Land Use

Updates to the City of Ottawa's *Official Plan*, *Transportation Master Plan* (which includes recommendations from the Ottawa Cycling Plan and the Ottawa Pedestrian Plan) and *Infrastructure Master Plan* were carried out in 2009 and again in 2013, and provide direction and policies to shape future growth in Ottawa. Since 2005, the City approved a Greenspace Master Plan and amended its Zoning By-Law as needed to implement planning decisions. It also approved other types of plans and policies, including:

- Subwatershed Plans
- Community Design Plans and Secondary Plans
- Transit-Oriented Development Plans
- Design Guidelines

The City also adopted and implemented policies such as the Urban Tree Conservation By-law and other policies to address specific land use issues.

Transportation

Since 2005, the City has:

- commenced construction of the 12.5 km Confederation Line light rail system that is projected to reduce GHG emissions by 38kt/year by 2031;
- passed an anti-idling by-law;
- installed an EV charging station at City Hall in partnership with Hydro Ottawa;
- purchased 175 hybrid buses and 40 hybrid vehicles;
- decommissioned 331 buses with an average age of 18-24 years; and
- encouraged active transportation initiatives e.g. bike-to-work month



City Hybrid Vehicle

In 2011, the City piloted the Laurier Segregated Bike Lane Project. And, in 2013, the bike lane was approved as a permanent facility; and a further 200 km of new cycling infrastructure was included in the new *Transportation Master Plan*.



Laurier Avenue dedicated bike lane



Transitway and transit vehicles

Buildings

Between 2008 and 2012, the City implemented retrofits at existing facilities that reduced propane and heating oil use by 44% and 71%, respectively. All City buildings constructed since 2005 are built to a minimum LEED certified standard, with most achieving silver or better.

In 2007, the City implemented its water efficiency program. Between 2007 and 2013, drinking water production was reduced by 9,653 megalitres through a variety of demand and supply management initiatives.



LEED Ambulance Station



The Robert O. Pickard Environmental Centre

Water and Solid Waste Management

The City, in partnership with Energy Ottawa and Integrated Gas Recovery Services Inc., built a landfill gas (LFG) power plant at the Trail Waste Facility that currently generates approximately 6 MW, enough to power 6,000 homes. Two mesophilic anaerobic digesters were built at the Robert O. Pickard Environmental Centre (ROPEC) allowing for expansion of the facility's co-gen plant to 2,430 kW.

The City also expanded the blue box program, introduced green bins in 2010, and moved to bi-weekly garbage collection in 2012. By the end of 2012, Ottawa residents had sent 18% less waste to landfill compared to the year before.

Infrastructure Improvements

The City has also taken extensive action to identify and mitigate risks to the water and wastewater systems. Since 2005, the following key initiatives have been carried out:

- Real Time Control Upgrades to manage/reduce combined sewer overflows.
- West End Flood Mitigation
- Orleans Flood Control
- Sandy Hill Wastewater Storage
- Cave Creek Collection Flood Mitigation
- O'Connor Area Flood Mitigation
- Trunk sewer upgrades
- Large Diameter Water Transmission Condition Assessment Program
- City-wide inlet control device installation
- Extraneous Flow Reduction

Major works included upgrading the Glen Cairn Pond, reconfiguring the Hazeldean Pump Station, constructing the Sandy Hill

Storage Tank, and twinning of the Rideau River Collector. These and other capital projects are improving the carrying capacity of the collection systems during wet weather events.



Light Rail Transit Tunnel Construction

Public Health Impacts

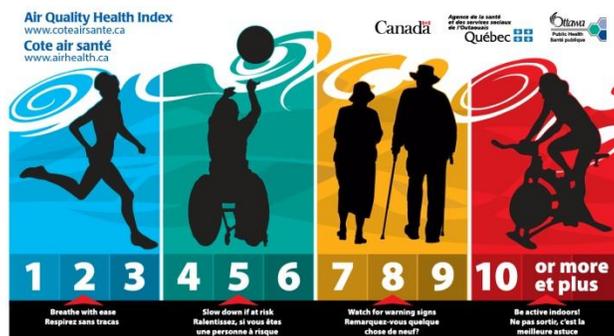
In 2007, Health Canada identified human health vulnerabilities to climate change in a comprehensive report - *Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity*.¹¹ The report highlighted 6 categories of potential health risks associated with climate change, their climate related causes and the projected and possible health effects associated with each risk. The City of Ottawa has been working to assess and mitigate these risks locally.

Ottawa's *Extreme Weather Plan* provides for public notification due to heat, cold, UV and air quality or smog. Ottawa Public

Health issues public notifications when the weather is forecasted to exceed a Humidex of 40 Celcius (C) or a wind-chill of -35 C or lower and when air quality is poor or the UV index is forecast to be very high.

A multi-organizational Extreme Weather Committee monitors and addresses emerging health risks associated with extreme weather, with a focus on high risk groups in the community such as the elderly.

In March 2013, Ottawa Public Health reported to the Ottawa Board of Health on Extreme Weather in Ottawa. The report outlined the increased resources required to combat illness associated with extreme weather in Ottawa; the strategies used to prevent adverse outcomes; and the research and evaluation planned to keep improving the Heat and Smog Action Plan. Refer to Appendix H for more information on the health impacts of climate change.



Promotion of the Air Quality Health Index in the National Capital Region

Emergency Planning

In 2012, the City released *Ottawa's Long-Term Risk and Prevention and Mitigation Plan* as part of the Choosing Our Future initiative that highlighted long-term risks and vulnerabilities and recommended additional measures for Ottawa's emergency management program.

In 2013, the City updated its *Emergency Management Plan* and is currently working on a Hazard Mitigation Program and Plan that will include mitigation actions to address vulnerabilities and hazards such as:

- Critical Infrastructure Failure
- Winter storm
- Summer storm
- Earthquake
- Public Health
- Hazardous Materials
- Public Safety



Emergency response

Concurrently, City departments are updating their Continuity of Operation Plans.



Road and sidewalk snow removal

Winter Event Preparedness

The City was one of the first municipalities to raise with Environment Canada the impact of climate change on the winter operations, which led to the creation of the "Winter Maintenance in a Changing Climate" summit in 2006. Over the years, the City has taken several steps to better manage winter ice and snow events, for example:

- Snow disposal sites have been engineered to accommodate volumes in excess of seasonal averages. Facilities are located to minimize driving time to reduce GHG emissions from the vehicles.
- Meteorological services have been contracted to provide detailed atmospheric forecasting to four zones in the city; pavement forecasts to

capture elements such as black ice and frost; and alerts lower than Environment Canada thresholds, such as freezing rain occurrences (any occurrence vs. 2hrs) and snowfall (3cm vs. 15cm).

- A Road Weather Information System has been installed to provide real-time weather and road condition information at key locations.

Provincial Policy & Programs

Land Use

In 2014, the Province approved a new Provincial Policy Statement to direct land use throughout Ontario. The new policies require Ontario municipalities to reduce greenhouse gas emissions and improve climate change adaptation through land use tools; and to maximize opportunities for renewable energy systems and alternative energy systems. Municipalities must also promote best practices in stormwater management.

Buildings

In 2012, *Ontario Building Code* requirements were strengthened to require energy and water efficiency design.

The Ontario Power Authority (OPA) provides rebates to households replacing inefficient furnaces and air conditioners. The purchase price offered to early applicants under the FIT and microFIT programs were also intended to incent

uptake, and growth in the renewable energy sector.

In 2013, the province expanded regulations governing local improvement charges (LIC) to include financing of energy retrofits. And, more recently announced that Infrastructure Ontario funds will be made available to municipalities and utilities to support local retrofit loan programs.¹²

All three of the main energy suppliers in Ottawa (Hydro Ottawa, Hydro One, and Enbridge Gas) provide incentives in accordance with provincial legislation to residents and organizations interested in becoming more energy efficient. A summary of existing programs is contained in Appendix D.

Transportation

Between 2013 and 2015 the province is widening Highway 417 by one lane in each direction between Nicholas Street and Highway 174. A new pedestrian overpass will be constructed to connect Tremblay Station with the Overbrook community.

Energy Production & Distribution

In 2009, the province adopted the Green Energy & Green Economy Act, and introduced the FIT and microFIT programs to encourage small and mid-size energy production by individuals and businesses. Since 2009, Hydro Ottawa has approved 619 renewable energy projects, with 559

completed to date. Hydro One has approved 450 projects, with 368 completed to date in Ottawa.¹³ This program caused significant growth in the renewable energy sector in Ottawa.

Other key changes mandated under provincial regulations were the following:

- Streamlined approvals for renewable energy projects
- Mandatory (unless waived by buyer) home energy audits prior to the sale of homes
- New programs for municipalities to ensure some project costs are recovered that are associated with community renewable energy projects.¹⁴

Energy Planning & Costs

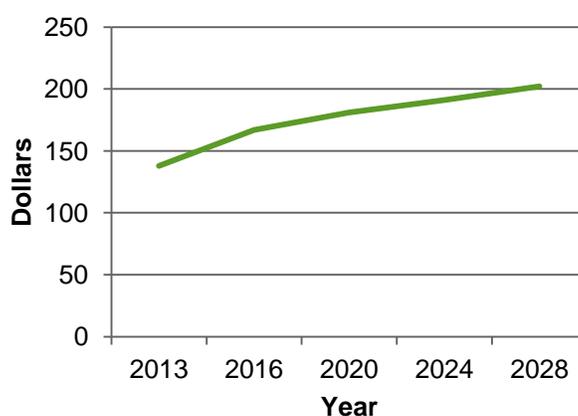
In Fall 2013, the province issued *Achieving Balance: Ontario's Long-Term Energy Plan*. The Plan includes the following concepts:

- Conservation first
- Providing reliable clean energy
- Increasing local storage
- Increasing net metering
- Regional planning and programs

The goals of this province-wide policy are ambitious, putting in place measures to make renewable sources 46% of provincial generating capacity by 2025.¹⁵ With a diverse mix of power sources including distributed wind, solar and hydro power, the province is moving towards a

more robust and resilient electric grid. Figure 3 illustrates how the province predicts energy costs to change over time as it implements this model of service delivery. Specifically, average residential electricity bills are expected to climb by a third by 2028.

Figure 3 - Forecasted Typical Residential Electricity Monthly Bill¹⁶



Federal Policy and Programs

Under the Green Municipal Fund, the Federation of Canadian Municipalities provides financial support to capital projects supporting innovation. Since 2005, the City has received \$1,560,925 in grants for various initiatives including a Grass Swale and Perforated Pipe Drainage System Study, and roll-out of the City's Residential Municipal Organics Composting Program.

Between 2007 and 2012, the federal government ran the ecoENERGY Retrofit - Homes Program, with over 35,000 Ottawa households carrying out some

retrofit project. Many more completed energy audits.

In addition, the City has allocated up to \$161.5 million of its federal Gas Tax fund transfers to its light rail project.

Community Leadership

Universities, Colleges, and School Boards

Both Carleton University and the University of Ottawa use central heating plants for heating, hot water generation and space humidification purposes. In 2012, Algonquin College opened its new Robert C. Gillett Student Commons building, which is certified LEED gold. Since 2011 the Ottawa-Carleton District School Board has put 13 microFIT systems in place and have another 12 in process for a total of 25. They also have real time data available at the participating schools. Approximately 67% of local elementary and secondary schools are participating in the City's Green Bins in Schools program.



The Algonquin Centre for Construction Excellence at Algonquin College



Photo of OCH installation

Ottawa Community Housing

Ottawa Community Housing (OCH) installed twenty-nine 10kW solar power generating systems, an 8,000 sq ft. solar wall, and replaced the toilets, showerheads, and basin aerators in all 15,000 units which reduced water consumption by 40%. OCH has prepared the "OCH Green Plan" which will provide guidance to control utility costs and reduce their impact on the environment,

while leading by example through the development of sustainable practices.

This year, OCH will be carrying out testing of alternative lighting systems followed by retrofits across its high density building stock. The program is expected to have a payback period between two to five years.

Ottawa Centre EcoDistrict

Invest Ottawa in partnership with the Ottawa Centre Ecodistrict Inc., and several organizations and businesses, is developing plans to work with property owners and the community to improve environmental and building stock quality and marketability of the downtown core.

Local Development Community

Several local developers have made it their goal to design and construct sustainable buildings. Example developments meeting LEED¹⁷ gold standard or better include The Currents (1227 Wellington Ave.), The Ottawa Train Yards (395 Terminal Ave.), and Ottawa Convention Centre. Most recently, proposals have been made to develop the property near the Chaudière falls into a best-in-class community that demonstrates leading edge approaches to land development and living.

HOW ARE WE PERFORMING?

The 2005 Air Quality Climate Change Management Plan set out 18 actions to be carried out to reduce and mitigate the effects of climate change. Much was accomplished, as set out in Appendix B. Estimating GHG emissions allows us to gauge the impact of those actions and helps to inform decisions moving forward.

Measuring GHG emissions

GHG emissions are calculated at the **community** level primarily by applying provincial averages on a proportional basis to Ottawa by using population, number of jobs and similar high level variables to determine Ottawa's share of the provincial total.

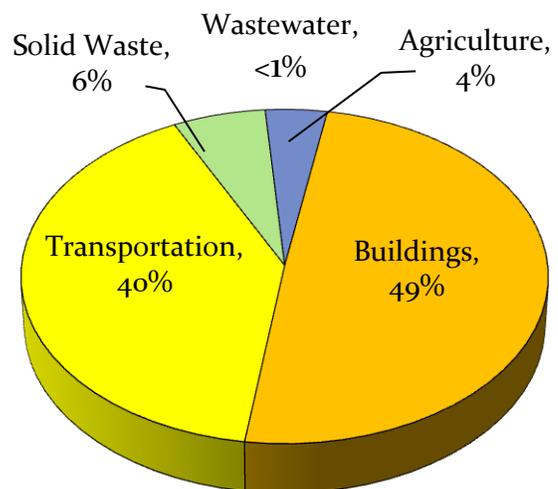
Calculation of **corporate** emissions are based primarily upon actual data, e.g. hydro and fuel bills, fleet mix and use, and gas monitoring systems. In both cases, formulae use emission averages and, particularly at the community level, have a significant margin of error.

Emission calculations are intended to help identify trends and to set policy. However, caution is needed when comparing year over year results as they represent a snap-shot in time. For example, 2008 numbers reflect the significant snow storm experienced in February and March that increased fleet fuel use over average winter use.

GHG Inventory Results

As illustrated by **Figure 4**, GHG Inventory results for 2012 indicate that building operations and transportation are the two activities that most greatly contribute to GHG emission and air pollution in Ottawa.

Figure 4: Percentage CO₂e Emissions by End Use, Ottawa 2012



Buildings

Most energy consumed in buildings is for temperature control (heating in winter, cooling in summer.) Secondly, energy is used for refrigeration and other systems that have a near constant energy draw. Lastly, energy is consumed by equipment that people use cyclically or intermittently such as lighting, household appliances and electronics, and by office or processing equipment.

The amount of energy consumed for these uses is a function of the following:

- A building's r-value (how well insulated it is, which strongly correlates to building age.)
- The energy efficiency of equipment, electronics, and appliances in use.
- The number and energy use behaviors of occupants.
- The strength of the local economy, with a strong economy generally demanding more energy.

As shown in **Figure 5**, inventory results indicate that the City of Ottawa reduced its facility emissions by approximately 30% between 2008 and 2012. While this significant decline is largely due to the province's decision to phase out coal power generation, it also can be attributed to the City's retrofit program that has seen many of its facilities become more energy efficient.

Figure 5- City & Community Building Emissions: 2004, 2008, 2012 (Kt CO₂e)

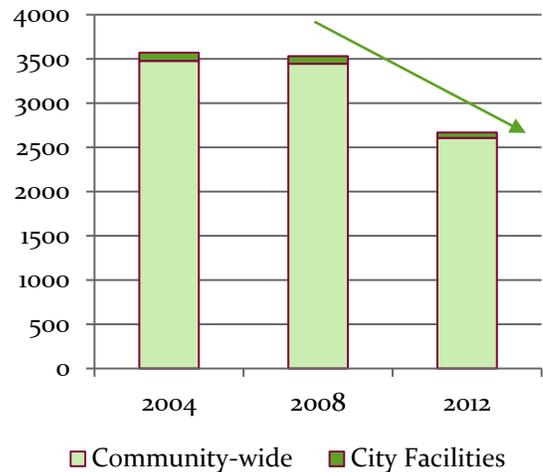
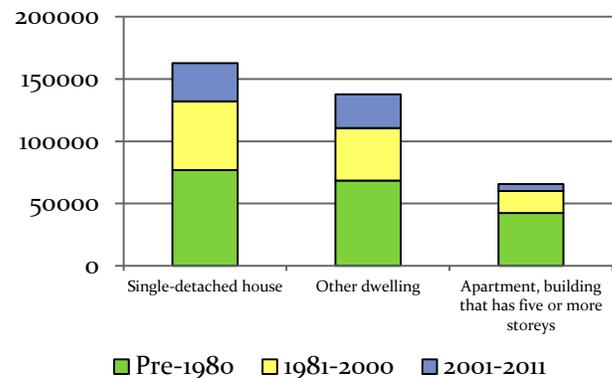


Figure 6 – Number of Dwellings by Age & Type¹⁸



Similarly, community emissions have also seen a significant decline in building emissions, roughly 24% between 2008 and 2012. This is also largely attributable to the phase out of coal, but is also likely attributable to the federal ecoEnergy program and the actions of building owners and managers to manage rising energy costs.

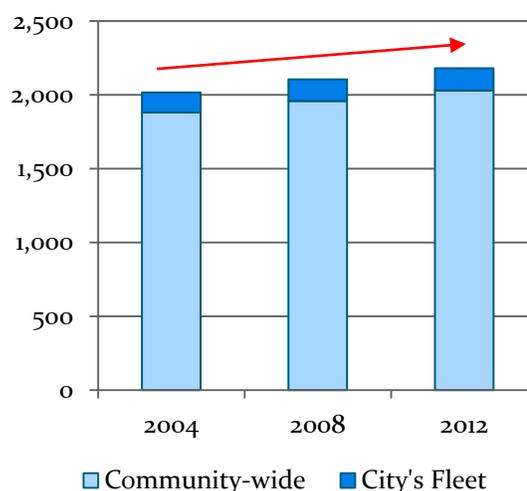
In order to achieve further reductions in building emissions, the challenge will be to retrofit the significant number of older homes (as shown in **Figure 6**) while ensuring that new buildings take advantage of the latest construction approaches and technology to reduce energy needs and mitigate risk.

Appendix E provides an overview of the energy supply and demand in Ottawa and, in particular, the options moving forward for achieving further reductions in building emissions. Appendix F examines the use of Local Improvement Charges (LICs) as a potential incentive to retrofit homes and businesses.

Transportation

The greatest challenge facing Ottawa's transportation sector is the growing population and continued reliance on the automobile as the preferred mode of travel. Growth in vehicle emissions, as illustrated in **Figure 7**, indicates that increased automobile ownership and use are outstripping improvements in auto emissions technologies.

Figure 7 - Vehicle Emissions: 2004, 2008, 2012 (kt CO₂e)



In 2013, the City adopted a *Transportation Master Plan* with a key goal being to increase walking, cycling and transit use. To that end, the City recently commenced a \$2.1 billion five-year light-rail transit (LRT) project that is expected to facilitate the achievement of a transit modal share target of 26% by 2031¹⁹. Stage 2 of the LRT network²⁰ will add a further 35km and 19 new stations to the system, and by 2023 is anticipated to provide 67% of the

population with LRT service within 5 km of their doorstep.²¹

Implementation of the light rail project is expected to reduce OC Transpo fleet emissions by approximately 94,000 tonnes per year by 2031. The Plan also recommends more cycling lanes, improvements to pathways in the City, and encourages car pooling.

As the City invests in light rail and vehicles to help promote transit use, the corporation will need to focus on ensuring the following:

- development occurs near transit;
- other incentives and disincentives are used to move people out of cars and onto transit; and
- fleet emissions continue to be managed by the corporation.

Furthermore, there is significant opportunity to increase the availability of charging stations for electric vehicles (EV) at key locations across Ottawa to facilitate uptake of EV by the public.



City of Ottawa hybrid vehicle

Solid Waste

Since 2008, the City has successfully reduced GHG emissions at the Trail Waste Facility by 18% through installation of the landfill gas-to-energy (LFG) facility and annual expansion and upgrades to the LFG collection system; and through implementation of the Green Bin program and bi-weekly garbage collection, both of which have reduced the tonnage sent to landfill.



LFG plant at Trail Waste Facility

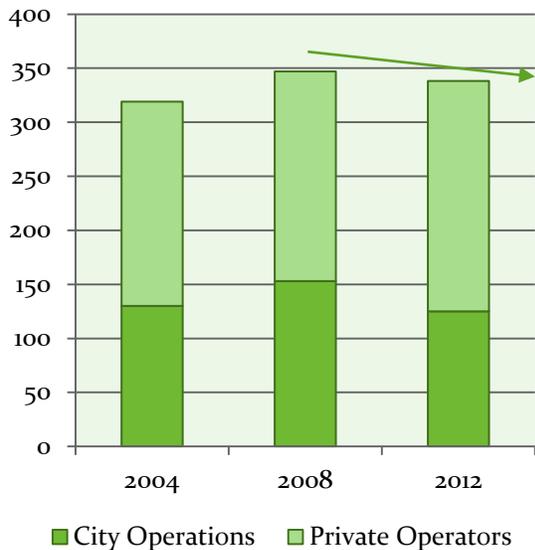


City recycling bins at curb

As shown in **Figure 8**, both the City and community have achieved emission reductions since 2005 despite an increase

in population. Unfortunately, the existing calculation methodology does not adequately allow for diversion programs and assumes that all waste from the industrial, commercial and institutional sectors goes to landfill. Therefore, the degree of reduction is likely underestimated.

Figure 8 - Solid Waste Emissions: 2004, 2008 and 2012 (kt CO₂e)



Complete inventory results are available in Appendix A.

Other Performance Indicators

Measuring GHG emissions is just one way of assessing how we are performing as a community in the areas of energy management and risk mitigation.

Smog Alerts & Respiratory Statistics

Smog advisories are issued by the Ministry of the Environment and Environment Canada. Since 2004, Ottawa has had between zero to five smog advisory days per year, with the exception of 2005 which saw a spike in advisory days at 25.

Ottawa residents who are most vulnerable to extreme weather events of heat and smog include people living with chronic illness (asthma, diabetes, heart disease, and respiratory disease) and those living alone.

In 2010, there were 258 hospitalizations due to asthma, a rate of 33.2 per 100,000 people in Ottawa. This rate is significantly lower than the rest of Ontario at a rate of 43.3 per 100,000 people. Hospitalization rates due to asthmas are highest for young children between 1-4 years old.

In 2008, the Ontario Medical Association estimated through a model analysis that roughly 500 premature deaths were attributable to smog pollution in Ottawa per year.²² This recognizes that a percentage of the population has underlying medical conditions such as cardiovascular disease that result in

complications of their pre-existing conditions that may result in death at levels of pollution healthy individuals may not even notice.

Energy Supply & Security

The electricity needs of the Ottawa region are met by a network of high voltage transmission lines which are an integral part of the Ontario bulk electricity system. Electricity is transmitted from Ontario power generating stations and delivered to homes and businesses through a network of distribution circuits.

Natural gas is delivered to Ottawa from Trans Canada Pipelines, receiving delivery at Richmond Gate, near the Village of Richmond and Hawthorne Gate on Hawthorne Road. In 2013 Enbridge completed a major pipeline reinforcement project in the west end to ensure system redundancy and future growth.

Locally, Energy Ottawa generates 38 MW at six hydroelectric stations at Chaudière Falls, and a further 6 MW at the Trail Road landfill gas-to-energy plant. And, roughly 764 MW of renewable generating capacity has been added to the grid through Hydro Ottawa and Hydro One projects.

In March 2014 Hydro Ottawa also announced a 40-year contract to expand Chaudière Falls increasing its capacity to 58 MW, enough clean energy to power 20,000 homes for a year.

Currently, FIT and MicroFIT contracts with the Ontario Power Authority (OPA) generally prohibit small generators from personally using the power they produce during a power outage. Increased local power generation, system breaks, and use of net metering and back-up systems would help to improve community security in energy supply but would involve multiple stakeholders like OPA, Ottawa Hydro, Hydro One, the Electrical Safety Authority, and others.

Natural Areas

Ottawa forests and wetland areas serve as natural water reservoirs, wind breaks, carbon storage areas, fuel reserves and air cleaners and help to moderate air temperatures and reduce overland water flow rates and erosion.

Remaining areas require landowner stewardship and protection in order that these functions are not lost. Tree cover in urban Ottawa is at 20%, well below the City's 30% target.

Appendix G expands on the value of retaining natural areas to mitigate the impacts of climate change, and a proposed approach for moving forward.



Tree planting to replace Emerald Ash
Borer losses



Home insulation installation

The Green Economy

According to Invest Ottawa,²³ this city has:

- Over 240 companies engaged in clean technologies.
- Over 4,600 people employed in clean technology.
- Over 2,000 post-secondary academic faculty supporting the clean-tech sector.

In 2012, the Canadian Mortgage and Housing Corporation reported that 42% of Ottawa households surveyed were planning to spend \$1,000 or more on a home renovation by the end of the year.²⁴

On-going investments in home renovations and upgrades represent a significant opportunity for the implementation of mitigating and adaptive measures. A well informed design and contractor community can help to encourage and facilitate those changes.

SETTING A NEW TARGET

Ontario's 2013 long-term energy plan forecasts modest increases in electricity generating capacity over the next twenty years based upon three key assumptions:

- ✓ continued reductions in per capita consumption
- ✓ continued trend toward less energy intensive economic development
- ✓ continued reductions in peak consumption

Between 2004 and 2012, Ottawa's **per capita emissions dropped from 7.3 tCO₂e to 5.8 tCO₂e**, a reduction of 20%.

Canadian municipalities are reporting difficulty in achieving their GHG reduction targets due to the effects of growth, despite the fact that their per capita emissions have decreased. For this reason, several municipalities such as Fredericton are moving towards setting per capita targets as a more realistic method of measuring the reduction in emissions.²⁵ (Appendix C identifies the approach and actions being proposed in other jurisdictions.)

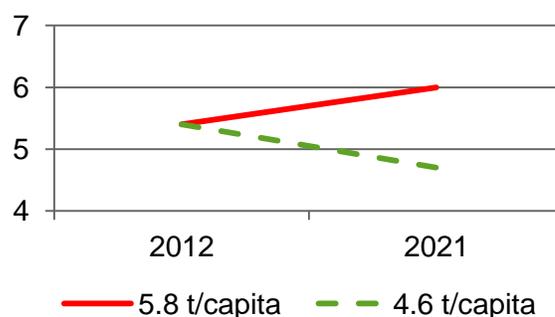
The 20% drop in per capita emissions seen since 2004 is largely attributable to changes at the provincial level in power generation. In April, the province of Ontario closed the last of the coal firing generators that were responsible for the higher emissions of the early 2000s. The *next* 20% reduction will require

individuals, businesses and institutions to take action.

Ottawa's population is projected to grow by 10,800 per year, roughly 1% per year, reaching 1,031,000 by 2021²⁶.

As shown in **Figure 9**, at the current 5.8 tCO₂e per person, community emissions could increase from 5,420 kt in 2012 to approximately 5,980 kt by 2021 simply due to population growth. If, however, through AQCCMP actions Ottawa can reduce per capita emissions to 4.6 tCO₂e, community emissions will actually decrease from 5,420 kt to 4,743 kt by 2021, or by approximately 12%.

Figure 9 - Projected Community Emissions (CO₂e Kt/year)



Therefore, to emphasize the need for individuals and organizations to take action moving forward, the **NEW TARGET** set by this Plan is the following:

By 2024:

Per capita GHG emissions decline to 4.6 tCO₂e.

SETTING PRIORITIES

While much has and is being done, there are several gaps yet to be filled. Moving forward, it is prudent to focus resources in areas that will enable the community to achieve this target. Therefore, it is recommended that the City of Ottawa's actions over the next five years focus on the following:

1. Continuing to implement cost effective improvements across City operations.
2. Working with partners to provide Ottawa residents with the information and tools they need to make informed decisions.
3. Working with partners to give assistance to those who want to make their homes, businesses, and investment properties more energy efficient and resilient.
4. Working with partners to provide direction and certainty to the design and construction industry for the creation of sustainable urban spaces and structures.
5. Developing a stewardship program to manage and secure land to serve as natural water reservoirs, wind breaks, air filters, and carbon sinks.

The attached Table of Actions identifies corporate actions; and community actions to be completed using existing funding. A comprehensive list of community actions

will be tabled early in 2015 and considered during the review of priorities for the next term of Council.

PERFORMANCE MONITORING AND REPORTING

Going forward, the corporate inventory will be completed annually and the community inventory once every four years, with a review and update of the Plan completed in five years.

In the interim, the following performance indicators are recommended to help assess the following:

- Progress towards the 2024 target;
- Achievement of Plan goals and objectives; and
- Effectiveness of the Action Plans.

Unless otherwise stated, the base year is 2012.

Corporate

1. No increase in corporate GHG emissions between 2012 and 2024.
2. No increase in GHG per customer-km from OC Transpo operations using 2013 as a base year.²⁷
3. Decrease annual kWh/m² purchased at City facilities by 4% by 2020.
4. Decrease the Total Litres Consumed per 100 kilometres for the municipal fleet by 8% by 2020.²⁸
5. Implement the *Wet Weather Infrastructure Management Plan* Flood Control Program by 2020, and 100% of flood relief measures by 2030.
6. Between 2012 and 2024, include renewable energy supplies in new city facilities wherever feasible.

Community

7. Between 2012 and 2024, no net loss of natural carbon storage areas (forests/wetlands).
8. Reduce per capita electricity use by 6% by 2020.
9. Reduce per capita residential natural gas consumption by 15% by 2020.
10. 50% of residents with sump pumps have back-up energy supplies by 2024.
11. Achieve the modal split targets contained in the *Transportation Master Plan*.
12. Achieve the waste generation and waste diversion targets contained in *Ottawa's Waste Plan*.

NOTES

¹ Refer to Appendix I for a discussion of mitigating risk through adaptation.

² 1991 and 2005 targets were set to conform to those recommended in the Kyoto Accord.

³ The base year 1990 was chosen in accordance with the Kyoto Protocol, however, data for that year is incomplete. GHG inventories conducted in 2004, 2008, and 2012 followed internationally recognized methods and are used to track our performance.

⁴ Ontario Ministry of Environment. *Achieving Balance: Ontario's Long-Term Energy Plan*, 2013.

⁵ Ibid

⁶ City of Ottawa. Annual Development Report (various years); net hectares refers to private lot fabric, excluding municipal right-of-ways and parks.

⁷ Ottawa Road Safety Reports

⁸ City Origin and Destination Survey

⁹ City of Ottawa. *Ottawa On the Move*, Vol. 1 2013.

¹⁰ City of Ottawa. Annual Development Report 2012. September 2013

¹¹ Canadian Public Health Association. *Health Effects of Climate Change and Air Pollution*

¹² Refer to Appendix F for details.

¹³ Energy Ottawa and Hydro One.

¹⁴ <http://news.ontario.ca/mei/en/2009/05/ontario-legislature-passes-green-energy-act.html>

¹⁵ Ontario Long Term Energy Plan, Figure 16, page 35.

¹⁶ Source: Ontario Ministry of Environment. *Achieving Balance: Ontario's Long-Term Energy Plan*, 2013.

¹⁷ <http://ottawa.ca/en/residents/water-and-environment/green-buildings>

¹⁸ Source: National Household Survey (NHS) Profile, 2011

¹⁹ The current 2011 morning peak period transit modal share is 22.4%

²⁰ <http://ottawa.ca/en/news/transportation-plan-charts-stage-2-rail-east-west-and-south>

21 <http://ottawa.ca/en/city-hall/public-consultations/planning-and-infrastructure/frequently-asked-questions>

22 Illness Cost of Air Pollution Study by Canadian Medical Association

23 <http://investottawa.ca/industries/clean-technologies/>

24 Canada Mortgage and Housing Corporation. Renovation and Home Purchase Report.

25 City of Fredericton Community Update January 2011

26 Ottawa 2013 Official Plan

27 During the years of detours leading up to the completion of the Confederation Line, OC Transpo's fuel consumption will likely increase, while ridership may not. It will be important to make sure that longer average trip lengths (due to detours) are captured so that total customer-kms increase similarly to total fuel consumption (and GHG emissions).

28 Municipal Fleet includes all light, medium, and heavy vehicles, but excludes police, transit, and off-road equipment.

Document 2: Taking Action

The following is a short-list of recommended actions based upon Roundtable results, subsequent research and assessment, and one-on-one consultations with key stakeholders. Actions with asterisks (**) are recommended for consideration in the 2015 budget. The remaining actions are for consideration by the new Council in its priority setting process for implementation thru to 2018. The actions are divided into corporate actions and community actions.

CORPORATE ACTIONS

Priority: Continue to implement cost effective improvements across City operations.

Buildings and Facilities	Supports Mitigation	Supports Adaptation
1. **Convert Ottawa's street lighting system to LED by 2020.	✓	
2. Complete an energy vulnerability assessment of all City facilities focusing initially on those that serve as emergency shelters.		✓
3. Develop a back-up power strategy that includes renewable energy supplies.		✓
4. Explore the possibility of using the existing City emergency power assets as a peak shaving measure for both the grid and City facilities.	✓	
5. **Work with the Ontario Power Authority (OPA), Electrical Safety Authority, Energy Ottawa and/or others to ensure FIT installations at City facilities can be used as a back-up energy supply.		✓
6. Develop a City policy re: EV charging stations and solar PV at new and existing City buildings.	✓	
7. Work with Hydro Ottawa to install EV charging stations in strategic locations at City facilities.		✓
8. Implement mitigating 'green' or cooling measures, as feasible, around City facilities, to reduce the 'Heat Island' effect.		✓
9. Explore the feasibility of a 'right-to-light' policy provision.	✓	
10. Continue to: <ul style="list-style-type: none"> ✓ Benchmark and monitor energy/water usage in City building types ✓ Implement the corporate Energy Management and Investment Strategy (formerly Smart Energy) ✓ Implement the corporate policy re: LEED construction for new City buildings ✓ Consider 'green roofs' on City facilities, as feasible 	✓	✓

Buildings and Facilities	Supports Mitigation	Supports Adaptation
<ul style="list-style-type: none"> ✓ Work with Energy Ottawa on the solar roof-top initiative on City facilities. ✓ Provide the services of an energy manager for city-based P3 and Alternative Funding Projects ✓ Insert within the RFP/RFQ documents procurement clauses that encourage vendors to provide City with available financial incentives from existing utility programs to deliver on energy efficiency objectives while controlling cost. 		

Transportation and Fleet	Supports Mitigation	Supports Adaptation
1. Investigate opportunities to use City 'community centre' parking lots, outside the Greenbelt, in proximity to transit services, to serve as <i>Park & Ride</i> or designated carpooling locations, similar to the success at Bob MacQuarrie and Ray Friel Recreation Complexes.		✓
2. Investigate and identify policies and programs to reduce automobile use and encourage alternative modes of transportation by 2018.	✓	✓
3. **Implement Vehicle Telematics for Municipal Fleet.	✓	✓
4. Continue to: <ul style="list-style-type: none"> ✓ Implement the Transportation Master Plan, including the Cycling and Pedestrian Plans ✓ Design and build 'Complete Streets' per Transportation Master Plan ✓ Support Transit Oriented Development initiatives ✓ Procure buses and other Transit vehicles that meet the latest emissions standards available at the time of manufacture ✓ Incorporate SmartDriver techniques into all driving instruction for all driver training at Transit Services ✓ Provide OC Transpo services for Ottawa festivals such as Canada Day, Bluesfest, Race Weekend, Folk Fest, Winterlude and other special events ✓ Monitor the Idling By-law and internal related procedures ✓ Update and implement the Green Municipal Fleet Plan, including the purchase of hybrid and electric 	✓	✓

Transportation and Fleet	Supports Mitigation	Supports Adaptation
<p>vehicles, as appropriate</p> <ul style="list-style-type: none"> ✓ Use the 'Eco-Driving' training policy/ practice ✓ Pilot the creation of 'bike and ride' amenities at designated community facilities (e.g. currently being piloted at Bob MacQuarrie Complex) ✓ Replace vehicles at their optimal life cycle dates so that the older vehicles are replaced with newer vehicles which are more fuel efficient and meet current emission standards. Funding for vehicle replacements is subject to Council approval as part of the annual budget process. ✓ Use 'grit' instead of sand as an abrasive on the roads, thus reducing particulate in the air and in catch basins and rivers ✓ Use regenerative air sweepers and proactive spring time sweeping program to reduce particulate matter in the air and out of the rivers ✓ Use 'Smart About Salt' program and monitoring of pre-wetting to reduce salt use ✓ Implement current road operational practices that have adapted to climate change, such as location of snow disposal facilities and the installation of real-time Weather Information Systems. ✓ Encourage flexible working schedules/locations for city employees, where feasible. 		

Stormwater Management, Solid Waste, and Wastewater	Supports Mitigation	Supports Adaptation
1. Complete and begin to implement the Eastern Subwatershed Stormwater Retrofit Plan.		✓
2. Add co-gen generating capacity as needed at the Robert O. Pickard Environmental Centre; work with Hydro Ottawa, OPA and Electrical Safety Authority and others to explore using the existing and expanded co-gen capacity for back-up supply.	✓	✓
3. Continue to: <ul style="list-style-type: none"> ✓ Promote and implement Low Impact Development Practices e.g. permeable pavement, grass swales, etc. ✓ Implement the Wet Weather Infrastructure Management Plan ✓ Implement the Infrastructure Master Plan 		✓

<ul style="list-style-type: none"> ✓ Expand recyclable collection and services across City facilities and in key public locations. ✓ Implement the Ottawa River Action Plan ✓ Implement the Pinecrest-Wesboro Stormwater Retrofit Plan ✓ Implement the Source Water Protection Plan(s) ✓ Complete and implement the Waste Plan, looking for ways to increase diversion 		
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Land Use and Agriculture	Supports Mitigation	Supports Adaptation
1. **Identify and prioritize land for protection, acquisition, and naturalization, taking climate change into consideration.	✓	✓
2. Increase the City's Land Acquisition Fund reserve.	✓	✓
3. **Complete the Forest Management Strategy that identifies ways to increase tree cover and maintain the health of this City asset.	✓	✓
4. Continue to: <ul style="list-style-type: none"> ✓ Implement the Official Plan (e.g. intensification measures) ✓ Promote green buildings through the development review process ✓ Invest in existing roads, water, wastewater, transit facilities and other infrastructure so that it can support redevelopment ✓ Implement the EAB Strategy ✓ Support the community garden program ✓ Base planning decisions for rural and urban communities on watershed and subwatershed plans that document existing conditions, assess the impacts of land use, and recommend way to protect and enhance the natural system ✓ Implement restoration measures in consultation with conservation authorities, landowners and others. 	✓	✓

Emergency Management	Supports Mitigation	Supports Adaptation
1. Implement Hazard Identification and Mitigation Program and Plan.		✓
2. Continue to: ✓ Review and refine the Hazard Identification and Risk Assessment for the Emergency Management Program; identifying natural, human-caused and technological hazards to the City of Ottawa based upon provincial guidelines and industry best practices ✓ Identify corporate resources through an Emergency Energy Plan, to address emergency energy-related issues		✓

Community Actions

There are many actions that the City can take to inform and assist the community in achieving reduced emissions. Options for further action will be tabled early in the next term of Council and undergo public review. In the meantime, staff would initiate the following actions in 2014, within existing resources. They are necessarily focused on working with partners to encourage individual and agency actions, as most changes are not within the control of the City.

1. Establish a Working Group to examine opportunities and constraints to building-use conversions in the downtown (in advance of anticipated reductions in federal government tenancy) and establish design requirements.
2. Explore the development of a local GHG Inventory process that assesses ways to potentially tailor the methodology to better reflect local Ottawa community conditions.
3. Establish a Task Force to investigate opportunities for district heating in the downtown.
4. Undertake an Energy Mapping analysis (similar to Guelph) to inform program options moving forward.

Appendix A – GHG Inventory Summary

1.0 INTRODUCTION

The purpose of this document is to present the 2012 community and corporate GHG inventory results; and to identify factors that led to changes since 2004 and 2008.

2.0 BACKGROUND

The City of Ottawa is a member of the *Partners for Climate Protection* (PCP) program of the Federation of Canadian Municipalities (FCM). The PCP is a network of Canadian municipalities committed to reducing GHG emissions and acting on climate change. The partnership currently has 240 municipal members, accounting for over 80% of the Canadian population.¹

The PCP program comprises five “milestones” used to guide municipalities to reduce their GHG emissions. As illustrated in Figure 1, both Milestones 1 and 5 require municipalities to inventory and monitor GHG emissions. In 2012, the City reached Milestone 5 and became one of only 21 municipalities to have completed all five steps.

Figure 1: PCP Program Milestone Framework



3.0 VARIABLES AFFECTING GHG EMISSIONS

GHG emissions and air quality are directly related to how much energy we consume, which is a function of many variables including the following:

- Population – Everyone is a consumer of energy. As the population of a community grows, so does energy demand unless people reduce their individual usage.
- Weather – Summer and winter temperatures place pressure on heating and cooling systems. Years with high snow fall increase vehicle gas consumption and snow removal requirements. Hot humid summers place pressures on the electricity grid.
- Power generation methodologies – In 2014, Ontario Power Generation closed the last of the province’s coal-fired electricity generating plants. More than any other action, the phase-out of coal power generation has reduced GHG emissions in Ontario, and by extension emission calculations for Ottawa.
- Regulatory changes – For example, changes in building codes and electrical standards can significantly reduce the demand for energy by requiring the construction of efficient buildings and installation of efficient fixtures; and, the requirement for waste recycling can reduce the volume going to landfill and consequent methane emissions.
- Technological changes – Regulatory change can drive technological improvements, and technological changes can drive the need for regulatory change. With the advent of the automobile came increased personal vehicle use, increased fuel consumption, and ultimately regulations governing vehicle emissions. Advancements in solar photovoltaic and other renewable energy supplies have the potential to further reduce GHG emissions per kWh consumed, and Ontario’s new Energy Plan directs that these new technologies be used. In a similar vein, reduced demand for electricity to power inefficient vacuum tube technologies has been offset by the pervasive use of modern electronic devices by a growing population.
- Energy availability and price – How much energy we use is a function of how much we must buy to meet our basic needs, and how much we can afford to buy to meet our wants. In Ontario, electricity prices are regulated to ensure that people of limited financial means can afford their basic needs; but are also set to discourage peak usage. Vehicle fuels are subject to a gas tax that discourages waste, and that can be used to fund transit systems.
- Consumer behaviours – Individual energy use and GHG emissions are a function of how we drive and care for our vehicles; the model of appliances we purchase; the degree to which our homes are well insulated and sealed; and any number of other consumer behaviours and decisions.

Most of these variables are NOT considered by the GHG model, which necessarily simplifies these and other factors to a few key variables. Community GHG emissions, in particular, are general approximations that are used to provide order of magnitude results for gross trend analysis.

3.1 Population Growth

Between 2004 and 2012, Ottawa’s population increased by roughly 86,000 people or 10%.

3.2 Weather

Figure 2 and 3 illustrate differences in temperature and snow fall between 2004, 2008, and 2012. Of note:

- The year 2008 saw significantly higher than average snowfall in February and March, which experienced 92.4 cm and 97.4 cm, respectively (compared to an average of 34.7 cm and 29.1 cm, respectively.)
- The average daily High temperature during July and August 2012 was 4°C above those experienced in 2004 and 2008; and the average daily Low temperatures in January 2004 was 6 and 8 degrees colder than in 2012 and 2008, respectively.
- Following a mild winter and low rainfall in 2012, level one and two droughts were declared for the Rideau River watershed whereby residents were asked to voluntarily cut their water consumption by 20%.² The lower rainfall also had an impact on the local agricultural section including livestock operations.³

Figure 2: Minimum (Nov-April) and Max Day (May-October) Avg. Temperatures (°C)

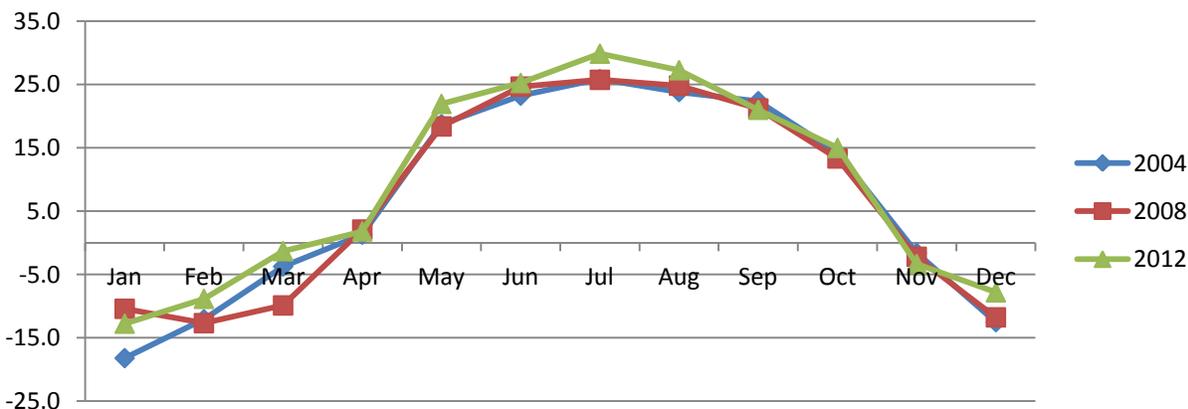
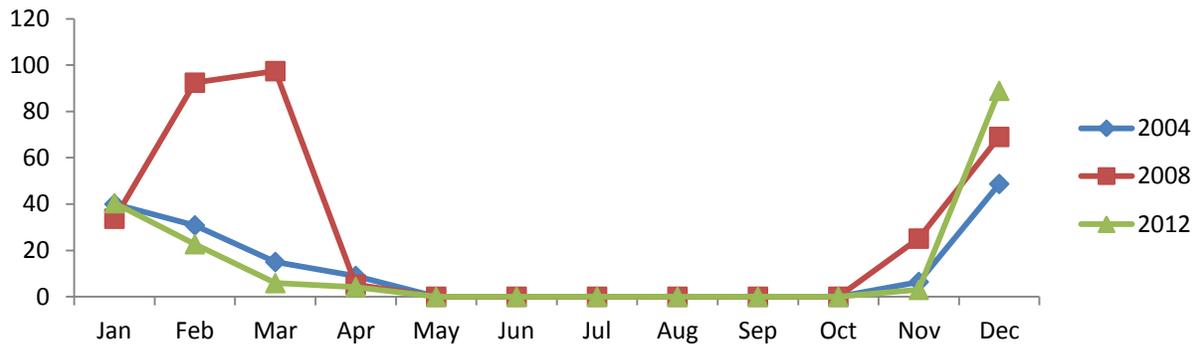


Figure 3: Total Snowfall (cm)



4.0 METHODOLOGY

GHG inventories carried out under the PCP program use the methodology established by ICLEI (www.iclei.org) and the protocols recommended by the Intergovernmental Panel on Climate Change and the World Resource Institute. The Canadian Standards Association (CSA) was contracted by the City to complete the 2012 inventory, and updated the 2004 and 2008 solid waste results based upon more current data and changes made to the reporting methodology. (Inventories are undertaken using the best available information at the time and may be revised subsequently if better data becomes available or improvements are made to GHG emissions modeling and analysis.)

Generally speaking, the approach used to calculate GHG emissions is the following:

- Within each sector (e.g. buildings, transportation), identify the primary sources and quantity of energy consumed (e.g. kWh of electricity, litres of heating oil) or gases generated (e.g. m³ of methane);
- Apply an emissions factor to each fuel type (different combustion processes yield different gases in varying quantities (i.e. tonnes of CH₄, CO₂, and N₂O));
- Apply a global warming factor that identifies the magnitude of impact of those emissions have on the atmosphere as measured in CO₂e⁴; and
- Sum the emission equivalents within each sector; and then across all sectors to yield the community or corporate results.

The inventory is divided into two categories for analysis: corporate and community emissions. **Corporate** emissions are defined as all emissions under the direct operational control of the City and include emissions from facilities, fleet (transit,

municipal, and police), solid waste, and wastewater treatment. Most data used to calculate corporate emissions come from municipal sources.

Community emissions are attributed to Ottawa as a whole and include emissions from buildings, transportation, solid waste, wastewater, and agricultural sources. Data used to calculate community emissions come from a variety of sources including City departments, Statistics Canada, and Natural Resources Canada.

As shown in Figure 4, the community inventory includes the corporate emissions since it comprises all activities within the community. Therefore, the corporate and community inventories are NOT to be added.

Figure 4 - Inventory



As noted previously, while community emissions are dependent on the choices that Ottawa residents make and can be influenced by the policies and programs of the City, the model is not that robust, and uses limited locally generated data.

Community GHG emission results are largely derived by applying provincial and federal metrics on a pro-rated basis to Ottawa and do NOT reflect actual energy consumption and emissions in Ottawa. While these data sources are the best available at this time, they lack the accuracy and subtleties that could be captured by using local data. As importantly, the current methodology limits the ability of the City to assess the impact of local programs and actions on community emissions. For this reason, it is recommended that the methodology be revised for the next round of emission calculations. By comparison, **Corporate** emissions were calculated using actual energy consumption or site-specific derived approximations, and yield more accurate GHG emissions results. That said, none of the results are exact as the methodology is continuously changing and improving and as a result, the final figures are only accurate in terms of their order of magnitude.

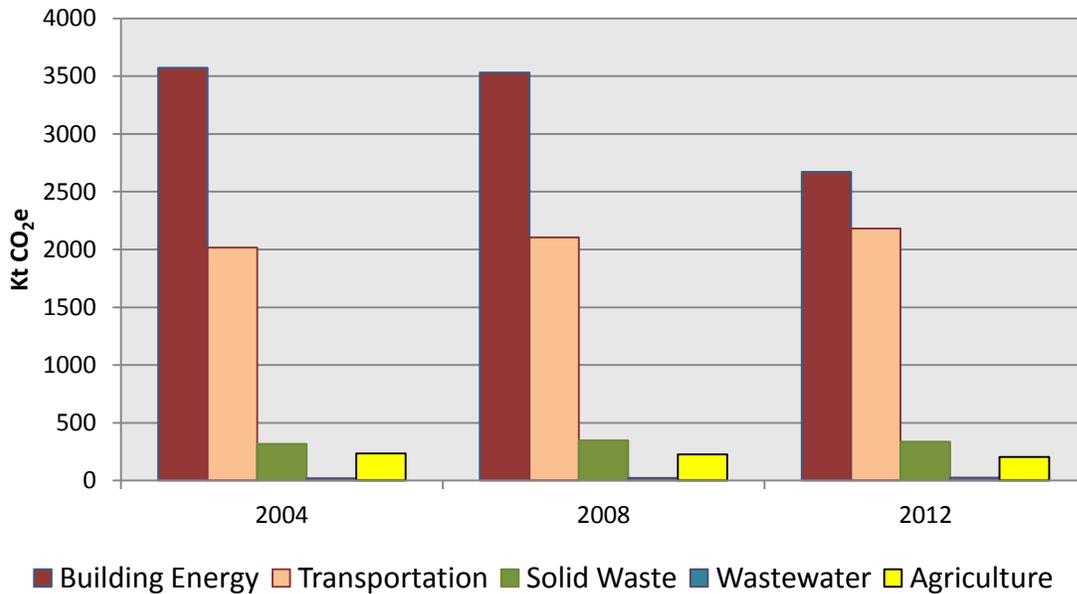
5.0 RESULTS

Due to the simplicity of the GHG emissions model, all Community results are rounded to the nearest kilotonne (kt.) Emissions are quoted in “CO₂e” or equivalent CO₂.

5.1 Overall Results

Figure 5 and Table 1 contain Community emissions by sector for the years 2004, 2008, and 2012 and show that, since 2004, community emissions have declined in the order of 12%. The greatest decrease occurred in emissions arising from the heating and cooling of buildings; and the greatest increase was in transportation emissions.

Figure 5: Community GHG Inventory Results



The drop in building emissions is largely due to the province's phase-out of coal powered electricity generation. Between 2008 and 2012, building emissions dropped by 30%. By comparison, emissions dropped by only 5% between 2004 and 2008.

Table 1: 2004, 2008, and 2012 Community Inventory Results

Emission Source	Emissions (kt CO ₂ e)			% Change between 2004 and 2012
	2004	2008	2012	
Building Energy	3,571	3,531	2,671	-25%
Transportation	2,016	2,105	2,181	8%
Solid Waste	319	347	338	6%
Wastewater	20	22	25	25%
Agriculture	234	227	205	-12%
Total	6,160	6,232	5,420	-12%

Emissions per Ottawa resident dropped approximately 21% between 2004 and 2012, from 7.3 to 5.8 t CO₂e per person as illustrated in Figure 6.

Figure 6: Population and Community GHG Emissions

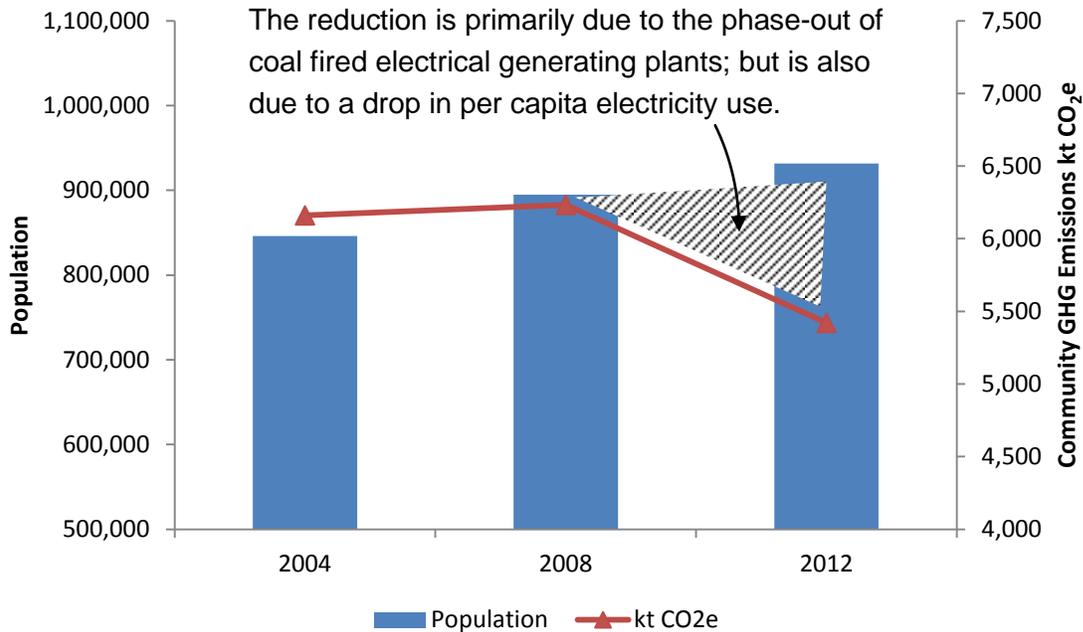


Figure 7 and Table 2 present **Corporate** inventory results for the years 2004, 2008, and 2012, and show that since 2004 emissions have decreased by 20.6 kt CO₂e, or 6%. Most of this reduction was achieved through implementation of an energy savings at municipal facilities; and due to the commissioning and operation of the landfill gas to energy co-gen plant at the City's Trail Waste Facility.

Figure 7: Corporate Inventory Emissions Results

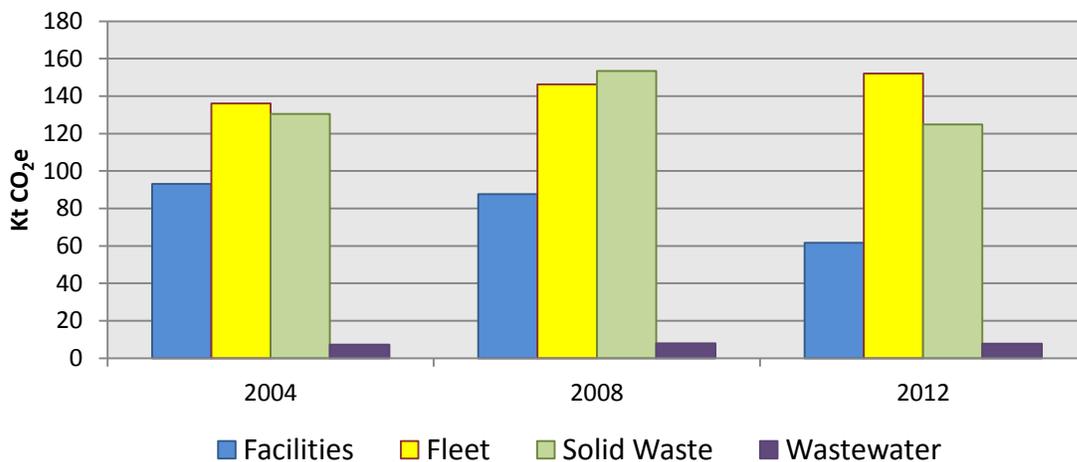


Table 2: 2004, 2008, and 2012 Corporate Inventory Emissions Results

Emission Source	Emissions (Kt CO ₂ e)			% Change between 2004 and 2012
	2004	2008	2012	
Facilities	93.1	87.7	61.7	-34%
Fleet	136.1	146.3	152.0	12%
Solid Waste	130.4	153.4	124.8	-4%
Wastewater treatment	7.2	7.9	7.7	7%
Total	366.8	395.3	346.2	- 6%

The following sections contain detailed results by sector. Explanations of results are largely confined to corporate emissions as, with few exceptions, community results cannot be tied to local actions and programs.

5.2 Facilities and Buildings Energy

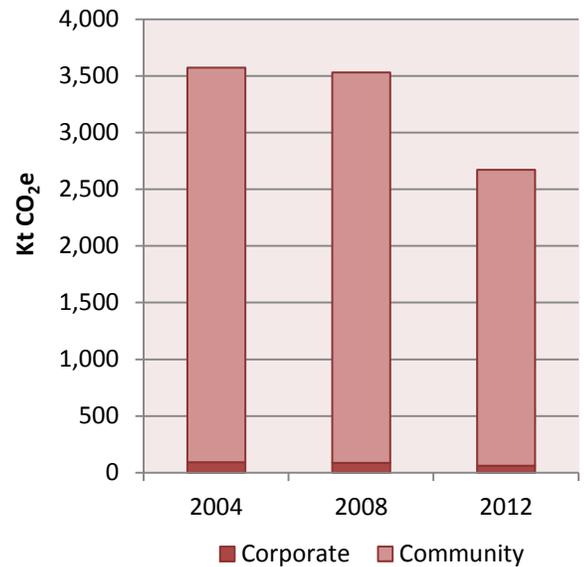
Between 2008 and 2012, community emissions from buildings dropped 25%, the largest reduction amongst all sectors. As noted previously, this decline is largely due to the province’s phase-out of coal fired electricity generating plants and move towards “cleaner” power generation sources, which reduced the provincial electricity intensity factor from 170 gCO₂/kWh to 97 gCO₂/kWh. Such a significant drop in this factor is unlikely to occur again as the last coal plant was closed in early 2014. Table 3 provides the steps followed to calculate emissions from all buildings in Ottawa; and, as a subset, how emissions were calculated for City facilities.

Table 3: Approach used to calculate Emissions from Buildings⁵

Residential Building Emissions	Commercial/Institutional Building Emissions	Corporate Facility Emissions
<ol style="list-style-type: none"> 1. Residential energy use in Ontario (peta joules.) 2. Prorate to the population living in Ottawa. 3. Divide into fuel/energy types 4. Multiply by emissions factors 5. Multiply each gas by its global warming potential factor. 6. Sum resultant CO₂e across all fuel types. 	<ol style="list-style-type: none"> 1. Commercial/Institutional energy use in Ontario (PJ) 2. Prorate to the number of jobs in Ottawa. 3. Divide into fuel/energy types 7. Multiply by emissions factors 4. Multiply each gas by its global warming potential factor. 5. Sum resultant CO₂e across all fuel types. 	<ol style="list-style-type: none"> 1. Sum all energy consumption billed to the City in 2012 by fuel/energy type. 2. Multiply volume of each fuel type by its emissions factor. 3. Multiply gases emitted by their global warming potential factor. 4. Sum resultant CO₂e across all fuel types.

As shown in Figure 8, between 2008 and 2012, municipal facilities increased in size by 670,000 sq.ft. Despite this, corporate building emissions declined by 30% due to a combination of actions carried out under the City's *Energy Management and Investment Strategy*, and the effect of the above noted change in the energy emissions factor for electricity. Without the change in the emissions factor, facility emissions would have declined by only 3% from 2008 levels⁶. However, the 3% decrease is fully attributable to significant work undertaken to improve energy efficiency at City facilities.⁷

Figure 8: Building/Facility Emissions



Most City facilities are heated and cooled by natural gas and electricity, with some also using heating oil or propane. Since 2003, the City has been increasing the number of natural gas accounts, rising from 241 accounts to 335 accounts. While some of these accounts were for new facilities, a large number of accounts were because of conversions to from heating oil and other energy sources to natural gas and natural gas has a lower emissions factor than the former. Other example projects carried out under the City's energy strategy are the following⁸:

- Replacement of High Density Discharge lamps and fixture in arenas with T5HO fluorescent technology (43 ice pads completed) (2007-2010);
- Replacement of all the T12 fluorescent lighting technology in the City with T8 technology (2004-2012);
- Three solar photovoltaic systems were installed through the Ontario's microFIT program with a total installed capacity of 23 kW: one on the roof of City Hall; one at the Transit Services Integrated Control Centre; and one at the Huron Early Education Centre (2010-2011); and
- LED lighting was installed at three indoor parking garages (2012).

Additionally, since 2005, all new corporate facilities over 500 m² are built to a minimum LEED Certified standard, and in some instances have achieved LEED Silver and Gold standards. The LEED policy has lowered the energy use per sq.ft. of new buildings.

5.3 Fleet and transportation

Table 4 provides the steps followed to calculate vehicle emissions. In summary, community transportation emissions were calculated by applying modelled results for one day over the entire year. Corporate GHG emissions were calculated using actual fuel consumed by the City’s fleet which includes: the transit fleet (i.e. OC Transpo, Para Transpo, O-Train), the municipal fleet (e.g. snow plows, garbage trucks, backhoes), and the police fleet. City fleet emissions are influenced by the size of the fleet, age and type of vehicles, actual usage, and fuel type. Biogenic emissions are excluded.

Table 4: Approach used to Calculate Transportation/Fleet Emissions⁹

Community Transportation Emissions	Corporate Fleet Emissions
<ol style="list-style-type: none"> 1. The City’s TRANs model is used to estimate total CO₂ emissions from vehicle trips for one weekday in October.¹⁰ 2. The one-day amount is applied over the entire year, with allowance for less traffic on weekends. 3. Vehicle counts during one hour of that one day are used to determine the ratio of vehicles on the road (80% light duty gasoline, 19% light duty diesel, 1% heavy duty diesel vehicles.) 4. CO₂ emissions are apportioned by vehicle/fuel type. 5. Emission factors are applied on a proportionate basis to each vehicle/fuel type to calculate tonnes of CH₄ and N₂O emitted. 6. Multiply tonnes of gas emitted by their global warming potential factor. 7. Sum resultant CO₂e across all fuel types. 	<ol style="list-style-type: none"> 1. Total fuel sales by type (gasoline, diesel, and propane.) 2. Multiply volume of each fuel type by its emissions factor. 3. Multiply tonnes of gases emitted by their global warming potential factor. 4. Sum resultant CO₂e across all fuel types.

In 2012, transit vehicles constituted approximately 75% of total corporate fleet emissions. Buses were the primary source, with less than 5% attributable to the O-Train and Para Transpo.

Between 2004 and 2012, transit fleet emissions increased by approximately 8% (almost 9 kt CO₂e); however, during that same timeframe, OC Transpo also increased its ridership by 12%, the number of kilometres travelled by 14%, and the number of buses increased by 300 to a total of 1,006. Over this same period, OC Transpo took the following actions that mitigated increases in emissions:

- Older buses were phased-out and new models purchased that included hybrids and double decker buses;

- A 'SmartDriver' training was introduced for bus drivers; and
- Network routing was optimized to better manage the kilometres travelled.

In 2012, **municipal** fleet (vehicles used by public works, ambulance, by-law etc.) constituted approximately 21% of corporate fleet emissions. Between 2004 and 2008, municipal fleet emissions increased by roughly 32%, but only increased by 3% between 2008 and 2012. Three key initiatives were used to mitigate increases in GHG emissions during this period:

- 40 hybrid vehicles were purchased;
- Fleet replacement was used to shift from diesel to gasoline powered vehicles;
- A higher ethanol-blend fuel was purchased.

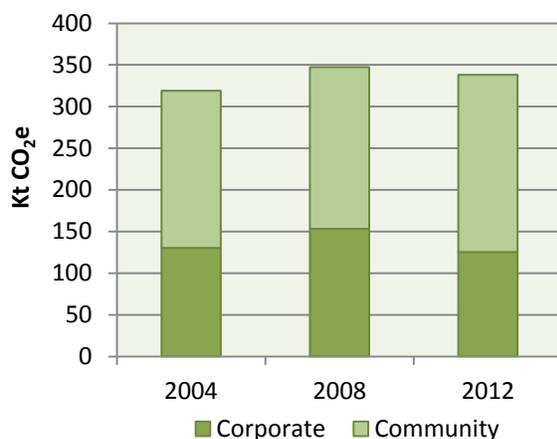
The **police** fleet makes up roughly 4% of the corporate fleet emissions. It experienced a similar trend as the municipal fleet, whereby the large shift from diesel to gasoline and the greater use of biofuels assisted in reducing emissions per vehicle.

Between 2004 and 2012, **community** transportation emissions increased by 165 kt CO₂e or 8%. Over that period, per capita transportation emissions saw a marginal drop from 2.38 t CO₂e per person to 2.34 t CO₂e. This may correspond to increased transit use, walking and cycling instead of private vehicle use and is a trend that will be monitored going forward.

5.4 Solid Waste

As with other sector emission calculations, community emissions are based upon the pro-rating of provincial data to Ottawa's population; and corporate emissions are based upon actual data or site-specific estimates for Trail Waste Facility (TWF.) Both the corporate and community emissions have been reduced by the amount of gas known to be collected and processed at the TWF, as shown in Table 5.

Figure 9: Solid Waste Emissions



Between 2004 and 2012, corporate solid waste emissions decreased by almost 6 kt CO₂e, or by 4%. In 2007, Powertrail Inc (a partnership between the City of Ottawa, Energy Ottawa, and Integrated Gas Services) introduced a landfill gas-to-energy plant at Trail Road that captures landfill gas and converts it into energy, minimizing the amount of gas that is flared

and yielding an 18% drop in emissions between 2008 and 2012

Between 2004 and 2012, community solid emissions increased by 22 kt CO₂e (6%), but decreased between 2008 and 2012 by 9 kt CO₂e (3%) as a result of the commissioning of the TWF go-gen plant. While the privately owned Carp Road landfill also underwent significant improvements in its landfill gas collection system during this period, the data needed to show reduced GHG emissions was not obtained. It is recommended that the City work with other local landfill operators to allow for improved and more representative reporting during the next inventory.

Table 5: Approach used to Calculate Emissions from Solid Waste

Community Emissions	Corporate Emissions (Trail Waste Facility)
<ol style="list-style-type: none"> 1. Amount of waste generated in Ontario. 2. Prorate to the population living in Ottawa. 3. Use Landgem model to estimate total GHG fugitive emissions (CH₄ and CO₂) generated from that tonnage of waste. 4. Subtract methane collected/processed at TWF (item 3 to right.) 5. Multiply net gases by their global warming potential factor. 6. Sum resultant CO₂e of both gas types. 	<ol style="list-style-type: none"> 1. Use reported emissions values sent to Environment Canada for Trail Waste Facility 2. Multiply <u>fugitive</u> landfill gases by their emissions factor. 3. Subtract CO₂ gas: <ol style="list-style-type: none"> a. recovered by the co-gen facility; b. recovered by the flare; 4. Multiply gases emitted from <u>co-gen</u> and <u>flare</u> by their global warming potential factor. 5. Multiply total tonnes of <u>leaf and yard</u> (L&Y) composted at Trail by their emissions factor 6. Multiply gases emitted from L&Y waste by their global warming potential factor. 7. Sum resultant CO₂e across all <u>sources</u>.

5.5 Wastewater Treatment

Wastewater emissions are generated from two primary sources: the City’s central sewage treatment plant: the Robert O. Pickard Environmental Centre (ROPEC); and from individual private septic systems. The only difference between the corporate and community emissions is that corporate emissions exclude septic system emissions while community emissions include them. Emissions were calculated based on a three-step methodology prescribed in the Climate Registry’s Local Operations Government Protocol. See Table 6 for a summary of how emissions are calculated.

As shown in Figure 10, community wastewater emissions have increased since 2004 with population growth and those living in the rural area on private septic systems. However, since 2008 there has been a modest reduction in emissions at ROPEC

attributed to an approximately 7% decrease in N₂O emissions from effluent discharged. (Emissions from effluent discharge account for roughly 70% of total wastewater emissions.)

Comparing 2008 and 2012, there was very little change in the number of people using septic tanks; however the BOD₅ load coefficient (i.e. the biological oxygen demand) in 2008 was lower than what was used to calculate 2012, which accounts for the change between years.

Table 6: Approach used to Calculate Emissions from Wastewater Treatment

1. CH₄ Emissions from ROPEC digesters	2. N₂O emissions from ROPEC processes	3. N₂O emissions from ROPEC effluent w/o denitrification¹¹
<ol style="list-style-type: none"> 1. Volume of digester gas produced in a day, applied over a year. 2. Multiply by fraction that is CH₄. 3. Multiply by default CH₄ destruction efficiency of digesters. 4. Multiply by global warming potential factor for CH₄. <p>PLUS</p> <ol style="list-style-type: none"> 5. Sum gases released: <ol style="list-style-type: none"> a) by the co-gen plant; b) by the flare; c) by boilers; and d) due to emergency releases. 6. Multiply by fraction that is CH₄. 7. Multiply by global warming potential factor for CH₄. 	<ol style="list-style-type: none"> 1. Population served by ROPEC. 2. Multiply by default factor for industrial and commercial discharges. 3. Multiply by default emission factor of N₂O released per person per year. 4. Multiply by global warming potential for N₂O. 	<ol style="list-style-type: none"> 1. Actual average Nitrogen discharged per day, applied over a year. 2. Multiply by N₂O emission factor wastewater effluent 3. Multiply by global warming potential factor of N₂O. <p>PLUS</p> <ol style="list-style-type: none"> 4. Population served by ROPEC. 5. Multiply by default factor for industrial and commercial discharges. 6. Multiply by kg of N produced per person over a year; MINUS nitrogen uptake during aerobic and anaerobic processes; MULTIPLIED by kg of BOD₅ produced per person over a year. 7. Multiply by default N₂O emission factor for wastewater effluent. 8. Multiply by global warming potential for N₂O.
For Community Emissions, add CH₄ emissions from private septic systems		
<ol style="list-style-type: none"> 1. Estimated population using septic systems. 2. Multiply by kg of BOD₅ produced per person over a year. 3. Multiply by default maximum CH₄ producing capacity of wastewater. 4. Multiply by efficiency factor of septic systems. 5. Multiply by global warming potential factor for CH₄. 		

Figure 10: Wastewater Emissions

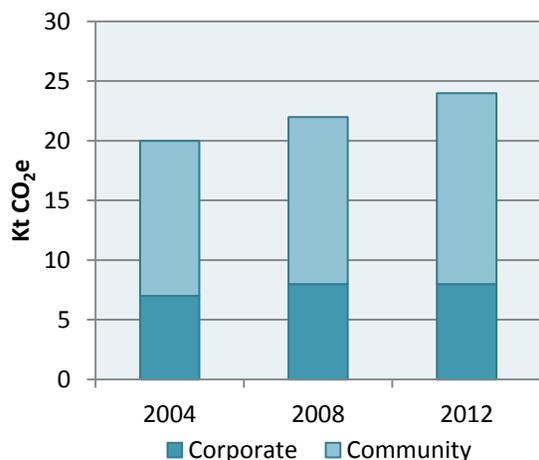
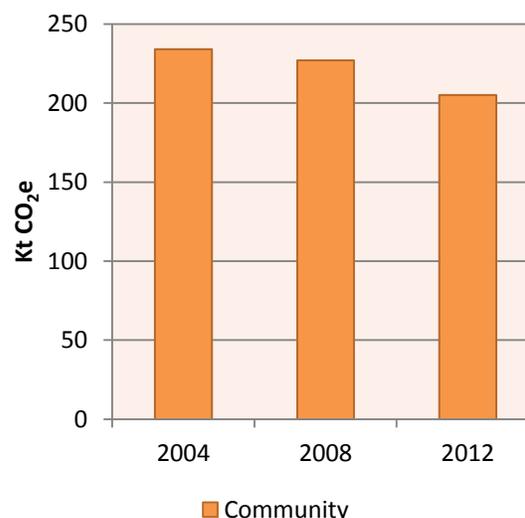


Figure 11: Agricultural Emissions



5.6 Agricultural Emissions

Agriculture is calculated within the community inventory only and includes agricultural land use and livestock operations. Emissions are calculated by prorating estimated provincial emissions from crop production and livestock operations to Ottawa based upon population. Emissions from soil vary according to whether it is in pasture, range or paddock use; and from livestock according to whether it is cattle or pig manure.

Between 2004 and 2012, emissions have been declining due to an apparent decline in the number of livestock farms and the number of animals. The calculations do not allow for the growing trend towards using biogen plants under the FIT program; or for the distribution and concentration of such farms across the province.

6.0 CONCLUSION AND RECOMMENDATION

While not a precise science, GHG emission calculations allow a community to see where and how they are generated, and to identify opportunities for improvement. The 2012 results, and year over year comparisons illustrate the impact of actions carried out by the corporation, particularly at the landfill and city facilities, but do not adequately show what is being done in the community. It is recommended that work be undertaken to improve the methodologies used for Ottawa in cooperation with ICLEI and community partners, to allow the 2018 inventory to be more robust and relevant to Ottawa.

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- 1 Partners for Climate Protection <http://www.fcm.ca/home/programs/partners-for-climate-protection.htm>
 - 2 <http://www.cbc.ca/news/canada/ottawa/level-two-drought-conditions-announced-1.1273025>
 - 3 http://www.agr.gc.ca/cb/index_e.php?s1=n&s2=2012&page=n120827a
 - 4 Equivalent CO₂ is a measure of the impact of radioactive gases such as methane and NO_x on the net amount of energy absorbed and held by the earth's atmosphere.
 - 5 Emissions were calculated based on provincial data from the National Energy Use Database and Statistics Canada, and emissions factors and intensity factors provided by Environment Canada.
 - 6 Calculation uses the 2008 electricity consumption intensity rate
 - 7 Data was provided by the City's Public Works Department based upon actual amounts purchased from electricity and fuel suppliers.
 - 8 Energy Conservation and Demand Management Plan 2015. Tabled April 2014 at Environment Committee.
 - 9 Data was provided by Transit Services, Public Works, and Environmental Services Departments, as well as Ottawa Police Services.
 - 10 The model was run to analyze one day in October as it is thought to represent the most accurate depiction of traffic in Ottawa as tourism levels are low, schools are running at normal capacity, and business travel is assumed to be average. Only one day was modelled due the extensive amount of time required to model city traffic.
 - 11 Plants with nitrification/denitrification treatment processes generate lower quantities of N₂O than those that lack those facilities, such as ROPEC. Accordingly, a different formula is used depending upon the treatment facilities in place.

Appendix B: 2005 Air Quality and Climate Change Management Plan Progress Report

1.0 Introduction

The 2005 Air Quality and Climate Change Management Plan (AQCCMP) included 18 actions to be completed to aid the City in achieving its corporate and community GHG emission reduction targets. Actions were phased to align with the Federation of Canadian Municipalities' Partners for Climate Protection milestones, as follows:

- Step 1: To create a GHG inventory and forecast
- Step 2: To set an emissions reduction target
- Step 3: To develop a local action plan
- Step 4: To implement the local action plan or a set of activities
- Step 5: To monitor progress and report on results

Since 2005, many of the actions have been completed. The following is a summary of the implementation status of 18 recommendations contained in the 2005 Plan.

2.0 Phase I: Planning and Monitoring

1. Refine Corporate Inventory of greenhouse gas (GHG) emissions including amalgamated municipalities.
 - Status: completed.
 - Details:
 - Baseline changed from 1990 to 2004; and
 - GHGs assessed and calculated for 2004, 2008, and 2012
 - Results updated in response to changing methodologies and receipt of new data.
2. Prepare a preliminary air emissions inventory and present summary to community.
 - Status: completed.
 - Details: emissions inventories were created and reported. For air quality, two areas had higher particulate matter (PM), and further studies at a more refined scale took place. The initial information was reported in 2008 and more detailed studies were completed. An [Air Quality Update](#) was provided to Council in September 2010.
3. Set-up and/or enhance an ambient air quality (AQ) monitoring program, and explore mobile PM_{2.5} monitoring station and ambient air monitoring analyzers.

- Status: completed.
 - Details: AQ monitoring was enhanced by the province, increasing the number of provincial AQ stations from one to two. Also two roadside mobile monitors were purchased and have been deployed upon request.
4. Identify steps to improve air quality in the community for such issues as smog, wood burning, road dust, etc.
 - Status: completed.
 - Details: a smog program was put in place by Public Health. The Air Quality Health Index was updated to include NO_x, O₃, and PM as pollutants. Partnerships involved Ottawa Public Health and the Province. In addition, the City purchased three new regenerative air street sweepers that reduce particulate matter (PM₁₀ and PM₂₅) through a closed loop vacuum system that collects dust and debris.
 5. Refine the community GHG emissions inventory and model future GHG emission levels.
 - Status: completed.
 - Details: A GHG inventory has been done for 2004, 2008, and 2012. The 2004 and 2008 results were reported to [Council in July 2012](#). Future emission scenarios were also prepared and included in the [Energy and Emissions Plan](#) received by Council in 2012.
 6. Refine priority air contaminant emissions data (incl. all sources e.g. road dust, mobile sources, heating and cooling, etc.).
 - Status: completed.
 - Details: AQ measurement was refined to 10 x 10 m resolution to include health impacts for key point sources of pollution. King Edward Street was monitored re: the impact of street widening on air quality. A 3D modeling of Albert Street was also created to understand the air canyon created by high-rise buildings.
 7. Initiate air quality source monitoring, and determine source apportionment of priority contaminants through modelling/ambient monitoring.
 - Status: completed.
 - Details: AQ was monitored at the OC Transpo Depot during its expansion. A report was completed. Some pre- and post- LRT monitoring was initiated.
 8. Stay current with climate change and air quality management initiatives in Canadian and international cities.

- Status: ongoing.
- Details: staff monitor reports, research pertaining to Climate Change; participate as feasible in webinars and workshops provided by federal and provincial government departments, non-government organizations and local conservation authorities; Ottawa is a member of Partners for Climate Protection Program through FCM and have access to resources and information.

Phase 2: Implementation of the Management Strategy

9. Research and implement possible regulatory changes for enhanced air quality and energy efficiency, explore the possibility of advocating for enhanced building energy efficiency considerations through changes to the Ontario and the National Building Codes, and identify potential changes related to energy efficiency and air quality responsibilities and requirements through the current update of the City of Ottawa Act.

- Status: completed.
- Details: the City provided input to the province's update of the Building Code. The new 2012 building code (Bill 51) requires greater energy efficiency than the previous codes. Air quality, climate change, and energy efficiency were integrated into the new Official Plan (2013) which in compliance with the new [Provincial Policy Statement](#) that came into effect April 2014. Staff participated in the 'Collaboration on Home Energy Efficiency Retrofits in Ontario (CHEERIO) initiative. And, most recently the Local Improvement Charge mechanism was examined as a tool to foster energy retrofits existing buildings.

10. Complete "already underway" management actions, as follows:

- a) Continue community/corporate vehicle anti-idling campaign.
 - Status: completed.
 - Details: building on the initial Anti-Idling Awareness Campaign (community centres, libraries, administration buildings) a more focussed Anti-idling Awareness Campaigns took place internally for specific fleets and externally for schools and hotels. Funding was provided by the federal government for all campaigns. In 2007, an [Idling Control By-law](#) was put into effect and included an education component with By-law Services. Data showed that the education campaigns and the By-law were effective. Ottawa Police implemented their own anti-idling policy and partnered with the National Research Council to develop a technical solution for their vehicles to reduce idling. This solution, initially designed for military vehicles and adapted to be

suitable for police vehicles, was installed in 30 Ottawa Police vehicles in 2012. Significant fuel savings were achieved as police vehicles idle 60% of the time.

b) Continue the City's corporate building retrofits.

- Status: ongoing.

Details: Between 2010-2014, Ottawa's Public Works Department implemented a Smart Energy Program per Council's approved investment of \$14 million. The benefits of this program included 9 million kWh in annual electrical savings; 400,000 m³ in annual natural gas savings; 90,000 m³ in annual potable water savings; the conversion of 11 sites from oil or propane to natural gas; the conversion of 1.4 million kWh of electricity use to natural gas; and the integration of over 70 unique building automation systems into one harmonized interface.

c) Review/enhance EnviroCentre partnership.

- Status: completed.
- Details: the EnviroCentre partnership was renewed in fall 2007 and terminated in 2012. EnviroCentre has relocated its offices to Rideau St. Opportunities are being investigated under the AQCCMP update for future partnering.

d) Conduct LEED training among City planners, regulators and identify additional LEED implementation in City projects.

- Status: ongoing.
- Details: Planning and Growth Management and Building Code Services staff received LEED training in 2012 and 2013. This training is ongoing as needed.

e) Promote waste reduction and diversion, and landfill gas co-generation (Energy Ottawa) in conjunction with Solid Waste Services.

- Status: ongoing.
- Details: The co-gen plant at Trail Waste Facility was commissioned in 2007; waste reduction and diversion continues to be promoted through *Take it Back!*, the collection of green bin, leaf and yard waste and blue and black box recyclables, and the online Waste Explorer search engine.

f) Continue District Energy project in partnership with Energy Ottawa.

- Status: completed.
- Details: a feasibility study was completed and it was determined that the project was not viable at the time.

- g) Update forest cover and carbon sink modelling through initiation of City Green feasibility project.
- Status: completed.
 - Details: two test areas where successfully mapped. This was a pilot to value Ottawa's forests with respect to air pollution, storm water retention and carbon sequestration. The results continue to be regularly used by Planning and Growth Management in the implementation of the Tree By-law and for other initiatives.

11. Implement the Smog Action Plan: Refinement of the City's corporate actions during smog events and development of enhanced messaging for the community.

Investigate the feasibility of implementing episode management plans during other periods of poor air quality (smog action plan, heat/ cold warnings, winter smog/poor air quality events, etc.).

- Status: ongoing.
- Details: as part of the Smog and Heat Action Plan, posters were distributed in all community centres, long term care homes, recreation facilities and select schools to encourage the public to reduce their emissions by choosing biking and walking instead of driving. Public announcements are released yearly (beginning in May) with tips to reduce emissions on smog advisory days, usually starting in May. Smog brochures were handed out at numerous environmentally related events e.g. Earth Day Fair, Eco-Fair, Green Expo. An Extreme Weather Working Group was created that included smog action planning. In March 2013 Ottawa Public Health reported to the Ottawa Board of Health on [Extreme Weather in Ottawa](#). This report outlines the impact of illness associated with extreme weather in Ottawa; the strategies used to prevent adverse outcomes and the research and evaluation planned to keep improving the [Heat and Smog Action Plan](#) first released in 2004, and updated in 2006.

12. Public Outreach and Involvement:

- a) Identify community and agency stakeholders for the range of measures identified within this Plan. Develop partnerships where objectives and timelines are common for the range of measures relating to information, education and influencing of behavioural change for improved air quality and reduced energy use.
- Status: completed.
 - Details: the City partnered with the following groups/departments to facilitate outreach to the public on the initiatives listed in this plan: Health Canada,

Environment Canada, Natural Resources Canada, National Research Council, Ontario Ministry of Environment, European Space Agency, University of Ottawa, Carleton University, NGO's (e.g. Clean Air Partnership, EnviroCentre, Earth Day Ottawa), Conservation Authorities, Hydro Ottawa, Energy Ottawa, and internally with most departments, especially Ottawa Public Health, Public Works, Transit Services, Information Technology Services, and Planning and Growth Management.

- b) Develop additional promotional materials on air quality and climate change impacts within Ottawa and the proposed measures to address these issues. Materials will be developed only if needed to augment existing materials from federal or provincial governments or NGOs.
 - Status: completed.
 - Details: the Air Quality and Climate Change Management Plan was promoted at outreach events. Other existing materials were used that supported messaging e.g. federal government material related to fuel and energy efficiency, wood burning.

13. Implement “new” management measures:

- a) Review current resource use (energy) and set targets for reduction.
 - Status: ongoing.
 - Details: Public Works established corporate targets and undertook many projects to facilitate energy efficiencies in city amenities.

- b) Develop a corporate green procurement policy.
 - Status: completed.
 - Details: green procurement was integrated into purchases by IT (laptops, notebooks, CPUs, monitors, printers), Public Works (rough paper, cleaning products) and various City fleets. A sustainable procurement guideline has been implemented corporately.

- c) Establish Better Buildings Partnership and/or institute Local Improvement Charges.
 - Status: ongoing.
 - Details: as per Council approved [Green Building Promotion Program](#), the Local Improvement Charge (LIC) tool was assessed for implementation in Ottawa. Refer to Appendix G for the findings and recommendations.

- d) Inventory green roofs in Ottawa, develop screening criteria to assess the potential for incorporating green roofs into development projects.

- Status: ongoing.
 - Details: An inventory of green roofs was completed in 2012.
- e) Develop and implement driver education for targeted commercial fleets and for the public (with Federal Government).
- Status: completed.
 - Details: Anti-idling campaigns took place internally and externally leading to an Idling Control By-law (2007) and Corporate Eco-driving Policy (2008).
- f) Implement freight fleet efficiency programs (with Federal Government).
- Status: completed.
 - Details: federal approach has changed and program is no longer feasible.
- g) Develop building, site and community Design Guidelines to help guide and encourage energy efficient developments, green buildings and green roofs.
- Status: ongoing.
 - Details: Design Guidelines have integrated elements that support energy/fuel/water efficiency via building, site and street design. A 'Green Checklist' was drafted to assist approval planners and the development industry.
- h) Promote and facilitate the development of new alternative energy projects using green or renewable energy sources such as wind, solar, heat recovery and use of process by-products.
- Status: ongoing.
 - Details: Council has supported community uptake of the Province's microFIT and FIT (Feed-in-Tariff) programs by passing support resolutions. The following alternative energy projects have been developed and supported: 2 Solar Parks, 20 building rooftop solar projects (4 installed, 16 pending), and Plasco pilot plant.

14. Develop a Climate Change Adaptation Strategy.

- Status: ongoing.
 - Details: Adaptation measures related to stormwater management have been carried out each year. Various measures were considered during update of the Infrastructure Master Plan and integrated into the 2014 AQCCMP.
- a) Reduce heat island effect.
- Status: ongoing.

- Details: Ottawa Public Health is working with Health Canada to assess the heat islands/cool sinks in Ottawa with respect to populations who are especially vulnerable to heat.

b) Climate change emergency response programs.

- Status: ongoing.
- Details: worked with the Office of Emergency Management on [Ottawa's Long-Term Risk Prevention & Mitigation Plan](#) and staff are continuing to work on a Mitigation Plan.

15. Refine Corporate GHG Reduction Target for 2007-2012.

- Status: ongoing.
- Details: a new target is included in the 2014 AQCCMP.

Phase 3: Evaluation of Management Measures

16. Evaluate and, if necessary, redesign the monitoring program to study long-term trends for parameters of concern.

- Status: ongoing.
- Details: the City now does a GHG inventory every 4 years; ambient air quality monitoring is measured through two provincial monitoring stations; forest cover is now being measured and other parameters continue to be identified to monitor long-term trends.

17. Evaluate measures to reduce energy consumption and monitor GHG emissions trends.

- Status: ongoing.
- Details: GHG mission estimates were prepared for 2004, 2008 and 2012. A GHG Roundtable was held in 2013. Public Works monitors and reports on energy use in City buildings annually.

18. Assess status of progress in achieving the goals of this plan, and refine the Strategy as needed.

- Status: completed.
- Details: the 2014 Air Quality and Climate Change Management Plan updates and replaces the 2005 Plan.

Appendix C: Trends in Municipal Climate Change Action Plans

Background

A survey of other municipalities was carried out to identify best practices in green house gas management at the municipal level. Four Canadian and two American municipal climate change mitigation action plans were reviewed in detail: [Toronto](#)¹, [Waterloo Region](#)², [Calgary](#)^{3,4}, [Vancouver](#)⁵, [Chicago](#)⁶ and [Portland](#)⁷ in addition to the Ottawa's own 2005 [Air Quality and Climate Change Management Plan](#). To gain a national and international perspective, guides and reports issued by the Canadian [Partners for Climate Protection](#) (PCP) program and by the international [C40 Cities Climate Leadership Group](#) (C40) were also reviewed. Plans from several other jurisdictions were consulted but are not captured in this summary.

Partners for Climate Protection (PCP)

The PCP program is a network of over 240 Canadian municipal governments, including the City of Ottawa, who have committed to acting on climate change by reducing greenhouse gas emissions. The program is the Canadian component of ICLEI's Cities for Climate Change Protection network (an international program with over 1,100 participating communities worldwide) and is a partnership between the Federation of Canadian Municipalities and ICLEI – Local Governments for Sustainability.

The PCP program promotes a five-step milestone framework that guides municipalities on how to take action against climate change with the five milestones being:

1. creating a GHG emissions inventory and forecast;
2. setting an emissions reduction target;
3. developing a local action plan;
4. implementing the local action plan and set of activities; and
5. monitoring progress and reporting results.

In 2012, the PCP released *Creating a change in climate through local action*, which identifies specific actions Canadian municipalities can take to reduce GHG emissions.

¹ City of Toronto. (2007). *Change is in the Air: Toronto's Commitment to an Environmentally Sustainable Future*. Toronto Environment Office. Toronto: City of Toronto.

² Waterloo Region. (2013). *A Climate Action Plan for Waterloo Region: Living Smarter in 2020*. Waterloo Region: Waterloo Region.

³ City of Calgary. (2011). *Calgary Community GHG Reduction Plan: Energy in the City*. Calgary: City of Calgary.

⁴ City of Calgary. (2006). [Calgary Climate Change Action Plan Target 50](#). Calgary: City of Calgary.

⁵ City of Vancouver. (2012). *Greenest City 2020 Action Plan*. Vancouver: City of Vancouver.

⁶ City of Chicago. (2008). *Chicago Climate Action Plan*. Chicago: City of Chicago.

⁷ City of Portland and Multnomah County. (2009). *Climate Action Plan 2009*. Portland: City of Portland Bureau of Planning and Sustainability and Multnomah County Sustainability Program.

C40 Cities Climate Leadership Group

C40 is a global network of 63 large cities committed to taking action to address climate change. Vancouver and Toronto are members of C40, which was established in the UK in 2005 before merging in 2006 with US President Clinton's Climate Initiative (CCI) Cities Program to reduce carbon emissions and increase energy efficiency in large cities across the world.

“C40 is committed to implementing meaningful and sustainable climate-related actions locally that will help address climate change globally.”

The C40 network provides an opportunity for member cities to exchange best practices on reducing climate emissions and to work together to promote climate-friendly technologies and influence the market place. The 2014 C40 report – [Climate Action in Megacities](#) presents data on current and planned climate actions in 59 of the 63 C40 member cities. Survey results indicate that cities are expanding their climate change actions, while focusing on areas where they have the most control and/or influence.

Results

Combined, the six cities reviewed have identified a broad range of local climate mitigation actions that reflect each city's unique circumstance and varying regulatory powers. Some actions are identified by several cities while others are more unique. Three tables were prepared:

Table 1 provides an overview of each plan.

Table 2 highlights corporate actions.

Table 3 identifies community actions listed in one or more of the plans.

Corporate actions are efforts cities can take to reduce GHG emissions resulting from day-to-day city operations. Community actions are efforts that the broader community as a whole can undertake to reduce their GHG impact. Interestingly, some actions carried out in Ottawa, although not explicitly in the 2005 AQCCMP, are identified by other jurisdictions. Examples include the following:

- installation and use of video conferencing facilities across city facilities;
- improvements to fleet efficiency;
- increase tree canopy on public and private lands; and
- establish public space recycling.

In summary, Ottawa's 2005 plan identified, and our community has carried out many of the same actions planned by other jurisdictions around the world.

Table 1: Trends in City Climate Change Plans - Overview

	Chicago	Portland	Calgary	Vancouver	Toronto	Waterloo Region	Ottawa	PCP	C40
Publication Date	2008	2009	2006 ⁸ 2011 ⁹	2011	2007	2013	2005	2012	2014
Member of the Federation of Canadian Municipalities' Partners for Climate Protection program	N/A	N/A	✓	✓	✓	✓	✓	-	-
Member of C40 Cities' Climate Leadership Group	✓	✓	-	✓	✓	-	-	-	-
Completed a GHG Inventory	✓	✓	✓	✓	✓	✓	✓	✓	-
GHG Reduction Target: Short-Term (e.g. ~2020)	✓	-	✓	✓	✓	✓	✓	✓	-
GHG Reduction Target: Long-Term (e.g. ~2050)	✓	✓	✓	-	✓	-	-	✓	-
GHG Reduction Sector Targets (e.g. Transportation – reduce average distance driven per resident by 20%)	✓	✓	-	✓	✓	-	-	-	-

⁸ Corporate action plan publication date.

⁹ Community action plan publication date.

Table 2: Trends in City Climate Change Plans – Corporate Actions

Notes

- a. This table is not an exhaustive list of actions identified in the six Plans reviewed, but is instead a sample of actions municipalities are proposing to undertake.
- b. Only new actions identified at the time of a Plan’s publication have been included, meaning on-going or completed actions have not.
- c. All actions are subject to budget and governmental approvals.
- d. The last two columns highlight if an action was identified in the PCP report *Creating a change in climate through local action* and the C40 report *Climate Action in Megacities*.

Actions focused on Corporate Efforts – Buildings/Facilities Sector	Chicago	Portland	Calgary	Vancouver	Toronto	Waterloo Region	Ottawa	PCP report*	C40 report*
▪ Implement green building policies for new City facilities (e.g. LEED)	-	✓	✓	-	-	-	✓	✓	✓ ¹⁰
▪ Retrofit projects in various City buildings (e.g. HVAC, insulation)	✓	-	-	✓	-	✓	✓	✓	✓ ¹¹
▪ Eliminate use of incandescent bulbs in all City-owned buildings, including Agencies, Boards and Commissions	-	-	-	-	✓	-	-	-	-
▪ Explore potential solar/green roof installation at City facilities	-	-	-	-	✓	✓	-	-	-
▪ Make City Hall a showcase of environmental sustainability (e.g. energy efficiency retrofits, renewable energy, etc.)	-	-	-	-	✓	-	-	-	-
▪ Purchase or generate electricity required for City operations from renewable sources	-	✓	-	-	-	-	-	✓	✓ ¹²
▪ Establish video and/or web conferencing capability in all major City and County facilities	-	✓	-	-	-	-	-	-	-
▪ Conversion of streetlights to energy-efficient LED fixtures	-	✓	✓	-	✓	✓	-	✓	✓ ¹³
▪ Energy efficiency upgrades in public housing units	-	-	-	-	-	✓	-	-	✓ ¹⁴
Actions focused on Corporate Efforts – Fleet Sector									
▪ Improve fleet efficiency (e.g. buses, waste collection vehicles, etc.)	✓	✓	✓	✓	✓	✓	-	✓	✓ ¹⁵
▪ Buy electric and plug-in hybrid vehicles for City fleets as they become commercially available	-	✓	-	-	-	-	-	✓	✓ ¹⁶
▪ Reduce corporate vehicle idling	-	-	-	-	-	-	✓	✓	✓ ¹⁷

¹⁰ At least 70% of cities have strong ownership or operational control, policy setting and enforcement, and budgetary control across municipal buildings.

¹¹ Insulation is the most popular action across the 53 responding C40 cities.

¹² 31% of actions in buildings focus on supplying clean energy within the building through integrated technology such as solar panels.

¹³ More than 90% of respondents report that they are taking action to reduce emissions from outdoor lighting.

¹⁴ 48 cities are increasing energy efficiency and/or retrofitting their existing public housing stock.

¹⁵ Improving bus engine technology is the most common climate action cities are taking to address the carbon impact of public buses.

¹⁶ Cities report the greatest number of actions to introduce electric vehicles into city owned fleets.

¹⁷ 24 cities are promoting fuel-efficient driving and reducing idling for their bus fleet.

Actions focused on Corporate Efforts – Solid Waste Sector	Chicago	Portland	Calgary	Vancouver	Toronto	Waterloo Region	Ottawa	PCP report*	C40 report*
▪ Stop the growth of waste generation and recover a percentage of all waste generated in City operations	-	✓	-	✓	-	-	-	-	✓ ¹⁸
▪ Establish public space recycling	-	✓	-	-	-	-	-	-	-
▪ Install methane collection at municipal owned landfill(s)	-	-	-	-	✓	✓	-	✓	-
▪ Explore/expand opportunities to increase low carbon electricity generation from City landfill(s) and wastewater treatment plants	-	-	✓	-	-	✓	✓	✓	✓ ¹⁹
Actions focused on Corporate Efforts – Other									
▪ Develop a corporate-wide green procurement policy	-	-	-	-	-	-	✓	-	✓ ²⁰
▪ Increase tree canopy on public and/or private lands within municipal borders	✓	✓	-	✓	✓	✓	-	✓	✓ ²¹
▪ Make local food available in community centres, parks, and other City-run facilities	-	-	-	✓	-	-	-	-	✓ ²²
▪ Support community agriculture through the use of public land and rooftops for growing food	-	✓	-	✓	-	-	-	✓	✓ ²³
▪ Look for opportunities to green community events that the City runs, sponsors, and permits	-	-	-	✓	-	-	-	-	-
▪ Eliminate combined sewer overflows	-	-	-	✓	-	-	-	-	-
▪ Explore District Heating System opportunities	-	-	✓	-	-	-	✓		

¹⁸ 5 of the top 10 actions reported by cities for future development are waste reduction actions.

¹⁹ A third of future planned actions will focus on generating energy from waste. Currently, 24 cities are generating energy from their landfill gas.

²⁰ Procurement is the least utilised lever and comprises only 6% of all reported actions.

²¹ Tree planting is the action over which cities overwhelmingly have strong power. Two-thirds of cities deliver these actions directly through projects and programs.

²² The most common actions in food and agriculture relate to community allotments and gardens and farmers' markets, two areas where many cities report having strong and partial powers.

²³ Agricultural initiatives, such as vertical farming and rooftop gardening, are emerging, but are not yet scaled significantly in the majority of cities.

Table 3: Trends in City Climate Change Plans – Community Actions

Notes

- a. This table is not an exhaustive list of actions identified in the six Plans reviewed, but is instead a sample of actions municipalities are proposing to undertake.
- b. Only new actions identified at the time of a Plan’s publication have been included, meaning on-going or completed actions have not.
- c. All actions are subject to budget and governmental approvals.
- d. The last two columns highlight if an action was identified in the PCP report *Creating a change in climate through local action* and the C40 report *Climate Action in Megacities*.

Actions focused on Community Efforts - Residential Building Energy sector	Chicago	Portland	Calgary	Vancouver	Toronto	Waterloo Region	Ottawa	FCM/PCP	C40 Cities
1. Promotion/Education <ul style="list-style-type: none"> ▪ Raise awareness about energy conservation and link between energy consumption and environmental impacts ▪ Comparative benchmarking to impact behaviour ▪ Monitor and report on the implementation of the Plan 	✓	✓	✓	-	✓	✓	-	-	✓ ²⁴
2. Financing Tools and Incentives <ul style="list-style-type: none"> ▪ Set up a funding mechanism for energy efficiency upgrades/retrofits ▪ Appliance trade-in programs ▪ Use price signals in permit fees for new construction as well as renovations to existing buildings to reward energy efficiency and greenhouse gas reductions ▪ Provide grants and/or credits for homeowners for household-scale renewable energy technologies 	✓	✓	✓	✓	✓	✓	-	✓	✓ ²⁵
3. Regulation <ul style="list-style-type: none"> ▪ Require building renovations meet green standards ▪ Mandatory green building standards for new buildings ▪ Require energy performance ratings for homes 	✓	✓	✓	✓	✓	-	-	✓	✓ ²⁶
Actions focused on Community Efforts - Non-Residential Building Energy sector									
1. Promotion/Education <ul style="list-style-type: none"> ▪ Energy labelling of buildings ▪ Develop building, site, and community Design Guidelines to encourage energy efficient developments ▪ Promote improved operation and maintenance practices in commercial buildings ▪ Explore public-private partnerships 	✓	✓	✓	-	✓	✓	✓	✓	✓ ²⁷
2. Financing Tools and Incentives	✓	✓	✓	✓	✓	✓	-	✓	✓ ²⁸

²⁴ Actions to improve energy efficiency in buildings account for more than 20% of activities across all sectors reported by C40 cities.

²⁵ 69% of actions focus on energy demand reduction – reducing the energy needed to heat and power buildings – through measures such as insulation or more efficient lighting.

²⁶ More than half of C40 cities reports using building codes to raise standards, but most of these efforts are still in the pilot or planning stage.

²⁷ Three of the top five most popular actions (audits and advice, energy performance certification and benchmarking) undertaken by the responding cities focus on measuring building performance rather than directly implementing changes to the building fabric or operation.

Actions focused on Community Efforts - Residential Building Energy sector	Chicago	Portland	Calgary	Vancouver	Toronto	Waterloo Region	Ottawa	FCM/PCP	C40 Cities
<ul style="list-style-type: none"> ▪ Set up a funding mechanism for energy efficiency upgrades/retrofits ▪ Use price signals in permit fees for new construction as well as renovations to existing buildings to reward energy efficiency and greenhouse gas reductions ▪ Establish a City business tax credit for installing solar panels and green/cool roofs ▪ Adopt incentives for new construction projects that consider life-cycle carbon emissions impacts 									
3. Regulatory <ul style="list-style-type: none"> ▪ Require building renovations meet green standards ▪ Mandatory green building standards for new buildings ▪ Increase the number of cool and/or green roofs 	✓	-	✓	✓	✓	-	-	✓	✓ ²⁹
Actions focused on Community Efforts - Transportation sector									
1. Promotion/Education <ul style="list-style-type: none"> ▪ Develop education campaigns promoting public transit and/or carpooling and car share initiatives 	✓	-	✓	-	-	✓	✓	✓	-
2. Financing Tools and Incentives <ul style="list-style-type: none"> ▪ Develop integrated rapid bus transit network ▪ Increase access to transit and improve transit facilities ▪ Support investments to provide high-performance broadband connectivity to businesses and residences to enable widespread e-commerce and telecommuting ▪ Accelerate the transition to plug-in hybrids and electric vehicles by supporting the installation of a network of electric car charging stations ▪ Explore the development and installation of a bike-share program 	✓	✓	✓	✓	-	✓	-	✓	✓ ³⁰
3. Regulatory <ul style="list-style-type: none"> ▪ Introduce by-laws to reduce vehicle idling time ▪ Implement cycling/pedestrian plans and/or use zoning by-laws for promoting highly walkable and bikeable complete neighbourhoods ▪ Revise zoning standards to include maximum parking requirements in areas that are well serviced by transit 	✓	✓	✓	✓	✓	✓	-	-	✓ ³¹

²⁸ Incentives and disincentives are the preferred method of implementation for one-fifth of actions in the Buildings sector across C40 cities.

²⁹ Nearly one-third of building-related actions are delivered through policy or regulations.

³⁰ 32% of reporting cities are encouraging vehicle owners to switch to electric vehicles or are developing charging infrastructure.

³¹ Over half of responding cities have measures in place to site new development in zones with strong mass transit connections.

Actions focused on Community Efforts - Solid Waste sector	Chicago	Portland	Calgary	Vancouver	Toronto	Waterloo Region	Ottawa	FCM/PCP	C40 Cities
1. Promotion/Education <ul style="list-style-type: none"> ▪ Work with community partners to encourage businesses and residents to purchase durable, repairable and reusable goods; to reduce waste, and to reduce consumption of carbon-intensive consumer goods and services ▪ Promote the use of alternative refrigerants in air conditioning units and refrigerators ▪ Increase diversion rates 	✓	✓	-	✓	-	✓	✓	✓	✓ ³²
2. Financing Tools and Incentives <ul style="list-style-type: none"> ▪ Provide assistance to businesses, contractors and construction firms on initiatives for increasing diversion rates ▪ Explore opportunities to expand the single-family residential food waste composting program to apartments and condominiums 	-	✓	-	✓	-	-	-	-	-
3. Regulatory <ul style="list-style-type: none"> ▪ Implement mandatory commercial food waste collection ▪ Explore options to completely phase out the use of hydrofluorocarbons (HFCs) in appliances ▪ Shift standard residential garbage collection to every other week ▪ Consider regulatory options to improve the efficiency of commercial waste collection service 	✓	✓	-	-	-	-	-	-	✓ ³³
Actions focused on Community Efforts – Energy Sector									
1. Promotion/Education <ul style="list-style-type: none"> ▪ Promote household renewable energy in an effort to double current household renewable energy generation ▪ Work with local energy distributors to explore and develop renewable energy generation opportunities ▪ Identify opportunities for and/or establish district energy systems 	✓	✓	✓	-	✓	✓	✓	-	✓
2. Financing Tools and Incentives <ul style="list-style-type: none"> ▪ Provide tools and incentives to make every home a hybrid home including the use of solar energy to heat water ▪ Facilitate the installation of at least 10 megawatts of on-site renewable energy, such as solar energy 	-	✓	-	-	✓	-	-	-	-
3. Regulatory <ul style="list-style-type: none"> ▪ Develop a policy framework that clearly articulates when the City will or will not consider different renewable energy sources for district energy systems ▪ Set standards for developments above a defined size that support the adoption of district energy 	-	-	✓	✓	-	-	-	-	-

³² 5 of the top 10 actions reported by cities for future development are waste reduction actions.

³³ Policy and regulation is the most commonly reported lever for delivering waste actions across all regions.

Appendix D - Existing Energy Incentive and Funding Programs

This document highlights existing energy incentive and funding programs that are offered by local utilities (i.e. Enbridge Gas Distribution, Hydro Ottawa, and Hydro One) and the City of Ottawa, as well as the provincial and federal governments. The information was gathered predominantly from Internet sources and was completed between February and April 2014. Note that the information presented is subject to change as the programs are continually evolving.

1.0 Utility Programs

1.1 Enbridge Gas Distribution

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>Commercial Energy Audit Program</u>	<ul style="list-style-type: none"> Financial incentives of up to \$5,000/building or \$15,000 for group of buildings to offset the cost of a professional energy audit 	<ul style="list-style-type: none"> Commercial customers – facilities consuming a minimum of 150,000 m³ of natural gas/year 	Ends Dec. 12, 2014	<ul style="list-style-type: none"> Identify cost effective opportunities to increase energy efficiency
<u>High Efficiency Boiler Program</u>	<ul style="list-style-type: none"> Rebates for installing high efficiency boilers 	<ul style="list-style-type: none"> Commercial customers who rent or purchase and install non-atmospheric hydronic boilers Boilers used for space heating and/or hot water heating 	Ends Dec. 12, 2014	<ul style="list-style-type: none"> Incentive to lower energy consumption and reduce cost.
<u>High Performance New Construction Program</u>	<ul style="list-style-type: none"> Program provides design assistance and incentives for building owners and architects who exceed the electricity efficiency standards specified in the Ontario Building Code in partnership with local utility 	<ul style="list-style-type: none"> Construction of new buildings and major renovation projects for the IC&I and agricultural sectors 	Ongoing	<ul style="list-style-type: none"> Increase awareness and identify opportunities for energy efficiency.

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>Home Weatherization Program</u>	<ul style="list-style-type: none"> Designed to make homes more energy efficient Enbridge pays for the cost of home improvements, such as insulation and draft proofing 	<ul style="list-style-type: none"> Low income Enbridge customers who own or rent a detached home, semi-detached home, row house or mobile home 	Dec. 31 2014 (renewed annually)	<ul style="list-style-type: none"> Reduces energy consumption Increased savings
<u>Industrial Energy Solutions</u>	<ul style="list-style-type: none"> Fee services and financial incentives designed to help industrial customers make the most of the energy they consume 	<ul style="list-style-type: none"> Industrial Enbridge customers 	Ends Dec. 31, 2014	<ul style="list-style-type: none"> Reduces energy consumption Increased savings
<u>Energy Compass</u>	<ul style="list-style-type: none"> A free diagnostic service designed to evaluate the operating efficiency of buildings and to identify energy efficiency improvement opportunities along with the applicable financial incentives 	<ul style="list-style-type: none"> Commercial customers 	Ends Dec. 12, 2014	<ul style="list-style-type: none"> Improved awareness of natural gas consumption
<u>Ozone Laundry</u>	<ul style="list-style-type: none"> The system generates ozone (O³), a naturally occurring molecule, which helps clean fabrics by chemically reacting with soils in the water Requires equipment be added to existing commercial washing machines 	<ul style="list-style-type: none"> Commercial customers that use natural gas for water heating and process over 100,000 lbs. of laundry/year 	Ends Dec. 12, 2014	<ul style="list-style-type: none"> Reduces the need for hot water thereby reducing natural gas consumption
<u>Retrofit Incentives</u>	<ul style="list-style-type: none"> Rebates for installing efficient appliances and systems in existing buildings 	<ul style="list-style-type: none"> Commercial projects 	Ends Dec. 12, 2014	<ul style="list-style-type: none"> Incentive to increase energy efficiency Cost savings

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>Savings by Design</u>	<ul style="list-style-type: none"> A green building initiative brought to help builders design and construct high performance buildings and houses Comprehensive program offering support and financial incentives during the design, construction and commissioning stages of projects 	<ul style="list-style-type: none"> Commercial and residential builders within the Enbridge Gas Distribution service area 	Ongoing	<ul style="list-style-type: none"> Identify cost effective opportunities to increase energy efficiency
<u>Showerhead Rebates</u>	<ul style="list-style-type: none"> A \$6 rebate for each standard showerhead with a flow rate of at least of 2.5 gallons/minute (gpm) replaced with an energy efficient showerhead of 1.5 gpm 	<ul style="list-style-type: none"> Commercial multi-residential customers 	Ends Dec. 12, 2014	<ul style="list-style-type: none"> Lower water and energy consumption/costs
<u>Run it Right Program</u>	<ul style="list-style-type: none"> Help commercial building customers achieve continuous operational savings through no cost / low cost energy efficient solutions 	<ul style="list-style-type: none"> commercial customers – buildings consuming over 100,000 cubic meters of natural gas annually 	Nov. 28, 2014 *multiple monitoring periods available	<ul style="list-style-type: none"> Identify cost effective opportunities to increase energy efficiency

1.2 Hydro Ottawa

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>Audit Funding</u>	<ul style="list-style-type: none"> Provides incentives to complete energy audits assessing the potential for energy savings to be achieved through equipment replacement, operational practices 	<ul style="list-style-type: none"> Ottawa businesses 	Ongoing	<ul style="list-style-type: none"> Identify cost effective opportunities to increase energy efficiency

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>Existing Building Commissioning</u>	<ul style="list-style-type: none"> Funds the evaluation process and recommended upgrades to increase the energy efficiency of Chilled Water Systems 	<ul style="list-style-type: none"> Owners or lessees of Chilled Water Systems in the IC&I sector 	Ongoing	<ul style="list-style-type: none"> Identifies opportunities to increase energy efficiency
<u>Demand Response Program</u>	<ul style="list-style-type: none"> Designed to identify new ways to manage electricity costs and receive additional financial incentives 	<ul style="list-style-type: none"> Ottawa businesses 	Ongoing	<ul style="list-style-type: none"> Identify cost effective opportunities to increase energy efficiency
<u>Fridge and Freezer Pickup</u>	<ul style="list-style-type: none"> Old fridge or freezer are removed from home for recycling at no cost Window air conditioners and dehumidifiers are removed from home for recycling at no cost 	<ul style="list-style-type: none"> Single-family and multi-residential Fridge or freezers (in working condition) that are 20 years or older are eligible Air conditioner and dehumidifier units (in working condition) must be 10 years or older 	Ongoing	<ul style="list-style-type: none"> Facilitate purchase and use of more energy efficient fridge Proper disposal of coolants Lower energy consumption/costs
<u>Heating and Cooling Incentive</u>	<ul style="list-style-type: none"> Receive up to \$650 when install an EnergyStar qualified central heating or cooling system 	<ul style="list-style-type: none"> Available to residents and businesses (with residential-type systems) who purchase and install eligible replacement central heating or cooling equipment through a participating contractor 	Ends Feb. 1 2015	<ul style="list-style-type: none"> Lower energy consumption/costs Improve payback period
<u>High Performance New Construction</u>	<ul style="list-style-type: none"> Provide technical assistance and generous financial incentives to help design teams go beyond the normal building design process, right from the early stages of design Also provide funding for custom projects that will deliver energy savings 	<ul style="list-style-type: none"> Construction of new buildings and major renovation projects for the IC&I and agricultural sectors 	Ongoing	<ul style="list-style-type: none"> Increase awareness and identify opportunities for energy efficiency.

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>peaksaver Plus</u>	<ul style="list-style-type: none"> ▪ A professionally installed programmable thermostat ▪ Online access to thermostat controls ▪ Energy display that shows electricity usage in real-time 	<ul style="list-style-type: none"> ▪ Single-family, multi-residential, commercial customers ▪ Must have a central air conditioning unit in good working order 	Ongoing	<ul style="list-style-type: none"> ▪ Lower energy consumption/costs ▪ Improved awareness of electricity use ▪ Control hot weather peaks in demand
<u>New Home Construction</u>	<ul style="list-style-type: none"> ▪ Designed to encourage home builders and renovators to construct energy-efficient homes by incorporating energy-efficiency into their construction or any extensive renovation 	<ul style="list-style-type: none"> ▪ Residential Hydro Ottawa customers 	Ongoing	<ul style="list-style-type: none"> ▪ Identify cost effective opportunities to increase energy efficiency
<u>Process and Systems Upgrade Program</u>	<ul style="list-style-type: none"> ▪ Provides financial incentives and technical expertise to upgrade key systems and improve energy management in daily operations 	<ul style="list-style-type: none"> ▪ Ottawa businesses 	Ongoing	<ul style="list-style-type: none"> ▪ Incentive to lower energy consumption/costs
<u>Retrofit Program</u>	<ul style="list-style-type: none"> ▪ Provides substantial financial incentives for replacing equipment with high efficiency equipment and for installing new control systems that will improve the efficiency of operational procedures and processes (up to 50% of project costs) 	<ul style="list-style-type: none"> ▪ Owners or tenants of commercial, institutional, industrial, agricultural and multi-residential facilities, including social housing 	Ongoing	<ul style="list-style-type: none"> ▪ Incentive lower energy consumption/costs
<u>saveONenergy Coupons</u>	<ul style="list-style-type: none"> ▪ Discounts on a wide range of eligible energy efficient products 	<ul style="list-style-type: none"> ▪ Downloadable coupons (available to all) 	Ends Dec. 31 2014 (renewed annually)	<ul style="list-style-type: none"> ▪ Incentive to reduce energy consumption

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>Small Business Lighting</u>	<ul style="list-style-type: none"> Free energy assessment of lighting and water-heating equipment to help identify opportunities for increased energy-efficiency Rebate up to \$1,500 for new energy-efficient lighting and equipment 	<ul style="list-style-type: none"> Ottawa stores and businesses that have an electricity demand of less than 50 kW 	Ongoing	<ul style="list-style-type: none"> Increased awareness Identify opportunities to increase energy efficiency. Improve payback period
<u>Social and Assisted Housing</u>	<ul style="list-style-type: none"> Financial incentives for making assisted and social housing buildings more energy-efficient 	<ul style="list-style-type: none"> Public and municipal housing, supportive housing and shelters, non-profits, cooperatives and affordable housing Receives electricity from Hydro Ottawa 	Ongoing	<ul style="list-style-type: none"> Incentive to increase homes energy efficiency
<u>Training and Support Program</u>	<ul style="list-style-type: none"> Designed to help get businesses access to the most up-to-date training needed to help save money and become more energy efficient Program covers some of the training costs 	<ul style="list-style-type: none"> Ottawa businesses 	Ongoing	<ul style="list-style-type: none"> Increased awareness on how to make a business more energy efficient.

1.3 Hydro One

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>Audit Funding</u>	<ul style="list-style-type: none"> Provides incentives to complete energy audits assessing the potential for energy savings to be achieved through equipment replacement, operational practices 	<ul style="list-style-type: none"> Ottawa businesses Hydro One customers 	Ongoing	<ul style="list-style-type: none"> Identify cost effective opportunities to increase energy efficiency

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>Demand Response Program</u>	<ul style="list-style-type: none"> Designed to identify new ways to manage electricity costs and receive additional financial incentives 	<ul style="list-style-type: none"> Ottawa businesses 	Ongoing	<ul style="list-style-type: none"> Identify cost effective opportunities to increase energy efficiency
<u>Fridge and Freezer Pickup</u>	<ul style="list-style-type: none"> Old fridge or freezer are removed from home for recycling at no cost Window air conditioners and dehumidifiers are removed from home for recycling at no cost 	<ul style="list-style-type: none"> Single-family and multi-residential households Fridge or freezers (in working condition) that are 20 years or older Air conditioner and dehumidifier units (in working condition) that are 10 years or older 	Ongoing	<ul style="list-style-type: none"> Facilitate purchase and use of more energy efficient fridge Proper disposal of coolants Lower energy consumption/costs
<u>Heating and Cooling Incentive</u>	<ul style="list-style-type: none"> \$250 rebate when replacing an old furnace with a new high-efficiency model \$400 (up to) rebate when replacing an existing central air conditioner 	<ul style="list-style-type: none"> Hydro One residential customers 	Ongoing	<ul style="list-style-type: none"> Lower energy consumption/costs Improve payback period
<u>High Performance New Construction</u>	<ul style="list-style-type: none"> Provide technical assistance and generous financial incentives to help design teams go beyond the normal building design process, right from the early stages of design Also provide funding for custom projects that will deliver energy savings 	<ul style="list-style-type: none"> Construction of new buildings and major renovation projects for the IC&I and agricultural sectors 	Ongoing	<ul style="list-style-type: none"> Increase awareness and identify opportunities for energy efficiency.

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>Home Assistance Program</u>	<ul style="list-style-type: none"> Designed to make homes more energy-efficient, Hydro One will pay for the cost of home improvements, such as insulation and draft proofing 	<ul style="list-style-type: none"> Low income customers who own or rent a detached home, semi-detached home, row house, mobile home, or multi-residential unit (buildings with no more than 3 floors) 	Ongoing	<ul style="list-style-type: none"> lower energy consumption/costs
<u>New Home Construction</u>	<ul style="list-style-type: none"> Encourage builders and renovators to build homes that incorporate energy efficiency 	<ul style="list-style-type: none"> Residential Hydro One customers 	Ongoing	<ul style="list-style-type: none"> Identify cost effective opportunities to increase energy efficiency
<u>Peaksaver Plus</u>	<ul style="list-style-type: none"> A professionally installed programmable thermostat 	<ul style="list-style-type: none"> Single-family, multi-residential, commercial customers with a central air conditioning unit in good working order 	Ongoing	<ul style="list-style-type: none"> Lower energy consumption/costs Improved awareness of electricity use Control hot weather peaks in demand
<u>PowerSaverPlus Online Energy Audit</u>	<ul style="list-style-type: none"> Online tool for learning how to reduce electricity consumption 	<ul style="list-style-type: none"> Residential or business 	Ongoing	<ul style="list-style-type: none"> Improved awareness of electricity use. Lower energy consumption/costs
<u>Process and Systems Upgrade Program</u>	<ul style="list-style-type: none"> Provides financial incentives and technical expertise to upgrade key systems and improve energy management in daily operations 	<ul style="list-style-type: none"> Ottawa businesses Hydro One customers 	Ongoing	<ul style="list-style-type: none"> Identify cost effective opportunities to increase energy efficiency
<u>Retrofit Program</u>	<ul style="list-style-type: none"> Provision of substantial financial incentives (up to 50% of project costs) for replacing equipment with high efficiency equipment, and for installing new control systems that improve the efficiency of operational procedures and processes 	<ul style="list-style-type: none"> Owners or tenants of commercial, institutional, industrial, agricultural and multi-residential facilities, including social housing 	Ongoing	<ul style="list-style-type: none"> Identify cost effective opportunities to increase energy efficiency

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>saveONenergy Coupons</u>	<ul style="list-style-type: none"> Discounts on a wide range of eligible energy efficient products 	<ul style="list-style-type: none"> Downloadable coupons (available to all) 	Ends Dec. 31 2014 (renewed annually)	<ul style="list-style-type: none"> Incentive to reduce energy consumption
<u>Small Business Lighting</u>	<ul style="list-style-type: none"> Free energy assessment of lighting and water-heating equipment to help identify opportunities for increased energy-efficiency Funding of up to \$1,500 is provided for new energy-efficient lighting and equipment 	<ul style="list-style-type: none"> Ottawa stores and businesses that have an electricity demand of less than 50 kW 	Ongoing	<ul style="list-style-type: none"> Improved awareness of electricity use. Incentive to reduce energy consumption Cost savings

2.0 Municipal Programs

2.1 City of Ottawa

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>High Volume User Program</u>	<ul style="list-style-type: none"> Rebates for water efficient toilets and waterless urinals, commercial dishwashers, and washing machines 	<ul style="list-style-type: none"> An IC&I property/facility consuming 25,000 m³ or more of water/year; or A multi-residential property with 6 or more units 	Ongoing	<ul style="list-style-type: none"> Reduce water consumption to reduce energy consumption.
<u>Indoor Water Efficiency Kits</u>	<ul style="list-style-type: none"> Provision of one low-flow showerhead, a bag test to determine showerhead flow rate, and one Toilet Tank Bank 	<ul style="list-style-type: none"> City of Ottawa resident 	Ongoing	<ul style="list-style-type: none"> Reduce water consumption to reduce energy consumption

3.0 Provincial Programs

3.1 Ministry of Energy

Program	Description	Eligibility	Timeline	Objective/Benefits
<u>Feed-in Tariff (FIT) Program</u>	<ul style="list-style-type: none"> Allows eligible participants to generate renewable energy (e.g. wind, solar photovoltaic, power, landfill gas, waterpower, and biomass and biogas) and sell it to the province at a guaranteed price for a fixed contract term. Available for renewable energy projects greater than 10 kilowatts. 	<ul style="list-style-type: none"> Open to all types of generators, including developers, community groups, and homeowners. 	Ongoing	<ul style="list-style-type: none"> Reduce greenhouse gas emissions
<u>microFIT program</u>	<ul style="list-style-type: none"> Allows eligible participants to generate renewable energy (e.g. wind, solar photovoltaic, power, landfill gas, waterpower, and biomass and biogas) and sell it to the province at a guaranteed price for a fixed contract term. Available for renewable energy projects of 10 kilowatts or less. 	<ul style="list-style-type: none"> Open to all types of generators, but of interest more so to homeowners, farmers, and small business owners, as well as institutions such as schools and places of worship. 	Ongoing	<ul style="list-style-type: none"> Reduce greenhouse gas emissions
<u>saveONenergy</u>	<ul style="list-style-type: none"> Provincially funded incentive program for homes and businesses to manage their electricity use and is offered through local electric utilities. 	<ul style="list-style-type: none"> Varies per program 	Varies per program	<ul style="list-style-type: none"> Incentive to reduce energy consumption Cost savings

3.2 Ontario Power Authority

Program	Description	Eligibility	Timeline	Objective/Benefits
Conservation Fund	<ul style="list-style-type: none"> ▪ Supports innovative electricity conservation projects. 	<ul style="list-style-type: none"> ▪ Non-profit and for profit incorporated entities including local distribution companies, technology companies, consulting firms, industry associations, educational institutions, and public sector organizations. 	Ongoing	<ul style="list-style-type: none"> ▪ Increase technological expertise

4.0 Federal Programs

4.1 National Resources Canada

Program	Description	Eligibility	Timeline	Objectives/Benefits
<u>ecoENERGY Efficiency for Industry</u>	<ul style="list-style-type: none"> ▪ The program will <ul style="list-style-type: none"> ○ Support the <u>Canadian Industry Program for Energy Conservation</u> ○ Support implementation of the <u>ISO 150001</u> Energy Management Systems standard. ○ Provide “<u>Dollars to \$ense Energy Management Training</u>” workshops ○ Provide newsletters, reports, guides, and manuals to increase awareness of energy efficiency. 	<ul style="list-style-type: none"> ▪ Canada’s industrial sector 	Ongoing	<ul style="list-style-type: none"> ▪ Accelerates energy-saving investments ▪ Exchange best practice information within Canada’s industrial sector

Program	Description	Eligibility	Timeline	Objectives/Benefits
<u>ecoENERGY Efficiency for Housing</u>	<ul style="list-style-type: none"> ▪ Encourages the construction and retrofit of low-rise residential housing through: <ul style="list-style-type: none"> ○ EnerGuide Rating System (for both <u>new</u> and <u>existing</u> homes) ○ <u>ENERGY STAR</u>[®] for New Homes ○ The <u>R-2000 Standard</u> 	<ul style="list-style-type: none"> ▪ Homeowners, contractors, and developers 	Ongoing	<ul style="list-style-type: none"> ▪ Reduces emissions ▪ Makes healthy workplaces and living spaces ▪ Saves money
<u>ecoENERGY Efficiency for Buildings</u>	<ul style="list-style-type: none"> ▪ Program provides tools to improve the energy performance of new and existing commercial and institutional buildings, including federally owned and operated buildings, through: <ul style="list-style-type: none"> ○ Canada's National Energy Code for Buildings, 2011 ○ <u>ENERGY STAR</u>[®] Portfolio Manager energy benchmarking tool ○ Federal Buildings Initiative 	<ul style="list-style-type: none"> ▪ Commercial and institutional building owners, with the exception of the Federal Buildings Initiative which applies to federal agencies only. 	Ongoing	<ul style="list-style-type: none"> ▪ Reduces Emissions ▪ Lowers energy consumption/cost ▪ Regulates
<u>ecoENERGY for Renewable Power</u>	<ul style="list-style-type: none"> ▪ Encourages the generation of electricity from renewable energy sources such as wind, low-impact hydro, biomass, photovoltaic, and geothermal energy ▪ Projects with contribution agreements receive a one cent per kilowatt-hour incentive for eligible production during their first ten years of operation. 	<ul style="list-style-type: none"> ▪ No new contribution agreements have been signed after March 31, 2011. 	No new agreements since 2011; program itself will end in 2021	<ul style="list-style-type: none"> ▪ Reduces emissions ▪ Encourage the use of renewable energy sources

4.2 Sustainable Development Technology Canada

Program	Description	Eligibility	Timeline	Objectives/Benefits
<u>SD Tech Fund</u>	<ul style="list-style-type: none"> Supports the late stage development and pre-commercial demonstration of clean technology solutions (i.e. products and processes that contribute to clean air, clean water, and clean land, that address climate change, and improve the productivity and the global competitiveness of the Canadian industry) 	<ul style="list-style-type: none"> Have expertise in sustainable development technology and be part of a project consortium that meets one of three descriptions given on the website. Eligible projects must focus on the development and demonstration of technologies that address issues of climate change, clean air, water, and soil quality, and be primarily located in Canada. 	Statement of interests to be submitted by April 16, 2014	<ul style="list-style-type: none"> Increased clean technology solutions expertise in Canada.
<u>NextGen Biofuels Fund</u>	<ul style="list-style-type: none"> Supports the establishment of first-of-kind commercial scale demonstration facilities for the production of next-generation renewable fuels and co-products. Encourages retention and growth of technology expertise and innovation capacity for cellulosic ethanol and biodiesel production in Canada. 	<ul style="list-style-type: none"> Project must demonstrate the technology at the pre-commercial pilot scale, produce next generation renewable fuel, and use feedstocks of Canadian biomass. 	Ongoing	<ul style="list-style-type: none"> Increased technological expertise and innovation capacity for renewable fuels in Canada.

4.3 Farm Credit Canada

Program	Description	Eligibility	Timeline	Objectives/Benefits
<u>Energy Loan</u>	<ul style="list-style-type: none"> Loan to help Canadian producers or agri-business owners to install on-farm energy sources (e.g. biogas, geothermal, wind, or solar power) 	<ul style="list-style-type: none"> Primary producers and agri-business owners. 	Ongoing	<ul style="list-style-type: none"> Make farm more cost effective and efficient

4.4 Infrastructure Canada

Program	Description	Eligibility	Timeline	Objective/Benefit
<u>Federal Gas Tax Fund</u>	<ul style="list-style-type: none"> Provides long-term funding for Canadian municipalities to help them build and revitalize their local public infrastructure. 	<ul style="list-style-type: none"> Canadian municipalities undertaking an eligible project that may include (but not limited to): <ul style="list-style-type: none"> Public transit Wastewater infrastructure Drinking Water Solid Waste Management Community Energy Systems 	Ongoing	<ul style="list-style-type: none"> Fund large-scale municipal projects Benefitted the City of Ottawa's Confederation Line project.

Note:

Financial incentive programs such as the federal ecoENERGY Retrofits – Home program and the provincial Home Energy Savings Program were highly successful programs that have since been discontinued. The ecoENERGY Retrofit – Home program in particular had considerable success, with over 640,000 Canadian households receiving over \$934 million in grants between 2007 and 2012, and helping homeowners to save on average 20 per cent on their home energy use.

APPENDIX E: Energy Supply and Demand in Ottawa

Introduction and Purpose

Much of this Plan focuses on the supply and use of energy—supply, because electrical power and other energy distribution systems are vulnerable to extreme weather events associated with climate change; and use, because the combustion of fuels used to generate electricity releases greenhouse gases that contribute to climate change, and other pollutants that pose health risks. The purpose of this appendix is to explore these two matters more fully with a focus on Ottawa. The objective is to identify feasible means for improving security of supply while at the same time reducing demand. As this document will show, demand management serves both purposes: reducing emissions and reducing risk of system failure. For the purpose of this analysis, demand management refers to both reducing consumption as well as managing peak use.

Energy Supply & Security

There are five main energy types supplied to Ottawa: electricity, natural gas, heating oil, propane, and vehicle fuels. All other sources (e.g. wood) represent a small fraction of the energy supply and are not included in the following discussion.

Electricity

Existing Power Supply

Most of Ottawa's electricity is produced by Ontario Power Generation, and transmitted to Ottawa via the Hydro One grid, which owns 97% of Ontario's 30,000 km of transmission lines.¹ Most electricity enters the city via two 500 kV transmission lines and a network of 230 kV and 115kV lines from the south and west. Energy is delivered from the transmission system to the distribution network through a number of transformer stations across the city. The largest of these are owned by Hydro One, while the remainder are owned by Hydro Ottawa.

Locally, electricity is distributed within the urban area by Hydro Ottawa (which is owned by the City of Ottawa) and in the rural area by Hydro One, with some exceptions.² Hydro Ottawa is Ontario's third-largest municipally-owned electrical utility and serves over 310,000 residential and commercial customers in the City of Ottawa and the Village of Casselman. In 2012, Hydro Ottawa delivered approximately 6% of the electricity distributed province-wide with 7570 gigawatt-hours (GWh).³

Energy Ottawa, Hydro Ottawa's wholly owned subsidiary, is Ontario's largest municipally-owned green power producer. Over the last ten years, Energy Ottawa has tripled its renewable energy generation from 80 gigawatt-hours (GWh) to over 330 GWh. Currently, Energy Ottawa's portfolio consists of the following:

- Six hydroelectric stations at Chaudière Falls on the Ottawa River with a total capacity of 38 MW.
- Two landfill gas-to-energy plants, one at the City of Ottawa's Trail Road Landfill and the other at the Laflèche Landfill in Moose Creek, with a combined generating capacity of 10.2 MW.

Recently, Energy Ottawa was awarded a 40-year contract to construct a 29 MW facility at Chaudière Falls, enough to power 20,000 homes.

The City of Ottawa also generates electricity. The Robert O. Pickard Environmental Centre uses digester gas and cogeneration to produce 2,430 KW of electricity, heat and reduce operating costs at the wastewater treatment plant. And, in 2011 the City installed three rooftop solar projects in partnership with Energy Ottawa (at City Hall, the Transit Services Integrated Control Centre, and the Huron Early Education Centre), and together are pursuing other opportunities to partner on City facilities.

Under the *Green Energy Act*, individuals and organizations can also generate electricity and sell it to the Ontario Power Authority under FIT and microFIT contracts. Several businesses and other organizations are pursuing renewable energy projects as a means to generate revenue and off-set rising energy costs. Local examples include:

- The Ottawa-Carleton District School Board has installed 13 10kW rooftop solar panels under the provincial microFIT program, as well as leased roof space for the installation of larger systems under the FIT program.
- The Eileen Tallman Co-operative recently entered into a 20-year contract to supply 11.73 kilowatt (KW) of solar power to the grid⁴ with financial backing from the Ottawa Renewable Energy Co-operative (OREC.)

In summary, while the majority of electricity consumed in Ottawa is generated at distant locations, there is a growing trend to generate power locally. With some exceptions the trend is for small scale, distributed installations.

Future Power Supply

In 2013, the provincial government released *Achieving Balance: Ontario's Long-Term Energy Plan*⁵ that outlines several energy policy directions, including:

- Continued use and upgrade of nuclear power generating stations as the backbone of Ontario's supply;
- Expanded use of clean energy to diversity the supply mix;
- Continued collaboration between natural gas and electricity utilities;
- Greater regional planning; and
- Increased local storage.

Table 1 presents Ontario's existing electricity supply mix⁶, which is a combination of nuclear power, hydroelectricity, natural gas, wind, bioenergy, solar photovoltaic, and coal.⁷

Table 1: Ontario's Electricity Supply Mix, 2013

Source	Production Today
Nuclear	57.9%
Hydroelectricity	23.4%
Natural Gas	10.9%
Wind, Biomass, Solar Photovoltaic (PV) and waste	5.8%
Coal	2% (phased out in 2014)

The provincial energy plan identifies four key areas available to improve the resiliency of the electricity power supply:

- Improve the existing power grid through transmission enhancements.
- Increase local storage, the use of Smart Grid and other technologies.
- Increase distributed power generation through greater implementation of clean energy.
- Reduce per capita base and peak demand through emphasis on conservation first.

Security of Supply

Because of the configuration and historical development of the transmission system in eastern Ontario, parts of our community are vulnerable to failures in the transmission grid. Between 10% and 25% of power outages in the Hydro Ottawa service area are due to transmission system interruptions.⁸ And, because the grid is integrated across power supplies and jurisdictions, there is always the potential for a major system failure such as occurred across the north-east of North America in July 2003.

Other causes of power outages include equipment failure, and adverse weather including lightning and tree contacts⁹, all of which are more likely to occur if weather events continue to become more severe. The extent of outages is significantly mitigated through redundant supply points, responsiveness of Hydro Ottawa's line crews, system automation, and tree trimming programs.¹⁰

In the meantime, it is worth noting that all local renewable energy supplies, with the exception of those installations designed specifically with this capability, such as hospitals, *cannot* be used during power outages, even on-site by their owners, because of how they are connected to the grid and of safety risks to hydro workers and the public. Therefore, individuals, organizations and major institutions will only be able to

generate on-site power to ensure continuity of service during power interruptions if their electrical systems are designed to operate in conjunction with the local distribution utility.

The most common form of back-up power is diesel generators. Whether hard-wired or portable, generators rely on a continuous supply of fuel; are susceptible to failure if not regularly operated and maintained; and are fewer in number than required to meet community needs over prolonged periods, particularly in winter when there is demand not just for power but also for heat.

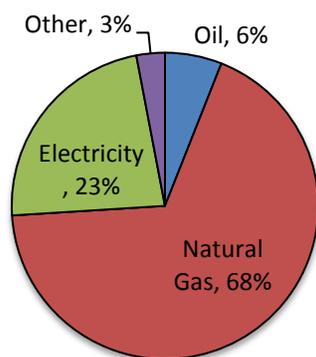
Therefore, this plan recommends that the City undertake a back-up power strategy that includes renewable energy supplies. A loss of power coupled with a run on limited fuel supplies would pose a significant risk to the community; therefore renewable energy sources should form a key role in any power continuity strategy. While it is recognized that the modern electrical power system is quite reliable, it would be prudent to provide back-up power in some strategic locations that don't have it today. Furthermore, it is recommended that the City work with the OPA, local distributors, the Electrical Safety Authority, and local utilities to help promote and enable continuity of supply by local generators and major institutions in particular.

Natural Gas

Enbridge Gas Distribution is Canada's largest natural gas distribution utility, with more than 1.9 million residential, commercial and industrial customers and over 35,000 kilometres of natural gas distribution pipeline in Ontario.¹¹ Gas is piped to Ottawa via TransCanada Pipeline infrastructure, and distributed locally by Enbridge. The gas originates from locations even more distant than the electricity supply, and has the same vulnerabilities with respect to limited transmissions corridors; but also built-in redundancies and back-up systems. In 2013 Enbridge completed a major pipeline reinforcement project in the west end to ensure system redundancy and the ability to meet the City's growing needs.

As shown in Figure 1, most Ontarians heat their homes using natural gas. This is true in Ottawa where in 2012 Enbridge has over 250,000 customers.

Figure 1: Home Heating Source¹²



As buried infrastructure, the natural gas distribution system is less vulnerable to extreme weather events with the exception of flooding, which occurs primarily during warm months, and to a lesser degree during winter thaws coupled with rain. It is the latter event that poses the greater risk due to our reliance on natural gas for heating.

The most common form of back-up heating supplies is electrical heaters, run either from the power outlets or by generators. Given Ottawa's climate, it is best practice for every household to have at least two forms of heat supply. The challenge is that electric heaters and most gas furnaces do not function during a power outage.

A typical gas furnace uses electricity to power the thermostat, ignition, and fan motor, and will not operate during a power outage. While many gas customers also have gas fireplaces, it is unknown what percentage. Therefore, the risk associated with a prolonged system-wide power outage of the type that occurred in 2003 is greater in the winter. For this reason, the same recommendations as made for the electrical power supply apply to the natural gas system due its reliance on the power grid.

Heating Oil and Propane

Home heating oil and propane are supplied by a variety of local distributors. The supplies are largely hauled to Ottawa and, therefore, are dependent upon road conditions. While an interruption in their supply would pose risks to their customers, the potential for wide-spread impacts on the community are not as great as posed by major disruptions of natural gas and power supplies.

Vehicle Fuels

Vehicle fuels are supplied by a variety of distributors across the city. Most vehicles in Ottawa use gasoline and diesel fuels, which are also the energy source for most light and heavy equipment, and back-up generators. These equipment and vehicles are required during emergencies to protect people and property, and for rescue, relief, and

recovery operations. Therefore, continuity of vehicle fuel supplies is critical for the City and community partners such as hospitals in order to maintain basic operations and effective emergency response.

Though not attributable to climate change, a major earthquake could cause a concurrent failure of the electrical power supply and an interruption of the vehicle fuel supply chain due to road and highway closures. Therefore, it is important to maintain an emergency supply within easy access of key facilities and for delivery of core services. Furthermore, wherever feasible, alternative energy supplies should be used for back-up power generation to allow light and heavy grade fuels to be dedicated to vehicle and equipment operation. This plan recommends that these factors be considered during the development of the back-up power strategy.

Individual Action

Residents can take action to ensure continuity of power supply and heat by taking the following actions:

- Installing back-up batteries or generators for sump pumps and key appliances including the furnace.
- Ensuring knowledge of how to use them and that they are installed by a professional electrician, inspected by the Electrical Safety Authority, and maintained regularly.
- Maintaining fresh fuel supplies for the above.
- Investigating options for installing renewable energy supplies such as solar PV as an alternative to the above.
- Planting trees away from power supplies; and pruning trees and shrubs before they reach overhead wires.
- Calling for utility locates before digging in lawns and gardens.
- Ensuring knowledge of proper fire place operation, and that the chimney is regularly maintained.
- Maintaining a supply of fire wood, kindling, and matches.

It is recommended that the City work in cooperation with local power distributors to increase community awareness of the opportunities to improve household resiliency.

Energy Demand and Conservation

Projected Energy Demand in Ontario

According to the Long-Term Energy Plan, electricity demand has been declining in Ontario in recent years due to a reduced consumption on the parts of the average residential household, business, and industrial users. Recent changes to the Ontario

Building Code, the availability of more energy efficient products, equipment, and appliances, and the favourable results of energy conservation programs have all attributed to this decline. The province anticipates demand for electricity will continue to remain flat over the next decade due to improvements in residential, commercial, and industrial electricity intensity in spite of economic growth.

In support of this, the provincial plan proposes to focus on increasing energy conservation efforts and is targeting a “long-term conservation target of 30 terawatt-hours (TWh) in 2032”, which would represent a 16% reduction in electricity use.¹³ Reductions of 2400 MW representing 10% of the peak demand are also in the plan. To achieve these targets, Local Distribution Companies (LDC) will have mandatory GWh targets to reduce electricity usage while the province’s Independent Electrical System Operator (IESO) will be tasked with the MW reduction challenge.

Energy Demand in Ottawa.

As discussed in Appendix A, buildings and vehicles are the two largest end-uses of energy in Ottawa, constituting roughly 89% of all GHG emissions. Therefore, most conservation efforts in Ottawa should target these two sectors.

The City has made significant efforts to plan for and facilitate greater **transportation** modal split by Ottawa residents. For example, in 2011 Council approved construction of the light-rail Confederation Line, which is estimated will reduce GHG emissions by 38,000 tonnes annually by 2031, the equivalent of removing 7,300 cars from use.¹⁴

Demand management is a major theme of the 2013 *Transportation Master Plan* and associated *Cycling Plan* and *Pedestrian Plan*, which identify several plans and projects to reduce private automobile use.¹⁵ As the owner of road rights-of-ways and the transit network, the City is well positioned to make significant improvements in transportation demand management during the life of this Plan.

By comparison, the City does *not* own most **buildings** in Ottawa, and is not in as strong a position to direct changes in behaviour and consumption. However, the City can be a catalyst for behavioural change and usage/peak demand reductions through education, incentives, policy, standards, and through planning and approval processes. The following is a discussion of demand management opportunities and constraints in Ottawa’s building sectors.

Electricity

Electricity demand varies depending on the season and time of day.¹⁶ During the summer months (May to October), demand is higher during the afternoon when air-conditioning use is greatest. During the winter months (November to April), there are two peak demand periods: one in the early morning, and one in the early evening. This

is due to the fact that there is increased use of heating, lighting, and appliances during this time.

Ontario has a “time of use” rate structure that discourages energy use during the peak times of day. Both the off-peak and on-peak prices have been climbing, as shown in Figure 2, with Figure 3 illustrating how total household electricity costs are projected to climb by roughly 33% over the next 14 years for a home using 800kWh/month.¹⁷ In 2011, 91% of Hydro Ottawa customers were residential accounts.

Going forward, it is anticipated that some measure of energy conservation will be driven due to electricity price increases.

Figure 2: Average Annual Price of Electricity in Ontario¹⁸

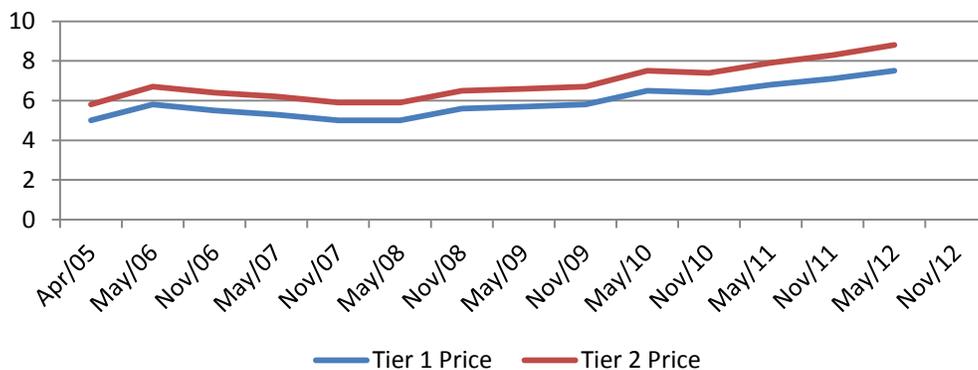


Figure 3: Forecasted Typical Residential Electricity Monthly Bill¹⁹

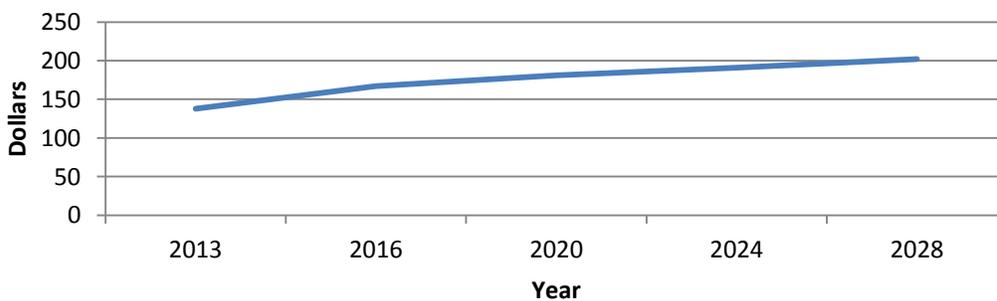
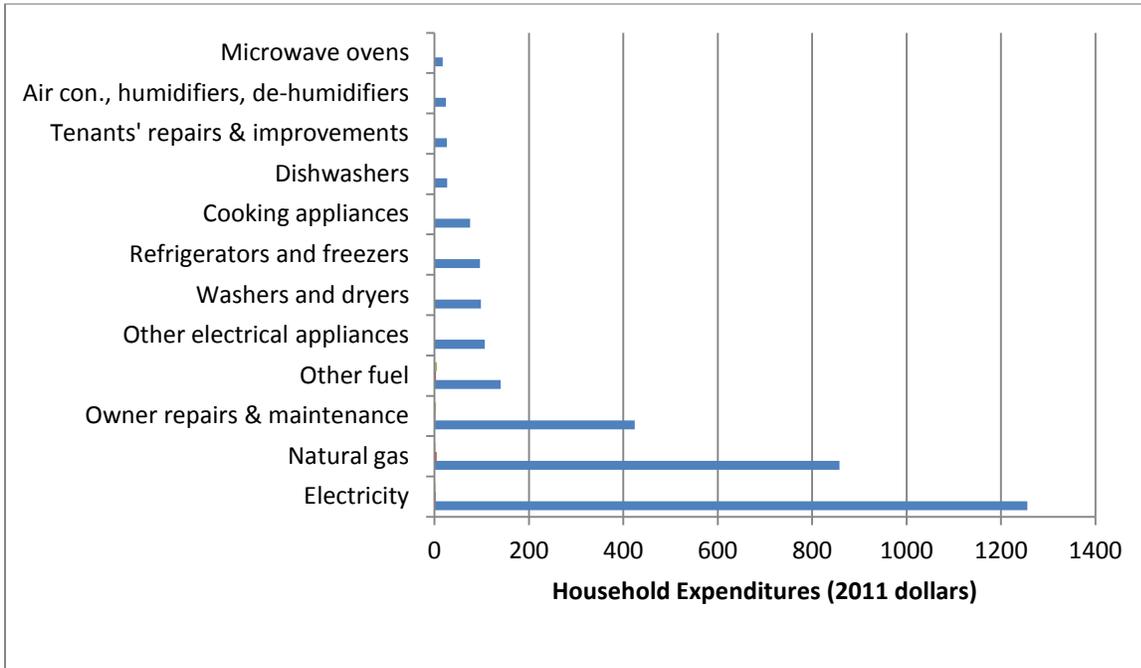


Figure 4 illustrates how these costs compare within the average annual household budget for related items, and show that as energy costs rise, the financial incentive to carryout retrofits will also increase. By discouraging on-peak use, the Independent Electricity System Operator is better able to meet demand during the high demand periods throughout the year.

Figure 4: Annual Household Expenditures in Ontario in 2011 dollars



Natural Gas and Heating Oil

Demand for natural gas and heating oil is greatest during the winter months. As shown in Figures 5 and 6, the price of the two fuels have trended in opposite directions in recent years, driving many to convert older oil furnaces to new energy efficient gas furnaces and air conditioners. Conversions have been further incented due to financial grants offered by the Ontario Power Authority.

Figure 5: Average Annual Price of Heating Oil in Ottawa²⁰

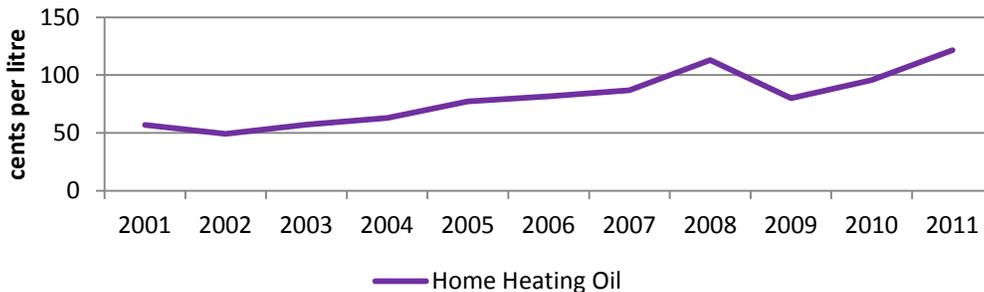
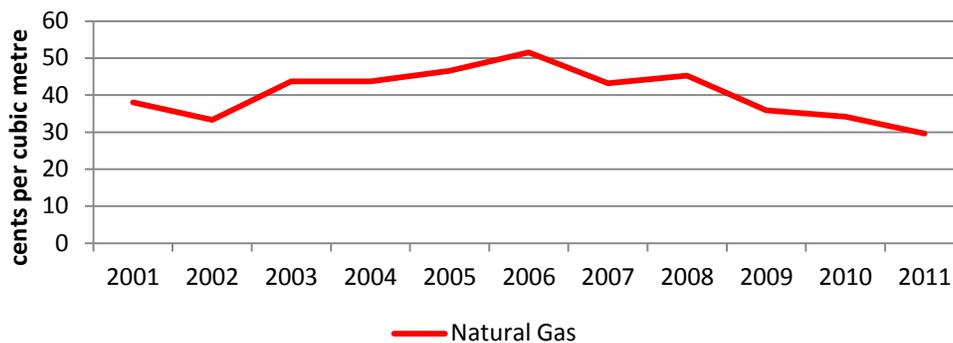


Figure 6: Average Annual Price of Natural Gas in Ontario²¹



Demand for these fuels is a function of how well the building is constructed and sealed, the efficiency of appliances in use including the heating, ventilation and air conditioning (HVAC) systems, and the habits of occupants.

Many programs exist to educate and encourage people and businesses to improve the energy efficiency of their homes and buildings as identified in Appendix D. The following is a discussion of the Ottawa housing market, and the options the City might consider to further encourage building retrofits, the purchase of efficient appliances, and modified habits to reduce energy demand.

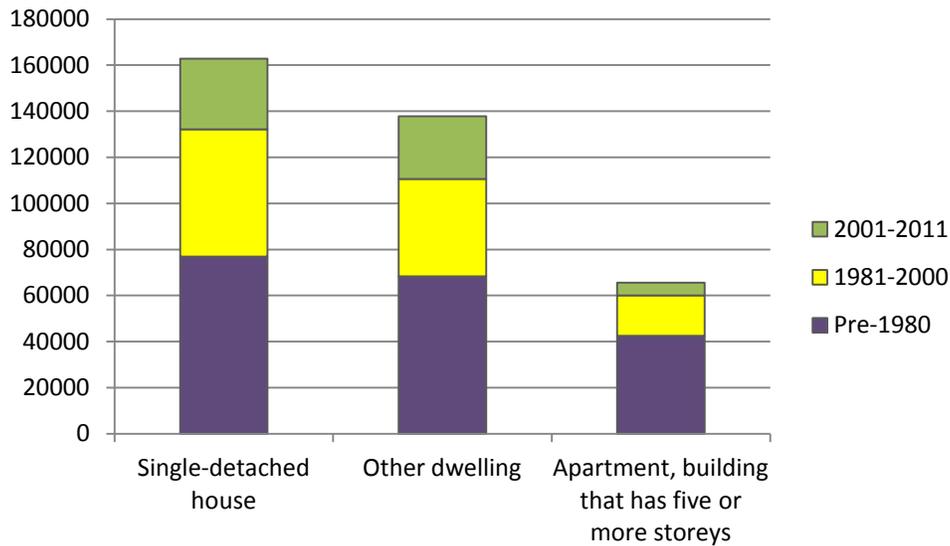
Residential Energy Demand Management in Ottawa

As shown in Figure 7, over 50% of Ottawa's housing units were built prior to 1980. According to Statistics Canada, in 2011 a relatively small number of dwellings built prior to 1980 required major improvements:

- 13,335 single detached units (9%) require major repairs²².
- 5,845 apartment units (14%) require major repairs.

However, while not requiring key structural improvements, the age of Ottawa's housing stock allows for typical lifecycle replacements such as basement finishing, roof repairs, window and door, and appliance replacements, at which time energy efficiency can be considered and addressed.

Figure 7: Number of Dwellings Based on Year of Construction²³



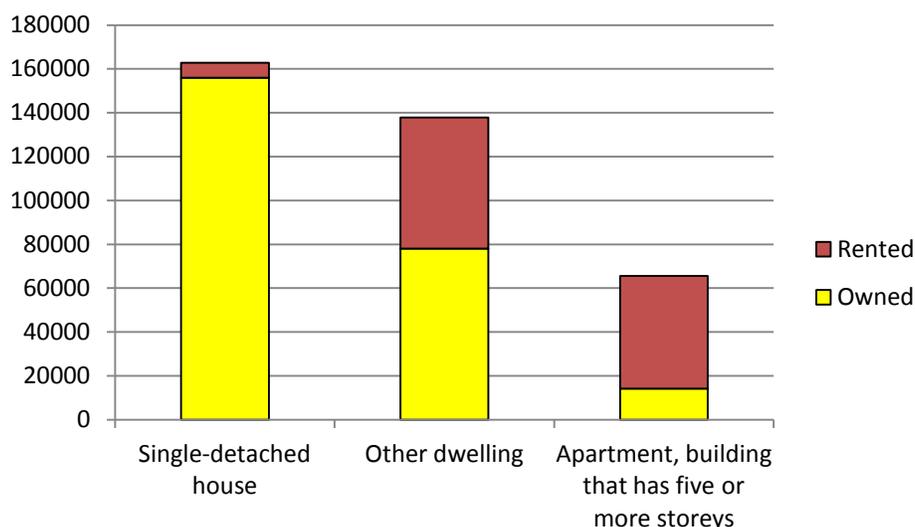
The Canadian Mortgage and Housing Corporation (CMHC) provides the average energy savings based on improvements for single family homes, as shown in Table 2:

Table 2: Average Potential Energy Savings Based on Improvements to Single Detached Homes

Type of House	Ceiling Insulation and draft-proofing	Replace Doors and Windows	Wall Insulation	Furnace Replacement
Pre WWII houses ²⁴	34%	11%	18%	34%
Post WWII (1945 to 1960) ²⁵ 1 ½ storey houses	34%	12%	14%	39%
1960's and 1970's ²⁶ 1-storey houses	37%	13%	9%	41%
Post 1960's ²⁷ 2-storey houses	26%	14%	5%	55%

If home ownership is taken as an indicator of household wealth, financial need is likely greatest amongst townhouse and apartment dwellers, who tend to rent rather than own their homes, as shown in Figure 8.

Figure 8: Number of Ottawa Dwellings by Ownership²⁸



The decision to carry out major retrofits in rental accommodations rests with the landlord. However, the decision to change behaviours and to make small changes such as using LED light bulbs rests with the tenants. Table 3 identifies the top energy and water saving opportunities in multi-unit residential buildings, according to CMHC:²⁹

Table 3: Percentage of Energy Used and Lost in Multi-unit Residential Buildings

How energy is used	Where heat is lost
44% space heating	31% windows
15% lighting	24% air leakage
15% domestic hot water	20% ventilation
15% other	16% walls
6% elevators	5% roof
5% cooling	4% doors

Opportunities exist for both building owners and tenants to make changes, but the economic model and relationships do not always facilitate such. For example, where utility costs are built into the rent, there is little incentive for a tenant to change behaviours. And, limitations under the *Landlord & Tenant Act* can make it difficult for a landlord to recover retrofit costs, particularly if utility costs are not included in rents. In short, encouraging retrofits and behavioural changes in tenant accommodations is challenging. (The same holds true for commercial rental properties.)

In 2010, Toronto surveyed residents and found that 85% of respondents had completed energy efficiency improvements to their homes in the past 5 years. Of the remaining 15%, 22% indicated no need; 10% indicated too costly; and 18% indicated they had already done previous work. The survey also found that barriers to taking action included: inability to supervise work, disruption to household, and timing of other/major work. In short, 'financial limitations' was not a major variable.

This finding is confirmed by the Environmental Commissioner of Ontario, in his 2011 report, *Restoring Balance – Results Annual Energy Conservation Progress Report*,³⁰ which notes the following barriers to energy conservation:

- Underpricing leads to increased electricity consumption and peak demand. (Energy is sold at a price that does not reflect its full cost, including the cost associated with its environmental impact.)
- Lack of information prevents consumers from taking actions to save energy.
- Conservation policy for different energy sources is not integrated.
- Strong governance has been lacking.
- Reach and effectiveness of available conservation programs are insufficient.

For these reasons, financial incentives, if employed, should be targeted at lower income owner-occupied or publicly-owned housing.

Potential Programs and Services

The province identifies the following options in its *Achieving Balance: Ontario's Long-Term Energy Plan*.³¹

- Conservation First - demand to 2032 will be offset by conservation programs and improved codes and standards;
- Greater regional planning and programs;
- Continued collaboration between natural gas and electricity utilities;
- Expanding current programs to assist with reaching a 10% reduction in peak demand (2025);
- Providing new financing tools for consumers, including energy efficient retrofits for residential properties (2015);
- Development of a 'Green Button' initiative that would give consumers access to their energy data and the ability to connect to tools to analyze and manage their energy use;
- Working with Ontario EcoSchools to bring more information about energy conservation to the classrooms.

Locally, there are a variety of energy conservation programs and incentives available to Ottawa residents, businesses and institutions as outlined in Appendix D. Hydro Ottawa

has been very successful in giving its customers access to information about their electricity consumption. The web portal MyHydroLink which available to all customers of Hydro Ottawa at www.hydroottawa.com provides detailed information about individual home or business time of use consumption and billing information. It also gives customers the ability to customize text alerts or email messages to help them manage their electricity consumption and to sign up for electronic billing.

Hydro Ottawa also offers the Peaksaver+ programmable thermostat and an energy display to both its residential and small commercial customers. Customers with central air conditioning and/or electric water heaters can qualify for the PeakSaver+ program. Financial incentives are also available for customers replacing their furnace and central air conditioner units with high efficiency models.

In partnership with the Ontario Power Authority (OPA), Enbridge and provincial partners, Hydro Ottawa is planning for the development of a full suite of conservation programs that will be available to customer for the 2015 to 2020 period.

Table 4 highlights which types of programs or services could be employed in Ottawa, targeting specific building types. As many similar programs already exist through local utilities, it is recommended that the City carryout most of those activities in partnership with partner organizations to avoid duplication and to enhance existing programs wherever possible. Specific proposals related to the following options will be brought forward early in the next term of council for consideration.

Table 4: Residential Energy Program Options

Program Type	Residential	Commercial, Institutional & Industrial
AWARENESS		
Promotion	✓	✓
Data Collection/Sharing		
Public Education	✓	✓
Trades Training	✓	✓
Recognition	✓	✓
INCENTIVES		
Giveaways	✓	
Rebates	✓	✓

Program Type	Residential	Commercial, Institutional & Industrial
Grants	✓	✓
Tax Credits	✓*	✓*
Loans (LIC) ³²	✓**	✓*
Community Improvement Plans (CIP)**	✓**	✓**
REGULATE		
By-laws	✓	✓
Compliance Promotion	✓	✓

* Targeted towards landlords. **Targeting a specific geographic area.

¹<https://static.hydroottawa.com/documents/publications/factbook/backgrounders/5-transmission.pdf>

²Refer to <https://www.hydroottawa.com/outages/> for an illustration of the jurisdictions of the two distributors in Ottawa.

³<http://www.hydroottawa.com/corporate/>

⁴<http://ottawarenewableenergycoop.com/>

⁵<http://news.ontario.ca/mei/en/2013/12/ontario-releases-long-term-energy-plan-1.html>

⁶ Ibid

⁷<http://news.ontario.ca/mei/en/2013/12/ontario-releases-long-term-energy-plan-1.html>

⁸“Let’s Talk Electricity Fact Book”, Hydro Ottawa.

⁹Ibid.

¹⁰Refer to “Let’s Talk Electricity Fact Book” for statistics regarding power outages in the Hydro Ottawa jurisdiction.

¹¹<https://www.enbridgegas.com/assets/docs/Appendix%20D%20-%20Ottawa.pdf>

¹² Ontario Power Authority 2011

¹³<http://news.ontario.ca/mei/en/2013/12/ontario-releases-long-term-energy-plan-1.html>

¹⁴<http://www.confederationline.ca/en/the-plan/why/>

¹⁵Insert link to these plans.

¹⁶<https://www.hydroottawa.com/residential/time-of-use/rate-periods/>

¹⁷Approximately 20% of electricity charges fund the local distributor. The remainder support costs for energy generation, transmission, debt retirement and regulators. (“Let’s Talk Electricity Fact Book”, Hydro Ottawa.)

¹⁸ Ontario Energy Board. Historical Electricity Prices.

¹⁹Ontario Ministry of Environment. Achieving Balance: Ontario’s Long-Term Energy Plan, 2013.

²⁰ Statistics Canada. Energy Statistics Handbook.

²¹ Statistics Canada. Energy Statistics Handbook.

²² Major repairs refer to the repair of defective plumbing or electrical wiring, structural repairs to walls, floors or ceilings, etc.

²³ National Household Survey (NHS) Profile, 2011

²⁴ <http://www.cmhc-schl.gc.ca/odpub/pdf/63643.pdf>

²⁵ <http://www.cmhc-schl.gc.ca/en/co/renoho/reensa/upload/63704.pdf>

²⁶ <http://www.cmhc-schl.gc.ca/en/co/renoho/reensa/upload/63706.pdf>

²⁷ <http://www.cmhc-schl.gc.ca/en/co/grho/reensa/upload/63681.pdf>

²⁸ National Household Survey (NHS) Profile, 2011

²⁹ <http://www.cmhc-schl.gc.ca/en/inpr/bude/himu/upload/Top-Ten-Water-and-Energy-Savings-Tips.pdf>

³⁰ <http://www.eco.on.ca/uploads/Reports-Energy-Conservation/2012v2/12CDMv2.pdf>

³¹ <http://news.ontario.ca/mei/en/2013/12/ontario-releases-long-term-energy-plan-1.html>

³² LIC stands for Local Improvement Charge. See Appendix G for detailed analysis of this option.

Appendix F: ASSESSMENT of the LOCAL IMPROVEMENT CHARGE (LIC) MECHANISM to FOSTER BUILDING RETROFITS

1. Introduction and Background

Background

In July 2012, Council received the *Green Building Promotion Program* report that identified six activities that could be undertaken to encourage green building in Ottawa, one being to *explore financial incentives for green building*. The analysis was to include “an assessment of the feasibility of a property-secured loan program providing financial aid for energy retrofits through a Community Improvement Plan (CIP), Local Improvement Charge (LIC), or other mechanisms”. The purpose of this appendix is to provide the results of that analysis.

Ontario Regulation 586/06 and 322/12

Under Ontario Regulation 586/06 *Local Improvement Charge – Priority Lien Status*, passed pursuant to the *Municipal Act, 2001*, municipalities are able to undertake works as a local improvement and recover the cost of the work from the benefiting properties via a special charge added to the property tax bill.¹ The municipality can spread the cost of a local improvement over multiple years to ease repayment. If the owner sells their property before the local improvement charge is paid off, the responsibility for the remaining payments can be transferred to the new property owner.

Until recently, this mechanism could only be used to finance local infrastructure projects such as sidewalks or water/sewer pipes. However, in October 2012, the Province of Ontario amended its LIC financing regulations with Regulation 322/12, also passed pursuant to the *Municipal Act, 2001*. This change gave municipalities the flexibility to use LICs as a financing tool to cover capital costs for a wide range of improvements on private properties, including energy efficiency, renewable energy, and water conservation retrofits.

LIC and City of Ottawa

A [2005 Pembina Institute](#) report led to informal discussions with City staff on the potential to apply the LIC mechanism to building retrofits. In 2007, the City (with support from Hydro Ottawa, Enbridge Gas and NRCan) commissioned SES Canada Research to conduct a survey to gauge homeowner and small business owner support for a property-based loan program for energy retrofits. In 2010, EnviroCentre undertook research of 300 homeowners as a follow-up to their energy audit work.

Collaboration on Home Energy Efficiency Retrofits in Ontario (CHEERIO)

Prompted by the regulatory change, the Toronto Atmospheric Fund initiated the Collaboration on Home Energy Efficiency Retrofits in Ontario (CHEERIO) in the fall of 2012. CHEERIO was funded by federal and provincial agencies and several Ontario municipalities.² The goal of CHEERIO was to collaboratively design a multi-municipal pilot to:

- Assess the effectiveness of LIC financing to accelerate residential retrofits; and
- Provide insights and guidance regarding full-scale implementation of LIC.

As a result of the initiative, two documents were prepared: *Local Improvement Charge (LIC) Financing Program Design for Residential Buildings in Ontario*, prepared by Dunsky Energy Consulting (the “Dunsky report”) and a legal review of *Ontario Regulation 586/06, as amended by O. Regs. 322/12 & 323/12, Local Improvements on Private Property by Agreement*, prepared by Aird & Berlis LLP, a Toronto law firm (the “CHEERIO legal review”).

City of Ottawa staff participated in the CHEERIO work and the Dunsky report and the Aird & Berlis legal review are posted on the [Clean Air Partnership](#) website.

2. LIC in North America³

United States

Generally referred to as Property Assessed Clean Energy (PACE) in the US, the first programs were launched in 2008.⁴ Thirty states now have PACE-enabling legislation.⁵ About thirty PACE programs have been launched in approximately 12 states. Additional programs are under development.⁶ These programs have a variety of administrative arrangements, financing, terms and conditions and focus.

Early PACE programs focused largely on the residential market. In July 2010, the Federal Housing Finance Authority (FHFA) was concerned that PACE financing was taking precedence over existing mortgages and issued a letter of concern about possible risks to mortgage holders. *This action brought a halt to virtually all residential PACE program activity.* Changes to address FHFA objections were put in place in some jurisdictions.⁷ Nationally, a proposed federal PACE Assessment Protection Act aims to address these concerns by ensuring adequate provisions and restrictions on financing. There are also outstanding legal actions against FHFA related to this matter.⁸

PACE programs for the commercial sector began gathering momentum in 2011, partly because of the impact of the FHFA on residential programs.⁹ As of February 2013, sixteen active programs in seven states covered commercial buildings.¹⁰ Some emerging programs are strictly commercial. Programs that cover both residential and

commercial scenarios often do so via parallel streams that access the same source of funds.¹¹

To summarize observations about the [US PACE programs](#):

- *Few municipalities currently operate PACE programs in the US.* The majority are administered *regionally or even state-wide*. Some municipalities that ran their own programs (including the first PACE programs – Berkley and Palm Desert) are now joining regional programs.
- Many programs do not require an energy audit and claim a fairly short turnaround from application to approval. Eligibility criteria are also typically modest and uncomplicated.
- Many programs fund water efficiency and/or renewable energy projects in addition to energy efficiency. Renewable energy is the main focus of some programs.
- Many PACE programs require use of designated contractors, based on existing registered qualifications, some training about the program, or both. Numerous programs stress the importance of promotion via registered contractors.
- Many PACE programs are part of a larger suite of offerings to inform, support and incent energy efficiency and renewable energy.

Canada

In contrast to the US, Canada has very little experience using the LIC mechanism for building retrofits. To date, only three *pilot programs* have been launched in Canada in Toronto, Vancouver and Halifax.

Toronto

In August 2013, Toronto City Council approved the implementation of the [Residential Energy Retrofit Pilot Program](#) for energy and water efficiency and conservation measures, the first program of its kind in Ontario.

Toronto received start-up funding of ~\$750K from the Ontario Power Authority, the Toronto Atmospheric Fund, NRCan, and local utilities. The City of Toronto launched its single-family Home Energy Loan Program ([HELP](#)) and its multi-residential High-Rise Retrofit Improvement Support Program ([Hi-RIS](#)) in February/March 2014, targeting up to 1,000 single-family homes and approximately 10 multi-residential buildings (representing approximately 1,000 housing units). Both programs are intended to be self-sustaining, operating within a \$20M funding envelope to be financed from the City of Toronto's working capital. Some features of the Toronto program include:

- The pilot targets *specific* neighbourhoods;
- The LIC will fund high efficiency furnaces, hot water heaters, window/door replacements, and insulation (exterior/attic/basement);
- An audit is required;
- There must be written sign-off by the mortgage holder;
- There is a Property Owner Agreement (POA) setting out the terms and conditions of the LIC;
- When approved, the applicant will receive 10% of the retrofit cost, and the remainder will be paid upon completion and an inspection;
- The repayment term is up to 15 years; and
- The interest rate is 2.78% plus a one-time admin fee of \$405.



Visit the [CHEERIO](#) results for background ‘needs analysis’ research and presentation provided by Toronto.

Vancouver

The City of Vancouver proposed the use of LICs to fund energy efficiency projects in its 2008 [Vancouver 2020: A Bright Green Future](#) plan. The Vancouver pilot had the following features:

- It targeted 500 homes; however, it received less than 10 applications;
- Repayment was through the tax bill but loans had to be paid out at time of sale;
- An energy audit was a requirement of eligibility;
- Vancity (banking) agreed to finance loans up to \$10,000 (to a maximum envelope of \$5M) at a fixed interest rate of 4.5% for a 10-year term; and
- The City of Vancouver committed \$500,000 in an interest-bearing loan loss reserve and VanCity put up \$1M for the reserve.

After one year and little response, the program was terminated.

Halifax

In contrast to the experience in Vancouver, the Halifax Regional Municipality (“Halifax”) has had success with its pilot [Solar City Program](#) with over 1500 registrants. In December 2012, Halifax Regional Council approved the start of a LIC-based pilot program to finance residential solar water heaters after financial support was received from Federation of Canadian Municipalities (FCM) in the form of a \$545,000 grant and a \$5,455,000 loan. Financing also included a \$1.25M contribution from Efficiency Nova Scotia to allow for rebates to reduce the cost for homeowners.¹²

The Halifax program is more of a 'turn-key' operation and has the following features:

- A free site assessment is provided and includes an estimated return on investment for the property owner;
- If approved, a solar contractor, pre-selected by the municipality, installs the solar hot water system;
- Loans are offered at 3.5% for a ten year term and there is an admin fee of \$336 which offsets the staff costs incurred by Halifax (1 full-time, 2 temporary employees are required to staff the program);
- Registrants can opt to do a one-time payment or finance their purchase through the LIC;
- To date 90% are choosing to use the LIC; and
- Total costs per home are typically \$6,400-\$8,500 plus financing costs.

In summary, the Halifax and Toronto approaches are very different for the following reasons:

- Halifax has bulk-purchased a product and installation services, while Toronto is leaving it up to homeowners to scope and manage their projects;
- Halifax is doing a payback analysis for the homeowner while Toronto is not;
- Halifax is selling a tangible product, while Toronto is selling a financing tool;
- Halifax is offering the above with and without financing, while Toronto is offering only the financing; and
- Halifax is assuming risk in managing the above while Toronto has less operational risk.

London, Hamilton, and the Region of Durham

London, Hamilton and the Region of Durham all participated in the CHEERIO initiative and are currently exploring options. Staff interviewed representatives of all three municipalities. In a [March 2014 report to Council](#), London advised that it will continue to monitor Toronto's program. Durham Region has postponed their program given the announcement by the province that utilities may undertake energy retrofit loans and billing. Hamilton is not pursuing a LIC program at this time.

3. Assessment of LIC as a Mechanism to Foster Retrofits

Cited advantages of LIC-based financing include:

- Long-term financing and low interest rates increase the likelihood that monthly payments can be offset by monthly savings;
- The loan attaches to the property, reducing risk to the owner of paying for benefits not received if the property is sold, before the loan is fully paid;

- LIC programs are intended to be fully ‘user pay,’ and therefore revenue neutral for municipalities; and
- The priority lien status for LIC loans protects municipalities in the event of default on payments.

Uptake

Experience with LIC programs to date shows that uptake is difficult to predict. Many factors impact people’s decisions and perceptions as outlined below.

- ***A property-based loan is not viewed as an asset by many homeowners***

In the 2010 Ipsos Reid survey for the City of Toronto, support for attaching the proposed low-interest loan to the homeowner was much stronger than support for attaching it to the property. While 70% of respondents indicated they would be more likely to purchase a home if they knew it was energy efficient, the proportion declined to 30% if there was an outstanding energy loan on the property. These views were also expressed in the 2013 Ipsos Reid focus groups conducted for the CHEERIO initiative. *The local improvement charge staying with the home was a key concern based on a sense that this would discourage buyers.*

- ***Natural gas prices are much lower today, thereby reducing the return-on-investment of energy saving measures***

The questions in the 2007 SES survey were explicitly framed on the assumption that improved efficiency would pay for the renovations; and specifically, that loan payments would be set to an amount less than the energy savings that would be achieved – an approach termed Pay as You Save (PAYS). At the time of the survey, natural gas prices were relatively high, compared to current rates.¹³ Given very low current and anticipated natural gas prices,¹⁴ PAYS would in most cases be difficult to achieve even with long-term loans.

- ***Interest rates are much lower, making it harder for municipalities to offer attractive financing***

In the 2010 Ipsos Reid survey of 500 Toronto homeowners, 16% of respondents said they were very likely to apply for a “very low interest loan”, and 26% said they were somewhat likely to apply. Further, private lending is not something municipalities traditionally do. Participants in the 2013 CHEERIO focus groups asked why a municipality would provide financing in competition with financial institutions. Both the Toronto and Halifax programs offer a fairly competitive interest rate but include an additional administrative charge of \$336-\$405, on a \$6,500-\$15,000 loan.

- **Access to financing may not be the most significant barrier to undertaking energy retrofits**

In the 2010 Ipsos Reid Survey, 74% of the Toronto homeowners who indicated an intention to undertake energy efficiency improvements in the next five years said they would finance those improvements through cash and savings. Another 9% said they would use a line of credit.

Finally, although LIC financing could be targeted to homeowners who are less able to access low-interest financing, the American Council for Energy-Efficient Economy (ACEEE) notes that *'Financing programs for homeowners have typically drawn low participation rates and tend to attract educated and motivated homeowners who are the least in need of financing opportunities. Financing for those who are most in need – people with low or fixed incomes and poor credit – has had low success.'*¹⁵

This analysis is supported by the results of a review of Ottawa's housing ownership statistics contained in Appendix F. Most of those who own a building asset have the financial means to make improvements to it. Those without the financial means more often do not own the asset or have control over it.

Potential Risks

There are some risks with the LIC mechanism as outlined in the following table.

Risk	Details
Risk of loan default	Municipalities can mitigate this risk by screening participants or capping the amount of the LIC based on the estimated property value. The CHEERIO legal review noted: <i>Any payment in arrears (and only the overdue amount) is subject to a special priority lien and may be recovered with costs by the municipality from both current and future owners of the property.</i>
Liability for the actual work	The CHEERIO legal review noted: <i>An indemnity and hold harmless clause will permit a municipality to mitigate its liability with respect to negligence claims resulting from the work undertaken by an independent contractor. While these clauses indemnify the municipality through contractual means, they will also meet property owners' needs by ensuring a right to seek a remedy from the independent contractor for any action that may be brought.</i>
Impact on Municipal Credit Rating	The concern is that raising capital in the debt market for a purpose other than a capital project could affect the municipal credit rating. Infrastructure Ontario recently announced that they can now lend

Risk	Details
	funds for LIC, although funding will not cover administrative costs.
Obligation of subsequent homeowners	The legal review for CHEERIO holds that amendments to the <i>Municipal Act, 2001</i> would be required to legally provide that LIC agreements between property owners and municipalities could be registered on title and enforced against subsequent owners of property.
Consent of mortgage holder	The CHEERIO legal review recommended a requirement that mortgage holders provide a consent form, acknowledging the primary lien with the municipality. Toronto is requiring the form.
Administrative Costs	Lower than anticipated program uptake on small loans will result in higher administrative costs.

4. LIC Design Options

The Dunsky Report, Document 2, outlined five key factors for a successful LIC program. Additional factors for success were observed through the PACE programs in the US.

Key Success Factors Dunsky Report	Additional Success Factors PACE experts ¹⁶
<ul style="list-style-type: none"> • Know your audience • Sell Hard • Keep it Simple • Be Attractive • Sensible Evaluations 	<ul style="list-style-type: none"> • Crib from others. Get access to documents. • Slow the launch to allow testing of systems; ensure documentation is adequate, etc. • Consider having a community advisory group to ensure input from stakeholders. • Take steps to minimize the likelihood of applicants not following through.¹⁷

Types of Energy Measures

A range of approaches are possible in terms of types of energy measures covered. Several options are summarized in the following table.

Options	Pros	Cons
1. <i>Allow a broad suite of energy saving measures.</i>	<ul style="list-style-type: none"> • Likely to have more appeal to homeowners -- all in one financing. 	<ul style="list-style-type: none"> • Not all measures funded will yield significant energy savings. • Renovations that take place over an extended period imply more complicated arrangements (e.g., installment payments).
2. <i>Require a 25% energy savings threshold based on an EnerGuide for Houses (EGH) rating; but allow a broad suite of measures.</i>	<ul style="list-style-type: none"> • Ensures that program objective is met. • Provides independent professional advice to homeowners, and assurance of benefits. • Enables better tracking of energy savings for program performance. 	<ul style="list-style-type: none"> • EGH rating imposes additional burden and cost. • Would eliminate potentially significant proportion of willing homeowners.
3. <i>Finance high-impact measures only: insulation, draft-proofing, and heating/cooling equipment upgrades.</i>	<ul style="list-style-type: none"> • Ensures that program objective is met. • Maintains simplicity of program. • Reduces risks with longer timeframe and more complex renovations (e.g. windows). 	<ul style="list-style-type: none"> • Will have less appeal to homeowners doing retrofit as part of broader renovations/ upgrades.

The Dunsky report identifies the following as primary measures:

- Attic insulation to R50
- Basement insulation to R12
- Wall insulation to R5
- Draft proofing/weatherization
- Install a high efficiency space heating system (gas furnace/boiler) (Eff. > 95%)
- Install a high efficiency water heater (condensing)

- Install a Central Air Conditioning system or electric furnace that satisfies saveONenergy incentive requirements.

Vancouver identified specific activities and potential savings over a 10-year period. Examples of Eligible Pilot Program Retrofit Activities and Estimated Savings¹⁸

Eligible Retrofit Activities	Cost	Reduced Energy Costs (savings) (over 10 years)*
EcoENERGY Audit	\$450	
HE Condensing Furnace	\$4,000	\$4,544
New Hot water tank	\$1,000	\$350
Attic Insulation	\$1,200	\$2190
Wall Insulation	\$2,400	\$2190
Weatherization	\$900	\$788
Basement Insulation	\$1,300	\$854

* Assumes a 2% per year average energy cost escalation and the modeled energy use

Potential Target Markets

Although Toronto has restricted its pilot program to specific neighbourhoods, the Dunsky report does not recommend restricting access to the program but suggests targeting a sector or neighbourhood(s), thereby maximizing marketing resources. The report also recommends focusing on homeowners already planning a renovation to encourage deeper savings. Older neighbourhoods in transition could also be targeted.

Eligibility Requirements

The Dunsky Report recommends the following eligibility requirements for a LIC loan:

- Applicant is property-title holder;
- No arrears on property taxes and mortgage in good standing;
- No involuntary liens on property;
- No recent bankruptcy; and
- Credit score check and recent bankruptcy check (optional).

Program Costs and Financing

There are two program costs - administrative and loan costs.

Administrative Costs

The Dunsky report estimates the following costs to establish and maintain or administer a three year pilot program. These budgets are derived from a review of US PACE programs. As shown, these costs vary with the number of registrants.

Expense Category	Expenses	100 Participants per year	250 Participants per year	500 Participants per year
Program Initiation Fixed Costs (A) – to create a program model and obtain Council approval	Program Plan and Initiation Legal and Financing	\$ 80,000	\$ 80,000	\$ 80,000
Program Set Up Costs (B) – to develop program tools and processes	Program Tools Application Database Marketing Materials Documentation (\$500-\$700 per participant)	\$ 70,000	\$ 150,000	\$ 250,000
Annual Fixed Costs (C) – recurring costs associated with administration	Human Resources Debt Servicing Marketing Overhead LIC Collection (\$140-\$400 per participant)	\$ 40,000	\$ 80,000	\$ 140,000
Per Participant Costs (D) – costs associated with credit checks, title searches, registering liens, establishing LIC roll, making collection	Register Liens Title Searches Application Reviews Documentation (\$400 per participant)	\$ 40,000	\$ 100,000	\$ 200,000
Total Program Set Up Costs (A+B)		\$ 150,000	\$ 230,000	\$ 330,000
Total Annual Operating Costs (C+D)		\$ 80,000	\$ 180,000	\$ 340,000
Total Admin Costs (Per Participant for 3 yr program)		\$ 1,300	\$ 1,050	\$ 900

Based on the Dunsky estimates, administrative costs for a three year program that funds 250 homeowners per year would be in the order of \$770,000. As a comparison, for its pilot program targeting 1000 single family homes and 10 multi-unit residential buildings, the City of Toronto estimates \$1.413M in on-going administrative costs but the City had an *additional* \$750K in grants for set-up. Halifax requires \$350K annually for its program and received \$545K from FCM for set-up.

Loan Costs and Funding Sources

Based on an assumed 250 participants per year and an average loan amount of \$14,000, the capital required to finance the LIC program loans would be \$10.5M. While there are a variety of options e.g. finance from existing municipal funds or partnering with a financial institution, the option to borrow from Infrastructure Ontario is probably the best option.

5. Conclusion

Based on the research to date, the following are areas of concern regarding a LIC program:

Mixed evidence of demand, need or take-up of the program – Vancouver had a very low take-up rate that they attributed to poor marketing. Halifax, on the other hand, has had some success. The ‘devil may be in the program detail’ and therefore there is merit in assessing programs more closely, obtaining feedback from participants as to the ‘elements of success.’ The PACE program in the US has had mixed reviews and success. It is largely state or regionally administered with more interest from the commercial sector than residential.

A pilot or program requires ‘start-up’ funding – Toronto invested grants of \$750K to research, review and develop their LIC program. Halifax obtained a \$545K grant from FCM. Ottawa has not secured ‘start-up’ funding to develop a LIC program. Staff time and resources are required to initiate a program and represent ‘sunk’ costs, whether it’s a pilot or a permanent program.

Inability of the municipality to compete with private sector lending rates – Toronto’s interest rate is competitive until you add their ‘admin’ charge, which, on a ‘10K loan’, adds another 1/2%. Both Toronto and Halifax staff identified the need for fulltime staff to cover marketing and administrative program costs. To cover these costs and make the LIC program ‘revenue neutral’, each city has added an admin charge, beyond the interest rate - \$405 for Toronto and \$336 for Halifax. When this amount is added to the loan interest, the rates may no longer be competitive with the rates of most financial institutions.

Legal Concerns – as noted in the Dunsky report and implemented in the Toronto HELP program, the homeowner is required to get sign-off from a mortgage holder to ensure the municipality has priority lien status. This requirement may be a challenge or barrier for interested participants, so monitoring the Toronto situation will be informative.

Ontario Energy Plan – the province recently announced ‘on-bill financing for energy retrofits’ in the release of its 2013 Long-Term Energy Plan. To date, program details

have not been released. Some cities such as Hamilton and Durham Region have deferred establishing a LIC program until details of the utility program become known.

Staff is therefore recommending the following activities:

Activity	Department	Timeframe
If feasible, participate in Ministry of Energy stakeholder meetings on proposed on-bill financing for energy retrofits	Hydro Ottawa	On-going
Further explore the US results of participation in commercial property LIC programs	ESD	On-going
Explore 'start-up' grant opportunities as obtained by Toronto and Halifax	ESD	June-Oct
Continue to monitor related activities in other Ontario municipalities	ESD	May - Oct
Continue to monitor Toronto's Energy Retrofit Pilot Program (after 12 months of activities, March 2015) and the Halifax Program	ESD	On-going
Prepare a report with recommendations related to the use of LIC financing in Ottawa	ESD, Legal, Finance, PGM	Fall 2015

¹ Council endorsed a [Local Improvement Policy on 10 May 2006](#) and procedural requirements for undertaking works as a Local Improvement.

² Natural Resources Canada, the Ontario Power Authority, the Ontario Ministry of Energy, Enbridge, the Region of Durham, and the cities of Guelph, London, Hamilton and Toronto.

³ Property-assessed financing is also emerging in other jurisdictions, including the United Kingdom, via the Green Deal Program. Loans attach to the property but are repaid via the electricity bill versus property taxes.

⁴ BerkleyFIRST was the first PACE program, focused on solar energy installation. See timeline at <http://www.berkeleydailyplanet.com/issue/2010-07-13/article/35831>.

⁵ <http://www.energymanagertoday.com/sacramento-office-park-retrofits-with-pace-financing-reduces-energy-27-094146/>

⁶ <http://pacenow.org/wp-content/uploads/2013/07/7.24.2013-PACE-Programs-and-Legislation-at-a-glance.pdf>

⁷ For example, Maine passed PACE legislation that makes PACE assessments subordinate to mortgages, and loan payments are not made via property tax. Maine also requires a homeowner debt to income ratio of less than 45%, and at least as much

equity in the home as the amount of the PACE loan - <http://www.energymaine.com/docs/PACE-Interim-Impact-Report-FINAL.pdf>. The HERO program in California requires property owners to meet rigorous lending guidelines. The Palm Desert PACE program requires participants to sign an additional disclosure statement related to FHFA's concerns.

⁸ The County of Sonoma and the California State Attorney's General Office, among others, are in litigation with FHFA, Fannie Mae and Freddie Mac over their PACE actions.

⁹ Managan, Katrina and Kristina Klimovich. Setting the PACE: Financing Commercial Retrofits, Institute for Building Efficiency, February 2013
<http://www.institutebe.com/InstituteBE/media/Library/Resources/Financing%20Clean%20Energy/Setting-the-PACE-Financing-Commercial-Retrofits.pdf>

¹⁰ Ibid.

¹¹ Dunsky report page 24.

¹² <http://www.halifax.ca/council/agendasc/documents/121211ca1111.pdf>

¹³ <http://www.ontarioenergyboard.ca/OEB/Consumers>

¹⁴ The price of natural gas has dropped steeply since record highs in 2005/2006.
<http://www.ontarioenergyboard.ca/OEB/Consumers/Natural%20Gas/Natural%20Gas%20Rates/Natural%20Gas%20Rates%20-%20Historical> is forecast to remain low in the coming years <http://knoema.com/ncszerf/natural-gas-prices-long-term-forecast-to-2020-data-and-charts>.

¹⁵ <http://www.aceee.org/topics/energy-efficiency-financing>

¹⁶ From Applied Solutions online webinar – Charlotte County PACE Program, January 31, 2013. Interview with staff from 4 US PACE programs.

¹⁷ Measures can include adjusting application fees, requiring projects to be ready for installation, and asking property owners to make a strong commitment to completing their projects as part of the application process. <http://grist.org/article/2010-03-01-what-berkeley-can-teach-us-about-taking-clean-energy-programs-to/>

¹⁸ Vancouver City Council: *Vancouver Retro-fit Energy Efficiency Financing Program for One and Two Family Dwellings*, May 5, 2011.

Appendix G: Risk Mitigation through the Protection of Natural Areas

This appendix describes how the removal of natural features can increase the impacts of extreme weather events; presents the growing evidence supporting economic valuation of natural areas; outlines current land protection mechanisms and strategies; and identifies opportunities to work in partnership with other stakeholders to achieve greater stewardship and conservation for climate change adaptation.

Why Protect Natural Areas?

Vegetation and natural areas serve the following functions on a localized, regional, and global level, several of which are important in *adapting* to extreme weather events and a changing climate:

- Stormwater retention (flood protection for crops, buildings, roads) ¹
- Shoreline stabilization (for roads, bridges, buildings, and docks)
- Streamflow maintenance (for recreation and agriculture purposes)
- Erosion control (windbreaks for farm fields)
- Rodent and insect control (habitat for predator species)
- Groundwater recharge (private and communal well systems and recreation)
- Water purification (hydrologic cycle)
- Air purification (particulate matter)
- Stable ambient air temperatures (reduces heat island effect)
- CO₂ storage and sequestration (in vegetation and soil)
- Noise and dust attenuation (e.g. near roads and extraction uses)
- Screening and privacy (e.g. from highways)
- Recreation and relaxation (active and passive activities, tourism)
- Numerous ecological processes
- Enhance property values²

Forests and wetlands provide major benefits to the community, including reduced hard infrastructure costs for water filtration and storage, additional cooling, and community liveability benefits³.

The Trust for Public Land, a U.S.-based non-profit land protection organization, conducted several studies on conservation investments in Ohio, Pennsylvania and New York and found a range of economic return on investments, varying between a 4-to-1 return (Ohio) to 7-to-1 (Pennsylvania and New York). The Trust found, for example, “that every \$1 invested in land conservation returned \$4 in natural goods and services

to the Ohio economy.”⁴ The Ohio Program, using 2012 dollars, gives an annual value to deciduous forest of \$2682/ha US, very close to Ottawa’s estimate of \$3060/ha.

The City of Ottawa piloted a similar program to assess the economic value of the ecosystem services and benefits provided by its urban forest cover, and found that within Ottawa⁵:

- Trees sequester close to 29,000 tonnes of CO₂ per year;
- Trees remove over 600,000 kg of pollutants from the air each year;
- Trees that shade homes reduce cooling costs by 20-50% in the summer;
- Trees that provide wind protection reduce heating costs by 10-15% in winter;
- A single tree on a property can increase property values from 9-30%; and
- Trees provide the equivalent of almost four million m³ of stormwater storage.

Traditionally municipalities and conservation agencies have focused primarily on ecosystem values such as biodiversity to target lands for conservation. Adding climate change mitigation and adaptation values enriches the business case for land stewardship and securement, for the purposes of flood protection and cooling sinks, among others.

How Much Land is Currently Protected?

The City of Ottawa and its surrounding communities continue to grow, with an economy that continues to attract new residents. The City is geographically very large at 2,790 km², of which 28% is available for development in villages and the urban area, 35% is agricultural lands, and 37% is natural areas.

The City’s recent update of its Urban Natural Areas Strategy summarized the greenspace network within the National Capital Commission (NCC) Greenbelt and the urban area of Ottawa, as detailed in Table 1. Of a total area of 57,710 hectares, 15,770 ha (27 per cent) is comprised of Natural Environment Area, Major Open Space, Significant Wetlands and Urban Natural Features,”⁶

Table 1: Greenbelt and Urban Natural Lands in Ottawa

Classification in the Official Plan	Area (ha)
Major Open Space	2689
Natural Environment Area	8106
Provincially Significant Wetland	3662
Existing and Proposed Urban Natural Features	1313
Total	15,770

Outside the urban boundary, the City owns over 10,000 hectares of rural land in such environmentally significant areas as the South March Highlands, the Carp Hills, Torbolton Forest, Cumberland Forest and Marlborough Forest.

The City of Ottawa also owns and cares for its own trees throughout the city. The urban tree canopy is a major asset and its stewardship has been recently enhanced by the City's Trees and Forests Maintenance Program. The inspection and tree trimming cycle has moved from 1-in-42 years to 1-in-7 years, aligning with best practices and reducing long term costs and liabilities.⁷

Tree cover varies considerably across the city with recent estimates finding 20% tree cover in the urban area, well below the 30% target citywide in the Official Plan. With the Emerald Ash Borer, the City is losing more of its tree cover although it is implementing replacement plans.

Other natural areas are owned and managed by a variety of governmental and non-governmental organizations:

- The National Capital Commission is a major landowner in the City of Ottawa, with a Greenbelt of roughly 20,600 hectares of which 14,950 hectares are in its ownership/control and one quarter is agricultural land.
- Three conservation authorities overlap geographically with the City of Ottawa: Rideau Valley CA, Mississippi Valley CA, and the South Nation CA. Collectively, they own and manage dozens of properties, with four significant conservation areas within the City of Ottawa.
- The Nature Conservancy of Canada has preserved approximately 4200 hectares of rare ecosystems and habitats within the entire Ottawa Valley Conservation Area of 9,827 square kilometres (an area much larger than the city limits, and including lands in both Ontario and Quebec).

How Does the City Currently Protect Natural Areas?

The City has an active role in land protection and securement, both in its own right and in partnership with other organizations and agencies.

Provincial Policy Statement

The 2014 Provincial Policy Statement (PPS) for land use strengthens the protection of natural areas, by calling for the identification and protection of natural heritage system features and areas and their ecological functions. The 2014 PPS, which came into effect on April 30, 2014, *require* the identification of such systems – a requirement absent in the 2005 version – and also require the application of provincial criteria for the identification of significant woodlands. They also now call for planning authorities to “promote” green infrastructure, defined as “natural and human-made elements that

provide ecological and hydrological functions and processes... [including] natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces, and green roofs.”

The City has defined its natural heritage system in the Official Plan and protects it through controls on development and, in some areas, through acquisition.

Greenspace Master Plan

The City’s Greenspace Master Plan (2006) sets out the long term vision and policies to preserve and protect greenspace in urban Ottawa.⁸ Greenspace is considered to be land that serves either or both of these purposes:

- The provision of recreation and leisure opportunities for the use and benefit of the public;
- Preservation of the natural environment and environmental systems.

The best way to preserve these functions is a network approach. As a connected and protected physical network of natural lands and open spaces, the network can constitute the permanent, defining feature of the city’s physical form – where it may grow and what areas should be protected. The City continues to grow this network in new communities through parkland dedication and a variety of other tools.

City of Ottawa Official Plan

The current Official Plan (with amendments) sets out the following targets from the Greenspace Master Plan – forest cover of 30% across the urban and rural area; 4.0 hectares of greenspace per 1,000 population in the urban area; open space and leisure land within 400 metres of every urban home.

Various sections of the Plan describe how natural areas will be protected.

Strategic directions (Section 2) define the Natural Heritage System citywide and establish watershed plans as the basis for land use planning.

- 1) *Designations and Land Use* (Section 3) sets policies to preserve the most significant natural features, identified individually as well as within a natural heritage system on maps in the Plan. Designation as Natural Environmental Areas, Urban Natural Features or Rural Natural Features may create an obligation for the City to acquire affected properties at the request of the landowner. Furthermore, OP policy requires the conveyance the natural heritage system to the City for \$1 within selected expansion areas added to the urban area in 2011.⁹
- 2) *Review of Development Applications* (Section 4) requires environmental impact statements and other studies in order to protect vegetative cover, surface water

quality through erosion prevention, endangered or threatened species, stormwater and groundwater quality, and landform features.

While land securement through acquisition is the strongest protection strategy in most cases, it is not the only strategy available to the City. Other techniques are employed when feasible, and tailored to the unique circumstances of a given transaction. Such techniques include land exchanges, which were used to acquire several Urban Natural Features, conservation easements, and creative financing solutions such as tax credits, or long-term leases such as the Nepean Sportsplex.

Where possible, the City also supports enhanced stewardship of lands in private hands without having to acquire. The Rural Clean Water Grants Program is an example of 'fostering stewardship'. Planning Growth Management staff is preparing a "sensitive environmental land stewardship framework" for consideration in the 2015 – 2019 Term of Council Priorities, which will recommend more coordination between departments and with external partners on the stewardship of both public and private lands.

How Are Other Agencies Currently Protecting Natural Areas in Ottawa?

The Ottawa region contains a high diversity of natural habitats and rare species. It is also home to a large number of organizations working to protect and conserve the natural environment, including the Ottawa Field Naturalists Club, the oldest natural history club in Canada.

The following are some of the significant initiatives undertaken by other organizations in Ottawa and environs to conserve natural areas and linkages:

- *National Capital Commission Greenbelt Master Plan (2013)*: The NCC's Greenbelt is largely complete. The Plan focuses on stewardship, enhancement of natural features, changes in management practices, and further connectivity between key protected areas through additional land securement of 481 hectares over the coming decades.
- *Nature Conservancy of Canada Ottawa Valley Conservation Plan (2013)* The Plan lays out a vision of preservation for the Ottawa Valley, and focuses on conserving rare ecosystems and representative communities, specifically, alvars, sand dunes, bogs, fens and grassland bird communities. The organization aims to raise \$4.775 million to acquire a target of 500 hectares in the Ottawa Valley (in both Ontario and Quebec), working with local partners and other levels of government.
- *Conservation Authorities* play an important role in conservation of source water through watershed planning, land conservation, flood prevention and warning systems, and landowner outreach and education. Each of the three local

conservation authorities acquires, owns, and manages land for preserves and public access.

- Other organizations such as Ducks Unlimited Canada, land trusts in the upper Mississippi-Madawaska and Rideau Valley watersheds, and the Ontario Heritage Trust, among others, play similar roles in regional conservation.
- The Ontario Land Trust Alliance and Canadian Land Trust Alliance provide support to local organizations through training, communications, and public awareness of the role of land trusts.

The City is fortunate to have this robust collection of organizations contributing to conservation locally. Nonetheless, there are gaps in the capacity, scope and funding for land stewardship and acquisition programs in Ottawa as detailed in the following section.

Opportunities for Improvement

- **A regional conservation plan.** The City, conservation groups and other municipal, provincial and federal agencies work on aspects of land conservation in the region. An overall vision for conservation amongst stakeholders, in which knowledge would be better shared and resources better targeted. While individual plans exist, they fail to draw the linkages in capacity, focus and implementation that may be needed to better leverage efforts.
- **Business case for land securement:** Currently the City and its conservation partners tend to focus primarily on ecosystem values such as biodiversity in targeting lands for conservation. Adding ecosystem values, features, functions along with climate change mitigation and adaptation values and functions, will assist in creating the business case for additional land securement, for the purposes of flood protection and cooling sinks, among others.
- **Dependability of funding.** An important step regionally would be the development of an endowed or dedicated funding stream, which is preferable to funding that is dependent on current political will or growth in general tax revenues. Neither the City nor most land trusts can count on a steady funding stream for conservation due to the lack of a dedicated funding mechanism.¹⁰
- **Multi-faceted.** Land acquisition is not the only solution available to protect natural areas. Ample stewardship models are available to enable landowners to participate without giving up ownership or control of their properties.
- **Responsive.** A land conservation regime must be able to seize opportunities when they come while working toward specific conservation targets. For example, planning for the purchase of small parcels to provide ecological corridors and linkages may be less flashy than snapping up high-profile acquisitions, which

sometimes exhaust people and budgets. On the other hand, high-profile parcels tend to have high ecological (and sometimes, historical and cultural) values as well as high development potential, and at times resources are best spent on their protection.

Next Steps

Members of the local and regional land conservation communities have engaged in discussions about greater cooperation and mutual support.¹¹ These discussions of partnerships have focused on the kind of structure that would best assist the participants, and have generally fallen into three main concepts:

a) *Establish an alliance or network to facilitate collaboration*

A strengthened network or alliance offers the hope of more support and collaboration without the necessity of organizational structures and constraints. Collaborative models exist elsewhere in Ontario amongst municipal and non-governmental partners, including York Region which set up a Land Securement Program and organizes and hosts a Land Securement Working Group. Through these mechanisms, York participates in joint conservation projects with land securement partners, and in particular, has a joint venture with the Nature Conservancy of Canada.

b) *Create a chapter within an existing organization*

Existing organizations, such as the Rideau Valley Conservation Foundation, have been proposed as potential homes for a new chapter to support focused additional local conservation work. A strong advantage is avoiding the duplication of administrative efforts and resources, and the built-in resources offered by the parent organization. A major drawback is the possible constraints placed by an existing organization on the new chapter.

c) *Create a new land trust for Ottawa*

A new land trust would provide a major focal point for organizing, planning and collaborating in Ottawa. With an independent director, staff and board, it would have the opportunity to create fresh relationships with both landowners and potential donors. However, it would also require resources to set up and operate, and could potentially compete with existing organizations in its fundraising and volunteer opportunities.

A working group with key partners to determine how the City can best direct its resources and efforts, research and discussions to improve the collective ability to secure public interest and funds to protect natural areas for climate adaptation as well as ecological functions, is now underway with some preliminary meetings planned for June 2014.

¹ Urban Natural Features Strategy update 20 Sept 2013

² Crompton, J.L. 2005. *The impact of parks on property values: empirical evidence from the past two decades in the United States*. *Managing Leisure* 10(4):203-218.

³ “Taking the economic benefits of green space into account Urban Climate” (Volume 7, Pages 1-134 - March 2014) [Urban Adaptation to Climate/Environmental Change: Governance, policy and planning](#).

⁴ Executive Summary, The Economic Benefits of Clean Ohio Fund Conservation, 2013, The Trust for Public Land; Pennsylvania’s Return on Investment in the Keystone Recreation, Park, and Conservation Fund, Trust for Public Land; The Economic Benefits of New York’s Environmental Protection Fund, Trust for Public Land

⁵ CityGREEN Pilot City of Ottawa in partnership with Federation of Canadian Municipalities and Tree Canada Foundation

⁶ [Urban Natural Features Strategy](#) update 20 Sept 2013, p. 7

⁷ Growing a Healthy Forest for the Nation’s Capital, report to the City of Ottawa Planning and Environment Committee, 11 May 2010, Ref N°: ACS2010-COS-PWS-0009, p. 4

⁸ [Greenspace Master Plan, City of Ottawa](#)

⁹ Policies 3.11 (6b) and 3.11 (7b)

¹⁰ For example, the City has spent millions of dollars in the past on land conservation, but the 2014 budget did not include additional allocations for land securement. The National Capital Commission has had a relatively secure funding source in its annual allocations from the federal government, but funding has been dramatically reduced in recent years. In contrast, conservation authorities’ funding streams are relatively well-established between provincial, municipal and self-generated funds.

¹¹ A 1999-2001 working group held numerous meetings, and charted a course for collaboration. The amalgamation of former municipalities into the current City of Ottawa subsumed much of that agenda. Again in 2011, a large group convened to understand who was doing what.

Appendix H: Public Health Implications of Climate Change in Ottawa

Introduction

In 2008, Health Canada identified human health vulnerabilities to climate change in a comprehensive report - [Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity](#)ⁱ. The findings of this report and other local and international studies have identified the potential health risks associated with climate change, their climate related causes and the projected and possible health effects associated with each risk.

The key climate change impacts that are likely to affect public health in Ottawa include:

- 1) **Temperature extremes** including higher temperatures and possibly colder temperatures, and more frequent and severe heat waves,
- 2) Increase in **extreme weather events and natural hazards** such as , severe storms, hurricanes, floods, wildfires and droughts,
- 3) Increase in **vector-borne diseases** such as Lyme disease and West Nile Virus,
- 4) Greater **air pollution** and lesser air quality,
- 5) **Contamination of food and water**, and
- 6) **Stratospheric ozone depletion**.

In March 2014 the International Panel on Climate Change (IPCC) updated their findings on climate change. In their report [Climate Change 2014 Impacts, Adaptation and Vulnerability](#), the IPCC found global evidence that climate change is already affecting food production; that poverty and economic shocks and could lead to war and homelessness; and that heat waves, drought and flooding will have the biggest toll on the poor, weak and elderlyⁱⁱ. They reconfirmed that glacier melting and permafrost warming and thawing are affecting runoff and water resources downstream.

The City of Ottawa has been working to ensure risks are assessed for our community and that mitigation and adaptive strategies are in place to address these risks when possible. Managing climate change involves reducing the hazard, reducing susceptibility to the hazard (including surveillance) and increasing the resilience of the community. This appendix reviews health risks associated with climate-related change and highlights Ottawa Public Health (OPH) responses to these threats.

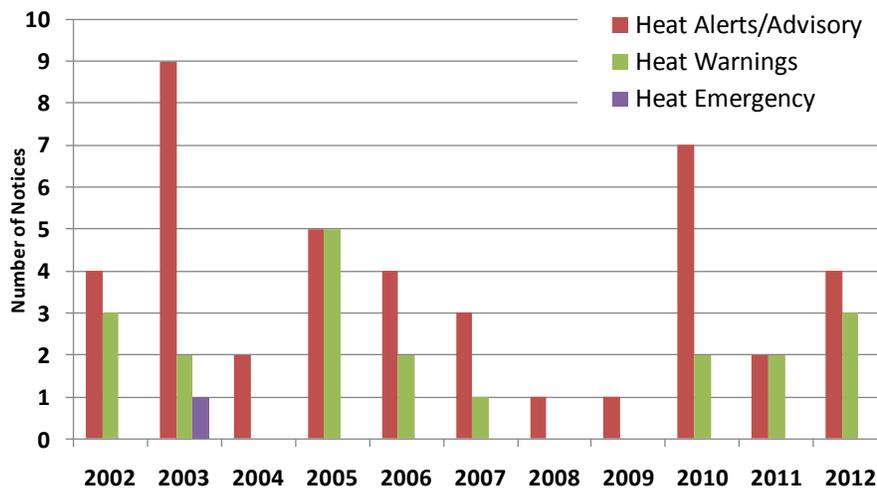
Risk 1) Temperature extremes including higher temperatures and possibly colder temperatures, and more frequent and **severe heat waves**.

It is projected that many larger Canadian cities could expect to experience a significant rise in the number of very hot, smoggy days, with more and longer heat wavesⁱⁱⁱ. Climate change is expected to increase the annual number of extreme heat days in Ottawa. Environment Canada projects that by mid-century, the average number of days per year where the temperature exceeds 30°C will double.

- The number of days per year when the temperature will exceed 30°C is projected to increase from the 22 days per year currently in Ottawa to over 40 days per year by the end of the century.^{iv}
- The number of days per year when the night time temperature will be greater than 22° C will increase from 4 per year to 18 per year by the end of the century.

OPH issues advisories and warnings to vulnerable populations and the general public for extreme heat, extreme cold, poor air quality and very high UV levels. Figure 2 illustrates how often heat advisories, warnings and emergencies are issued in Ottawa. In 2013 OPH issued heat advisories and warnings on 21 days, and experienced 1 day when the UV was forecast to be higher than 10, as well as 1 smog advisory day.

Figure 1: Number of Extreme Heat Advisories Issued in Ottawa (2002-2012)



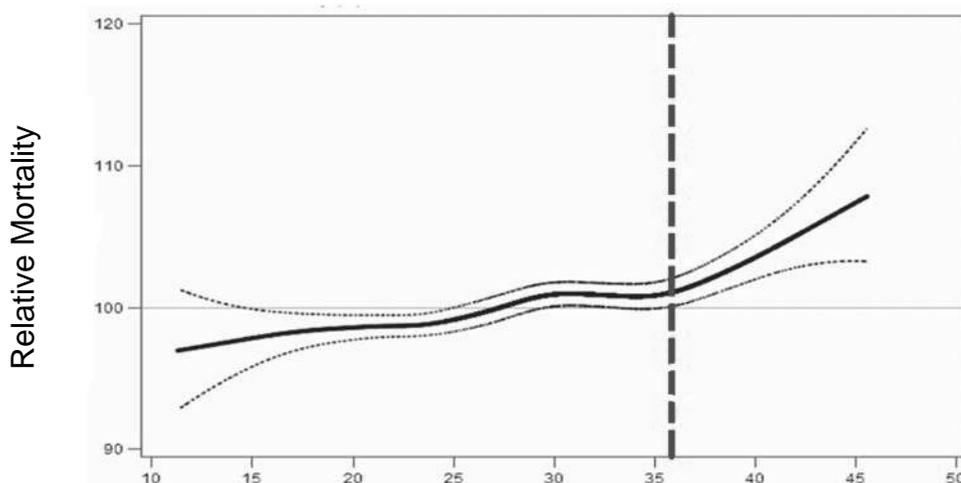
Each year in Ottawa there are approximately 77 emergency room visits directly related to exposure to extreme heat, such as heat exhaustion and heat stroke, and approximately 81 visits per year directly related to extreme cold, such as hypothermia and frostbite.^{vi} Extreme weather also increases emergency room visits due to co-morbid conditions such as cardiovascular or respiratory disease, therefore using only diagnoses such as heat stroke underestimates the true burden of health of extreme weather.^{vii,viii}

. This increase in hot weather, combined with an aging population, is expected to result in an increase in heat-related deaths in urban centres.

Health Canada estimates that current heat-related mortality rates, will nearly triple between 2021 and 2040, increasing by nearly five-fold between 2051–2070 and by more than eight-fold before the turn of the century 2100^{ix}.

Figure 2 illustrates the increase in relative mortality over baseline in Ottawa with 95% confidence intervals when humidex values are greater than 36 C. This is the justification behind the notification trigger currently used in Ottawa.

Figure 2: Relative Mortality in Ottawa Compared with Humidex values (1986-2005)



Given the burden that hot weather can have on health, especially for some of the most vulnerable, OPH works with other City departments to ensure the public, media and partners who work directly with vulnerable populations are informed about hot weather events. More specifically, OPH issues public notifications when the weather is forecasted to exceed a Humidex of 40 C. OPH also informs residents when cold weather threatens frostbite and hypothermia when the wind chill is forecast to be -35 C or colder and when the air quality in the Ottawa-Gatineau region is poor and the UV index is high to ensure that residents are aware and can take steps to protect themselves.

OPH recently reported to the Ottawa Board of Health on [Extreme Weather in Ottawa](#) in March 2013. This report outlined the burden of illness associated with extreme weather in Ottawa. It describes the strategies used to prevent adverse outcomes and the research and evaluation planned to keep improving the [Heat and Smog Action Plan](#) first released in 2004, and updated in 2006.

OPH formed an Extreme Weather Committee in 2002 to address emerging health risks associated with extreme weather. The committee has representatives from City departments and community organizations with at-risk clients. Membership of the committee includes OPH; Ottawa Paramedic Service; Community and Social Services Department; Parks, Recreation and Cultural Services Department; Corporate Communications Department; Environmental Policy & Programs Unit of Environmental Services Department; the Salvation Army; and the Red Cross.

The goals and objectives of the committee are to:

- To develop an integrated community plan that would protect the health of the population in Ottawa during extreme weather,
- To increase public understanding of the health issues related to extreme weather, cold, heat and smog.
- To develop a plan to mobilize community action when extreme weather is forecasted, and
- To develop an evaluation framework to assess the effectiveness of various strategies.

OPH has many resources for the public and institutions on how to plan for hot and cold weather and prevent heat and cold related illnesses and deaths. At risk groups and their service providers have been identified and provided with resources and training on preparing for extreme weather events.

OPH advocates for adaptation of the urban environment which minimizes the impact of heat retention inherent in the built environment by increasing the ratio of vegetated to impermeable surfaces, thereby reducing the “urban heat island” effect.

Risk 2) Increase in extreme weather events and natural hazards such as, severe storms, hurricanes, floods, wildfires and droughts.

More frequent and severe heat waves and overall warmer weather with possible colder conditions will result in more heat-related illnesses and deaths and particularly respiratory and cardiovascular within Ontario. There may also be changed patterns of illness and death due to cold. More severe weather events such as storms, hurricanes, floods, wildfires and droughts may impact human health in the following ways:

- Death, injury and illness from violent storms, floods, etc
- Social and emotional injury and long term mental harm from loss of loved ones, property and livelihood
- Damage to infrastructure and strains on emergency and health services.
- Health impacts due to food or water shortages

- Illnesses related to drinking water contamination
- Effects of displacement of populations and crowding in emergency shelters
- Indirect health impacts from ecological changes, infrastructure damages and interruptions in health services, and
- Psychological health effects, including mental health and stress-related illnesses.

Everyone is affected by the impact of extreme weather events, but the groups who have been identified as being at higher risk in Ontario include seniors, socially disadvantaged people, people with pre-existing illnesses; infants and children; emergency response workers and people living in northern communities. This is due to factors such as reduced ability to regulate body temperature, restricted mobility, occupational exposure or limited access to warm or cool indoor areas.

There were 23 disaster-level extreme weather events in Ontario between 2003 and 2012^x. These involved 9 floods, 4 storms or thunder storms, 4 tornadoes, 4 wildfires and 2 winter storms. This resulted in over 770,000 people being impacted by utility disruptions and over 10,000 people being evacuated during these events. A heat-health emergency has only been declared once in Ottawa in 2003 due to a widespread power outage that coincided with hot weather.

OPH works with the City Office of Emergency Management (OEM) to identify and plan for public health emergencies as they relate to manmade or natural disasters. OPH maintains a list of key service providers to vulnerable populations such as school boards, emergency shelter administrators and is in close contact with others that provide acute care services such as the Hospital Emergency Preparedness Committee of Ottawa (HEPCO). OPH encourages residents to have emergency plans and prepare for 72 hours without services in the event of a disaster or emergency.

Risk 3) Increase in vector borne diseases such as Lyme disease and West Nile virus.

Increases in infectious diseases transmitted by insects, ticks and rodents are possible within the Ottawa area with changes in the biology and ecology of various disease-carrying insects, ticks and rodents. Factors such as the faster maturation of pathogens within these vectors as well as longer disease transmission seasons, could result due to warmer temperatures. Public health threats include the increased incidence of vector-borne infectious diseases native to Canada, the introduction of infectious diseases new to Canada, and the possible emergence of new diseases, and of those previously eradicated in Canada.

Lyme disease is an infection caused by *Borrelia burgdoferi*, a bacteria transmitted through the bite of an infected tick. Although Ottawa is not yet considered to be

endemic, the incidence of Lyme disease in the City is increasing. In 2013, 47 human cases of Lyme disease reported to OPH met the Ontario Ministry of Health's definition for the disease, an increase from 19 cases reported to OPH in 2012. . Of these cases, two cases reported being exposed in the Ottawa area and one case had an unknown exposure.

Most of these Ottawa residents were bitten by a tick in nearby areas such as Perth, Rideau Lakes, Gananoque, and from travel in the U.S. Though Lyme is a treatable disease, if left untreated, can cause neurological, joint, or cardiac problems. Symptoms can occur weeks to years after the bite.

Both West Nile virus (WNV) and Eastern equine encephalitis (EEE) are infections spread by mosquitoes. OPH has a control plan to reduce the risk of WNV and EEE. WNV causes asymptomatic or mild infections for the most part, but in a small number of cases, can cause serious illness. In 2013 there were 4 confirmed cases of WNV reported to OPH, down from 8 cases in 2012, and no cases reported between 2007 and 2011. EEE is very rare but serious viral illness. There has never been a reported case of EEE in Ontario, but it has been detected in mosquitoes and horses in the province. OPH's control plan includes education, surveillance, elimination of mosquito breeding sites, larvaciding and a plan for controlling adult mosquitoes if circumstances are deemed necessary.

OPH collects surveillance data about infectious diseases from the provincial databases in order to inform OPH programs and ensure adequate control measures are in place to prevent disease outbreaks. Vector borne infectious diseases such as Lyme, EEE and WNV are closely monitored.

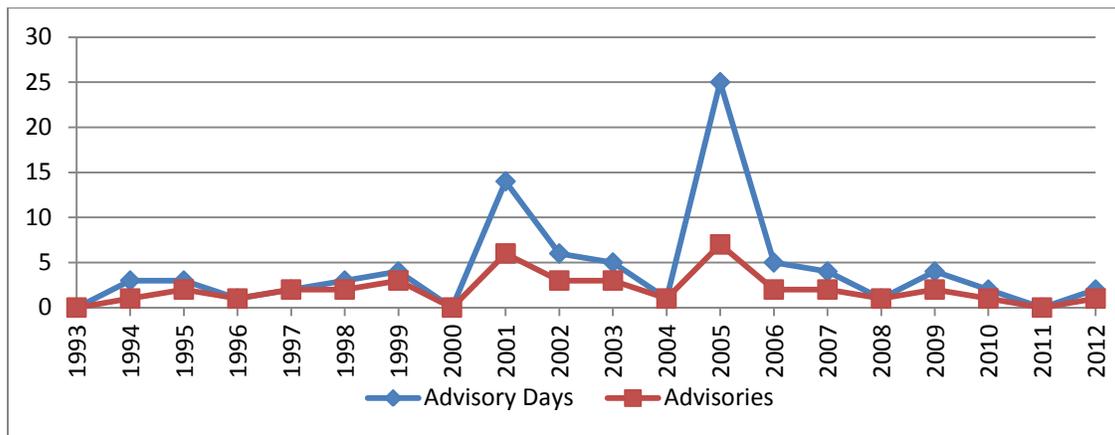
Risk 4) Greater air pollution and lesser air quality.

Air quality is expected to decline with climate change due to higher levels of ground-level ozone and airborne dust (including smoke and particulates from wildfires), as well as increased production of pollens and spores by plants^{xi}. This will result in a wide range of health impacts, including:

- Eye, nose and throat irritation and shortness of breath and exacerbation of asthma symptoms
- Chronic obstructive pulmonary disease and other respiratory conditions
- Exacerbation of allergies
- Heart attack, stroke and other cardiovascular diseases
- Increased risk of certain types of cancer, and
- Premature death.

In Ottawa, it is estimated that air pollution is responsible for 503 acute premature deaths per year^{xii}. The Ontario Medical Association estimates that across Ontario, it is responsible for 9,500 deaths per year along with 4,597 hospital admissions, over 39,500 emergency room visits and 262,315 doctors' office visits. Figure 3 illustrates the number of smog advisories and smog advisory days issued by the Ontario Ministry of the Environment(MOE) between 1993 and 2012. Smog advisories are issued when the air quality is expected to be poor and adverse health impacts are expected due to region-wide air quality conditions.

Figure 3: Smog Alerts Issued for Ottawa (1993-2012)



OPH forwards the MOE smog advisories to a list of community service providers and issues public service announcements to the public to raise awareness of increased health risks. OPH promotes the use of the Air Quality Health Index (AQHI) through education sessions, media campaigns and resource distribution to Ottawa residents.

OPH encourages reduction of emissions through promoting adherence of the Idling bylaw and the hydronic heater bylaw that reduce air pollution impacts of idling vehicles and wood boiler smoke emissions. OPH also promotes walking, biking and other forms of active transportation as well as the use of public transportation to reduce the number of vehicles and the burning of fossil fuels.

Risk 5) Contamination of food and water.

Runoff from heavy rainfall may increase the likelihood that drinking and recreational waters will become contaminated. Behavioural changes attributable to warmer temperatures may also contribute to increased risk of food- and water-borne infections associated longer BBQ and swimming seasons.

Foodborne Illnesses

Most food-borne illnesses are most prevalent in summer months in Ontario, with more than double the number of cases reported in July and August compared to winter month's.^{xiii} Public Health Ontario (PHO) reports 3,700 cases of foodborne illness every year in the province, but this number is estimated to be only 4% of the actual number of cases. PHO estimate the true number of foodborne illnesses to be 100, 000 cases per year. Forty-two percent of the reported food-borne illness cases reported contracting their illnesses in a private home setting. This highlights the significant impact of home food safety on the burden of food-borne illness. While children are most likely to be diagnosed with foodborne illnesses, people over 65 years of age are at the highest risk of hospitalization and even death from their illnesses.

OPH provides food and water safety education and training for food handlers and the general public. In addition, home food safety resources are available on-line or by booking a course with OPH.

Recreational Water Contamination

Recreational water use is impacted by heavy rainfalls that wash contaminants from the land into water bodies used for activities such as swimming and boating. Very heavy rainfalls have resulted in both storm and sanitary sewer overflow into rivers because the sewer infrastructures have been unable to keep up with treatment during storm surges. This has resulted in no-swim advisories issued by OPH at public beaches. In 2013 the City of Ottawa supervised beaches were open for swimming 88.6% of the time compared to only 60.9% in 2011 and 79.5.% of the time between 2007 and 2013. Improvements to infrastructure to prevent combined sewer overflows during heavy rainfall have resulted in improved beach water quality.

OPH monitors beach water quality on a daily basis during swimming season at the supervised beaches in Ottawa. No-swim advisories are issued when water quality is predicted to be poor.

Drinking Water Contamination

Approximately 20% of Ottawa residents rely on private wells for drinking water in the rural areas of Ottawa. While shallow private wells are the highest risk of contamination during heavy rainfall and flooding events, deeper, drilled wells still at risk. The remaining 80% of Ottawa resident's drinking water comes from two treatment plants on the Ottawa River and from several communal wells operated by the City. No compromises have been made to the water quality coming from the drinking water treatment plants due to flooding or rainfall events in the past. Boil water advisories have been issued on occasion to people relying on drinking water from the City's communal

wells, mostly due to drop in water main pressure from power disruptions during storms. Impacted residents are contacted personally when boil water advisories are issued.

OPH encourages Ottawa residents to take advantage of free well water testing provided by Public Health Ontario Laboratories. . OPH provides residents with resources on well water protection and information about this free testing service. OPH meets regularly with the City to review water quality issues at the water treatment plants and communal wells.

Risk 6) Stratospheric ozone depletion.

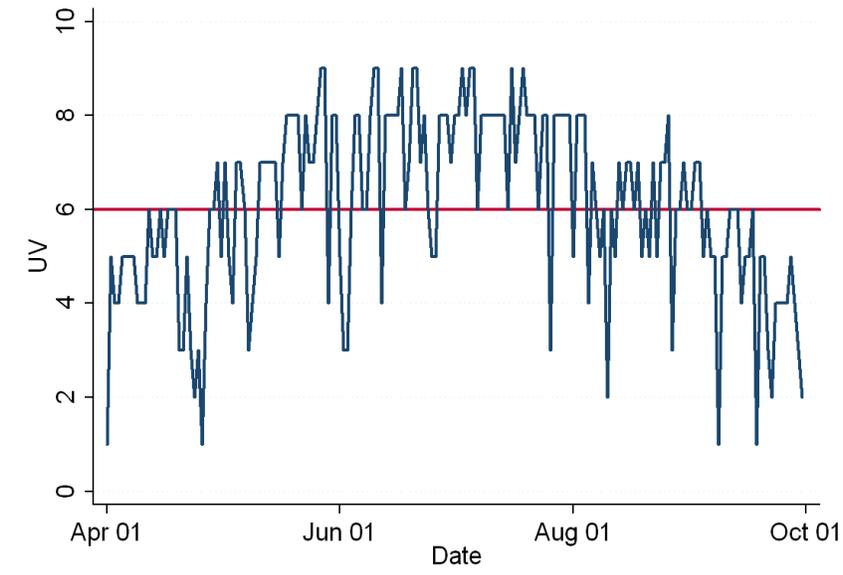
Some of the gases responsible for climate change such as chloro- and fluorocarbons will cause depletion of the stratospheric ozone layer. Temperature related changes to the stratospheric ozone chemistry are expected. As a result, Health Canada predicts that there will be increased human exposure to UV radiation. .

Exposure to UV radiation from sunlight causes sunburn, premature skin aging, skin cancer, eye problems and weakening of the immune system. People will have greater exposure to UV radiation, both in terms of the changes resulting from the stratospheric ozone layer, as well as the changes in behaviour due to people spending more time outside in the sun in warmer weather. There is no safe level of exposure to UV radiation. Environment Canada reports on UV levels and provides forecasted next day levels on a daily basis.

Figure 4 illustrates that in the 182 days from April 1st to September 30th in 2012, 115 days or 2/3 (63%) had a UV index of 6 or higher requiring behaviour modification for UV protection.

OPH promotes sun safety and UV awareness to all age groups. Sun damage early in life can result in skin cancers later so it is important to practice safe sun behaviours early in life. Small children are more susceptible. OPH monitors UV levels and sends out public warnings when the UV level is forecast to be 10 or higher.

Figure 4: UV levels in Ottawa (April- September) 2012



ⁱ Health Canada. Human health in a changing climate: A Canadian assessment of vulnerabilities and adaptive capacity. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2008.

ⁱⁱInternational Panel on Climate Change, Climate Change 2014: Impacts, Adaptation and Vulnerability, March 2014. <http://ipcc-wg2.gov/AR5/>

ⁱⁱⁱ Canadian Public Health Association. [Health Effects of Climate Change and Air Pollution](#). 20

^{iv} Casati and Yagouti (2013) Health Canada.

^v National Ambulatory Care Reporting System - ER Visits 2009-2013, Ontario MOHLTC, IntelliHEALTH ONTARIO, Extracted: April 10, 2013

^{vi} National Ambulatory Care Reporting System - ER Visits 2009-2013, Ontario MOHLTC, IntelliHEALTH ONTARIO, Extracted: April 10, 2013

^{vii} Semenza JC, McCullough JE, Flanders D, McGeehin MA, Lumpkin JR. Excess hospital admissions during the July 1995 heat wave in Chicago. *Am J Prev Med* 1999;16(4):269–277

^{viii} Ye X, Wolff R,2 Yu W, Vaneckova P, Xiaochuan P, Tong S. Ambient temperature and morbidity: A review of epidemiological evidence. *Environ Health Perspect* 2012;120:19–28

^{ix} Martin et al, 2012. Climate change and future temperature-related mortality in 15 Canadian cities. *Int J Biometeorology* 56:605–619

^x 8. Public Safety Canada. Canadian disasters database [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2013 Sept 13. Available from: <http://www.publicsafety.gc.ca/cnt/rsrscs/cndn-dsstr-dtbs/index-eng.aspx>

^{xi} Health Canada, Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity, 2008.

^{xii} *National Illness cost of Air Pollution, CMA 2008/ Illness cost of Air Pollution, OMA 2008*

^{xiii} Ontario Agency for Health Protection and Promotion (Public Health Ontario). *Foodborne Illness: What we don't know can hurt us*. Toronto, ON: Queen's Printer for Ontario; 2014

APPENDIX I: Managing Risk Through Adaptation

This appendix summarizes how the changing climate is likely to affect Ottawa, and what the City of Ottawa and the broader community is currently doing to mitigate and adapt to these changes.

In its *Adaptation Strategy and Action Plan*, the province of Ontario defines the concept of adaptation:

Adaptation is the process societies go through in order to cope with an uncertain future. Adapting to climate change entails taking measures to reduce the negative effects of climate change — or take advantage of the positive effects. For example, faced with greater storm activity, we may change the way we design and build our roads, bridges and buildings to better withstand these weather events.

The first section of this appendix summarizes the scope and scale of potential risks to Ottawa; the second section summarizes what the City and larger community are already doing to address these risks.

1. Risk Identification

Scientific studies have produced a wealth of evidence predicting global temperature increases. In 2009, a provincial expert panel distilled the existing scientific studies to help Ontarians understand the threat posed by climate change locally. Their report, *Adapting to Climate Change in Ontario*,¹ predicts that by 2050, using “middle of the road” assumptions about the increase in emissions, the province’s annual average temperatures will increase 2.5-3.7°C from a 1990 baseline.

The average annual mean temperature in Ottawa has increased over the last century by 1.7°C, according to data from Environment Canada’s weather station here, as shown in Figure 1.²

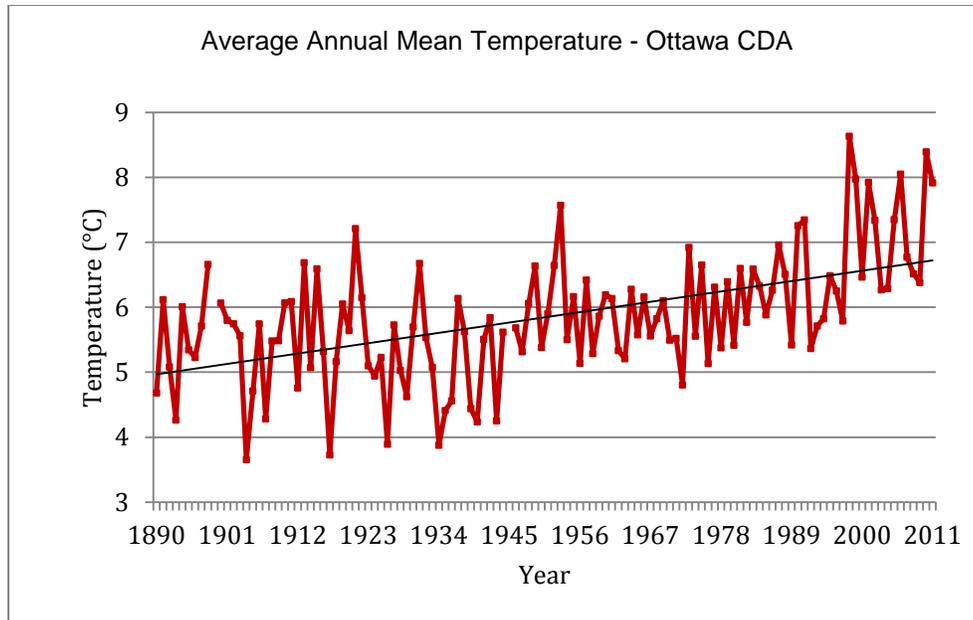


Figure 1: Historical Temperature Trend for Ottawa CDA, Ontario

Climate science predicts not only warming of average temperatures, but also increasing frequency and severity of storms and other severe weather events.³ Natural Resources Canada's (NRCAN) report *From Impacts to Adaptation: Canada in Changing Climate 2007* states, "Since 1948, average annual temperatures in Ontario have increased by as much as 1.4°C. This trend is projected to continue, with the most pronounced temperature increases occurring in winter. Projections also indicate that intense rainfall events, heat waves and smog episodes are likely to become more frequent."⁴ Ontario's expert panel on climate adaptation predicts hotter summers, with the number of days over 30°C more than doubling by 2050.⁵

The recently released Intergovernmental Panel on Climate Change (IPCC)⁶ *Fifth Assessment Report: The Physical Science Basis (2013)* predicts warming over lands and more frequent hot days, as well as an increase in the frequency, intensity and/or amount of heavy precipitation events over the course of the 21st century.⁷ We will not only experience more extreme events, but also more temperature variability, heat waves and droughts.

Ottawa must therefore prepare for changes in:

- Precipitation – frequency, duration, intensity (e.g. snow, rain, and ice storms)
- Temperature – variability, intensity and duration (e.g. heat waves and cold snaps)
- Wind – direction and speed (e.g. tornados).

1.1. Scope of Impacts

The impacts of a changing climate are wide reaching. This section focuses on serious threats to people's health and safety, and to the economy.

Power Interruptions

With more extreme weather events and other changes in the environment, Ottawa is likely to experience more power interruptions and disruptions in fuel supplies over both the short and long term.⁸ Heavy storms knock down power lines, wind storms topple trees on to power lines, storm flows submerge infrastructure, and heat waves push peak electricity demand beyond capacity.

The 1998 ice storm, which covered a wide area from southern Ontario through Quebec, required a massive rebuilding of electricity infrastructure in Ottawa. Approximately 600,000 electricity consumers were affected, with damage to 100 high-voltage transmission towers and replacement of 10,500 poles.⁹ While not caused by an extreme weather event, the August 2003 blackout demonstrated our vulnerability to prolonged and large-scale outages.¹⁰

Infrastructure Damage

Severe storms impact municipal infrastructure such as roads, bridges and buildings, as well as private residential and commercial properties. Wind tears off roofs, blows down trees and scatters damaging debris. Rain storms cause flooding when they exceed the capacity of municipal infrastructure, which is occurring more often than current probability calculations predict.¹¹

Greater variability in temperatures puts stress on infrastructure such as roads and bridges. According to a report by NRCAN, "climate variability exacerbates rutting, thermal cracking and frost heaving of paved surfaces... Freeze-thaw cycles have increased in recent years in [southern and eastern Ontario]."¹²

A particular local effect of increasingly hot summers and droughts is the drying and cracking of soils around foundations of buildings – in particular, with locally widespread Leda clay. Foundations can be damaged and basement walls crack when surrounding soils subside, shrink or shift.

Crop and Livestock Losses

Hot summers and more frequent droughts may affect the agricultural sector in Ottawa. Changes in precipitation, temperature, and frequency and intensity of storm events may reduce farm yields and cause crop damage and heat stress to livestock. It is unknown

whether these negative effects will counterbalance benefits to the sector through longer growing seasons and increased presence of carbon dioxide in the atmosphere.¹³

Farms are also vulnerable to the risks of pests and diseases. Warmer temperatures may mean the northern migration of insects and insect-borne diseases, affecting both crops and livestock; flooding could increase the spread of vector-borne infectious diseases affecting primarily livestock.¹⁴

Threats to Public Health

Human health may also be affected by the ability of certain diseases to spread beyond their former ranges due to a warmer climate. The insects that spread Lyme disease, West Nile Virus and malaria, among others, may expand their ranges further into Ontario and infect more Ontarians.¹⁵

Hotter summer days, heat waves and increased smog are likely to have an impact on public health, with “implications for asthma, chronic respiratory disease, cardiovascular disease,” according to a study on the impacts of climate change on public health in Ontario.¹⁶

Recreation and Tourism Losses

Warmer, shorter winters also pose a challenge to the winter outdoor recreation sector in Ottawa.¹⁷ Shorter skating seasons on the Rideau Canal, reduced skiing and skating opportunities, and fewer opportunities for traditional outdoor activities such as ice fishing will impact recreation providers that depend on colder weather conditions.

Changing Ecosystem

As average temperatures increase, local ecosystems may experience changes in species composition as new species move into the region and existing species adapt, or not. This dynamic could result in the loss of native species and spread of invasive species, threatening ecosystem stability and diversity. For example, invasive species such as the Asian long-horned beetle, Emerald ash borer and dog strangling vine thrive in warmer climates and have already exhibited significant consequences to local ecosystems and urban forest canopies.

According to Ontario’s Ministry of Natural Resources, climate change is not only affecting individual species, but also the composition of ecological communities in Ontario. The effects of climate change on the functioning of ecological communities compound the impacts of urbanization, habitat loss, pollution, and fragmentation.¹⁸

1.2. Scale of Impacts

The Insurance Bureau of Canada (IBC) gathered top experts to boil down the findings and predictions of climate scientific studies, producing *Telling the Weather Story* in 2012. The report finds increased occurrence of extreme weather events, and resulting escalation of expenses to the industry:

“Insurers have seen first-hand the financial impacts of severe weather, as insured losses from natural catastrophes have ranged between \$10B and \$50B a year internationally over the past decade and in 2011 topped \$100B. In Canada, catastrophic events cost roughly \$1.6B in 2011 and almost \$1B in each of the two previous years.”¹⁹

The report highlights flooding and storm losses in Ontario, such as the 2010 wind and thunderstorm in the southern Ontario town of Leamington and surrounding areas, which cost \$120 million in insured losses to residential and commercial properties. A 2011 tornado in Goderich, Ontario, killed one person, injured 37, and cost \$110 million.

Moreover, the IBC’s tally of weather-related insured losses shows that 2013 was the most expensive in Canadian history, at nearly \$3 billion.²⁰ The December 2013 ice storm in Burlington, Ontario contributed to this catastrophic year, with losses of \$275 million.

2. Key Adaptation Strategies and Responses

Resources and commitment are required to adapt to the effects of climate change on Ottawa, by both the City of Ottawa and its private, non-profit, and community partners. The most recent report from the IPCC’s Working Group II, released on March 31, 2014, emphasizes the need for leadership and action by local governments and the private sector. This section highlights key strategies that are being implemented in the City of Ottawa, in the following three broad categories:

- Planning for Resiliency
- Increasing Infrastructure Resiliency
- Improving Emergency Preparedness

2.1. Planning for Resiliency

In 2012, the Environmental Commissioner of Ontario, in a review of the province’s *Climate Change Adaptation Strategy*, wrote, “Land use planning is a critical mechanism for implementing climate change adaptation at the municipal level.”²¹ The province responded in its 2014 revisions to the Provincial Policy Statement requiring

municipalities to consider potential impacts of climate change, and to support measures that reduce greenhouse gas emissions and climate change adaptation.²²

Land Use, Transportation and Infrastructure Planning

Urban intensification serves to increase resiliency over the long term in two key ways. Firstly, higher density areas have a lower developmental footprint, which helps to preserve open space, slow habitat loss and maintain tree cover – all of which help to mitigate the heat island effect and maintain ecological services such as water filtration. Secondly, building transit-oriented development neighbourhoods encourages residents to reduce their dependence on the automobile, resulting in reduced greenhouse gas emissions and insulating them from oil price shocks. Emergency response is also more readily facilitated in compact communities as opposed to low density, widespread settlement patterns.

On November 26, 2013, Ottawa City Council unanimously passed the Official Plan (OP), Infrastructure Master Plan, Transportation Master Plan, Ottawa Cycling Plan and Ottawa Pedestrian Plan.²³ These five plans promote and support compact urban development, the linking of development with transit and infrastructure, and reinforce climate change adaptation strategies.

Under the OP, the City has created design guidelines for different types of communities and infrastructure, including landscaping principles encouraging preservation of site vegetation, increasing biodiversity, linking parks to the greenspace network and neighbourhood fabric, and connecting them with green buffers and other features.²⁴

An example is the City's Urban Design Guidelines for Low-rise Infill Housing. This May 2012 document guides new housing design in established neighbourhoods, and applies to all infill development in the OP's general urban designation. It calls for minimizing pavement for parking, planting of trees, compact form to allow for greater surface areas for infiltration of stormwater, and other such measures.

Focusing development in mixed use centres, main streets and villages; improved mass transit, including the new light rail Confederation Line; high-density development at transit nodes; encouraging small-scale infill intensification in areas with partially-separated sewers;^{25 26} and incorporation of features like drainage swales and permeable paving – are all ways to create a more resilient City.

Watershed Planning

Local Conservation Authorities (CAs) play a major role in preserving water quality in the region. The Rideau Valley, Mississippi Valley and South Nation Conservation Authorities conserve lands, protect streambanks, and monitor water levels and flooding

risks in the watersheds including Ottawa. The City of Ottawa works collaboratively with CAs to support watershed planning and management.

For example, the City supports the Landowner Resource Centre, managed in partnership with the Rideau Valley CA. Voluntary programs run through the Centre help landowners undertake projects that improve stormwater management and water quality, and to replant their lands with trees to increase forest cover.

Increasing Permeable Surfaces and Green Infrastructure

Reducing threats of flooding involves reducing flows at source and their direction and discharge. Greener, more permeable landscapes help to reduce flows by increasing uptake of water in plants and soils, infiltration of water into soils, and slowing discharges into the city's piped systems.²⁷

Trees in Trust

This free service to provide street trees to residences in Ottawa, on City-owned street frontage, is intended to help restore and expand the urban tree canopy. Tree planting services are also available for parks or street frontages identified by community groups, or via grants to public schools. Over 100,000 trees are to be planted in 2014.

Emerald Ash Borer Response

This invasive pest threatens about 25% of the City's tree cover. The City is monitoring, removing, and treating some ash trees to prevent a complete die-off of this major component of Ottawa's tree canopy. The City has also enhanced its tree planting program. However, it will take decades for their maturation and the replacement of the existing tree canopy.

Green Roofs

Green roofs can provide enhanced insulation, reduce the heat island effect, slow stormwater flows, and add biodiversity. The City has constructed green roofs on two of its buildings, one at the Britannia Wastewater Purification Plant and the other at OC Transpo's Articulated Bus Dispatch Building.

Three significant new green roofs have been installed on buildings in the community, including 10,684 square metres at the Canadian War Museum, 4,000 square metres at the Algonquin Centre for Construction Excellence, and 6,782 square metres at the Ottawa Courthouse.

2.2. Increasing Infrastructure Resiliency

Infrastructure assets must be built or strengthened to withstand harsher weather, higher variability in temperatures, changing soil conditions and other stressors. In its 2012 update to the Building Code, the Province of Ontario incorporated significant changes, many of which reinforce resiliency in buildings. Examples include²⁸:

- Revising the building code's objectives to include infrastructure capacity constraints to construction, limiting greenhouse gas emissions and release of pollutants, and protecting soil and water quality;
- Adding strong new energy conservation requirements;
- Requiring sewage back-water valves in new residential buildings;
- Protecting water supplies from contamination by requiring backflow preventers in new commercial buildings, hotels, manufacturing plants and multi-unit residential buildings.
- Promoting water conservation measures such as low-flow appliances, rainwater recycling and non-potable water systems.

Building Design and Construction

Between 2010-2014, Ottawa's Public Works Department implemented a Smart Energy Program per Council's approved investment of \$14 million. The benefits of this program included 9 million kWh in annual electrical savings; 400,000 m³ in annual natural gas savings; 90,000 m³ in annual potable water savings; the conversion of 11 sites from oil or propane to natural gas; the conversion of 1.4 million kWh of electricity use to natural gas; and the integration of over 70 unique building automation systems into one harmonized interface.²⁹ The program is expected to exceed its mandated 5-year simple pay back before the end of 2014 at which time, the City will realize \$2 million in annual energy savings.

The City of Ottawa has also adopted a policy that all new City buildings will be certified in the LEED[™] green building certification system. As of April 2014, the City had constructed 16 LEED[™] certified buildings: 4 Gold, 9 Silver and 3 Certified and 9 additional buildings are currently undergoing the certification process and four LEED[™] registered facilities that are under construction and will pursue certification. Lansdowne Park is pursuing LEED Neighbourhood Development (ND) Stage II. (LEED ND looks at not only the individual buildings but the entire site and takes into account such things as transportation, public health linked to the built form and sustainable infrastructure.)³⁰

Stormwater Management (SWM)

It is critical to improve infrastructure capacity to withstand higher water flows due to more severe or frequent storms. Increased flows can overwhelm pipe capacity, and cause basement flooding. Urban expansion and impermeable surfaces exacerbate the problem, with less permeable surface area to absorb precipitation, sending it into municipal storm drains. In severe events, this results in flooding, property damage, and loss of life.

The need to account for climate change impacts to storm drainage and SWM systems is reflected in the City's Sewer Design Guideline. For new development, storm drainage designs are required to incorporate a number of robust and cost-effective redundant features such as inlet control devices, overland flow routes with outlets to SWM facilities or watercourses, backwater valves on service laterals, and SWM pond outlet structures with high capacity overflows. Designs must be tested to assess performance for extreme historical rainfalls. Further, for older neighbourhoods that have experienced flooding, drainage systems are retrofitted, to the extent possible, to include these features, and improve the level of service.

In addition, the City has also completed a best practices review of adaptive approaches to respond to the anticipated impacts of climate change on local rainfall patterns as a further step in considering additional climate change adaptation measures for SWM and drainage infrastructure.³¹

The City's Ottawa River Action Plan (ORAP) represents a comprehensive, major commitment towards improving the health and the safety of the community's surface water. The 2010 Plan comprises 17 initiatives with a \$250 million spending plan over five years, focused on reducing combined sewage overflows, reducing stormwater impacts, improving wastewater treatment, and measuring and monitoring performance.³²

Eight of ORAP's initiatives are intended to reduce Combined Sewer Overflows (CSOs). Real time controls have been added to monitor flows in sewers and critical outfalls that allow for operational changes during storm events to mitigate both flooding and over flow to the river. While CSOs have been reduced by up to 80% since 2006, further funding is being sought from the province and the federal government to build a storage facility to service the downtown. The tunnels will hold excess runoff until sufficient capacity exists in the system to convey it.

Sandy Hill Park flood storage facility

After years of chronic flooding in Sandy Hill Park and wet basements in residences surrounding it, the City invested in a flood storage solution with many benefits. A

reservoir tank with a capacity of 12,500 cubic metres was installed under the park, with additional surface run off storage in the form of a 'dry pond' of 3,800 cubic metres. Overflow sewage, which exceeds current capacity in large storm events, is now directed to the storage tank during these peak events. Excess surface runoff is directed to the dry pond area, a relatively rare occurrence. Both strategies make the park usable year-round and alleviate pressure on the stormwater system. The park now has a play structure, wading pool, and washrooms and changing facilities, integrated into the building that houses the tank's controls.

The Ottawa River Action Plan also called for the development and implementation of the *Wet Weather Infrastructure Management Plan (WWIMP)*, which was prepared in 2013. "This Plan focuses on managing excessive flows within pipe networks and overland in order to reduce impacts on people, property and the environment. Some of the issues addressed include basement and surface flooding, system operation and maintenance, capacity for intensification and growth and environmental protection." ³³

The key elements of the WWIMP are the following:

1. Capacity Management Program: to assure capacity allocations for proper system operation under both existing and planned growth;
2. Extraneous Flow Reduction Program: to alleviate basement flooding by determining sources of extraneous flows, proposing cost-effective measures to address them, and implementing projects;
3. Flood Control Program: to assess causes and solutions for flooding by identifying flood-prone areas and developing solutions linked to new level-of-service targets.

ORAP recognized the importance of not only addressing the impacts of CSOs but also uncontrolled stormwater runoff through two other ORAP projects: the preparation of SWM retrofit plans for the Pinecrest Creek/Westboro area and the Eastern Subwatersheds area (subwatersheds of Taylor, Bilberry, Voyageur and Green's Creeks). The Pinecrest/Westboro SWM Retrofit Plan has been prepared and is being implemented. The Eastern Subwatersheds SWM Retrofit Plan is to be completed in 2014.

Implementation of stormwater management retrofits within rights-of-way and on City-owned properties will require a long-term effort over several decades to complete. Most will be carried out on an opportunistic basis, when roadways, City buildings and parking lots require major renewal or come to the end of their life cycle.

Reduce Vulnerability to Interruptions in Power Supply

Ontario's Long Term Energy Plan's "Conservation First" directive sets the stage for local power generation in Ottawa. The mandate is clear: serve a growing customer base not by expanding power supply, but by squeezing more work out of every megawatt. Since the 1998 ice storm, local utilities, the City, and the province have rebuilt the transmission and distribution systems, and moved towards a more diverse energy supply mix, modernized distribution, greater conservation, demand management, and enhanced preparedness for supply interruptions.

Hydro Ottawa is modernizing the electricity grid with communications and power system control technologies to enhance its flexibility and responsiveness to producer and consumer needs. Digital sensors and monitoring devices, and automation and communications networks, will help control the flow of power and sense disturbances on the lines. Further work is needed to enable small producers to use power during outages and to benefit from the reliability of locally-installed generating capacity.

Local renewable energy development can reduce the community's dependence on transmission lines and central power plant. Hydro Ottawa's renewable energy supply currently stands at approximately 10% of capacity.³⁴ Its subsidiary, Energy Ottawa, is the largest municipally-owned producer of green power in Ontario, with 38 megawatts of hydroelectric power producing 255,000 megawatt hours of electricity per year in Ottawa. It also owns and operates in partnership with Integrated Gas Recovery Services a landfill gas-to-energy plant at the Trail Road Landfill, with a capacity of 6 megawatts.

In addition, Energy Ottawa has installed two 10 kilowatt rooftop solar projects in partnership with the City of Ottawa (one at Ottawa City Hall and the other at Transit Services Integrated Control Centre), and together are exploring and finalizing other opportunities to partner on City facilities. Energy Ottawa offers a variety of energy management services in order to assist its customers with efficiency retrofits, lighting management and green building development – which all contribute to helping the private sector adapt their facilities and buildings.³⁵

Demand Management programs are used to reduce and mitigate this risk, for example:

- Blackouts and brownouts occur when demand outstrips supply, mainly on the hottest days when electricity demand for air conditioning spikes.
- Demand Response programs use pricing as an incentive for reduction in electricity use among voluntary large industrial users and residential consumers, with significant price increases during peak periods -- but overall reduction in rates for participants who plan their consumption accordingly.

- Installation of smart meters enables time-of-use billing and real-time information to the consumer, so that consumers control their usage and minimize their peak consumption.

2.3. Improving Emergency Preparedness

The City of Ottawa must be prepared for increased flooding, very hot days, ice storms and other damaging and dangerous weather events. The Office of Emergency Management, Ottawa Public Health (OPH), Infrastructure Services and many other city departments play a role in emergency preparedness.

Extreme weather warnings

OPH works with other city departments and partner organizations to address the risks posed by extreme weather.

OPH communicates to vulnerable populations directly and through media and partners when the humidex is forecasted to exceed 35°C (Heat Advisory) and 40°C (Heat Warning), and when the wind chill is forecasted to fall to -25°C (Frostbite Advisory) and -35°C (Frostbite Warning).

During hotter temperatures, OPH coordinates distribution of Hot Weather Resource Kits, works with air conditioned facilities to provide respite from heat, and keeps swimming pools open for residents to cool down. In cold weather, OPH works with shelters to provide adequate, warm, indoor space for those in need. OPH also issues advisories for high levels of smog (based on information provided by Ontario's Ministry of the Environment and Environment Canada) and ultraviolet exposure.

Emergency Response Plans

The City of Ottawa has strengthened its emergency response capacity with a series of initiatives designed to ensure timely, appropriate, and robust response to natural or man-made emergencies.

The City is currently preparing a Hazard Mitigation Plan that will undergo a peer review by the Emergency Management Accreditation Program team in order to achieve formal accreditation in 2014. The accreditation process helps the City to identify areas needing improvement and fosters excellence and accountability.

City departments are developing a Continuity of Operations Plan (COOP) that will establish mechanisms to ensure the provision of: executive authority and policy direction; allocation of staff, resources and equipment; ability to provide and acquire resources; and, cancellation and resumption of services during a protracted emergency event.

The City's Environmental Services Department (ESD) has conducted emergency simulations to give staff the experience of conducting, in a controlled setting, responses to power outages, earthquakes and flooding that may eventually be required in real-time.

A review of all existing ESD Incident Escalation and Response Plans (IERP) is currently being conducted, to ensure the IERPs are current with the City's latest Emergency Management Plans and all required provincial and federal legislation.

Critical Infrastructure Management

Redundancy and back-up systems are necessary to protect or maintain the functioning of critical infrastructure during extreme weather events and other hazards. The City's two water purification plants and wastewater treatment plant all have back-up generators which activate if a power disruption is experienced.

The City of Ottawa conducted a study of critical infrastructure in its entire central water distribution system from 2004-2010. Every watermain and valve in the system is now identified according to its significance to the level of service, especially for critical customers such as hospitals, and for vulnerable service areas, such as those served only by one watermain. This information enables a more targeted and flexible response to breaks in water mains and interruptions in service.

¹ [Adapting to Climate Change in Ontario 2009](#), p. 15

² Ontario Centre for Climate Impacts and Adaptation Resources: Climate Trends. Historical Climate [Trends for Ottawa CDA, Ontario](#); Daily temperature data from the Ottawa CDA weather station, obtained from the Environment Canada website, was averaged to obtain monthly values for temperature.

³ From the IPCC report, precipitation has increased in the mid-latitudes of the Northern Hemisphere; in North America, both the frequency and intensity of heavy precipitation events has increased. IPCC Summary for Policy Makers, p. 8, Figure SPM.2

⁴ Chiotti, Q. and Lavender, B. (2008): [Ontario; in From Impacts to Adaptation: Canada in a Changing Climate](#) 2007, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush, p. 229 of Chapter 6

⁵ [Climate Ready: Ontario's Adaptation Strategy and Action Plan 2011-2014](#), p. 2

⁶ The IPCC is a scientific body established by the World Meteorological Organization and the United Nations in 1988.

⁷ [Intergovernmental Panel on Climate Change \(IPCC\) Fifth Assessment Report: The Physical Science Basis](#), from summary table, p.7, [Summary for Policymakers](#)

⁸ From Impacts to Adaptation, p. 252 "Future changes in the frequency and magnitude of extreme weather events, particularly ice storms, heavy snow storms and wind storms, are likely to increase the risk of interrupted electricity supply and distribution... In the event of future catastrophic failures of the electricity transmission system, large urban

areas are at higher risk of extended blackouts because local electricity generation, as a percentage of local electricity consumption, is very low...”

⁹ From Impacts to Adaptation, p. 251

¹⁰ From Impacts to Adaptation, p. 252

¹¹ IBC p. 18

¹² From Impacts to Adaptation, p. 254

¹³ Ontario Centre for Climate Impacts and Adaptation Resources, [“Climate Change Impacts and Adaptation A Literature Review of the Canadian Agriculture Sector.”](#) July 2011 p. 4

¹⁴ Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR), [Factsheet: Agriculture: in a changing climate](#)

¹⁵ Climate Ready: Ontario’s Adaptation Strategy and Action Plan 2011 -2014, p. 13

¹⁶ [“Adaptation to climate change in the Ontario public health sector,”](#) Jaclyn A Paterson, James D Ford, Lea Berrang Ford, Alexandra Lesnikowski, Peter Berry, Jim Henderson and Jody Heymann, *BMC Public Health* 2012, **12**:452

¹⁷ Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR), [Factsheet: Tourism and Recreation: in a changing climate](#)

¹⁸ [Ontario Ministry of Natural Resources, Community-Level Effects of Climate Change on Ontario's Terrestrial Biodiversity, CCR36](#) p. 22

¹⁹ Insurance Bureau of Canada (IBC), [Telling the Weather Story](#), p. 5

²⁰ [Insurance Bureau of Canada web site](#) accessed Feb. 28, 2014

²¹ [Ready for Change? An Assessment of Ontario’s Climate Change Adaptation Strategy](#), p. 12

²² Provincial Policy Statement 2014, section 1.8.1

²³ As of the writing of this text, the plans were all before the provincial Ministry of Municipal Affairs and Housing for approval before coming into effect.

²⁴ [City of Ottawa Community Design Guidelines](#)

²⁵ [Intensification Benefits in Partially-separated Sewer Areas](#), Infrastructure Master Plan, Section 6.3

²⁶ [Infrastructure Master Plan, Section 6.1.6](#)

²⁷ See Appendix I for more detailed discussion of the need for protection of natural areas as an adaptation strategy.

²⁸ Ontario Ministry of Municipal Affairs and Housing, [Summary from “Ontario 2012 Building Code, O. Reg 332/12”](#)

²⁹ <http://app05.ottawa.ca/sirepub/mtgviewer.aspx?meetid=6331&doctype=AGENDA>

³⁰ <http://app05.ottawa.ca/sirepub/mtgviewer.aspx?meetid=6331&doctype=AGENDA>

³¹ City of Ottawa, 2013 [Infrastructure Master Plan](#) (Bolivar Report)

³² City of Ottawa, [Ottawa River Action Plan](#)

³³ City of Ottawa, [Wet Weather Infrastructure Management Plan](#)

³⁴ Personal communication with Greg Clarke, Energy Ottawa, March 3, 2014

³⁵ Appendix F details local utilities’ energy conservation and efficiency programs

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