City of Windsor
Corporate Climate Action Plan

LURA
LISTEN · UNDERSTAND · RELATE · ADVANCE

Garforth International llc
Energy Productivity Solutions

ICLEI
Local Governments for Sustainability

City of Windsor

March 6, 2017

Funding/Financial Support

Preparation of this Corporate Climate Action Plan was carried out with assistance from the Federation of Canadian Municipalities (FCM) and administered through the Partners for Climate Protection Program. Notwithstanding this support, the views expressed in this report are the personal views of the authors, and FCM accepts no responsibility for them.

© 2017 City of Windsor. All Rights Reserved.

Contents

.....

Chapter 1 – Introduction, Background and Context 1

The Need for a Corporate Climate Action Plan 1

Overview of a Corporate Climate Action Plan 2

Linkage Between Corporate Climate Action Plan Link to Other City Plans 2

Chapter 2 - The CCAP Plan Development Process 4

Federation of Canadian Municipalities Partners for Climate Protection Program 4

Fulfilling the PCP Program Requirements 5

How to Read This Plan 6

Chapter 3 – City of Windsor Energy Consumption and GHG Emissions Inventory and Forecast 7

City of Windsor's Corporate Energy Use (2014) 7

City of Windsor's Corporate GHG Emissions (2014) 8

Projected Energy Use by Corporate Operations in 2041 8

Current and Projected Costs of Energy to the City 9

Projected GHG Emissions from City of Windsor's Corporate Operations in 2041 11

Chapter 4 – City of Windsor Targets 12

City of Windsor's Targets for GHG Emission Reductions 12

Chapter 5 –Overview of the Recommended Actions 14

Summary of Recommended Action by Category 15

Chapter 6 - Organizational and Institutional Policy Change 16

P1: Create an Internal 'Energy First' Ethic 16

P2: Integrate Energy Solutions into Land Use Policies 17

P3: Ensure Sufficient Resources to Support Implementation 17

P4: Increase Staff Training, Education, and Awareness 17

P5: Continue to Pursue Funding and Incentive Opportunities 18

P6: Create a Corporate Energy Task Force 19

Chapter 7 - Buildings 21

B1: Continue Existing Building Retrofits 21

Implement Planned Retrofits 2014 – 2018 22

Complete Future Retrofits (2018+) 22

B2: Increase Efficiency through New Building Design 23
Adopt New Building Procurement Energy Performance Standards 23
Continue to Conduct Building Audit and Re-commissioning 23
B3: Continue to Improve Operations, Maintenance, and Monitoring 24
Continue Energy Data Management 24
Install and Upgrade Building Automation Systems (BAS) 24
Expand Sub-Metering 25
Implement Energy Performance Labelling 25
Consider Energy Dashboards 26
Advance Energy Efficient Operations and Maintenance Practices 26
B4: Integrate Supportive Infrastructure for Existing and New Buildings 26
Integrate Cycling Infrastructure 26
Adopt District Energy Ready Building Design 27
Integrate Combined Heat and Power 27
Chapter 8 - Non-Transit Fleet 30
F1: Continue to Implement the Actions Prescribed in the Greening the City Fleet Manual 31
Continue the Alternative Fuel Study 31
Continue Right-Sizing Vehicles and Reducing Fleet Size 31
Advance and Improve the Operation, Monitoring and Maintenance Program 32
F2: Review the Efficient Driver Training Program 33
F3: Advance Anti-Idling Initiatives and Technologies 33
F4: Review Renewable Natural Gas Opportunities 34
F5: Explore Benchmarking Opportunities 34
Chapter 9 -Transit Fleet 36
T1: Advance Vehicle Replacement 36
T2: Join the Canadian Urban Transit Research & Innovation Consortium (CUTRIC) 36
T3: Explore Alternative Propulsion Vehicles 37
T4: Continue Efficient Driver Training 37
Chapter 10 - Water and Wastewater Processing 39
W1: Develop Long-Term Water Conservation and Sanitary and Stormwater Master Plans 39
W2: Implement Water & Wastewater Treatment Plant Upgrades and Retrofits 40
W3: Develop an Integrated Site Energy Plan 40

W4: Review Renewable Natural Gas Generation 41
Chapter 11 - Street Light and Intersection Light Conversion 43
S1: Complete Street Light and Intersection Light Conversion to LED 43
Chapter 12 – Renewable Energy Generation 44
R1: Explore Net Metering 44
R2: Continue to Invest in Rooftop Solar Photovoltaic 45
R3: Explore Parking Lot Solar Photovoltaic 45
Chapter 13 – Corporate Solid Waste Management 47
G1: Conduct a Solid Waste Audit Program 47
G2: Establish a Corporate Waste Diversion Target and Strategy 48
G3: Collaborate with Neighbouring Communities to Establish an Organics Program 48
Chapter 14 –Summary and Impacts of Energy and Emission Reductions 49
Summary of the Impacts of Energy and Emissions Reductions for the City of Windsor 49
The Cumulative Impacts of Energy and Emissions Reductions for the City of Windsor 56
Chapter 15 – Implementation Considerations 57
Monitoring and Verification 57
Reporting and Plan Renewal 58

Figure 1: Relationship of the CCAP to Provincial and City of Windsor Planning 3
Figure 2: Process to Develop the CCAP 4
Figure 3: PCP Milestone Program 5
Figure 4: Baseline Energy Use by Source and by Sector for City of Windsor Operations (2014) 7
Figure 5: GHG Emissions by Source and by Sector for City of Windsor Operations (2014) 8
Figure 6: Corporate Business-As-Usual Energy Projection (2014-2041) 9
Figure 7: Projected Cost of Energy by Source for the City of Windsor (2014-2041) 10
Figure 8: Projected Cost of Electricity for the City of Windsor (2014-2041) 11
Figure 9: Projected Emissions by Source for the City of Windsor (2014-2041) 12
Figure 10: Sectors included in the CCAP 14
Figure 11: Estimated GHG Emission Reductions from Proposed Actions (2014-2041) 56

Table 1: Impacts of Recommended Organizational and Institutional Policy Change Actions 20
Table 2: Impacts of Recommended Building Actions 28
Table 3: City of Windsor Non-Transit Fleet (2016) 30
Table 4: Impacts of Recommended Non-Transit Fleet Actions 35
Table 5: Impacts of Recommended Transit Fleet Actions 38
Table 6: Impacts of Recommended Water and Wastewater Processing Actions 41

Table 7: Impacts of Recommended Street Light and Intersection Light Conversion Actions 43
Table 8: Impacts of Recommended Renewable Energy Generation Actions 46
Table 9: Impacts of Recommended Solid Waste Management Actions 48
Table 10: Summary of Impacts of Energy and Emissions Reductions for the City of Windsor 49
Table 11: Key Performance Indicators 57

Chapter 1 – Introduction, Background and Context

The Need for a Corporate Climate Action Plan

Ontario's Ministry of the Environment and Climate Change (MOECC) reports that the average annual temperature in Ontario has increased by 1.4°C over the last 60 years. Models suggest that by 2050, the average annual temperature in Ontario could increase by another 2.5°C to 3.7°C. In Windsor, the impacts of climate change have been felt through more frequent tornado warnings, extreme heat events, and most recently as a result of flooding in Windsor, Tecumseh, and Lakeshore.[1] All of these events have significant impacts for our health, wellbeing, infrastructure, environment, and economy.

What is Causing Climate Change?

The climate is changing, both globally and locally, due to an increase of greenhouse gases (GHGs) released into the atmosphere. While GHGs are naturally found in the environment and can fluctuate in nature through events like volcanic eruptions and forest fires, anthropogenic (human-caused) sources are contributing large quantities of GHGs into the environment at a faster rate than our atmosphere can accommodate. Fossil fuels such as petroleum-based products (gasoline or diesel), and natural gas are the greatest human-caused contributors to GHG emissions, and are used to run equipment, generate lighting, and heat and operate our buildings and power our vehicles.

The Corporation of the City of Windsor (referred to as 'the City') has demonstrated leadership in climate action by actively pursuing GHG emission reductions through policies and actions in current municipal plans such as the Strategic Vision (2016), Official Plan (2010), Corporate Energy Management Plan (2014), and the Environmental Master Plan (2006). The City's Corporate Climate Change Action Plan (CCAP) will guide the City towards reducing GHG emissions and energy use and help the City prepare for legislative changes and Cap-and-Trade initiatives by senior levels of government. In addition, this Plan will demonstrate the City of Windsor's commitment to being an environmentally progressive community in the province of Ontario.[2] The timing of this plan is particularly important as it aligns with the Ontario Climate Change Action Plan (2016-2020). There are many revenue generating mechanisms contained in the Plan to help transition Windsor to a low carbon future including: Ontario's newly developed Cap-and-Trade system, new grants, rebates, and other subsidies which include:

- $3.8 billion in funding towards building retrofits and solar power generation;
- $285 million in electric vehicle incentives including rebates; and
- Funding to offset policy changes to building codes and mandatory electrical vehicle charging stations.

[1] The Canadian Press, Rainstorm, flooding in Windsor, Ont., area damaged more than 1,700 homes, Sept 30, 2016.
[2] The Globe and Mail, Ontario to spend $7 Billion on Sweeping Climate Change Plan, May 16, 2016.

Through the development of this Plan, Windsor is positioning itself to take full advantage of available funding and help contribute to the province's low carbon vision.

Overview of a Corporate Climate Action Plan

A Corporate Climate Action Plan is a corporate-wide plan to reduce energy and emissions from municipal operations and fleets. The CCAP focuses exclusively on energy and GHG emissions that are directly controlled by the City. The CCAP includes direct and indirect GHG emissions produced by the City as a result of its operations. The CCAP does not include emissions that are a consequence of activities from sources not controlled or owned by the City (including third-party contractors, construction activities, business, or air travel) or those that occur outside Windsor's geographical boundary.

The CCAP is tightly linked to, and takes direction from, the broader Community Energy Plan (CEP) that looks to address energy and climate change within the community of Windsor. With the City of Windsor operations and fleet accounting for approximately one per cent of overall community energy use and two per cent of overall community-wide emissions, the CCAP adopts the overarching vision, goals, principles, and targets established through the CEP with a particular focus on the City's infrastructure and assets.

As a "living document," the CCAP identifies actions with positive impacts to Windsor's economy, environment, and energy security. As the Plan evolves, there will be more technical and financial analysis needed to refine targets and energy and emissions reduction potential.

Linkage Between Corporate Climate Action Plan Link to Other City Plans

Like the CEP, the CCAP supports a number of key strategic plans within the City, including:

- The City's Official Plan (2010) includes key directions on land use, environmental stewardship, and urban design that promote compact development; support sustainable transportation with greater opportunities for walking, cycling, and transit; and encourage the design and construction of energy efficient buildings.
- The newly adopted 20-Year Strategic Vision (2016) that centres on three main goals for the City to achieve over the next 20 years: (1) create more jobs in Windsor; (2) change Windsor's reputation; and, (3) improve quality of life in Windsor.
- The Environmental Master Plan (2006) specifically relating to Goal D – "Use Resources Efficiently: To increase resource efficiency, conserve water, energy and reduce waste."
- The Climate Change Adaptation Plan (2012) focuses on potential climate change impacts including risks associated with increased precipitation and temperatures and the capacity to limit GHG emissions.
- The Corporate Energy Management Plan (CEMP) (2014) responds to Ontario Regulation 397/11 and the *Green Energy Act* that requires public agencies such as municipalities, universities, schools, and hospitals to report energy use and GHG emissions to the Ministry on an annual

basis, as well as develop five-year Conservation Demand Management plans.[3] The CEMP outlines actions to reduce the energy consumption of City buildings from 2014-2018.

- The Greening the City Fleet Manual (2012) is the guiding document to improve fuel efficiency, reduce air emissions and fuel costs associated with the City's fleets. The actions selected for inclusion in the Plan involve introducing more fuel-efficient vehicles and converting to cleaner fuels.

Figure 1 shows how the CCAP relates to City and provincial planning strategic initiatives.

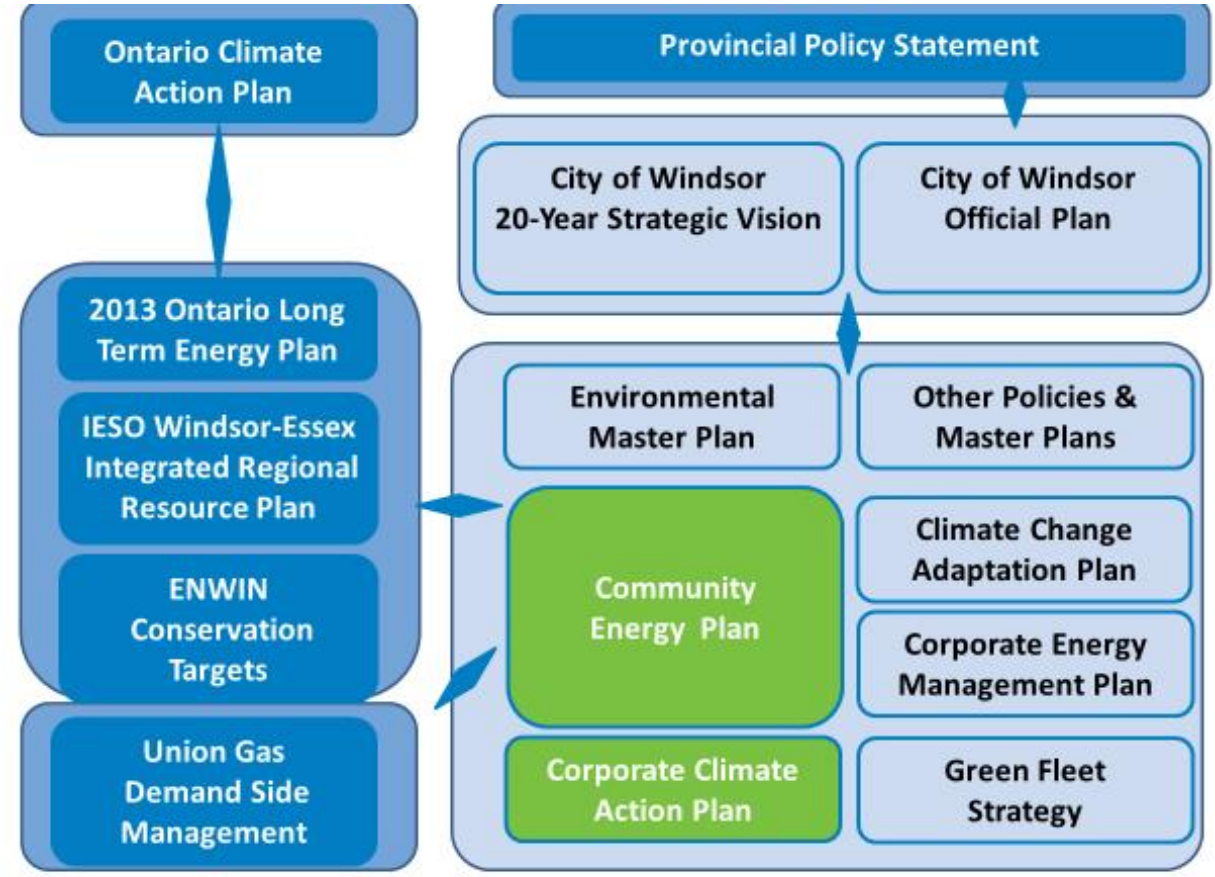

Figure 1: Relationship of the CCAP to Provincial and City of Windsor Planning

[3] Government of Ontario, O. Reg. 397/11: Energy Conservation and Demand Management Plans, filed under *Green Energy Act* 2009.

Chapter 2 - The CCAP Plan Development Process

The Corporate Climate Action Plan was developed over the course of 18 months and involved the active participation of a multi-departmental task force representing a number of divisions in the City administration. The Task Force was supported by a team of consultants led by Lura Consulting and ICLEI Canada. The Corporate Staff Task Force helped shape all aspects of the plan's development. The process began with creating a shared understanding of current energy use using 2014 as the baseline year and modelling future energy use to 2041 if no changes are made to address energy in the City's operations. Having a shared understanding of the current and future state allowed the Corporate Staff Task Force to shape the corporate targets, strategies, and actions and identify implementation considerations. The CCAP development process is summarized in Figure 2.

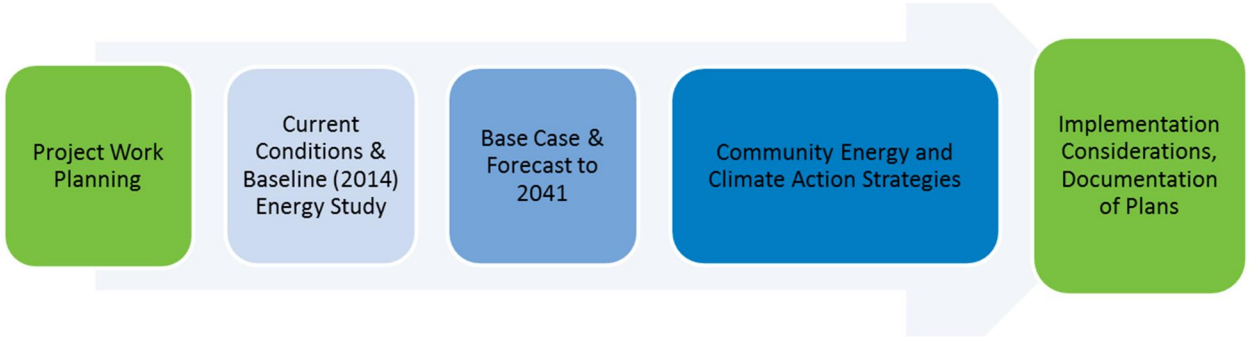

Figure 2: Process to Develop the CCAP

Federation of Canadian Municipalities Partners for Climate Protection Program

The Partners for Climate Protection (PCP) program is a network of Canadian municipal governments that have committed to reducing GHG emissions and acting on climate change. Since the program's inception in 1994, over 250 municipalities have joined PCP by making a public commitment to reduce emissions.[4] The PCP program connects more than 1,100 municipalities worldwide and provides a voluntary five-milestone framework to guide communities in reducing GHG emissions (Figure 3). As part of the PCP program, municipalities receive recognition for each of the five milestones completed for corporate operations or community level action.

[4] Federation of Canadian Municipalities, Partners for Climate Protection, 2016.

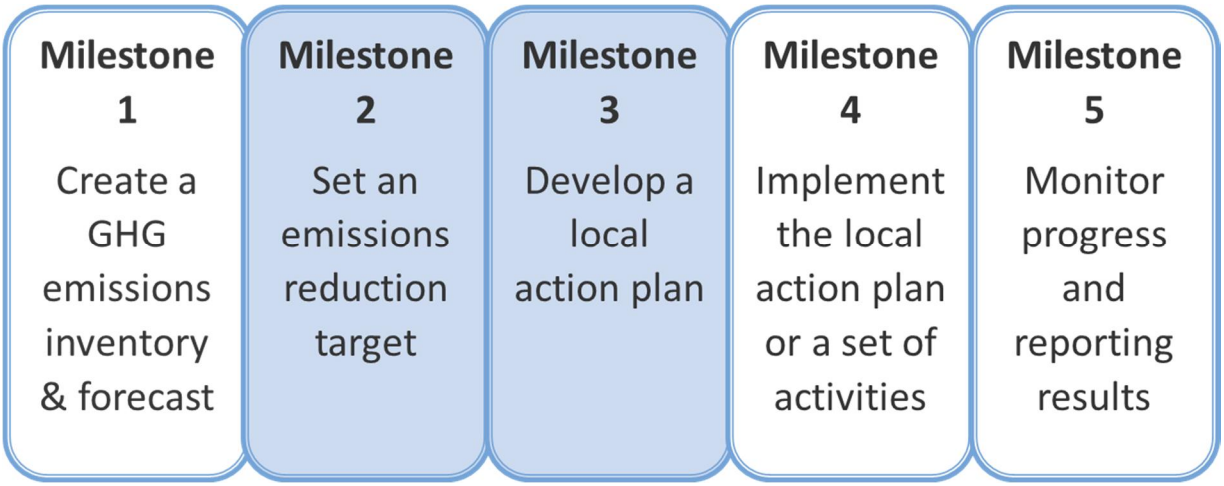

Figure 3: PCP Milestone Program

The City of Windsor joined the PCP network in December of 2002. Direction to implement the milestones associated with the PCP program is set out in the City's Environmental Master Plan (2006), specifically under Objective Ab: Reduce air emissions and water pollution discharges from City operations. The City achieved Milestone One in October 2008 through the completion of the Inventory of Greenhouse Gas Emissions Report. The CCAP provides an update to Milestone One, sets an emissions target (Milestones Two), and develops an action plan to meet that target (Milestone Three).

Fulfilling the PCP Program Requirements

The FCM's Green Municipal Fund finances Climate Change Action Plans (including Windsor's CCAP) that achieve Milestones One, Two, and Three of the PCP program.

In order to meet the Green Municipal Fund and Ministry of Energy requirements for both the PCP program and the Municipal Energy Plan program, the CCAP:

- Assesses Windsor's energy use and GHG emissions;
- Identifies alignment and integration with other plans and processes;
- Identifies goals, objectives, and targets;
- Defines a local action plan to address GHG emissions from corporate operations;
- Defines an implementation strategy;
- Considers impact of future growth and options for local clean energy generation; and
- Supports local economic development.

This Plan provides the City with an opportunity to develop a target and action plan which fulfils the needs for PCP Milestones Two (Reduction Target and Forecast) and Three (Action Plan) as well as provides an updated Milestone One (GHG Inventory). Milestones Four (Implementation) and Five (Monitoring) will be achieved through implementing the CCAP and monitoring progress and reporting results.

How to Read This Plan

The CCAP is organized in the following manner:

- The CCAP adopts the community-wide Vision, Principles, and Goals for energy use and greenhouse gas emission reductions as identified in the Community Energy Plan;
- Chapter Three provides a review of how the City of Windsor uses energy now (using a baseline of 2014). This includes the types and percentages of fuel used, sectoral energy use, greenhouse gas emissions by sector and by fuel type, as well as the costs of energy for the City;
- Chapter Three also provides an indication of what will happen by the year 2041 if the City does not address energy use and greenhouse gas emissions;
- Chapter Four provides targets for energy use and greenhouse gas emission reductions from City operations;
- Chapters Five through 13 present the strategies for each sector (5 – Overview, 6 – Organizational and Policy change, 7 – Buildings, 8 – Non-Transit Fleet, 9 – Transit Fleet, 10 – Water and Wastewater, 11 – Street and Intersection Lights, 12 – Renewable Energy Generation, and 13 - Waste). Each chapter presents the proposed strategies, and the estimated GHG reduction and energy reduction savings where estimates are possible, as well as estimated implementation costs, potential cost savings, and suggested implementation timeframes. Enabling strategies that facilitate other actions but do not have quantified energy or GHG emissions reductions are included as appropriate;
- Chapter 14 provides a summary of the estimated emissions reductions from actions identified in the CCAP; and
- Chapter 15 outlines how implementation of the CCAP will occur, including monitoring and verification as well as reporting and plan renewal.

Chapter 3 – City of Windsor Energy Consumption and GHG Emissions Inventory and Forecast

With a population of approximately 211,000 as recorded in the last census[5], Windsor is the tenth largest municipality in Ontario and the 23rd largest in Canada.[6] In 2014, the baseline year for this Plan, the City of Windsor's total energy use was approximately 839,990 GJ and cost approximately $22 Million.[7] Total GHG emissions were approximately 30,470 Tonnes CO_2e. This equates to approximately 4 GJ and less than 0.2 Tonnes CO_2e per person in 2014.

City of Windsor's Corporate Energy Use (2014)

The City's 839,990 GJ of energy use per year is primarily from buildings (including the airport), transit and City fleets, water and wastewater processing, and street and intersection lights. Electricity use accounts for 43 per cent of all energy use for the City. Electricity is used most often for lighting (including street and intersection lights) or to operate equipment within municipal buildings. Natural gas used to heat municipal buildings accounts for 23 per cent of corporate emissions. Diesel and gasoline combine to account for 23 per cent (18 per cent and five per cent respectively), which are the fuels used to power Windsor's transit and non-transit fleets. District Energy (DE) heating and cooling account for 11 per cent (seven per cent and four per cent respectively) of total energy used as shown in Figure 4.

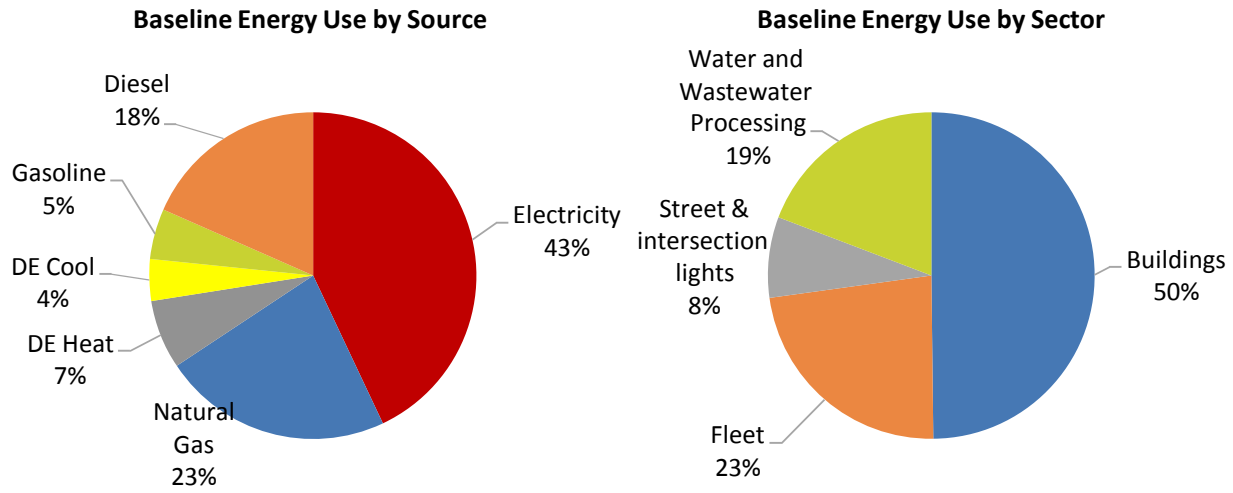

Figure 4: Baseline Energy Use by Source and by Sector for City of Windsor Operations (2014)

[5] Note StatsCanada released new population data in 2017 that indicate Windsor's population in 2016 was 217,188. All energy and GHG emission analysis used the 2011 census data which was available at the time of publication.
[6] StatsCanada, 2011 Census Program, Census of Windsor, Ontario.
[7] Based on consultants' estimate using representative Ontario average costs. Note this value is higher than the municipal energy costs represented in Figure 6 of the CEP as it is inclusive of all costs whereas the CEP value is representative of the costs associated with buildings only.

City of Windsor's Corporate GHG Emissions (2014)

The City of Windsor's total emissions of 30,470 Tonnes CO_2e are generated from the use of diesel, gasoline, electricity, natural gas, and district energy heating and cooling. The City's GHG emissions predominantly stem from buildings (at 44 per cent) and from Windsor's fleet (at 42 per cent). Most building emissions are generated from electricity and natural gas, used to heat and power each of the City's 200+ buildings, while fleet emissions are generated from diesel and gasoline use. Windsor's street and intersection lights generate three per cent of corporate emissions and Windsor's water and wastewater processing plants account for eleven per cent of emissions as shown in Figure 5.

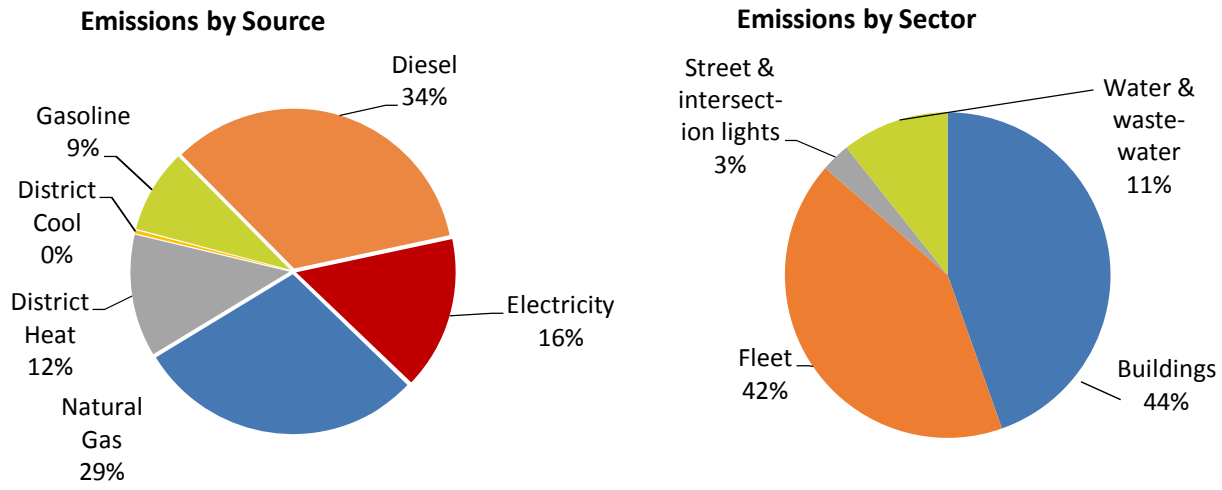

Figure 5: GHG Emissions by Source and by Sector for City of Windsor Operations (2014)

Projected Energy Use by Corporate Operations in 2041

The business as usual (BAU) scenario is used to understand future energy use and GHG emissions for the City of Windsor if no changes are made beyond what is already planned by the City and through provincial activities.

Figure 6 illustrates that under the BAU scenario, total energy consumption for the City will increase by 30 per cent from approximately 839,990 GJ (combined total) to approximately 1,124,580 GJ in 2041 based on population growth and future service needs.

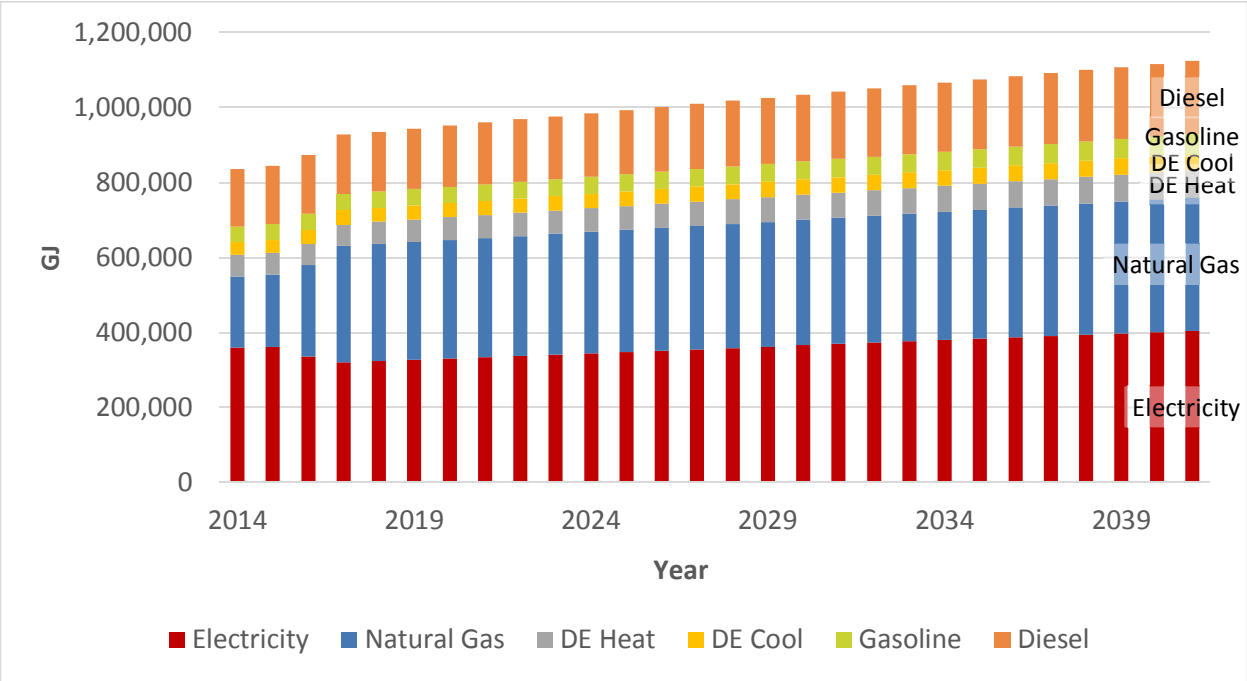

Figure 6: Corporate Business-As-Usual Energy Projection (2014-2041)

Current and Projected Costs of Energy to the City

With energy costs that are unpredictable and on the rise in Ontario, the City is looking for ways to mitigate energy cost fluctuations. It is estimated that the energy costs to the City in 2014 were approximately $22 million. Figure 7 illustrates the projected costs of energy for all sources except electricity. Figure 8 highlights the projected costs for electricity for the City in 2041 which are significantly higher than the costs projected for other sources.[8]

It is anticipated that energy costs will increase by 120 per cent at the lower risk range and by 275 per cent at the higher risk range by 2041. This would increase annual energy costs from $22 million per year to $48.8 million at the low end of the range and $81 million per year at the high end in 2041. This poses a significant cost risk for all sectors in Windsor.

[8] Based on consultants' estimate using representative Ontario average costs.

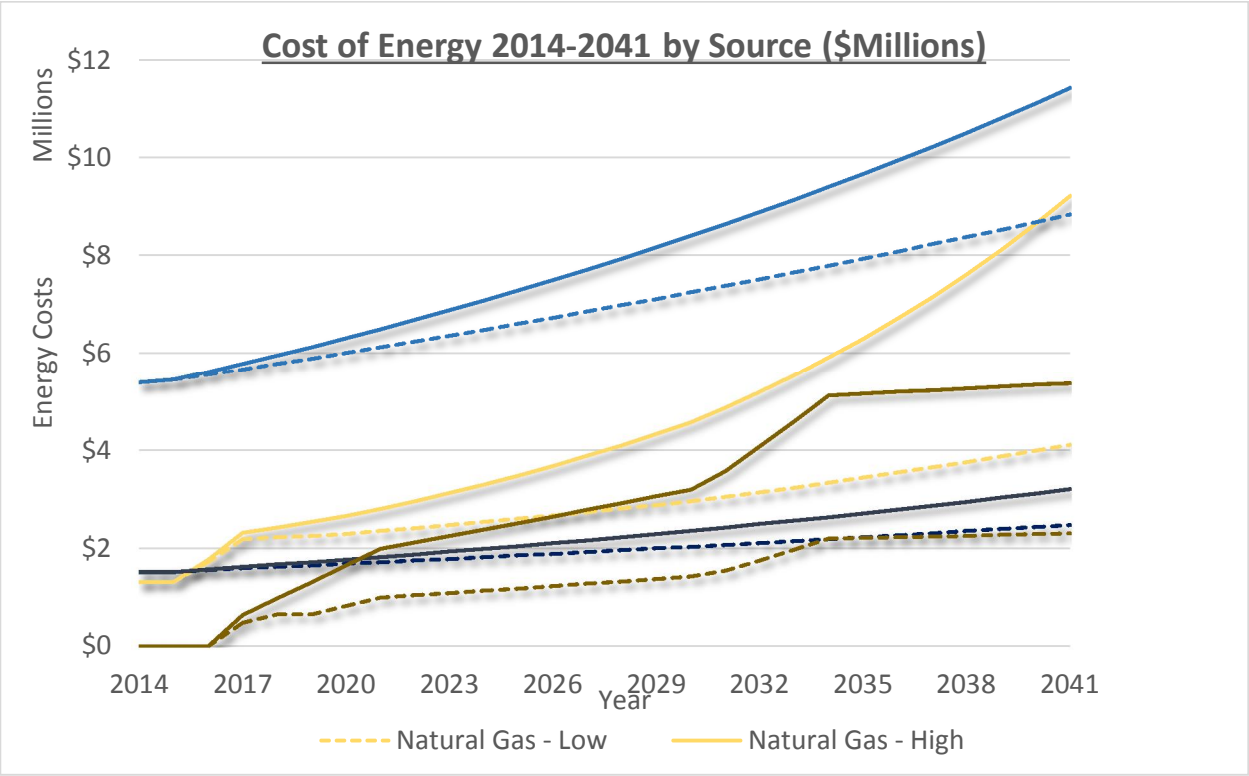

Figure 7: Projected Cost of Energy by Source for the City of Windsor (2014-2041)

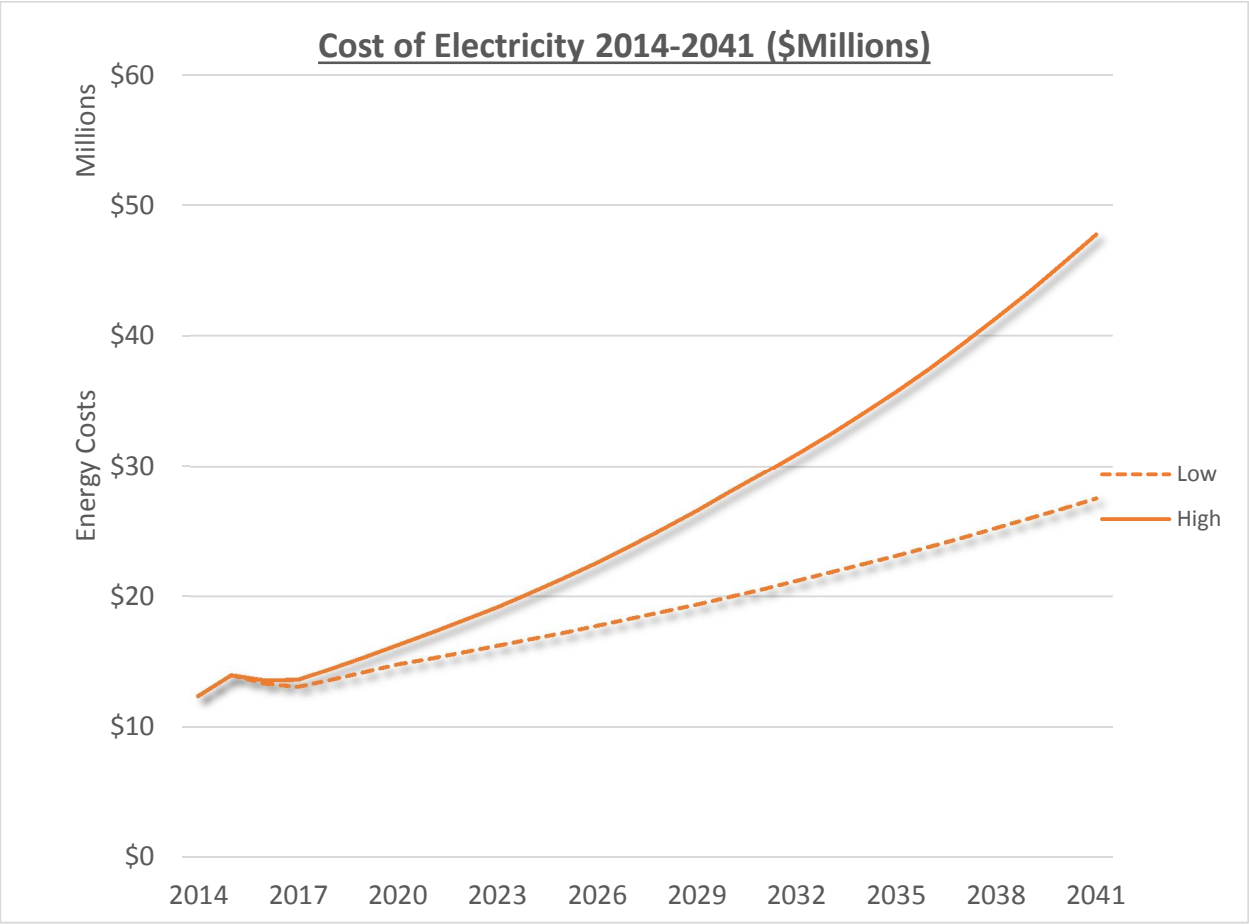

Figure 8: Projected Cost of Electricity for the City of Windsor (2014-2041)

Projected GHG Emissions from City of Windsor's Corporate Operations in 2041

Figure 9 Illustrates that under the BAU scenario, total GHG emissions for the City will increase by 43 per cent from 30,470 Tonnes CO_2e (combined total) to 43,670 Tonnes CO_2e in 2041.[9]

[9] Note District Energy Cooling represents a minimal amount of the total emissions and therefore does not show up on the graphs. District Cooling represents 100 Tonnes CO_2e in 2014 and 138 Tonnes CO_2e by 2041.

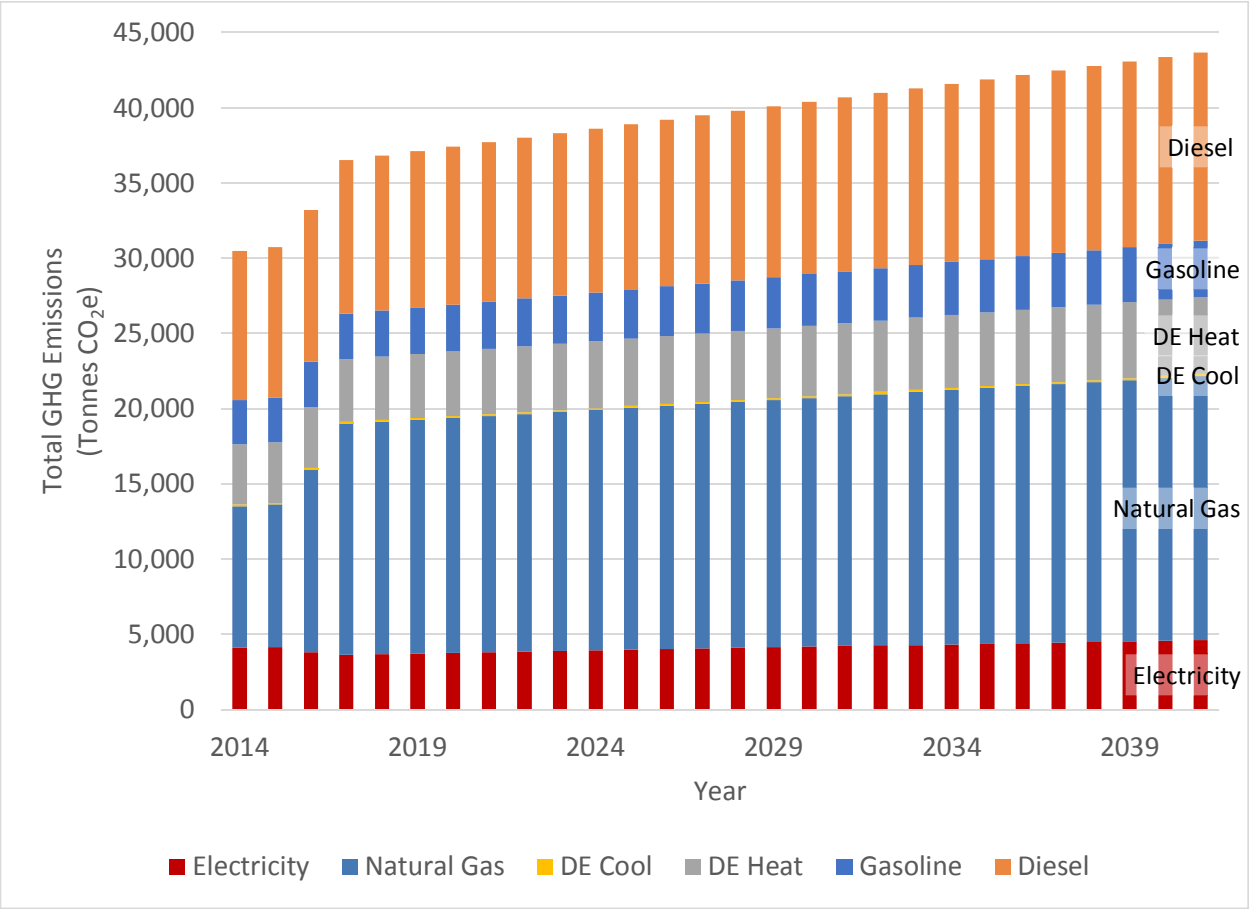

Figure 9: Projected Emissions by Source for the City of Windsor (2014-2041)

Chapter 4 – City of Windsor Targets

City of Windsor's Targets for GHG Emission Reductions

The Corporate Energy Management Plan sets a target to reduce building energy use by 10 per cent by 2018 from the 2014 baseline.[10] This ambitious target covers planned energy initiatives for all of Windsor's building retrofits, upgrades and initiatives with the intent to reduce both energy consumption and greenhouse gas emissions. The CCAP builds on the CEMP and includes transit, non-transit fleet, water and wastewater processing, streetlights, and solid waste management.

[10] Corporate Energy Management Plan 2014, pg. 10.

The CCAP establishes a long-term plan to 2041, with targets that align with both the CEP and the Ontario Climate Change Action Plan. The City of Windsor will reduce its primary energy use from the 2014 baseline by:

- **11% by 2030;** and
- **25% by 2041.**

Similarly, the City of Windsor will reduce its GHG emissions from the 2014 baseline by:

- **20% by 2030;** and
- **40% by 2041.**

These targets are based on, and will be achieved through the implementation of the recommended actions outlined in this Plan.

Chapter 5 –Overview of the Recommended Actions

The City of Windsor's recommended actions reflect best-in-class among other Ontario municipalities and are designed to meet the City's corporate targets.

These actions were developed with guidance from the Corporate Staff Task Force that represents relevant departments responsible for implementing the recommended actions and are designed to meet the unique needs of the City. As changes to policy, legislation, technology, climate, and/or other changes occur, the actions will evolve. The recommended actions are strategically aligned with the CEP, are within the control of the City, and all have positive environmental and economic outcomes given the anticipated increases to the costs of energy.

The recommended actions under each sector integrate initiatives that are planned or underway since 2014 and include new recommendations to advance GHG emission reduction from corporate operations. Each of the actions is based on estimates for energy and emission reduction from existing and proven technologies. As noted previously, more detailed technical and financial analysis will be required to refine energy and emission reduction potential.

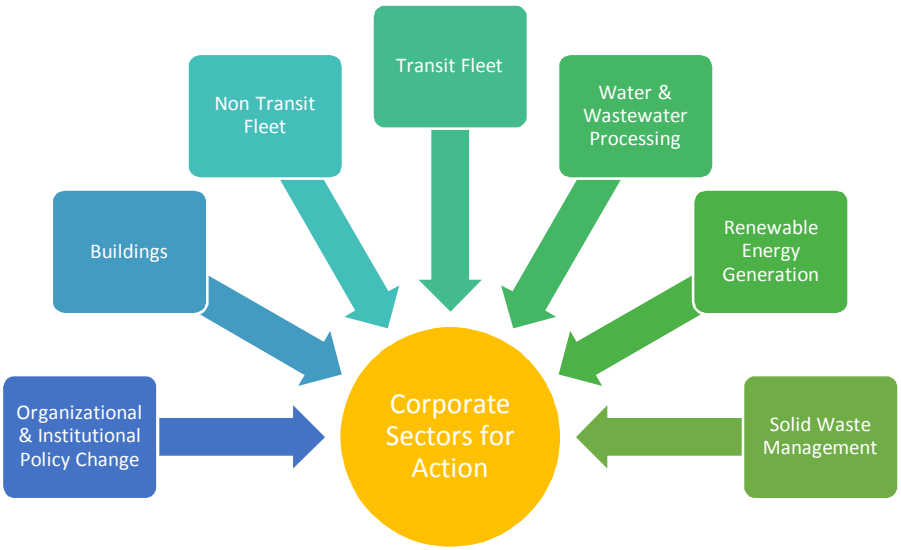

Figure 10: Sectors included in the CCAP

Figure 10 shows the categories that encompass the recommended actions. These categories include: (1) Organizational and Institutional Policy Change, (2) Buildings, (3) Non-Transit Fleet, (4) Transit Fleet, (5) Water & Wastewater Processing, (6) Street and Intersection Light Conversion, (7) Renewable Energy Generation, and (8) Solid Waste Management. The recommended actions under each category integrate initiatives that are planned or underway since 2014 and include new recommendations to advance GHG emission reduction from corporate operations. Each action is based on solid estimates for energy and emission reduction from existing and proven technologies. Footnotes are provided to clarify data sources and assumptions used to derive energy and emissions reductions, co-benefits, implementation costs, implementation timeframes, the department responsible for implementation, and funding.

Summary of Recommended Action by Category

Category	Recommended Action
ORGANIZATIONAL & INSTITUTIONAL POLICY CHANGE	
	P2: Integrate Energy Solutions into Land Use Policies
	P3: Increase Staff Training, Education and Awareness
	P4: Continue to Pursue Funding and Incentive Opportunities
	P5: Create a Corporate Energy Task Force
BUILDINGS	B1: Continue Existing Building Retrofits
	B2: Increase Efficiency through New Building Design and Building Replacement
	B3: Continue to Improve Operations, Maintenance, and Monitoring
	B4: Integrate Support Infrastructure for Existing and New Buildings
NON TRANSIT FLEET	F1: Continue to Implement the Actions Prescribed in the Greening the City Fleet Manual
	F2: Review the Efficient Driver Training Program
	F3: Advance Anti-Idling Initiatives and Technologies
	F4: Review Renewable Natural Gas (RNG) Opportunities
	F5: Explore Benchmarking Opportunities
TRANSIT FLEET	T1: Advance Vehicle Replacement
	T2: Join Canadian Urban Transit Research & Innovation Consortium
	T3: Explore Alternative Propulsion Vehicles
	T4: Continue Efficient Driver Training
WATER & WASTEWATER PROCESSING	W1: Develop Long- Term Water Conservation and Sanitary and Stormwater Master Plans
	W2: Implement Water & Wastewater Treatment Plant Upgrades and Retrofits
	W3: Develop an Integrated Site Energy Plan
	W4: Review Renewable Natural Gas Generation
STREET & INTERSECTION LIGHTS	S1: Complete Street and Intersection Light Conversion to LED
RENEWABLE ENERGY GENERATION	R1: Explore Net Metering
	R2: Continue to Invest in Rooftop Solar Photovoltaic (PV)
	R3: Explore Parking Lot Solar Photovoltaic
SOLID WASTE MANAGEMENT	G1: Conduct a Solid Waste Audit Program
	G2: Establish a Corporate Solid Waste Diversion Target and Strategy
	G3: Collaborate with Neighbouring Communities to Establish an Organics Program

Chapter 6 - Organizational and Institutional Policy Change

The recommended actions below build upon existing initiatives and further recommends pursuing funding and incentive opportunities and the creation of a Corporate Energy Task Force. Although these actions have no direct GHG emission reductions associated with them, they form the foundation for a transition to energy efficiency at the organizational and institutional policy level with an emphasis on life-cycle costs rather than upfront costs.

The following is a brief description of the recommended actions in the Organizational and Institutional Policy Change category:

1. Create an Internal 'Energy First' Ethic
2. Integrate Energy Solutions into Land Use Planning Policies
3. Ensure Sufficient Resources to Support Implementation
4. Increase Staff Training, Education, and Awareness
5. Continue to Pursue Funding and Incentive Opportunities
6. Create a Corporate Energy Task Force

Table 1 provides a summary of the impacts of each recommendation, including an estimation of potential GHG emissions and energy use reductions, cost savings, implementation costs, and suggested timeframe.

P1: Create an Internal 'Energy First' Ethic

The City is responsible for developing and maintaining internal corporate systems, policies, practices, and asset-management plans. These are all tools that can be used to bring energy issues to the forefront of decision-making. There is a need to emphasize mechanisms to conserve energy and water, reduce GHG emissions, reduce waste, and enhance resiliency through the corporate culture.

There are a few key actions to better integrate an "energy first" ethic into the corporate culture. The first is to ensure that the Asset Management Policy and Framework integrates sustainability as an integral part of how we manage our community assets to help ensure the highest environmental standard and is financially viable over the long-term. Secondly, it is important to establish a procurement policy for new community assets that considers the life-cycle implications of energy use. By integrating the lifecycle costs of both the upfront capital investment and maintenance and operations costs over the long term, the City should be able to reduce the financial costs of energy infrastructure and develop a mechanism to-re-invest the savings into other energy initiatives. This is discussed further under the Buildings category.

Recommendation: The City should foster an "energy first" ethic across the organization by:

- Ensuring the Asset Management Policy and Framework integrates sustainability for community assets including energy infrastructure and ensuring it is implemented thoroughly;
- Establishing a procurement policy for new community assets that considers the life-cycle implications of energy use; and

- Establishing a mechanism to re-invest energy dollars saved to fund other climate change and energy related City initiatives.

P2: Integrate Energy Solutions into Land Use Policies

This recommendation is also covered in a number of areas within the CEP, as it is foundational to many of the changes at the community level. Land use planning can play a significant role in how communities advance smart energy solutions. The CEP identifies a number of key areas for policy integration to the Official Plan, Secondary Plans, and supporting planning policies. These include:

- Designating and planning of a net zero neighbourhood;
- Designating and planning of District Energy Areas;
- Designating and planning of a Low-Energy Economic Development Neighbourhood;
- Continuing to strengthen policies relating to active transportation and transit oriented development;
- Integrating land use planning, transportation planning, active transportation and transit oriented development policies; and
- Continuing to strengthen policies that advance compact and complete communities.

Recommendation: Planning staff should integrate energy supportive policies into all relevant plans and policy documents.

P3: Ensure Sufficient Resources to Support Implementation

During the discussions with the Corporate Staff Task Force, staff noted the need for resources – both financial investment and staff resourcing – to ensure the CCAP's implementation is coordinated, funded, and effective. Staff noted this may need to be a new staff position(s) that concentrates primarily on the implementation of the CCAP, its alignment with the Environmental Master Plan, and Climate Adaptation Plan. This role could be shared with the Community Energy position identified in the CEP. The role for the staff person(s) would involve monitoring, liaison, tracking, outreach, education and awareness, training, as well as obtaining funding.

P4: Increase Staff Training, Education, and Awareness

GHG emission reduction needs to be integrated into the everyday practices and the thinking of all staff and visitors to City facilities, and this is only possible through strong communication and awareness. Good communication does not just happen. It requires careful planning and implementation. To communicate strategically, City administration will need to identify key audiences, determine the information that they need, and adapt your messages appropriately for each one. ENERGY STAR offers a variety of communication resources, such as posters and templates that Windsor can customize to help spread the word to employees, customers, and stakeholders. These resources are available on the ENERGY STAR web site.[11]

[11] EnergyStar, Guidelines for Energy Management, pg. 20.

The Corporate Energy Management Plan already recommends a phased approach to an energy awareness and education campaign. Through an education and awareness campaign, the CEMP anticipates a 1.5 per cent decrease in energy consumption every eighteen months with expectations to expand the programs as deemed appropriate.[12] Although recognized as a key recommendation of the CEMP to continually integrate energy efficiency and GHG emission awareness into all staff training, the education and awareness campaign has yet to be implemented. The CCAP recommends that education, training and awareness are key instruments to institutionalize an "energy first" ethic among City employees.

From a staff training perspective, the City can develop a common training program and offer it to various disciplines within the Administration. Such a program could encompass energy and development/re-development that includes elements of project assessment, RFP development and impact benchmarking as well as efficient operations, maintenance and behaviour change techniques that would further the energy first ethic across the Administration.

Recommendations:

A corporation-wide energy awareness and education campaign should be developed and implemented to:

1. Provide a strategic framework for engaging staff in efficiency activities;
2. Educate all staff about the importance of emissions reduction and outline what all departments and individual staff members can do to help grow a culture of conservation;
3. Identify high-impact behaviours and outline specific engagement tactics to implement over the next five years to target those behaviours;
4. Consider incentives and recognition; and
5. Define an evaluation process to measure impacts of the campaign.

In addition, a comprehensive training program should be created or identified that will foster deeper understanding across the organization on the impacts of energy choices in procurement, design, construction, operation and maintenance.

P5: Continue to Pursue Funding and Incentive Opportunities

As energy efficiency and emission reduction becomes an increasing priority for all levels of government, funding opportunities will become available to help transition Windsor to an efficient, low carbon future. There are already a number of existing avenues for funding that align with the recommended actions identified in the CCAP including:

- Ontario's Climate Change Action Plan will provide seven billion dollars in funding over the next four years influencing several areas of the Plan including:
    - $3.8 billion in funding towards building retrofits and solar power generation;

[12] Corporate Energy Management Plan 2014, pg. 3, 54.

    - $285 million for electric vehicle incentives including electric vehicle rebates and infrastructure installation rebates; and
    - Funding to help offset policy changes to building codes and mandatory electrical vehicle charging stations.
- For new buildings, Windsor can benefit from the New Building Canada Fund (Infrastructure Canada) and the saveONenergy program (offered through EnWin and IESO);
- For existing building retrofits, there is the saveONenergy program (offered through EnWin and IESO) as well as financial incentive programs for commercial/institutional buildings offered by Union Gas and Hydro One;
- The City can pursue potential funding opportunities with EnWin and IESO to partially fund monitoring and reporting activities for electricity consumption and GHG emissions;
- The City can also capitalize on Federal Gas Tax Funding and the Green Municipal Fund for infrastructure improvements in areas such as water, wastewater, roads, energy, and transportation.

Recommendation: The City should continue to actively pursue available funding opportunities to advance implementation of the recommended actions within the Plan.

P6: Create a Corporate Energy Task Force

Energy use and GHG emissions relate to many departmental activities across the Corporation. As such there is a need for a multi-departmental committee that can coordinate the implementation of energy and emissions reduction related projects. The concept of a multi-departmental task force was identified in the EMP, the Greening the City Fleet Manual, as well as the CEMP.[13]

To date, numerous departments have regular discussions relating to energy use, however, there is no formal multi-disciplinary group discussing energy across the administration as a whole. Building on the recommendations of the EMP, CEMP and Greening the City Fleet Manual, it is proposed that a team of corporate operational stakeholders with direct responsibility for the consumption of energy within their respective jurisdictions form a Corporate Energy Task Force with a mandate to ensure the efficient use of energy is a priority within their respective operations and throughout the municipal workplace.

It is proposed that the Corporate Energy Task Force meet quarterly with the following objectives:

- Promote, support, and assist with the implementation of a broad range of energy consumption reduction measures as identified in the Corporate Energy Management Plan;
- Integrate best practices into daily operations where applicable;
- Provide a forum for cross pollination of ideas and energy management strategies that benefit the Corporation; and

[13] The Environmental Master Plan, 2006, pg. 47, Greening the City Fleet Manual, 2012, pg. 15, Corporate Energy Management Plan, 2014, pg. 54.

- Assist with the execution of the Corporation's energy education and awareness campaign.[14]

Recommendation: A Corporate Energy Task Force should be created, including staff from Corporate Projects, Facilities, Pollution Control, Planning, Asset Management, the CAO's Office, Fleet, Transit Windsor, Environmental Services, and Geomatics as well as the City Engineer. The mandate and scope of the Task Force should include GHG emissions reductions, economic development, and alignment with the CEP.

Table 1: Impacts of Recommended Organizational and Institutional Policy Change Actions

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Costs ($)	Estimated Potential Savings ($/yr)	Suggested Timeframe
P1: Create an Internal 'Energy First' Ethic	Indirect		Nominal	Indirect	2017
P2: Integrate Energy Solutions into Land Use Policies	Indirect		Nominal	Indirect	2017
P3: Ensure Sufficient Resources to Support Implementation	Indirect		$75,000-$125,000[15]	Indirect	2017
P4: Increase Staff Training, Education and Awareness	Indirect		Nominal	Indirect	2017
P5: Continue to Pursue Funding and Incentive Opportunities	Indirect		Nominal	Indirect	2017
P6: Create a Corporate Energy Task Force	Indirect		Nominal	Indirect	2017

[14] Corporate Energy Management Plan (2014) pg. 57.
[15] Note this refers to additional staff to support implementation of both the CCAP and the CEP.

Chapter 7 - Buildings

The Corporate Energy Management Plan calls for action to address energy efficiency and emissions in some of the Corporation's 200+ buildings through planned retrofits. The CEMP outlines planned initiatives from 2014 to 2018 and has identified future initiatives under a more aggressive approach.

The recommended actions for buildings include the planned initiatives identified in the CEMP (i.e. Corporate Wide Energy Efficiency and Retrofit Program, Energy Audits of over fifteen facilities with high energy intensity, and behavioural measure improvements such as the implementation of the Energy Awareness and Education Campaign)[16] as well as additional actions to move beyond the 2018 timeframe. By building on these actions, Windsor will be able to plan future community assets with both energy efficiency and prudent purchasing in mind.

The following is a brief description of the recommended actions in the Building category:

1. Continue Existing Building Retrofits
2. Increase Efficiency through New Building Design
3. Continue to Improve Operations, Maintenance, and Monitoring
4. Integrate Supportive Infrastructure for Existing and New Buildings

Table 2 provides a summary of the impacts of each recommendation, including an estimation of potential GHG emissions and energy use reductions, cost savings, implementation costs, and suggested timeframe.

B1: Continue Existing Building Retrofits

The City of Windsor currently operates over 200 buildings of a variety of sizes, encompassing approximately 3 million square feet of space.[17] Through the CEMP, energy conservation and strategic management of energy use has been planned and documented. The CEMP outlines the critical steps needed to reduce the effects of greenhouse gas emissions on the environment, ensure a reliable energy supply, and secure a sustainable community in the near-term (2014-2018).[18] The implementation of the proposed energy audits and studies could generate an annual projected electricity reduction of 4.2 million kWh and an annual GHG emissions reduction of 1,220 tonnes, which under current pricing assumptions could result in an annual cost-savings of $504,000-$1,260,000 by 2041.[19]

[16] Corporate Energy Management Plan, pg. 18, 20 and 52.
[17] Ibid, pg. 7.
[18] Ibid, pg. 2.
[19] Ibid, pg 2.

In 2008 and 2009, comprehensive energy audits were undertaken on 157 sites (approximately 78 per cent of total buildings) which led to energy reduction measures being implemented across a broad spectrum of building types throughout 2010-2012. Energy reduction measures at that time included lighting retrofit and redesign, mechanical modifications, controls installation including building automation system upgrades and re-commissioning, water, building envelope, and renewable power generation. These combined measures have so far reduced 1,127 tonnes of GHG emissions annually.[20]

Implement Planned Retrofits 2014 – 2018

The City has identified a number of buildings that are considered to be the largest energy users within its building inventory including:

- WFCU Centre
- Forest Glade Arena
- South Windsor Arena
- Lanspeary Park Outdoor Rink
- Charles Clark Square Outdoor Rink
- 400 City Hall Administrative Building
- Capitol Theatre
- Huron Lodge Long-Term Care Facility
- Windsor International Aquatic and Training Centre and Adventure Bay

The CEMP outlines planned retrofits for many of these buildings by 2018 resulting in combined 26,000 GJ energy and 750 tonnes GHG emission reductions.

Recommendation: The City should continue with planned retrofit initiatives, integrate stronger energy efficiency requirements into the retrofits (where feasible), and monitor the energy performance of retrofitted buildings.

Complete Future Retrofits (2018+)

Building on the successes of the CEMP retrofits, this Plan calls for deep energy efficiency retrofits beyond 2018 that target a 20 – 50 per cent reduction in building energy use for the facilities with the highest energy intensity (GJ/m^2). There are approximately 49 facilities that are amongst the highest energy intensity that equal to 60 per cent of built floor space (note: Not all of these facilities will be retrofitted, some may be replaced).

A deep energy efficiency retrofit is a complete, whole-building package that includes elements such as high efficiency windows, supplementary insulation, lighting upgrades, weather-stripping, programmable controls, efficient appliances, etc.

[20] Ibid, pg. 18.

Recommendation: The City should complete deep energy efficiency retrofits in buildings with the highest energy intensity in 2018 and beyond in order to achieve significant energy cost savings.

B2: Increase Efficiency through New Building Design

In the Corporate Energy Management Plan, the opportunity to maximize energy efficiency through the design and construction of new buildings was identified. The CEMP suggests that a draft policy stipulating that all newly constructed public buildings be LEED-Gold certified (applies to all buildings planned after 2016).[21]

Recommendation: To deepen energy savings and reduce emissions from new buildings, the City should develop a minimum energy efficiency standard for all new buildings (e.g., 70 per cent more efficient than existing buildings).

Adopt New Building Procurement Energy Performance Standards

Energy planning and performance of new Windsor facilities should begin at the earliest possible stage to increase the capabilities and opportunities for energy savings. This procurement policy would operate in conjunction with a "highest energy performance" policy which would evaluate the lifecycle analysis of all future procurement. The development of this policy is an important step to limit inefficient purchases with limited lifespans that would have to be retrofitted or upgraded.

Recommendation: The City's procurement process should outline the requirements for energy standards when designing and constructing new City of Windsor facilities to maximize energy performance and a highest energy performance policy.

Continue to Conduct Building Audit and Re-commissioning

Changing occupant needs, space reprogramming, building renovations, and obsolete systems can wreak havoc on the efficiency of a building's energy-using systems. Often there are incidences when building renovations do not consider required HVAC modification, resulting in either a much larger space than required being heated and cooled, or multiple ductless air conditioning units are purchased and deployed. This approach increases operating cost and often results in increased construction and recurring costs. These issues can be avoided through re-commissioning. Re-commissioning provides a rigorous investigative approach to identifying problems and systems integration issues. It is assumed that 15 per cent reductions can be achieved through auditing and re-commissioning. Actual energy use reductions will be confirmed through more detailed analysis of individual sites.[22]

Recommendation: The City should continue to conduct building audits and re-commissioning before proceeding with costly building retrofits.[23]

[21] Corporate Energy Management Plan, 2014, pg. 39.
[22] ICLEI Canada, 2016.
[23] Natural Resources Canada, ecoENERGY Efficiency for Buildings, 2012.

B3: Continue to Improve Operations, Maintenance, and Monitoring

Renovating existing buildings and designing new energy efficient buildings is an important part of any CCAP, yet if these practices are not paired with effective operations and maintenance, then the net benefit can be lost. By knowing more about how and where energy is being used, a stronger business case for investing in maintenance and upgrades becomes apparent.

There are a number of practices that can help Windsor track their building efficiencies and prioritize areas for maintenance:

Continue Energy Data Management

To efficiently manage energy use requires effective monitoring systems that provide accurate feedback, ideally in real-time. The ability to analyze useful data will serve to reinforce the concept that while energy is considered a constant cost, it is variable and can be influenced by practice. Making individuals accountable and empowering them with the tools to better control energy use is fundamental and stresses the importance of engaging people in the development and execution of an energy management plan.[24]

In 2016, the City of Windsor implemented Energy Management Software for collecting and tracking monthly energy billing information.[25] This allows facility staff and energy administrators to better understand the energy use for each facility over time and react and respond to operational abnormalities. Enhancing access to the energy consumption data will enable staff to better understand the consumption and cost impacts of energy efficiency actions.

Recommendation: Energy Demand Management software should continue to be used to identify energy misuse and opportunities for improvement.

Install and Upgrade Building Automation Systems (BAS)

The Corporation currently has several types of building automation systems (BAS) in a number of facilities. A BAS is a tool that assists operational and administrative staff to optimize the day to day management of a facility. The ability to integrate buildings systems including heating, ventilation, air conditioning (HVAC), lighting, and security with energy data management information is essential and provides for a comprehensive enterprise wide energy management program.[26] The primary goals of BAS for Windsor are:

- Direct energy use reduction by way of equipment/lighting scheduling or load shedding;
- Data collection to inform complex energy use reduction (e.g., identifying opportunities for district energy integration, behavioural/policy changes, strategic asset investment, etc.);

[24] Corporate Energy Management Plan, 2014, pg. 65.
[25] Personal communications, Sokol Aliko (Nov, 2016).
[26] Corporate Energy Management Plan, 2014, pg. 66.

- Operating cost reductions due to fewer required person-hours of oversight by way of automation; and
- Standardization for portability of operators within the City.[27]

Transit Windsor has recently gone through the process of upgrading its BAS. This upgrade will provide an opportunity to pilot BAS functionality and ease of use, assess the impact to energy consumption based on benchmark data, approximate a general implementation cost per facility, and determine unforeseen technical challenges in integration.[28]

Recommendation: The City should continue to install and upgrade BAS systems as needed. In addition, the creation of a framework to share energy data with facility operators and site supervisors/managers will be helpful as a means of educating them and fostering initiatives to more actively manage heating and cooling of unoccupied areas.

Expand Sub-Metering

Energy sub-metering allows for individual areas within a building or buildings among a site to have energy consumption measured through unit-specific individual meters. As a result, sub-metering systems not only promote conservation but also offer cost-saving potential by identifying units, processes, and equipment that are not energy-efficient.

While sub-metering is relatively new to the City of Windsor, installations have occurred at all of the City's main energy consumers.[29] The City has conducted an energy sub-metering and data analytics pilot program in the past and has now started discussion with stakeholders regarding BAS upgrading, integration and expansion.[30] The City of Windsor has recently begun installing sub-meters at major energy consuming sites, including the WFCU Sports-Entertainment Centre.[31]

Recommendation: The City should continue to develop energy analytics to alert building operators when City facilities are under-performing with regard to energy consumption. In addition, the energy sub-metering program should continue to be expanded from 2017 onward.

Implement Energy Performance Labelling

Energy Performance Labelling is a low-cost tool that can help Windsor communicate its building energy efficiency targets and performance. The Ministry of Energy is looking to move in the direction of energy performance disclosure with proposed amendments to the *Green Energy Act*, 2009 that include energy performance disclosure for large buildings. The federal Pan-Canadian Framework on Clean Growth and Climate Change also indicates that federal, provincial and territorial governments will work together with the aim of requiring labelling of building energy use. Energy Performance Labelling is also recommended as part of the Community Energy Plan.

[27] Personal communications, Cole Nadalin (Nov, 2016).
[28] Ibid.
[29] Personal communications, Sokol Aliko (Nov, 2016).
[30] Ibid.
[31] Ibid.

Recommendation: The City should post Energy Performance Labelling on all City buildings.

Consider Energy Dashboards

Energy dashboards are virtual systems that show real-time data and are an effective communication tool when used in conjunction with other initiatives. Dashboards could be displayed on site in the form of a display screen or online through a web interface. An energy dashboard can present a buildings real-time energy use, along with a historical line graph to compare real-time energy use to historical energy use. Although it is difficult to quantify the impact that a dashboard has, it helps keep energy savings messages top-of-mind for building occupants who make daily energy related decisions. The right message can engage, inform, challenge, and promote energy efficiency and ensure occupants know that energy efficiency is a priority at City facilities. When results and metrics from data analytics software are used, the message becomes even more powerful.

Recommendation: Energy and sustainability dashboards be incorporated by means of an online web interface or physically displayed in all City buildings where people congregate or pass by on a regular basis.

Advance Energy Efficient Operations and Maintenance Practices

The Ontario Ministry of Energy's *A Guide to Preparing Conservation and Demand Management Plans* suggests that behavioural changes, including those relating to operations and maintenance (O&M) behaviours of employees, have the potential to reduce energy use by five to ten per cent.[32] Coupled with the implementation of energy efficient technologies, there is a potential to increase energy savings to as high as 15 per cent.[33]

Recommendation: Behaviour change and operations and maintenance training should be implemented to optimize energy savings within corporate operations and maintenance.

B4: Integrate Supportive Infrastructure for Existing and New Buildings

Supportive infrastructure includes services and supplies needed to sustain an organization in its day-to-day operations. The supportive infrastructure included in this Plan will complement other initiatives and can have both direct and indirect effects on energy and emissions to both existing and new buildings. The following actions are identified to support sustainable energy systems, but do not include quantified GHG emissions, costs or implementation timing in the analysis:

Integrate Cycling Infrastructure

Developing municipal cycling infrastructure is important in helping achieve Ontario's vision of becoming Canada's premier cycling province.[34] More and more people are choosing cycling as their preferred way to get around. By developing cycling infrastructure, Windsor can support and encourage the growth of cycling while simultaneously reducing both corporate and community emissions.

[32] Ministry of Energy, *A Guide to Preparing Conservation and Demand Management Plans,* November 12, 2013, pg. 17, Section 5.3.3.
[33] Corporate Energy Management Plan 2014, pg. 3.
[34] Ontario Ministry of Transportation, #CycleON Ontario's Cycling Strategy, 2013.

The Bicycle Use Master Plan was adopted in 2001. Windsor annually funds the construction of cycling infrastructure was awarded $325,000 in 2016 to help integrate cycling supportive infrastructure through the Ontario Municipal Cycling Infrastructure Program which provides funding for up to 50 per cent of total eligible costs for a cycling infrastructure project.[35] Active transportation is considered in transportation studies such as roadway environmental assessments.

Other supported policies and procedures include:

- Engineering Best Practice BP4.3.1 Widening During Pavement Rehabilitation on Local Roads which directs consideration for cycling facilities on all related projects; and
- The Bike Parking Policy has been established in addition to the provisions within the zoning bylaw.

Recommendation: The City should continue its commitment to developing cycling infrastructure by including bike racks and cycling-related storage for both new buildings and review opportunities for expanded services at existing buildings. Cycling supportive facilities such as showers and change rooms should also be considered in future building retrofits and new buildings to encourage active transportation. It is also recommended that the City continue to integrate cycling provisions for existing and new roads.

Adopt District Energy Ready Building Design

Connecting buildings to district energy can result in significant energy savings. This process begins by planning to place heating and cooling systems in a building location that can easily connect to district heating (and cooling). In addition, the 800 kilowatt Combined Heat and Power due to be installed in the City's Aquatic Complex in the next couple of years can be easily reconfigured to serve the City Centre District Energy network, as a potentially valuable network heating asset.

Recommendation: All new City of Windsor buildings in designated District Energy Areas (see Chapter 9 of the Community Energy Plan) should be designed to accommodate connection to district energy.

Integrate Combined Heat and Power

Combined heat and power (CHP), also known as cogeneration has the potential to reduce energy consumption and GHG emissions. By using the heat by-product of electrical generation, substantial energy savings is conceivable when electricity is generated on site.[36] Under the CCAP, it is assumed that an additional 50 to 60 MW of CHP will be associated with the district energy systems by 2041.

Recommendation: High efficiency CHP should be integrated into building design where appropriate, to improve overall fuel efficiency and enhance the economics of the district energy utility.

[35] Ontario Ministry of Transportation, Ontario Municipal Cycling Infrastructure Program, 2015 and Ontario Ministry of Transportation, Cycling Infrastructure Funding By Municipality, 2016.
[36] University of Waterloo, Integration of Combined Heat and Power Generations, 2006.

Table 2: Impacts of Recommended Building Actions

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Total Costs ($)	Estimated Potential Savings ($/yr)	Suggested Timeframe
B1: Continue Existing Building Retrofits	4,300	113,860[37]	$15,500,000-$38,600,000[38]	$3,273,000-$5,972,000	Existing retrofits 2016-2020 Deep retrofits 2020+
B2: Increase Efficiency through New Building Design	1,300	25,140[39]	$17,000,000 (additional cost premium)	$2,183,000-$3,447,000[40]	Ongoing
B3: Continue to Improve Operations, Maintenance and Monitoring	1,600	58,950	$900,000-$10,000,000	$2,215,000-$3,966,000[41]	Ongoing 2022
B4: Integrate Supportive Infrastructure • Integrate Cycling infrastructure	Indirect		Nominal		Ongoing

[37] Continued Existing Buildings Retrofits Energy Reduction Assumptions: 60% of floor space retrofitted to achieve an average energy reduction between 25%-35%.
[38] Retrofit Assumptions: $10/ft^2 – $25/ft^2. Estimated from case studies in: Guide to building the case for deep energy retrofits (RMI); The Economics of Green Retrofits (Nils Kok); How to Calculate and Present Deep Retrofit Value (RMI). In some cases retrofits can cost much higher, estimates range from $10-150 /ft^2.
[39] Increase Efficiency through New Building Design Energy Reduction Assumptions: All new buildings are 70% more efficient than baseline by 2041.
[40] Continued Existing Buildings Retrofits Energy Cost Savings Assumptions: This assumes $280/ft^2 construction cost for high efficiency new buildings, and further assumes that additional costs of achieving high efficiency over conventional building represent 8% of the total cost. Cost as listed represents that 8% cost premium. Source: Corporate Sustainable Building Policy (City of Burlington); Net Zero and Living Building Challenge Financial Study (International Living Future Institute, NBI, Skanska).
[41] Increase Efficiency through O&M Cost Savings Assumptions: Low range = estimate for assessment and commissioning –High range = installation of full BAS for all facilities.

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Total Costs ($)	Estimated Potential Savings ($/yr)	Suggested Timeframe
• Adopt District Energy Ready Building Design	TBD		Nominal	Supplemental to retrofit and new building	Ongoing as buildings are retrofitted or built
• Integrate Combined Heat and Power	TBD		Nominal	Supplemental to retrofit and new building	Ongoing as buildings are retrofitted or built

Chapter 8 - Non-Transit Fleet

Close to a third (31 per cent) of the City's corporate emissions result from fleet fuel consumption, including transit, ambulance, fire small fleet[42], police, and corporate vehicles.[43] Of that percentage, the non-transit fleet accounts for 34 per cent and Transit Windsor accounts for 66 per cent of total City fleet emissions. Modelled projections reveal that total projected emissions will sharply decrease by 2041 if the City integrates electric vehicles and other emission reducing technologies into their fleets.

Without a significant reduction in fleet-emitted GHGs (transit and non-transit), the City will only be able to modestly slow future emissions as opposed to achieving a significant reduction.

For the purposes of this Plan, the City's non-transit fleet refers to the corporate fleet managed by the Operations Department's Fleet Division, as well as fire, police and parks. The City's non-transit fleet consists of more than 500 on and off road vehicles as indicated in Table 3. The City, through normal unit replacement, has greened its Parks vehicles by purchasing eight Tier 3 compliant and fourteen Tier 4 interim and Tier 4 Final compliant diesel mowers. These mowers represent about 30 percent of the diesel Parks fleet uses and provide reduced GHG emissions and better fuel economy.

The Plan's recommendations for the non-transit fleet aim to contribute to the *Greening the City Fleet Manual's* objectives to manage fuel consumption, promote environmentally friendly vehicles, and evaluate alternative fuels.[44]

Table 3: City of Windsor Non-Transit Fleet (2016)

City of Windsor Non Transit Fleet	
Corporate Fleet	279
Fire	30
Police	106
Parks	108
Total	523

The following is a brief description of the recommendations in the non-transit fleet category. Those noted with * are linked to actions for Transit Windsor fleet but have components that are unique to the non-transit fleet:

[42] The Fire Small Fleet refers to administrative vehicles used by the Fire Department.
[43] Greening the City Fleet Manual, 2012, pg.3.
[44] Ibid, pg. 9.

1. Continue to Implement the Actions Prescribed in the Greening the City Fleet Manual
2. Review the Efficient Driver Training Program*
3. Advance Anti-Idling Initiatives and Technology*
4. Review Renewable Natural Gas Opportunities
5. Explore Benchmarking Opportunities*

Table 4 provides a summary of the impacts of each recommendation, including an estimation of potential GHG emissions and energy use reductions, cost savings, implementation costs, and suggested timeframe.

F1: Continue to Implement the Actions Prescribed in the Greening the City Fleet Manual

Currently, the City of Windsor's non-transit fleet has one hybrid vehicle in the corporate fleet[45] and there are also two solar vehicles used by the Parks department. In 2006, a Council resolution to further 'green' the City's fleet in order to reduce emissions was passed.[46] As a result, the Greening the City Fleet Manual was developed (for non-transit fleets aside from police) and implementation began in 2012 to help facilitate the purchase of green vehicles including hybrid, electric or alternative fuel vehicles where available in the appropriate class of vehicles, when operationally and economically feasible and when funding is available.[47] If successfully implemented, the Greening the City Fleet Manual, along with the Sustainable Purchasing Guide, will result in an increasing number of energy efficient vehicles moving forward.

Continue the Alternative Fuel Study

In 2012, Canada harmonized the Corporate Average Fuel Economy (CAFE) standards for post-2016 vehicle models with the fuel efficiency regulations of the United States. These updated fuel efficiency standards require an 80 per cent improvement in mileage by 2025 from the current standards.[48] This positive step means that as Windsor upgrades its non-transit fleet vehicles, the City will realize higher fuel efficiency.

The City of Windsor is currently undertaking an alternative fuel study to better understand enhanced fuel efficiency and lower carbon options available for the corporate fleet and how to best shift to using alternative fuel technologies. The study includes alternative fuel vehicles such as hybrid electric and full electric vehicles.

Recommendation: The City should continue to explore and integrate alternative fuel vehicles into the non-transit fleet.

Continue Right-Sizing Vehicles and Reducing Fleet Size

City departments are actively engaged in right-sizing their corporate fleets and ensuring vehicles purchased meet the specific job function requirements necessary. Examples of this include: downsizing

[45] Greening the City Fleet Manual, 2012, pg. 2.
[46] Ibid, pg. 1 CR374/2006.
[47] Ibid, Purchase Green Vehicles Action, pg. 20.
[48] Globe and Mail, Canada to copy Obama's fuel efficiency rules, 2012.

15 per cent of the corporate pickup fleet, downsizing 25 per cent of the Fire small fleet from mid-size cars and minivans to hatchbacks, and introducing mobile offices in Compliance and By-Law Enforcement vehicles since 2009.[49]

Through right-sizing, City departments are rationalizing their fleet and considering the possible elimination of vehicles. This process, together with the contracting out of some City services, has resulted in a reduction of eight per cent of the corporate fleet since 2009.[50]

Recommendation: The City should continue the practice of right-sizing vehicles and reducing the fleet size where possible to achieve a further 10 per cent reduction in fuel use.[51]

Advance and Improve the Operation, Monitoring and Maintenance Program

To ensure the cleanest possible emissions and optimal fuel economy, proper vehicle maintenance is essential. Emissions from well-maintained vehicles are 20 to 50 per cent less than those from engines that are not properly maintained. The City has planned maintenance programs in place, at regular intervals, based on the industry standard for each vehicle. Maintenance is tracked in a fleet management system and records are kept for each vehicle. Advanced systems assist the fleet manager in monitoring and evaluating the performance of the existing fleet and support better decision-making about future vehicle purchases. Advanced practices include storage tank fuel level monitoring, tire audits, and filling tires with nitrogen to increase vehicle fuel efficiency and reduce tire wear. Regular maintenance assures optimal fuel economy and minimal emissions for each vehicle within the City of Windsor fleet.[52]

The City's fuel management system currently has fuel economy tracking capabilities. In order for a vehicle to be refueled, the vehicle's odometer reading must be entered into a system. This provides the capability to track fuel consumption on a per-vehicle basis. This could also be used to pinpoint fuel consumption issues with individual vehicles, or even driving habits (ex. excessive idling).[53]

Fuel economy is equally affected by maintenance. Well-maintained engines and properly inflated tires can significantly increase fuel efficiency for cars and trucks. Studies show that properly inflated tires can improve the fuel economy of passenger vehicles by approximately three per cent and even more for diesel trucks with heavy loads.[54]

Preventative maintenance programs have been revised to ensure servicing intervals that minimize maintenance, repair and fuel costs and reduce emissions. These programs also ensure compliance with Commercial Motor Vehicle Registration (CVOR) Requirements.

[49] Greening the City Fleet Manual, 2012, Appendix D, Right Size Vehicles.
[50] Ibid, pg. 2.
[51] Greening the City Fleet Manual, 2012, pg. 28.
[52] Ibid, pg. 12.
[53] Ibid, pg. 13.
[54] Ibid, pg. 13.

Recommendation: The City should continue to use the Corporation's fuel management system and conduct an internal review to identify any areas of improvement. In addition, it is recommended that preventative maintenance practices continue on all non-transit and Transit Windsor fleet vehicles.

F2: Review the Efficient Driver Training Program

The Corporate Driver Management Program has been reorganized and fuel training has been enhanced to include fuel efficient driving habits and communicate the City's anti-idling by-law. In 2007, an assessment was completed that identified 'high risk' drivers. As a result, simulator training is provided to all drivers at Windsor Fire and Rescue Services as well as workers who may operate snow plows. A five year retraining requirement was established for the program.[55]

Drivers of fleet vehicles are encouraged to be aware of, and apply all "green driving practices", by performing optimal driving behaviours, practicing anti-idling, and hypermiling (a driving practice using efficient stopping and acceleration) techniques, regularly checking tire pressure, as well as looking for opportunities to carpool.

It is estimated that through efficient driver training, the City can reduce the number of kilometers driven and decrease non-transit fleet emissions by up to five per cent.

Recommendation: The Corporate Driver Management Program should be continued and an internal review undertaken to identify any opportunities for improvement.

F3: Advance Anti-Idling Initiatives and Technologies

Anti-idling technology ensures that the vehicle can maintain the interior temperature and battery charge without wasteful fuel consumption. Anti-idling technologies are available that will automatically shut down a vehicle if it has been idling for too long. Shut-down systems are designed to limit engine idling to a pre-determined timeframe such as ten minutes. The technology has an override function that restarts the engine automatically should the temperature fall below set limits or if the battery drains below a safe operating level. These devices save fuel, reduce engine wear, and reduce emissions.

The City has adopted other initiatives that reduce idling time including the purchase of LED lights for truck arrow bars, safety strobes, and other vehicle lighting which draw less power and allow battery systems to function more efficiently. Air or coolant-heaters installed in light and heavy-duty vehicles allow the vehicle to warm with the engine off which reduces idling.

The City of Windsor has had an idling control by-law in place since 2001 (By-Law 233-2001). The by-law was updated in 2017 and applies to all City and community vehicles, with some exceptions including vehicles that require the engine to run to operate specific equipment.[56]

[55] Greening the City Fleet Manual, 2012, pg. 3-4.
[56] Ibid, pg. 17.

Recommendation:

The City should:

- Incorporate a trial run of anti-idling technology with the potential for implementation in all appropriate vehicles;
- More proactively enforce the idling control by-law;
- Ensure that new staff members be educated on an ongoing basis about vehicle anti-idling systems once installed and the importance of not idling vehicles unnecessarily; and
- Use the GPS/AVL system to document vehicles that are being idled excessively.

F4: Review Renewable Natural Gas Opportunities

Renewable natural gas (also called biomethane) is a potential alternative fuel produced by upgrading biogas from waste biomass sources. The biogas may come from an anaerobic digester, a wastewater treatment plant or a landfill. Once upgraded, renewable natural gas can be used interchangeably with natural gas.[57] Natural gas vehicles are capable of operating on 100 per cent renewable natural gas, which enhances the carbon reduction benefits of natural gas vehicles while using energy produced from waste sources.

Recommendation: The City should assess the possible benefits and feasibility of renewable natural gas for fueling the corporate fleet.

F5: Explore Benchmarking Opportunities

Benchmarking the City fleet against other fleets to track progress is a practice that will help Windsor advance its progress by adopting best practices. The City of Windsor currently participates in annual benchmarking initiatives with MBN Canada, formerly Ontario Municipal Benchmarking Initiative (OMBI), and with the Canadian Association of Municipal Fleet Managers (CAMFM). The City is also a member of the E3 Fleet Program and is considering participating in the associated rating program.

The North American Fleet Association (NAFA) Sustainable Fleet Accreditation Program is a distinctive program that provides tools to help automotive fleets measure and track environmental impacts. By participating in the NAFA, the City would join a select group of fleet leaders from the U.S. and Canada including the Ontario Ministry of Transportation and receive ongoing insight, support, marketing materials, and recognition for their commitment to sustainability.[58] A key benefit to accreditation for the City of Windsor is the ability to benchmark against leading municipalities and public agencies.

Recommendation: The City should consider joining the North American Fleet Association (NAFA) Sustainable Fleet Accreditation Program.

[57] Canadian Natural Gas Vehicle Alliance, Renewable Natural Gas, 2016.
[58] NAFA Fleet Management Association accessed November 14, 2016.

Table 4: Impacts of Recommended Non-Transit Fleet Actions

Actions	Estimated GHG Reduction Potential (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Total Costs ($)	Estimated Potential Savings ($/yr)	Suggested Timeframe
F1: Continue to Implement the Actions Prescribed in the Greening the City Fleet Manual	4,000	54,850[59]	$1,200,000	$2,722,000-$3,503,000	Ongoing
F2: Review the Efficient Driver Training	125	1,060[60]	Staff time[61]	$232,000-$345,000	Ongoing
F3: Advance Anti-Idling Initiatives and In-Vehicle Technology	130	1,120[62]	$0-100,000	$244,000-$386,000	2017
F4: Review Renewable Natural Gas	TBD: Impacts require further evaluation				As appropriate
F5: Explore Benchmarking Opportunities	Indirect		Nominal	TBD	Ongoing

[59] Assumptions: Assumes total fleet fuel efficiency meets North American CAFE fuel standards through a combination of more efficient vehicles, right-sizing, and preventative maintenance:

- Further ten per cent reduction in fuel use through right-sizing;
- 15 per cent of non-transit fleet vehicles are electric by 2041; (aligns with provincial targets)
- Operations, monitoring, and maintenance practices.

Note: The implementation cost represents the cost of EVs and charging infrastructure over the cost of traditional vehicles. It does not account for lower maintenance costs for EVs. Operational savings would be realized by lower fuel consumption (and costs).

[60] Assumptions: Estimates for fuel savings from driver training vary significantly. It has been assumed here that they can achieve five per cent reductions in fuel use. Note: other cities have more aggressive reduction estimates e.g.: Edmonton's Fuel Sense program which aims for a five to ten per cent reduction in total fuel use.

[61] Implementation costs for this action would mostly consist of employee time plus some incidentals, ICLEI Canada.

[62] Assumptions: Estimated fuel saving from anti-idling programs range from 1-10%. (Reference: BC Municipal Climate Action Toolkit Estimates 10% reduction).

Chapter 9 -Transit Fleet

Through Windsor's *Greening the City Fleet Manual* and the *Transit Master Plan,* the City has recognised the significant role Transit Windsor plays in both reducing community emissions as well as the responsibility it has, considering that it contributes 21 per cent of all corporate emissions.[63] Transit Windsor plays a critical role in protecting the environment by avoiding single occupant vehicle use and supporting more compact development to reduce the carbon footprint for community emissions. Transit Windsor has the ability to balance travel demand management and reduce emissions which will be incredibly important to meet both community and corporate targets by 2041.[64]

The following is a brief description of the recommended actions in the Transit Fleet category:

1. Advance Vehicle Replacement
2. Join the Canadian Urban Transit Research & Innovation Consortium
3. Explore Alternative Propulsion Vehicles
4. Adopt Alternative Fuel Use and Efficiency
5. Continue Efficient Driver Training

Table 5 provides a summary of the impacts of each recommendation, including an estimation of potential GHG emissions and energy use reductions, cost savings, implementation costs, and suggested timeframe.

T1: Advance Vehicle Replacement

In 2007, the Ministry of Transportation amended the Ontario Bus Replacement Program (OBRP) to encourage the retirement of buses after 12 years.

In 2016, Transit Windsor completed a *Fleet Asset Management Plan* in order to improve the efficient and effective management of its assets. A 12 Year Bus Life Cycle analysis was completed and recommended to support the reduction of operating expenditures while improving fleet reliability, emissions and public perception. Transit Windsor is positioning itself to operate a newer fleet.

Recommendation: As per the Fleet Asset Management Plan, bus replacement should be the first priority for Transit Windsor with an objective to replace buses after the recommended 12 year life cycle.

T2: Join the Canadian Urban Transit Research & Innovation Consortium (CUTRIC)

The Canadian Urban Transit Research & Innovation Consortium (CUTRIC) was incorporated in August 2014, with the objective to support industry-academic collaborations in the development of the next generation of technologies for Canadian transit and transportation systems. These advancements will

[63] City of Windsor, Transit Master Plan – "The Way Forward," 2006, pg. 3.
[64] Ibid, pg. 156-158.

help drive forward innovation in transportation across Canada, leading to job growth and economic development. CUTRIC works to produce innovative solutions to decrease fuel consumption, reduce GHG emissions, avoid wasted assets, and eliminate redundancies in operations, thereby saving taxpayers' money while supporting entrepreneurial opportunities for Canadian innovators. [65]

Recommendation: Transit Windsor should join CUTRIC to support collaborative innovation and integrate clean technology solutions that lower transportation emissions and help Windsor meet its climate change goals.

T3: Explore Alternative Propulsion Vehicles

Transit Windsor has already committed to actively reducing their fuel consumption and has purchased more fuel-efficient vehicles. A decline in fuel consumption and the use of greener vehicles has resulted in a six per cent reduction in GHG emissions since 2005. Already, 29 of Windsor's 118 units (25 per cent) within the Transit fleet are hybrid vehicles and Transit Windsor will continue to look at new ways to reduce emissions and operating costs.[66]

Transit Windsor is continuing to evaluate the most current propulsion systems and potential environmental improvements through its involvement with academic collaborations and transit industry associations like the Canadian Urban Transit Association, Ontario Public Transit Association, and. Transit Windsor continues to advocate for government support for public transit and environmental improvements.

Alternative fuel use has been researched and summarized by the City of Windsor for many years now.[67] As part of the City of Windsor's alternative fuel study, hybrid electric, and full electric vehicles have been researched to assess whether they are viable options. Other municipalities across Canada are already beginning to phase in long-range battery electric transit buses after completing similar trials.

Recommendations:

Transit Windsor should continue to explore alternative fuels to find the best solutions for Transit Windsor's fleet in regards to energy efficiency, emission reduction and fuel use.

Starting after 2030, this Plan proposes that 80 per cent of buses convert to alternative fuels by 2041 to support a low-carbon transportation system, based on the availability, cost, and reliability of new models.[68]

T4: Continue Efficient Driver Training

Transit Windsor has implemented the *SmartDriver for Transit* program. This program was created by Natural Resources Canada and later modified in co-operation with the transit industry. The intent of the

[65] CUTRIC, About CUTRIC, 2017.
[66] Greening the City Fleet Manual, 2012, pg. 3 and 4.
[67] Greening the City Fleet Manual, 2012, pg. 11 (and Appendix B).
[68] Note: Conversion to electric buses has been used to model the impacts of conversion to alternate propulsion vehicles.

program is to reduce fuel consumption and exhaust emissions by educating drivers on how the engine uses fuel, how exhaust emissions affect the environment, how fuel use affects engine maintenance, and how much fuel might be saved through fuel-efficient driving. Defensive driving techniques are included, recognizing the correlation between safe driving practices and increased fuel efficiency.

Recommendation: Efficient driver training should continue and an internal review should be undertaken to identify any opportunities for improvement and consideration of incentives for efficient driving practices.

Table 5: Impacts of Recommended Transit Fleet Actions

Actions	Estimated GHG Reduction Potential (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Total Costs ($)	Estimated Potential Savings ($/yr)	Suggested Timeframe
T1: Advance Vehicle Replacement	Included in T3				2017-2026
T2: Joining CUTRIC	Indirect		Nominal membership	Indirect, linked to outcomes of CUTRIC	2017+
T3: Explore Alternative Propulsion Vehicles	8,000	89,930[69]	$52,000,000	$2,623,000-$2,853,000	2030-2041
T4: Continue Efficient Driver Training	60	1,060[70]	Nominal	$174,000-$276,000	Ongoing

[69] Explore Alternative Propulsion Vehicles Energy Reduction and Cost Savings Assumptions: 80 per cent of Transit fleet is electric by 2041. Total fleet fuel efficiency increases to meet CAFE standards for North America. Performance of electric buses is based on existing electric bus technologies.

Note: Implementation Cost assumes $550,000 cost premium for an electric bus, but does not include cost of charging infrastructure or lower costs associated with maintenance of EVs, or available subsidies. $550,000 represents current cost of EV bus over traditional diesel; it is very likely that these costs will decrease as the technology matures.

[70] Continue Efficient Driver Training Assumptions: Estimates for fuel savings from driver training vary significantly. It has been assumed here that they can achieve 5% reductions in fuel use. Note: other cities have more aggressive reduction estimates e.g.: Edmonton's Fuel Sense program which aims for a 5-10% reduction in total fuel use.

Chapter 10 - Water and Wastewater Processing

The actions recommended for water and wastewater processing aim to reduce GHG emissions and energy use associated with water and wastewater processes, and capitalize on opportunities for on-site energy generation and recovery. The following is a brief description of the recommended actions in the Water and Wastewater Treatment category:

1. Develop a Long-Term Water Conservation and Stormwater Management Plan
2. Continue Water & Wastewater Treatment Plant Upgrades and Retrofits
3. Develop an Integrated Site Energy Plan
4. Review Renewable Natural Gas Generation

Table 6 provides a summary of the impacts of each recommendation, including an estimation of potential GHG emissions and energy use reductions, cost savings, implementation costs, and suggested timeframe.

W1: Develop Long-Term Water Conservation and Sanitary and Stormwater Master Plans

The Windsor Utilities Commission (WUC) is responsible for ensuring that the quality of water supplied to residents meets all standards established by the MOECC's Drinking Water Quality Management Standard. WUC collects, treats, stores, and distributes water to both consumers in the City of Windsor and the Towns of LaSalle and Tecumseh.[71]

The City of Windsor owns and operates two wastewater treatment facilities; 1) the Lou Romano Water Reclamation Plant and 2) the Little River Pollution Control Plant. These wastewater treatment facilities treat all wastewater originating within the City of Windsor as well as the Towns of Lasalle and Tecumseh. The quantity of wastewater treated is related to the amount of water treated at the A.H. Weeks Plant that is used in homes and business, as well as the stormwater flow entering the sewer system. Completion of the Sanitary and Stormwater Master Plans by the City, as well as other guidance documents will look for solutions to reduce inflow and infiltration into the sewer systems.

In addition to the two wastewater treatment plants, the City operates 43 pumping stations. Equipment (such as pumps, motors, and other treatment equipment) is required to operate 24 hours a day, seven days a week, leading to a significant amount of energy use and associated GHG emissions. Any actions by the City that can reduce the amount of water consumption and stormwater entering the sewer systems will have positive impacts on the amount of energy used and quantity of GHG emissions released by reducing the number of pumps that may be triggered or the length of time pumps have to run.

[71] City of Windsor Drinking Water System, Ministry of the Environment Inspection Report, 2014.

A long-term water conservation plan provides strategies that enhance and extend the commitment to leading water conservation programming, water resource protection, energy conservation, and greenhouse gas reduction. A long-term water conservation strategy is one of the conditions of approval of the MOECC for expanding sewage flow capacity.

Recommendation: The City should prepare a Water Conservation Plan and complete the Sanitary and Stormwater Master Plans, as well as any other guidance documents that aim to reduce inflow and infiltration into the City's sewer system.

W2: Implement Water & Wastewater Treatment Plant Upgrades and Retrofits

The Lou Romano Water Reclamation Plant and the Little River Pollution Control Plant are the first and third largest energy users within the City's building portfolio.[72] As such, the City upgrades and retrofits their water and wastewater treatment facilities on an ongoing basis. Two notable improvements already completed include aeration blower upgrades at Lou Romano and motor upgrades and sub-metering at Little River. The City operates 43 sanitary and storm pumping stations[73] which, while much smaller than a water or wastewater plant, have strong potential for significant energy and emission reduction upgrades.

Cumulatively, these upgrades could combine for a seven per cent reduction in electricity consumption and a three per cent reduction in greenhouse gases.[74] Further retrofits aiming at a 25 per cent reduction in energy use are planned in alignment with other facilities retrofit schedules.

This Plan assumes a 20 per cent reduction in energy use through retrofits and a further 10 per cent through operational efficiencies.

Recommendation: The City should complete upgrades to pumping stations and investigate energy and emission reducing upgrades such as the installation of variable frequency drives (VFDs) on pumps and the use of micro-hydro turbines to generate emissions-free, clean energy.

W3: Develop an Integrated Site Energy Plan

The City of Windsor recognizes the importance of looking at energy more strategically and holistically, and is interested in developing an Integrated Site Energy Plan (ISEP) for wastewater facilities. An ISEP would result in recommendations to optimize investments and management measures between end-use efficiency and energy supply choices.

Recommendation: The City should develop an Integrated Site Energy Plan for water and wastewater facilities.

[72] Corporate Energy Management Plan 2014, pg. 38.
[73] Ibid, pg. 51.
[74] Ibid, pg. 40-44.

W4: Review Renewable Natural Gas Generation

Renewable natural gas or biomethane is produced by upgrading biogas from waste biomass sources to pipeline quality. The biogas may come from an anaerobic digester, a wastewater treatment plant or a landfill. Once upgraded, renewable natural gas can be used interchangeably with natural gas.[75] This provides an opportunity for the City to capture biogas produced from wastewater treatment, upgrade it, and use it where natural gas sources are required.

In 2015, the City of Windsor undertook a preliminary study of the anaerobic digestion of biosolids for the purpose of generating renewable natural gas. The estimated pay-back period did not warrant further study, however, this study did not include the costs of carbon and the possibility of offset credits now outlined in the Province's Cap and Trade program. Based on this information and expected rise in energy costs, it is recommended that a review of this study be completed.

Recommendation: The City should further investigate opportunities for renewable natural gas generation at water and wastewater facilities.

Table 6: Impacts of Recommended Water and Wastewater Processing Actions

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Total Costs ($)	Estimated Potential Savings ($/yr)	Suggested Timeframe
W1: Develop Long-Term Water Conservation and Sanitary and Stormwater Master Plans	TBD - Possible impacts of water conservation require further evaluation		1L/s infiltration is equal to approximately $50,000/year[76]	$1,104,000-$1,911,000	2020
W2: Implement Water & Wastewater Treatment Plant Upgrades and Retrofits	800	40,680	TBD - Specific retrofits will determine costs[77]	$560,000-$978,000	Ongoing
W3: Develop an	TBD		$75,000-	Dependent	2020

[75] Canadian Natural Gas Vehicle Alliance, Renewable Natural Gas, 2017.
[76] Regional Public Works Commissioners research study – preliminary numbers.
[77] Assumptions: Best practice retrofits and process improvements from Consortium for Energy Efficiency, Initiative Description: CEE National Municipal Water and Wastewater Facility Initiative (2007). Possible impacts of pump efficiencies require further evaluation.

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Total Costs ($)	Estimated Potential Savings ($/yr)	Suggested Timeframe
Integrated Site Energy Plan			$100,000	on outcomes of the Site Plan	
W4: Review of Renewable Natural Gas Generation[78]	310	18,800	TBD	$1,460,000[79]	2022

[78] Assumptions: Renewable natural gas generation evaluation will require further analysis.
[79] Source: Memo to City re: Anaerobic digestion of biosolids – preliminary results (2015), pg. 7.

Chapter 11 - Street Light and Intersection Light Conversion

S1: Complete Street Light and Intersection Light Conversion to LED

The City of Windsor is responsible for the operation and maintenance of over 23,500 street lights within City boundaries.[80] While street lights do not contribute a significant amount of GHG emissions for the City, retrofitting High Pressure Sodium (HPS) street lights to LED (Light Emitting Diode) reduces maintenance costs[81,] and results in an annual reduction of streetlight energy consumption by 29 per cent. This equates to a five million kWh reduction or just under three per cent of the Corporation's annual electricity usage.[82] In 2016, the City of Windsor completed the replacement of all standard street and intersection lights with LED and has already begun to experience the benefits of this process.[83] Table 5Table 7 provides a summary of the impacts of street and intersection light conversion, including an estimation of potential GHG emissions and energy use reductions, cost savings, implementation costs, and suggested timeframe.

Recommendation: Full audits should be conducted to assess energy performance of the LED conversion and opportunities considered for retrofitting sports field lighting as well as automated controls that correspond to sports field bookings and/or scheduled time of use.

Table 7: Impacts of Recommended Street Light and Intersection Light Conversion Actions

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Total Costs ($)	Estimated Savings ($/yr)	Suggested Timeframe
Street and Intersection Light Conversion[84]	300	24,490	$15,136,100[85]	$2,400,000	Intersection lights completed in 2014 Street lights completed in 2016

[80] Corporate Energy Management Plan 2014, pg. 2.
[81] Note that the annual streetlight maintenance costs will be reduced by over $900,000 as the lamp recycling program will increase from once every five years to once in fifteen years. Corporate Energy Management Plan 2014, pg. 3, 52. Less frequent re-lamping will also reduce the required materials and associated labour.
[82] Corporate Energy Management Plan 2014, pg. 2-3, 52.
[83] Ibid, pg. 20.
[84] Assumption: 27% reduction in electricity use through streetlight retrofit.
[85] Total estimated cost of project upon completion provided by the City of Windsor, 2016.

Chapter 12 – Renewable Energy Generation

Solar energy has the highest return on investment of any renewable form of energy and global solar installations have continued to rise by over 50 per cent a year since 2006. As the cost of solar continues to drop and energy generation potential continues to increase, the solar industry is poised to assume a larger role in energy generation on both a community and corporate level. A number of municipalities are installing commercial-scale systems to off-set facilities with large energy footprints.[86]

The City began its renewable energy program in 2011 with the installation of three solar thermal water heating systems at several outdoor pools – Mic Mac, Remington Park, and Lions (Lanspeary) – saving approximately 35 per cent of natural gas consumed during the summer months.[87] Since then, Windsor has invested in three PV installations to reduce electricity from the grid by 2,000 MWh and the City has leased land to Samsung to install 50 MW of solar at the airport.

This Plan identified opportunities for the Corporation to generate 39 per cent of its corporate energy needs from renewable solar energy. [88]

The following is a brief description of the recommended actions in the Renewable Energy Generation category:

1. Explore Net Metering
2. Continue to Invest in Rooftop Solar Photovoltaic
3. Explore Parking Lot Solar Photovoltaic

Table 8 provides a summary of the impacts of each recommendation, including an estimation of potential GHG emissions and energy use reductions, cost savings, implementation costs, and suggested timeframe.

R1: Explore Net Metering

According to the Ontario Energy Board, electricity consumers in Ontario that produce some of their own power from a renewable resource may take advantage of the “net metering” initiative. Net metering will allow the City to consume renewable electricity generated onsite and sends excess electricity to the

[86] The disruptive potential of solar power, McKinsey Quarterly, 2014.
[87] Corporate Energy Management Plan 2014, pg. 4, 59.
[88] The assumptions for Windsor’s corporate electricity demands in 2041 include the increase in electricity needs for electric Transit vehicles and buses.

distribution system for a credit toward its energy costs. In essence, it's a "trade" of the electricity supplied against electricity the City consumes.[89]

Recommendation: The City should pursue net metering opportunities as it relates to renewable electricity generation at City facilities.

R2: Continue to Invest in Rooftop Solar Photovoltaic

The City of Windsor has built a 350 kW photovoltaic array on the roof of the Windsor International Aquatic and Training Center which is expected to generate approximately 500,000 kWh of electricity annually for the next 20 years.[90] Other solar installations include a 500 kW array on the roof of the Transit Windsor/Bus Garage[91] and a 500kW photovoltaic array at the WFCU Centre in August of 2016.

Moving forward, the City has prepared a list of 25 sites that have generation potential based on NRCAN modelling. If the City were to develop these sites, approximately 5,000 MWh could be generated annually (based on 1,100 kWh/kw).

Recommendation: The City should continue to invest in rooftop solar to meet a portion of the Corporation's electricity demands.[92]

R3: Explore Parking Lot Solar Photovoltaic

As solar becomes more economic, ground-mounted solar photovoltaic systems offer a unique use of municipal assets to help offset the rising cost and demand of energy.

Using a solar canopy system to cover parking lots with solar panels is emerging as one of the fastest growing segments of the solar market.[93] Considering the City of Windsor has 132,000 square meters of parking lots, over half of which have enough daily sunlight to potentially generate solar power, investing in solar carports is an untapped resource for renewable energy generation. By combining the solar canopy potential of facilities with floor areas higher than 1,000 m^2 and the measurements of their parking lot areas, this Plan assumes that approximately 66,000 square meters can be developed for solar power generation. This would yield 8,266 kW or 9,000 MWh of energy generation per year.

Recommendation: The City should invest in parking lot solar installations to meet a portion of the City's electricity demands.

---

[89] Adapted from Ontario Energy Board, Net Metering accessed January 25, 2017. http://www.ontarioenergyboard.ca/oeb/Industry/Rules%20and%20Requirements/Information%20for%20Generators/What%20Initiatives%20are%20Available.

[90] This solar array is under contract with the Independent Electricity System Operator (formally the OPA), earning the City a yearly average income of $250,000. Corporate Energy Management Plan 2014, pg. 3, 60.

[91] Note: the roof of the Transit Windsor/Bus Garage sustained damage from the August 2016 tornado. The installed solar array is current sitting idle while repairs are taking place.

[92] Based on 66% rooftop coverage for sites bigger than 25,000 ft^2 and 50% cover for all City buildings less than 25,000ft^2.

[93] Solar Industry Magazine, Solar Canopies Turn Parking Lots into Power Plants with Benefits, 2015. Washington Post, The best idea in a long time: Covering parking lots with solar panels, 2015.

Table 8: Impacts of Recommended Renewable Energy Generation Actions

Actions	Estimated GHG Reduction Potential (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Total Costs ($)	Estimated Potential Savings ($/yr)	Suggested Timeframe
R1: Net Metering	Indirect		TBD		2017+
R2: Continue to Invest in Rooftop Solar Photovoltaic[94]	300	28,000	$14,500,000	$2,110,000-$3,704,000	Follows from net-metering timing
R2: Explore Parking Lot Solar Photovoltaic[95]	450	39,000	$28,900,00	$3,015,000-$5,235,000[96]	Follows net-metering timing

[94] Assumptions: Implementation includes the installation of solar panels. $2,500/kW for >500kW installation, $3,500/kW for <500kW installation.
[95] Assumptions: Assuming $3,500/kW for Parking Lot Solar installation.
[96] Assumptions: The cost savings assume all electricity generated by solar panels replaces grid supplied electricity purchased at market rates. In cases where projects are part of FIT or MicroFIT programs – savings will depend on the price paid for electricity generated.

Chapter 13 – Corporate Solid Waste Management

The City of Windsor has continuously participated in diverting and reducing solid waste from municipally operated buildings and is working towards meeting the community solid waste diversion objective of 60 per cent by 2019; however, this target will not be achieved unless a greater volume of organic matter is diverted from landfill.[97] While solid waste diversion will continue to be a priority for the City, the impact of solid waste on overall emissions is quite minimal (typically around five per cent) and therefore has not been quantified in this Plan.

The following is a brief description of the recommended actions in the Corporate Solid Waste Management category:

1. Conduct a Solid Waste Audit Program
2. Establish a Corporate Waste Diversion Target and Strategy
3. Collaborate with Neighbouring Communities to Establish an Organics Program

Table 9 provides a summary of the impacts of each recommendation, including an estimation of potential GHG emissions and energy use reductions, cost savings, implementation costs, and suggested timeframe.

G1: Conduct a Solid Waste Audit Program

As part of the Environmental Master Plan, the City of Windsor has identified many ways to reduce solid waste, particularly by reducing paper use within City operations as well as increasing the amount of recyclable material collected on-site at all City facilities.[98]

A corporate waste audit process can help identify how much solid waste each of the City's buildings is generating. This will give the City a better understanding of which corporate facilities would benefit from further solid waste reduction actions and planning. In 2015 waste audits were conducted at Adventure Bay, both City Hall buildings as well as 1266 McDougall and recycling facilities were enhanced in these buildings.

Recommendation: The City should conduct a solid waste audit program to benchmark how well it is doing to meet solid waste reduction goals.

[97] SWMMP, 2012 to be updated in 2017.
[98] Environmental Master Plan, 2006, pg. 37.

G2: Establish a Corporate Waste Diversion Target and Strategy

The waste audits performed in 2015 showed between 10.3 % (WIATC and Adventure Bay) and 63.5% (1266 McDougall) diversion rates, while the possible diversion rates achievable was between 49% and 88%. Following the original audit at the WIATC and Adventure Bay improvements were made to the recycling facilities in line with best practices. A spot audit following the improvements showed a dramatic increase of diversion rates to 51%. Using the results of solid waste audits will guide the setting of waste diversion targets for City facilities.

Recommendation: The City should develop and formalize a Corporate Waste Diversion Target and Strategy.

G3: Collaborate with Neighbouring Communities to Establish an Organics Program

Recommendation: The City should continue to collaborate with neighbouring municipalities to establish an organics program.

Table 9: Impacts of Recommended Solid Waste Management Actions

Actions	Estimated GHG Reduction Potential (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Total Costs ($)	Estimated Potential Savings ($/yr)	Suggested Timeframe
G1: Conduct a Solid Waste Audit Program	Indirect		TBD		2017+
G2: Establish a Corporate Waste Diversion Target and Strategy	Indirect		TBD		2017+
G3: Collaborate with Neighbouring Communities to Establish an Organics Program	Indirect		TBD		2017+

Chapter 14 –Summary and Impacts of Energy and Emission Reductions

Summary of the Impacts of Energy and Emissions Reductions for the City of Windsor

Table 10 summarizes the emissions reduction potential from the actions identified in the CCAP.

Table 10: Summary of Impacts of Energy and Emissions Reductions for the City of Windsor

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Costs (Total Cost)	Estimated Potential Savings ($/yr)	Suggested Timeframe	Assumptions
P1: Create an Internal 'Energy First' Ethic	Indirect		Nominal	Indirect	2017	
P2: Integrate Energy Solutions into Land Use Policies	Indirect		Nominal	Indirect	2017	
P3: Ensure Sufficient Resources to Support Implementation	Indirect		$75-125,000	Indirect	2017	Shared with CEP Project Administrator
P4: Increase Staff Training, Education and Awareness	Indirect		Nominal	Indirect	2017	
P5: Continue to Pursue Funding and Incentive Opportunities	Indirect		Nominal	Indirect	2017	

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Costs (Total Cost)	Estimated Potential Savings ($/yr)	Suggested Timeframe	Assumptions
P6: Create a Corporate Energy Task Force	Indirect		Nominal	Indirect	2017	
B1: Continue Existing Building Retrofits	4,300	113,860	$15,500,000-$38,600,000	$3,273,000-$5,972,000	Existing retrofits 2016-2020 Deep retrofits 2020+	60% of floor space retrofitted to achieve an average energy reduction between 25%-35%. This recommendation is in line with the recommendations in the Community Energy Plan. Retrofit costs assume $\$10/ft^2$ – $\$25/ft^2$. Estimated from case studies in: Guide to building the case for deep energy retrofits (RMI); The Economics of Green Retrofits (Nils Kok); How to Calculate and Present Deep Retrofit Value (RMI). In some cases retrofits can cost much higher, estimates range from \$10-150 $/ft^2$.
B2: Increase Efficiency through New Building Design and Building Replacement	1,300	25,140	$17,000,000	$2,183,000-$3,447,000	Ongoing	All new buildings are 70% more efficient than baseline by 2041. Cost savings assumes $\$280/ft^2$ construction cost for high efficiency new buildings, and further assumes that additional costs of achieving high efficiency over conventional building represent 8% of the total cost. Cost as listed represents that 8% cost premium.

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Costs (Total Cost)	Estimated Potential Savings ($/yr)	Suggested Timeframe	Assumptions
B3: Continue to Improve Operations, Maintenance and Monitoring	1,600	58,950	$900,000-$10,000,000	$2,215,000$ 3,966,000	Ongoing 2022	Low range = estimate for assessment and commissioning High range = installation of full BAS for all facilities.
B4: Integrate Support Infrastructure for Existing and New Buildings	Indirect/TBD		Nominal		TBD	Supplemental to retrofit and new buildings.
F1: Continue to Implement the Actions Prescribed in the Greening the City Fleet Manual	4,000	54,850	$1,200,000	$2,722,000-$3,503,000	Ongoing	Assumes total fleet fuel efficiency meets North American CAFE fuel standards through a combination of more efficient vehicles, right-sizing, and increased maintenance. • Further 10% reduction in fuel use through right-sizing. • 15% of fleet vehicles are electric by 2041. • Operations, monitoring and maintenance practices. Note: This represents the cost of EVs and charging infrastructure over the cost of traditional vehicles. It does not account for lower maintenance costs for EVs.

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Costs (Total Cost)	Estimated Potential Savings ($/yr)	Suggested Timeframe	Assumptions
F2: Review the Efficient Driver Training Program	125	1,060	Staff time	$232,000-$345,000	Ongoing	Estimates for fuel savings from driver training vary significantly. It has been assumed here that they can achieve 5% reductions in fuel use. Note: other cities have more aggressive reduction estimates e.g.: Edmonton's Fuel Sense program which aims for a 5-10% reduction in total fuel use. Implementation costs for this action would mostly consist of employee time plus some incidentals, ICLEI Canada.
F3: Advance Anti-Idling Initiatives and Technologies	130	1,120	$0-100,000	$244,000-$386,000	2017	Estimated fuel saving from anti-idling programs range from 1-10%.
F4: Review Renewable Natural Gas	TBD: Impacts require further evaluation				As appropriate	
F4: Explore Benchmarking Opportunities	Indirect		Nominal	TBD	Ongoing	
T1: Advance Vehicle Replacement	Included in T3				2017-2026	
T2: Joining CUTRIC	Indirect		Nominal membership	Indirect	2017+	Impacts are linked to actions as outcomes of CUTRIC.

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Costs (Total Cost)	Estimated Potential Savings ($/yr)	Suggested Timeframe	Assumptions
T3: Explore Alternative Propulsion Vehicles	8,000	89,930	$52,000,000	$2,623,000-$2,853,000	2030-2041	Modelled to assume 80% of Transit Windsor fleet is electric by 2041. Total fleet fuel efficiency increases to meet CAFE standards for North America. Performance of electric busses based on existing electric bus technologies. Implementation cost assumes $550,000 cost premium for electric bus, does not include cost of charging infrastructure or lower costs associated with maintenance of EVs, or available subsidies. $550,000 represents current cost of EV bus over traditional diesel; it is very likely that these costs will decrease as the technology matures.
T4: Continue Efficient Driver Training	60	1,060	Nominal	$174,000-$276,000	Ongoing	Estimates for fuel savings from driver training vary significantly. It has been assumed here that they can achieve 5% reductions in fuel use. Note: other cities have more aggressive reduction estimates e.g.: Edmonton's Fuel Sense program which aims for a 5-10% reduction in total fuel use.

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Costs (Total Cost)	Estimated Potential Savings ($/yr)	Suggested Timeframe	Assumptions
W1: Develop Long-Term Water Conservation and Sanitary and Stormwater Master Plans	TBD - Possible impacts of water conservation require further evaluation		1L/s infiltration is equal to approx. $50,000/yr	$1,104,000-$1,911,000	2020	Regional Public Works Commissioners research study – preliminary numbers.
W2: Implement Water & Wastewater Treatment Plant Upgrades and Retrofits	800	40,680	TBD	$560,000-$978,000	Ongoing	Implementation costs will be determined based on specific retrofits to be completed. Best practice retrofits from Consortium for Energy Efficiency, Initiative Description: CEE National Municipal Water and Wastewater Facility Initiative (2007).
W3: Develop an Integrated Site Energy Plan	TBD		$75,000-100,000	TBD	2020	Projected savings are dependent on outcomes of the Site Plan.
W4: Review of Renewable Natural Gas Generation	310	18,800	TBD	$1,460,000	2022	Renewable natural gas generation evaluation will require further analysis.
S1: Complete Street and Intersection Lights Conversion to LED	300	25,490	$15,136,100	$2,400,000/year	Completed 2016	27% reduction in electricity use through streetlight retrofit. Intersection lights and street light conversion completed in 2014 and 2016 respectively.

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Costs (Total Cost)	Estimated Potential Savings ($/yr)	Suggested Timeframe	Assumptions
R1: Net Metering	Indirect		TBD		2017+	
R2: Continue to Invest in Rooftop Solar PV	300	28,000	$14,500,000	$1,900,000-3,300,000	Follows from net-metering	Implementation is installation of solar panels. $2,500/kW for >500kW installation, and $3,500/kW for <500kW installation.
R3: Explore Parking Lot Solar PV	451	39,673	$28,900,00	$2,700,000-4,700,000	Follows net-metering	Assuming $3,500/kW. The cost savings assume all electricity generated by solar panels replaces grid supplied electricity purchased at market rates. In cases where projects are part of FIT or MicroFIT programs – savings will depend on the price paid for electricity generated.
G1: Conduct a Solid Waste Audit Program	Indirect		TBD		2017+	
G2: Establish a Corporate Waste Diversion Target and Strategy	Indirect		TBD		2017+	
G3: Collaborate with Neighbouring Communities to Establish an Organics Program	Indirect		TBD		2017+	

The Cumulative Impacts of Energy and Emissions Reductions for the City of Windsor

As noted in Chapter 3, the estimated energy costs to the City in 2014 were approximately $22 million and are anticipated to increase to $48.8 - $81 million per year by 2041. It is estimated that the combined impact of these actions result in a potential $20.5-32.6 million cost savings per year. The actions in the Plan result in approximately 21,630 Tonnes CO_2e/year reductions as shown in Figure 11.

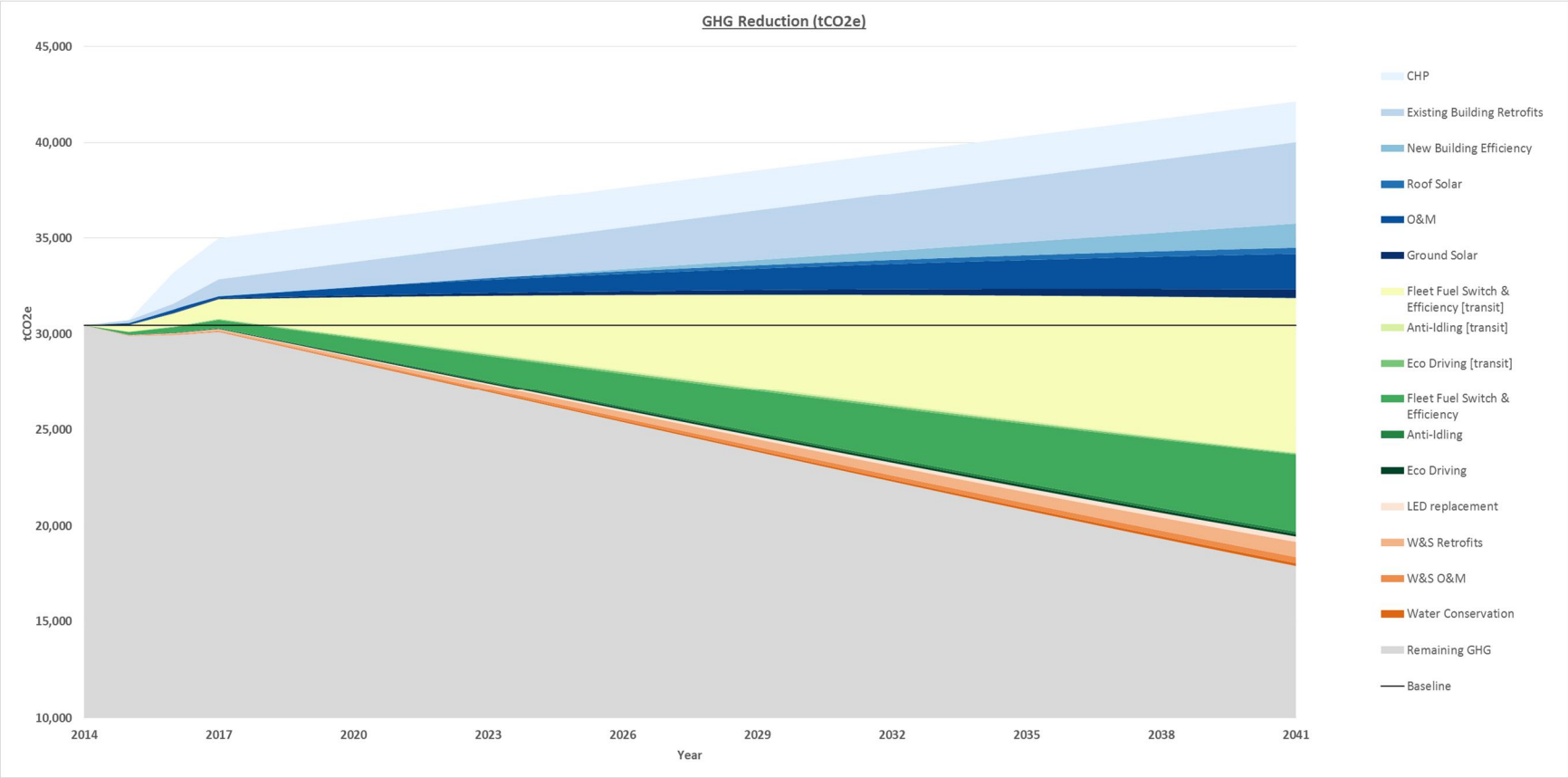

Figure 11: Estimated GHG Emission Reductions from Proposed Actions (2014-2041)

Chapter 15 – Implementation Considerations

Monitoring and Verification

Continuous monitoring, verification, and reporting is an integral part of energy management and is necessary to track consumption, cost savings, or cost avoidance resulting from implemented projects. Incorporating a monitoring and evaluation process will provide information to help assess progress and better understand how energy consumption might be further reduced.[99]

Natural Resources Canada and the Canada Green Building Council are working in collaboration with partners to develop a National Energy Benchmarking Framework. In Ontario, the Ministry of Energy is in the midst of developing an energy and water reporting and benchmarking initiative for large buildings that would, if passed, enable implementation of a reporting and benchmarking initiative.

Energy benchmarking provides building owners with information about building performance over time, compared to past performance as well as to similar buildings. With energy benchmarking data, building owners can make informed decisions about how to manage and operate their buildings, and strategically invest and implement improvements to buildings where beneficial.[100] Natural Resources Canada is using ENERGY STAR Portfolio Manager – a free web-based application, to measure building performance for a select number of building types in Canada.[101]

Table 11 provides a set of potential performance indicators for consideration that will help the Corporation monitor progress over time. The indicators presented in Table 11 below have been identified based on best practices and use readily available data sources.

Table 11: Key Performance Indicators

Key Performance Indicator	Measurement
Building Energy Intensity	GJ/m^2
Building Emissions Intensity	GHG/m^2
Building Energy Cost Intensity	\$/m^2
Non-Transit Fuel Efficiency	Unit fuel/km
Non-Transit Total Fuel Used	Total L of fuel types used

[99] Corporate Energy Management Plan 2014, pg. 65.
[100] National Energy Benchmarking Framework: Report on Preliminary Working Group Findings, Canada Green Building Council, January 2016.
[101] Government of Canada, Natural Resources Canada, Energy STAR Portfolio Manager Access Page, 2016. Note: Portfolio Manager can serve as a complement to the PCP Milestone Tool, helping to track data about municipal performance and contributions to provincial and federal government emissions and climate change targets.

Key Performance Indicator	Measurement
Non-Transit Number of Vehicles in Different Classes	# of vehicles with greater fuel efficiency, hybrid, EV etc.
Transit Fuel Efficiency	Unit fuel/km
Transit Total Fuel Used	Total L of fuel types used
Transit Number of Vehicles in Different Classes	# of vehicles with greater fuel efficiency, hybrid, EV etc.
Water Efficiency	GJ/L
Wastewater Efficiency	GJ/L
Street and Traffic Light Efficiency	GJ/light
Renewable Energy Generation	KW produced
Renewable Energy Generation Percentage	% of energy demand from renewable energy

It is recommended, particularly for building retrofit projects, that there be a system put in place to verify that the project is performing as expected and that the anticipated efficiencies are being realized. To ensure that applicable projects are performing, it is recommended that a baseline measure of performance before initiation as well as a measure of performance after installation be used to verify that the intended efficiency results are being achieved.

Reporting and Plan Renewal

The CCAP is considered a living document that is able to be updated and adapted to changing provincial and federal legislative initiatives.

It is recommended that a progress report be prepared on the CCAP on a biannual basis as per the CEP. In addition to ongoing monitoring and reporting, the initiatives and underlying assumptions of the CCAP will be frequently examined to ensure that any major developments are integrated. The CCAP will need to be flexible in order to adapt and respond to the changes in federal and provincial-level energy and emission commitments.

Renewal of the CCAP should occur at a minimum of five year intervals in alignment with the renewal of the Climate Change Adaptation Plan, Environmental Master Plan and Community Energy Plan.