

Windsor's Community Energy Plan

A Powerful Plan for the Future



Garforth International llc
Energy Productivity Solutions

I.C.L.E.I
Local
Governments
for Sustainability

City of Windsor
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Message from the Community Task Force

Windsor needs a clear vision of our energy future in order to compete with other cities across the globe. We believe this plan will set Windsor on the right path to improve the local economy and quality of life for our residents. Some of the recommended strategies in this plan are bold and challenging but are necessary to ensure Windsor is a city of the future rather than of the past. We are looking to inspire local leaders to join us as stewards of a strong and vibrant Windsor and help us achieve our powerful plan for the future.

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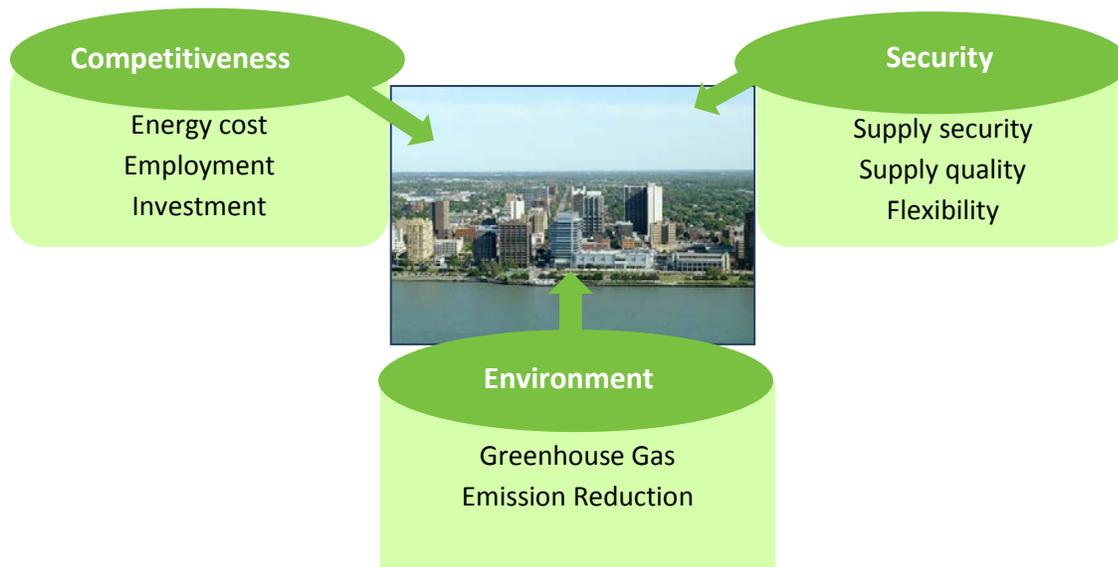
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Executive Summary

Purpose of the Community Energy Plan

Every day, energy is used to heat and cool homes as well as power industry and businesses across Windsor. Trucks and cars use fuel to move people within and around the community, contributing to Windsor's local economy.

The Community Energy Plan (CEP) looks at all these activities and recommends strategies for a smart energy future. The CEP is a long-term plan that identifies ways to support Windsor's local economy by increasing competitiveness, creating jobs in the energy sector, and serves as a business retention strategy. The CEP also identifies ways to improve energy efficiency, improve energy security, and reduce greenhouse gas emissions while contributing to the overall quality of life of the Windsor community. The CEP describes and quantifies the types of energy used in the entire Windsor community by homes, buildings, and travel, and explores how population, employment and land use impact Windsor's energy needs.



The CEP will help the Windsor community by identifying local priorities and determining how energy should be generated, delivered and used now and into the future. The CEP will require action from various community partners and organizations, and is not intended to be undertaken by the City of Windsor alone.

How the Plan was Developed

The Community Energy Plan was developed over the course of 18 months under the thoughtful guidance of a multi-stakeholder task force representing all of the major sectors in the Windsor community. The Task Force was supported by City staff and a team of consultants led by Lura Consulting and Garforth International Inc., with support from ICLEI Canada. The Community Task Force helped shape all aspects of the CEP's development. The process began by creating a shared understanding of current energy use using 2014 as the baseline year, and projecting future energy use (base case) for 2041 with no changes to address energy in Windsor. This shared understanding of the current and future energy use in Windsor allowed the Task Force to shape the vision, principles, goals, and targets by asking: "What do we need to do today to achieve the types of outcomes we wish for 2041?"

Community stakeholders and members of the general public were also encouraged to learn about the CEP at a number of community events and provide their insights and feedback through these events and online surveys.

The Plan aligns with policy direction from the City's current Official Plan, 20-Year Strategic Vision, and the Environmental Master Plan. It supports efforts of numerous City plans including Climate Change Adaptation Plan, Corporate Energy Management Plan, and the Green Fleet Strategy. Recommendations outlined in the CEP should be integrated into these plans as they are updated. The CEP is supported by a distinct Corporate Climate Action Plan that identifies recommended actions for the City of Windsor to take to address energy and greenhouse gas emissions from its own operations (found in Appendix A).

The CEP was funded in part through the Ministry of Energy's (MOE) Municipal Energy Plan (MEP) program and the Federation of Canadian Municipalities (FCM) Green Municipal Fund for the Partners for Climate Protection (PCP) program. The MEP program aims to support efforts of municipalities in understanding their community's energy use and GHG emissions, identifying opportunities for energy efficiency and clean energy initiatives, and ultimately developing a plan to meet local goals. The PCP program is a network of more than 250 communities across Canada with 75 in Ontario committed to reducing GHG emissions from both municipal operations and community sources.

CEP Vision

The Community Energy Plan aims to create economic advantage, mitigate climate change, and improve energy performance. It strives to position Windsor as an energy centre of excellence that boasts efficient, innovative, and reliable energy systems that contribute to the quality of life of residents and businesses.

Targets

Through the implementation of this Plan, the Windsor community will:

1. Reduce per capita primary energy use by 40 per cent from 2014 baseline by 2041; and
2. Reduce per capita GHG emissions by 40 per cent from 2014 baseline by 2041.

These ambitious and transformative targets support global efforts to keep global temperature increases within 1.5°C and meet the targets identified in the 2016 Ontario Climate Action Plan.¹ The Province is targeting about a 60 per cent reduction in emissions by 2041 relative to 1990 which is about 50 per cent relative to 2014. The CEP target of 40 per cent is consistent with the Provincial Plan's overall direction.

These targets will be achieved through the implementation of the CEP Strategies and position the Windsor community as an energy leader by achieving today's best practices by 2041.

Windsor's 2014 Baseline Energy Use

To be able to define a vision, targets and strategies for the future, the City of Windsor, Community Task Force and the consulting team established 2014 as the baseline year for the CEP as it is the most recent complete dataset. Data were provided by EnWin and Union Gas for electricity, natural gas, and compressed natural gas usage respectively. Transportation energy use was determined using fuel sales data collected from Kent Marketing Fuel as well as through a traffic model prepared by the City to capture vehicle kilometres travelled (VKT). Data were also collected about the types, size, age, and location of homes and buildings in Windsor.

¹ <https://www.ontario.ca/page/climate-change-action-plan>.

Quick Facts: Windsor's Energy Use in 2014

Costs of Energy (2014)

- The total amount the Windsor community spent on energy (including electricity, natural gas, and transportation fuels) was **\$842 million dollars** spent on electricity, natural gas, and transportation fuels across the Windsor community, **80 per cent of which leaves the local economy.**
- Total amount the City of Windsor spent on energy: **\$22 million**

Energy Use (2014)

- Total energy used by the Windsor community: **38 million GJ** or **182 GJ per person** of which **49 per cent** was used by buildings:
- Total energy used by the City of Windsor: **839,990 GJ** which represents **only 1 per cent of the total** energy used in Windsor.
- This means that even if industries and the municipality were to significantly reduce the amount of energy they use, the amount of money spent on energy in Windsor would not significantly decrease. To reduce costs, action is needed to reduce energy use associated with buildings and transportation

Greenhouse Gas Emissions (2014)

- Total amount of GHG emissions produced by the Windsor community: **1.9 million Tonnes** of which **36 per cent** comes from **transportation.**
- Total amount of GHG emissions produced by the City of Windsor: **30,470 Tonnes**

In comparison to other communities in Canada and best in class communities around the world, Windsor's energy use per household:

- Is 35 per cent higher than the Ontario average and more than twice the Danish average;
- Uses 20 per cent more energy per square metre of home than the Ontario average and more than 3 times German A-rated homes; and
- Uses about the same amount of energy on a per square metre basis as the Canadian average for non-residential buildings which is still more than twice the German average.

In addition to comparisons with Ontario, Canadian averages and best in class performers such as Copenhagen and Germany, the CEP also looked to the City of Mannheim, Germany, a Twin City to Windsor, for institutional, policy and energy performance benchmarks. Mannheim has a similar

population as Windsor, a significant industrial community and is recognized as an innovator in implementing municipal and regional energy plans over many years. The City of Mannheim currently uses 82 GJ/ person/year of energy (compared to Windsor's 182 GJ/person/year). Mannheim aims to reduce a further 20 per cent by 2020.

These examples demonstrate that there is room for improvement in terms of energy performance and economic advantage in Windsor.

The Implications of Not Acting on Energy and Climate

Without any actions at the local level the implications for Windsor are significant. Implications include:

- **Increases in the costs of energy:**
 - Through the community survey many Windsorites indicated that the price of hydro is high and due to fixed costs, it is perceived that personal energy conservation does not result in substantial cost savings. Although energy prices are beyond the community's control, the CEP aims to mitigate the effects of energy costs to users in two key ways:
 - By conserving energy and focusing on energy efficiency; and
 - By switching the type of energy supply.
 - These two strategies result in changes to the fuel cost structure to lower costs because the total cost of energy to the user is influenced by the price/unit of energy used and the amount of energy used.
 - For the Windsor community there is a potential total costs increase from \$842 million per year in 2014 to \$1.8-\$3.1 billion per year by 2041.
 - For the City of Windsor, there is a potential total costs increase from \$22 million per year to \$48.8-\$81 million per year by 2041.
- **Increases to the total amount of energy used:**
 - For the Windsor community there is a potential 22 per cent increase from 38.5 Petajoules/year to 46.9/ Petajoules/year¹ by 2041.
 - For the City of Windsor there is a potential 30 per cent increase from 839,990 GJ to 1,124,580 GJ in 2041.
- **Increases in the total amount of GHG emissions:**
 - For the Windsor community there is a potential 19 per cent increase from 1.85 million Tonnes to 2.2 million Tonnes by 2041.
 - For the City of Windsor there is a potential 43 per cent increase from 30,470 Tonnes to 43,670 Tonnes.

The financial and environmental impacts for Windsor are significant. A commitment to action towards addressing energy and emissions now and in the future is needed. Whether driven by economics, innovation, GHG emission reduction, environmental stewardship, risk mitigation, quality of life, or

preparing for future legislation, the basis for proactively addressing energy use in Windsor is strong and the time for action is now.

Recommended Strategies for Windsor

The plan recommends sixteen strategies reflect that best-in-class actions and are designed to meet Windsor’s vision and goals. Each will have an implementation and investment plan. The community strategies presented in the CEP were developed in collaboration with the Community Task Force, City staff and consulting team.

The CEP strategies include:

Strategies	
Residential	<ol style="list-style-type: none"> 1. Create a Deep Retrofit Program for Existing Homes 2. Enforce Compliance with the Ontario Building Code for New Residential Development 3. Integrate Energy Performance Labelling for Homes and Buildings 4. Create a Net Zero Neighbourhood as an Opportunity for Transformative Change at the Neighbourhood Scale
Commercial/ Institutional	<ol style="list-style-type: none"> 5. Create a Deep Retrofit Program for Existing Businesses and Public Buildings 6. Enforce Compliance with the Ontario Building Code for New Commercial and Institutional Development
Industrial	<ol style="list-style-type: none"> 7. Continually Increase Industrial Energy Efficiency 8. Reinforce a Windsor Network and Mentorship Program for Transfer of Best Practices
Transportation	<ol style="list-style-type: none"> 9. Encourage a Modal Shift towards Public Transit 10. Develop and Implement an Active Transportation Master Plan 11. Foster the Adoption of Electric Vehicles 12. Continue to Advance Smart Energy Systems by integrating into the Land Use Planning Process
District Energy	<ol style="list-style-type: none"> 13. Designate and Plan District Energy Areas 14. Create a Gordie Howe International Bridge Low-Energy Economic Development Area
Renewable Energy	<ol style="list-style-type: none"> 15. Encourage the Installation of Solar Arrays
Education and Communication	<ol style="list-style-type: none"> 16. Develop an Education and Communication Campaign to Support the CEP

These strategies are supported by twenty-nine specific actions identified and described in the Corporate Climate Action Plan to be taken by the City of Windsor to reduce energy use and mitigate climate change impacts. These include:

	Strategies
Organizational & Institutional Policy Change	P1: Create an Internal 'Energy First' Ethic 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 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

By advancing all strategies identified in the CEP, Windsor can:

- **Mitigate energy cost risks:**
 - For the Windsor community: Potential savings of \$8.6 billion - \$12.4 billion
 - For the City of Windsor: Potential savings of \$20.5 million - \$32.6 million

- **Reduce total energy use:**
 - For the Windsor community: 29 per cent reduction
 - For the City of Windsor: savings of approximately 499,000 GJ per year

- **Reduce total GHG emission:**
 - For the Windsor community: Achieve 24 per cent below 2014 and 43 per cent below 1990.
 - For the City of Windsor: Reduce 21,630 Tonnes CO₂e/year
 - Align the Windsor community with the Ontario Climate Action Plan target of 40 per cent GHG emission reduction by 2030.

Implementation

As a community-wide plan and living document, the CEP vision and goals cannot be met by the City alone and require the active participation of numerous stakeholders in the Windsor community with support from the Province to help Windsor achieve the Provincial GHG emission reductions targets. The CEP includes guidance for: governance and administration; anticipated level of investment required; tracking and monitoring; strategies to further reduce GHG emissions; recognition; and plan renewal. Similarly the Corporate Climate Action Plan identifies energy and GHG emission reductions; estimated total costs; estimated potential savings; and suggested timeframes for each suggested action the City of Windsor can take to reduce GHG emissions. The Corporate CAP includes recommendations on tracking and monitoring the City's progress; and suggested timelines for plan renewal that align with the CEP.

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List of Acronyms

Acronym	Meaning	Acronym	Meaning
AFV	Alternative Fuel Vehicle	IESO	Independent Electricity System Operator
ATMP	Active Transportation Master Plan	IRRP	Integrated Regional Resource Plan
BAU	Business-As-Usual	LDC	Local Distribution Company
CCAP	Climate Change Action Plan	LIC	Local Improvement Charge
C/I	Commercial/Institutional	LNG	Liquefied Natural Gas
CEP	Community Energy Plan	LTEP	Ontario Long-Term Energy Plan
CHP	Combined Heat and Power	MEP	Municipal Energy Plan
CMA	Census Metropolitan Area	MOE	Ministry of Energy
CNG	Compressed Natural Gas	MOECC	Ministry of Environment and Climate Change
CO₂	Carbon dioxide	MURB	Multi-unit Residential Buildings
COP	Conference of Parties	NRCan	Natural Resources Canada
EMOS	Energy Management Operating System	OBC	Ontario Building Code
EPD	Energy Planning District	PCP	Partners for Climate Protection
EPL	Energy Performance Labelling	PV	Photovoltaic
EV	Electric Vehicle	RE	Renewable Energy
FCA	Fiat Chrysler Automobiles	RNG	Renewable Natural Gas
FCM	Federation of Canadian Municipalities	tCO₂e	Tonnes of Carbon Dioxide Equivalent
GFA	Gross Floor Area	UNFCCC	United Nations Framework Convention Climate Change
GHG	Greenhouse gas	VKT	Vehicle Kilometers Travelled
GIS	Geographical Information System	WALT	Windsor Area Long-term Transportation Study
GJ	Gigajoule	WE EDC	WindsorEssex Economic Development Corporation
GJ/m²	Gigajoule per meter squared		

Glossary of Terms

Term	Definition
Active transportation	Active transportation refers to any form of human-powered transportation – walking, cycling, and using a wheelchair, in-line skating or skateboarding.
Asset management (AM)	Asset management is the co-ordinated activity of an organization to realize value from its assets. Asset management involves the balancing of costs, opportunities and risks against the desired performance of assets, to achieve organizational objectives (balancing may need to be considered over multiple timeframes). Asset management enables an organization to examine the need for, and performance of, assets and asset systems at different levels and in conjunction with non-asset solutions. Additionally, it enables the application of analytical approaches towards managing assets over the different stages of their lifecycle.
Baseline	Estimation of the current (2014) energy use and greenhouse gas emissions.
Business-as-usual	A scenario for future patterns of activity which assumes that there will be no significant change in priorities, or no major changes in technology, economics, or policies, so that normal circumstances can be expected to continue unchanged.
Climate change adaptation	Climate change adaptation is defined as actions taken to help communities and ecosystems cope with changing climate condition. It is an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. The City of Windsor has a Climate Adaptation Plan that is linked to this Community Energy Plan.
Climate change mitigation	Climate change mitigation is an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases. Mitigation is any action taken to permanently eliminate or reduce the long-term risk and hazards of climate change to human life, property. The Community Energy Plan covers the climate change mitigation aspects for the community. A City of Windsor Corporate Climate Action Plan that identifies actions for the City to take to address climate change is found in the Appendix to this document.
Combined heat and power	Cogeneration or combined heat and power (CHP) is the use of a heat engine or power station to generate electricity and useful heat at the same time.
Compressed natural gas (CNG)	CNG is natural gas under pressure which remains clear, odorless, and non-corrosive.

Term	Definition
Electrical conversion losses	The difference between the energy value of the fuel used to make electricity and the energy value of electricity itself.
Environmental Master Plan	The City of Windsor Environmental Master Plan serves as a guide for improving environmental performance across the City. It is closely tied to a number of other master plans and strategies within the City relating to energy, climate adaptation, and land use planning.
Gigajoule (GJ)	A gigajoule (GJ) is a derived unit of energy in the International System of Units. It equals one billion Joules. The amount of energy represented by one GJ is equivalent to 278 kWh.
Greenhouse gases	A greenhouse gas absorbs and radiates heat in the lower atmosphere that otherwise would be lost in space. The main greenhouse gases are carbon dioxide (CO ₂), methane (CH ₄), chlorofluorocarbons (CFCs), and nitrous oxide (N ₂ O). The most abundant greenhouse gas is CO ₂ – carbon dioxide.
HOT2000	HOT2000 is a residential energy analysis and rating software and the Canadian standard for evaluating the energy performance of houses and multi-unit residential buildings.
Independent Electricity System Operation (IESO)	IESO is an organization that operates Ontario's power system and electricity market, forecasts the demand and supply of electricity for the near term, and oversees the balance between the provincial demand and supply of electricity in real time.
Integrated Regional Resource Plan	The IRRP is a plan that looks ahead 25 years at the long-term trends for electricity demand in the Windsor Essex Region.
Kilowatt-hour (kWh)	A kilowatt-hour is a unit of electrical energy used as the basic billing unit and equals the use of 1 thousand watts of electricity in one hour.
Liquefied natural gas (LNG)	LNG is natural gas (predominantly methane, CH ₄ , with some mixture of ethane C ₂ H ₆) that has been converted to liquid form for ease of storage or transport. It takes up about 1/600th the volume of natural gas in the gaseous state. It is odorless, colorless, toxic and non-corrosive.
Local Improvement Charges (LIC)	Municipalities, through local improvement charges, have the ability to recover the costs of capital improvements made on public or privately owned land from property owners who will benefit from the improvement. A local improvement is a project undertaken by a municipality that provides a benefit to properties in the vicinity, such as sidewalks and sewers.

Term	Definition
	<p>Municipalities can use the local improvement process to undertake a capital project and recover all or part of the cost of the project by imposing LICs on properties that benefit from the work.</p> <p>Municipalities are not specifically limited in the types of capital projects they can undertake. Projects have included:</p> <ul style="list-style-type: none"> • Installation of water and wastewater infrastructure • Roadway reconstruction such as repaving • Construction of a sidewalk, curb, and installation of street lighting • Construction of traffic calming features, such as speed bumps <p>In the CEP, LICs are used as a funding mechanism for the residential and commercial and institutional retrofit program.</p>
<p>Long-term Energy Plan (LTEP)</p>	<p>Ontario launched its first Long-Term Energy Plan (LTEP) in 2010. It was reviewed and updated in 2013 with input from people across Ontario. The LTEP takes a pragmatic approach designed to balance the following five principles: cost-effectiveness, reliability, clean energy, community engagement and an emphasis on conservation and demand management before building new generation.</p> <p>In the fall of 2016, the Province initiated a process to update the LTEP to continue to adapt to changes in how energy is used and new technologies. The updated LTEP is anticipated to be released in 2017.</p>
<p>Megawatt (MW)</p>	<p>A megawatt is a unit of power equal to one million watts, used as a measure of the output of a power station. In the CEP it is used in relation to solar photovoltaic power.</p>
<p>Net zero home (NZE)</p>	<p>A net-zero energy home is designed and built to reduce household energy needs to a minimum and includes on-site renewable energy systems, so that the house may produce as much energy as it consumes on a yearly basis. An NZE home is not necessarily “off-grid”, as it can be connected to the electricity grid, so that it can supply electricity to the grid when it is producing more than it needs and draw from the grid when household demands exceed the amount of electricity produced on site. Taken over the year, the energy supplied to the grid balances the energy drawn from the grid, thus achieving net- zero annual energy consumption.</p>

Term	Definition
Net zero neighbourhood	A net zero-energy community (or neighbourhood) is one that has greatly reduced energy needs through efficiency gains such that the balance of energy for vehicles, thermal, and electrical energy within the community is met by renewable energy.
Partners for Climate Protection	The PCP program is a network of more than 250 communities across Canada with 75 in Ontario committed to reducing GHG emissions from both municipal operations and community sources. The PCP program uses a 5-milestone framework that includes: (1) creating a greenhouse gas emission (GHG) inventory; (2) Developing targets and forecasts; (3) preparing local action plans; (4) implementation; and (5) monitoring. The CEP fulfils the requirements for Milestones 1-3 for both the City of Windsor operations and Windsor community.
Re-commissioning	<p>Commissioning is a quality management process applied to buildings during their design, construction and operation. It ensures that building systems and equipment are installed and operating correctly. Building commissioning typically includes systematic verification and testing, staff training and thorough documentation of all systems.</p> <p>Recommissioning is a re-optimization process that ensures that existing equipment and systems operate optimally. It provides a rigorous investigative approach to identifying problems and systems integration issues.</p>
Renewable natural gas	Renewable natural gas is biogas that is captured and upgraded to generate energy. RNG is a constructive use of methane emissions, fully interchangeable with conventional natural gas and a clean and sustainable energy source.
Solar photovoltaic	Systems that convert the light of the sun into electricity either for use locally or for delivery to the wider electricity grid.
Tonne	A metric tonne is equal to 1,000 kilograms and is a measure of greenhouse gas emissions

Chapter 1 – Introduction – The Need for Action

Overview



With a population of approximately 211,000 people, Windsor is Ontario's tenth largest city.² Strategically located on the Canada-United States border, Windsor benefits from its proximity to North American markets and its location at a strategic water, rail, air, and highway transportation gateway. The City's natural riverfront setting is one of the many attributes that supports a high quality of life for its diverse population. Looking to the future, Windsor is dedicated to leveraging its entrepreneurial spirit and skilled labour force to develop a new and more diversified economy.

Recent weather-related events in Windsor, such as severe rainfalls and flooding, have brought into focus the urgency of taking action on climate change. Reducing greenhouse gas emissions (GHGs) in all sectors is vital to limiting the rate and extent of climate change. Over the past decade, and further to the environmental impacts of an unpredictable climate, the costs of energy have increased significantly in Ontario, creating heightened economic uncertainties for residents and businesses.

To address the multifaceted challenges ahead, Windsor has developed a Community Energy Plan (CEP). The CEP is centred on supporting local economic development while improving energy efficiency, modifying land use planning, reducing energy consumption and greenhouse gas emissions, and fostering green energy solutions.

Windsor's history of industrial excellence has created a labour force uniquely positioned to tackle the climate challenge with new, more efficient and sustainable products and services that will serve not only the City's needs but those of other communities in the region. Implementing the CEP will contribute to a Windsor that is more economically competitive, energy secure, and environmentally responsible and will position the City among global leaders in smart energy planning.

² [Population and dwelling counts, for Canada, provinces and territories, and census subdivisions](#), 2011, Statistics Canada. 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.

What is a Community Energy Plan?



Every day, energy is used to heat and cool homes as well as power industry and businesses across Windsor. Trucks and cars use fuel to move people within and around the community, contributing to Windsor's local economy.

The CEP looks at all these types of activities and recommends strategies for a smart energy future. This CEP is a long-term plan that identifies ways to support Windsor's local economy by increasing Windsor's competitiveness, creating jobs in the energy sector, improving energy efficiency, and improving energy security.

The CEP describes the types of energy

used in the entire Windsor community, how much energy is used by homes, buildings, and travel, and how population, employment and land use impact Windsor's energy needs.

This CEP is funded in part through the Ministry of Energy's (MOE) Municipal Energy Plan (MEP) program and the Federation of Canadian Municipalities (FCM) Green Municipal Fund for the Partners for Climate Protection (PCP) program. The MEP program aims to support efforts of municipalities in understanding their community's energy use and GHG emissions, identifying opportunities for energy efficiency and clean energy initiatives, and ultimately developing a plan to meet local goals.

The PCP program is a network of more than 250 communities across Canada with 75 in Ontario committed to reducing GHG emissions from both municipal operations and community sources (referred to as 'community').

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 CEP:

- 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 (city owned) operations;
- Defines an implementation strategy;
- Considers impact of future growth and options for local clean energy generation; and
- Supports local economic development.

This CEP fulfills both the requirements for the MEP program and the PCP program's complementary milestones of: (1) Creating a community-wide greenhouse gas emissions inventory and forecast; (2) Setting a community-wide emissions reductions target, and (3) Developing a local action plan.

Energy and Climate Change in Canada and Ontario

What is the Government of Canada Doing?

In 2015, Canada participated in the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) and committed to the Paris Agreement – an enduring, legally-binding treaty on climate action which contains emission reduction commitments from 195 countries starting in 2020. The COP21 target aims to keep a global temperature rise this century well below two degrees Celsius and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels. At COP21, Prime Minister Trudeau committed to setting new federal GHG emission reduction targets and requiring other levels of government to contribute to reducing Canadian GHG emissions.

In 2015, the Canadian government made a number of commitments to address climate change, including:

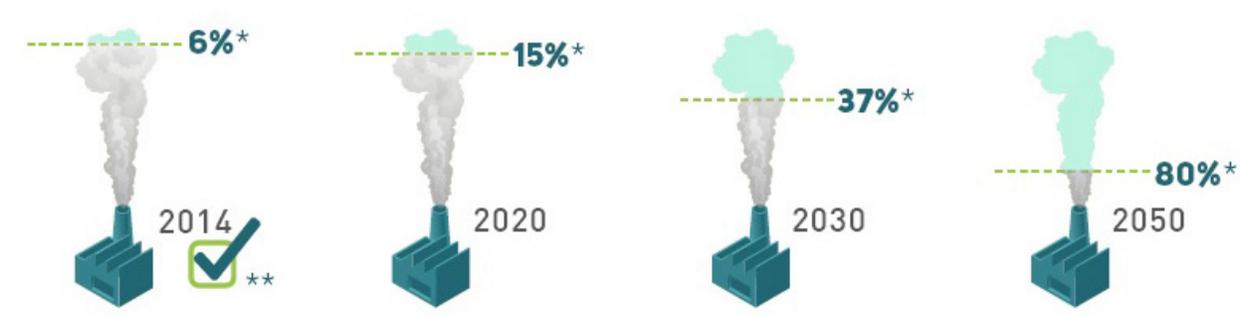
- Setting a GHG emissions reduction target of 30 per cent below 2005 by 2030 and announcing plans for further regulatory action, including addressing methane and hydrofluorocarbons.
- Working with provinces and territories to establish the pan-Canadian framework for addressing climate change. The framework includes investigating carbon pricing, investing in clean energy technology, infrastructure, and innovation.
- Establishing the Low-Carbon Economy Trust Fund to fund projects that reduce carbon, fulfilling Canada's commitment to phase out subsidies for the fossil fuel industry, and invest in clean energy and clean technology.³

In 2016, the Canadian Parliament voted to support the ratification of the Paris Agreement and participated in COP22 in Marrakesh. There, the Canadian government stressed the importance of making clear commitments to ensure nations are accountable, enhancing action on climate adaptation, promoting collaborative approaches to climate action, fostering investment toward a low-carbon future for all, promoting transparency and accountability, sharing knowledge and experiences, and advocating to sustain the momentum on climate action globally. In December 2016, the Pan Canadian Framework on Clean Growth and Climate Change was released. The plan outlines the pathways to meeting Canada's 2030 target, while growing the economy and building resilience to adapt to a changing climate.

³ Government of Canada, [Canada's Way Forward on Climate Change](#), 2015.

What is the Ontario Government Doing?

In 2015, the Government of Ontario released its detailed five-year *Climate Change Action Plan* to support the implementation of the Ministry of the Environment and Climate Change's (MOECC) *Climate Change Strategy (Nov 2015)*. The *Climate Change Strategy* identifies a new interim target of reducing GHG emissions by 15 per cent below 1990 by 2020, 37 per cent below 1990 levels by 2030 and committed to the long-term target of reducing emissions by 80 per cent below 1990 levels by 2050 as illustrated in Figure 1. The *Climate Change Action Plan* (CCAP) includes specific commitments to meet the near-term 2020 emission reduction target and establish the framework necessary to meet the 2030 and 2050 targets through actions to address the economy, including transportation, buildings, industry, energy, waste, agriculture, forestry, and government.⁴ The MOECC notes that collaboration between municipalities, businesses, industry and residents across the province is key in helping Ontario to reach its targets.



- * below 1990 greenhouse gas emission levels
- ** based on the 2016 National Inventory Report

Figure 1: Ontario's Greenhouse Gas Reduction Targets

Over the past decade, the Ontario government has completed several initiatives to help shift dependence on fossil fuels towards more sustainable and lower carbon energy options and to foster greater energy conservation across public sector organizations (see Figure 2). These include:

- In 2009, the Ontario Legislature passed Ontario Regulation 397/11 and the *Green Energy Act*. The *Green Energy Act* 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 developing five-year Energy Conservation and Demand Management plans.⁵
- In 2012, the Ontario Building Code was updated with the highest standards for energy efficiency in Canada by incorporating an EnerGuide energy efficiency rating of 80 for new homes. The OBC updates included the adoption of the rigorous efficiency requirements of ASHRAE SB10 for non-residential construction.⁶

⁴ Government of Ontario, [Climate Change Strategy](#), 2015.

⁵ Government of Ontario, O. Reg. 397/11: Energy Conservation and Demand Management Plans, filed under *Green Energy Act* 2009.

⁶ See Ministerial Announcement from January 2017: <http://www.mah.gov.on.ca/AssetFactory.aspx?did=15944>

- In 2013, the Ministry of Energy released the updated Long-Term Energy Plan (LTEP) emphasizing that conservation and demand management (CDM) should come before new generation is built as a key part of the province's collective effort to lower GHG emissions. At the same time, the MOE released a new province-wide conservation framework called the Conservation First Framework. The framework's intent is to reduce annual electricity consumption by seven terawatt-hours by the end of 2020 and provide Local Distribution Companies (LDCs) with targets for conservation and long-term, stable funding for CDM programs.
- In 2013, the Ministry of Energy launched the Municipal Energy Plan program, which provides funding to Ontario municipalities to develop a Community Energy Plan.⁷
- In 2015, the Ministry established the \$325 million-dollar Green Investment Fund aimed to fund projects that address climate change, grow the economy, and create jobs. Green Investment Fund projects are geared towards helping homeowners and businesses use less energy, support more electric vehicle charging stations, retrofit social housing, and help support local environmental organizations and Indigenous communities with tools to address climate change.
- In 2016, Ontario passed the *Climate Change Mitigation and Low-carbon Economy Act* that enables Ontario to join the biggest carbon market in North America.⁸



⁷ [Ontario Ministry of Energy](#), 2015.

⁸ The *Climate Change Mitigation and Low-Carbon Economy Act* enables Ontario to join the biggest carbon market in North America. The Act makes Ontario accountable for responsibly and transparently investing every dollar from the cap and trade program into actions that reduce greenhouse gas pollution, create jobs and help people and businesses become more climate conscious. Government of Ontario, [Climate Change Ontario](#).

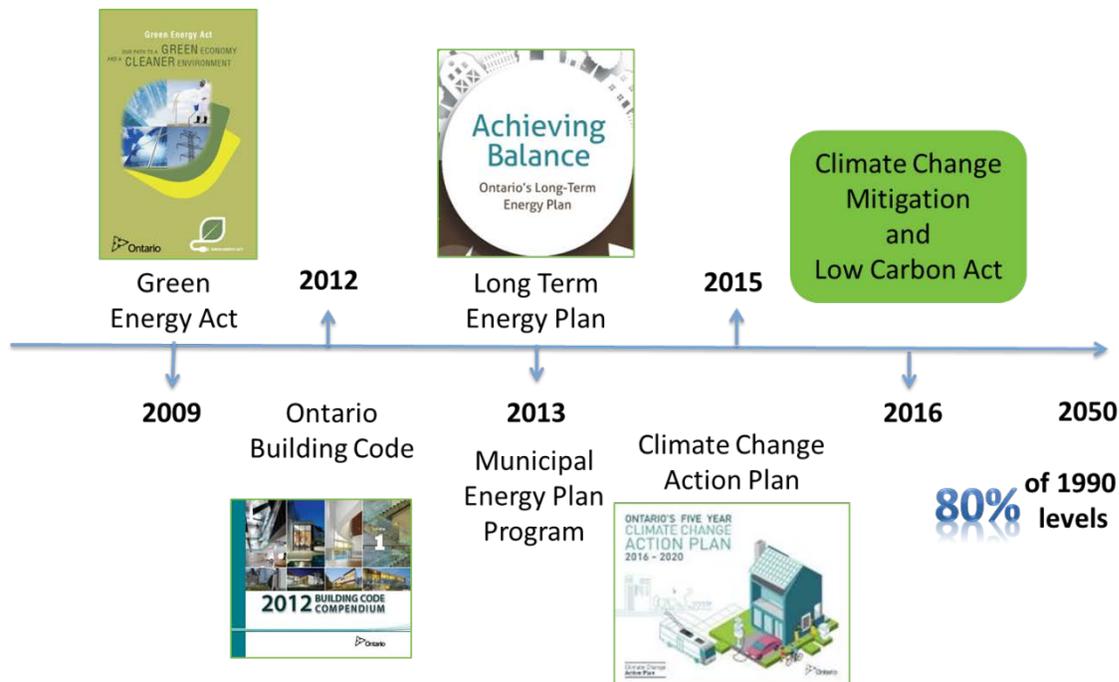


Figure 2: Progression of Energy Policy in Ontario

At the same time, the Independent Electricity System Operator (IESO) has been carrying out regional planning activities through the development of Integrated Regional Resource Plans (IRRP) for areas across the province. The Windsor Essex IRRP is the link between provincial and local planning. It ensures a reliable supply of electricity to the Windsor-Essex area and considers conservation, generation, transmission, and distribution resources along with innovation initiatives. EnWin and Union Gas have also developed conservation and demand management targets and programs that support local residents, businesses, and industries to reduce their carbon footprint.

What is the City of Windsor Doing?

Municipalities across Ontario play a critical role in advancing Canada's commitments to reducing greenhouse gas emissions while contributing to the green economy.

Communities such as Guelph, Burlington, Newmarket, and London have developed Community Energy Plans that foster and promote economic advantages for their communities while addressing greenhouse gas emissions.

The City of Windsor aims to create a more sustainable community for its residents. The City's Official Plan (2010) provides overall direction for land use and planning at the city level. It includes key directions on land use, environment, and urban design that help to promote compact development, support sustainable transportation with greater opportunities for walking, cycling, and public transit, and encourage design and construction of energy efficient buildings. The newly adopted 20-Year Strategic Vision (2015) serves as a cornerstone for Council and City Administration when making

decisions with respect to programs, services, and infrastructure. It centres on three main goals for the City of Windsor 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. Finally, the Environmental Master Plan (2010) serves as a guide for improving environmental performance across the City. It is closely tied to a number of other master plans and strategies within the City relating to energy, climate adaptation, and land use planning.

The City of Windsor joined FCM's PCP network in December of 2002. The City's 2006 Environmental Master Plan provides direction to implement the milestones associated with the PCP program, specifically under Objective Ab: Reduce air emissions and water pollution discharges from City operations. The City achieved Milestone 1, the completion of the Inventory of Greenhouse Gas Emissions Report in October 2008. The CEP will provide an update to Milestone 1, will set an emissions target (Milestones 2) and develop an action plan to meet that target (Milestone 3).

In 2015, Mayor Drew Dilkens committed Windsor to the Compact of Mayors⁹, a global network of cities pledging to reduce greenhouse gas emissions, enhance resilience to climate change, and track progress in a standardized and transparent manner. Windsor joins many other Canadian cities in this commitment including Toronto, Montreal, Vancouver, Calgary, Edmonton, and Halifax. The completion of the CEP, in addition to co-benefiting strategic planning documents including Windsor's Climate Change Adaptation Plan, also contributes to and aligns with the requirements of the Compact of Mayors.

The Community Energy Plan is embedded within the City's master planning and strategic planning processes. It provides an opportunity for Windsor to position itself as a leader in smart energy amongst Ontario municipalities, as well as provides a catalyst for action under the 20-year Strategic Vision by advancing job creation, creating a new reputation as a centre of excellence and continuing to contribute to the quality of life of residents.

Did You Know?

The CEP is complemented by a Corporate Climate Action Plan that provides guidance to City staff on climate mitigation actions for City of Windsor assets. Recommendations outlined in the CEP should be integrated into these plans as they are updated.

Figure 3 shows how the CEP relates to energy planning activities in Ontario and strategic planning initiatives at the City.

⁹ See <https://www.compactofmayors.org/>.

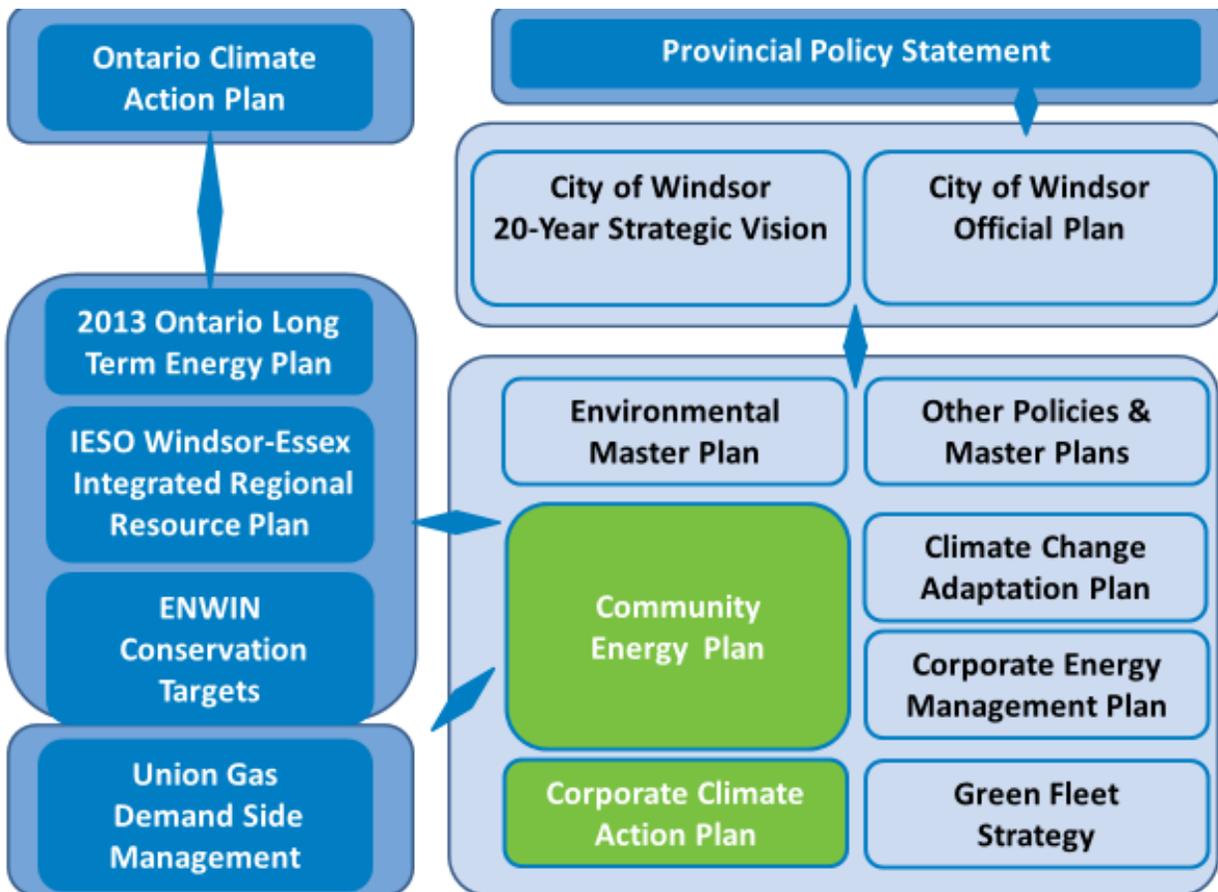


Figure 3: Relationship of the CEP to Provincial and City of Windsor Planning

How the Plan was Developed

The Community Energy Plan was developed over the course of 18 months and involved the active participation of community leaders and City staff in its development. The Plan was prepared under the thoughtful guidance of a multi-stakeholder task force representing all of the major sectors in the Windsor community. The Task Force was supported by City staff and a team of consultants led by Lura Consulting and Garforth International llc., with support from ICLEI Canada. The Community Task Force helped shape all aspects of the CEP’s development. The process began by creating a shared understanding of current energy use using 2014 as the baseline year, and projecting future energy use (base case) for 2041 with no changes to address energy in Windsor. This shared understanding of the current and future state of energy use in Windsor allowed the Task Force to shape the vision, principles, goals, and targets by asking: “What do we need to do today to achieve the types of outcomes we wish for 2041?” The Community Task Force contributed to defining the strategies and implementation considerations to achieve the vision. The planning process is identified in Figure 4.

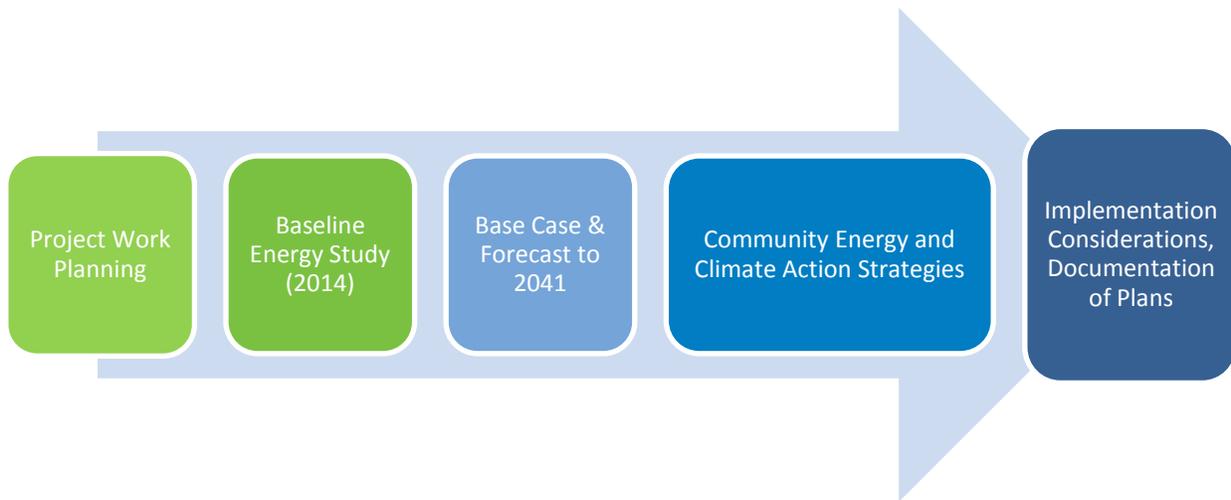


Figure 4: Community Energy Planning Process

Throughout the process, the broader community was engaged through a series of pop-up consultations at local events and venues. Through the community consultation process, the City team was able to educate approximately 600 residents about the plan, and the importance of establishing a shared vision for a smart energy future for Windsor. Approximately 70 of those residents provided their insights to the proposed CEP strategies. The face-to-face engagement was augmented by two online surveys. The first asked residents about their thoughts on the importance of energy conservation as well as the biggest challenges and opportunities associated with implementing the CEP. Approximately 70 individuals participated in the initial survey. The second survey was issued with the release of the draft CEP for public comment. Almost 300 individuals participated in the second survey, designed to gauge the support for the vision, principles, and strategies identified in the CEP. The majority of comments received were supportive of the overall direction of the CEP and served to strengthen the recommendations and clarify some of the terminology. Information updates were also provided on the City’s website for those who wished to stay informed about the project.

Utility companies played a key role in supporting data collection to document the baseline conditions. Both EnWin and Union Gas played an active role in shaping the CEP strategies. Local businesses were represented on the Community Task Force and also engaged through discussions with the Windsor Essex Chamber of Commerce and the WindsorEssex Economic Development Corporation (WE EDC).

City staff participated on the Community Task Force as well as the City Staff Task Force to help shape both the Corporate Climate Action Plan (please see Appendix A) and the CEP. Senior City managers were introduced to the project and engaged to review the proposed strategies prior to preparation of the Draft Plan.

City Council was engaged early in the process to ensure their understanding of the project and the imperative for smart energy planning at the community level. Throughout the CEP’s development, Council had the opportunity to ask questions about the amount of energy currently being used, the

trends and projected forecasts for energy consumption in Windsor, and the proposed strategies in the Plan. Lastly, Council was presented the final CEP for approval in summer 2017.

How to Read This Plan

The Community Energy Plan is organized as follows:

- Chapter 2 highlights the Vision of the CEP, its principles, goals, and targets for energy use and greenhouse gas emissions reductions by all energy users within Windsor's city boundaries (referred to as the "community").
- Chapter 3 provides a review of how the community of Windsor uses energy now (using a baseline of 2014). This includes the types and percentages of fuel use, energy use, and greenhouse gas emissions by sector and fuel type, as well as the costs of energy by sector and by fuel type. This chapter also introduces the concept of energy mapping and shows how energy is used across the various neighbourhoods in Windsor.
- Chapter 4 provides an indication of what will happen by the year 2041 if the community does not address energy use and greenhouse gas emissions.
- Chapters 5 through 8 present the strategies for each sector (Chapter 5 – Strategies for Homes, Chapter 6 – Strategies for Business and Institutions, Chapter 7 – Strategies for Industry, Chapter 8 – Strategies for Transportation). Each chapter presents the sectoral background, proposed strategies (including an overview of the strategic recommendation), target participation levels, energy and GHG emissions reduction potential, program design details, funding mechanisms, potential delivery agents, timing, benefits, and examples from other communities where applicable. Enabling strategies that facilitate other strategies but do not have quantified energy or GHG emissions reductions are included as appropriate.
- Chapters 9 and 10 present proposed strategies and impacts for district energy and renewable energy generation.
- Chapter 11 provides a summary of the collective benefits of implementing the Community Energy Plan.
- Chapter 12 outlines the implementation strategy for the CEP as a whole and includes recommendations relating to: governance and administration, funding, community engagement and behavior change, tracking and monitoring, recognition, and plan renewal.
- Finally, a complementary **Corporate Climate Action Plan** was also developed to specifically identify actions that the City of Windsor as a corporation can take to reduce the GHG emissions and energy use from Corporate owned infrastructure and fleets. The Corporate Climate Action Plan is presented in Appendix A.

Chapter 2 – Vision, Principles, Goals, and Targets

Vision

The Community Energy Plan aims to create economic advantage, mitigate climate change, and improve energy performance. It strives to position Windsor as an energy centre of excellence that boasts efficient, innovative, and reliable energy systems that contribute to the quality of life of residents and businesses.

Guiding Principles

The principles outlined below provide direction for the development of the strategies presented in this Plan and will guide the CEP through implementation. These principles can be used to “test” and validate actions as the plan moves forward. All proposed solutions, projects, or initiatives should consider these principles:

- Ensure and enhance a sustainable energy system
- Maximize efficient use of energy
- Ensure that individual tax impacts are at least cost neutral
- Retain as many energy dollars in the City as possible
- Demonstrate global leadership
- Advocate for urgent action to address climate change
- Create a competitive and economic advantage for Windsor

Goals

The CEP vision is also supported by a series of goals that bring focus to creating economic advantage, mitigating climate change and improving energy performance within the community.

By 2041, the CEP aims to address:

- **Building Efficiency:** Increase energy efficiency of all new and existing buildings in Windsor.
- **Industrial Efficiency:** Foster a shift towards low carbon technologies.
- **Transportation Efficiency:** Foster a shift towards low carbon transportation that integrates EV infrastructure, promotes alternative fuel vehicles, low carbon fuel options, as well as public transit and active transportation as mechanisms to reduce the number of vehicles on the road.
- **Energy Generation and Distribution:** Create an adaptive, sustainable, affordable, and reliable local energy supply.
- **Land Use:** Design, build, and revitalize neighbourhoods as complete communities that offer multi-modal transportation options.
- **Economic Development:** Create new market opportunities for innovative energy solutions that are attractive for local and new businesses, and through high quality, affordable, clean energy services foster retention and growth of existing businesses and industries.

- **Behaviour Change and Awareness:** Build awareness about energy investment in Windsor and create a culture of energy conservation amongst residents, business, institutions, and industry.
- **Training and Education:** Build knowledge, skills, and technical capacity through partnerships that deliver innovative energy solutions at the local scale.

Targets

Through the implementation of this Plan, the Windsor community will:

- Reduce per capita primary energy use by 40 per cent from 2014 baseline by 2041; and
- Reduce per capita GHG emissions by 40 per cent from 2014 baseline by 2041.

These ambitious and transformative targets support global efforts to keep global temperature increases within 1.5C and meet the targets identified in the 2016 Ontario Climate Action Plan.¹⁰ The Province is targeting about a 60 per cent reduction in emissions by 2041 relative to 1990 which is about 50 per cent relative to 2014. The CEP target of 40 per cent is consistent with Provincial Plan's overall direction. As is normal for municipal plans, the CEP does not include some key areas that are included in the Provincial plan, the most obvious being land use, forestry, aviation, and shipping.¹¹

These targets position the Windsor community as an energy leader by achieving today's best practices by 2041. These targets will be achieved through the implementation of the CEP Strategies discussed in Chapters 5 through 10.

Chapter 3 – Windsor's Current Profile (2014)

Windsor's Community Profile

Windsor's current population is approximately 211,000. From 2006 to 2011, the population decreased by 2.6 per cent as shown in Figure 5.¹² Along with the population decrease, many residents and businesses have relocated to the edge of the City and to neighbouring municipalities. This leaves many opportunities for re-investment in the City's core through vacant building rehabilitation and brownfield redevelopment. In addition, new growth areas such as Sandwich South present opportunities to

¹⁰ <https://www.ontario.ca/page/climate-change-action-plan>.

¹¹ Under UNFCC guidelines, a municipal plan will generally exclude emissions from sources considered regional or national in nature including aviation, shipping, isolated industrial or military facilities, etc. A municipal energy plan will also exclude the non-energy related greenhouse gas impacts of Land Use, Land Use Change and Forestry (LULUCF).

¹² The percentage of the population aged 65 and over was 15.7 per cent in 2011, compared to the national average of 14.8 per cent. The percentage of the working age population (15 to 64) was 67.1 per cent and the percentage of children aged 0 to 14 was 17.2 per cent.

consider the development of new energy districts and Net Zero Neighbourhood areas (see Chapter 9 for descriptions). Population in the Windsor Census Metropolitan Area (CMA) is forecast to grow at 0.6 per cent in 2016 and 0.7 per cent in 2017, a gradual improvement on the estimated 0.5 per cent growth in 2015.¹³

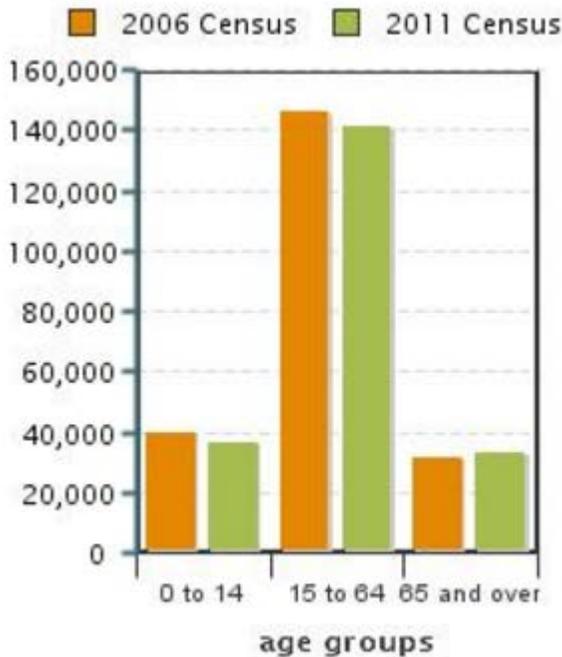


Figure 5: Windsor's Population (2006-2011)

(outside Windsor), adapting to the changes in the automotive industry and further diversification will be necessary to Windsor's future economic success.

Job creation is one of the key priorities identified in the City's 20-year Strategic Vision. Windsor has experienced significant unemployment over recent years. However, due to a stabilized manufacturing sector, growth in small industries, and progress in the finance, insurance and real estate sectors, total employment has increased exponentially over the past year.¹⁴ The current unemployment rate of Windsor is 5.7 per cent, well below both the provincial rate of 6.3 per cent and the federal rate of 6.8 per cent.¹⁵

Maintaining this low unemployment rate will continue to be a priority for Windsor as the City aims to address the recent decline in manufacturing jobs across the province.

industries are manufacturing and agriculture

While the automotive sector has seen fluctuating job creation and losses, the automotive manufacturing sector is still twice as large as the next biggest industry in Windsor – non-commercial services. Despite the provincial trend, WE EDC notes that "the fact that manufacturing output has expanded for five straight years is obviously good news for the region's economy and is a key driver behind the area's

¹³ Ontario Chamber of Commerce: 2016 Regional Economic Update (Windsor-Sarnia Economic Region).

¹⁴ Ibid.

¹⁵ [Labour force characteristics by province \(monthly\) \(Quebec, Ontario, Manitoba\)](#), November 2016.

¹⁶ Sarnia is developing its petrochemicals infrastructure for diversification into bio-based chemicals production and refinery. This transition to a "Bio-hybrid Chemistry Cluster" will give a boost to supporting manufacturing industry. Agriculture is also enhanced as it provides feedstock for biochemical and biomaterials development.

¹⁷ Ontario Chamber of Commerce: 2016 Regional Economic Update (Windsor-Sarnia Economic Region).

recovery. Specifically, manufacturing output increased by an average of 4.4 per cent per year from 2010 to 2014.”¹⁸

The automotive manufacturing sector remains an important element of the local economy and auto manufacturers have made commitments to new production that are helping to drive some economic growth in the City, including Fiat Chrysler Automobiles’ \$2 billion re-tooling investment in the Windsor plant.¹⁹ Windsor is being recast with efforts to diversify the economy²⁰ through tourism/sports tourism, transportation logistics, as well as advanced manufacturing. Growth industries include health and life sciences, and creative and renewable energy technologies.²¹

The strategies presented throughout the CEP must look to continue to create jobs, diversify the economy, and embrace innovation so that the local economy can continue to expand and grow.

Establishing the Baseline and Business as Usual Forecast

To be able to define a vision, targets and strategies for the future, the City, Community Task Force and the consulting team needed to establish a baseline timeframe for the CEP and understand what sectors are using energy, what types of energy are being used, and where that energy is being used in Windsor.

The Timeframe for the Plan

The City, Community Task Force, and consulting team identified a baseline year of 2014 to begin the process using the most recent complete set of data available and forecasted energy use to 2041 based on available population and employment growth projections and the current Official Plan framework. This timeframe provides Windsor with almost three decades to advance transformative energy solutions at the community-scale and aligns with a number of other community energy planning processes in Ontario. Community Task Force members recognized that transformational change takes time, but urged the City to consider both long-term solutions and those that could be initiated immediately upon adoption of the CEP by Council.

¹⁸ WindsorEssex Economic Development Corporation, [Workforce Demographics](#), 2016.

¹⁹ Ontario Chamber of Commerce: 2016 Regional Economic Update (Windsor-Sarnia Economic Region)

²⁰ Diversification efforts are set out in this 2011 WindsorEssex Economic Development Corporation economic roadmap (<http://www.choosewindsor.essex.com/roadmap>). It includes agri-business, however this pertains to the county municipalities. The City used the roadmap as a basis for creating an job retention and economic diversification incentive program that does not include agri-business:

<http://www.citywindsor.ca/residents/planning/Plans-and-Community-Information/Know-Your-Community/Community-Improvement/Pages/Economic-Revitalization-Community-Improvement-Plan.aspx>.

²¹ Canada Mortgage and Housing Corporation.

Understanding the Types of Energy Being Used and Users

Data were collected to determine the types of energy being used and by whom. The baseline energy use reflects actual energy used in Windsor, based on metered data where possible. Data were provided by EnWin and Union Gas for electricity, natural gas, and compressed natural gas respectively.

Transportation energy use was determined using fuel sales data collected from Kent Marketing Fuel and a traffic model prepared by the City to capture vehicle kilometres travelled (VKT). Data were also collected regarding the types, size, age, and location of homes and buildings in Windsor.

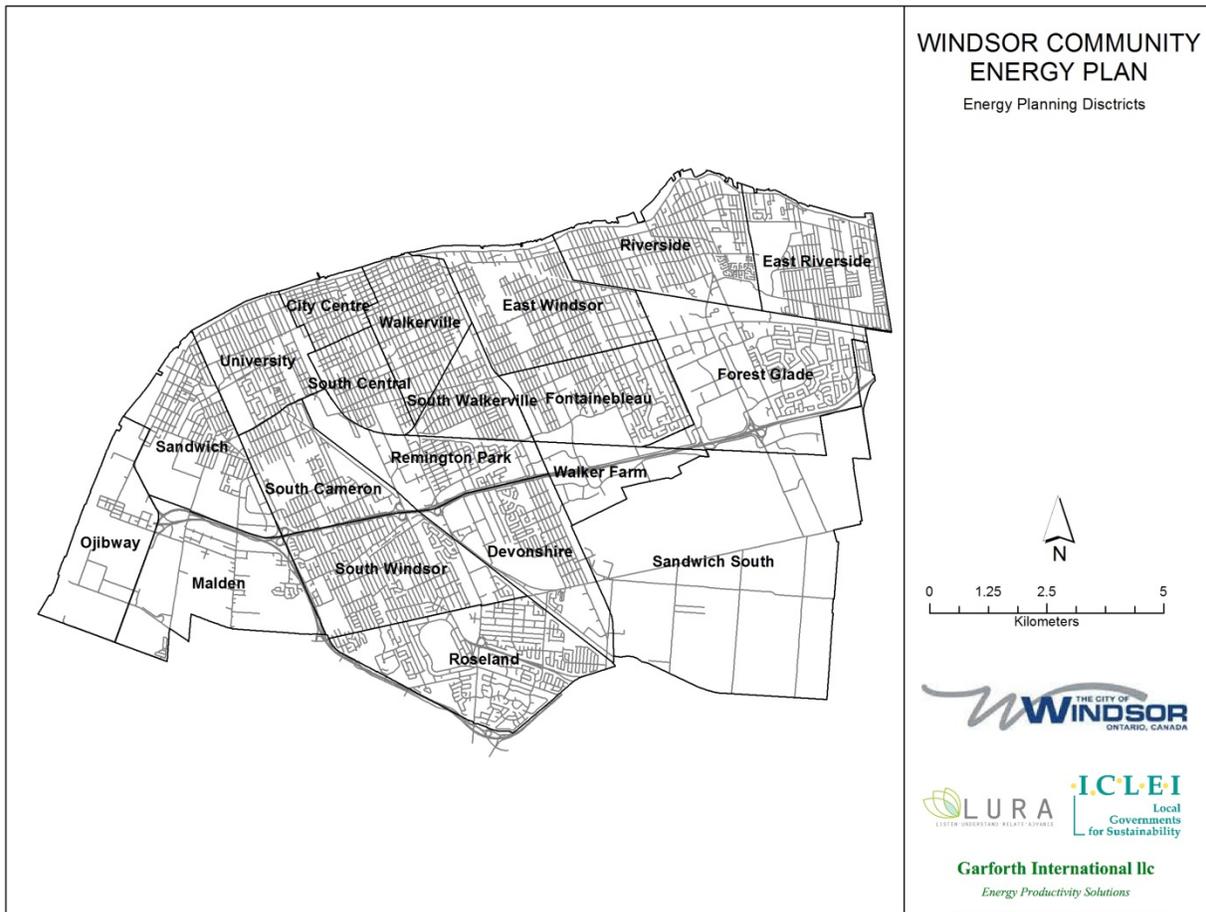
Emissions coefficients for each fuel type were based on data from Environment Canada's annual *National Inventory Report* to determine the amount of GHGs being released into the atmosphere from activities in Windsor.²² The National Inventory Report provides emissions coefficients for each fuel type, as well as specific coefficients for electricity by province based on the local generation mix.

Understanding Where Energy is Being Used

The development of energy maps provides a better understanding of where energy is currently being used, assess energy use across the City in the future, and be modified to address changes to provincial policy or efficiency changes. The maps created help identify specific planning districts or neighbourhoods that are candidates for various strategies identified in Chapters 5 to 10.

To create the energy maps, the consulting team built a model of energy use that links metered consumption data from the baseline to the geographical location of specific buildings. The consulting team gathered Geographical Information System (GIS) coordinates of the over 76,000 parcel fabric files and property assessment roll files from the City. The assessment data were linked to the property data based on the roll numbers. The project team then created 20 Energy Planning Districts (EPD) that are aligned with the current 20 planning districts (Map 1). The EPDs range in size from slightly more than 200 hectares to approximately 2,532 hectares. Note that transportation is excluded from all maps.

²² Environment and Climate Change Canada, [Canada's Greenhouse Gas Emissions](#), 2016.



Map 1: Energy Planning Districts in Windsor (2014)

Once building information was matched to geography, energy data from the baseline were matched to the building inventories based on archetype of building energy performance developed using HOT2000 and the National Screening Tool for New Building Design energy modelling software. The result was a set of archetypes of buildings with modelled energy intensity values (GJ/m²) for electricity, natural gas, and various end uses including heating, cooling, domestic hot water, and appliances/lighting.

The characteristics of each Energy Planning District including the gross floor area (residential and non-residential) and the main building types in each EPD are provided in Table 1.

Table 1: Energy Planning Districts

EPD Name	Total Gross Floor Area (m ²)	Residential GFA (m ²)	Non-Residential GFA (m ²)	Main Building Types
Ojibway	289,929	730	289,199	Industry, Warehousing
Sandwich	1,061,234	457,922	603,312	Industry, Offices, Housing
Malden	124,689	95,231	29,459	Offices, Housing
University	1,204,560	583,545	621,015	Offices, Education, Retail, Housing
South Cameron	481,867	351,996	129,871	Retail, Housing
South Windsor	1,072,053	824,337	247,716	Education, Housing
Roseland	1,185,758	822,968	362,790	Housing
City Centre	960,654	396,409	564,245	Offices, Retail, Municipal, Housing
South Central	832,835	445,838	386,996	Offices, Medical, Industry, Housing
Remington Park	756,354	208,048	548,306	Offices, Retail, Industry
Devonshire	604,985	290,492	314,493	Industry, Retail, Offices
Walkerville	1,348,481	825,675	522,806	Offices, Retail, Education, Housing
South Walkerville	590,963	299,245	291,718	Retail, Offices, Industry, Housing
East Windsor	1,405,042	860,848	544,193	Education, Offices, Retail, Housing
Fontainebleau	952,940	492,704	460,236	Offices, Industry, Housing
Walker Farm	305,542	5,079	300,463	Industry, Offices
Sandwich South	100,061	41,604	58,457	Industry, Airport
Riverside	1,415,553	1,051,763	363,791	Education, Housing
East Riverside	546,271	497,680	48,591	Housing
Forest Glade	1,240,367	669,486	570,882	Housing, Industry
TOTAL	21,334,094	9,221,601	12,112,494	Residential 43 per cent , Non-residential 57 per cent

As Table 1 shows, the five most significant residential areas are Riverside, East Windsor, Walkerville, South Windsor, and Roseland, which together contain nearly 50 per cent of the housing stock in Windsor. Industry in Windsor is primarily located around the airport, in Walker Farm, Forest Glade, and Sandwich South. There are also concentrations of industry in Ojibway and Malden and along Walker Road and the Rail Corridor. Commercial businesses are located throughout the City, but most densely located in the City Centre as well as along a number of transit corridors, including Tecumseh, Wyandotte, Division, and Provincial roads.

The Cost of Energy in Windsor

In 2014, Windsor spent over \$842 million dollars on energy.²³ This cost is associated with 38 million GJ of energy used directly by the community and includes all electricity, natural gas, gasoline, and diesel used within the City boundaries by businesses, industry, homes, City buildings, and fleets, as well as all gasoline and diesel used for cars and trucks in the City.

Of the total energy costs, 46 per cent of the dollars spent in Windsor was used for transportation purposes – gasoline and diesel for cars, trucks, and commercial vehicles as shown in Figure 6. Residential buildings (homes, apartments and condos) and commercial and institutional buildings (businesses, schools, university, and health care) together account for 39 per cent of the total money spent on energy. Industrial spending accounted for 14 per cent of the total, while municipal buildings and fleets costs only account for 1 per cent. This means that even if industries and the municipality were to significantly reduce the amount of energy they use, the amount of money spent on energy in Windsor would not significantly decrease. To reduce costs, action is needed to reduce energy use associated with buildings and transportation.

Did You Know?

\$842 million dollars was spent on electricity, natural gas, and transportation fuels in 2014 across the Windsor community.

Of the total energy costs, 39 percent and 46 percent of the dollars spent in Windsor were used for buildings and transportation purposes respectively. Industry accounts for 14 per cent of the total, while municipal buildings and fleets costs only account for 1 per cent. To reduce costs, action is needed to reduce energy use with buildings and transportation.

²³ Based on consultants' estimate using representative Ontario average costs.

Energy costs for local businesses and homeowners are a key issue in Windsor and across Ontario. The Windsor-Essex Regional Chamber of Commerce has noted that the costs of hydro are driving down profits for local businesses, which has negative impacts for the local economy, leads to job losses and businesses opting to leave the province.²⁴ Energy costs are expected to grow if no action is taken to address energy use at the community level.

How much of the money spent on energy stays in Windsor?

When thinking about the costs of energy to a community, there is a need to consider where the energy is coming from, how it is generated, and the costs of the processes to deliver that energy to the light switch or the gas tank. In Windsor, it is estimated that approximately 80 per cent of the money spent on energy leaves the local economy. Therefore, the solutions proposed to address energy costs in Windsor must adhere to the guiding principles to keep as many energy dollars in Windsor as possible and to create an economic advantage through attractive energy solutions that help to retain existing businesses and attract new ones to the community.

Did You Know?
 Approximately 80 per cent of the money spent on energy in Windsor leaves the local economy.

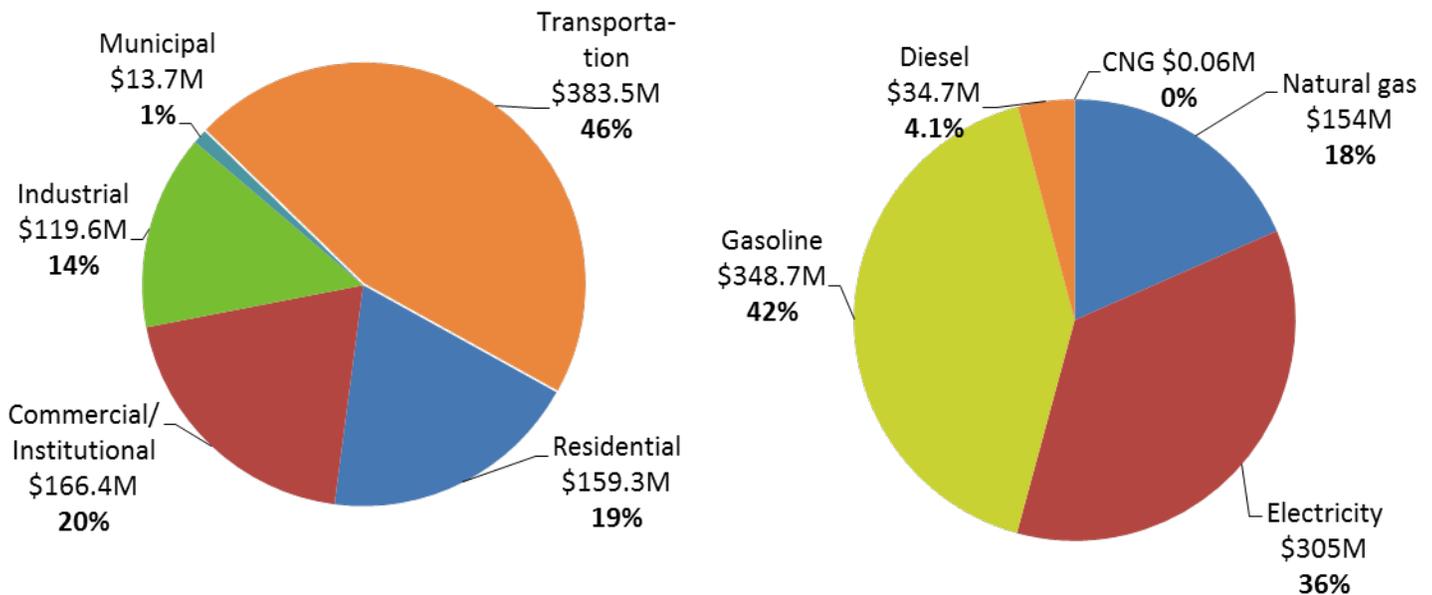


Figure 6: Energy Cost by Source and by Sector (2014)

²⁴ [Hydro costs slashing profits of Windsor region businesses](#), CBC News, Nov. 2016.

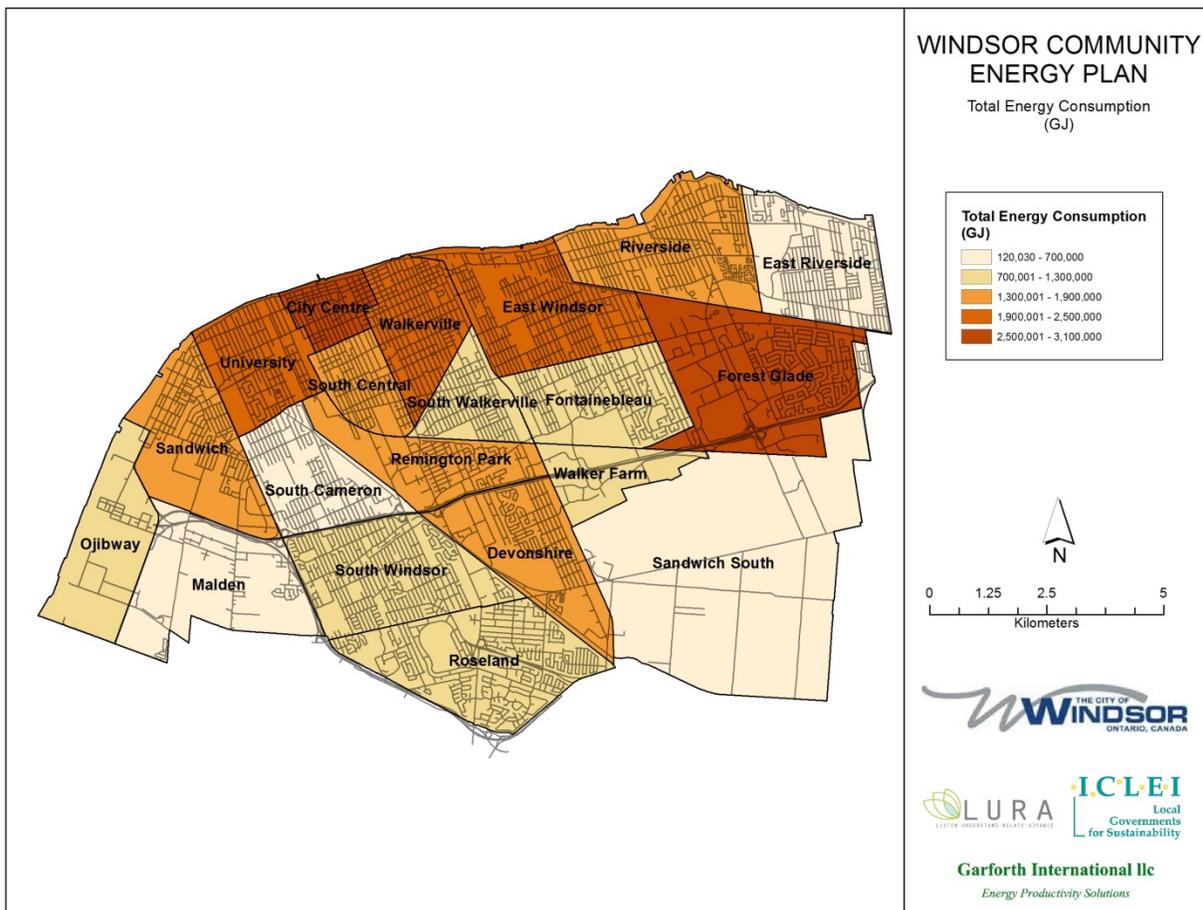
The Amount of Energy Used in Windsor



the East Windsor Planning District.

How Much Energy is Windsor Using in Total?

The Windsor community used 38 million GJ or 182 GJ per person in 2014. The highest energy use amongst residential buildings and industry occurs in City Centre, East Windsor, and Forest Glade as shown in Map 2. These neighbourhoods use more energy due to a mix of factors including medium to high density build out of older less efficient single detached homes, heavy commercial around the Devonshire Mall, and industry to the west of



Map 2: Total Energy Consumption (GJ) (2014)

Did You Know?

The Windsor community used 38 million GJ or 182 GJ per person of energy in 2014.

Moderate to high total energy use occurs in the neighbourhoods of Riverside, Walkerville and the University, followed by moderate total energy use in Sandwich, Remington, and Devonshire. Ojibway, South Windsor, Roseland, South Walkerville, and Fontainebleau have moderate to low total energy use, while Malden, South Cameron, Sandwich South, and East Riverside have the lowest total energy use.

Did You Know?

The City of Mannheim – a Twin City to Windsor currently uses 82 GJ/ person/year of energy and aims to reduce a further 20 per cent by 2020. Mannheim’s experience suggests that not only is it possible to reduce energy use within the community, it is possible to do so and retain economic advantage.

Best in class communities around the globe have found ways to reduce per person energy use and foster economic development and advantage. For example, the City of Mannheim – a Twin City to Windsor with many of the same characteristics (i.e. a university city with a strong industrial base and a population of 300,000 located on the Rhine and Neckar Rivers) – currently uses approximately 82 GJ/ person/year of energy and aims to reduce that by another 20 per cent by 2020. On a household scale, Windsor households use approximately 142 GJ of energy, whereas the average for Danish households is 68 GJ/household. This suggests that not only is it possible to reduce energy use within the community, it is possible to do so and retain economic advantage. The City of Windsor is fortunate and well positioned to reach out to the City of Mannheim as a Twin City to access those who helped foster their transition towards a smart energy system.

How Much Energy is Used by Each Sector?

When looking at the total amount of energy use from a sectoral perspective, energy use is fairly evenly distributed across the residential, commercial and industrial sectors, with 24 per cent, 25 per cent, and 24 per cent of total site energy use respectively as shown in Figure 7. This means about half of the energy used in Windsor (49 per cent) is used by buildings, including houses, apartments, condos, businesses, offices, shops, schools, the university, and health care buildings. This is similar to the picture of Ontario energy demand as a whole, where buildings and the transportation sector accounted for 73 per cent of the total energy demand in Ontario in 2014 with buildings – both residential and non-residential – accounting for approximately 37 per cent.²⁵ Relative to many communities, the percentage of energy use by the industrial sector (24 per cent) is fairly high in Windsor given that there are a number of large industries within the City, including Ford and Fiat Chrysler as well as others. Transportation accounts for 26 per cent of the total energy use which includes gasoline and diesel used by cars, trucks, and commercial vehicles that is purchased within the City boundaries (including bridge and tunnel transportation).

²⁵ Conservation: Let’s Get Serious. Annual Energy Conservation Progress Report 2015/2016. Environmental Commissioner of Ontario, published in November 2016. p.12.

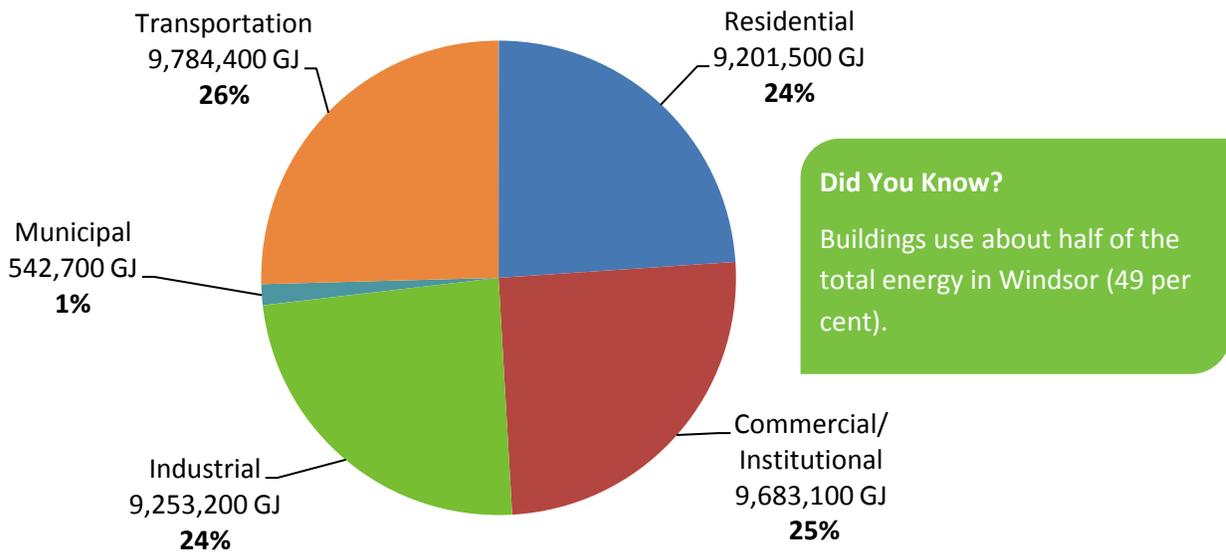


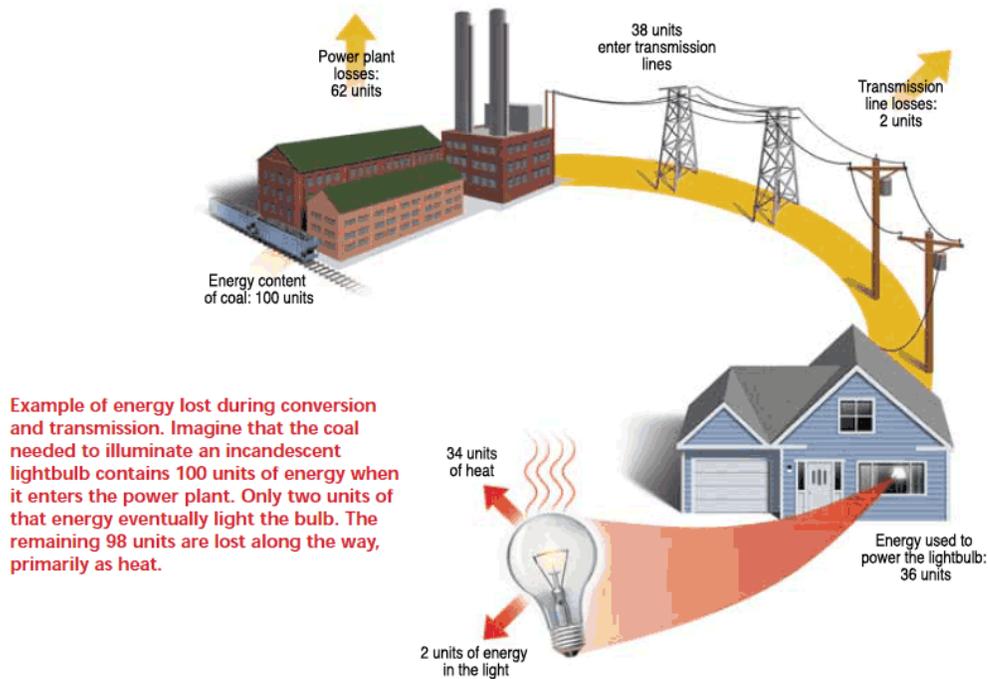
Figure 7: Energy Use by Sector (GJ) (2014)

A Lost Opportunity – Energy Conversion

Another significant factor when thinking about energy end-use at the community level is to understand how much energy it takes to bring primary energy (energy that is taken directly from natural sources such as fossil fuels, oil, natural gas, wind, and solar) to the light switch or fuel tank and how much energy is lost as it shifts from one form to another. For example, when electricity is generated from thermal fuels such as gas, coal or uranium, nearly two thirds of the fuel’s energy value is lost as heat at the power plant. There are further losses in the transmission lines that bring the power to Windsor. There are similar but smaller conversion losses to bring fuels and natural gas to Windsor’s filling stations and buildings.

Did You Know?
The Windsor community uses only about 70 per cent of the total amount of energy it needs due to conversion losses.

In Windsor, the total energy used in the community is 38 million GJ or 182 GJ per person in 2014. However, an additional 29 per cent of energy is needed to bring that total energy to the community which is lost through the conversion process. That means the Windsor community has paid for 54 million GJ or 255 GJ per person to be able to use only about 70 per cent of that amount. For homes and buildings, conversion loss accounts for approximately 17 per cent of the total amount of energy (including losses for municipal buildings) as shown in Figure 8. For industry, conversion losses are 9 per cent and in the transportation sector, conversion losses are 2 per cent. The strategies put forward to create economic advantage and increase energy efficiency must also consider how to reduce the amount of energy that is wasted through conversion.



Source: National Academy of Sciences, <https://www.nap.edu/read/12204/img/page8-img1.png>

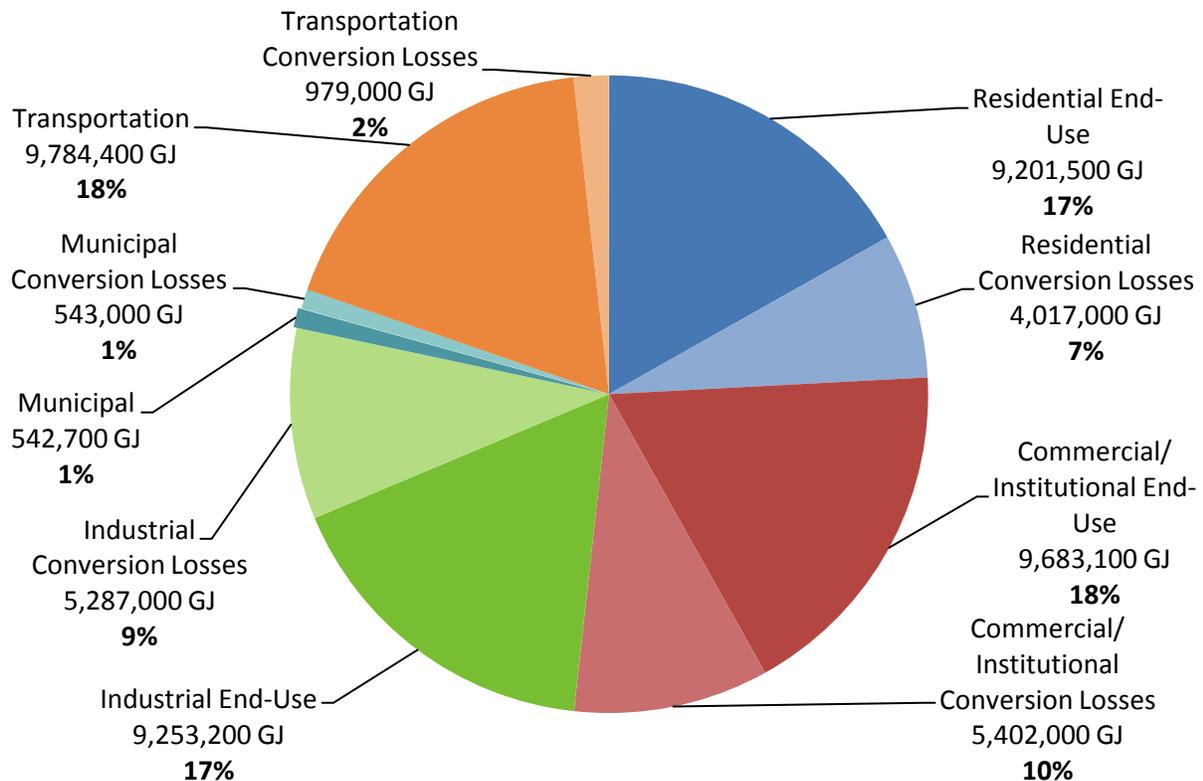


Figure 8: Energy Use by Sector with Conversion Losses (2014)

What Types of Energy are being Used?

Figure 9 below shows the total amount of energy used by energy type. Natural gas and electricity together account for 80 per cent of the energy used in Windsor, while 20 per cent of the total energy used is by transportation fuels.

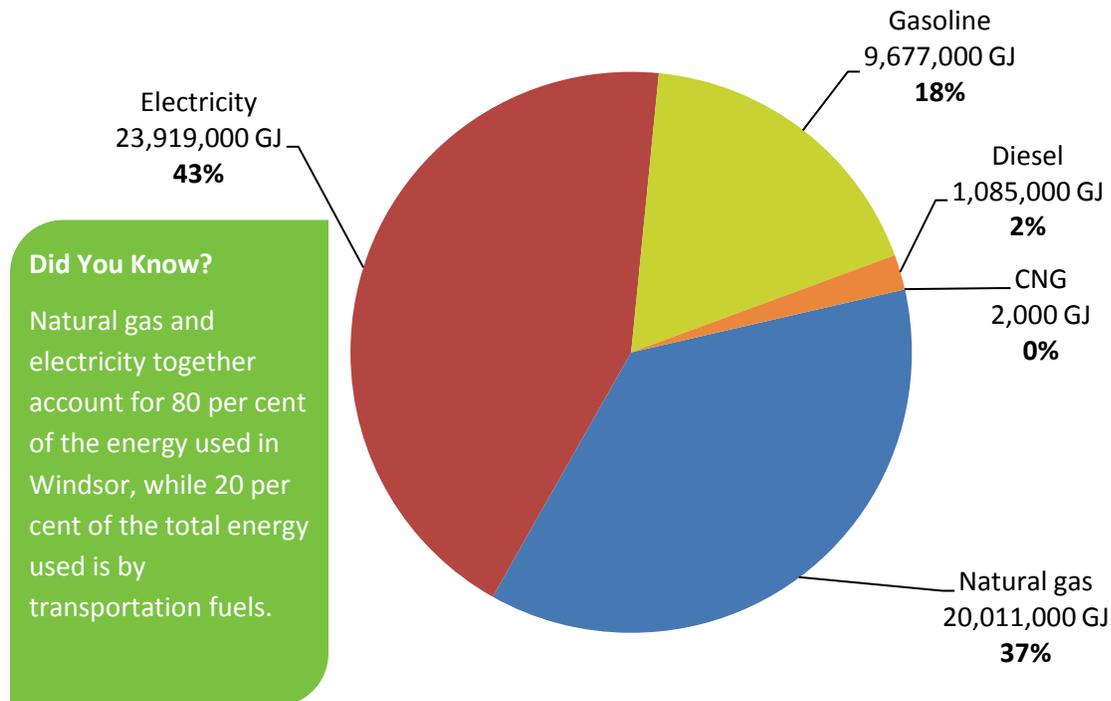
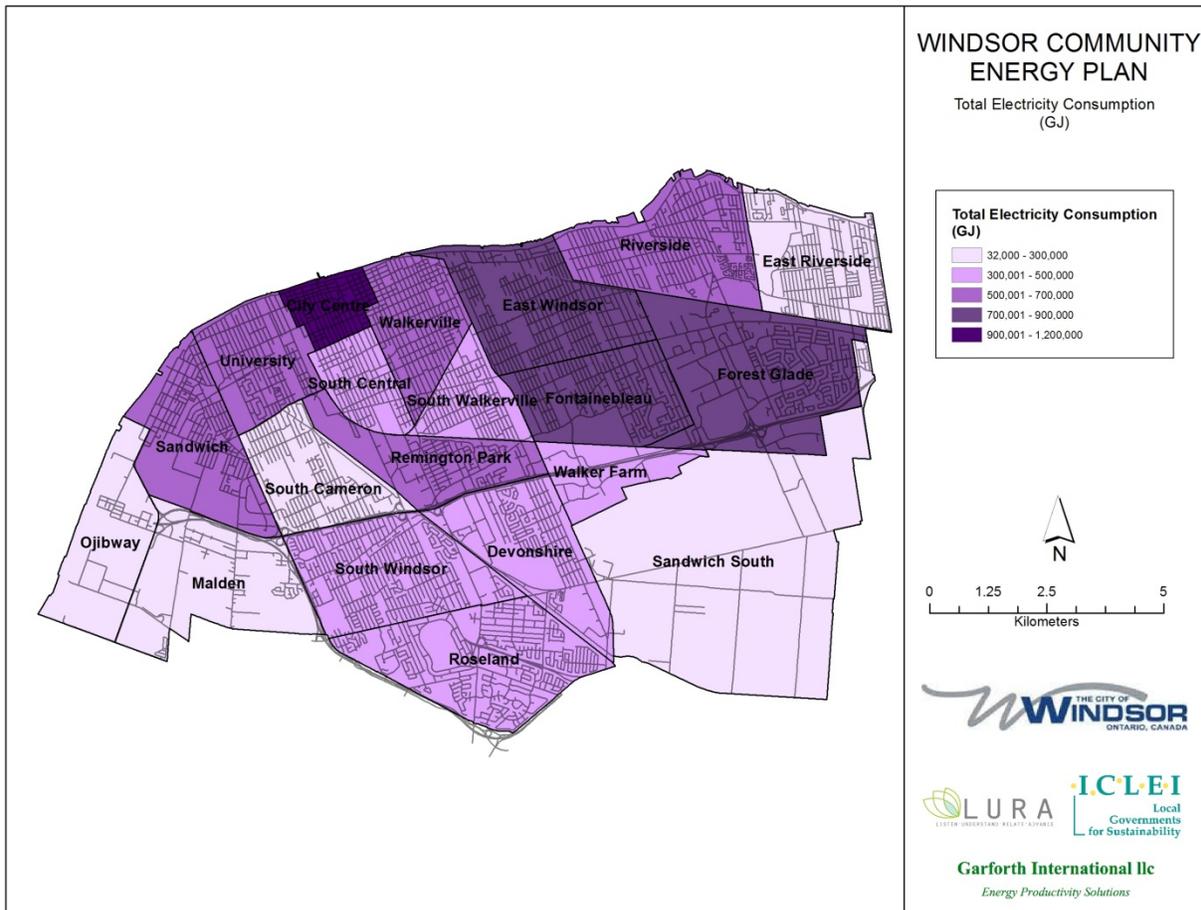


Figure 9: Fuel Use by Utility (2014)

Electricity accounts for 43 per cent of the total energy used and is used for air conditioning, lighting, appliances, and equipment in homes and businesses. Natural gas accounts for 37 per cent of the total energy used in Windsor. It is used for cooking and space heating in homes, offices, and retail spaces, as well as for heating, and industrial processes in the industrial sector.²⁶

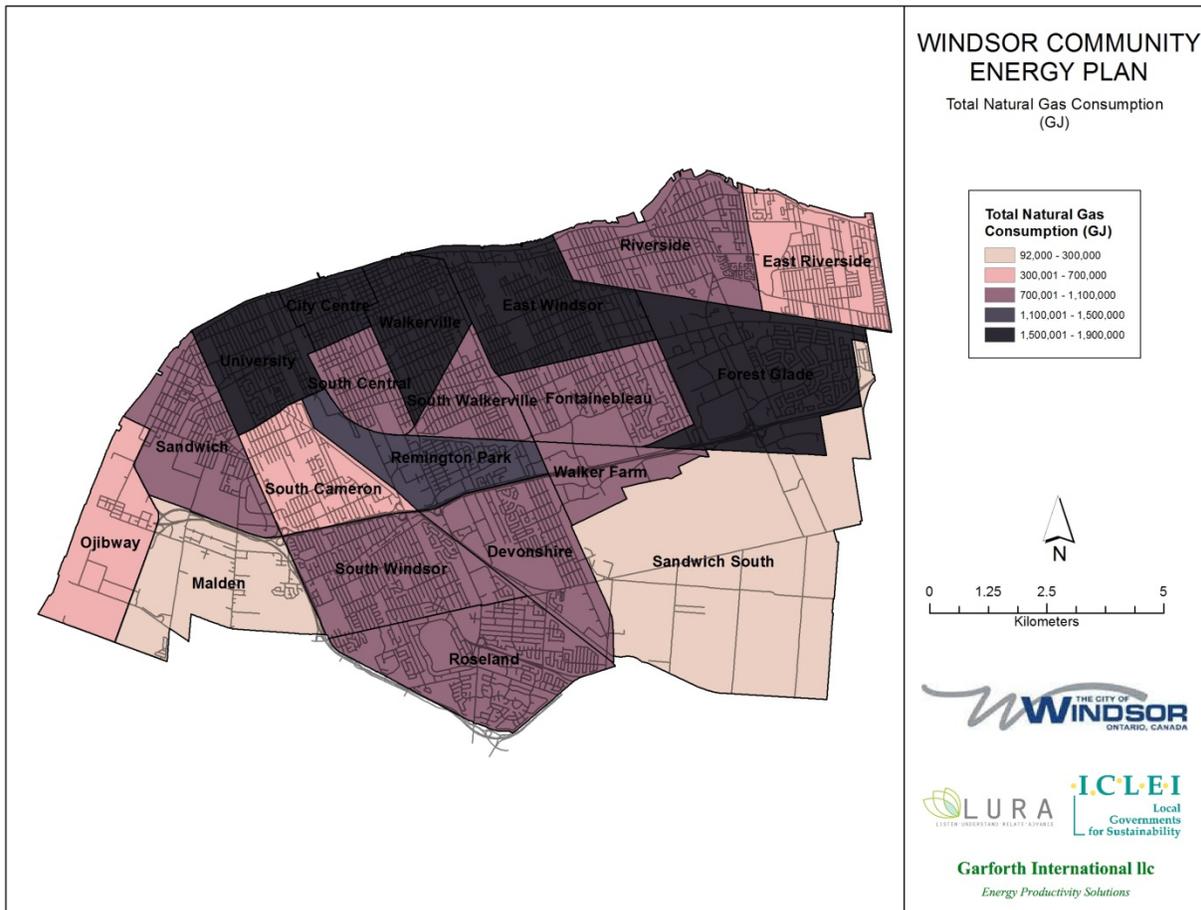
Map 3 shows the total amount of electricity used by the residential, commercial, institutional and industrial sectors in 2014. City Centre has the highest electricity use mainly due to high concentration of offices. East Windsor, Fontainebleau, and Forest Glade, dominated by industrial use, also have moderate to high electricity usage.

²⁶ Note the use of CHP is covered in the heating category and the use of gas for the in-boundary baseload/ peaker plants is excluded. The emissions from these plants are aggregated in the overall electricity emissions index of the province.



Map 3: Total Electricity (GJ) (2014)

Map 4 shows the total amount of natural gas used by the residential, commercial, institutional, and industrial sectors in 2014. University, City Centre, Walkerville, East Windsor, and Forest Glade had the highest natural gas use. The university itself is a major consumer of natural gas which includes use for its on-site combined heat and power (CHP) and heating distribution. City Centre is dominated by office heating, while Walkerville is characterized by mostly residential heating. East Windsor and Forest Glade are predominantly industrial uses. Moderate to high natural gas use was also seen in Remington Park, predominantly from Industry.



Map 4: Total Natural Gas Use (GJ) (2014)

The Amount of Greenhouse Gas Emissions Emitted in Windsor

Did You Know?

The Windsor community contributed 1.9 million Tonnes of GHG emission – higher than the Ontario average.

Transportation emissions account for 36 per cent of the total emissions.

In 2014, the Windsor community contributed 1.9 million Tonnes of GHG emissions into the atmosphere. This is approximately 8.8 Tonnes of CO₂e per person which is higher than the Ontario average of 6.2 Tonnes of CO₂e per person, and in line with the Canadian average of 9.7 Tonnes of CO₂e per person. Some of this difference can be attributed to the high volume of bridge traffic transiting through Windsor.

Figure 10 indicates that emissions from the industrial, residential, and commercial and institutional sectors account for 20 per cent, 22 per cent, and 22 per cent of the total respectively.

Transportation sector emissions are by far the highest at 36 per cent of the total. Windsor's transportation emissions are equal to those within the province which are 36 per cent.²⁷ It is important to note that the emissions caused by any particular sector result from the combination of the amount of energy used and the carbon content of the specific energy type.

Like overall energy use, there is room to reduce emissions in Windsor while advancing the CEP principles of demonstrating global leadership and committing to urgent action to address climate change, while adding clear competitive advantage. Cities such as Copenhagen have reduced GHG emissions to 3.5 Tonnes of CO₂e per person.²⁸ The strategies identified in this plan aim to reduce per person GHG emissions by 40 per cent from 2014 baseline by 2041. This would bring the per person GHG emission to 6 Tonnes of CO₂e.

Did You Know?

Cities such as Copenhagen have reduced GHG emissions to 3.5 Tonnes of CO₂e per person.

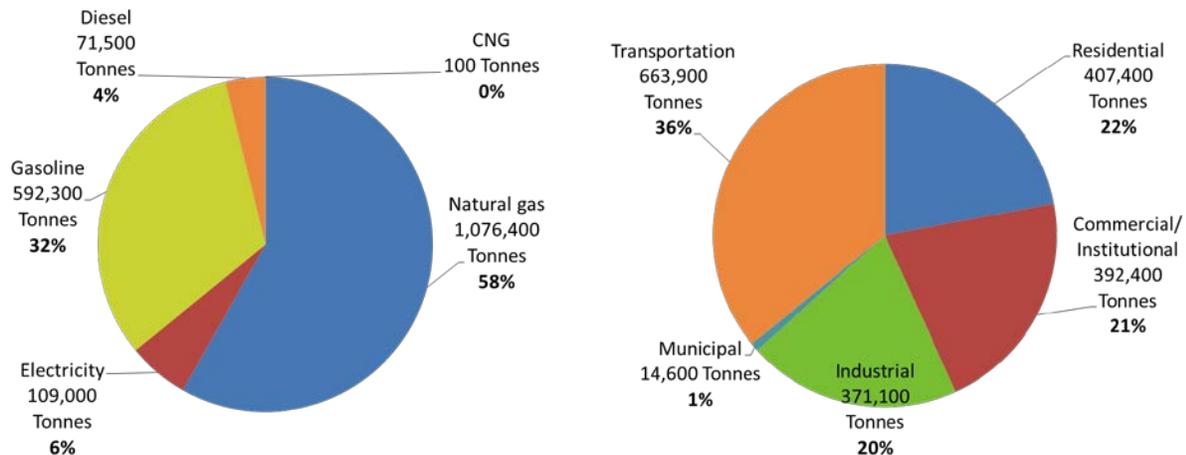
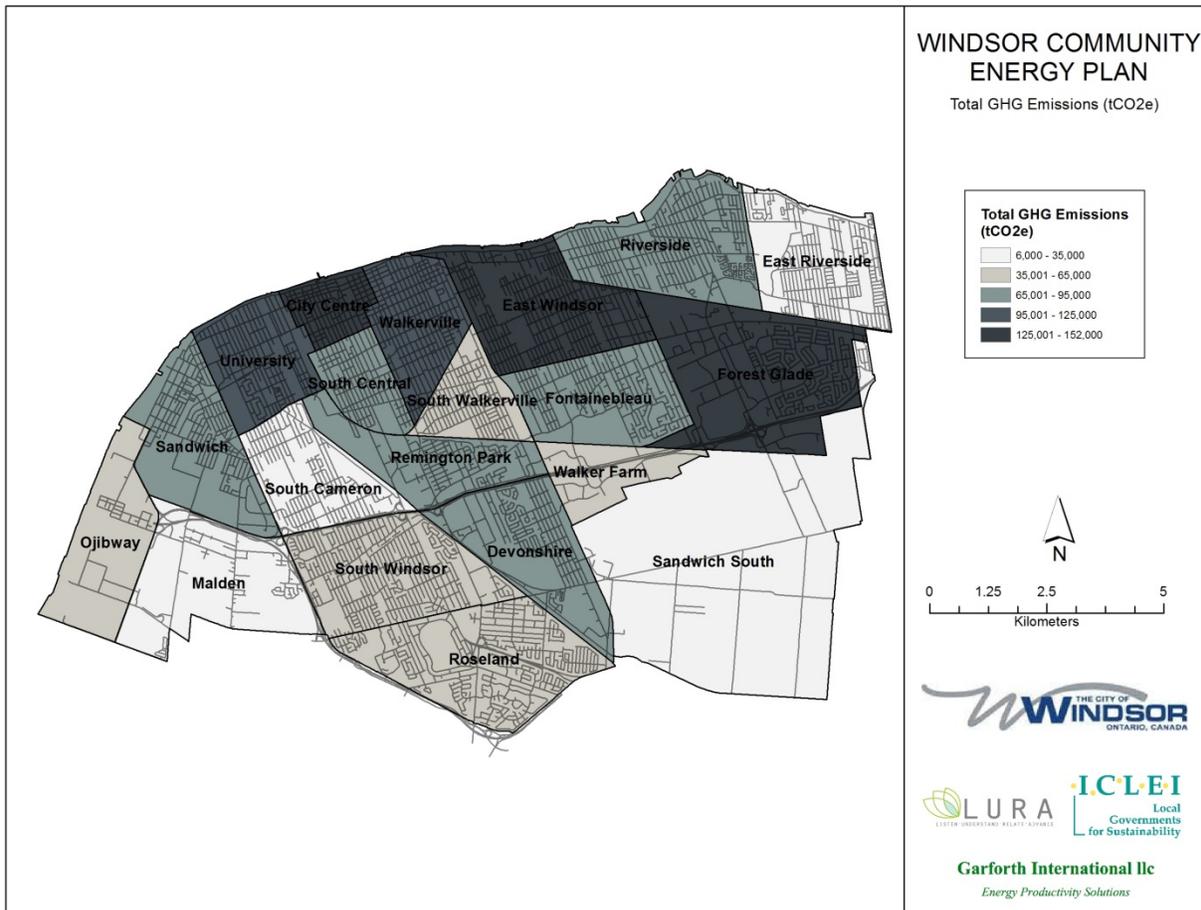


Figure 10: Greenhouse Gas Emissions by Source and Sector (Tonnes CO₂e) (2014)

Map 5 below shows that the highest GHG emissions from home buildings and industry occur in City Centre, East Windsor, and Forest Glade. The GHG emissions follow the electricity and natural gas use in each of the planning districts, with natural gas use being the major driver.

²⁷ Conservation: Let's Get Serious. Annual Energy Conservation Progress Report 2015/2016. Environmental Commissioner of Ontario, published in November 2016. p.13.

²⁸ The energy efficiency strategy of Copenhagen was triggered by the 1973 oil crisis which exposed the dependency on oil not only for transportation but also for much of its electricity. From this initial pressure to avoid dependence on single foreign sources grew a sustained holistic approach to efficiency, supply flexibility and environmental performance.



Map 5: Total Greenhouse Gas Emissions (Tonnes CO₂e) (2014)

How Windsor Compares to Other Communities

Windsor's energy and emissions performance overall is compared to the Canadian and Ontario averages and comparable community best practices globally in Table 2.

The City of Copenhagen was chosen as one benchmark. It has a similar climate, is recognized as one of the most attractive and livable cities, and is highly competitive in an economy similar to Canada's. Copenhagen also has a well-documented energy and climate policy history from the early 1970's. The overall energy performance of Germany has also been used as benchmark, especially for buildings, again as a well-documented area relative to energy performance. The CEP also looked to the City of Mannheim, a Twin City to Windsor, for institutional, policy and energy performance benchmarks. Mannheim has a similar population as Windsor, a significant industrial community and is recognized as an innovator in implementing municipal and regional energy plans over many years.

Table 2 indicates that Windsor's energy use per household:

- Is 35 per cent higher than the Ontario average and more than twice the Danish average;
- Uses 20 per cent more energy per square metre of home than the Ontario average and more than 3 times German A-rated homes; and
- Uses about the same amount of energy on a per square metre basis as the Canadian average for non-residential buildings which is still more than twice German average.

Did You Know?

Windsor's average household uses:

- 35 per cent more than the average Ontario home
- 20 per cent more energy/ft² than the energy intensity of an average Ontario home

In addition, Windsor has about the same level of GHG emissions per person as the Canadian average, which is still higher than the Ontario average and nearly three times higher than equivalent GHG emissions per person in Copenhagen.

Overall this suggests there is significant opportunity to reduce the energy use of households in Windsor through aggressive

retrofit programs and mechanisms to improve energy efficiency for new construction that will help move towards global best practices by 2041.

Table 2: Windsor's Energy and Emissions Benchmarking

Item	Windsor Baseline	Canada Average	Ontario Average	Comparable Best Practice ²⁹
Utility/household (GJ)	142	106	107	68 ^a
Utility/m ² (Res) (GJ)	1.00	0.79		0.29 ^b
Utility/m ² (non-res) (GJ)	1.61	1.65		0.72 ^c
GHG / person (Tonnes CO _{2e})	8.8	9.7	6.2	3.5 ^d

²⁹ Superscripts: (a) Use per home is 35 per cent above Ontario average and more than twice Danish average; (b) Use per square meter of home 20 per cent higher than Ontario average which is more than 3 times the typical German A-rated home which represents about 30 per cent of the current new construction market; (c) Use per square meter of non-residential is around the Canadian average but more than twice German average; and (d) GHG/capita is comparable to Canada average but nearly 3 times the average per capita emissions for the City of Copenhagen.

Chapter 4 – A Projection of Windsor’s Energy Use in 2041

The base case or business as usual scenario is used to understand what energy use would be like in Windsor, in the absence of a CEP and with only actions already planned within the City and through provincial activities. The base case provided a discussion point for the Community Task Force to assess Windsor’s ability to achieve the provincial energy and GHG emissions reduction targets and Windsor’s own 40 per cent energy and 40 per cent GHG emission reduction targets. Base case scenario planning is an important tool to allow Windsor to better understand the costs and risks associated with a “wait and see” approach to 2041 or the absence of any significant energy-related action.

The consulting team, with guidance from the City and the Community Task Force, used the following assumptions to develop the base case for 2041:

- Demolition rate for existing homes and buildings will follow historical trends;
- Existing homes and businesses will have the same average efficiency;
- New homes will be added to align with population growth projections (0.98 per cent) to all EPDs respecting density targets;
- New homes and commercial buildings will comply with the current day Ontario Building Code energy standards;
- New commercial and industrial will be added to align with employment growth rates (1.06 per cent);
- Light vehicle kilometres travelled (VKT) will align with population growth and heavy VKT will align with employment growth;
- Vehicle efficiency will remain at 2014 levels;
- Neighbourhoods will tend to remain predominately zoned for single-functions;
- Energy pricing will look at both lower range (based on LTEP) and higher range (based on utility risk planning estimate) to estimate risk and opportunity for Windsor;
- Energy supply mix will stay the same; and
- The Ontario Cap-and-Trade program will come into effect in 2017.

Projected Energy Costs by Source to 2041

The economy is one of the key drivers for changing how energy is used in Windsor. As noted, energy costs are unpredictable and have been rising in Ontario, leading businesses and residents to question what options they have to retain their economic advantage and quality of life. Figure 11 and Figure 12 below illustrate the cumulative impacts of the energy cost risks to Windsor by 2041 (without inflation).

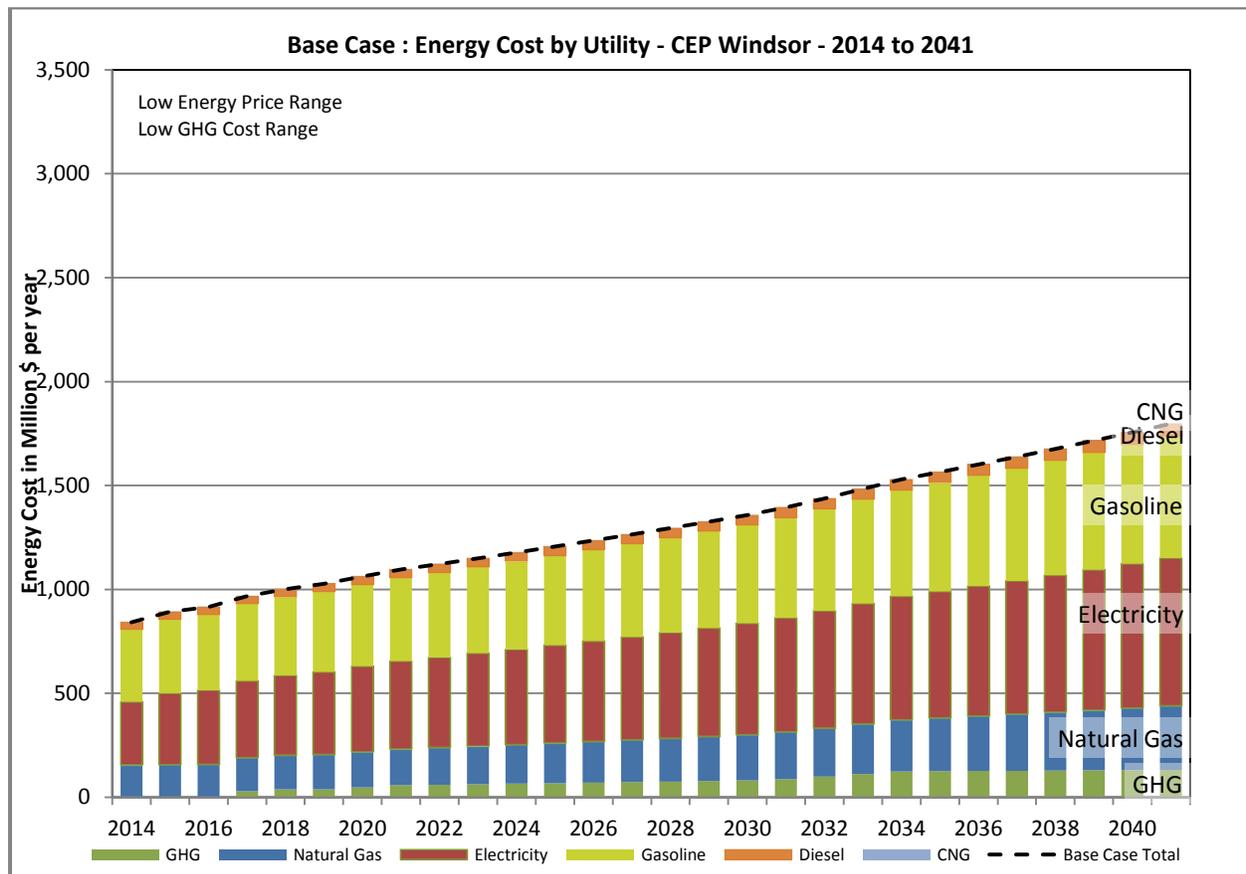


Figure 11: Projected Lower Range of Energy Cost Risk (2014 to 2041)

Did You Know?

It is anticipated that energy costs will increase by 120 per cent at the lower risk range and by 280 per cent at the higher risk range. This would increase annual energy costs from \$842 million per year to \$1.8 billion and \$3.1 billion per year in 2041 respectively. This poses significant cost risk for all sectors in Windsor.

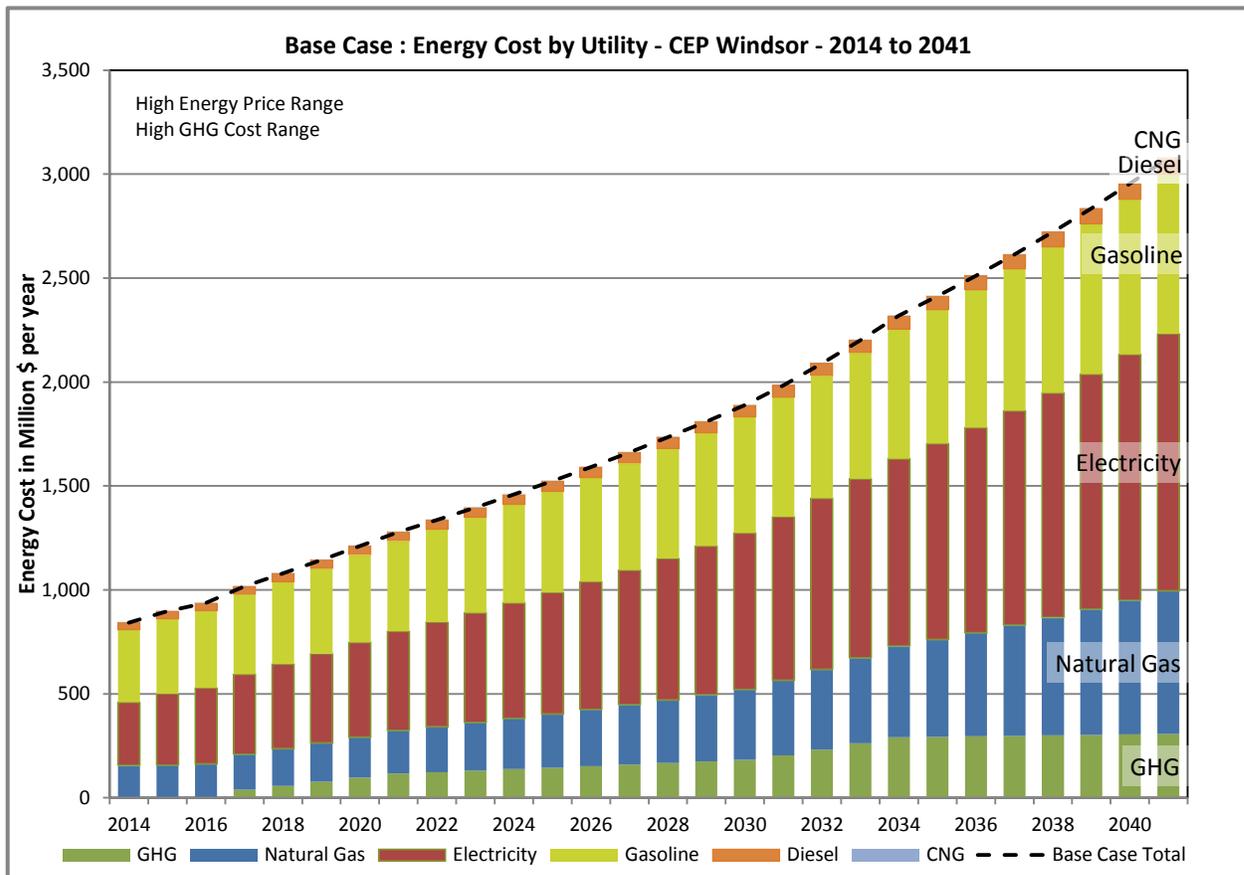


Figure 12: Projected Higher Range of Energy Cost Risk (2014 to 2041)

Projected Energy Use by Sector and by Source to 2041

Projected Energy Use by Sector

The projected end-use energy by sector is presented in Figure 13. There is a gradual steady increase in all sectors except for municipal which remains at 2 per cent of the total energy profile of the community. This suggests without any action taken at the local level that by 2041, total energy use in Windsor in Petajoules (PJ),³⁰ will increase from 38.5 to 46.9 PJ (22 per cent). This represents a significant increase in annual transportation source use from 9.8 to 12.8 PJ (27 per cent), industry source use from 9.3 to 11.4 PJ (23 per cent), commercial and institutional source use from 10.2 to 11.9 PJ (17 per cent), and residential source use from 9.2 to 10.9 PJ (18 per cent).

³⁰ One Petajoule (PJ) is one million Gigajoules (GJ).

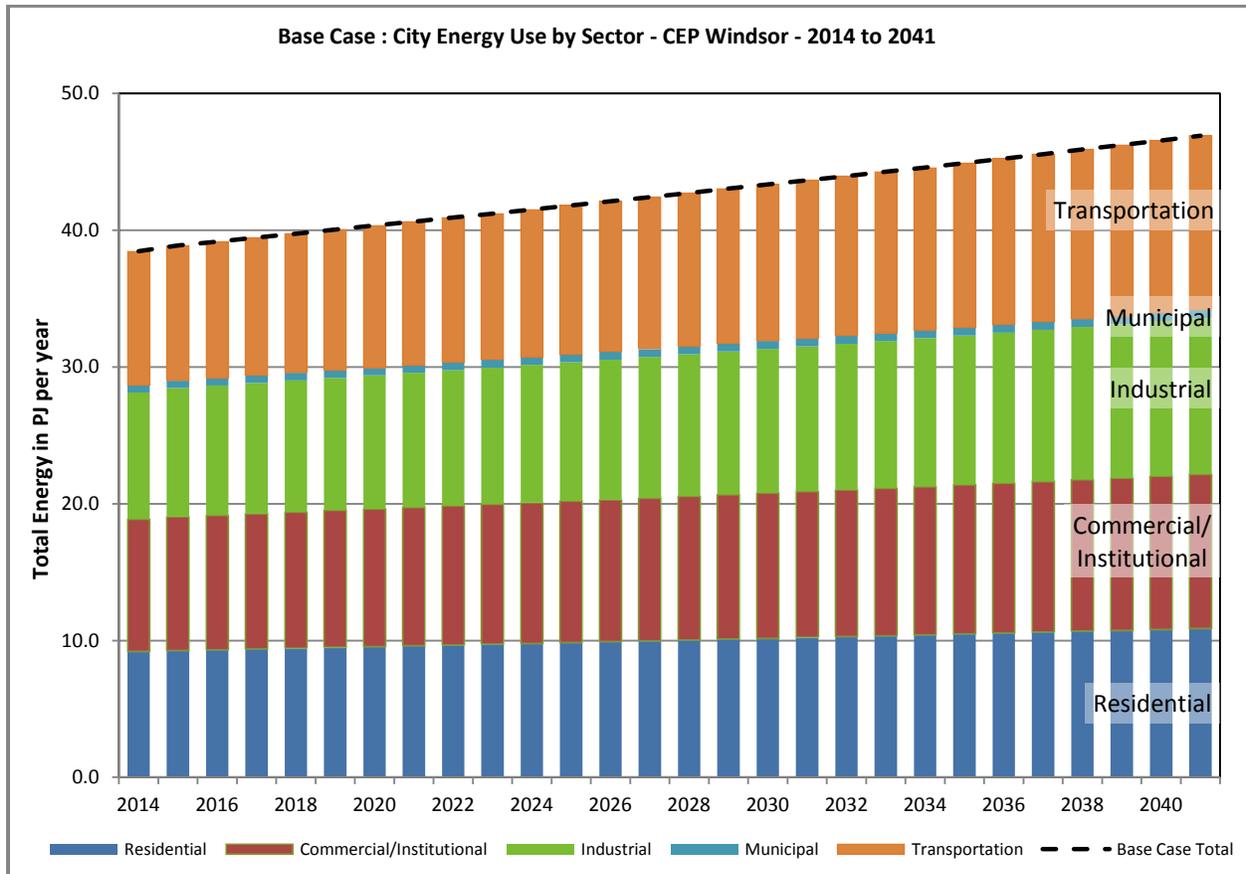


Figure 13: Projected Energy Use by Sector (2014 to 2041)



Projected Energy Use by Utility

The projected energy use by utility and fuel type is presented in Figure 14. There is a gradual steady increase in all fuel types as a result of relatively small projected population and employment growth rates. This suggests that, without any action taken at the local level, energy use in Windsor will increase overall from 38.5 to 46.9 PJ/year (22 per cent). This represents a significant increase in annual electricity use from 9.6 to 11.4 PJ (19 per cent), natural gas from 19.1 to 22.8 PJ (19 per cent), gasoline from 8.8 to 11.4 PJ (30 per cent), and diesel from 1.0 to 1.3 PJ (30 per cent).

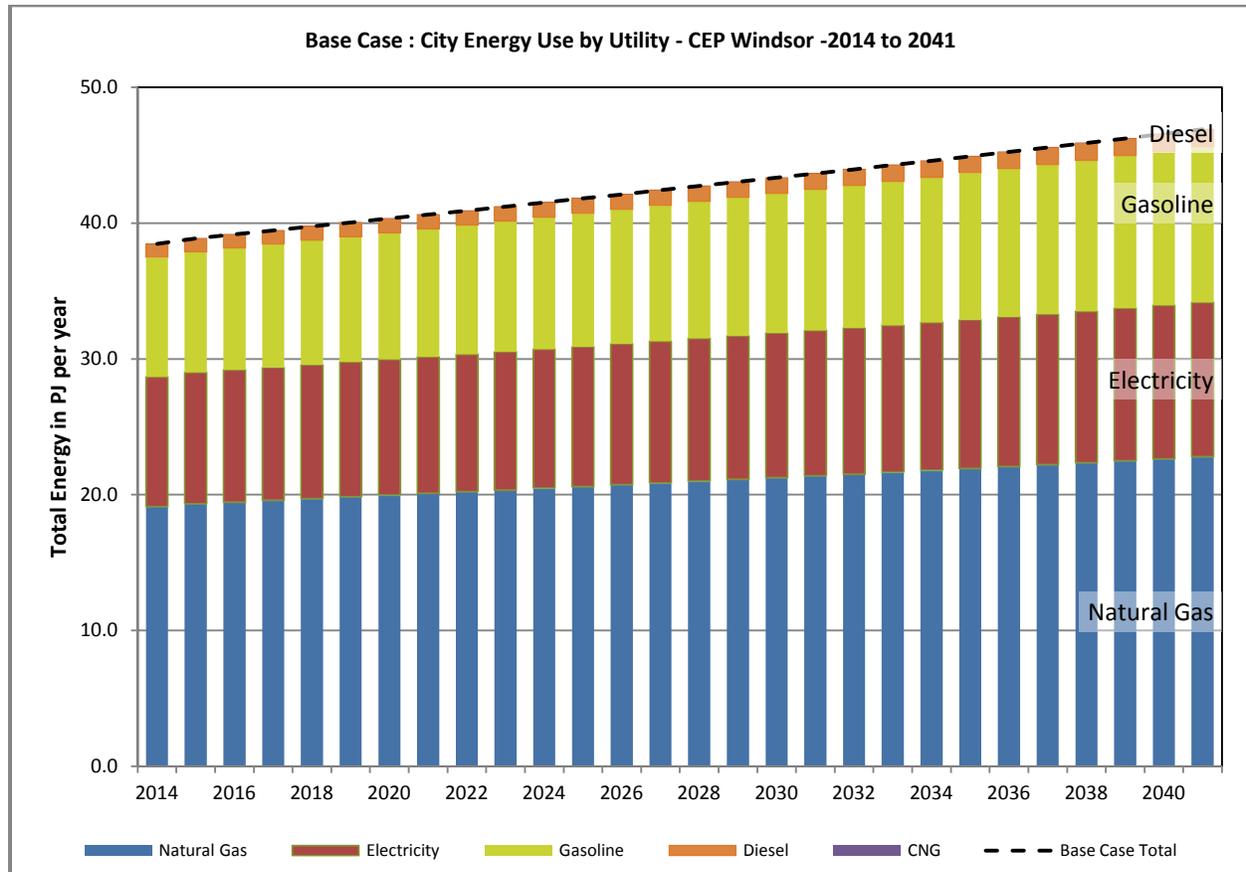


Figure 14: Projected Energy Use by Utility and Fuel (2014 to 2041)

Projected Greenhouse Gas Emissions to 2041

Figure 15 and Figure 16 show total GHG emissions by sector will grow if no action is taken at the local level. Total GHG emissions would increase from 1.85 to 2.2 million Tonnes by 2041 (19 per cent) if no action is taken. The residential sector (22 per cent of total emissions) and non-residential sector (43 per cent) would be expected to remain as the higher emitting sectors. However, the transportation sector would increase its relative proportion given the carbon intensive nature of transportation fuels.

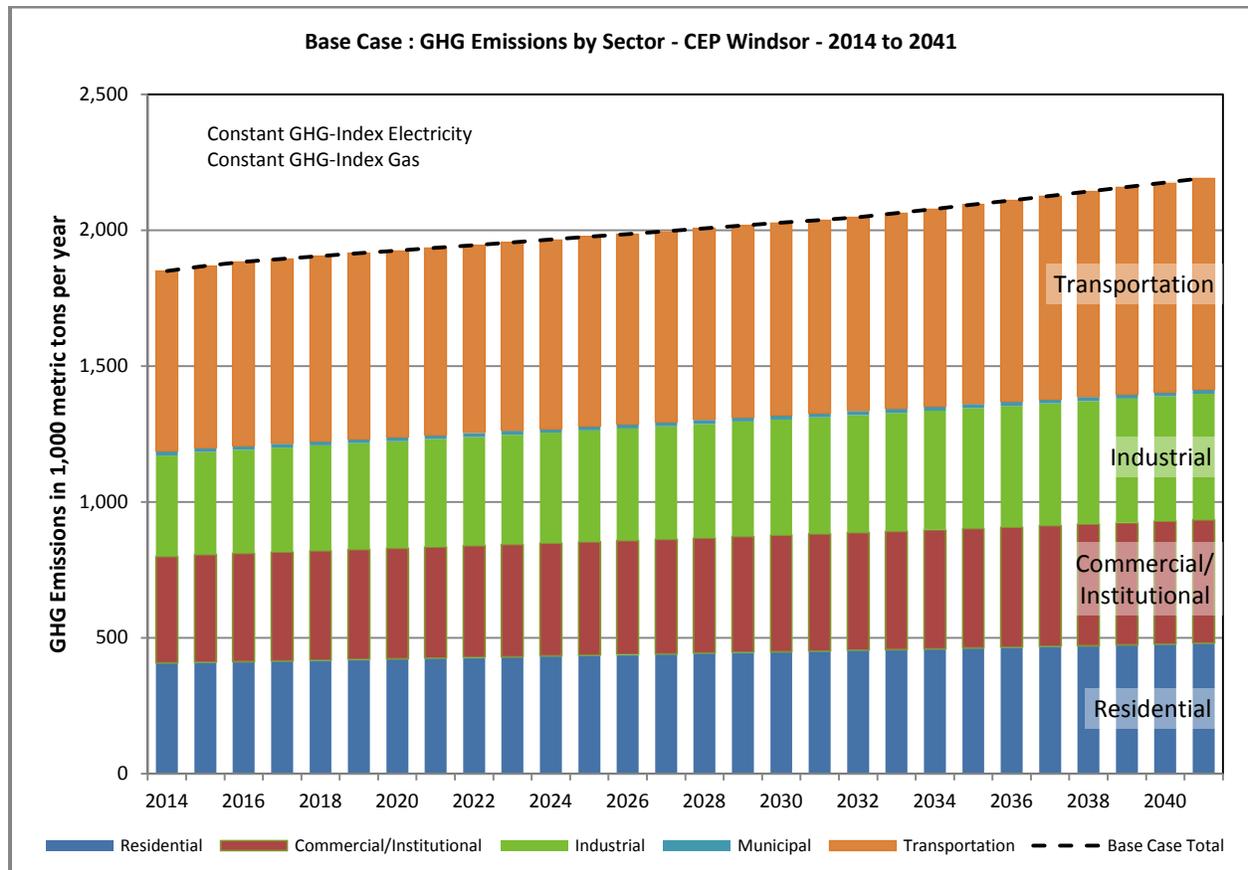


Figure 15: Projected Greenhouse Gas Emissions by Sector (2014 to 2041)

Did You Know?

Total GHG emissions in Windsor would increase from 1.85 to 2.2 million Tonnes by 2041 (19 per cent) if no action is taken.

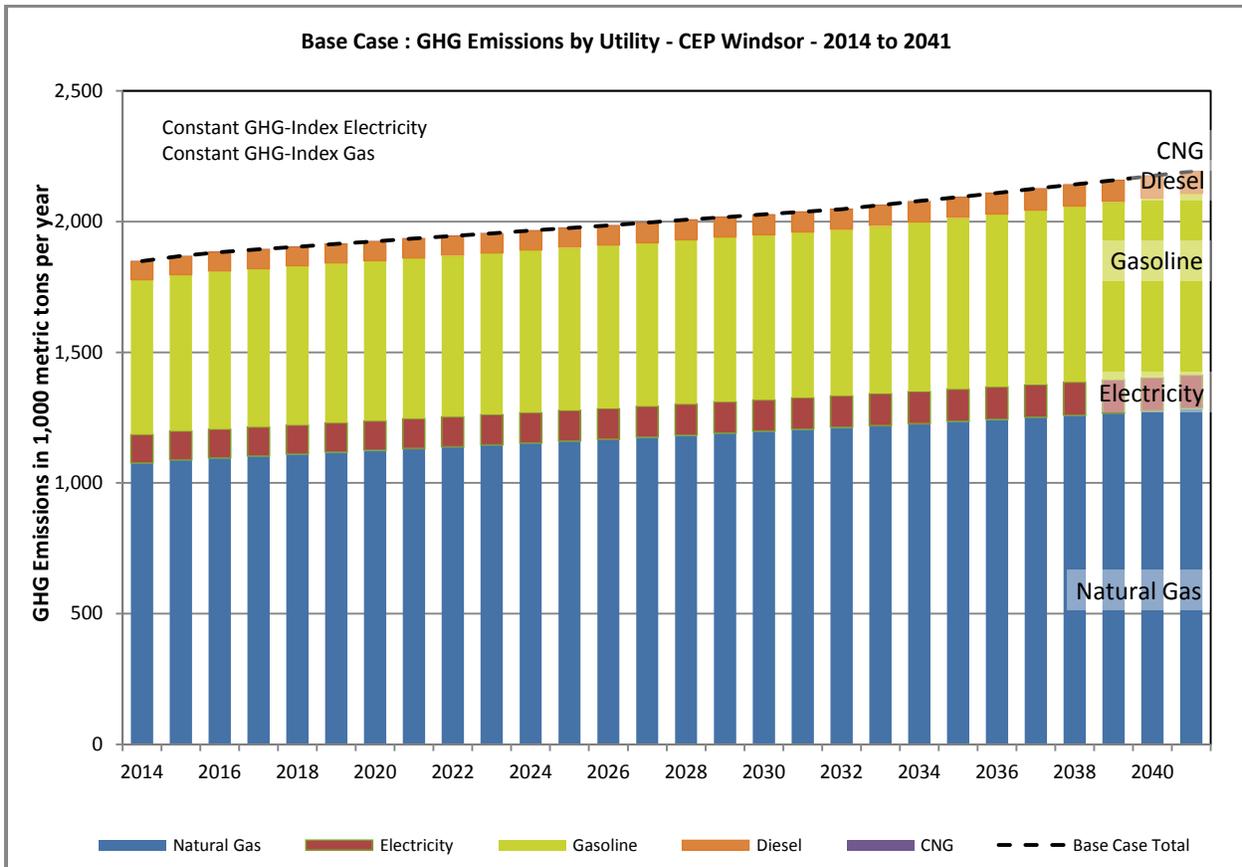


Figure 16: Projected Greenhouse Gas Emissions by Utility and Fuel (2014 to 2041)

Did You Know?

The impacts for Windsor are significant as illustrated with the completion of this community-wide review and future projections. A commitment to action towards addressing energy and emissions now and in the future is imperative. Whether driven by economics, innovation, GHG emission reduction, environmental stewardship, risk mitigation, quality of life, or preparing for future legislation, the basis for proactively addressing energy use in Windsor is strong and the time for action is now.

Chapter 5 - Residential Sector

Background Characteristics of Homes in Windsor



Windsor has a deep and rich history, as embodied in the neighbourhoods that comprise the City. In 1935, Windsor, Sandwich, East Windsor, and Walkerville united to form the City of Windsor. According to the City, “This amalgamation was intended to address the crushing debt and social demands brought by the Great Depression.”³¹ In the 1960s, the City of Windsor further expanded its boundaries and tax base by successfully annexing Riverside, Ojibway, and parts of Sandwich Townships.

What is the Residential Building Profile?

Windsor has historically and continues to be characterized by single detached housing as shown in Figure 17. Single detached homes make up a large percentage (65 per cent) of residential buildings in Windsor. Semi-detached homes and row/townhouses make up a combined 11 per cent, while multi-unit residential buildings (MURBs) make up 24 per cent.

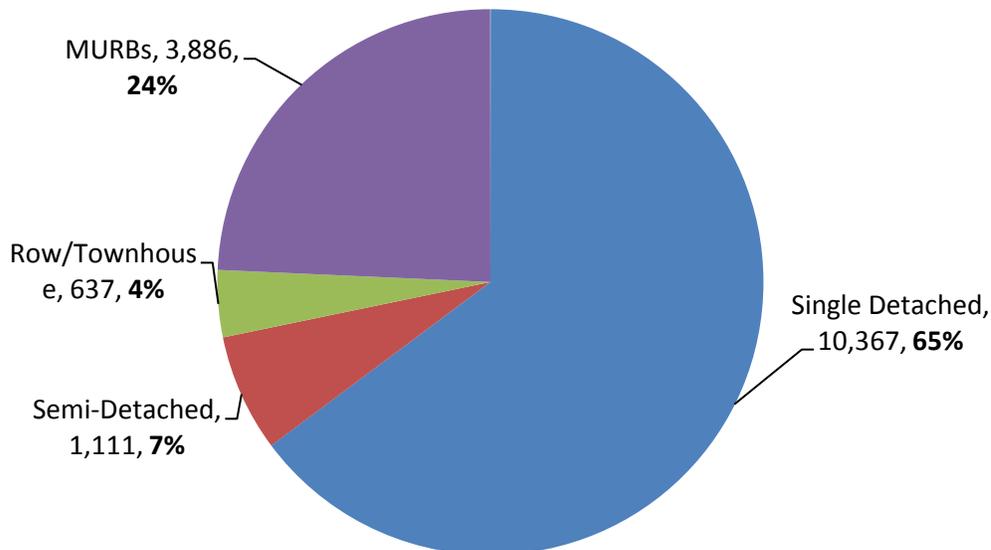


Figure 17: Windsor's Residential Profile (2014)

³¹ City of Windsor, [History of Windsor](#), retrieved Dec. 2016.

According to Statistics Canada, single detached homes have the highest average household energy use in Ontario at 136 GJ per household. This compares to 94 GJ per household for multi-units (including doubles, duplexes, and row/terrace homes) and 33 GJ per household for apartments. At 0.80 GJ/m², single-detached dwellings in Ontario also have higher energy intensity (GJ per m² of heated area) compared to other building types – 0.68 GJ/m² for multi-unit buildings and 0.39 GJ/m² for apartments.³²

How Old are Windsor Homes?

The average year a home was built in Windsor is 1955, which is reflective of the age of the City as a whole. There are a significant number of homes (9 per cent) that are from the pre-1900 to 1930s. During the 1930s, fewer houses were constructed and instead, an increase in the renewal of buildings occurred in the 1940s through to the 1970s. Construction slowed in the 1970s and 80s, and has steadily increased through the 1990s to 2010 (representing 10 per cent of all homes in Windsor) as shown in Figure 18.

Did You Know?

The average age a home was built in Windsor is 1955 and there are a significant number of homes that are from the pre-1900 to 1930s. Older homes have a higher energy intensity than newer homes.

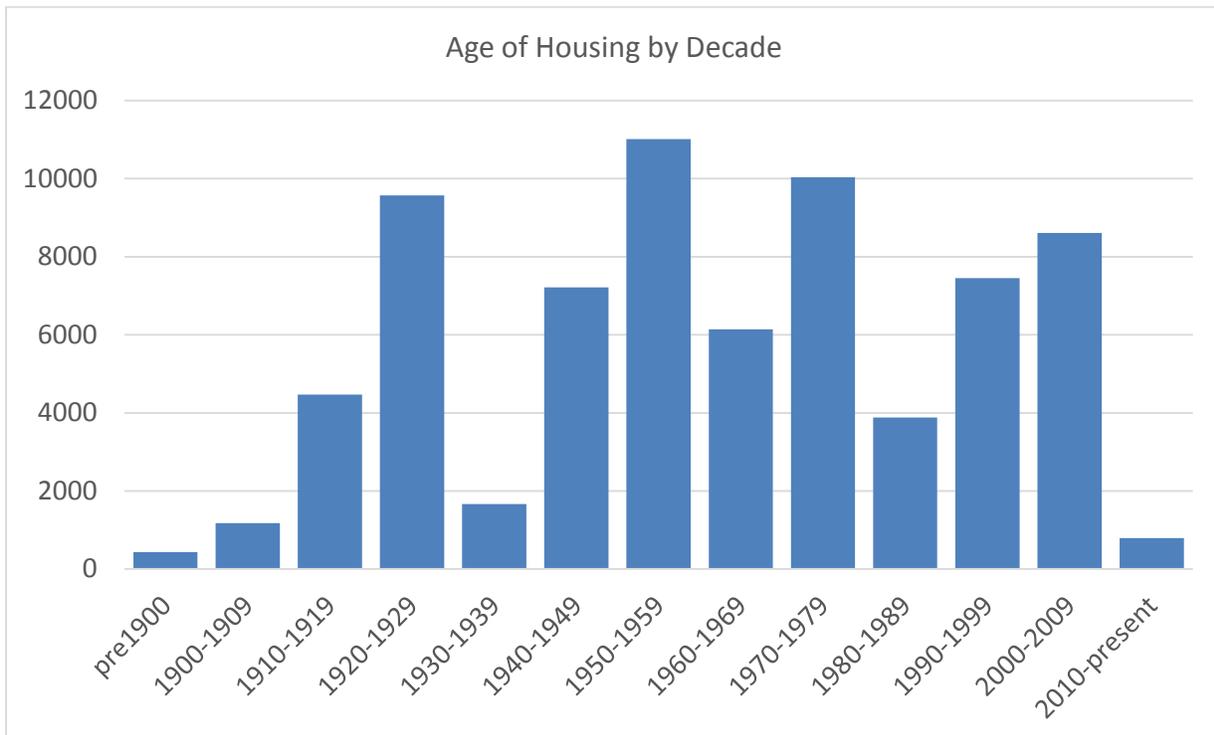


Figure 18: Windsor's Residential Building Age

³² [Statistics Canada](#), 2015.

There are numerous factors that contribute to household energy use, including the cost of fuel, the local climate, and the home’s characteristics, including age, type, and size as well as how it is constructed. According to Statistics Canada, newer homes in Ontario use less energy due primarily to increased energy standards in building construction practices, as shown in Table 3. Homes constructed in the 1990s and more recently tend to be larger in size, accounting for higher average energy per household, although they are more efficient.

Table 3: Average Energy Use per Household in Ontario³³

Year	Average GJ/household
Before 1946	128
Between 1946 and 1960	100
Between 1961 and 1977	108
Between 1978 and 1995	105
1996 or later	119
All households	107

Homes built in 1977 or earlier use on average more energy per household and have an average energy intensity of 0.82 to 0.89 GJ/m² whereas houses built in 1996 or later have an intensity of 0.67 GJ/m².³⁴ Newer homes use less energy per m² of heated area than older dwellings. Modern construction practices and changes to building codes – such as the use of improved insulation and more efficient heating and cooling systems – have contributed to newer homes being more energy efficient.³⁵ The Ontario Building Code is continually updated to increase energy efficiency standards; the current 2012 OBC is considered one of the most energy efficient building codes in North America. The Windsor Census Metropolitan Area (CMA) housing statistics for 2016 show 675 single detached homes and 360 MURBs for a total of 1,035 new housing units.³⁶ New residential housing construction (since 2010) accounts for 0.5 per cent of all residential buildings, making a strong case to focus on the delivery of comprehensive retrofit programs for existing buildings over new construction incentives.



³³ Statistics Canada, 2011.

³⁴ [Statistics Canada](#), 2015.

³⁵ Statistics Canada, 2015.

³⁶ Windsor-Essex Economic Development, Monthly Economic Monitor, November 2015. p.3. Note: Windsor CMA includes the City of Windsor and the Towns of Amherstburg, Lakeshore, LaSalle and Tecumseh.

How Much and Where is Energy Used in the Residential Sector?

The residential sector accounts for 9.2 PJ or 24 per cent of the total energy used in Windsor and is responsible for 407,000 Tonnes CO₂e emissions or 22 per cent of the total GHG emissions in the City.

Energy is used in homes for a variety of purposes, but the single biggest energy use in Ontario homes is space heating, followed by water heating as shown in Figure 19. Space heating and hot water heating in Windsor homes is predominantly supplied by natural gas (90 per cent); however there is one neighbourhood with baseboard electric heating (10 per cent). Electricity for cooling is a relatively small part of the energy use of homes in Ontario. This is partly caused by the fact that the end-cooling energy is typically 4 to 5 times more than the electricity used, and that many older homes do not have air-conditioning. Research conducted by the Fraser Institute indicates that Ontarians spend on average approximately 2.6 per cent of their total household income on in-home energy costs, and when the costs of gasoline are added the average is approximately 5.9 per cent of total household income.³⁷

Identifying solutions that reduce the amount of energy used for heating purposes will provide the biggest benefit for homeowners while contributing to achieving the overall community vision and goals of the CEP.

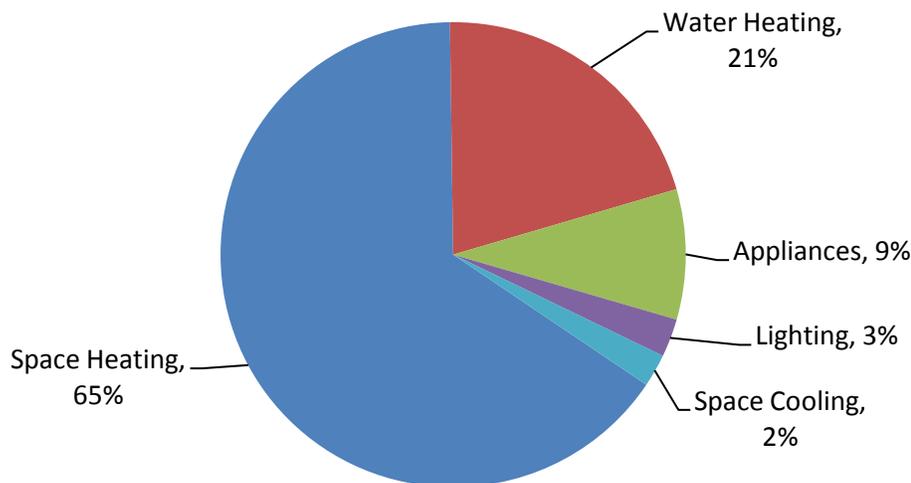
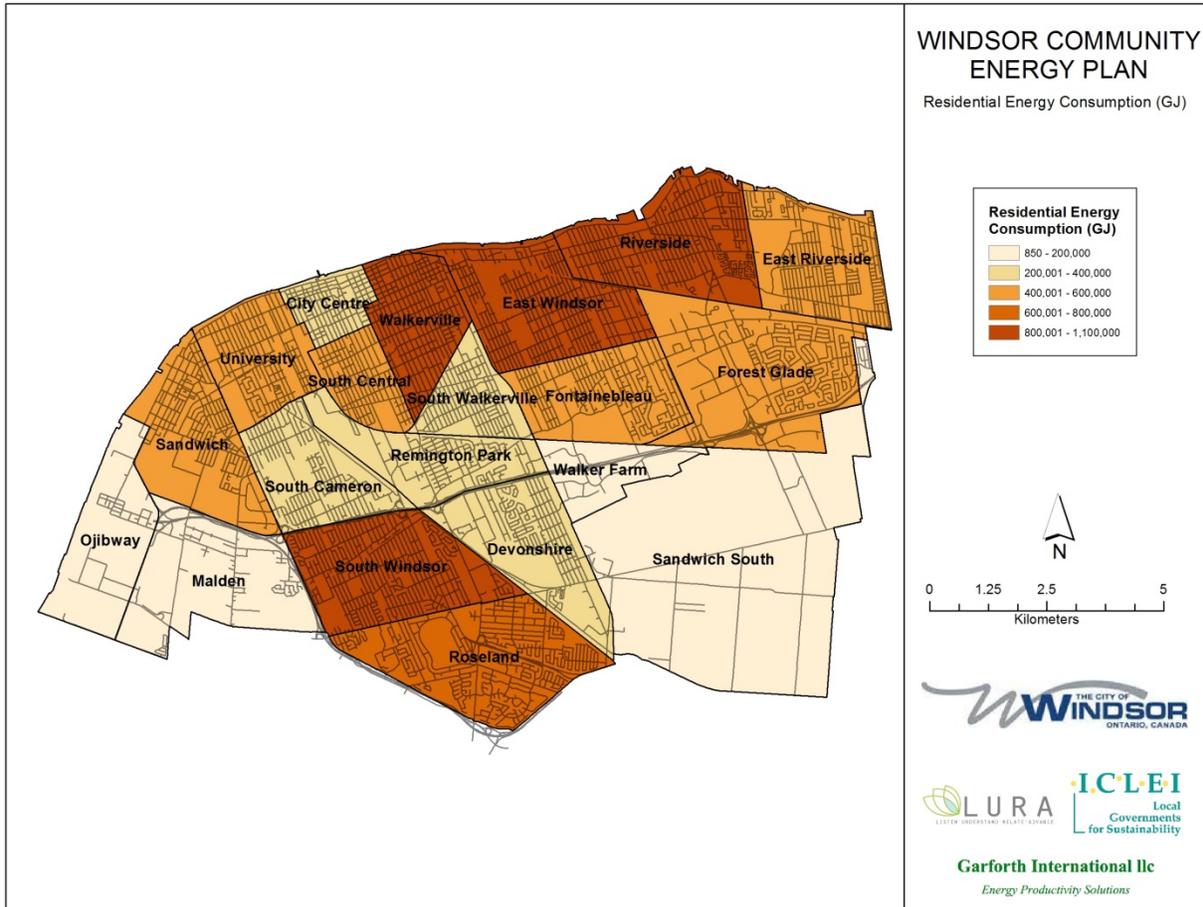


Figure 19: Energy Use in Homes in Residential Sector in Ontario (2013)³⁸

³⁷ Kenneth P. Green, Taylor Jackson, Ian Herzog and Milagros Palacios. Fraser Institute. (2016) Energy Costs and Canadian Households: How Much Are We Spending? Table 2: Energy spending as a percent of total household spending. p.8.

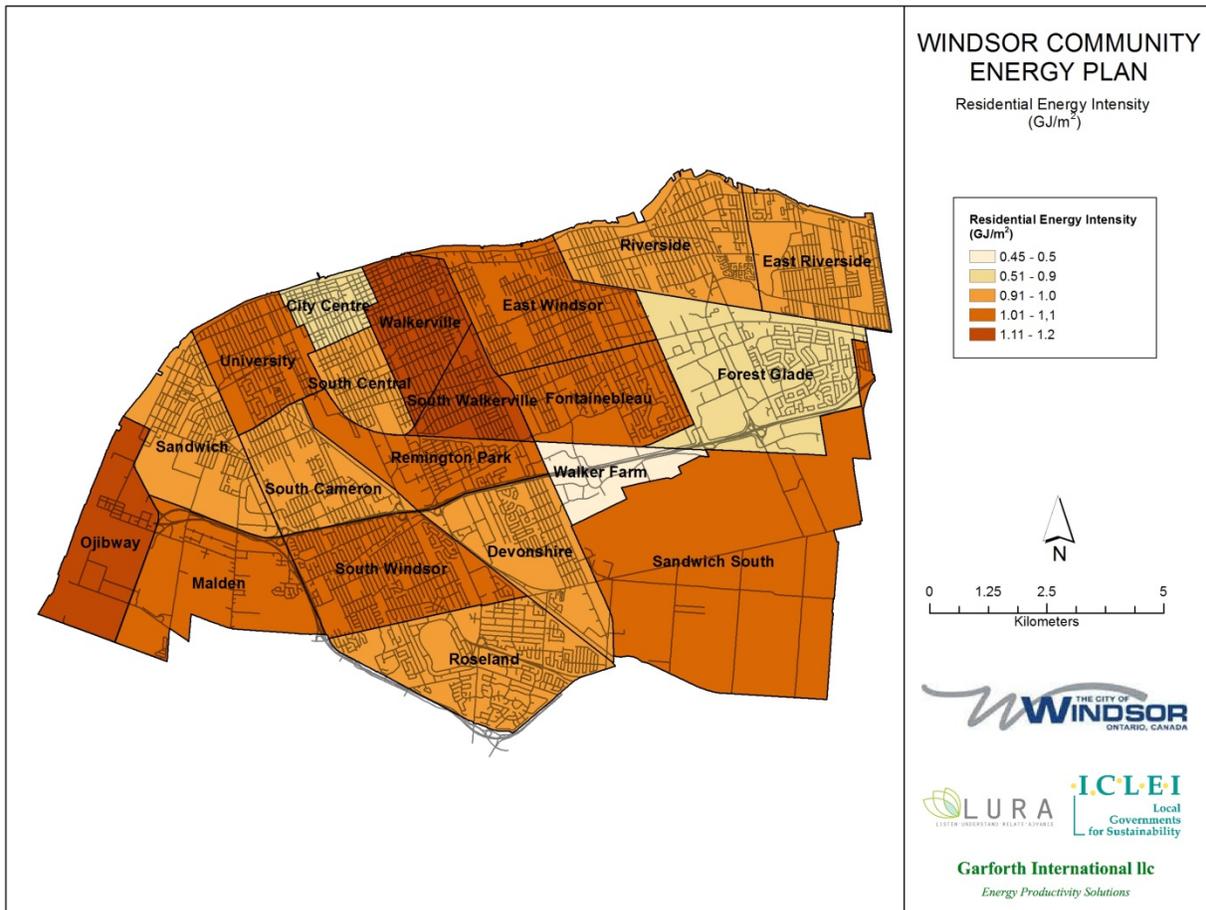
³⁸ Statistics Canada, 2015. Extracted from Residential Sector, Ontario¹ Table 2: Secondary Energy Use and GHG Emissions by End-Use.

Map 6 illustrates the total energy use across the City for homes, apartments, and condos. The neighbourhoods of South Windsor and Roseland show the highest total energy use, followed by Walkerville, East Windsor, and Riverside. As noted previously, these five neighbourhoods together contain nearly 50 per cent of the housing stock in Windsor. Total energy use provides one of the key pieces of information to begin to plan for residential retrofit strategies.



Map 6: Total Residential Energy Use (GJ) (2014)

The second key piece of information is the energy intensity of these neighbourhoods. Map 7 shows that energy intensity (the amount of energy used per gross floor area) is fairly high across the City. This is primarily due to the overall age of the housing stock in Windsor, suggesting that residential retrofits can occur City-wide, without the need to target specific neighbourhoods. Walker Farm has particularly low residential energy intensity as it is predominantly industrial with few houses within the neighbourhood. City Centre and Forest Glade's energy intensity values are lower than other neighbourhoods as well. City Centre's lower than average energy intensity can be attributed to the fact that there are more MURBs in the neighbourhood, while Forest Glade's overall residential intensity values are influenced by the amount of industrial activity that is occurring in the neighbourhood.



Map 7: Residential Energy Intensity (GJ/m²) (2014)

Recommended Strategies for Homes

The following four strategies are recommended for homes in Windsor:

1. Create a Deep Retrofit Program for Existing Homes;
2. Continue to Ensure Compliance with the Ontario Building Code for New Residential Development;
3. Integrate Energy Performance Labelling for Homes and Buildings; and
4. Create a Net Zero Neighbourhood as an Opportunity for Transformative Change at the Neighbourhood Scale.

Each strategy is described in more detail below.

Strategy 1: Create a Deep Energy Retrofit Program for Existing Homes



The recommended approach for Strategy 1 includes:

Description: The residential retrofit program is a voluntary program for those homeowners who are looking to increase the value of their property (or rental value), improve their home comfort, and decrease their energy costs. The retrofit program is designed to offer a standardized set of home retrofit packages to address the most common high energy uses in the home (i.e. space heating, insulation, appliances, water heating, windows, etc.). Other options beyond the core package could include: reroofing, solar PV/thermal, ground source heat pumps, etc. Standardizing the retrofit package means there is no need to conduct energy audits, but rather participants are eligible if they meet set criteria relating to retrofits already completed on their home. The packages are complete and address all aspects of energy use in the home, unlike the small-scale upgrades offered by traditional rebate programs. The energy cost reduction in the first year would typically be at least as high as the annual payment to fund the retrofit.

Did You Know?

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, energy efficient appliances, etc.

- **Target Participation Level:** The program would aim to have 80 per cent of all homes (single detached, semi-detached and MURB) participate by 2041. The program would be designed to allow for a gradual ramp up for delivery, starting with about 325 homes per year with a goal to increase to 2,500 retrofits per year for a total of 51,750 retrofits per year completed by 2041. The detailed program design would require flexibility to begin the program with fewer participating homes to ramp up to full scale.
- **Energy and GHG Emission Reduction Potential:** The deep energy retrofit program aims to improve energy efficiency by 30-50 per cent depending on the age and size of the home. This would result in 3.2 PJ or 29 per cent energy reduction and 145,000 Tonnes or 30 per cent GHG emission reductions in the community by 2041.
- **Program Design:** The program is designed to use standardized retrofit packages that are quality controlled and offered at standardized prices.

A program administrator is responsible for promoting the program, screening applicants, training contractors, assigning contractors from a prequalified list, ensuring quality control, fostering positive relationships with homeowners and participants, and managing the funding and financing. The program boosts local employment opportunities by teaming with local contractors and material suppliers. Wherever possible the existing energy efficiency programs

from EnWin and Union Gas would be blended into the deep retrofit package and package pricing.

Contractors deliver the service and provide competitive pricing since they have a steady stream of work. New local jobs are created to complete the retrofits, manage services, and administer the program. There is a need for qualified, trained contractors to deliver the program in Windsor. This would create new skillsets, employment and expertise in the community that are transferable to similar programs across Ontario, Canada and internationally. There is an emphasis on buying local products and materials where possible.

Private investors provide investment for some initial start-up costs and capital for financing retrofits.

- **Funding Mechanism:** Recently, the province has made changes to the *Municipal Act, 2001* that allow municipalities to use local improvement charges (LIC) through Infrastructure Ontario's Loan Program to fund renewable energy and energy improvements on public or private properties.

The program is designed to use the Local Improvement Charges (LIC) mechanism to leverage funds for implementation. Participation is voluntary and is cost neutral or cost positive from inception. Should a homeowner wish to participate, they enter into an agreement with the City to apply the LIC as a specific charge to their property tax bill. The LIC charge would be removed once the cost of the retrofit is recovered. The LIC is linked to the property itself, not the individual property owner. Unlike a home equity loan which is tied to the borrower and the borrower's credit rating, the LIC is related to the property and the pooled property tax collection risk of the City. The LIC model should establish a self-financing solution and therefore there is no ongoing cost to the City. Therefore, if the home is sold, the LIC continues with the new home owner until the full value is recovered, reducing the risk to the City.³⁹ Obviously, the energy efficiency value will be greater from retrofitting older less efficient properties and the marketing will emphasize this. However, the market uptake will ultimately be decided by consumers.

- **Potential Delivery Agent:** It is recommended that a new entity be created to serve as the program administrator and lead the detailed design, business plan development and ultimately administer the residential retrofit program. The program delivery organization could take a number of legal forms: (1) The entity could be a wholly owned City department or municipal corporation; (2) It could equally be an extension of the non-regulated activities of EnWin; (3) it could be a public/private partnership; or (4) the same entity could lead the design, delivery and administration of both the residential and commercial retrofit program.⁴⁰

³⁹ LIC Primer: Using Local Improvement Charges to Finance Residential Energy Upgrades, Sonja Persram, Sustainable Alternatives Consulting Inc. for CHEERIO, 2013.

⁴⁰ Please note this is a suggested option given EnWin's current role. The final delivery agent will be defined as part of the development of a business plan for implementation.

- **Timing:** The goal is to start the retrofit program in 2018.
- **Benefits:**
 - **Homeowners:** Increased property or rental value, improved home comfort, reduced energy costs, and a favourable funding mechanism with more predictability and lower costs than a home equity loan.
 - **Delivery agent:** Low management costs, leadership role, and creation of a template or model applicable in other communities.
 - **Contractors:** Predictable high-volume retrofit project flow and significantly improved margins. Contractor overheads often exceed 35 per cent, however by creating volume and standardized packages, overhead will drop and net margins will increase.
 - **Windsor community:** High quality employment, community economic development, improved neighbourhoods, reputation, and housing and building affordability.
 - **Investors:** Acceptable returns and low risk investment.
 - **Property Market:** Availability of Energy Performance Labels when a property is sold or rented creates market transparency on energy efficiency in the local property market.

Did You Know? Other Communities Well on Their Way

The **Collaboration on Home Energy Efficiency Retrofits in Ontario (CHEERIO)** program has implemented a pilot project to assess the effectiveness of LIC financing as a tool for deep residential energy retrofits while designing communication tools, a monitoring and evaluation framework, and sharing guidance to help achieve full-scale implementation.

Guelph Energy Efficiency Retrofit Plan (GEER) encourages residents to make energy efficiency improvements to their homes by retrofitting insulation, windows, weatherizing, climate control devices, furnaces, air conditioners, and heat recovery systems. The upfront costs of these retrofits are paid through the program, making the investment affordable for most homeowners. The homeowner then repays these costs over a 5 to 25-year period at low interest rates through special monthly charges on their tax bill (i.e.: LIC). If the homeowner sells their property before the cost of the retrofit is fully paid off, the new homeowner assumes responsibility for making the remaining payments. Program participants benefit from the energy upgrades and related energy cost savings. The program also benefits the local economy by creating jobs for contractors and equipment suppliers while at the same time reducing GHG emissions. The GEERS program will be pilot tested amongst 20 homes in 2018.

Strategy 2: Continue to Ensure Compliance with the Ontario Building Code for New Residential Development

The following is the recommended approach for Strategy 2:

- **Description:** New residential development is occurring in Windsor at a rate of approximately 1 per cent /year. The proposed strategy is to continue to ensure new development complies with the most current Ontario Building Code (OBC). Additional adjustments to the OBC are coming into effect in early 2017. These changes are proposed to achieve a further 15 per cent energy efficiency beyond those achieved through the 2012 OBC energy efficiency requirements.⁴¹ It is anticipated that future adjustments to the OBC will be made in 2019, 2024 and 2029, each with 5 per cent efficiency gain on the previous version as the OBC continues to move towards net-zero buildings in the future.

This strategy focuses on allowing the residential development marketplace to continue to implement stepwise improvement in the energy efficiency of new residential buildings that are 100 per cent compliant with the 2012 OBC and subsequent building code updates.

- **Target Participation Level:** 100 per cent of new residential buildings.
- **Energy and GHG Emission Reduction Potential:** In an ideal world, all new construction would meet OBC code efficiency. In reality this is often not the case. Transparency from energy performance labeling (see Strategy 3) ensures this will happen and through market awareness typically pushes customers to understand and ask for above code performance.
- **Program Design:** It is anticipated that market transformation towards net zero new construction will occur primarily as a result of updates to the OBC.

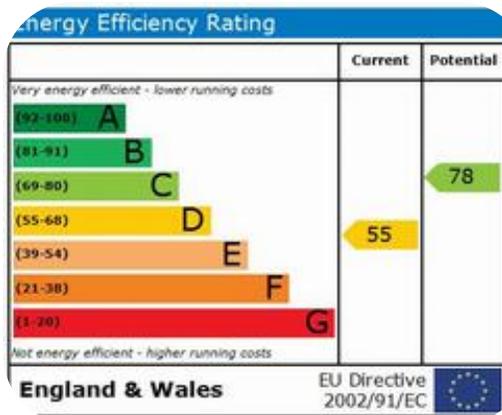
The City's role will be to continue to ensure compliance with the OBC for all new homes constructed in the municipality. The City can also accelerate transformation through changes to policy documents, creation of sustainable development guidelines and/or the application of market-based tools.

- **Funding Mechanism:** N/A.
- **Potential Delivery Agents:** Home builders, developers, real estate agents, and City role in compliance.
- **Timing:** Ongoing.
- **Benefits: Homeowners:** Achieve full value for money spent on a new home supported by transparent energy performance labels.

⁴¹ MMAH Supplementary Standard SB-12, Energy Efficiency for Housing, Draft for Stakeholder Feedback.

Enabling Strategies to Foster Greater Home Efficiency

Strategy 3: Integrate Energy Performance Labelling for Homes and Buildings



Energy Performance Labelling (EPL) is a low-cost tool that can help share the energy performance of all buildings. The MOE has indicated that it is looking to move in the direction of energy performance disclosure with proposed amendments to the *Green Energy Act, 2009* that aims to include energy performance disclosure for large buildings. It is recommended that EPLs be available on all homes before and after retrofit and particularly at the point of sale or rental so that occupants can understand the energy efficiency of the home before entering agreement for purchase or rental.

It is also recommended that EPLs be available on all commercial and public buildings in Windsor, which can begin at any time, and provides an opportunity for leadership and early examples for the rest of the community. EPLs may also be considered for industrial facilities. EPL provides a low-cost performance validation and transparency tool. It is recommended that Windsor use the Natural Resources Canada (NRCan) EnerGuide Rating System as its performance measurement tool and use an independent certification process.

For both homes and buildings, the EPL should be a simple statement of performance based either on known energy use, or observed building condition. The EPLs would typically be issued by private contractors with recognized capability, hired by the property owner or manager. The goal should be to make the labels meaningful, cost efficient and convenient for both the buyer and seller. The experience of markets that have had EPLs in use for many years should be used to inform the final program design.⁴²

Some of the benefits of including EPLs on buildings are:

- Transparency regarding the overall energy performance of a building when a new or existing home/building is being purchased, sold, or rented;
- An incentive to invest in upgrades to inefficient homes and buildings before putting the home on the market;
- Increased home and building values; and
- Acts as a real estate marketing tool similar to others such as WalkScore.⁴³

⁴² Among others, these include all member states of the EU and Japan. Extensive background on the EU is available from the European Commission <https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings>.

⁴³ www.walkscore.com.

Enabling Strategy 4: Create a Net Zero Neighbourhood as an Opportunity for Transformative Change at the Neighbourhood Scale

Many cities in Canada and around the world are seizing the opportunity to plan neighbourhood scale developments as Net Zero Energy areas. These neighbourhoods create as much energy in a typical year as they consume. They are viewed as desirable places in which to live and work and result in premium property prices and rents.

Greenfield lands and large redevelopment sites represent opportunities to plan and design Net Zero neighbourhoods.

It is recommended to develop a neighbourhood energy and climate concept that may include the following:

- Orientation and education for all stakeholders;
- Land-use plan with emphasis on walkable mixed-use areas that reduce vehicle use;
- Access to community transit within and beyond the net-zero neighbourhood that reduce individual vehicle use;
- Construction efficiency standards to near passive or net-zero house levels;
- Urban design and policies to maximize use of zero emissions vehicles of all types;
- Urban design encouraging “complete streets” that encourage walking and minimize vehicle use;
- Consider creating a special purpose Multi-Utility Company managing integrated smart networks providing electricity, district heating, cooling, water and waste water supply and distribution services; and
- Financial incentives.



Chapter 6 - Commercial and Institutional

Background Characteristics of the Commercial Businesses and Public Sector in Windsor



What is the Commercial and Public Sector Building Profile?

The commercial sector is comprised of office (27 per cent of the total), retail (19 per cent), schools (15 per cent), accommodation (5 per cent), as well as hospitals, restaurants, warehouses, and other, as shown in Table 4.

Table 4: Windsor's Commercial and Institutional Buildings Profile

Commercial and Institutional Building Type	# of Units	GFA	Percentage of Total (%)
Hotel or Motel	47	534,467	5.6
Office (non-medical)	838	2,441,262	25.8
Medical Office Building	58	133,091	1.4
Non-food Retail Store	640	1,477,424	15.6
Food or Beverage Store	136	336,861	3.6
Restaurant	177	215,628	2.3
Other	559	1,494,250	15.8
Warehouse	113	360,992	3.8
Elementary or Secondary School	99	1,467,985	15.5
Hospital	4	289,587	3.1
Nursing or Residential Care Facility	25	235,131	2.5
University and College	24	260,126	2.7
Municipal	129	226,344	2.4
Total	2,849	9,473,148	100

Employment in the commercial sector is diverse in Windsor. There are numerous small to medium size businesses operating in and around the city as show in Table 5 including over 68 per cent with fewer than 10 employees.

Table 5: Business Size Profile in Windsor (2011)

	Number of Businesses -June 2015	Percentage of Companies with Employees (%)
Without employees	9659	
Total, with employees	6033	
1 to 4	2897	48.0
5 to 9	1230	20.4
10 to 19	879	14.5
20 to 49	650	10.8
50 to 99	202	3.4
100 to 199	96	1.6
200 to 499	52	0.9
500 +	27	0.5

Source: Canadian Business Patterns, Statistics Canada

The top commercial and public sector employers (excluding the manufacturing sector as covered under the industrial chapter) are shown in Table 6.

Table 6: Major Commercial and Public Sector Employers in Windsor (2011)

Company Name	Type of Business
University of Windsor	University
Greater Essex County District School Board	Primary and Secondary Schools
Windsor Regional Hospital	Hospitals
City of Windsor (Including Police)	Municipal Government
Windsor Essex Catholic District School Board	Primary and Secondary Schools
Caesars Windsor	Casino
Hotel Dieu Grace Hospital	Hospitals
Sutherland Group Canada	Call Center
St. Clair College of Applied Arts & Technology	College
Canada Border Services Agency	Federal Government
Green Shield Canada	Insurance
Conseil Scolaire de District des Ecoles Catholique	Primary and Secondary Schools

Windsor is home to numerous public sector buildings owned and operated by the University of Windsor, Windsor-Essex Catholic District School Board, Greater Essex County District School Board (collectively representing 56 elementary, 16 secondary, and 2 post-secondary within the city boundary), Windsor Regional Hospital, long-term care facilities, and municipal buildings. Public sector agencies such as these are required to report annually on their overall energy use through the *Green Energy Act*. Figure 20 shows an energy performance disclosure process underway through the Environmental Commissioner of Ontario's Interactive Map that illustrates the energy use of over 15,000 public sector buildings across the province using their 2011-2013 *Green Energy Act* reporting data.⁴⁴ The map shows larger sized dots for high energy intensity buildings, and smaller dots for those with lower intensity. Green dots represent schools, colleges, universities, and libraries; red dots represent administrative buildings, storage, and water and wastewater treatment; blue dots represent hospitals and emergency response; and orange dots represent community, sports, and recreational facilities.

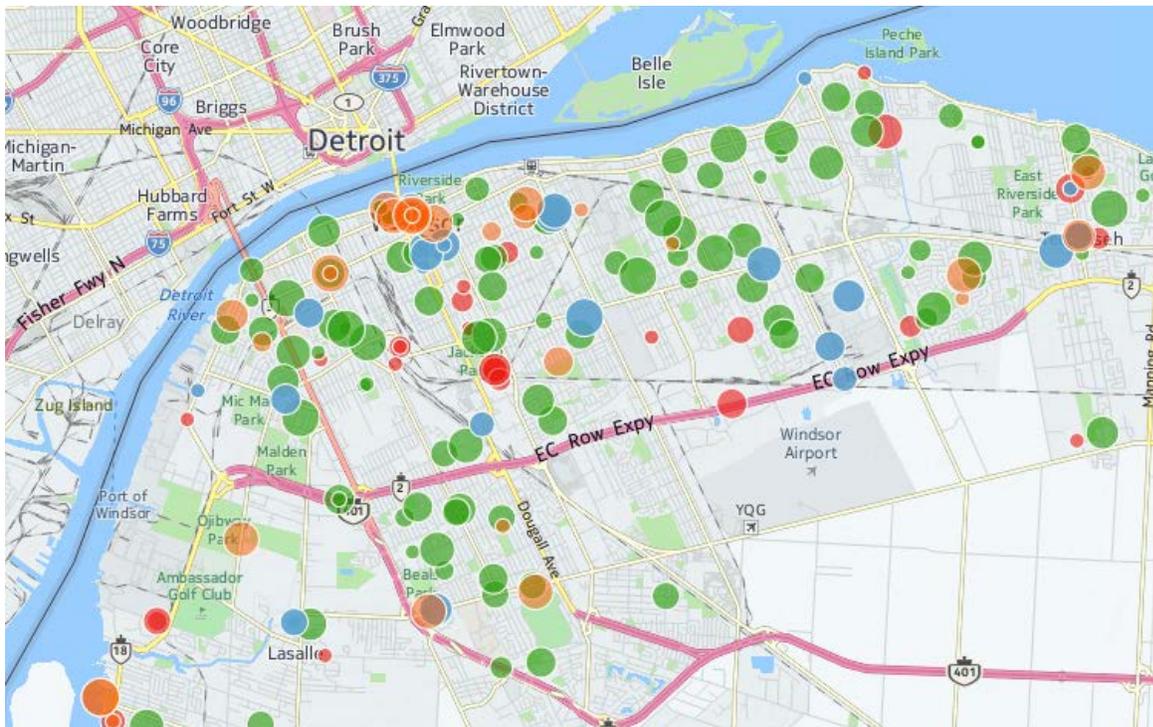


Figure 20: Energy Use by Public Sector Buildings in Windsor Reporting through the GEA (2014)

In terms of new construction, there has been growth in the commercial sector. According to WE EDC data, the Windsor CMA shows 2016 year-to-date building permits for industrial, commercial and institutional were valued at \$31.1 million, \$74.5 million, and \$74.2 million respectively for a total of \$153 million dollars of investment. This is a slight downward trend in the amount of residential sector

⁴⁴ Environmental Commissioner of Ontario, [Energy Consumption Across Ontario's Broader Public Sector Buildings Interactive Map](#), 2016.

investment (< \$4million), and industrial investment (<\$39 million) compared to 2015; however the commercial sector investment trends upwards (> \$4million) compared to the 2015 data.⁴⁵

How Much and Where is Energy Used in the Commercial and Institutional Sector?

The commercial and institutional sector accounts for 10.2 PJ or 26 per cent of the total energy used in Windsor and is responsible for 407,000 Tonnes CO₂e emissions or 22 per cent of the total GHG emissions in the city.

Businesses and public sector buildings (schools, university, health care, and municipal buildings) use energy for space heating, water heating, lighting, as well as cooling and equipment, as shown in Figure 21. Electricity used for cooling is a relatively small part of the energy use.

Did You Know?

The commercial and institutional sector accounts for 10.2 PJ or 26 per cent of the total energy used in Windsor and is responsible for 407,000 Tonnes CO₂e emissions or 22 per cent of the total GHG emissions in the city.

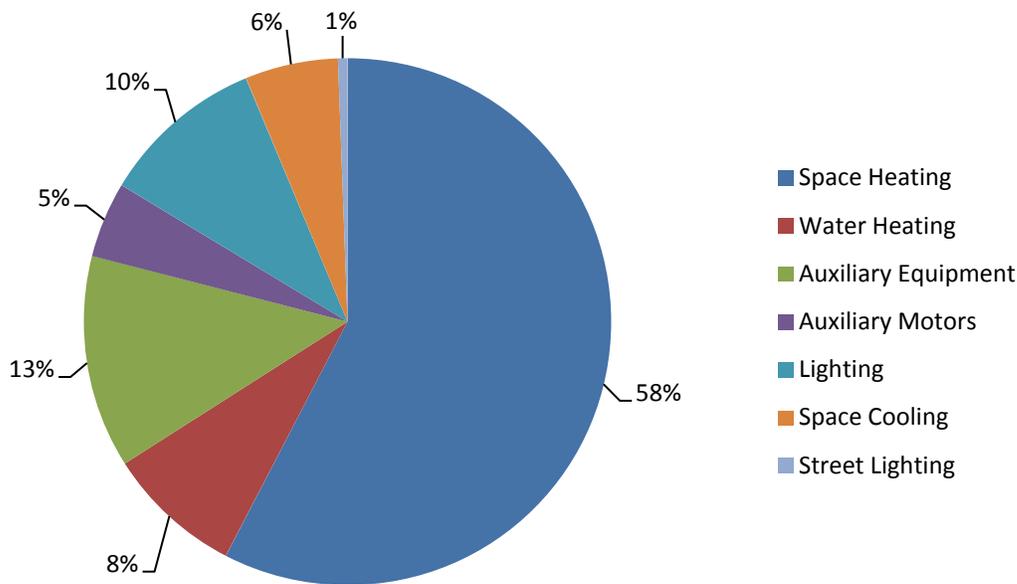


Figure 21: Energy Use in the Commercial and Institutional Sector (2013)

Across Ontario in 2014, commercial, institutional, and public buildings used 16 per cent of the total energy in the province, primarily for natural gas (60 per cent), electricity (31 per cent), propane (3 per cent), oil (2 per cent), and gas and diesel (4 per cent) as shown in Figure 22.⁴⁶

⁴⁵ Windsor-Essex Economic Development, Monthly Economic Monitor, November 2015. p.4. Note: Windsor CMA includes the City of Windsor and the Towns of Amherstburg, Lakeshore, LaSalle and Tecumseh.

⁴⁶ Environmental Commissioner of Ontario. Conservation: Let's Get Serious, p.60.

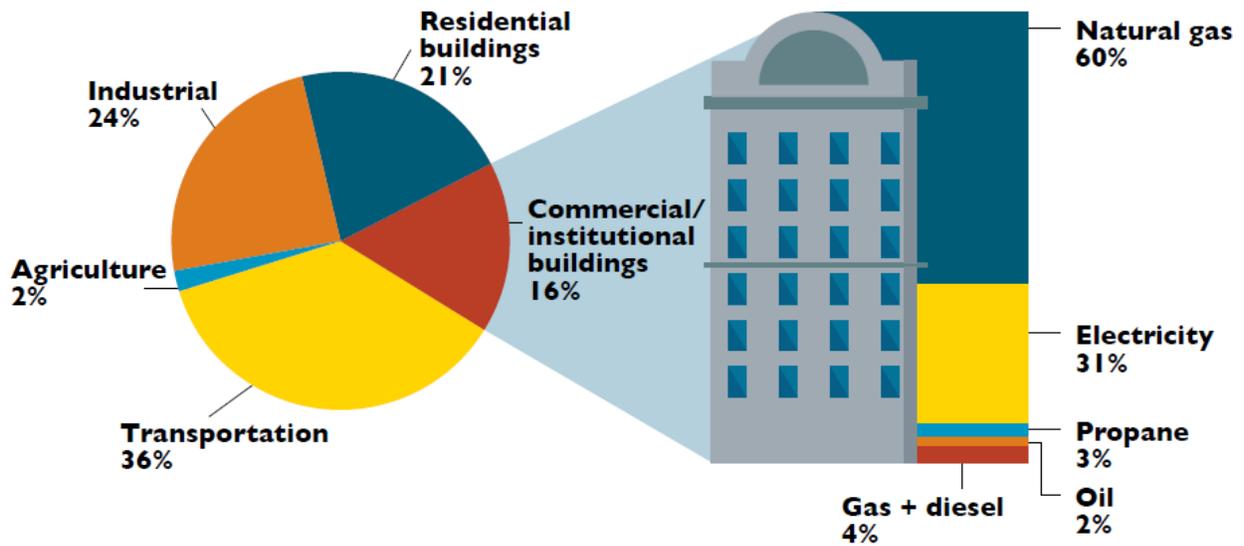
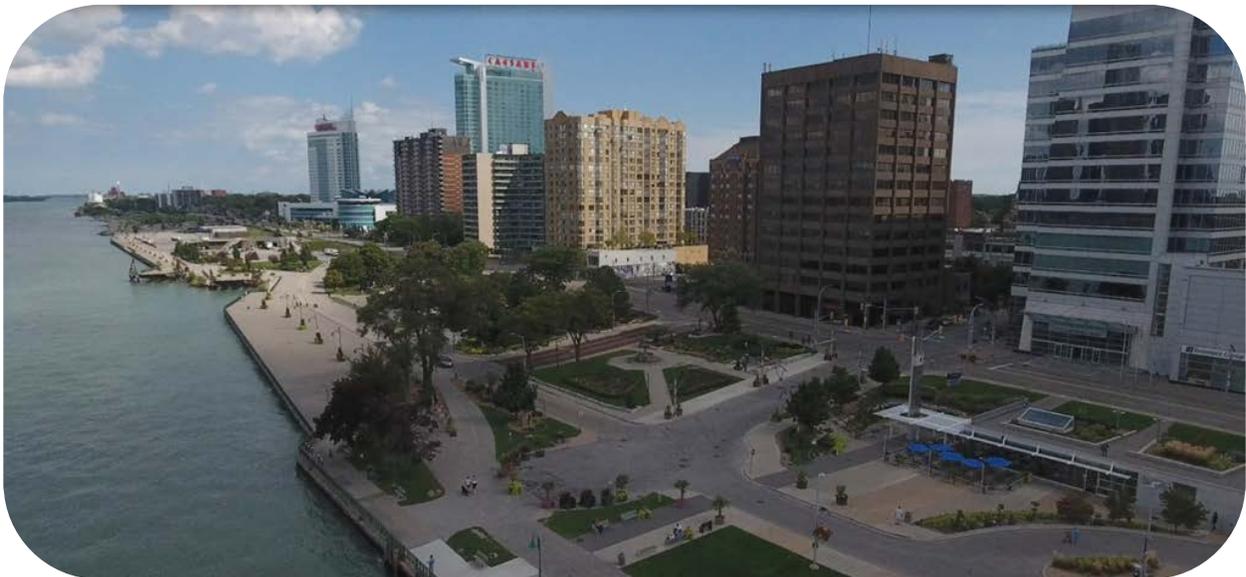
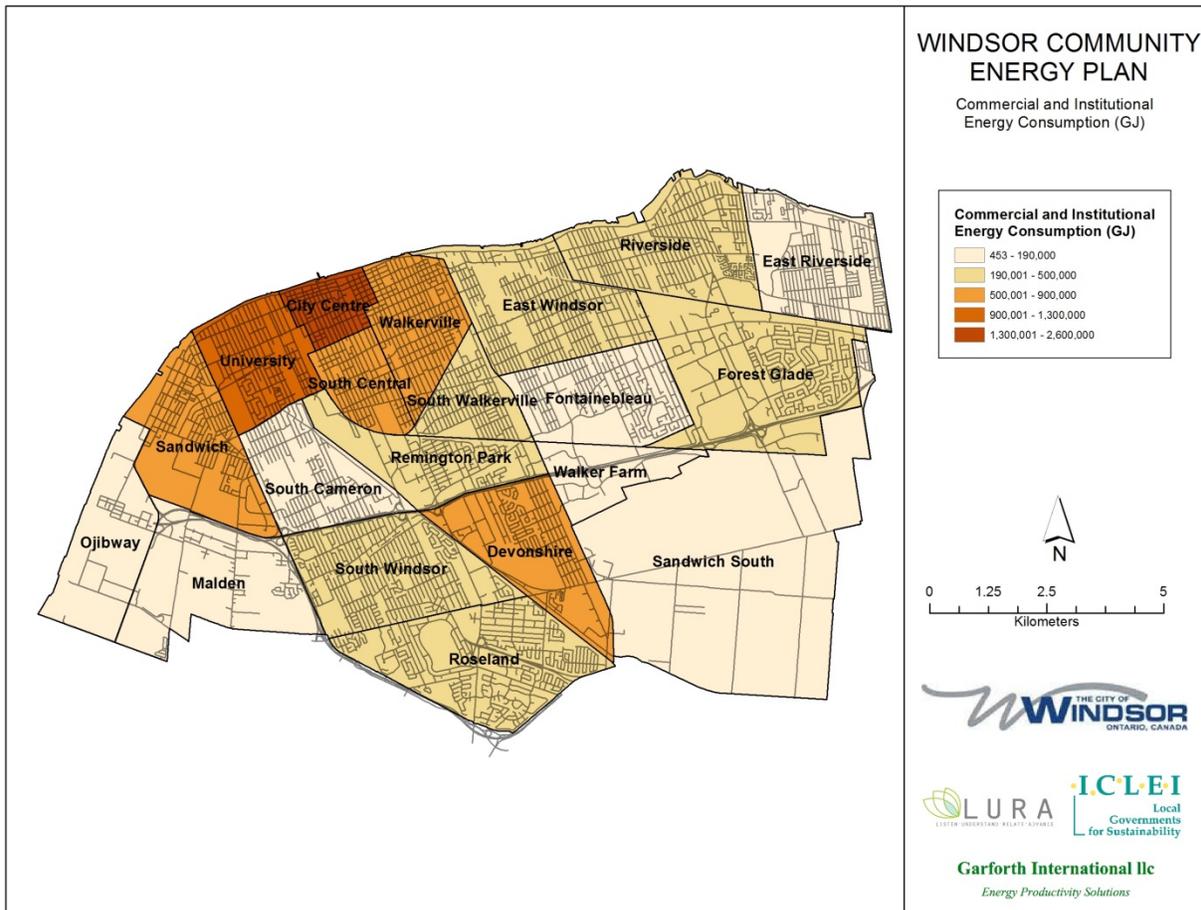


Figure 22: Ontario's Total Energy Use for Commercial and Institutional Buildings (2014). Extracted from ECO Annual Energy Conservation Progress Report – 2015/2016

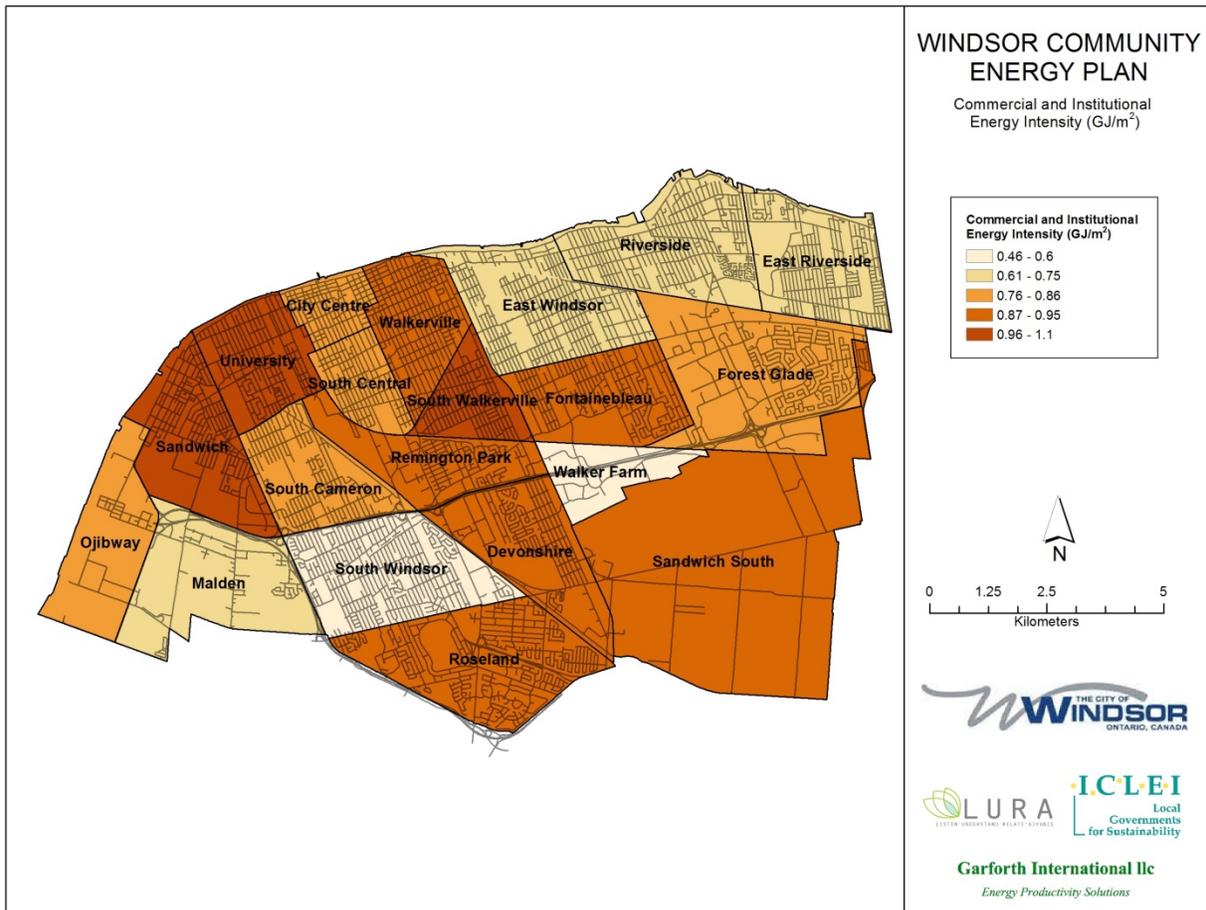


Map 8 illustrates the total energy use across the City for businesses, the university, hospital, health care and public sector buildings. Not surprisingly, City Centre, and University show the highest total energy use as these are the two neighbourhoods with the greatest density of commercial businesses in the city.



Map 8: Total Commercial and Institutional Energy Use (GJ) (2014)

Map 9 shows that energy intensity (GJ/m²) in the commercial and institutional sectors is fairly consistent across the City. Walker Farm is particularly low as it is predominantly industrial with few homes and some smaller businesses within the neighbourhood. South Windsor and to lesser degree Riverside, East Riverside, East Windsor, and Malden have lower energy intensity values as well. These are predominantly residential neighbourhoods, including Malden which consists of primarily vacant land.



Map 9: Commercial and Institutional Energy Intensity (GJ/m²) (2014)

Recommended Strategies for Businesses and Public Buildings

The following two strategies are identified for businesses and public buildings in Windsor:

1. Create a Deep Retrofit Program for Existing Businesses and Public Buildings; and
2. Continue to Ensure Compliance with the Ontario Building Code for New Commercial and Institutional Development.

Each strategy is described in more detail below.

Strategy 5: Create a Deep Retrofit Program for Existing Businesses and Public Buildings

The following is the recommended approach for Strategy 5:

- **Description:** Similar to the residential program, the commercial and institutional retrofit program is a voluntary program for those businesses looking to increase the value of their property and/or decrease their energy costs. The retrofit program offers a standardized set of retrofit packages to address the most common high energy uses in the building (i.e.: space heating, insulation, water heating, etc.). Other options beyond the core package could include: reroofing, solar PV/thermal, ground source heat pumps, etc. Standardizing the retrofit package means there is no need to conduct energy audits, but rather participants are eligible if they meet set criteria relating to retrofits already completed on their building.
- **Target Participation Level:** The program would aim to have 60 per cent of businesses and public sector buildings participate by 2031. This will result in about 38,000 m² of retrofit activity per year. The program would be designed to allow for a gradual ramp up for delivery.
- **Energy and GHG Emission Reduction Potential:** The deep energy retrofit would be a standardized package that aims to improve energy efficiency in businesses and public sector buildings by 20– 50 per cent depending on the age and size of the building. This would result in 2.0 PJ less energy or 17 per cent and 70,000 Tonnes or 15 per cent GHG emission reductions by 2041.
- **Program Design:** The program is designed to use tailored retrofit packages that are quality controlled and offered at standardized prices as defined in the non-residential retrofit program. Wherever possible the existing energy efficiency programs from EnWin and Union Gas would be blended into the deep retrofit package and package pricing.
- **Funding Mechanism:** The non-residential retrofit program can use local improvement charges (LIC) to fund renewable energy and energy improvements on public or private properties.

The program design is similar to that of the residential retrofit program and uses the LIC mechanism to leverage funds for implementation. **Participation is voluntary and is cost neutral or cost positive from inception.** Like the residential program, if the building is sold, the LIC continues with the new building owner until the full value is recovered, reducing the risk to the City.⁴⁷

- **Potential Delivery Agent:** It is recommended that a new entity be created to serve as the program administrator and lead the detailed design, business plan development and ultimately administer the retrofit program. Program administration can be delivered through a number of legal forms: (1) The entity could be a wholly owned City department or corporation; (2) It could equally be an extension of the non-regulated activities of EnWin;⁴⁸ or (3) it could be a

⁴⁷ LIC Primer: Using Local Improvement Charges to Finance Residential Energy Upgrades, Sonja Persram, Sustainable Alternatives Consulting Inc. for CHEERIO, 2013.

⁴⁸ Please note this is a suggested option given EnWin's current role. The final delivery agent will be defined as part of the development of a business plan for implementation.

public/private partnership, or (4) it could be the same entity that delivers both the residential and non-residential retrofit program.

- **Timing:** Assuming the retrofit program begins in 2018, this would involve retrofitting up to 140 buildings annually for a total of 2,100 retrofits completed by 2031.
- **Benefits:**
 - **Business and building owners:** Increased property or rental value, improved comfort, reduced energy costs, and a favorable funding mechanism.
 - **Delivery agent:** Low management costs, leadership role, creation of a template or model applicable in other communities.
 - **Contractors:** Predictable high-volume retrofit projects with competitive pricing.
 - **Windsor community:** High quality employment, community economic development, improved neighbourhoods, reputation, and housing and building affordability.
 - **Investors:** Acceptable returns and low risk investment.

Strategy 6: Continue to Ensure Compliance with the OBC for New Commercial and Institutional Development

The following is the recommended approach for Strategy 6:

- **Description:** New commercial and public sector building development is occurring in Windsor at a rate of a little over 1 per cent year. The proposed strategy is to continue to ensure new commercial and public sector development complies with the most current Ontario Building Code as per the new residential development strategy.

This strategy also focuses on allowing the commercial development marketplace to continue to implement stepwise improvement in the energy efficiency of new buildings that are 100 per cent compliant with the 2012 OBC and subsequent building code updates.

The City can also consider using the permitting process for both new construction and significant renovations as an opportunity for clarifying energy performance expectations and extended possibilities beyond code compliance. This could include locally permissible incentives such as increased density or priority permit handling.

- **Target Participation Level:** 100 per cent of new buildings.
- **Energy and GHG Emission Reduction Potential:** Transparency will ensure compliance and potentially drive the market to ask for above code performance.
- **Program Design:** It is anticipated that market transformation towards net zero new construction will occur primarily as a result of updates to the OBC.

The City's role will be to ensure compliance with the OBC for all new buildings.

- **Funding Mechanism:** N/A
- **Potential Delivery Agent:** Builders and developers, City role in compliance.
- **Timing:** Ongoing.
- **Benefits: Business Owners:** Owner or renter value for money supported by energy performance labels.

Chapter 7 – Industrial

Background Characteristics of the Industrial Sector in Windsor

What is the Industrial Sector Building Profile?

Manufacturing is the largest industry in the Windsor Region, comprising over 25 per cent of the Region’s economy and 19 per cent of direct employment. The manufacturing sector is predominantly automotive assembly and automotive parts manufacturing; however, machinery manufacturing, pharmaceutical manufacturing and food/beverage processing are also significant employers in the Windsor CMA.⁴⁹

Automotive manufacturing operations are the single largest industry type in Windsor. According to Unifor, Windsor has the highest auto industry concentration in Canada with an assembly plant, major engine operations, and more than 50 other independent auto parts operations as shown in Table 7.⁵⁰ Major industrial employers include Fiat Chrysler, Ford, Dakota, Flex-N-Gate, Kautex, Lakeside Plastics, Magna, Syncreon, Veltri, Ventra, and TRW.

Table 7: Largest Manufacturing Employers⁵¹

Company	Employees	Industry
Fiat Chrysler Canada	4,700	Motor Vehicle Body Manufacturing
Ford Motor Company of Canada	2,700	Motor Vehicle Gasoline Engine and Engine Parts Manufacturing
A.P. Plasman Corporation	1,000	Plastic Product Manufacturing
Valiant Machine & Tool Inc.	650	General-Purpose Machinery Manufacturing
Jamieson Laboratories Ltd.	520	Pharmaceutical and Medicine Manufacturing
A.P. Plasman - Windsor Plant 1	400	Miscellaneous Fabricated Metal Product Manufacturing
Accucaps Industries Limited	400	Miscellaneous Chemical Product Manufacturing
NutriCorp International	400	Pharmaceutical and Medicine Manufacturing

The automotive industry in Windsor directly employed 12,000 people and produced vehicles and parts worth \$11 billion in 2014.⁵²

⁴⁹ Canadian Manufacturers & Exporters. Regional Manufacturing Profile, Windsor Region. 2015. <http://www.cme-mec.ca/download.php?file=583lh990l.pdf>

⁵⁰ Ibid.

⁵¹ Ibid.

How Much and Where is Energy Used in the Industrial Sector?

The industrial sector accounts for 9,253,200 GJ or 24 per cent of the total energy used in Windsor and is responsible for 371,100 Tonnes CO₂e emissions or 20 per cent of the total GHG emissions in the City.

Industries each use energy for a variety of purposes. In the automotive sector, for example, energy is used for elements such as compressed air, process steam, metal forming, lighting, ventilation, air conditioning, painting, materials-handling, and welding. According to the US EPA, natural gas is used primarily for heating, paint booth curing ovens, steam, and hot water production while electricity is used in many different applications as shown in Table 8.⁵³

Did You Know?

The industrial sector accounts for 9,253,200 GJ or 24 per cent of the total energy used in Windsor and is responsible for 371,100 Tonnes CO₂e emissions or 20 per cent of the total GHG emissions in the City.

Table 8: Major Energy Uses in Automotive Plants (EPA, 2015)⁵⁴

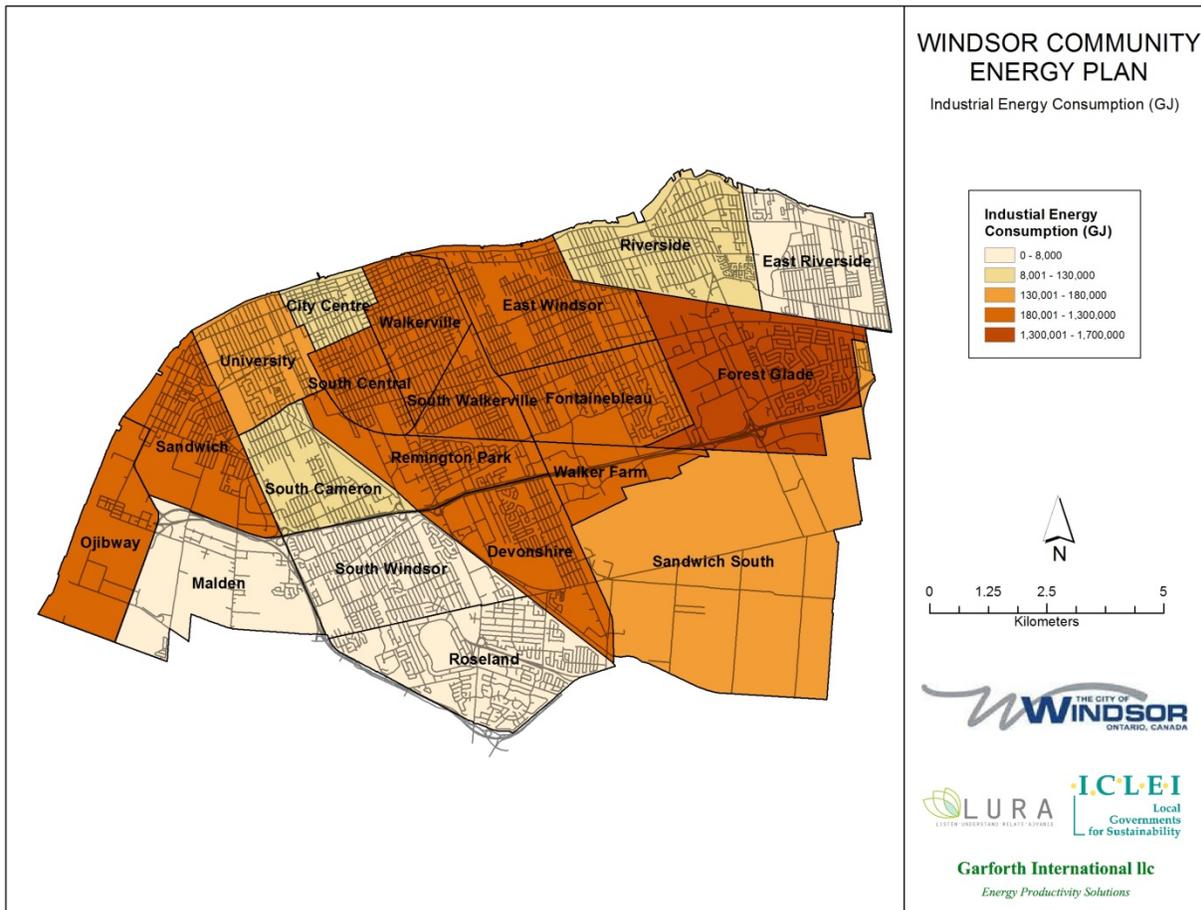
Use/ Process	Use Share of energy use (%)
Paint Booths	30 – 50
HVAC	11 – 20
Lighting	15
Compressed air	9 – 14
Welding	9 – 10
Material handling / tools	7 – 8
Metal forming	2 – 9
Miscellaneous / other	4 – 5

Map 10 illustrates the total energy use across the City for industry. Industry in Windsor is primarily located around the airport, in Walker Farm, Forest Glade, and Sandwich South. There are also concentrations of industry in Ojibway and Malden and along Walker Road and the Rail Corridor as reflected in Map 10 below.

⁵² Unifor, What the Auto Industry Means to Windsor. <http://www.unifor.org/en/what-auto-industry-means-windsor>. August 2015.

⁵³ Ibid.

⁵⁴ EnergyStar Industrial Insights, Automotive Plants. February 2015. ENERGY STAR Energy Efficiency Improvement and Cost Saving Opportunities for the Vehicle Assembly Industry. https://www.energystar.gov/sites/default/files/tools/Industry_Insights_Auto_Assembly_2015.pdf.



Map 10: Total Industrial Energy Use (GJ) (2014)

Most manufacturing industries have a systematic, data driven approach to managing energy efficiency and carbon footprint for their operations. The relative efficiency of industry between North America and other regions of the world shows much narrower variations than in the buildings and transportations sectors. Companies with world class corporate energy management programs typically outperform their industry peer average energy use by as much as 30 per cent. Some of these corporations are represented in Windsor.

Recommended Strategies for Industry

The following two strategies are identified for the industrial sector in Windsor:

1. Continually Increase Industrial Energy Efficiency; and
2. Reinforce a Windsor Network and Mentorship Program for Transfer of Best Practices.

Each strategy is described in more detail below.

Strategy 7: Continually Increase Industrial Efficiency Energy

The following is the recommended approach for Strategy 7:

- **Description:** Both Fiat Chrysler Automobiles (FCA) and Ford have well developed approaches world-wide to energy management. Both are active members of the US EPA Energy Star Focus on Energy Efficiency in Motor Vehicle Manufacturing.⁵⁵ This group represents the energy management leaders of all major North American vehicle manufacturers. They meet regularly and have developed tools for managing and assessing the energy performance of assembly plants, as well as sharing best practices.

Ford has a consistent approach globally to reducing energy and emissions (Energy Management Operating System (EMOS)). FCA is on the A-List of the Carbon Disclosure Project, with well documented major reductions in GHG emissions.

Fiat Chrysler recognizes its role in addressing climate change effects along its value chain and aims to reduce the CO₂ emissions of its products and processes from design, production, distribution, use and the end-of-life phase.⁵⁶ The FCA Windsor Assembly Plant began production of the 2017 Chrysler Pacifica Plug-in Hybrid in December of 2016. The Pacifica is the industry's first electrified family hauler and is a serves strong indication of sustainable change within the industry, being manufactured at the same plant that produced North America's first minivan in 1983.⁵⁷ FCA also aims to reduce its plants' worldwide energy consumed per vehicle produced by 30 per cent and to reduce its CO₂ emissions per vehicle produced by 32 per cent from 2010 to 2020.

These two companies, among others, bring a wealth of experience and energy management expertise to the manufacturing community in Windsor. The recommended approach is to encourage regular informal benchmarking and best-practice exchange with the goal to make Windsor's entire manufacturing sector a role model of effective energy management.

There is an informal network of energy managers through the Ontario Industrial Accelerator Program that includes commercial, industrial, and municipal representatives including Fiat Chrysler and the University of Windsor which is a useful basis for a local Windsor strategy to reinforce best practice sharing.

- **Target Participation Level:** All industries in Windsor.
- **Energy and GHG Emission Reduction Potential:** Aimed at achieving continuous improvement of 1 per cent increased efficiency per year through to 2041 in line with demonstrated best practices. This would be supported by internal and external global benchmarking to align with corporate energy, climate or sustainability plans and targets.

⁵⁵ [ENERGY STAR Focus on Energy Efficiency in Motor Vehicle Manufacturing](#), ENERGY STAR, accessed Dec 2016.

⁵⁶ [2015 Sustainability Report](#), Fiat Chrysler Automobiles, accessed Dec 2016.

⁵⁷ [WAP begins production of Pacifica Hybrid minivan](#), Windsor Star, December 2016.

- **Program Design:**
 - Encourage delivery of an “Energy Management Forum” comprising all manufacturers in Windsor building on the existing informal network.
 - Encourage industries that already have comprehensive corporate energy, climate or sustainability programs to continue to rigorously implement them.
 - Encourage manufacturers with limited energy management programs to design and implement world-class approaches in their plants and other buildings.
- **Funding Mechanism:** Many elements of a well-rounded industrial energy management program would be eligible for a range of federal, provincial and utility incentives.⁵⁸ Specifically, provincial programs can support the costs of hiring energy management resources.⁵⁹
- **Delivery Agent:** Industrial energy efficiency is market driven; therefore, industries will be responsible for advancing this strategy.
- **Timing:** Ongoing.
- **Benefits:**
 - Long-term competitiveness of Windsor sites
 - Corporate recognition of Windsor locations
 - Pooling effect for preparing incentive proposals
 - Cooperative efficiency projects with neighbours or the community

Enabling Strategies to Foster Greater Energy Efficiency in Windsor

Enabling Strategy 8: Reinforce a Windsor Network and Mentorship Program for Transfer of Best Practices

Energy managers within the industrial sector, particularly in the automotive sector, have a depth of knowledge and skills in effectively managing energy use of their buildings and operations. It is recommended that this skillset, expertise and asset within the community be recognized through the establishment of a Windsor-specific network of energy experts to demonstrate, encourage, and mentor others in the business community to adopt ever increasing energy efficient practices. This network would include both large and small industry, manufacturers and all scales of business.

The Association of Energy Engineers (AEE) is in the process of developing a local "Southwestern Ontario" Chapter of comprised of many knowledgeable Energy Managers from various sections. This group may provide a platform from which to build a Windsor Network and Mentorship program.

⁵⁸ Natural Resources Canada, [Definitions](#), accessed Dec 2016.

⁵⁹ See <https://www.saveonenergy.ca/Business/Program-Overviews/Energy-Managers/Multi-Site-Customer-Energy-Managers.aspx>.

The mentorship program components could include:

- Facilitating partnerships, professional networking, coaching and career development;
- Fostering knowledge/best practice sharing including industry trend awareness;
- Transferring knowledge about energy and GHG benchmarking (e.g., audits), core competencies, energy disclosure, target setting, and monitoring practices;
- Establishing and acting on carbon reduction commitments;
- Engaging and educating local businesses on energy and GHG emissions, opportunities for reduction and efficiency, and the business case;
- Encouraging student mentorship and training; and
- Fostering technological innovation.

The mentorship program could also extend to engage Twin City facilities managers, utilities (including EnWin, Union Gas and MVV), and business developers who have successfully created a profitable business model for energy management at the community level such as MVV Energie AG in Mannheim.



Chapter 8 - Transportation

Background Characteristics of the Transportation Sector in Windsor

What is the Transportation Sector Profile?

The Windsor Area Long-Range Transportation Study showed that 86 per cent of all area households have at least one car, and that the car dominates 80 per cent of all study area trips, followed by walking at 10 per cent, transit at 3 per cent, cycling at 2 per cent, and other modes at 5 per cent (school bus, taxi). The study also showed that roadway traffic grew by up to 9 per cent per year between 1990 and 1996. This highlights the fact that the Windsor area is very auto-dominated, as are most small to medium-sized cities in Ontario.⁶⁰

Of the approximately 2.2 billion kilometres travelled by vehicles in Windsor in 2014, over 90 per cent is roughly evenly split between cars and light-duty trucks, the latter category including SUVs and pick-up trucks, many of which are used as personal cars.

Windsor is also unique with significant entry points for heavy truck traffic to and from the United States. While it is estimated that the transportation and warehousing sector contributed over \$525 million dollars to the Windsor CMA economy in 2015, there are energy and GHG contributions resulting from this sector.⁶¹ Specifically, heavy truck transit between the Ambassador Bridge and Highway 401 accounts for about 3 per cent of kilometre, but over 7 per cent of transportation energy.

Around the world and across Ontario, there is a growing understanding that electric vehicles will play a significant role in reducing fuel consumption and GHG emissions in the transportation sector, while benefiting air quality. All the major global automotive companies, including Ford and FCA, have significant electric vehicle development efforts and a growing range of commercially available vehicles.

Electric vehicle (EV) adoption is starting slowly in Ontario. Approximately 5,650 EVs are currently registered in the province, and as of 2014 only account for 0.05 per cent of Ontario's overall passenger vehicle population. In Windsor, the number of electric vehicles is even lower at 0.01 per cent of all passenger vehicles. The Ontario Climate Action Plan sets a target of having 5 per cent of all passenger vehicles on the road in 2020 be electric.⁶² As in the rest of Ontario, hybrid and electric cars and commercial vehicles are a small part of the total vehicle mix in Windsor.

⁶⁰ Windsor Area Long-Range Transportation Study, 1999. Executive Summary p.1.

⁶¹ City of Windsor.

⁶² Conservation: Let's Get Serious. Annual Energy Conservation Progress Report 2015/2016. Environmental Commissioner of Ontario, published in November 2016. p.45.

How Much Energy is Used in the Transportation Sector?

According to the Environmental Commissioner of Ontario's Annual Energy Report, "transportation is Ontario's largest source of greenhouse gas emissions and typically is the largest energy use. In 2014, the transportation sector consumed 36 per cent of Ontario's energy."⁶³ In Windsor, the transportation sector accounts for 26 per cent of the energy used, 36 per cent of GHG emissions and 46 per cent of the energy costs. This is approximately 3.2 Tonnes GHG/capita in Windsor, which is lower than the Canadian average of 4.0 Tonnes GHG per person, but there is significant room for improvement as cities such as Copenhagen and Mannheim have achieved averages of 0.9 Tonnes and 1.6 Tonnes per person respectively.

Transportation GHG emissions is predominantly CO₂ as a result of the combustion of fossil fuels such as gasoline. There are a number of factors that affect the amount of GHG emissions from vehicles, including the type of vehicle, average vehicle weight, efficiency of the vehicle, and the carbon content of the fuel.

Did You Know?

In Windsor, the transportation sector accounts for 26 per cent of the energy used, 36 per cent of GHG emissions and 46 per cent of the energy costs.

There are three key actions to curb transportation GHG emissions at the community level: (1) support the shift to shared and public transit; (2) adoption of electric vehicles and alternative fuels such as compressed natural gas, biodiesel, and hydrogen; and (3) land use policies that promote mixed use, compact urban form and promote active transportation options such as walking and cycling. Each one is described below.

Recommended Strategies for Transportation

The following four strategies are identified for the transportation sector in Windsor:

1. Encourage a Modal Shift towards Public Transit;
2. Develop and Implement an Active Transportation Master Plan;
3. Foster the Adoption of Electric Vehicles; and
4. Continue to Advance Smart Energy Systems by integrating into the Land Use Planning process.



Each strategy is described in more detail below.

⁶³ Ibid, p.36.

Strategy 9: Encourage a Modal Shift towards Public Transit

The following is the recommended approach for Strategy 9. (Note it is linked to Strategy 10 below):

- **Description:** Transit Windsor contributes significantly to reducing GHG emissions and congestion at the community level by reducing the number of vehicles on local roads. Transit Windsor's fleet includes 122 transit buses, 29 of which are hybrids, and 26 per cent of the fleet is currently using alternative fuels. These buses are covering 13 routes across the City and cross border.
- **Target Participation Level:** The CEP aims to double transit ridership by 2041 (i.e.: increase transit modal share from 3 per cent to 6 per cent).⁶⁴
- **Energy and GHG Emission Reduction Potential:** For every passenger km that switches from car to bus, the emissions drop by at least a factor of three.
- **Program Design:** Transit Windsor is already in operation. As per the Windsor Area Long-term Transportation Study (WALT) study, it is recommended that Transit Windsor expand services and encourage greater transit ridership within the City.
- **Funding Mechanism:** Through the Climate Action Plan, the province has committed to making additional investments in transit. In 2015-16, for the first time, Ontario is expected to spend more on transit (\$3.6 billion) than on highways (\$3.2 billion) with \$5.4 billion allocated for 2016-2017.⁶⁵ The federal government has also announced major investments in transit infrastructure - the 2016 budget allocated \$3.4 billion to public transit over a three-year period. Ontario will receive \$1.5 billion, the largest portion across the country.⁶⁶ It is recommended that Transit Windsor pursue funding opportunities where possible to foster transit expansion.
- **Delivery Agent:** Transit Windsor
- **Timing:** Ongoing
- **Benefits:** Increased options to travel to work, school, home, and recreation; reduced household transportation costs; reduced roadway congestion; fuel savings; GHG emission reductions; community growth and revitalization; and economic benefits.

Did You Know?

- Every \$1 invested in public transit generates approximately \$4 in economic returns.
- Every \$1 billion invested in public transit supports and creates more than 50,000 jobs.
- Every \$10 million in capital investment in public transit yields \$30 million in increased business sales.

Source: APTA, 2016. <http://www.apta.com/mediacenter/ptbenefits/pages/default.aspx>

⁶⁴ WALT Study, 1999. Section 4.3.

⁶⁵ Ibid, p.41.

⁶⁶ Ibid, p.41.

Strategy 10: Develop and Implement an Active Transportation Master Plan

The following is the recommended approach for Strategy 10:

- Description:** The WALT Study identifies a number of strategies to address transportation and travel patterns in the city. At the time of the study, cycling and walking only represented 2 per cent and 10 per cent respectively of all modes of travel. Cycling in the City is accommodated primarily through the trail and recreation-way systems, as well as on-road cycling facilities including bike lanes, sharrows and signed routes.⁶⁷ On top of the recreation trails, the City maintains and is enhancing the wide network of sidewalks to encourage walking.

The Bicycle Use Master Plan is a 20-year guide that establishes a vision, guiding principles and goals for cycling in Windsor. It contains an identified cycling network, strategies for education and awareness, promotes cycling-transit links and recommendations for establishing bike parking.

Official Plan policies that foster the development of walkable, cyclable communities are in place including:

- 3.2.3.1: Windsor will work toward achieving a sustainable transportation system where all modes of transportation can play a more balanced role. The creation of mixed use and employment centres will allow businesses and services to be closer to homes and allow greater opportunities for walking, cycling, and transit.
- 6.9.1.7: To increase the use of walking, cycling, and public transportation within the designated Mixed Use area by fostering a strong live-work-shopping-recreation relationship.
- 6.11.1.10: To enhance pedestrian, cycling, and public transportation access to and within the City Centre.

Effective land use planning policy can support walking and cycling as viable modes of transportation for commuter, recreational, and other travel. The Official Plan can support the creation of linked networks of “complete streets” creating a comprehensive and attractive pedestrian, transit, bicycle and e-bike network. The objective is to maximize the connectivity of roads for pedestrians and cyclists, and ensure dedicated bike lanes, bike parking and charging infrastructure are made available in the city. The bike parking infrastructure should address measures to minimise theft and vandalism.



⁶⁷ WALT, 1999. p. 4.2.

There is also significant potential to reduce light vehicle trips through employment and school centred orientation and outreach programs to encourage ride sharing, cycling and even walking as part of daily commuting patterns.

On June 05, 2017, Council directed administration to move forward with an Active Transportation Master Plan study that will develop a comprehensive forward-thinking plan to increase transportation options and establish a strategy for walking, cycling, transit and other forms of active transportation.

- **Target Participation Level:** Targets will be defined in the forthcoming Active Transportation Master Plan (ATMP). In the interim, it is recommended that the City continue to work towards the WALT Transportation Master Plan and Bicycle Use Master Plan recommendation of continued development of on-road bikeways and off-road trails to facilitate increased and safe cycling.⁶⁸ The CEP assumes at least 2 per cent of light vehicle trips can be eliminated through mixed use, compact urban form, and good urban design. Targets may be refined through the development of the ATMP.
- **Energy and GHG Emission Reduction Potential:** A relatively modest elimination of 2 per cent of average journeys results in emissions reduction of about 8,000 Tonnes CO₂, or about 1 per cent, of the total transportation emissions in 2041. Reduction potential may be refined through the development of the ATMP.
- **Program Design:** It is recommended that the City continue to prepare an Active Transportation Master Plan looking at public transit, bicycling and walking that expands the trails network, provides dedicated on-road cycling routes, and maintains sidewalks that facilitate safe, interesting, and convenient walking. Council recently directed the establishment of a Bike Share Sub-Committee that will consider establishing a citywide bike share program which may compliment the University of Windsor's recently launched campus bike share program.

It is recommended that the City continue to review Official Plan policies to strengthen the integration of safe cycling and walking as viable modes of transportation in the city as part of the ATMP process.

- **Funding Mechanism:** City approved budget
- **Delivery Agent:** City of Windsor through the development of the ATMP, Official Plan, Transportation Master Plan, and Transportation Demand Management updates and associated planning tools.
- **Timing:** 2017
- **Benefits:**
 - **Individuals:** Research indicates that healthy communities design can decrease the risk of death from all causes by 22 per cent when people walk 29 minutes/day for 7 days/week and decrease the risk of diabetes by 30 per cent. In terms of cycling, research suggests a

⁶⁸ Ibid, Ex.p.6.

decrease risk of death from all causes by 28 per cent for those who cycle 2.5 hours/week.⁶⁹

- **Community:** Reduced medical costs relating to death and chronic disease and increased economic development.

Strategy 11: Adoption of Electric Vehicles and Alternate Fuel Vehicles

The following is the recommended approach for Strategy 11:

- **Description:** As noted above Ontario's Climate Change Action Plan has established a 5 per cent target for EV adoption across the province supported by a number of actions. These include: providing incentives for electric vehicles; working towards eliminating the HST on zero emission vehicles; providing free overnight electric vehicle charging; encouraging residents to replace older vehicles with electric options; and ensuring there is charging infrastructure widely available across the province.⁷⁰ The very low emissions of Ontario's power system and the lower cost relative to gasoline and diesel favour electrification of a significant part of the fleet. The likelihood of lower electric vehicle prices and incentives for adoption align with this trend.
- **Target Participation Level:** 10 per cent of light duty cars and trucks to be alternate fuel (or electric) by 2041.
- **Energy and GHG Emission Reduction Potential:** Achieving the 10 per cent target will result in about 40,000 Tonnes CO₂, or about 5 per cent, of the total transportation emissions in 2041.
- **Program Design:** Municipalities themselves have limited capability to influence the uptake of alternate fuel vehicles (AFV). Measures that can be taken include increasing visibility of AFVs through adoption in municipal fleet; installation of public charging stations; working with local businesses to increase adoption of AFVs in corporate fleets; and, importantly for Windsor, working with the automotive industry to advocate for expanded AFV production in Windsor.

It is recommended that the City encourage the use of AFV by installing strategic charging stations, offering preferred parking and sharing success stories.

Transit Windsor has been interested in exploring alternative fuels and has considered electrification of its fleet since 2012. It is recommended that the transition of Transit Windsor fleet to any alternative fuels continue to be considered.

As part of a potential transition strategy, Union Gas can also work with the City to explore solutions such as installing compressed natural gas (CNG) refueling stations on Highways or exploring opportunities for CNG/ liquefied (LNG) for waste haulers and long haul freight.

- **Funding Mechanism:** The province is investing \$246 million to \$277 million in the transition to AFV. Funding will be allocated to:

⁶⁹ Gardener, Dr. Charles, AMO Conference presentation, 2016. Designing the Built Environment, Improving Quality of Life.

⁷⁰ See Green Investment Fund for example: https://news.ontario.ca/mto/en/2016/07/electric-vehicle-charging-stations-coming-soon.html?_ga=1.161437881.567667572.1481578486.

- Offering an EV rebate program to 2020 for leasing or buying an eligible electric vehicle (up to \$14,000 per vehicle), including rebates for purchase and installation of home charging stations (up to \$1,000 per station);
- Establishing a four-year free overnight electric vehicle-charging program for residential and multi-unit residential customers;
- Offering a rebate to low- and moderate-income households that will help them replace old cars with new or used electric vehicles or a plug-in hybrid; and
- Working with Plug'n Drive, a non-profit electric vehicle advocacy organization, to establish and operate a facility to showcase electric vehicles and related technology to Ontarians across the province.
- **Delivery Agent:** Province, City, and Union Gas (for CNG as part of a transition strategy).⁷¹
- **Timing:** Ongoing
- **Benefits:**
 - **For vehicle owners:** EVs can decrease fuel costs; lower maintenance and operating costs; provide access to incentives; and contribute to Ontario's commitment to reducing greenhouse gas emissions.
 - **For business owners:** greener fleet; greener reputation; and benefits for residents.
 - **For the City:** demonstrate local and global leadership; reduce health and environmental effects of traffic; reach municipal greenhouse gas reduction goals, and contribute to Ontario's commitment to reducing greenhouse gas emissions.

Enabling Strategies to Foster Transportation Efficiency

Enabling Strategy 12: Continue to Advance Smart Energy Systems through Effective Land Use Planning

The City's Official Plan and supporting planning policies can be effective tools to advance smart energy systems as they relate to energy efficiency and conservation, net-zero neighbourhoods (as discussed in Chapter 5), district energy (as discussed in Chapter 9), renewable energy (as discussed in Chapter 10), and transit oriented development. Transit-oriented development is one of the main ways to encourage the shift away from personal vehicle use to public transit and active transportation options. This approach emphasizes creating complete communities and neighbourhoods where higher densities are planned near transit infrastructure, with transit priority lanes and transit routes to major employment centres (e.g. City Centre, international border crossing, industrial/business parks, etc.). The City's Official Plan can incorporate complete community and complete street elements to encourage energy conservation in Windsor.



⁷¹ Note this is a suggested option given Union Gas' current role. The final delivery agent will be defined as part of the development of a business plan for implementation.

Chapter 9 – District Energy

Background and Current District Energy System in Windsor

What is a District Energy System?

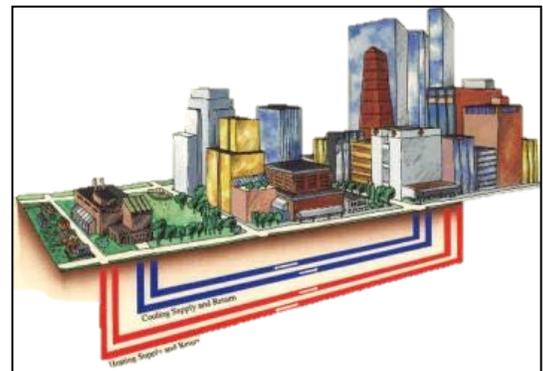
Modern District Energy systems use a network of insulated pipes to efficiently and reliably deliver heating and cooling from the place where the heating or cooling is generated, to homes, buildings, and industrial facilities. Buildings are connected to the network with a compact substation that replaces the individual furnaces, boilers, and chillers in each building.

District Energy networks allow multiple central and decentralized sources to be mixed together, creating lower cost, lower emissions, and added reliability to the overall heating and cooling supply. Potential sources include combined heat and power generators and high-efficiency gas boilers and chillers. District Energy systems are a pathway to weather resilient, low carbon cities. They can recover and distribute surplus and waste heat, along with a range of renewable heating and cooling sources. The network allows for economies of scale since the generation of heating and cooling in a few larger plants is a better use of assets rather than having thousands of boilers and chillers each heating and cooling individual buildings.

Networks can balance the supply and generation of heat both by time and location. The heating and cooling demands change throughout the day in differing ways for residential, commercial, industrial and public buildings. The network matches and manages these changing patterns, while also ensuring the efficient, cleanest and lowest cost mix is used. Adding thermal storage further allows daily and seasonal services to be optimized.

There are thousands of profitable small, medium and large modern District Energy systems in place across the world. They are growing in both size and number using well proven, highly reliable technology and generating attractive returns to their communities.

A successful, city-scale District Energy system is typically run by a thermal utility that ensures service quality and manages the metering and billing of the heating services.



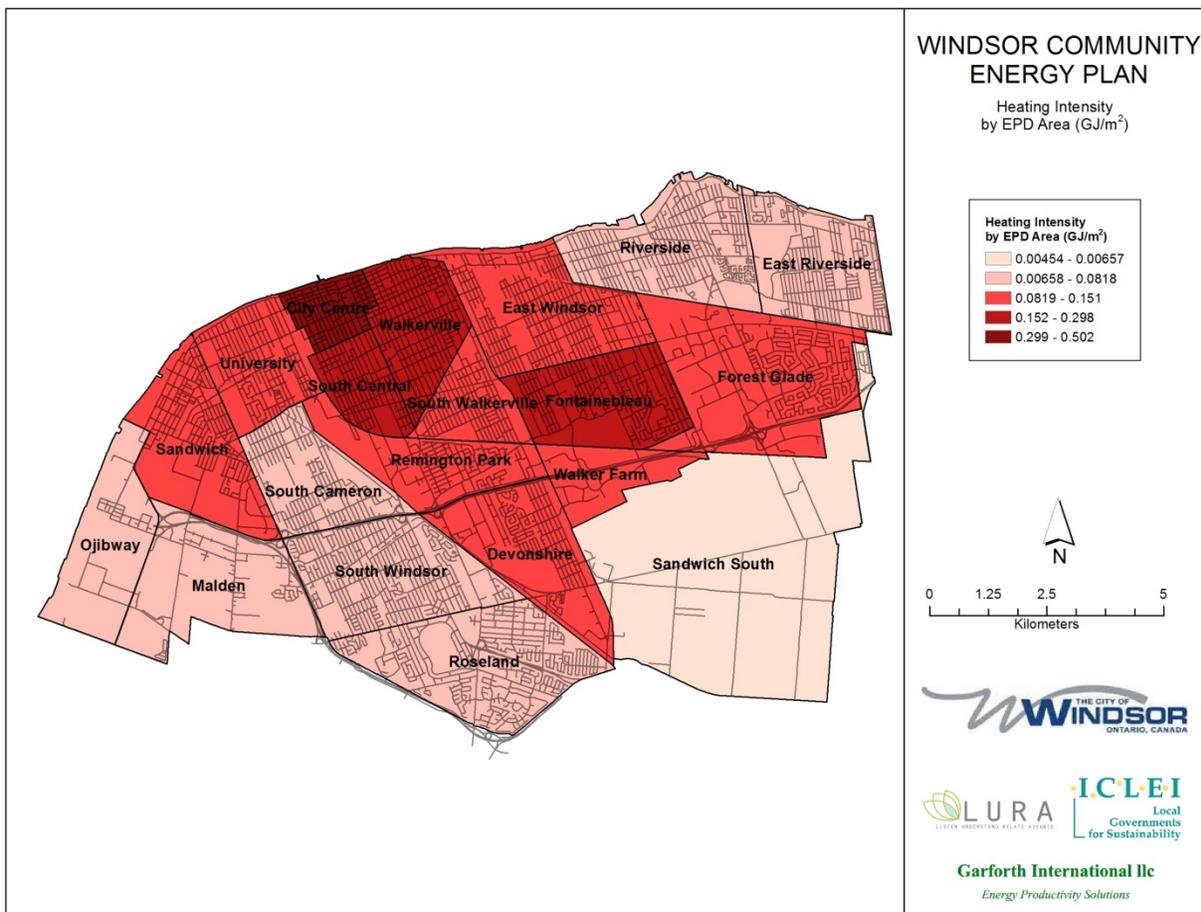
Benefits of District Energy

The benefits of District Energy are:

- Consumers benefit from reliable supply, stable lower cost energy, reduced maintenance costs and increased space.
- The environment benefits from reduced energy waste and decreased emissions.
- The community benefits from added local employment and a profitable municipal utility.
- The investors and shareholders benefit from stable, long-term returns.

What is the Current District Energy System in Windsor?

The heat demand intensity map of the City of Windsor from the building demand modelling is shown in Map 11 for the 2014 baseline.



Map 11: Heat Map of Windsor (2014)

The dark red areas have relatively high density of potential customers for a district heating system. The City of Windsor, through the Windsor Utilities Commission, assessed the long-term benefits of District Energy for the community in 1995. The benefits were judged attractive enough to build the first phase of a downtown District Energy network anchored on the Casino with service starting in 1996.



Figure 23: Windsor District Energy System Map

In addition to the Casino, the network provides heating and cooling to ten buildings – 350 City Hall (cooling only), 400 City Hall Square, All Saints Church, 250 Windsor, Justice Facility, RBC Business Centre, Transit Terminal, Aquatic Complex, and Art Gallery.

Heat is supplied from boilers in a centre in the Casino and cooling from both the Casino and a centre adjacent to the Aquatic Complex. The cooling centre includes ice storage. The network is modern and uses pre-insulated pipes that comply with the recognized current global standards.

The heating and main cooling centres are owned and operated by Enwave Energy Corporation, a private company with municipal energy interests in both Canada and the USA. The network and a cooling peaking plant is owned and operated by the Windsor Utilities Commission through a division known as District Energy Windsor.

There are currently no City policies to encourage or require major renovation or new construction to use District Energy. There are limited sales and marketing efforts and no approved business plan to drive growth. The new City Hall will be connected, however, recent major renovations by the University in the City Centre currently have no plans to connect. Even more surprisingly is that the recent Casino expansion did not connect.

There is a second District Energy system on the campus of the University of Windsor owned by the University. This provides heating and cooling to all major buildings on the campus.

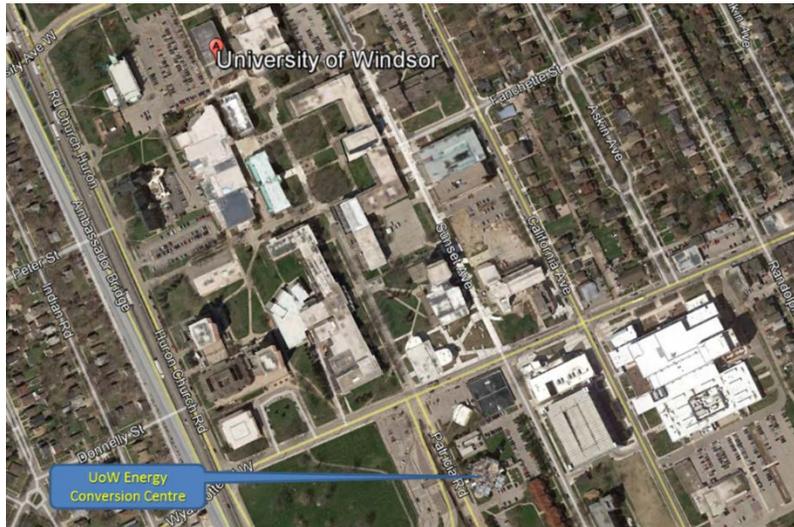


Figure 24: University of Windsor Campus Overview

Both heating and cooling is supplied from the University’s Energy Conversion Centre on the south side of the campus. The heating is supplied with a combination of central steam boilers and a small gas turbine, while cooling is supplied from central electrical chillers. The network is from an earlier generation, with heating distributed using steam, an approach with significantly higher losses and less operating flexibility than the modern system in the City Centre.

Existing Industrial and Commercial Area

While there are no existing District Energy systems in industrial areas of Windsor, the characteristics of these areas are relevant. Industry is both a major user of heating and cooling and often a creator of significant amounts of waste heat.

Specifically, along the axis from the river down Walker Rd. to the Walker Farm area near the airport, there are some significant energy assets. These include the Ford and Chrysler plants, the JP Wiser Distillery, and two Combined Heat and Power (CHP) generation facilities.

This is an area targeted by City Planning to attract incoming industrial and commercial investment, raising the possibility that a tailored approach to managing energy services could be a competitive added value relative to neighbouring cities, including Detroit.

Future Development and Redevelopment Areas

Greenfield lands and large redevelopment sites represent opportunities to plan and implement district energy systems. Energy and climate impacts should be included in future discussions about the planning or redevelopment of these areas.

Opportunities and Challenges

Unlike many cities in Canada, the decision by the City and the Windsor Utilities Commission to approve and invest in the first steps to build modern District Energy in the mid 1990's puts Windsor at an advantage. However, growth is key. Like all utilities, the long-term viability depends on the number of customers relative to the scale of the underlying infrastructure to ensure system sustainability. An approved growth plan clearly needs to be addressed, initially focusing on the City Centre and South Central EPDs.

The overall economic and environmental performance of a District Energy utility is a complex mix of the portfolio of sources, the number, type and location of customers. Specifically, the lack of CHP in the City Centre system negatively impacts the economics and resilience of the City. CHP is an aspect that should be addressed relatively soon, especially around the approval in principle to install CHP at the Aquatic Complex which has the potential to be a signifying asset to any extension of the downtown district energy structure.⁷²

The split ownership of the system between Enwave Energy Corporation and the Windsor Utilities Commission means the opportunities and investments cannot be viewed as a whole, which is clearly constraining the possibility to develop a cohesive vision for the future. It also limits the flexibility to continuously optimize overall system performance on an operational basis. Rethinking the ownership structure presents very real opportunities and is recommended to be part of the detailed growth plan.

Like hundreds of similar campuses across North America, the University of Windsor has an opportunity to drastically reduce energy costs as well as their carbon footprint. Recent Integrated Energy and Climate Plans on comparable Canadian academic institutions indicate energy costs and environmental impact can be roughly halved. Reconfiguring and upgrading the campus district energy supply and distribution is a significant part of this potential.

The University Energy Conversion Centre is only three kilometers from the western edge of the Downtown network. Linking an upgraded University network to the City Centre would bring new optimization and energy source sharing possibilities. This linkage would also allow new customers in both the City Centre and University EPDs to be pursued, and open the area south of the University as potential for district energy.

Windsor, like many communities, is challenged by changes in global manufacturing. It also simultaneously competes and cooperates with the neighbouring US cities, which have lower energy and labour costs. Many industrial areas in the world are reconfiguring their utility services to offer a tailored range of traditional and non-traditional utilities. In addition to gas, water, and electricity, they may also offer district heating and cooling, process steam, waste heat recovery, and even compressed air. This

⁷² The City has received approval in principle with the installation of an 800KW CHP plant at the Aquatic Complex (Dec. 2016).

can create multiple economic and other benefits to an industrial investor and should be seriously considered as part of the detailed growth plan.

Potential District Energy customers within future greenfield and large redevelopment sites would provide a unique opportunity to ensure this energy system meets the economic and environmental needs of the future. These areas are opportunities to create urban design and policy considerations to make a “Net-Zero” neighbourhood in terms of both the amount of energy they use and the emissions they create. Among many other innovative energy solutions, District Energy will undoubtedly be part of the considerations.

Recommended Strategies for District Energy

The following strategies are identified for District Energy in Windsor:

1. Designate and Plan District Energy Areas; and
2. Create a Gordie Howe International Bridge Low-Energy Economic Development Area.

Each strategy is described in more detail below.

Strategy 13: Designate and Plan District Energy Areas

The following is the recommended approach for Strategy 13:

- **Description:** District Energy Areas where the City will actively encourage relevant new construction or major renovations to connect to district heating networks and, where offered, district cooling, should be formally defined. Connection would be voluntary, economically feasible and accessible.

As a priority, large parts of the University, City Centre, and South Central districts should be designated and planned as an area for comprehensive District Heating and Cooling. Heating will be available in all designated areas; cooling networks and services may be less comprehensive owing to the climate and relative infrastructure costs.⁷³

The Walker Road Corridor and large parts of the Walker Farm District would also be designated and planned for comprehensive District Energy Services. Specifically, in areas targeted for industrial expansion or redevelopment, other utilities would be available on a tailored basis to meet the industrial users’ needs. In addition to heating and cooling services, these may include

⁷³ As a rule, district energy systems need relatively high density of heating and cooling demand to give acceptable economic and technical performance. As the networks grow, the density constraints lessen. The current and anticipated heating needs across Windsor were assessed to select potentially attractive areas. Owing to the climate, cooling densities are lower and may not always support a continuous district cooling network.

process steam, process chilling; purchase of waste heat; and investment and operating energy assets such as CHP and renewables.⁷⁴

As the district energy service grows, further District Energy Areas may be designated and planned, supported by a detailed business plan.



Figure 25: Potential District Heating Areas

- **Target Participation Level:** 10 per cent of the City’s heating needs and associated cooling requirements by 2041.
- **Energy and GHG Emission Reduction Potential:** The CEP assumes that by 2028, the 70 per cent of targeted existing buildings will be connected to the heating network in the City Centre/South Central area, and 50 per cent in the Walker Corridor. This means that in any given year beyond 2017, 70 per cent of all new buildings or major renovations will be connected to the District Energy network. These assumptions account for about 10 per cent of the total heating needs of the City. Obviously, this could increase if, as would be normal, the DE services extend beyond the initial designated and planned areas.

⁷⁴ This is not a complete list. The final list will be an individual negotiation between the investor, the municipal utility and the City Economic Development department. As tailored services are made available for one consumer, similar services can be offered, probably under more attractive terms to the next consumer, maybe also with retroactive benefits to earlier consumers. This idea is to create a virtuous circle of high-value added energy services as a magnet to inbound investment.

- **Program Design:**

Target District Energy Customers

The following customers will typically benefit from district energy and should be encouraged to become district energy consumers any time new construction or significant renovations are planned in an area designated and planned for district energy.

- City and other institutional buildings
- Mid and high rise apartment buildings
- Large commercial and warehouse facilities
- Industry

The City is considering a major new greenhouse at the southern end of the South-Central district near the Kennedy High School.⁷⁵ The recommendation would be to include the greenhouses and High School and surroundings in the City Core District Energy system for cost, environmental and public awareness reasons. This location is also close to three significant City buildings all of which would be candidates for future connection.

Targeted promotion to incumbent property owners and developers as well as to outside companies and developers looking for new opportunities should be done.

Create University Node

The City and the University will develop and implement an integrated energy master plan aimed at both:⁷⁶

- Breakthrough efficiency and economic energy performance for the Campus including modernizing the campus district energy supply and network.
- Interlinking the University network with the City Centre network to optimize operation and enable wider expansion of the customer base.

District Energy Combined Heat and Power

As the District Energy network grows, high efficiency CHP will be added based on the growth in heat demand, improving overall fuel efficiency and the City's resilience, as well as enhancing the economics of the District Energy utility. Under the CEP an additional 50 to 60 MW of CHP will be associated with the District Energy systems by 2041.

The 800 kilowatt CHP due to be installed in the 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. This was originally approved to primarily reduce electricity costs. Its

⁷⁵ Greenhouse can benefit from CHP associated DE systems by using some of the exhaust carbon-dioxide to stimulate growth – this relatively common configuration in countries like the Netherlands.

⁷⁶ As an example, [Sheridan College](#), Ontario, developed and approved an IEMP that will increase efficiency by 50 per cent, reduce emissions by 60 per cent and deliver attractive cost saving and investments returns. This is now being implemented. The expansion of the District Energy Portion beyond the Campus in both Oakville and Brampton is now being evaluated.

economic and environmental value can be enhanced as part of the wider District Energy strategy.

Reinforce Institutional Structure

The City already has the basic institutional framework through WUC's DEW division to implement the District Energy recommendations of the CEP. The basic operational and customer service structure is already in place.

Following approval of the CEP, it is recommended that the City encourages the Windsor Utilities Commission to begin to work with key partners and stakeholders⁷⁷ to develop a detailed Business Plan for the growth of District Energy as outlined in the CEP recommendations. The Plan will have distinctly different business models for the thermal utility services serving the residential, institutional and commercial customers group and the services for industrial consumers.

- **Funding Mechanism:** Funding will be defined in detail within the district energy business plan.
- **Potential Delivery Agent:** In addition to the many marketing, technical, organizational and operational aspects, this Plan will include the future ownership and investment structure of the ongoing District Energy Utility. There are many successful examples to draw on from around the world that range from 100 per cent municipal ownership to 100 per cent private. Some form of public-private partnership⁷⁸ is the most probable outcome.

In the early stages, potential consumers will understandably be unsure and may be skeptical about the costs, risks and benefits of district energy. The following supporting elements will be needed:

- Comprehensive background information on District Energy
- Peer installation visits in Canada and elsewhere
- Construction guideline to ensure a building is "District Energy Ready"
- Planning and Permitting Guidelines
- Potential non-financial incentives
- **Timing:** Ongoing
- **Benefits:** There are multiple benefits to district energy for Windsor, including: flexible building designs, lower operations and maintenance costs, better energy delivery, greater price stability, enhanced comfort, reduced GHG emission, and the retention of more energy dollars in the Windsor community.

⁷⁷ These stakeholders/partners will include the City Financial, Planning, and Economic Development Departments; Chamber of Commerce; Union Gas; Enwave; potential investors; developers and construction players; along with Regional and Provincial staff.

⁷⁸ Windsor's Sister City, Mannheim, has a successful profitable municipal utility, MVV Energie AG, which manages most of the City utility services, including robust and growing district energy. This has evolved from a 100 per cent city owned utility to 51 per cent /49 per cent City/Private over the past two to three decades. Its experiences may be useful background to guide Windsor in developing the detailed final recommendations.

Enabling Strategies to Support District Energy

Enabling Strategy 14: Create a Gordie Howe International Bridge Low-Energy Economic Development Area

The new Gordie Howe International Bridge, due to open in 2020, will redefine the western edge of the City in the Ojibway, Sandwich and Malden districts. This will become one of the busiest crossings between the USA and Canada. The area around the bridge will be potentially attractive for both commercial and industrial investors. The attractiveness can be enhanced by providing packages of utility services tailored to the needs of potential investors.

The concept would be to provide a flexible, multi-utility structure that would offer customized service packages managed by a special purpose entity. These services could include district heating and cooling, process steam, process refrigeration, compressed air, and waste heat recovery provided as shared utilities. This would make the site highly attractive to prospective investors through lower and more stable energy costs, reduced initial investments and reduced environmental impact.

The recommendation is for the City to designate and plan the area around the end of the Gordie Howe Bridge to be a Low-Energy Economic Development Area providing client-specific energy services. The immediate first step would be to develop an Integrated Energy Master Plan for this area that will offer a wide range of shared energy services that would be attractive to industrial, heavy commercial, and transportation developers. The possibility of creative residential development as part of a mixed use strategy should not be ruled out.

The designated areas would recognize sensitive environmental assets such as the Ojibway Nature Complex and the Black Oak Heritage area. This area has some major existing energy assets including the West Windsor and Brighton Beach power plants. These have the possibility not only to serve the Ontario grid with power, but also be part of a fully integrated local energy solution by making their waste heat and spare capacity available to the community.

Industrial/commercial parks with tailored shared energy solutions are relatively common in parts of Europe⁷⁹ and Asia, however are still rare in North America. Implementing one on such an attractive location could be an added competitive advantage for the City.

⁷⁹ As an example, the municipal utility from Mannheim, MVV Energie AG, operates such a facility remote from Mannheim – the Gersthofen Industrial Park in Bavaria – see https://www.mvv.de/de/mvv_energie_gruppe/mvv_enamic/mvv_enamic_igs_gersthofen_2/index.jsp

Chapter 10 – Renewable Energy Generation

Background Characteristics of Renewable Energy Status in Windsor



By far the largest single renewable energy project underway in Windsor is the installation of about 50 Megawatts of solar photovoltaic generation on a 300-acre site at the Airport.

This is being developed under the Large-Scale FIT incentive program of Ontario with land being leased to Samsung. The City benefits from the contribution, along with many similar large scale solar projects in Ontario, to reduce the Province's low overall emissions from its power system.

A relatively small number of homes and commercial businesses have installed rooftop solar under the Small-Scale FIT program. These users benefit from reduced overall electricity costs and the community benefits from further emissions reductions.

Ontario has a rapidly growing number of utility sized wind-turbines, again contributing to the low emissions of the power system. None are installed in Windsor.

On the thermal side, there is no significant use of renewable biofuels or other renewable thermal sources including solar. The University, Chrysler, and Ford CHP installations can be considered "clean" supplies that create electricity and heat more efficiently than typical systems in the past.

Opportunities and Challenges

Solar and wind power generation is growing at 20 to 25 per cent worldwide. Globally, costs are plummeting with solar PV down about 60 per cent and wind down nearly 30 per cent of the original cost in the last 7 years. This cost trend, combined with Ontario's supportive policies, is making solar steadily more attractive for individual property owners within Windsor.

The FIT programs are likely to become less economically attractive over the coming years as the use of solar PV scales up and costs further reduce.⁸⁰

Utility scale wind power will continue to grow as a major part of Ontario's power system, driven predominantly by Provincial policy and continued reductions in costs.

⁸⁰ The probability is that the FIT program will morph into some kind of net-metering which would still make Solar PV economically viable given current cost trends.

Recommended Strategies for Clean and Renewable Energy

Strategy 15: Encourage the Installation of Solar Arrays

- **Description:** The widespread installation of small and medium sized solar arrays should be actively encouraged throughout the Plan period to:
 - Create a significant source of carbon free electricity within the City;
 - Reduce electricity costs for building owners and tenants; and
 - Reduce the summer power peak demand of the City.
- **Target Participation Level:** The CEP estimates a realistic target would be a total of 90 MW generation split roughly equally between homes, commercial and institutional buildings, and ground mounted arrays.
- **Energy and GHG Emission Reduction Potential:** This would generate approximately 3 per cent of the City's future power needs.
- **Program Design:** The installations would be a mix of home and building rooftops, walls, and balconies along with ground based and parking covers.



Wind Power

The CEP assumes the City would continue to benefit from a sustained Provincial policy and makes no specific local recommendation. The one exception to this may be in future plans for greenfield areas.

Biofuels/Biogas

The District Heating strategy enables multiple heat sources to be efficiently combined. Biomass and biogas sources should be added as the heating network achieves reasonable scale and they become economically viable. This will probably be in five to ten years from the start of the plan. The Net Zero Neighbourhood may include biofuel heating from the start. The CEP assumes no biofuelled heat sources are used, so this is a potential future strategy to further reduce overall emissions.

Solar Thermal

Solar thermal sources will be included in the efficiency retrofit packages for residential, institutional and commercial building retrofits outlined in Chapters 5 and 6 to supply some or all of the domestic hot water and space heating needs and further reduce emissions. Again, the CEP assumes no solar thermal heat sources are used, so this is a potential strategy to further reduce overall emissions.

Larger scale solar thermal arrays can also be a source of heat for the district heating networks; however, this is not recommended as more cost effective alternatives are likely to be available for the foreseeable future.

- **Funding Mechanism:** N/A
- **Delivery Agent:** various
- **Timing:** Ongoing
- **Benefits:** There are numerous benefits to renewable energy generation including:
 - Renewable energy generation is considered safe, clean and quiet and highly reliable.
 - Solar arrays do not create GHG emissions.
 - Solar arrays can be mounted on roofs, thereby not taking any farmland out of production.



Chapter 11 - Community Education and Communication

Background Characteristics of Community Education in Windsor

Energy is a hot topic for many households in Ontario as energy prices continue to increase in the province. As such, there is a need for ongoing community discussion and education about smart energy communities and how they can address job creation, the City's reputation, and quality of life. Discussions about climate change and benefits to transforming the energy future of the city towards sustainable economic development are also needed.

Recommended Strategies for Community Education

Strategy 16: Develop a Community Education and Communications Campaign

- **Description:** Communication, education and outreach efforts to engage and mobilize the residents of Windsor are necessary to help build community understanding of the benefits of the CEP, demonstrate how they can participate in programs and convey the resulting positive impacts to quality of life in Windsor.
- **Target Participation Level:** As many Windsorites as possible
- **Energy and GHG Emission Reduction Potential:** Although direct GHG emission reductions are not anticipated from education, the strategy will provide the foundation for meaningful change across other strategies.
- **Program Design:** The City of Windsor will continue to provide updates on the progress of the CEP through the City website and social media channels. Education and awareness will continue through activities linked to other environmental, economic development or city initiatives such as Open streets, Earth Day, Earth Hour, etc. It is recommended that the City develop a short video series to explain the benefits of the CEP at the community level which can be shown at City events and on social media. A key role for both the CEP Project Administrator and the Community Implementation Task Force will be to identify strategic partnerships for the development of an effective engagement strategy to foster uptake of the retrofit programs identified through the CEP.

Key Concepts to be Included in the Education Campaign

The community survey revealed there are a number of key energy concepts that Windsorites are not familiar with. Having a better understanding of our energy system will help everyone make better informed decisions about the energy used in the community, at work and at home. The following concepts should be included as part of a comprehensive education and awareness campaign:

- Residential retrofit program
- Local improvement charges
- District energy systems
- The difference between energy cost and energy price
- Roles and responsibilities

- **Funding Mechanism:** N/A
- **Delivery Agent:** City of Windsor
- **Timing:** Immediately
- **Benefits:** Changing how energy is used in the community has numerous benefits. Ensuring that residents have a solid understanding of energy in Windsor will allow community members to make informed decisions about the kind of energy they use, how energy costs and pricing factor into decisions, as well as understand the economic and environmental benefits for individuals, businesses and society. Ensuring community members have an opportunity to improve energy literacy will provide benefits to the understanding and eventually uptake for all strategies identified in the CEP.



Chapter 12 – Impacts and Benefits of Taking Action on Energy and Climate for Windsor

Implementation of the full suite of strategies identified above will provide the Windsor community with significant economic and environmental benefits.

As noted in Chapter 4, the consulting team, with guidance from the City and the Community Task Force, developed the baseline of energy use in 2014, and the base case or business as usual scenario to understand what energy use would be like in Windsor, in the absence of a CEP and with only actions already planned within the City and through provincial activities in 2041.

The base case scenario allowed the consulting team, City and Community Task Force to assess Windsor's ability to achieve the provincial energy and GHG emissions reduction targets and Windsor's own 40 per cent energy and 40 per cent GHG emission reduction targets.

The base case indicated that in the absence of the CEP, total energy use in Windsor will increase from 38.5 to 46.9 PJ (22 per cent) and total GHG emissions would increase from 1.85 to 2.2 million Tonnes (19 per cent) by 2041.

By advancing all strategies identified in the CEP, Windsor is able to reduce its total energy use by 29 per cent and total GHG emission by 24 per cent below 2014 and 43 per cent below 1990. This brings the Windsor community close to achieving the Ontario Climate Action Plan target of 40 per cent GHG emission reduction by 2030.

Figure 26 shows that by advancing all strategies identified in the CEP, Windsor is able to reduce its total energy use by 29 per cent and total GHG emission by 24 per cent below 2014 and 43 per cent below 1990.

This brings the Windsor community close to achieving the Ontario Climate Action Plan target of 40 per cent GHG emission reduction by 2030, but also suggests the Windsor community would still require significant effort to achieve the 80 per cent GHG emission reduction target identified by the Province for 2050. Figure 26 also re-iterates that addressing corporate emissions from the City of Windsor operations, while important, will not be sufficient to achieve significant gains in climate mitigation. Significant action is required across all sectors, with a particular need to address emissions from buildings in Windsor and transportation solutions across the province.

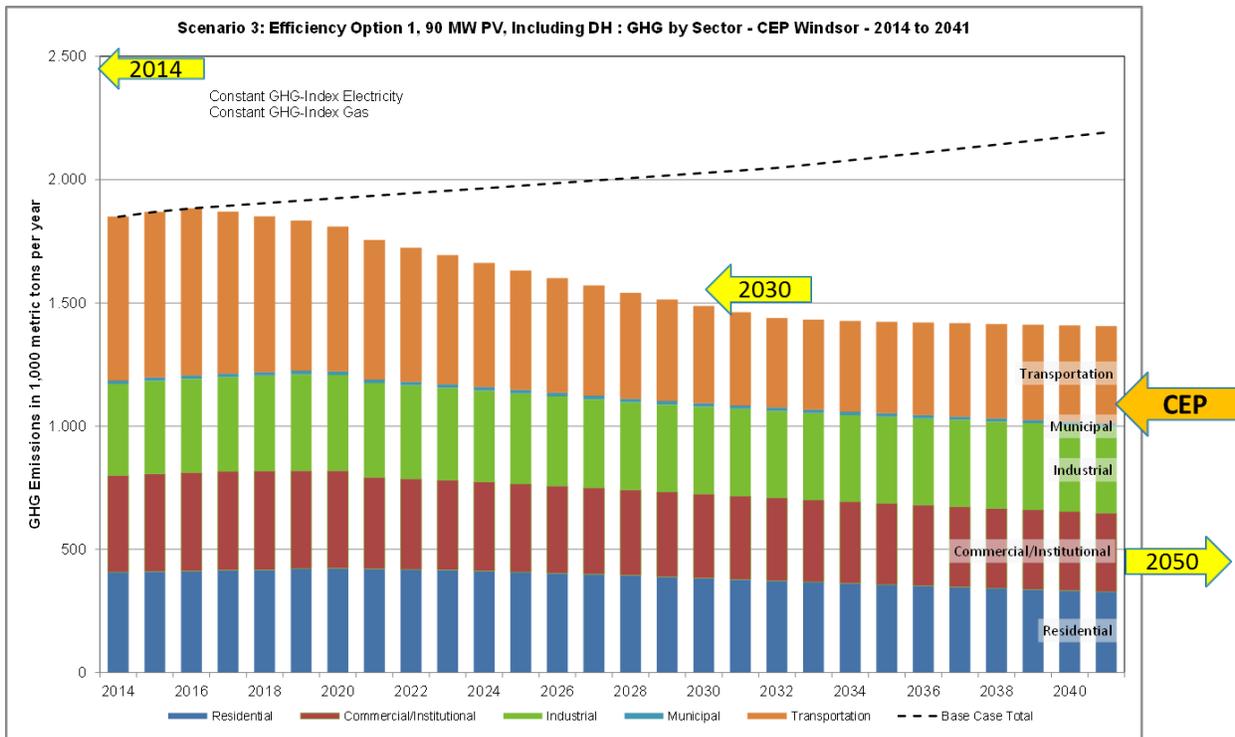


Figure 26: GHG Emissions Reductions Achieved through the CEP (2014 - 2041)

Similarly, the base case indicated that in the absence of the CEP, annual energy costs would increase from \$842 million per year to a range of \$1.8 billion to \$3.1 billion per year by 2041.

Through implementation of the strategies identified in the CEP, the Windsor community will be able to mitigate energy costs risks of \$8.6 billion to \$12.4 billion as shown in Figure 27 and Figure 28 respectively. This signifies the importance of this Plan and the CEP strategies described previously to both the environment and the Windsor economy.

Through implementation of the strategies identified in the CEP, the Windsor community will be able to mitigate energy costs risks of \$8.6 billion to \$12.4 billion.

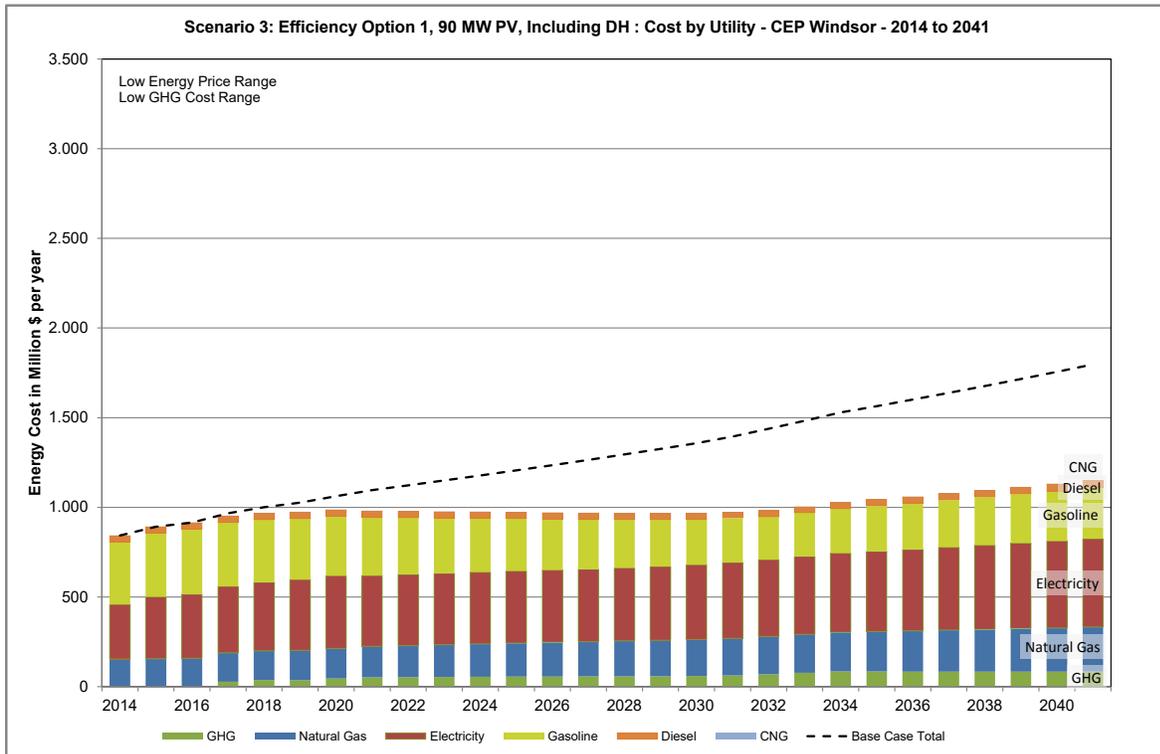


Figure 27: Low Range of Energy Cost Risk Avoidance as a Result of Implementing the CEP Strategies

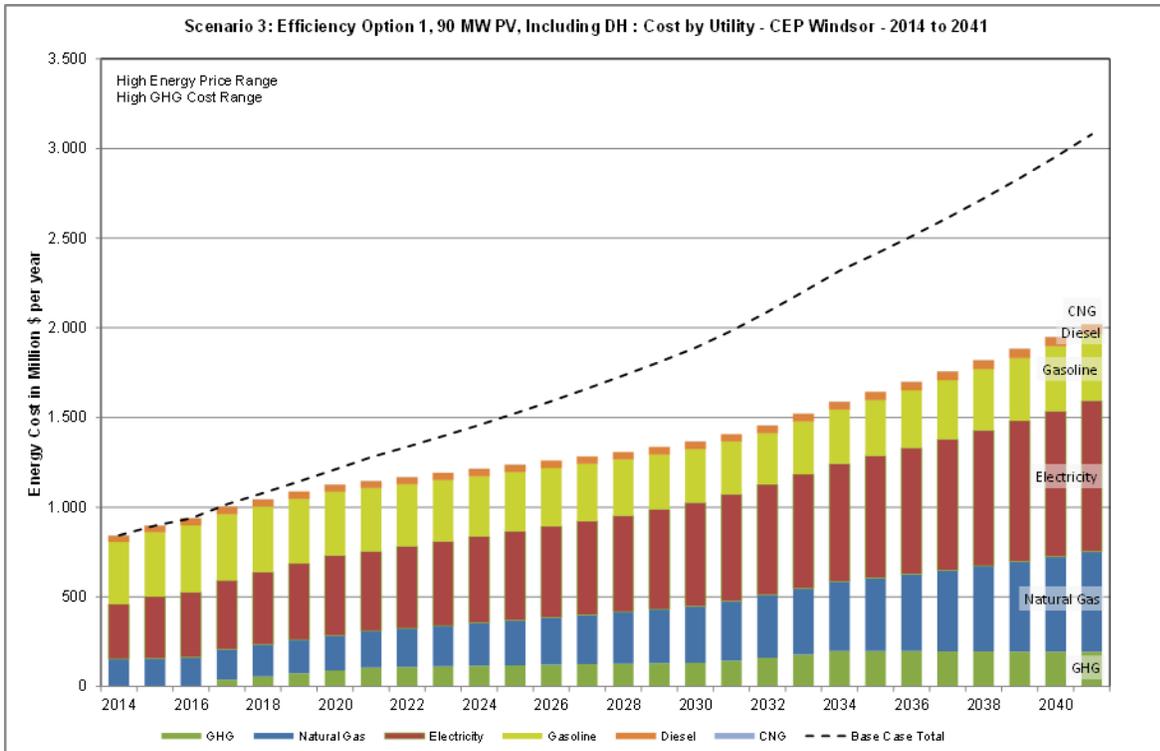


Figure 28: High Range of Energy Cost Risk Avoidance as a Result of Implementing the CEP Strategies

The strategies described throughout Chapters 5 to 10 have numerous benefits for homeowners, contractors, the Corporation of the City of Windsor, community groups, utilities, the province and Canada, including:

For Homeowners

- Reduced energy and maintenance costs
- Increased property value
- Increased comfort
- Environmental improvement

For Implementation Network - Contractors

- High project volume
- Minimal marketing expense
- Higher margins
- Reduced General and Administrative costs
- Reduced risks with Strategic Implementation Network Material Partners
- Growth potential – Other cities

For Natural Gas and Electric Utilities

- Scale support of statutory efficiency targets
- Reduced future capital requirements

For the City of Windsor

- Contribution to CEP energy cost and GHG goals
- Reduced energy costs spent in community
- Local employment
- Increased property value
- Role model for other cities

For Community Groups

- Neighbourhood revitalization
- Environmental benefits
- Potential funds for other social projects
- Competitive spirit/cohesion
- Youth employment as a public good

For the Province and Canada

- Show leadership as a community addressing its energy future in Ontario and Canada
- Contribute to the greenhouse gas emission reduction targets established by the province and Canada



Chapter 13 – Implementation Framework and Next Steps

Governance and Administration

The recommendations contained in the CEP cannot and should not be led exclusively by the City alone. Many of the proposed strategies rely on partnerships with external organizations such as local utilities and industries and, in some instances, the Province to ensure their success. **Please note that these are suggested roles and will need to be confirmed with each community partner prior to implementation.** The following provides a framework for implementation governance.

City of Windsor: The City of Windsor has direct control of only 1-2 per cent of the energy used within the community; however, it does have a key leadership role and responsibility for moving the City forward and enhancing the quality of life of its residents. The key roles for the City are three-fold:

- (1) To provide oversight for the implementation of the CEP, including the assignment of a dedicated **CEP Project Administrator**, who will ensure the various policies, planning, and implementation support elements are aligned for the Plan to move forward. The CEP Project Administrator will act as a catalyst for implementation, working with partners to develop detailed business plans, seeking funding for initiatives, regularly monitoring and reporting on progress, engaging with City Council, staff, and stakeholders and coordinating a Community Implementation Task Force.
- (2) To set policy direction that drives the community towards transformational change and smart energy systems at the community level. This includes integrating energy efficiency into planning documents, as well as policies to support net-zero neighbourhoods or communities, transit-oriented development, district energy, and renewable energy.
- (3) To demonstrate energy efficiency and smart design in city-owned buildings, fleets and practices.

EnWin: EnWin provides reliable and cost effective electricity services in Windsor. They have played an active role in the Community Task Force and supported the baseline energy study with the provision of consumption data.

EnWin is responsible for delivering conservation and demand management programs through the IESO's saveONenergy program to advance the Conservation First Framework and LTEP objectives. Their portfolio also includes operation of the current district energy system in the City. Under both roles, EnWin plays a critical role in achieving the objective for District Energy expansion within the City. They are also a key strategic partner for the City as it looks at how to advance retrofit programs and renewable energy generation, and a key source of consumption data to support monitoring activities.

Union Gas Limited: Union Gas provides reliable and cost effective natural gas services and delivers natural gas demand-side management (DSM) programs. Union Gas played important roles in providing consumption data that formed the basis for understanding energy use in Windsor and actively participated on the Community Task Force.

Like EnWin, Union Gas has a potential role to play in the retrofit programs, particularly those for ICI sectors. They also have a role to play in discussions on future directions for district energy in Windsor, and they are exploring opportunities under their own mandate for combined heat and power (CHP), RNG, and CNG/LNG in the transportation sector that will also further the goals of the CEP. Union Gas will also be a key source of consumption data to support monitoring activities in the future.

Industrial, Commercial, and Institutional (ICI) Sectors: As energy use in the ICI sector represents 20 per cent of Windsor's total energy use, the ICI sector is instrumental in the Plan's implementation. The ICI sector can support implementation by participating in energy conservation programs, evaluating and implementing CHP, supporting district energy, and renewable energy solutions. The industrial sector has an additional opportunity to create a mentorship program as energy leaders in the community, building on existing informal structures and professional associations.

WindsorEssex Economic Development Corporation: The WindsorEssex Economic Development Corporation is responsible for advancing economic development and prosperity in the WindsorEssex region. It is the region's lead economic development agency and a dedicated catalyst for business growth and expansion. They attract new businesses to the region, help strengthen existing businesses and support entrepreneurship. This organization contributes significantly to the community and can play an important role in the promotion of the economic benefit that is achievable through the implementation of the CEP, and helps create effective partnerships for implementation.

Windsor-Essex Regional Chamber of Commerce: The Chamber of Commerce aims to provide leadership that advances the global competitiveness, economic prosperity and quality of life of the Windsor Essex region and enhance relationships with our current partners while establishing new strategic partnerships. The Chamber of Commerce can play an important role in the promotion of the economic benefit that is achievable through the implementation of the CEP, and help create effective partnerships for implementation.

Independent Electricity System Operator (IESO): In addition to working with neighbouring municipalities to develop the Windsor Essex Integrated Regional Resource Plan, the IESO should be consulted on an ongoing basis. The IESO's Integrated Regional Resource Plan looks at regional electricity planning in the Windsor area (and other Regions in Ontario) from three levels – (1) regional system planning, (2) provincial or bulk system planning, and (3) local distribution system planning. The City of Windsor can partner with the IESO to align Windsor's CEP and the Windsor Essex Region IRRP as they both move forward and evolve.

Province of Ontario: As one of the funding bodies for the preparation of the CEP, the province through the Ministry of Energy can foster avenues for knowledge sharing amongst Ontario municipalities that have, or wish to have, a Community Energy Plan. The City of Windsor and CITF through the CEP Project Administrator should work with the Province to share experience and gain support as the CEP is approved and implemented.

Community Implementation Task Force: The City should coordinate and facilitate a committee of community partners that meet on a regular basis each year to oversee and reflect on: (1) the progress being made on the CEP recommendations, (2) energy reduction and GHG emission reductions achieved, and (3) opportunities for future CEP work planning and prioritizing future work. The Community Task Force (CTF) established through the development of the CEP included broad representation across Windsor. The CTF should transition to a Community Implementation Task Force and include any additional members who are leading strategies within the CEP. The CITF should meet on a regular basis (4-6 times per year).

University of Windsor: In addition to being an active member of the CITF, the University is developing a focus on transportation research. The CEP is calling for an innovative multi-faceted approach to both reducing the economic and environmental impact of transportation while enhancing neighbourhoods. The University could provide a valuable research base as this aspect of the CEP is rolled out.

Investment Requirements

Federal Investment

The 2016 federal budget provides significant funding opportunities, including \$75 million in 2016-2017 under “Building Capacity in Municipalities to Address Climate Change”, \$125 million in 2017-2018 to help “Fund Innovative Green Municipal Projects” as an extension of the existing Green Municipal Fund, \$401 million under “Clean Technology”, \$86 million to “Support Energy Efficient and Renewable Energy Development”, and \$57 million to “Move to a Cleaner Transportation Sector”, among others.⁸¹

Provincial Investment

The province released the Climate Change Action Plan in 2016 that identifies specific strategies and funding through the greenhouse gas reduction account (GGRA) to “create good jobs, help people and businesses reduce their carbon footprint, save money, and accelerate a shift to a more sustainable society”.⁸² Table 9 highlights the funding available to programs across the province that addresses climate change.

⁸¹ Government of Canada, Budget 2016: Growing the Middle Class.

⁸² <https://news.ontario.ca/opo/en/2016/06/ontario-releases-new-climate-change-action-plan.html>.

Table 9: Ontario's Investment for Climate Action⁸³

Actions	Investments In The Plan
Increase availability and use of low carbon fuel	\$115-175M
Increase the use of electric vehicle incentives	\$246-257M
Support cycling and walking	\$115-225M
Increase the use of low carbon trucks and buses	\$215-290M
Improve energy efficiency of multi-tenant buildings	\$680-900M
Increase energy efficiency in schools and hospitals	\$400-800M
Reduce emissions from heritage buildings	\$40-80M
Help homeowners reduce their carbon footprints by supporting additional choice	\$681-824M
Set lower-carbon standards for new buildings	N/A
Promote low-carbon energy supply and products	\$60-100M
Help individuals and businesses manage their energy use and save money	\$200-250M
Training, workforce and technical capacity	\$45-70M
Strengthen climate change policies in the municipal land-use planning process	N/A
Support municipal and other stakeholder climate action	\$270-325M
Reduce congestion and improve economic productivity	\$10-20M
Help industries adopt low-carbon technologies	\$875M-1.1B
Collaborate with Indigenous communities	\$85-96M

In addition, there is ongoing funding through IESO programs (conservation fund, renewable energy development, funds for Aboriginal communities), that can be leveraged to foster a transition to long-term energy sustainability.

Municipal Investment

Table 10 outlines the timelines and estimated costs associated with implementation of the strategies identified in the CEP chapters above. The first recommendation is to dedicate funds towards complete detailed mapping of the City structured to support the Business Plans for District Energy, Residential, and Non-Residential sub-strategies. The mapping will be similar for each sub-strategy with a different data set used for each. Potentially the detailed mapping will be incorporated into planning and other policy documents and will need to be updated regularly. At a minimum, the mapping will cover the immobile energy (R and ICI and local supply). In an ideal world, it would also include transportation energy by planning district and by various transportation sectors. This will require a whole new level of transportation data acquisition and management. This is unlikely to be in place for at least a few years to come.

⁸³ Source: Adapted from Ontario Climate Change Action Plan.

Table 10: Municipal Investment Required for Implementation

Strategy	Timelines	Estimated Total Cost to City	Funding Source
Prepare Detailed Energy Mapping to support Residential, Industrial, Commercial, Institutional, and District Energy strategies	Complete by 2018	\$75,000 ⁸⁴ Cost associated with detailed sector based energy mapping	Recoverable cost assuming programs go ahead. Costs allocated to Residential, ICI and District Energy Business Plans
Create a Deep Retrofit Program for Existing Homes	Complete business plan in 2018, Program begins in 2019	\$80,000 ⁸⁵ plus mapping allocation. Costs associated with detailed business plan development	Recoverable cost assuming program goes ahead Uses LIC as funding mechanism
Enforce Compliance with the Ontario Building Code for New Residential Development	Ongoing	N/A reinforced expectations arising from EPL program	N/A
Integrate Energy Performance Labelling for Homes and Buildings	Starting in 2018	Minimal costs associated with designing and rolling out EPL plan	Non-recoverable cost. Potential funding from FCM, Province, NRCan or City. Ongoing cost covered by user fees.

⁸⁴ Consultants' estimate based on recent comparable projects in Ontario.

⁸⁵ Based on the CHEERIO Working Group LIC Financing Pilot Program Design study carried out by Dunsky Consulting. This study indicates that program initiation fixed costs to set up the legal, planning, and reporting aspects of a program model would be \$80,000, regardless of the size of the eventual program.

Strategy	Timelines	Estimated Total Cost to City	Funding Source
Create Net Zero Neighbourhood as an Opportunity for Transformative Change at the Neighbourhood Scale	Starting in 2018	City staff to develop the policy and planning guidelines for a “net zero” neighbourhood in general. Resources may be needed to support guidelines development.	Non-recoverable cost. Potential funding from FCM, Province, NRCan, City or key stakeholders.
Create a Deep Retrofit Program for Existing Businesses and Public Buildings	Complete business plan in 2018, Program begins in 2019	\$80,000 plus mapping allocation Costs associated with detailed business plan development. Note integration with the business plan development for the residential program would permit some cost savings.	Recoverable cost assuming program goes ahead Uses LIC as funding mechanism
Enforce Compliance with the Ontario Building Code for New Commercial and Institutional Development	Ongoing	N/A reinforced expectations arising from EPL program	N/A
Continually Increase Industrial Energy Efficiency	Ongoing	N/A	N/A
Reinforce a Windsor Network and Mentorship Program for Transfer of Best Practices	2017	N/A – Facilitated by CEP Project Administrator	N/A
Encourage a Modal Shift Towards Public Transit	Ongoing – Start 2018	Provision for annual cost for outreach and studies	Non-recoverable cost. Federal and provincial incentives

Strategy	Timelines	Estimated Total Cost to City	Funding Source
Develop and Implement an Active Transportation Master Plan	Start 2017	Approved budget	City budget
Foster the Adoption of Electric Vehicles	Ongoing – Start 2018	N/A - Encourage through outreach by CEP Project Administrator N/A – Planning policy - parking and charging guidelines	Federal and provincial incentives ⁸⁶ Potential stakeholder support from Ford/FCA
Continue to Advance Smart Energy Systems through Effective Land Use Planning	In place by 2018	N/A – Planning policy guidelines	N/A
Designate and Plan District Energy Areas and supply DE services	Start 2017	Official Plan designation of DE areas in existing corridors	Recoverable cost assuming program goes ahead Uses private capital and maybe city/utility participation as investment mechanism. Ongoing as a thermal utility
	Start 2019	\$100,000 plus mapping allocation for costs associated with detailed business plan development for expansion of the DE system	
Create a Gordie Howe International Bridge Low Energy Economic Development Area	Starting in 2018	City staff time to develop the policy and planning guidelines	N/A

⁸⁶ See for example: [Electric Vehicle Charging Incentive Program](#), Ontario Ministry of Transportation, Oct. 2016.

Strategy	Timelines	Estimated Total Cost to City	Funding Source
Explore Renewable Energy Generation	Ongoing	N/A – Encourage through outreach by CEP Project Administrator Utilize provincial standard offer programs	N/A End-user or third-party capital
Engage a CEP Project Administrator	2018	\$75,000-\$125,000/year FTE ⁸⁷	Identification of funding is part of CEP Project Administrator role, shared costs to be explored with other partners including opportunity to seek capacity building funding. This role(s) can be shared with the CCAP.
Develop and Deliver a CEP Education and Outreach campaign	Could begin immediately or linked to the launch of the residential retrofit program	\$25,000	Identification of funding is part of the City's role, shared costs to be explored with other partners.
Facilitate the Community Implementation Task Force	Post-approval of the CEP by Council	Nominal	N/A

⁸⁷ Recurring cost.

Other Investment

The immediate next step for three key strategies – Residential Retrofit, ICI Retrofit, and District Energy – is to develop decision grade business plans. In each case, it is likely that these plans will call for the creation of profitable entities. The returns are expected to be well above the returns from Municipal bonds. This will result in the entities seeking long-term funding from the private capital or equity markets once the respective risk-adjusted business plans are completed.

Participation of private equity or capital funding does not exclude the City or its affiliate EnWin being a co-investor or owner and any, or all, of the new entities. In fact, the greater the participation by the City in a public-private financing model, the greater the potential benefits to the City's residents.

Ongoing Tracking and Monitoring

Windsor's energy and emissions profile and climate are fairly unique within the Ontario context. Therefore, it is recommended that progress of implementing the CEP be measured against the City's own 2014 baseline rather than comparisons to other municipalities. By benchmarking against Windsor's own baseline, the community will have a clear picture of how the community is using energy now, how strategies are performing, and what opportunities exist for improvements.

For municipal operations and those of public sector institutions such as the hospital and local schools, the level of energy performance will be reported and published on an annual basis in compliance with the *Green Energy Act, 2009* requirements. Industries, such as Ford and Fiat Chrysler also generate annual report cards on their overall performance that can be referenced. The City, however, will need a more comprehensive approach to monitoring the whole community energy profile (including residential, transportation, businesses, and those not captured under the other mechanisms identified). It is recommended that a comprehensive inventory of energy use and GHG emissions be completed at least on a biennial basis.

The following provides a set of potential performance indicators for consideration that will help Windsor monitor progress over time. The indicators presented in

Table 11 have been identified based on best practices and use readily available data sources.

Table 11: Potential Community Performance Indicators

Community Performance Indicator	Measurement
Primary Measures	
Total energy use	GJ
Total energy use per capita	GJ/capita
Percentage change in total energy use per capita from CEP baseline	%
Total energy use per full time job	GJ/job
Percentage change in total energy use per full time job from CEP baseline	%
Total GHG emissions	Tonnes CO ₂ e
GHG emissions per capita	Tonnes CO ₂ e/capita
Percentage change in GHG emissions from CEP baseline (2014)	%
Percentage change in GHG emission from OCAP baseline (1990)	%
Total energy cost	\$
Secondary Measures	
Total energy use by sector	GJ
Energy use by sector as percentage of total	%
Total energy use by source	GJ
Energy use by source as percentage of total	%
Residential energy intensity	GJ/m ²
Completed Residential Retrofits	#
Residential retrofits as % of 2014 existing homes	%
Commercial / Institutional energy intensity	GJ/m ²
Completed Commercial / Institutional Retrofits	#
Commercial / Institutional retrofits as % of 2014 existing C/I buildings	%
Transportation energy use per vehicle km travelled	GJ/km
Percentage change in transportation energy use per VKT from CEP baseline	%
Number of District Energy Clients	#
Total installed capacity of distributed Solar PV	MW
GHG emissions by sector	Tonnes CO ₂ e
GHG emissions by sector as percentage of total	%
GHG emissions by source	Tonnes CO ₂ e
GHG emissions by source as percentage of total	%

Strategies to Further Reduce GHG Emissions

The CEP provides the Windsor community with an ambitious roadmap to a smart energy future by 2041. The CEP strategies will bring Windsor amongst the leaders in community energy on the global scale. However, the GHG emissions reductions achieved through the complete implementation of the 16 strategies identified in the plan will fall slightly short of achieving the Ontario target of 80% reduction in GHG emission by 2050 below the 1990 levels. The following are additional potential strategies that the community could pursue to bridge the gap and align fully with the Ontario target.

- Home & Building Efficiency - Increase penetration of retrofit programs
- Transportation Efficiency – Implement further improvements to public transit service and accelerate the transition to electric vehicles
- Industrial Efficiency – Increase the targets for more aggressive continuous improvement
- District Energy:
 - Consider more aggressive targets to connect more customers to the DE system;
 - Accelerate the transition to bio-fuels where possible;
 - Consider the selective inclusion of geo-thermal heating into the energy network; and
 - Promote aggressive heat recovery from commerce and industry
- Solar Arrays - Expand beyond 90 MW target.

Each of these strategies would require further detailed design and development following the initial program delivery identified throughout the previous chapters.

Recognition

As noted in the introduction, the CEP is designed to fulfill the requirements for both municipal (corporate) and community Milestones 1, 2, and 3. Milestones 4 and 5 will be achieved through implementing the CEP. It is recommended that the City continue to participate in the PCP program as one of the key Climate Action recognition programs in Canada and formally submit for Milestone recognition. It is also recommended that Windsor continue to participate in the Compact of Mayors and receive recognition under that parallel framework.

Plan Renewal

The CEP is considered a living document that is able to be updated and adapt to changing provincial and federal legislative context as well as in relation to the Windsor-Essex Integrated Regional Resource Plan. Renewal of the CEP should occur at a minimum of five year intervals in alignment with the renewal of the climate adaptation plan and the Environmental Master Plan.