

City of Vaughan

Municipal Energy Plan

Plug into a Smart Energy Future



vaughan.ca/Environment

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Message from the Stakeholder Advisory Group

The Stakeholder Advisory Group for the Vaughan Municipal Energy Plan is pleased to present Vaughan's Municipal Energy Plan (MEP) for reducing greenhouse gas emissions. We want to congratulate the City of Vaughan for showing leadership in developing this Plan and applaud Lura Consulting for guiding the process. We are grateful to have an opportunity to support further implementation of *Green Directions Vaughan* and to contribute to addressing climate change. The Stakeholder Advisory Group and the City thank the Federation of Canadian Municipalities and the Ontario Ministry of Energy for financial support to develop the MEP.

The MEP builds on and replaces the Community Climate Action Plan. Many Vaughan citizens contributed throughout the process. The Stakeholder Advisory Group reflects a broad range of agencies and sectors with a strong commitment to addressing climate change and to taking action to protect human health and the environment. We want to thank all of those that contributed to this Plan.

We know that immediate action is required to mitigate the impacts of climate change. More intense weather events causing flooding and more extreme climate variability such as heat waves are already being manifested here at home and in many parts of the world. We understand the serious health consequences associated with climate change – impacts to cardiovascular and respiratory health as a result of air pollution and extreme heat events, increased incidence of infectious diseases related to waterborne diseases and emerging vector-borne diseases, and increased risk for vulnerable populations.

Governments are working to create the tools to foster real action to reduce greenhouse gas emissions:

- At the 2015 United Nations Climate Change Conference in Paris (COP21), 195 countries adopted the first-ever universal, legally binding global climate deal.
- The federal government is engaging with provincial counterparts to develop a carbon-pricing framework.
- Ontario's Climate Change Strategy sets a vision for climate-resilient communities and to create a low-carbon economy.

The City of Vaughan Municipal Energy Plan puts us on a path to create a climate-resilient community and participate in a low-carbon energy future. We all have a part to play in initiating action and achieving results in these areas to reduce greenhouse gas emissions – at home, at work or school, and on the move. Let's get started!

1 Introduction

1.1 What is a Municipal Energy Plan?

In 2013, the Ministry of Energy (MOE) announced that it would be supporting local energy planning efforts in Ontario by launching the Municipal Energy Plan (MEP) program. The MEP program aims to support municipalities' efforts 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 their goals.

The MEP takes a holistic approach to energy planning at the community level, taking into account energy generation and transmission infrastructure, land use planning, economic development and overall education on energy issues by the community at large.

The purpose of the MEP is to help municipalities¹:

1. Assess the community's energy use and greenhouse gas (GHG) emissions;
2. Identify opportunities to conserve, improve energy efficiency and reduce GHG emissions;
3. Consider the impacts of future growth and options for local clean energy generation; and
4. Support local economic development.

1.2 Shifting Context of Energy Planning in Ontario

Energy planning in Ontario continues to make significant progress towards clean, reliable energy solutions that will ensure an efficient, low energy intensive future. Conservation and demand management have taken on a much more significant role in recent years, and this has happened at the provincial, regional and municipal levels.

The Ministry of Energy (MOE) has identified conservation as a key part of the province's collective effort to reduce GHG emissions in both its Long-Term Energy Plan (LTEP) and the Conservation First Framework. The LTEP is designed to balance five principles of cost-effectiveness, reliability, clean energy, community engagement, and emphasizes conservation and demand management before building new generation. Ontario Regulation 397/11 also came into force, which requires public agencies (such as municipalities, universities and hospitals) to report on their energy use and GHG emissions to the MOE on an annual basis, in addition to developing 5-year conservation and demand management plans.

The Ontario Power Authority, now merged with the Independent Electricity System Operator (IESO), has been carrying out regional plan activities on an ongoing basis since its inception in 2005. These integrated regional plans examine generation, transmission, distribution and conservation options from a regional perspective. The IESO released the York Region Integrated Regional Resource Plan in April 2015 and is continuing to engage with the Local Advisory

¹ Ministry of Energy – <http://www.energy.gov.on.ca/en/municipal-energy/>

Committee (LAC) to further define mid and longer-term strategies for the York Region Integrated Regional Resource Planning area.²

Energy planning at the municipal or community-wide level is therefore a natural extension of these changes that have been shifting the context of energy management in Ontario at the provincial and regional levels. Taking a holistic, integrated systems approach in energy planning has seen some cities around the world (most notably Copenhagen and other cities in Germany and Scandinavia) become energy secure, efficient, sustainable, cost-competitive and environmentally friendly. The MEP program offers Ontario municipalities a key mechanism and platform for municipal and community level action to achieve this as well.

On a global scale, climate change and the reduction of global GHG emissions has taken on increased importance. At the 2015 United Nations Climate Change Conference in Paris (COP21), 195 countries adopted the first-ever universal, legally binding global climate deal.³ This MEP provides a platform for realistic short-term actions, but also sets the stage for more advanced opportunities and transformational targets down the road – such as those invoked through the Paris Agreement – that will help set Vaughan in the right direction to a smart energy future.

1.3 Why a MEP for Vaughan?

In early 2014, the City of Vaughan (the City) approved its first Community Climate Action Plan (CCAP) focused on the reduction of community GHG emissions. The newly released Ontario Municipal Energy Plan Program presented the City with an exciting opportunity to delve further into understanding local energy needs and consumption patterns from a geographical perspective and presented an opportunity to align the CCAP within the Municipal Energy Planning framework. Vaughan was one of the first eight municipalities to receive funding from the MOE to develop a Municipal Energy Plan.⁴

A MEP is an important tool for Vaughan to ensure energy security, support local economic development, foster a culture of social responsibility and sustainability, and to identify ways to reduce the community's energy consumption and GHG emissions. The MEP considers the environmental and economic benefits of how energy is consumed and generated in the community, as well as how this impacts the quality of life of Vaughan's residents.

As a “living document,” the MEP identifies actions and opportunities with positive impacts to Vaughan's economy, environment, and energy security and will be updated to reflect new data as it becomes available. Building climate-resilient communities will provide many more opportunities to meet energy needs in a more decentralized, flexible and responsive way than

² IESO – <http://www.ieso.ca/Pages/Ontario's-Power-System/Regional-Planning/GTA-North/default.aspx>

³ The Paris Agreement sets out a global action plan to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change. 195 countries signed the agreement.

⁴ The MOE provides successful applicants with funding for 50% of eligible costs to develop a MEP, up to a maximum of \$90,000.

past technology provided. The Vaughan MEP advances the energy discussion and positions the City and Vaughan citizens to reduce vulnerability to energy price increases and to be participants, rather than just consumers, of the emerging low-carbon energy economy.

1.4 How Does This Plan Align with Other City Plans?

Like the CCAP, the MEP retains the overarching vision and environmental ethic from Green Directions Vaughan – the City’s Community Sustainability and Environmental Master Plan. Green Directions Vaughan is designed to guide the Vaughan community to a more sustainable future by addressing environmental, cultural, social and economic issues. It has linkages to the Vaughan Official Plan (VOP 2010) in guiding the City’s growth as well as Vaughan’s master plans, such as for transportation, water, stormwater, parks and recreation (Active Together), and finance.

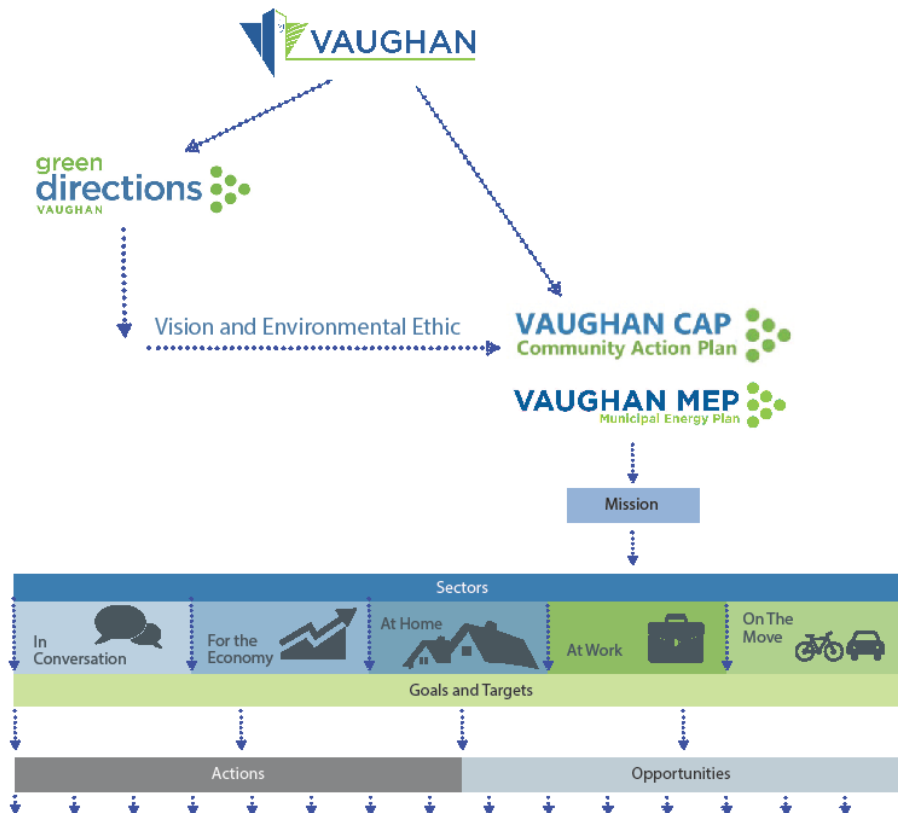


Figure 1: Alignment of CAP and MEP with Green Directions Vaughan

A key driver to develop the CCAP is Vaughan’s membership in the Partners for Climate Protection (PCP) program – a voluntary five-milestone framework used to guide municipalities to reduce GHG emissions. In addition, the York Region Official Plan (ROP 2010) requires the development of Community Energy Plans at the following geographic scales:

- a municipal-wide Community Energy Plan (ROP 2010 policies 4.1.14 and 5.2.13);

- for each Regional Centre (ROP 2010 policy 5.2.24); and
- for each New Community Area (ROP 2010 policy 5.6.10).

Hence, the MEP is intended to conform with the ROP 2010 policies requiring the preparation of a municipal-wide energy plan.

The MEP is designed to replace the CCAP, and as such retains the CCAP mission, goals, actions and opportunities as its foundation. The MEP adds two additional goals for economic development and community engagement as well as provides the identification of potential geographical locations for actions and opportunities in the residential sector to occur. It is a living document that will be updated as new information becomes available and as monitoring of energy use and GHG emissions informs progress on goals and targets.

1.4.1 Vaughan Term of Council Priorities

The City of Vaughan Service Excellence Strategy Map 2014-2018 describes the approach to be a “City of Choice”. It identifies Council priorities and the strategic initiatives the administration will undertake to build capacity, focus and deliver on those priorities so that the City will be successful and sustainable for the long term. The revision and implementation of *Green Directions Vaughan* is a “key activity” measuring progress on the Term of Council Priority: “To continue to cultivate an environmentally sustainable City”. The MEP defines targets and specific actions that can be undertaken by the City, in collaboration with community partners, further implement *Green Directions Vaughan*.

As a corporation, the City is demonstrating leadership in climate change mitigation through implementation of the Energy Conservation and Demand Management Plan, which was approved by Council in June 2014. Based on the results of a facility energy audit, the Energy Conservation and Demand Management Plan identifies a target for a 10% overall reduction in energy consumption for facilities on per person served basis below the 2011 baseline year by 2020. Progress is monitored by annual reporting in accordance with the *Ontario Energy Conservation Leadership Act*. Energy saving retrofits in City facilities is tracked as a “key activity” to implement the Service Excellence Strategy Map.

1.5 How was this Plan Developed?

In October 2014, the first Stakeholder Advisory Group meeting for the development of the Vaughan MEP was held. The advisory group is a non-political body whose members are key stakeholders representing various sectors and different perspectives across Vaughan. The advisory group was an extension of the CCAP Steering Committee and provided guidance, critique and suggestions, shared technical advice and knowledge, and actively participated throughout the Plan’s development.

Since that initial meeting, the City held four more meetings throughout key stages of the project. A brief summary of the five meetings and topics covered follows.

Table 1: Stakeholder Advisory Group Meetings Summary

Meeting #	Date	Topics Covered
1	October 8, 2014	<ul style="list-style-type: none"> Understanding of Project Objectives Overview of MEP planning process Understanding of SAG framework and roles and responsibilities Discussion on opportunities, challenges and goals
2	November 4, 2014	<ul style="list-style-type: none"> Update on data collection process Review of Regional Planning context (OPA presentation) Best Practices review from other community energy plans Review of Burlington's Community Energy Plan Review of Markham's MEP process and discussion opportunities on integration with Vaughan
3	May 26, 2015	<ul style="list-style-type: none"> Present and discuss Vaughan's baseline, economic analysis and draft energy maps Discuss alignment and integration with CCAP
4	November 5, 2015	<ul style="list-style-type: none"> Present and discuss updated baseline, Business-As-Usual forecast, and energy maps Discussion on MEP actions to "round out" the CCAP Discussion on implementation considerations and approach
5	January 19, 2016	<ul style="list-style-type: none"> Discuss draft Vaughan Municipal Energy Plan

The advisory group was instrumental in providing key inputs and overall direction in each of the six phases of the MEP work, as shown below.

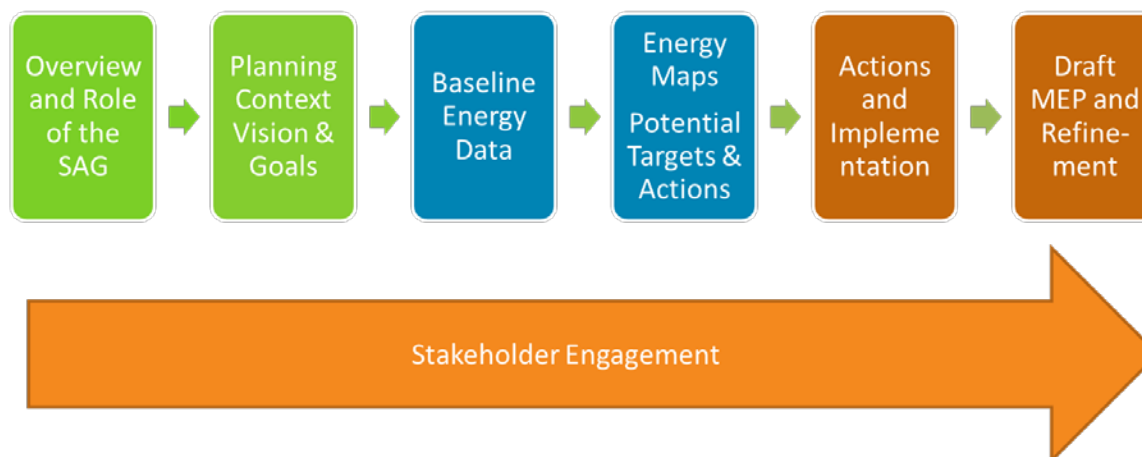


Figure 2: Vaughan Municipal Energy Plan Development Process

1.5.1 Analyzing Vaughan's Energy Use

The analysis of Vaughan's energy consumption involved linking actual metered energy use with a database of residential and non-residential buildings in the city. Vaughan is divided into 63 geographic block areas for community planning purposes. Each of the block plans address lot patterns, road and pedestrian networks, and location of community services such as schools, parks and community centres. Block plans essentially serve as a comprehensive blueprint for the creation of individual plans for subdivisions where large parcels still remain. Using the

existing geographic block areas as planning units, Energy Planning Districts (EPDs) were created using an inventory of all properties and built floor space categorized based on building type and age (*Figure 3*).

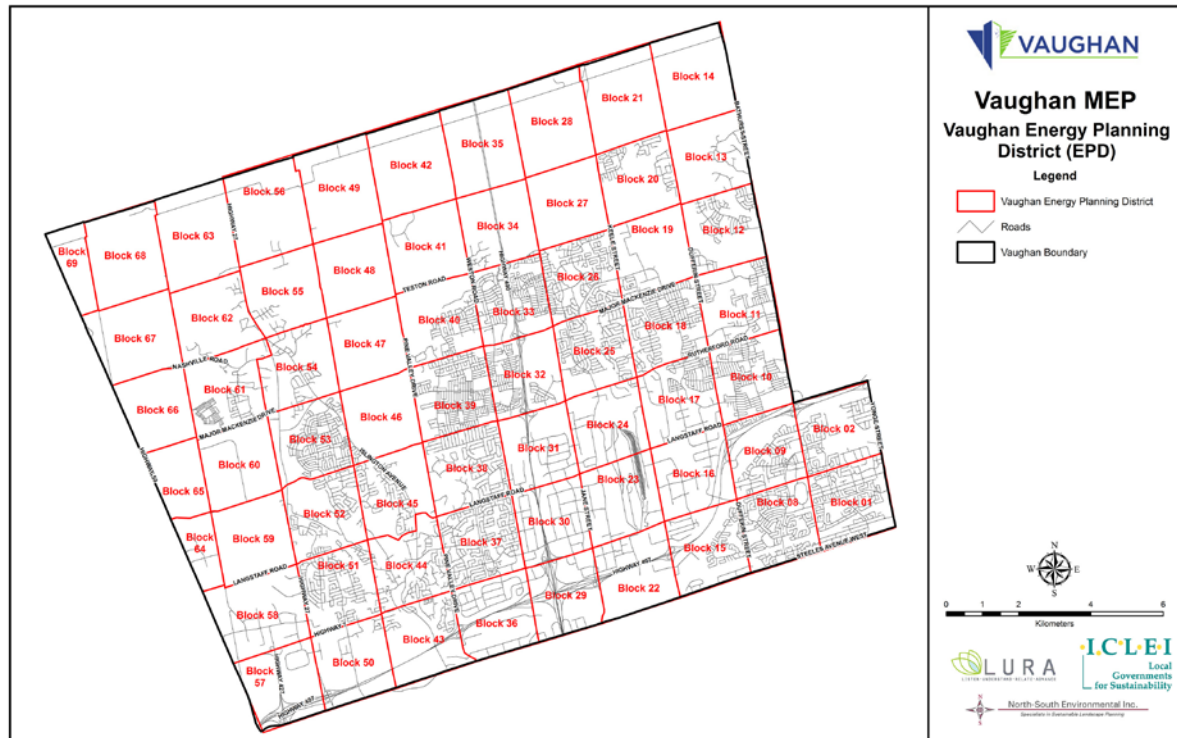


Figure 3: Energy Planning Districts

The EPDs will allow City departments to better correlate between the maps and future planning initiatives (e.g., EPDs with higher residential energy consumption and older dwelling units can be prioritized for area-specific retrofit programs ahead of EPDs that have relatively lower energy consumption).

HOT2000 and the Screening Tool for New Building Design - open software developed by Natural Resources Canada - were used to create models of typical energy use for Vaughan buildings⁵. These programs use average energy use characteristics of houses and buildings in Canada that allowed for the generation of housing 'archetypes' that can be applied to houses of different ages and types. The archetypes were used to derive energy intensity values (GJ per m²) for the different housing categories. The intensity values were then applied to all existing housing based on building age and type to create a model of total residential energy use for Vaughan.

The resulting total energy use values were then verified through comparison to actual energy consumption for Vaughan. Modelled values were then adjusted to match metered data within 1%. The result is an Energy Use Database (EUDB) for all properties based on each EPD, with

⁵ HOT2000 was used to model low-rise residential, and the Screening Tool was used to model multi-unit residential buildings. Non-residential buildings were not modeled.

energy use values assigned to built floor space that match total metered energy use. This allowed for very detailed analysis of energy use in the residential sector, and these resulting energy use values were ultimately used in the creation of this Plan's energy maps.

While an inventory of energy use for the commercial and industrial sectors was completed, there was insufficient detail of property data to build similar models for these sectors. Acquiring detailed data on the existing floor space of non-residential buildings in Vaughan in the future would allow for this level of analysis to be completed. In the future, the City of Vaughan hopes to be able to fill these gaps and develop a model of energy consumption in the non-residential sector similar to the residential one presented in this plan.

Once a complete model of energy use and emissions in Vaughan was built, a Business-As-Usual (BAU) projection was created to illustrate how Vaughan's energy use would evolve over the plan horizon to 2031 assuming that annual increase in built floor space would match annual projected population increases for residential properties and projected employment for non-residential properties. Transportation energy use was also assumed to increase in line with projected population growth.

2 Setting Direction for a Smart Energy Future

In order to align with the CCAP, this Municipal Energy Plan retains the Green Directions Vision and Environmental Ethic and CCAP mission and goals.

2.1 Vision

Sustainability First

Sustainability means we make decisions and take actions that ensure a healthy environment, vibrant communities, and economic vitality for current and future generations.

Environmental Ethic

- Lead by example as responsible stewards of our community
- Decisions entail determining the impact of our actions on the environment, weighing social/cultural consequences, and understanding financial implications
- Actions enhance both the natural and built environments

2.2 CCAP and MEP Mission

The Vaughan community is committed to acting on climate change now and in the future. We will reduce greenhouse gas emissions through leadership and education, fostering a culture of social responsibility. Our efforts will strive to improve human health and economic benefits while sustaining our planet.

2.3 CCAP and MEP Goals

The CCAP identified goals, and supporting actions and opportunities under three easily relatable categories, including:

1. **At Home (Residential and Waste);**
2. **At Work (Industrial, Commercial and Institutional);** and
3. **On The Move (Transportation).**

Through the MEP process, two additional areas of focus were identified:

4. **For The Economy (Economic Development);** and
5. **In Conversation (Education and Raising Awareness on Energy Issues).**

For the Economy

Advisory group members identified economic development as an important goal to include as a part of this Plan. As the City, stakeholders and the community work towards implementing the actions described in Section 6, numerous economic opportunities will arise for businesses in Vaughan.

The MEP can stimulate economic development in the form of new businesses that focus on the energy sector, whether this is alternative/renewable energy sources, energy storage solutions, conservation and efficiency, retrofit programs, and other innovative solutions. All of these businesses have the potential to thrive in a community that is growing while making energy conscious decisions and concerted efforts to lower GHG emissions on a per capita basis.

In Conversation

In its Long-Term Energy Plan document and through its Conservation First Framework, the Ministry of Energy has identified conservation as a key part of the province's collective effort to reduce GHG emissions. It's important to note, however, that conservation and demand management programs provide not only environmental but economic benefits as well: for every \$1 invested in energy efficiency programs, Ontario avoids about \$2 in costs to the electricity system⁶. Energy efficiency and conservation is an effective way of reducing not only Vaughan's vulnerability to energy price increases, but the energy bills of residents as well.

Education, awareness and behaviour change programs are all part of instilling a "culture of conservation" amongst the broader community. As the City and a number of stakeholder organizations work on community engagement initiatives, the key benefits to the local economy and environment must be integrated.

CCAP and MEP Goals

1. **At Home (Residential and Waste)**
 - Goal 1.* We will reduce the amount of electricity and natural gas used in our homes through conservation, improved efficiency, and use of renewable energy sources.
 - Goal 2.* We will reduce the amount of waste generated in our homes that end up in landfill.

⁶ Ministry of Energy, "Conservation First: A Renewed Vision for Energy Conservation in Ontario"

- Goal 3.* The City will continue to look at planning policy that supports more sustainable homes, developments and neighbourhoods.
2. **At Work** (Industrial, Commercial, Institutional)
- Goal 4.* Our businesses, schools, and industries will reduce the amount of electricity and natural gas they consume through conservation, improved efficiency, and use of renewable energy sources.
- Goal 5.* Our businesses, schools, and industries will improve their waste management practices and demonstrate leadership in waste management activities.
- Goal 6.* The City will continue to encourage more sustainable commercial developments through policies, standards and planning practices.
3. **On the Move** (Transportation)
- Goal 7.* We will reduce our reliance on cars, choose more efficient vehicles and take more sustainable forms of transportation.
- Goal 8.* The City will continue to encourage more sustainable transportation in Vaughan through policies and land use planning practices.
4. **For the Economy**
- Goal 9.* We will stimulate economic development in Vaughan in the form of new businesses that focus on the energy sector.
5. **In Conversation**
- Goal 10.* We will raise awareness among Vaughan residents of the benefits of a smart energy future through focused educational programs and initiatives.

3 What is Vaughan's Current Community Energy Profile?

Since incorporation in 1991 (when Vaughan's population was 111,000 residents), the city has grown by a staggering 187%. In 2013, the baseline year for this study, the population was 312,882. Based on the community's electricity and natural gas consumption, total energy use in Vaughan in 2013 amounted to 36 million GJ and total GHG emissions were approximately 1.58 million tonnes of CO₂ equivalent⁷. This equates to 115 GJ and 5.04 tonnes of CO₂ equivalent on a per-capita basis in 2013.

At 152 GJ/household⁸, Vaughan energy use per home⁹ is higher than both the Canadian (105 GJ/household)¹⁰ and Ontario averages (107 GJ/household). Residential energy consumption per m² of built floor space in Vaughan (0.50 GJ/m²) is comparable with both the Canadian (0.56 GJ/m²) and Ontario (0.52 GJ/m²) averages. In both instances, however, Vaughan's baseline performance indicators are much higher than the best practice in Denmark and Germany – 70.5 GJ/household and around 0.25 GJ/m².

⁷ Based on electricity and natural gas consumption figures from PowerStream and Enbridge, respectively, as well as energy figures for the transportation sector.

⁸ 152 GJ/household is based on 13,272,532 GJ of energy consumed in the residential sector, divided by 87,194 dwellings.

⁹ Per-capita and per-household values differ in that the former is calculated by dividing the total figure (energy consumption or GHG emissions) by the number of residents in Vaughan, while the latter divides the total figure by the number of dwellings in Vaughan.

¹⁰ Stats Canada 2011 data. <http://www.statcan.gc.ca/pub/11-526-s/2013002/aftertoc-aprestdm1-eng.htm>

3.1 Vaughan's Housing Profile

As the chart below indicates, Vaughan has experienced enormous growth starting in 1980-1989 when 22,350 new homes were constructed. From 1990-1999, more than 18,000 new homes were constructed and during 2000-2009 Vaughan saw that number almost double to 34,200 new homes. As of early 2016, the average age of a residential dwelling in Vaughan is about 20 years, reflecting the amount of new construction since 1980.

Table 2: Vaughan Building Age Profile

Building Age	Count
Pre-1945	376
1945-1969	1,674
1970-1979	3,024
1980-1989	22,350
1990-1999	18,170
2000-2009	34,209
2010-2013	7,391

The map below shows Vaughan's housing stock, categorized by year built. From 1975 to 1989, two areas experienced large growth in housing starts: (1) in the southwestern part of Vaughan, west of Highway 400 from Highway 27 to Weston Road and north of Highway 7 (Woodbridge)¹¹, and (2) in the southeastern corner, south of the 407 and between Dufferin and Yonge Streets (Thornhill)¹². In addition, there was some development near the intersection of Keele Street and Major Mackenzie Drive.¹³

From 1990 to 2012, Vaughan experienced huge growth from Langstaff Road northwards, spanning from Highway 27 all the way to Bathurst Street.¹⁴ This reflects the build-out in the Carrville and Vellore planning areas articulated in Official Plan Amendment 600.

¹¹ EPD #s 37, 38, 43, 44, 45 and 51

¹² EPD #s 1, 2, 8, 9 and 15

¹³ EPD #s 18, 25 and 26

¹⁴ EDP #s 9, 10, 11, 12, 17, 18, 20, 25, 26, 32, 33, 38, 39, 40, 52, 53 and 54



Figure 4: Housing Age

A large majority of Vaughan's building stock is comprised of single-family detached homes (71%). Single-family row/town houses, single-family semi-detached houses and multi-unit residential buildings make up the rest of the building stock in fairly equal amounts (9 to 10.5%). According to Statistics Canada¹⁵, single-detached dwellings have the highest average household energy use in Ontario at 136 GJ per household. This compares to 33 GJ per household for apartments and 94 GJ per household for multi-unit buildings (including doubles, duplexes and row homes). This is an important consideration for Vaughan, as the average size of a single-family home in Vaughan is quite large, at approximately 313 m².¹⁶ This compares to an average size of a new, single-detached house of 186 m² in Canada, according to the Canadian Home Builders' Association.¹⁷

Homes built after 2010 adhere to the more stringent 2012 Ontario Building Code and are therefore more energy efficient. However, these homes make up a fairly small percentage (8.5%) of total housing stock in Vaughan.

¹⁵ <http://www.statcan.gc.ca/pub/11-526-s/2013002/t007-eng.htm>

¹⁶ Municipal Property Assessment Corporation (MPAC), Vaughan Housing Data

¹⁷ Canadian Home Builders Association, Pulse Survey – Winter 2013/2014 Survey Results (National & All Regions)

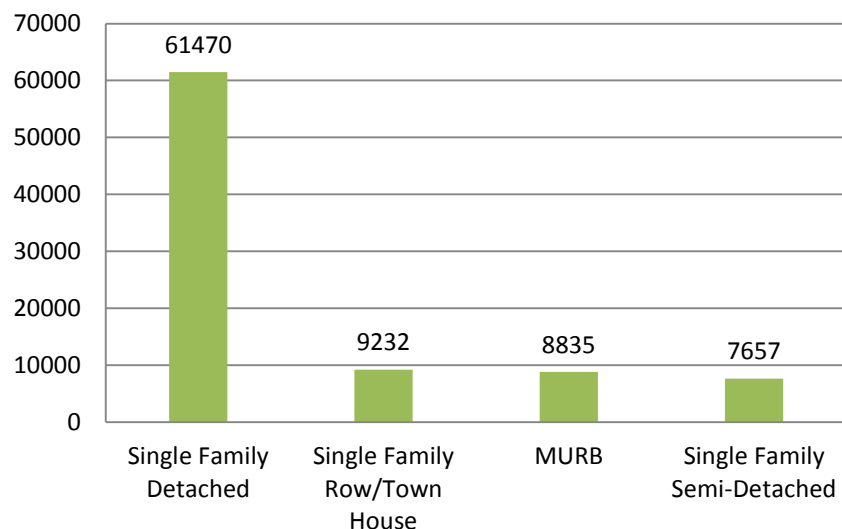


Figure 5: Vaughan Residential Building Type Profile (2013)¹⁸

Additionally, Statistics Canada shows that Ontario households that are rented consumed less energy than those that are owned – 53 GJ per household compared to 123 GJ per household¹⁹. As of 2011, Vaughan had a very high home ownership rate of 92.2%, compared to Ontario and Canada figures of 71.4% and 69%, respectively.²⁰

3.2 Vaughan's Baseline Energy Use Profile

Energy use by sector indicates that the residential (37%) and commercial (29%) sectors are together responsible for around 67% of energy use in Vaughan (Figure 7)²¹. The industrial sector²² has seen a decline in recent years, and is now responsible for 18% of total energy use. This decline has been driven by the elimination of the small mining and oil and gas extraction industry, as well as a decline in employment in “heavy industry” such as transportation, equipment and machinery manufacturing, as well as chemical, metal, wood and paper manufacturing.

¹⁸ Source: Municipal Property Assessment Corporation

¹⁹ <http://www.statcan.gc.ca/pub/11-526-s/2013002/t008-eng.htm>

²⁰ Canadian Index of Wellbeing, The Vaughan Community Wellbeing Report 2015

²¹ All energy sources are standardized and have been converted to joules for the purpose of comparison.

²² Please note that in this Plan, the industrial and commercial sectors are defined according to rate classes that the local utilities apply.

Table 3: Profile of Vaughan’s Industrial and Commercial Sectors (2006 – 2013)

Type	2006 Employees	2013 Employees	% change
Heavy Industry	45,321	39,835	-12%
Light Industry	27,045	40,741	51%
Commercial	75,027	109,310	46%

More than half of the energy used in Vaughan is natural gas consumption (53%; Figure 6) that is used to heat and cool homes and businesses – this supports the residential and commercial consumption values in Figure 7. Electricity accounts for 31% of the energy used in Vaughan, with 11% being supplied by gasoline, 4.6% diesel and 0.15% propane (Figure 6).

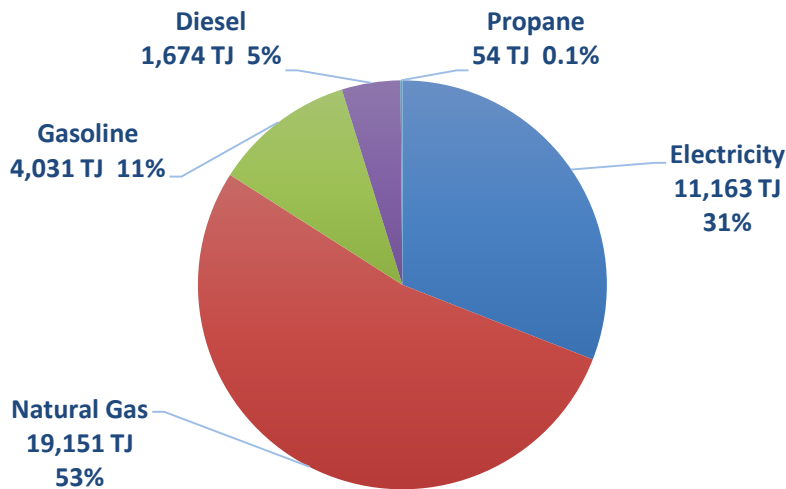


Figure 6: Energy Use by Source (2013)

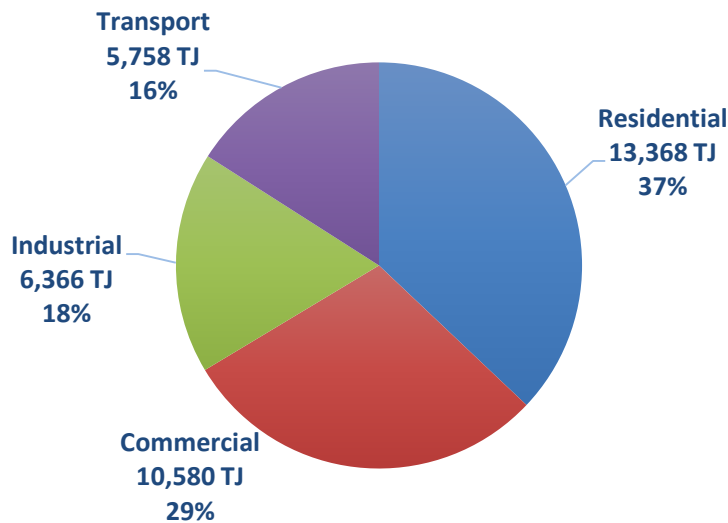


Figure 7: Energy Use by Sector (2013)

3.2.1 2013 Total Residential Energy Consumption (GJ)

In addition to the baseline energy study and economic analysis, an energy mapping exercise was completed based on Vaughan's electricity and natural gas consumption data. Energy mapping has proven to be an effective method of visually representing total energy use, and to help identify specific areas within a municipality for conservation and retrofit opportunities. The energy maps presented subsequently focus on the residential sector.²³

Figure 8 below shows Total Residential Energy (GJ) in Vaughan for the base year of 2013. The blue EPDs represent areas with zero/low total energy consumption and the red EPDs show those areas with higher total energy consumption. As mentioned in Section 1.6, the subsequent energy maps are based on modelled energy use values that were assigned to all existing housing in Vaughan, matching total actual metered energy use.

In the map below, four energy planning districts (EPD1, 8, 37 and 39) have the highest energy consumption (both natural gas and electricity) by residential users. Referring back to *Figure 4*, three of these four EPDs (EPD1, 8 and 37) have a housing stock predominantly built in the 1975-1989 range, representing older, less energy efficient housing. Meanwhile, EPD39 has a newer housing stock but due to its density and large number of single-family detached houses (it has the highest floor area of all the EPDs), it has higher residential energy consumption overall.

In addition to looking at total energy consumption, it is important to consider energy intensity when targeting specific areas or neighbourhoods for retrofit or efficiency programs. Specifying specific EPDs for retrofit programs would also need to consider density, gross residential floor area, as well as the amount of market penetration for existing programs within the EPD.

In Table 4 below, we can see energy intensity figures²⁴ for select EPDs. These energy intensity figures account for differences in density and floor area, and show which EPDs consume relatively more total energy (a lower energy intensity figure is better as it indicates this EPD is more energy efficient and that it uses relatively less energy on a per-area basis).

This table shows that while there is only a 14% difference in total residential energy consumption between EPD1 and EPD39 for example, the energy intensity is much higher on a relative basis (28%) in EPD1. EPD39, with the fourth highest total residential energy consumption in comparison was designed and built to EnerGuide 80 rating, which is why it has one of the lowest energy intensity figures of all the EPDs.

²³ Also, as noted in Section 1.5.1, since detailed data on the existing floor space of non-residential buildings was not available, a detailed database of energy consumption and energy maps were not developed for the non-residential sector as this would have involved too many assumptions.

²⁴ Calculated by taking total residential energy consumption and dividing by gross residential floor area for a given EPD

Table 4: Residential Energy Consumption – Intensity Figures for EPD1, 8, 37 & 39

EPD	Total Residential Energy Consumption (GJ)	Gross Floor Area, Residential (m ²)	Energy Intensity (GJ/m ²)
1	944,141	1,582,219	0.597
8	939,530	1,607,754	0.584
37	854,688	1,569,442	0.545
39	828,379	1,771,860	0.468

Of the four EPDs with highest residential energy consumption, energy intensity is highest in EPD1, followed by EPD 8, 37, and then 39.

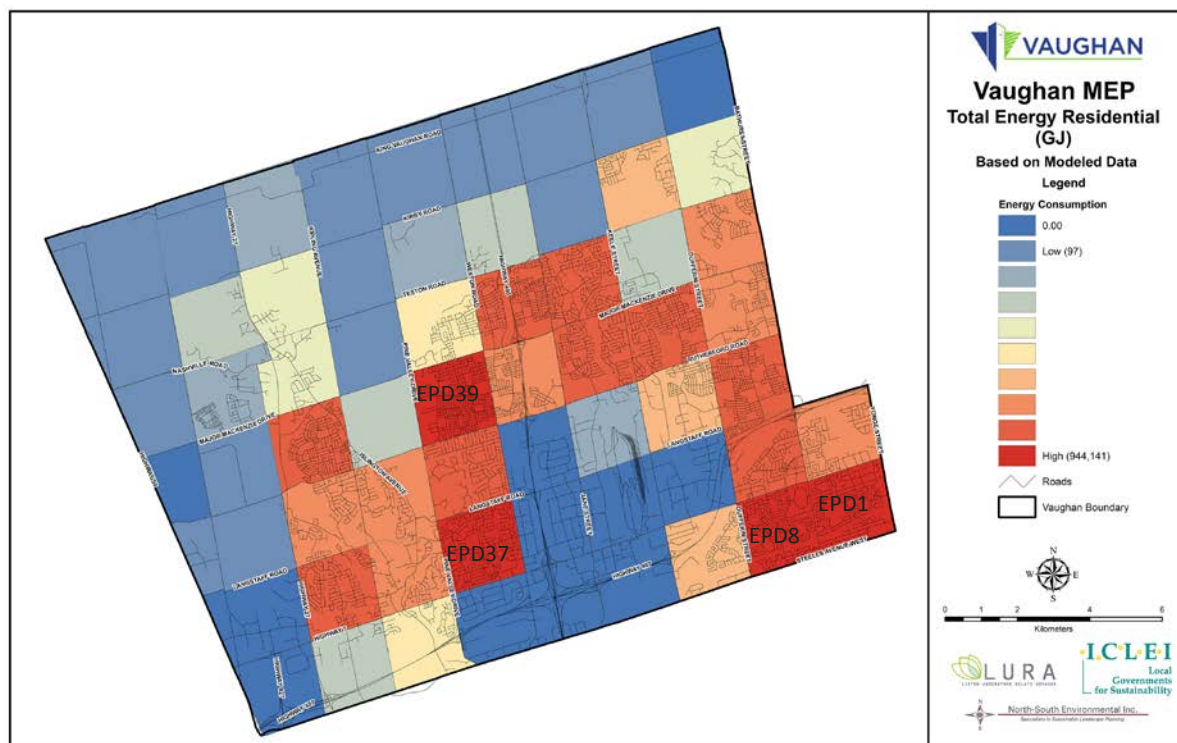


Figure 8: Total Residential Energy Consumption (GJ) (2013)

3.2.2 2013 Total Residential Natural Gas Consumption (GJ)

The story continues in the map for residential natural gas consumption in Vaughan. Again, we see that EPD1, 8, 37 and 39 have the highest natural gas consumption rates in this category.

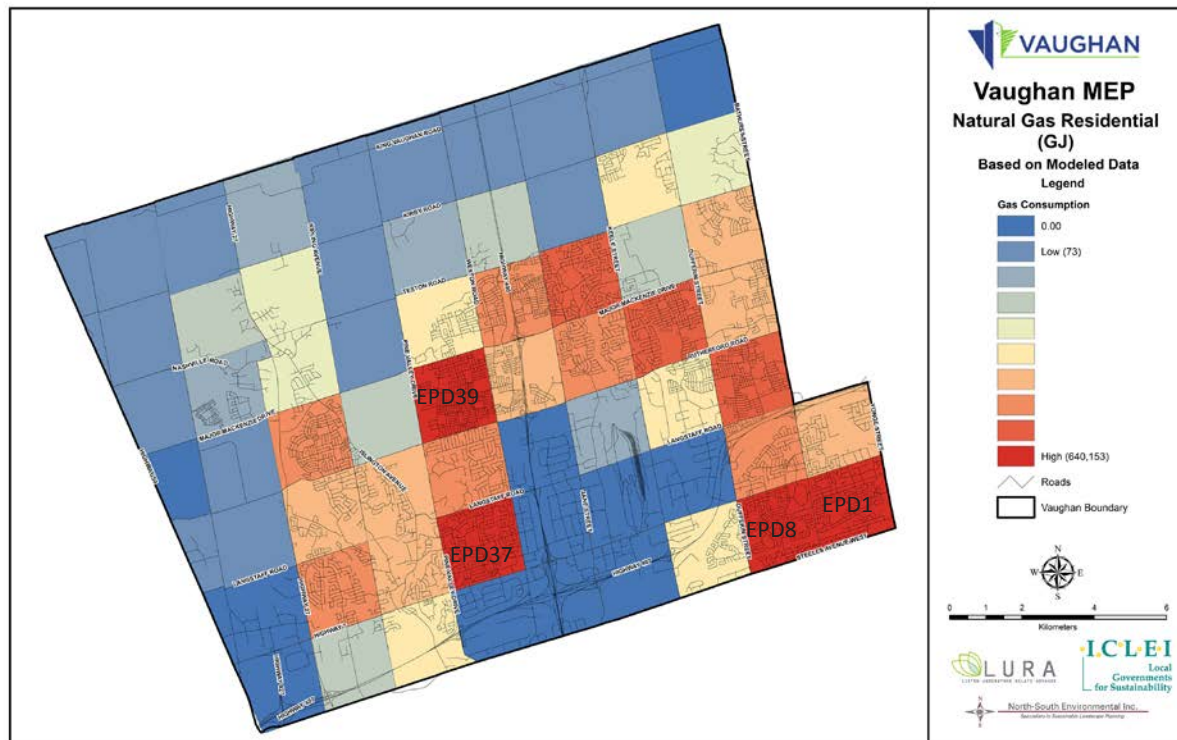


Figure 9: Residential Natural Gas Consumption (GJ) (2013)

Dwelling unit density is a factor in the areas of higher natural gas consumption. However, the impact of building age has a more prominent correlation to natural gas consumption rates (*Figure 9*) as compared to the electricity consumption rates shown in *Figure 10*. This is due to the fact that natural gas is predominantly used for space heating in Vaughan, suggesting that areas with higher natural gas consumption have an older housing stock built to older, less efficient building codes. Electricity consumption tends to remain more stable since appliances and lighting are upgraded more frequently.

Table 5 illustrates residential natural gas consumption intensity figures for EPD1, 8, 37 and 39. Again, it's evident that as a Block designed to EnerGuide 80 rating, EPD39 has a much lower natural gas intensity compared to EPD1, 8 and 37. Higher natural gas consumption intensity figures are seen in the houses of EPDs 37, 8 and 1, in ascending order. In referring back to *Figure 4*, we can see that these areas have relatively older housing stock, with most houses built from 1975 to 1989.

Table 5: Residential Natural Gas Consumption – Intensity Figures for EPD1, 8, 37 & 39

EPD	Total Residential Natural Gas Consumption (GJ)	Gross Floor Area, Residential (m ²)	Natural Gas Intensity (GJ/m ²)
1	621,266	1,582,219	0.393
8	640,153	1,607,754	0.398
37	632,248	1,569,442	0.403
39	589,768	1,771,860	0.333

3.2.3 2013 Total Residential Electricity Consumption (GJ)

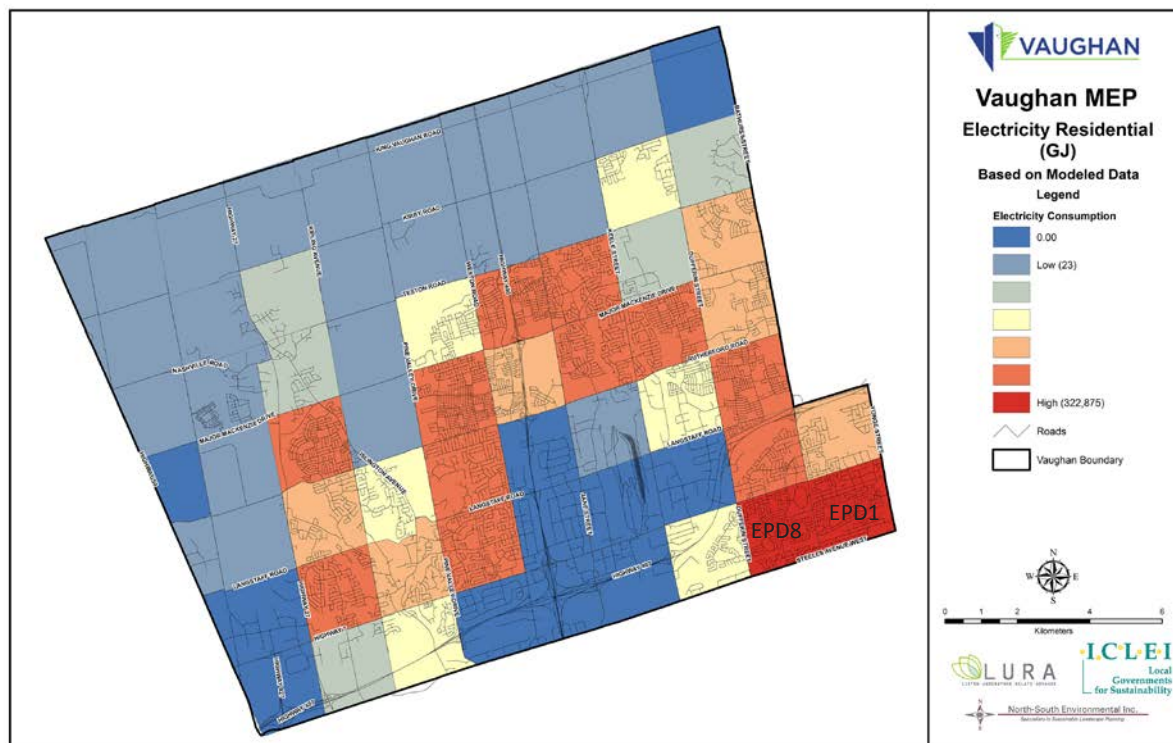


Figure 10: Residential Electricity Consumption (GJ) (2013)

Figure 10 illustrates residential electricity consumption in Vaughan. A large number of Energy Planning Districts²⁵ are relatively high consumers of electricity. However, EPD1 and EPD8 clearly stand out as the highest areas in Vaughan with respect to electricity usage.

Since electricity is mainly used for space cooling, lighting, and operating household appliances, EPDs with both higher electricity consumption and electricity intensity are prime targets for retrofit programs that aim to replace old, inefficient appliances such as refrigerators, washing machines and air conditioners. As seen in Table 6 below, not only are EPD1 and EPD8 districts

²⁵ EPD9, 10, 18, 25, 26, 33, 37, 38, 39, 51 and 53

the highest electricity consumers, at energy intensity figures of 0.204 and 0.186 GJ/m², respectively, they also have much higher intensity than other EPDs with relatively high total electricity consumption figures (in the table below, EPD 37 and 39 were included in order to illustrate this fact).

Table 6: Residential Electricity Consumption – Intensity Figures for EPD1, 8, 37 & 39

EPD	Total Residential Electricity Consumption (GJ)	Gross Floor Area, Residential (m ²)	Electricity Intensity (GJ/m ²)
1	322,875	1,582,219	0.204
8	299,377	1,607,754	0.186
37	222,440	1,569,442	0.142
39	238,611	1,771,860	0.135

3.3 Energy Mapping Analysis

Table 5 shows that EPDs 37, 8 and 1 have the highest natural gas intensity figures on a GJ/m² basis and that the 3 EPDs are relatively close using this metric. At the same time, Table 6 indicates that EPD1 and 8 have a much higher electricity intensity while also having higher total residential electricity consumption.

Overall, the energy mapping analysis suggests that EPD1 and EPD8 in particular may serve as primary locations to study the potential impacts of various retrofit programs in these parts of Vaughan.

Table 7: Residential Unit Profiles for EPD1, 8, 37 & 39

EPD	Number of Residential Units	Gross Floor Area, Residential (m ²)	Average House Size (m ²)	Average Age of House
1	6,432	1,582,219	246	1988
8	6,987	1,607,754	230	1989
37	4,708	1,569,442	333	1987
39	5,382	1,771,860	329	2005

As illustrated in Table 7, EPD8 has the highest number of residential units followed by EPD1. Furthermore, in reviewing the residential unit profiles for EPDs 1, 8, 37 and 39, the average house size in EPDs 1 and 8 are much smaller than in EPDs 37 and 39, for example. As a result, we can conclude that EPDs 1 and 8 have houses that are older, smaller and less energy efficient, making these two EPDs candidates for further detailed analysis for suitability for retrofit programs. This analysis also demonstrates that reliable data regarding dwelling unit age and dwelling unit type will assist in developing the aforementioned retrofit programs.

3.4 Vaughan’s Baseline GHG Emissions Profile

With a 31% population increase from 2006 to 2013, it makes sense that the residential sector is now responsible for the largest share of GHG emissions (35%) on a per-sector basis, compared to 26.6% in 2006. Similarly, the transportation sector has experienced a GHG emissions rise from 19.8% in 2006 to 25% in 2013 due to Vaughan’s population growth.

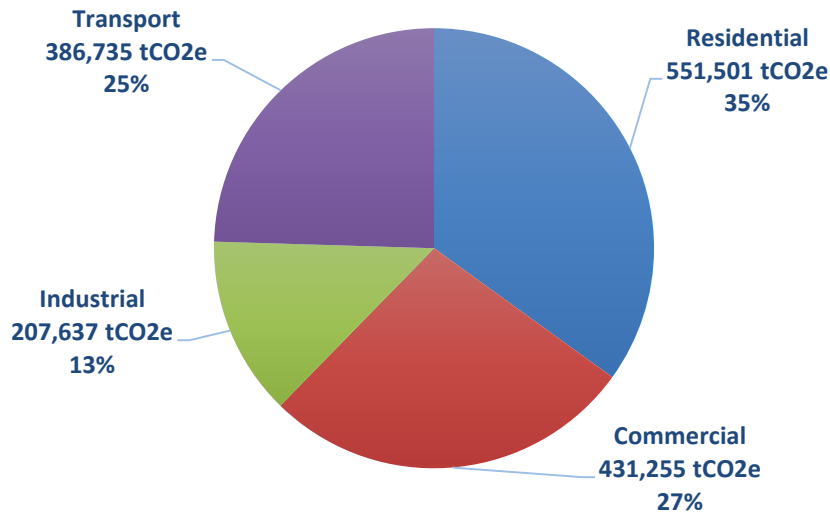


Figure 11: GHG Emissions by Sector (2013)

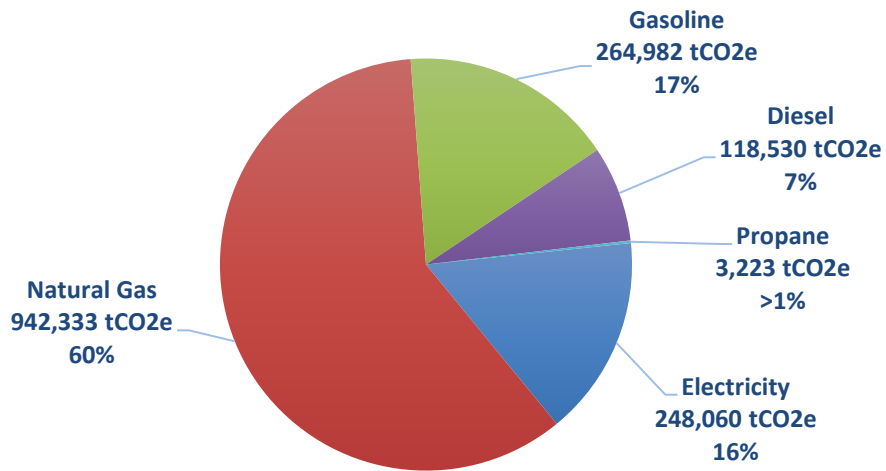


Figure 12: GHG Emissions by Source (2013)

In comparison to the CCAP figures (6.8 tonnes of CO₂ equivalent per capita), the MEP analysis indicates that Vaughan's GHG emissions are 5.04 tonnes of CO₂ equivalent²⁶ on a per capita basis in 2013. Vaughan's GHG emissions picture has improved in recent years due to the aforementioned changes in the industrial sector as well as Ontario's successful coal phase-out program.²⁷ The CCAP and MEP numbers differ because solid waste emissions are not included in the MEP figure, but also because the energy efficiency programs offered by Vaughan's local utilities (PowerStream and Enbridge) have become more aggressive and forecast higher uptake in the coming years.

3.5 The Economic Impact of Vaughan's Energy Use

Based on consumption figures and commodity prices for electricity, natural gas, gasoline, diesel and propane, and using a model developed by the City of London, Ontario, it is estimated that Vaughan spent approximately \$834 million on energy in 2013. Of this total, 60% is attributed to electricity costs, 18% gasoline, and 15% natural gas. While natural gas is estimated to account for 15% of costs for purchasing energy, it comprises 53% of energy use (Figure 6) and accounts for 60% of GHG emissions (Figure 12). Electricity accounts for higher costs for purchasing energy, yet comprises 31% of energy consumption (Figure 6) and only 16% of GHG emissions (Figure 12). Hence, managing costs while converting fossil fuel energy use to Ontario's relatively low-carbon electricity grid is an important component of long-term energy planning and climate change mitigation. This emphasizes the ongoing need for energy efficiency and conservation, to continue reducing overall energy use on a per capita basis, as a critical part of GHG emissions reductions strategies.²⁸

²⁶ CO₂ equivalent is a metric measure that is used for easy comparison of emissions from various GHGs based on their global warming potential (GWP). By using this measure, we are able to tally the total emissions from different sources, including electricity, natural gas, gasoline, diesel and propane.

²⁷ <http://www.energy.gov.on.ca/en/archive/the-end-of-coal/>

²⁸ It should be noted that in the latest LTEP, the MOE foresees that ratepayer savings will be realized as a result of reduced FIT prices, the ability to dispatch wind generation, the amended Green Energy Investment Agreement, and the decision to defer new nuclear.

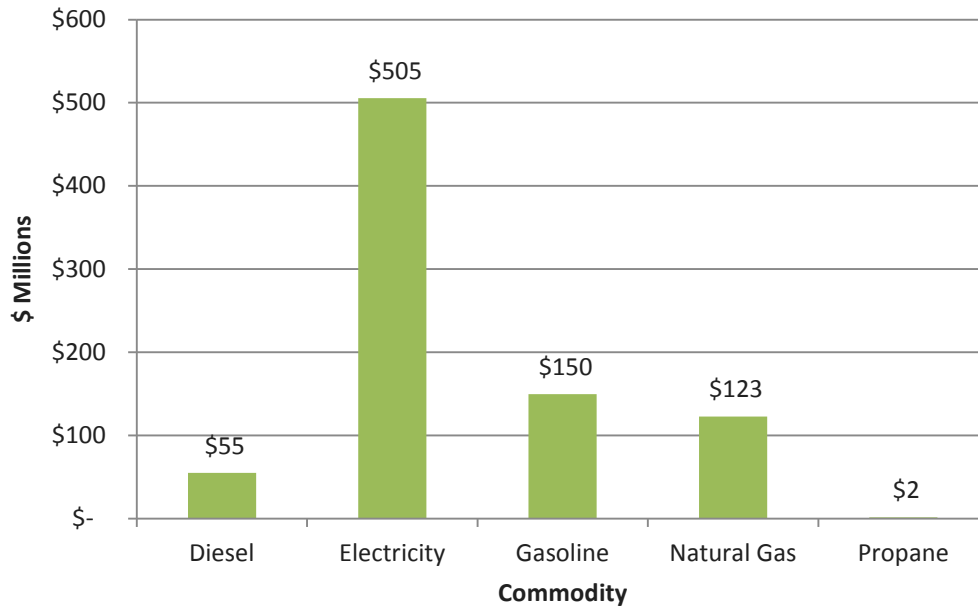


Figure 13: Energy Costs (\$ Millions) (2013)

Out of the \$834 million spent on energy in the community, Figure 14 shows that nearly half (47%) is going to Ontario businesses, including the businesses that generate and transmit power in Ontario. 18% of energy dollars stay in Vaughan (mostly to local utilities), 17% go to Canadian businesses (mostly to Western Canada) and 12% go to the provincial government.

Understanding the magnitude of dollars spent on energy needs – and where those dollars are allocated within the different economies – will help to drive conservation efforts by engaging the community in a conversation driven by financial capacity (improving energy literacy). It is hoped that this approach will help engage new audiences by communicating the energy consumption in dollars, a more relatable unit of measurement.

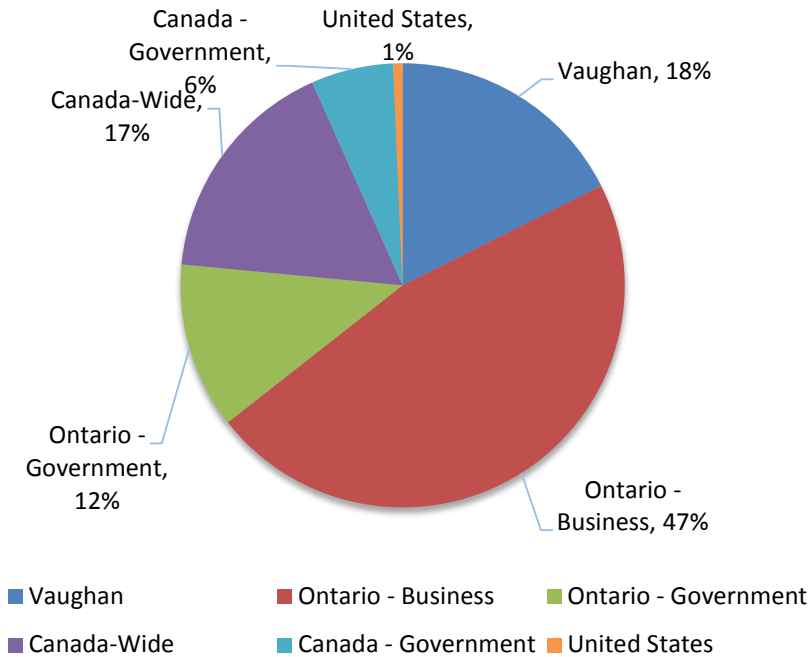


Figure 14: Vaughan's Energy Expenditure - Where Does the \$ Go?²⁹

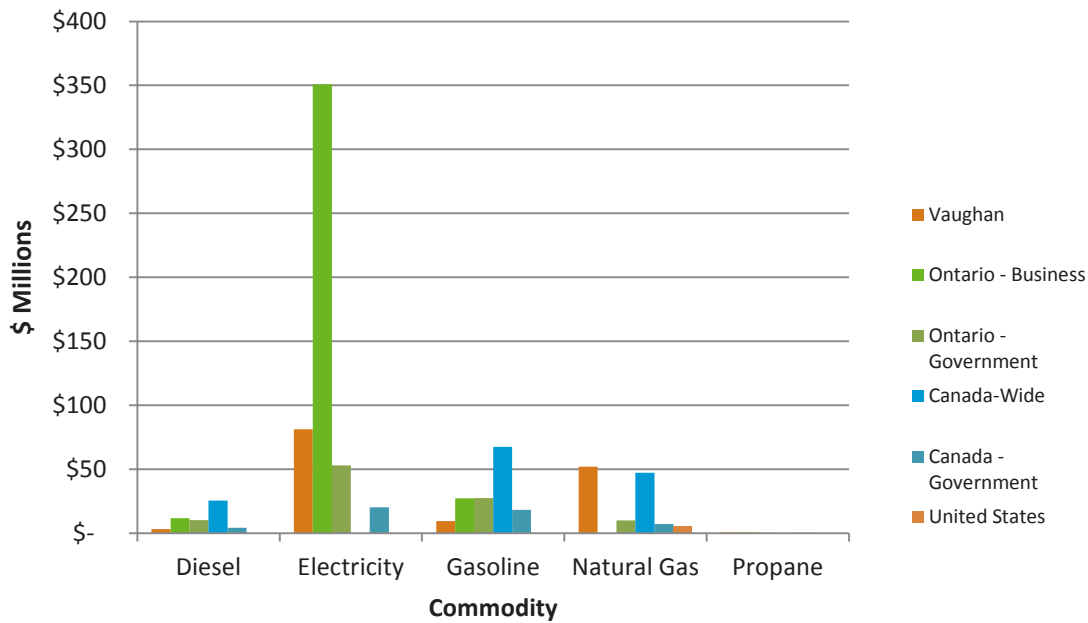


Figure 15: Vaughan's Energy Expenditure - by Commodity (2013)

²⁹ The energy expenditure estimate uses a range of assumptions and generally allocates the cost of purchasing energy in the following sector categories: commodity cost (i.e. generation and/or production); storage (fossil fuels only); delivery (primarily local businesses); and HST (Federal and Ontario governments, with debt retirement calculated separately). The 12% share of energy costs attributed to the Ontario government, for example, primarily reflects HST as the revenue from Hydro One power generation is attributed to Ontario businesses for the purposes of the calculation.

4 What is Vaughan's Energy Future In 2031?

As mentioned throughout Section 3, Vaughan has experienced impressive population growth in recent years. Vaughan is expected to continue growing and by 2031 Vaughan's population is anticipated to be around 427,900 people and 497,400 by 2041³⁰. This means that compared to 2015 figures, more than 100,000 additional people will call Vaughan home by 2031. That is a lot of people – and a lot of energy that will be consumed – therefore the City and partner agencies need the objectives and tools set out in the MEP, aligned with Provincial and regional energy planning initiatives, to better forecast what the future looks like and plan for future energy needs.

4.1 The Implications of Business as Usual

In order to determine what this expected growth means for Vaughan's energy consumption and GHG emissions profile, modelled Business-As-Usual (BAU) projections were conducted by sector and source from 2013 to 2031. For this report, BAU projections assume no further changes to the per capita GHG emissions. That is, the ongoing impact of existing changes to building codes, new construction requirements, transit enhancements, and conservation and efficiency retrofit programs have not been incorporated into the BAU projections as a baseline.

The figure below shows the modelled BAU total GHG projections using the 2006 baseline (CCAP) and the 2013 baseline (MEP). The process of developing an energy model projection through the MEP uses an in-depth dataset that has provided the City with an opportunity to refine its anticipated level of GHG emissions to 2031. The results suggest that Vaughan has an 14% lower GHG emissions for the business-as-usual scenario than anticipated through the CCAP when using the current updated data for 2013. This change can be attributed primarily to three key factors that have changed in Vaughan and in Ontario between 2006 and 2013: (1) the province's successful phase-out of coal; (2) the significantly increased conservation efforts and conservation targets of local utilities; and (3) changes in the Vaughan economy that have shifted away from carbon intensive industries. As a result, the refined BAU was used to set a new GHG emissions reduction target.

³⁰ York Region, 2041 Preferred Growth Scenario – 2041 Population and Employment Forecasts. Please note that 2041 growth scenario subject to change as Region goes through Comprehensive Review process.

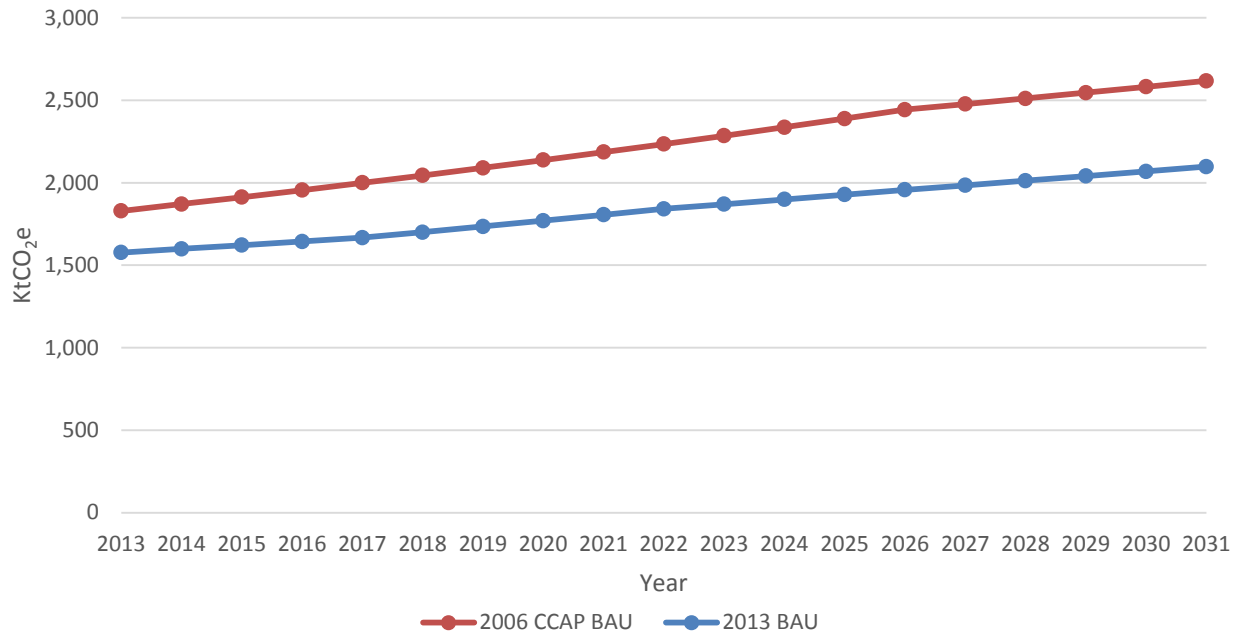


Figure 16: Comparison of 2006 and 2013 BAU Total GHG projections (ktCO₂e) (2013-2031)

Figure 17 below shows how overall energy consumption is expected to increase under the 2013 to 2031 BAU projection on a per-sector basis. Vaughan’s total consumption is anticipated to grow from 36 million GJ to 48 million GJ; the residential, commercial, industrial and transportation sectors are all expected to grow at relatively similar rates with respect to their energy consumption.

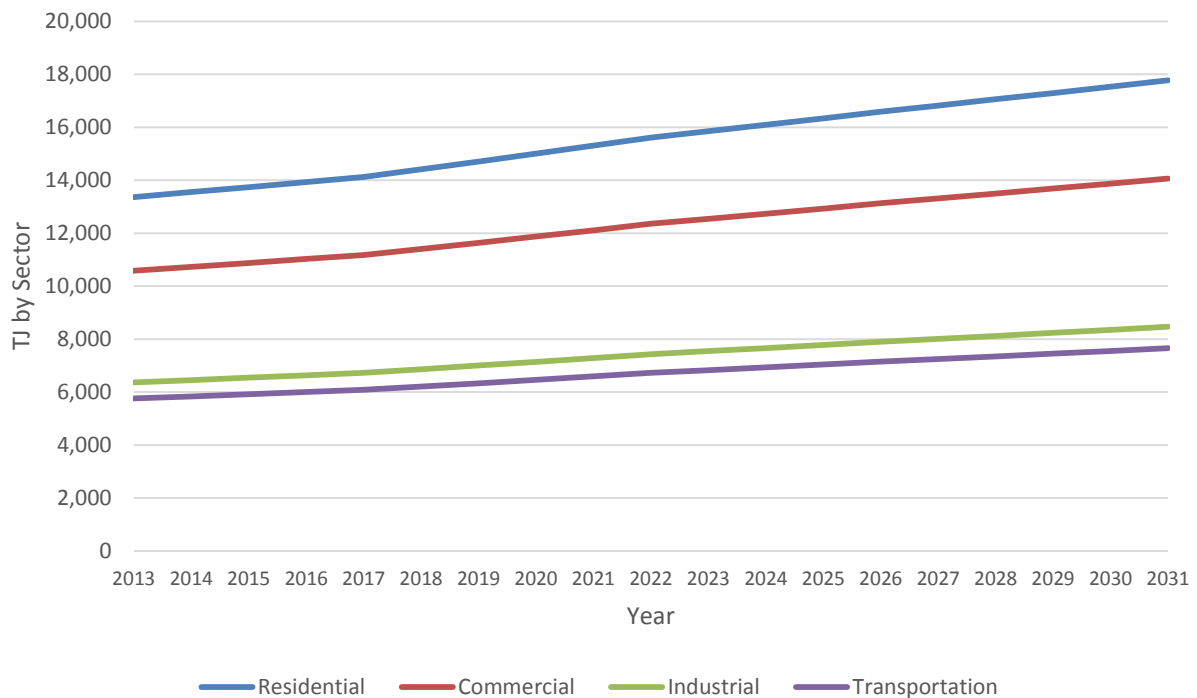


Figure 17: Business-As-Usual Projection – Energy Consumption by Sector (2013-2031)

Figure 18 suggests that energy used in buildings (natural gas and electricity) will continue to be the majority of energy consumption for Vaughan.

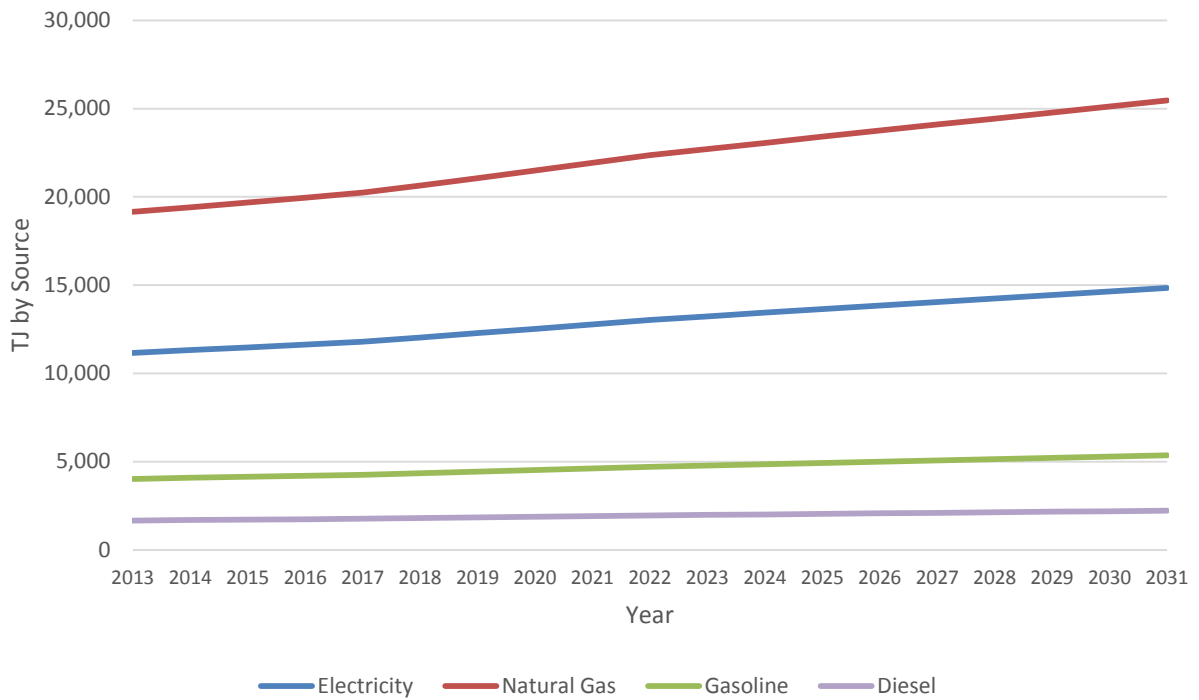


Figure 18: Business-As-Usual Projection – Energy Consumption by Source (2013-2031)

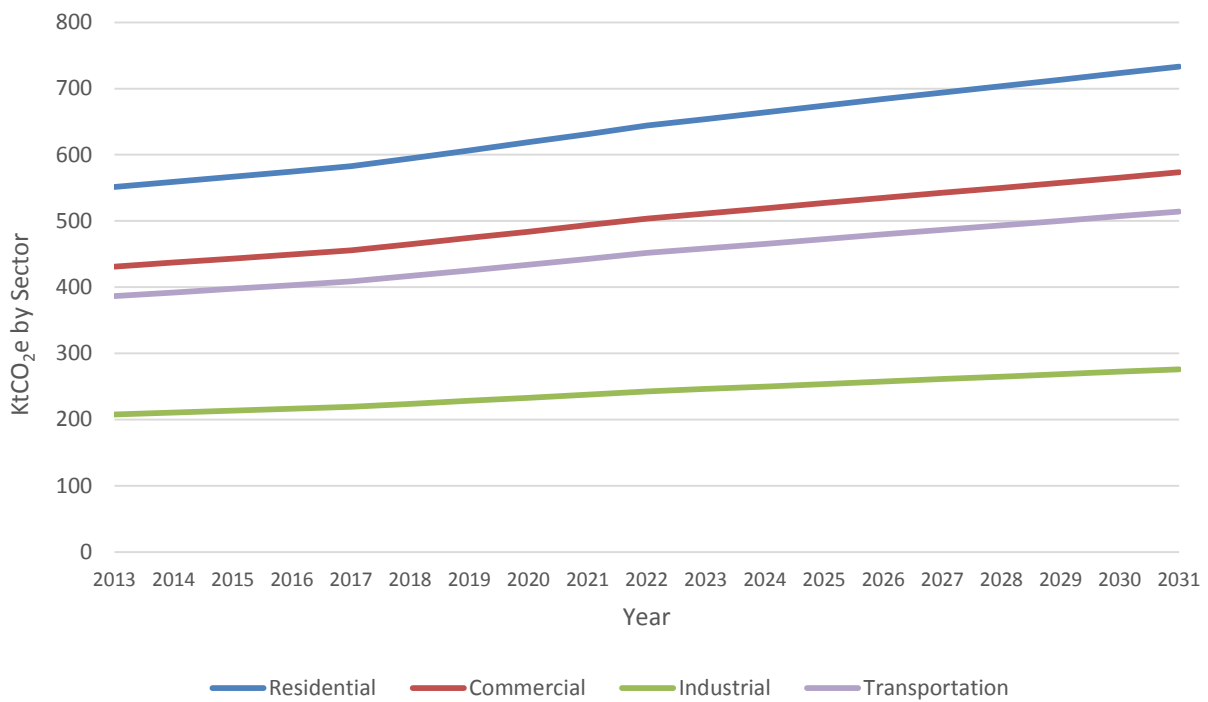


Figure 19: Business-As-Usual Projection – Total GHG Emissions by Sector (2013-2031)

Figure 19 shows how the importance of different sectors changes when we consider the GHG impacts. In particular, because of the carbon intensive nature of transportation fuels, the transportation sector is a much greater proportion of total emissions.

As population and overall energy consumption grows, so will overall GHG emissions. Based on expected growth in Vaughan, the residential sector will continue to be the sector with the highest emissions, followed by the commercial and transportation sectors.

Without a plan to address community energy consumption, Vaughan is less prepared to respond to changes in energy prices, impacts of climate change legislation or to take advantage of investments in energy infrastructure. These in turn can impact resident quality of life, and business energy innovation and competitive advantage. Projecting the 2013 per capita GHG emissions for the estimated population in 2031, and assuming no further changes to the per capita GHG emissions, shows that the Vaughan community will contribute up to 2.1 million tonnes of CO₂ equivalent on an annual basis.

How Much is 2.1 Million Tonnes of CO₂ equivalent?

The same amount of CO₂ equivalent:

- Produced by 401,000 passenger vehicles on the road each year.
- The average amount of electricity used by 173,800 homes in one year.
- The same amount that 48 million 10-year old trees can capture and store in one year.

4.2 Future Developments

Looking forward, there are some exciting changes coming to the Vaughan community in the near future. These changes will have an impact on Vaughan’s energy consumption and GHG emissions. By developing a MEP strategy that considers the future of energy in the community, the City of Vaughan and partners are better positioned to integrate sustainable energy thinking into new developments and new initiatives as opportunities arise.

A few key policy planning projects are in the planning stages in Vaughan.

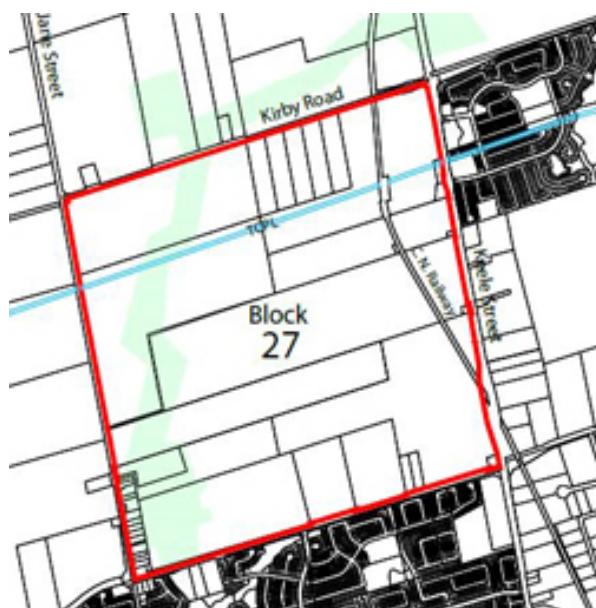


Figure 20: Block 27 Map

Block 27 will be a new residential community located in North Maple – it will be bordered by Kirby Road to the north, Teston Road to the south, Jane Street to the west and Keele Street to the east.

This new community area will be designed to be compact, vibrant, inclusive, healthy, sustainable and diverse. It will be primarily residential with a mix of housing types, and will also have community facilities such as schools, parks, retail stores, restaurants and offices. The proposed GO Rail Station in the vicinity of Kirby Road, will be planned as a multi-modal transit station surrounded by a mix of residential, office and commercial uses designed to support this mobility hub.³¹



Figure 21: Block 41 Map

Block 41 will also be a new community area and will be bordered by Kirby Road to the north, Teston Road to the south, Pine Valley Drive to the west and Weston Road to the east.

Block 41 is one of Vaughan’s few remaining greenfield development areas, with portions currently designated “Community Area”, “Natural Area and Countryside”, and “New Community Area”.³² Like Block 27, Block 41 will be primarily residential with a mix of housing types.

³¹ https://www.vaughan.ca/projects/policy_planning_projects/Pages/New-Community-Area---Block-27.aspx

³² https://www.vaughan.ca/projects/policy_planning_projects/Pages/New-Community-Area---Block-41.aspx



Figure 22: Mackenzie Vaughan Hospital Project Map

In addition, development of the new **Mackenzie Vaughan Hospital Project** is underway in Vaughan on Major Mackenzie Drive, just east of Highway 400. The new hospital will offer core, specialty and regional hospital services and is the first hospital to be built in the Southwest York Region in more than 50 years.

The need for a hospital in Vaughan is widely recognized and is a key priority for the community. The City owns the lands, between Highway 400 and Jane Street, north of Major Mackenzie Drive. In order to maximize the benefits of building a new hospital in Vaughan,

the City is exploring opportunities to add related healthcare facilities on the surrounding hospital lands that would serve Vaughan residents and provide economic benefits to the community.³³

The **Vaughan Metropolitan Centre (VMC)** has long been planned to become the city's "downtown". It is recognized in the *Growth Plan for the Greater Golden Horseshoe* as an "urban growth centre". The VMC Plan Review began in December 2008 under the umbrella of Vaughan Tomorrow, the City's growth management strategy. The final approved VMC Secondary Plan will form part of Volume 2 of the Vaughan Official Plan (VOP 2010).

The vision of a new downtown incorporates a vibrant, modern urban centre for residents and businesses that encompasses all amenities of urban lifestyle from inspiring multi-use office towers, residences, open green space and urban squares, pedestrian shopping areas and restaurants, to walking and cycling paths. With an 8.6 kilometre subway extension line (six new subway stations) including a new regional transportation hub, businesses will have direct and seamless connections to Toronto through York University, and the Greater Toronto Area. The VMC comprises approximately 179 hectares (442 acres) of development opportunities and is proposed to include:

- 1.5 million square feet of office space, at minimum;
- 750,000 square feet of retail space;
- 12,000 residential units to be home to 25,000 people;
- Density targets of 200 people and jobs per hectare by 2031;
- Employment targets of 11,500 jobs of which 5,000 will be new office jobs.

³³ <https://www.vaughan.ca/projects/community/Pages/Mackenzie-Vaughan-Hospital-.aspx>

5 GHG Emissions Reduction Target

Building on the methods used in the CCAP, the MEP GHG emission reduction target has been established to align with the unique characteristics of the Vaughan community. As noted in Section 3, Vaughan's population is growing at a significant rate. As such the CCAP GHG emission reduction target had anticipated that the strong growth of Vaughan's population, employment and economy meant that overall GHG emissions would increase even with a 20% per capita target for reduction. The 20% per capita GHG emission reduction target was established as an ambitious yet achievable one based on the planned actions and opportunities identified in the CCAP.

As noted in Section 3, through the process of data analysis and refinement, the MEP business-as-usual scenario has been reduced to a total of 2,097 ktCO₂e in 2031, providing the City with an opportunity to reassess its target for GHG emission reduction. Again, there are three significant factors that have changed in Vaughan that decreased the BAU projection: (1) the province's successful coal phase out; (2) the greatly increased efforts by the local utilities in terms of conservation targets and programs; and (3) the change in the Vaughan economy which has shifted away from carbon intensive industries.

The GHG emissions projections based on a strong dataset results in a GHG emissions target calculated as a 22% per capita reduction from the 2013 BAU projection to 2031 (equivalent to an absolute growth in GHG emissions of 3.8% above the 2013 baseline). This target is based on and will be achieved through implementation of the updated MEP Actions outlined in Section 6 below. This would result in a total GHG reduction of 459,900 tonnes/year, bringing the community's total GHG emissions to approximately 1,637 ktCO₂e by 2031.

In November 2015, the Ontario government took the next step in the fight against climate change by releasing the updated Climate Change Strategy. The province has committed to reducing emissions 80% below 1990 levels by 2050 and the latest strategy also sets a mid-term GHG reduction target of 37% below 1990 levels by 2030.

The strategy outlines that government collaboration will be key and that the targets will not be achieved without the hard work of municipalities, organizations, individuals, businesses and industry across the province. As the province looks to integrate climate change mitigation and adaptation considerations into government decision-making and long-term planning, support from municipalities in Ontario will be needed. The 22% target outlined in this Plan indicates that the City of Vaughan is a willing and able partner to the province as it looks to contribute to the targets set out in the Climate Change Strategy.

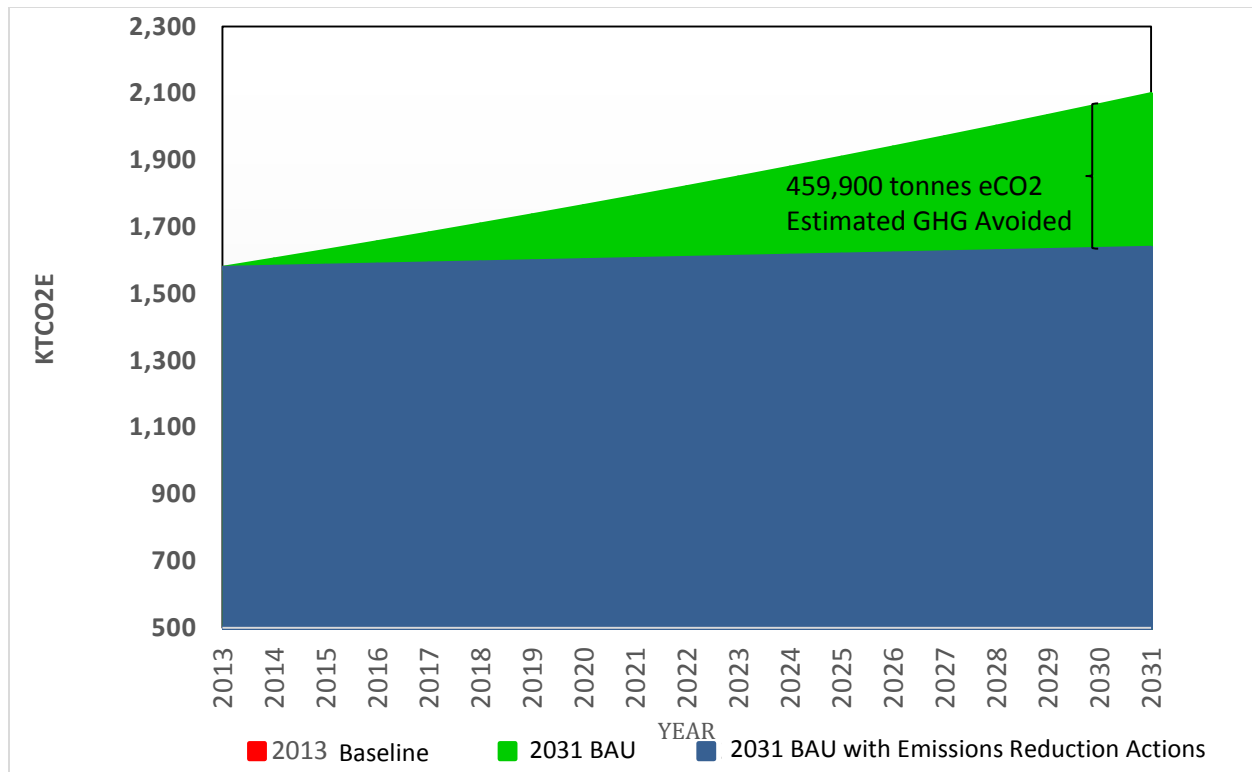


Figure 23: Updated GHG Reduction Potential - MEP Actions (ktCO₂e) (2013-2031)

6 Actions and Opportunities to Reach the MEP Target

The following provides an overview of the 9 actions that will help Vaughan reach the GHG emission reduction target by 2031. In addition to these 9 actions, 9 other opportunities are outlined that can further reduce energy consumption and GHG emissions in Vaughan.

Actions: Actions are projects, programs or initiatives that will be completed to help reach the emission reduction target. They are currently being led or investigated by partner organizations and have support and commitment from community members. Actions were identified through the development of the CCAP and updated through the MEP.

Opportunities: Opportunities are new ideas for projects, programs and initiatives that have strong potential to help reduce GHGs; however they still require further exploration to determine feasibility, and partners to lead them.

6.1 Actions and Opportunities At Home

Actions

New Construction Requirements for Residential

Strategy 1: Encourage new residential buildings be designed, built and ultimately operated using energy more efficiently.

Both Enbridge and PowerStream encourage energy efficiency for new

Buildings	<p>construction in the residential sector through programs and incentives.</p> <p><u>Strategy 2:</u> Ensure that residential development adheres to current Ontario Building Code.</p> <p>The GHG avoidance potential reflected here is based on the assumption that all new residential construction is fully compliant with the Ontario Building Code of the time. In Vaughan, roughly 20-25% of new construction occurred between 2006 and 2011. In 2012, the Ontario Building Code was updated, meaning that new homes constructed under its requirements would receive an EnerGuide rating of 80 and be more efficient than those built before 2012. Future building codes may be even more aggressive and this will therefore impact future estimates for this strategy.</p> <p><u>Strategy 3:</u> Implement the innovative Sustainability Metrics for use in the planning process. Consider tracking energy use and GHG emissions savings, in collaboration with Vaughan’s municipal partners (Richmond Hill and Brampton), resulting from implementation of the Sustainability Metrics.</p> <p>The <i>Sustainability Metrics</i> and <i>Sustainable Community Development Guidelines</i>³⁴ framework aims to reduce the overall ecological footprint of new developments and redevelopment projects in Vaughan. The guidelines address activities to focus on compact urban form, walkability, and urban tree canopy as well as resource efficiency related to energy, potable water and stormwater management.</p> <p>The Sustainability Metrics will inform the future City-Wide Urban Design Guidelines Manual project. The Sustainability Metrics is currently in the testing stage.</p>
Residential Energy Conservation and Efficiency Retrofit Program	<p><u>Strategy 4:</u> Develop and implement coordinated residential energy conservation and retrofit programs that target existing households (single family homes and apartments) to promote and increase participation in energy conservation at home.</p> <p>Approximately 37% of energy used in Vaughan is used by homes, and approximately 98% of homes were constructed prior to the 2012 Ontario Building Code.</p> <p>A number of existing programs are offered by Enbridge and PowerStream that provide avenues to increase energy literacy amongst homeowners, and provide incentives to upgrade to more efficient equipment and to use energy more wisely.</p>
Residential Waste Diversion	<p>Deliver a comprehensive curbside 4Rs waste management program (reduce, reuse, recycle, recover) for residents by working with the Region to fully implement their SM4RT Living – Integrated Waste Management</p>

³⁴ <http://www.vaughan.ca/sustainabilitymetrics>

[Master Plan](#). The Plan focuses on reduction and reuse to help get the Region towards zero waste over the next 40 years, including a food waste reduction strategy. Organic waste materials have the most impact on GHG emissions since decomposition of organic waste in landfills produces a gas that is composed primarily of methane, which is a greenhouse gas.

Opportunities

Sustainable Neighbourhood Retrofit Pilot

A number of communities in and around the Greater Toronto Area have begun to explore ways to accelerate sustainability and carbon neutrality in neighbourhoods. The Vaughan community could develop a pilot program aimed at creating a “carbon neutral” neighbourhood to demonstrate what can be done at the local level and test mechanisms to implement climate action and sustainability principles.

Program components could include:

- Social marketing to foster sustainable behaviours;
- Comprehensive deep residential energy and water efficiency retrofits;
- Connect with York Region’s Water for Tomorrow program;
- Incentives such as Local Improvement Charges (LICs) to undertake energy efficiency improvements on private property with willing property owners;
- Consideration of solar PV and/or solar thermal installations;
- Voluntary program for GHG emission offsets;
- Encouraging local food production (e.g. community gardens) and eating local food (e.g. farmers markets);
- Neighbourhood composting; and
- Climate adaptation measures to reduce climate change impacts (e.g. planting trees, conserving natural areas).

Implementing a residential neighbourhood retrofit project that includes a 30-50% energy reduction in 1,000 pre 1990 single-family detached homes, and 2,000 units of Multi-Unit Residential housing would achieve 5,500 tons of GHG avoidance potential by 2031. Targeting specific neighbourhoods or EPDs (specifically EPD 1 and 8) that have higher energy consumption intensities will provide the City with the best outcomes from the pilot program.

<p>Deep Residential Retrofit Program</p>	<p>A deep residential retrofit program would take the residential energy conservation and efficiency retrofit initiative described above to the next level. Deep energy retrofits typically include whole-building analysis and unlike conventional energy retrofits, they do not simply focus on isolated system upgrades (such as lighting, heating, ventilation, etc.) but address many systems at once.</p> <p>Under this approach, deep energy retrofits have the potential to achieve much larger energy savings than conventional programs.</p> <p>Targeting specific neighbourhoods or EPDs that have a higher number of buildings with overall poor efficiency with multiple systems nearing the end of useful life would provide the City with the best outcomes from the any potential deep residential retrofit program.</p>
<p>District Energy</p>	<p>Facilitate the installation and use of district energy in energy planning districts where there is appropriate development density and thermal load.</p> <p>District energy systems produce steam, hot water or chilled water at a central plant that can be used by a number of buildings for heating, cooling and hot water. This means that individual buildings don't need their own boilers or furnaces, chillers or air conditioners which results in increased energy efficiency, reduced GHG emissions and cost savings. District Energy feasibility studies will be encouraged to assess if there is sufficient thermal load and as a result, opportunities to implement district energy systems continue to be pursued.</p>
<p>Roof Top Solar Photovoltaic</p>	<p>In partnership with PowerStream, explore municipal tools to facilitate the uptake of roof top solar PV installations and estimate GHG emissions avoidance and reduced peak energy demand.</p>

6.2 Actions and Opportunities At Work

Actions

<p>New Construction Requirements for Commercial Buildings</p>	<p><u>Strategy 5:</u> Encourage new commercial construction to be designed, built and ultimately operated with improved energy efficiency.</p> <p>PowerStream and Enbridge encourage energy efficiency for new construction in the commercial and industrial sectors through conservation management programs.</p> <p><u>Strategy 6:</u> Implement the innovative Sustainability Metrics for use in the planning process.</p> <p>As described above, the <i>Measuring Sustainability of New Development</i> framework aims to reduce the overall ecological footprint of new developments and redevelopment projects in Vaughan. The guidelines address activities to reduce energy consumption and GHG emissions, and</p>
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	<p>focus on compact urban form, water conservation, waste reduction, improved mobility and connectivity, and enhancing natural heritage systems and the urban forest. Not all IC&I developments may require the Sustainability Metrics to be provided if the proposed development is not covered by the City’s Site Plan Control By-law.</p> <p>The reduction in impacts for new construction of IC&I is due to two factors: 1) electricity is a greater portion of energy use in the non-residential sector, and since the grid is now much cleaner, energy efficiency measures that impact electricity will have a proportionally smaller reduction in GHG; and 2) the economy did not grow as anticipated from the 2006 baseline and there is less new construction in the IC&I sector.</p>
<p>IC&I Energy Conservation and Efficiency Retrofit Program</p>	<p><u>Strategy 7:</u> Develop and implement coordinated conservation and efficiency retrofit program targeting existing operations to promote and increase participation in existing programs.</p> <p>Recognizing that the Industrial, Commercial energy use in Vaughan accounts for approximately 47% of the total energy use, there is a need for continued efforts to promote energy efficiency in existing IC&I buildings.</p> <p>Opportunities exist to improve coordination of programs, implement best management practices and increase participation in the large number of IC&I Conservation Demand Management programs delivered by Enbridge and PowerStream. TRCA’s Community Transformation programs and Partners in Project Green have demonstrated engagement with Commercial and Institutional sectors in achieving best-in-class energy efficiency.</p>
<p>Environmental Leaders Network</p>	<p><u>Strategy 8:</u> Establish a Vaughan-specific network of environmental leaders to demonstrate and encourage sustainability and climate action leadership amongst the Industrial, Commercial & Institutional sector.</p> <p>Program components could include:</p> <ul style="list-style-type: none"> • Facilitate sector-specific partnerships and knowledge/best practice sharing; • Local business energy and GHG benchmarking (e.g., audits), disclosure, target setting, and monitoring (e.g., Sustainability CoLab) • Carbon reduction commitments; • Engagement and education for local businesses on energy and GHG emissions, opportunities for reduction and efficiency, and the business case (e.g. workshops, breakfast series, etc.); • Opportunities for sustainability training; • Foster technological innovation; • Awards and recognition, company promotion and branding; and

	<ul style="list-style-type: none"> • Green Procurement Guide to assist local businesses to purchase environmentally friendly products. <p>The City of Vaughan has supported Windfall Ecology Centre in the development of the ClimateWise Business Network under the Sustainability CoLab Framework. A series of community workshops were hosted throughout 2015 to engage a cross section of sustainability leaders from Vaughan and the greater York Region area. These sessions gathered important input for program design and the services to be offered to organizations across York Region as part of the framework. It is anticipated that ClimateWise will be launched in 2016.</p>
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Opportunities

Eco-Business Zone	<p>Eco-Business Zones promote business-to-business networks to work together on green programs or projects so that costs are shared and implementation can happen more quickly.</p> <p>The Vaughan community can look for opportunities to pursue the creation of an Eco-Business Zone to allow businesses to collaborate and share resources in support of sustainability, GHG emission reduction and leadership.</p> <p>Components of an Eco-Business Zone could include:</p> <ul style="list-style-type: none"> • Pursuing district energy projects; • Energy audits and green building retrofits; • Expansion of green space and natural landscapes; • Strategies to attract green businesses; and • Encouraging collaborative economic opportunities (e.g. office sharing, energy co-ops, auto-sharing).
Operator Training	<p>Establish an Operator Training program to educate building operators and managers on ways to improve building performance. BOMA to lead initiative, providing an effective and low-cost option for training municipal building operators.</p>

6.3 Actions and Opportunities On The Move

Actions

Land Use Planning Policy	<p><u>Strategy 9:</u> Continue to advance a smart community energy system and foster energy conservation and efficiency through effective land use planning.</p> <p>Section 8.5 of the Vaughan Official Plan (VOP 2010) includes policies to</p>
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advance a comprehensive approach to energy conservation that will improve the quality of life for Vaughan's residents, minimize impacts on the natural environment and reduce greenhouse gas emissions. Within the VOP 2010 Section 8.5 there are 10 policies to address energy including:

- To support a pattern of growth and development that minimizes electricity, natural gas and gasoline consumption;
- To develop community energy plans as part of the Block Plan and Development Concept Plan processes as appropriate for Intensification Areas, lands designated as New Community Areas, and as yet undeveloped Employment Areas;
- To work with York Region to develop a city-wide community energy plan;
- To prioritize energy conservation and efficiency in the industrial and manufacturing sectors;
- To support reductions in peak electricity consumption;
- To support the development of district energy systems in areas of appropriate development density;
- To support and encourage alternative and renewable energy generation and support increased energy independence;
- To support best practices for incorporating energy generating technology and infrastructure into community design and buildings;
- To support opportunities for alternative energy production in the Countryside that do not adversely affect agricultural practices or prime agricultural land; and
- To encourage municipal and on-site energy generation initiatives that support the air quality and natural heritage policies.

In addition, the VOP 2010 Section 4 includes policies to transform transportation in Vaughan. The City also has a comprehensive [Transportation Master Plan](#) that aims to reduce automobile dependence and move Vaughan closer to achieving the goal of a more livable and sustainable community.

The City of Vaughan can support reduced GHGs from transportation by implementing the land use planning policies identified in the Transportation Master Plan. These policies include:

- Integrating transportation planning with the Official Plan;
- Focusing development in the Centres and Corridors;
- Creating "Complete Communities"; and
- Strengthening relationship between land use and transportation planning services.

Together these policy directions provide a strong platform for the City to use land use planning as a mechanism to advance integrated energy

	systems.
Active Transportation and Transportation Demand Management	<p><u>Strategy 10</u>: Implement active transportation and Transportation Demand Management (TDM) initiatives outlined in the City’s Transportation Master Plan in support of its vision of reducing automobile dependence and moving Vaughan closer to achieving the goal of a more livable and sustainable community. This Action is supported by a specific Term of Council Priority in the 2014-2018 Service Excellence Strategy Map: “Continue to develop transit, cycling and pedestrian options to get around the City”.</p> <p>The VOP Section 4 includes policies to support active transportation and TDM policies continue to include:</p> <ul style="list-style-type: none"> • To support walking and cycling as viable modes of transportation for commuter, recreational and other travel; • To support a comprehensive pedestrian and bicycle network; • To maximize the connectivity of the street network for pedestrians and cyclists; • To plan for dedicated bike lanes, bike parking infrastructure; • Among others. <p>In addition the Transportation Master Plan includes policies to:</p> <ul style="list-style-type: none"> • Support TDM organizations; • Work with large employers to develop TDM programs; • Implement Safe Routes to School program; • Implement 20/20 The Way to Clean Air program; • Work with developers to encourage alternative modes of transportation; • Facilitate seamless connections between different modes of travel; • Support the development of car-sharing and bike-sharing programs; and • Develop a comprehensive and connected network of pedestrian and cycling facilities; and • Require TDM plans for new development. <p>Of particular interest, York Region is piloting a TDM program for new developments that will explore the use of individualized marketing campaigns to encourage the reduction of single occupancy vehicle trips starting in 2016.</p>
Public Transit Enhancements	<p><u>Strategy 11</u>: Implement the “transit first” approach outlined in the City’s Transportation Master Plan in support of its vision of reducing automobile dependence and moving Vaughan closer to achieving the goal of a more</p>

	<p>livable and sustainable community.</p> <p>Transit network improvements continue to include:</p> <ul style="list-style-type: none"> • Rapid transit expansion; • Improved access to GO regional transit service; • Designated Transit Priority Corridors; • Bus service expansion; and • Transit fare and service integration.
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Opportunities

Anti-Idling Efforts	<p>Promote the City’s Anti-Idling Bylaw and establish Idle-Free Zones around sensitive populations (e.g. daycares, schools, long-term care facilities, hospitals) through enhanced awareness and outreach activities.</p>
Use of Alternative Fuels	<p>Implement initiatives to promote and encourage the use of alternative fuels, such as:</p> <ul style="list-style-type: none"> • Encouraging businesses to explore green fleet options (e.g. biodiesel, natural gas, electric, hybrid) through education, awareness, and incentives (e.g. provincial Electric Vehicle Incentive Program); • Encouraging the uptake of alternative fuels/vehicles by residents (e.g. hybrid, electric, natural gas, renewable natural gas) through education and awareness initiatives; and • Develop a program that provides incentives to taxi cabs operating in Vaughan to switch to hybrid or low emission vehicles.
Electric Vehicle Charging Stations	<p>Electric vehicles can have significant emissions benefits over conventional vehicles, with no tailpipe emissions for an all-electric mode and overall less GHG emissions compared to conventional vehicles, depending on sources of electricity generation.</p> <p>There is an opportunity to facilitate installation of charging stations around the City for electric vehicles (e.g. work with businesses, utilities, etc.).</p> <p>The City of Vaughan is working internally to advocate for electric vehicle charging stations to be incorporated in building design for City of Vaughan facilities.</p> <p>Additionally, the City of Vaughan has recently become a member of the TRCA’s Partners in Project Green Electric Vehicle Network. This program offers subsidies for members to expand the electric vehicle charging network.</p>

6.4 Summary of Actions and Impacts

Action	Partners		Environmental Benefits			Health, Social and Economic Benefits	Total Cost	Total City Investment Made to Date
	Lead Partner(s)	Collaborators	GHG Avoidance Potential at 2026 (Tonnes eCO ₂ /Year)	GHG Avoidance Potential at 2031 (Tonnes eCO ₂ /Year)	Other Environmental Benefits			
<p>New Construction Requirements for Residential Buildings</p> <p><u>Strategy 1:</u> Encourage new residential buildings to be designed, built and ultimately operated using energy more efficiently.</p> <p><u>Strategy 2:</u> Ensure that residential development adheres to current Ontario Building Code.</p> <p><u>Strategy 3:</u> Implement the innovative Sustainability Metrics for use in the planning process.</p> <p>The 2031 estimate of GHG avoidance potential presented does not reflect an increase in voluntary participation but rather reflects the energy intensity of the new energy grid. Voluntary participation in the Sustainability Metrics could result in even further GHG emission reductions across Vaughan.</p>	<p>PowerStream and Enbridge</p> <p>City of Vaughan</p> <p>City of Vaughan* Development community (including: real estate developers, commercial developers, home builders, and architects/engineers)</p>	<p>York Region Partner municipalities Building industry and stakeholders</p>	46,000	66,800	<ul style="list-style-type: none"> Local air quality Stormwater management Water conservation Natural heritage 	<ul style="list-style-type: none"> Reduced utility costs Increased value of homes Strengthened green technology industry Increase physical activity from better built form and connectivity Improved access to nature Improved air quality Reduction in Urban Heat Island 	\$180,000	\$22,500
<p>Residential Energy Conservation and Efficiency Retrofit Program</p> <p><u>Strategy 4:</u> Develop and implement coordinated residential energy conservation and retrofit programs that target existing households (single family homes and apartments) to promote and increase participation in energy conservation at home.</p> <p>The increase in the 2013 GHG avoidance potential is a result of the utilities' updated conservation and demand management program targets, which provide significant opportunities to increase energy savings and reduce GHG emissions in Vaughan.</p>	<p>PowerStream and Enbridge</p>	<p>City of Vaughan</p> <p>IESO</p> <p>Canada Mortgage and Housing Corporation</p> <p>QUEST</p> <p>Renewable energy suppliers</p> <p>Community groups</p> <p>Toronto and Region Conservation Authority</p>	4,000	13,700	<ul style="list-style-type: none"> Local air quality Stormwater management Water conservation Natural heritage 	<ul style="list-style-type: none"> Reduced utility costs Increased value of homes Strengthened green technology industry Improved air quality Reduction in Urban Heat Island 	Utilities investment is \$8,500,000/year	In-kind support
<p>Residential Waste Diversion</p>	<p>York Region</p>	<p>York Region Public Health</p>	32,000	32,000*	<ul style="list-style-type: none"> Reduced waste/resour 	<ul style="list-style-type: none"> Reduced disposal costs 	York Region investment is	In-kind support

Action	Partners		Environmental Benefits			Health, Social and Economic Benefits	Total Cost	Total City Investment Made to Date
	Lead Partner(s)	Collaborators	GHG Avoidance Potential at 2026 (Tonnes eCO ₂ /Year)	GHG Avoidance Potential at 2031 (Tonnes eCO ₂ /Year)	Other Environmental Benefits			
	City of Vaughan	Windfall Ecology Centre Earth Hour Vaughan Vaughan C.A.R.E.S. York Region Environmental Alliance Goodwill			ces	<ul style="list-style-type: none"> Cost savings in homes 	\$800,000/ year (for 2014-2018)	
<p>New Construction Requirements for Commercial Buildings</p> <p><u>Strategy 5:</u> Encourage new commercial construction to be designed, built and ultimately operated with improved energy efficiency.</p> <p><u>Strategy 6:</u> Implement the innovative Sustainability Metrics for use in the planning process.</p>	PowerStream and Enbridge City of Vaughan	York Region Partner municipalities Development community Canada Green Building Council	166,000	121,400	<ul style="list-style-type: none"> Local air quality Stormwater management Water conservation Natural heritage 	<ul style="list-style-type: none"> Reduced business operating costs Reduced labour and maintenance efforts Strengthened green technology industry Increased climate resiliency 	Covered above in residential	Covered above in residential
<p>IC&I Energy Conservation and Efficiency Retrofit Program</p> <p><u>Strategy 7:</u> Develop and implement coordinated conservation and efficiency retrofit program targeting existing operations to promote and increase participation in existing programs.</p> <p>The increase in the 2013 GHG avoidance potential is a result of the utilities' updated conservation and demand management program targets, which provide increased opportunities for energy savings and reduced GHG emissions in Vaughan.</p>	PowerStream and Enbridge IC&I sector Partners in Project Green	City of Vaughan IESO Community groups York Region Public Health Toronto and Region Conservation Authority	45,000	64,800	<ul style="list-style-type: none"> Local air quality Stormwater management Water conservation Natural heritage 	<ul style="list-style-type: none"> Reduced business operating costs Strengthened green technology industry Improved corporate image Reduction in Urban Heat Island 	Utility investment is \$9,000,000/ year	In-kind support
<p>Environmental Leaders Network</p> <p><u>Strategy 8:</u> Establish a Vaughan-specific network of environmental leaders to demonstrate and encourage sustainability and climate action leadership amongst the Industrial, Commercial & Institutional sector.</p>	Windfall Ecology Centre	City of Vaughan			<ul style="list-style-type: none"> Local air quality Energy conservation Water conservation 	<ul style="list-style-type: none"> Reduced business operating costs Improved corporate image Increased access to learning opportunities and sharing of best 		\$6,000

Action	Partners		Environmental Benefits			Health, Social and Economic Benefits	Total Cost	Total City Investment Made to Date
	Lead Partner(s)	Collaborators	GHG Avoidance Potential at 2026 (Tonnes eCO ₂ /Year)	GHG Avoidance Potential at 2031 (Tonnes eCO ₂ /Year)	Other Environmental Benefits			
						practices		
<p>Land Use Planning Policy Strategy 9: Continue to advance a smart community energy system and foster energy conservation and efficiency through effective land use planning.</p> <p>The GHG avoidance potential for 2026 and 2031 reflects the impacts of effective land use planning policies for transportation. GHG avoidance potential from energy conservation and efficiency policies are captured through the various other actions identified in the MEP.</p>	City of Vaughan	York Region Metrolinx York Region Public Health	7,200	7,200	<ul style="list-style-type: none"> Local air quality Natural heritage 	<ul style="list-style-type: none"> More efficient use of land Increased physical activity Stronger communities Shorter commute times Improved air quality Reduced travel costs Local economic development 	Through Secondary Plans, Block Plans, TMP (Transportation Master Plan)	\$500,000 to develop TMP
<p>Active Transportation and Transportation Demand Management Strategy 10: Implement active transportation and Transportation Demand Management (TDM) initiatives outlined in the City’s Transportation Master Plan in support of its vision of reducing automobile dependence and moving Vaughan closer to achieving the goal of a more livable and sustainable community.</p>	City of Vaughan York Region Metrolinx (and Smart Commute)	York Region Public Health Community groups IC&I sector	66,000	66,000	<ul style="list-style-type: none"> Local air quality 	<ul style="list-style-type: none"> Increased physical activity Reduced travel costs Improved air quality 	\$80,000 (over past 8 years)	\$80,000 (past 8 years)
<p>Public Transit Enhancements Strategy 11: Implement the “transit first” approach outlined in the City’s Transportation Master Plan in support of its vision of reducing automobile dependence and moving Vaughan closer to achieving the goal of a more livable and sustainable community.</p>	Metrolinx York Region City of Vaughan	York Region Public Health	88,000	88,000	<ul style="list-style-type: none"> Local air quality 	<ul style="list-style-type: none"> Increased physical activity Shorter commute times Reduced travel costs More job opportunities Improved air quality 	Through Secondary Plans, Block Plans, TMP (Transportation Master Plan)	\$500,000 to develop TMP
	* Note the GHG emission reduction from waste will be updated		Total GHGs Avoided: 450,200/Year)*	Total GHGs Avoided: 459,900/year				

7 Implementation Framework & Next Steps

This section provides guidance on how to transition from planning to implementation. A solid Implementation Framework is necessary in order to ensure goals and objectives are accomplished in a timely and efficient manner. Guidance is also provided on how to continue to augment the MEP so that it may remain relevant as Vaughan continues to grow.

7.1 Roles and Responsibilities

Community Partners

As in the CCAP, the Actions and Opportunities described herein will require the efforts of many members of the Vaughan community to move this document from a plan to a reality. It cannot be implemented by a single organization, business, utility, industry or the City alone. To succeed, the MEP must be embedded into community and corporate culture, and implemented by all members of the Vaughan community as a whole.

To make sure the MEP continues to move forward, the City of Vaughan will:

1. Partner with Key Stakeholders for MEP Program Delivery
2. Continue the MEP Stakeholder Advisory Group
3. Facilitate Collaboration through the City of Vaughan

7.1.1 Partner with Key Stakeholders for MEP Program Delivery

Among the 9 actions and 9 opportunities, there are a number of organizations that can help to move the community MEP forward. Partners can play an important role in:

- **Educating** the Vaughan community about the importance of creating a smart energy future, energy conservation opportunities and the economic benefits that can be achieved by the community;
- **Building support** for implementation amongst their peers and within their sectors;
- **Resourcing and sharing expertise** as utilities and technical service providers have a wealth of knowledge and expertise that can continue to shape the actions and opportunities identified in the plan;
- **Aligning** the MEP actions and opportunities to the mandates, priorities and targets of their own organizations and processes;
- **Sharing** best practices from other communities;
- Delivering **actions** that are identified in the plan or others that contribute to the goals and targets;
- **Advocating** for continuing to make a smart energy future a priority in Vaughan;
- **Supporting funding** solutions for actions and opportunities; and
- **Monitoring and reporting.**

Specific stakeholders for Municipal Energy Plan implementation include:

- **City of Vaughan** – The goals and targets of the MEP can influence and are influenced by the various plans in several City departments. The Policy Planning and Environmental

Sustainability, Transportation Services, Environmental Services, Economic Development and Finance departments, to name a few, can play key roles in providing policy direction and facilitating effective implementation to advance MEP objectives. Ultimately, everyone will play a role in ensuring success.

- **Local Utilities** – PowerStream, Enbridge, thermal energy distributors and fuel suppliers all have an active role to play in supplying the Vaughan community with reliable and cost efficient energy services. These organizations play a critical role as both providers of energy supply and as leaders in conservation and demand management program design and delivery. In addition, they provide the City with the consumption data that forms the basis for understanding energy use in the community. Local utilities can support action planning, implementation, best practice information sharing, and have an important role to play in monitoring and reporting.
- **Industrial, Commercial and Institutional sectors (ICI)** – As energy use in the ICI sector represents 47% of Vaughan's total energy use, the ICI sector is instrumental in the Plan's implementation. The ICI sector has a role to play in supporting monitoring and reporting by sharing their energy data. They also play a key role in planning, implementing energy conservation actions and supporting system integration solutions and renewable energy applications. The institutional sector has an additional opportunity to participate in innovative pilot projects, facilitate knowledge sharing, and play a leadership role in implementing smart energy solutions within their own facilities to demonstrate benefits for others. In doing so, they can help to encourage sector-wide participation and promotion for a smart energy future.
- **Community champions** – Whether they be not-for-profit organizations, schools, business leaders, City staff or members of Council, community champions can also play an important part in building awareness about the MEP and helping to increase the overall energy literacy of the community. Many organizations can support program implementation and educational initiatives.
- **Toronto and Region Conservation Authority (TRCA)** - The TRCA vision, the *Living City*, has a focus on providing expertise and delivering programs in the areas of ecology, sustainable community development, and environmental education. The Ontario Climate Consortium is positioned to help municipalities engage with a network of universities to undertake research that provides leading edge policies and practices for municipalities to respond to climate change risks and uncertainty. The Living City Campus, located in the City of Vaughan, has a growing portfolio of research partnerships with universities and the private sector to help bring technology and practices to the market place with a world-wide reach through the BRE Innovation Park. Partners in Project Green has launched a Service Centre to work directly with business in commercialization of the green products needed to address GHG emissions reductions, among many other sustainability issues. Through the Community Transformation Programs, TRCA is delivering energy efficiency programs in the ICI sectors that are achieving some of the best energy efficiencies in North America. Through the Sustainable Neighbourhood Retrofit Action Plan (SNAP) programs, TRCA works with municipalities and utilities to engage neighbourhoods in taking action that achieves a

variety of sustainability outcomes, including energy efficiency, rain water management, urban tree canopy renewal and other initiatives.

- **York Region and neighbouring local municipalities** – Establishing effective partnerships within municipal borders is very important, but there is a need to look to the Region and neighbouring municipalities for potential partnerships. Three other municipalities in York Region have, or are currently working on respective community energy plans: The Town of Markham, the Town of Newmarket and the Town of East Gwillimbury. There are opportunities to look for resource and best practice sharing, joint program or project implementation, shared data collection, monitoring, reporting and education.
- **Independent Electricity System Operator (IESO)** – In addition to working with York Region and our neighbouring municipalities, the IESO should be consulted on an ongoing basis. The IESO's Integrated Regional Resource Plan looks at regional electricity planning in York Region (and other Regions in Ontario) from three levels – (1) regional system planning, (2) provincial or bulk system planning and (3) local distribution system planning. Aligning, integrating, and adjusting Vaughan's MEP based on some of the key findings from the York Region IRRP at all three levels makes sense. A City of Vaughan representative should attend all Local Advisory Committee Meetings.
- **Ministry of Energy** – The Ministry has a unique role as a prime funding partner for the development of the MEP. As the first MEPs are completed and eventually moved into the implementation phases, the Ministry will have the opportunity to ensure there are avenues for knowledge sharing amongst Ontario municipalities that have, or wish to have, a Municipal Energy Plan. This will be an important piece as more municipalities in Ontario look to develop their own energy plans.

Continue the MEP Stakeholder Advisory Group

The City should coordinate and facilitate a committee of community partners that meet on a regular basis each year to reflect on the actions and opportunities completed, energy reduction and GHG emission reductions achieved, and to look at opportunities in the future for CCAP and MEP work planning and prioritizing future work. The stakeholder group established through the development of the CCAP and MEP include broad representation across the Vaughan community sectors and represent key contributors to energy planning initiatives. Action partners will be included in the group. It is anticipated that the partners who are leading and participating in the delivery of specific actions will self-organize their team.

Facilitate Collaboration through the City of Vaughan

Although community partners have a large role in implementing components of the MEP, the City of Vaughan also plays a key role. The City will continue to act as a facilitator, helping to implement the MEP in order to achieve benefits for the City and community. The City's role is to guide the overall MEP process and the annual work planning and prioritization process, reduce barriers, coordinate efforts, help information flow, build capacity, and leverage resources. Embedding the MEP into the City's operations can be fulfilled through the existing resources at the City under the banner of *Green Directions Vaughan, the Community Sustainability and Environmental Master Plan*. The City also has been identified in leading and

supporting roles in a number of the Actions and Opportunities that will be coordinated on a per project or action basis.

7.2 Mobilizing the Community

An ongoing conversation about smart energy communities, climate change and their impacts in the community is important for the success of the Plan. Communication, education and outreach efforts to engage and mobilize the Vaughan community are necessary to help build community understanding of the benefits of an integrated community energy system, the mechanisms by which programs can be delivered as well as the potential impacts to residents' quality of life.

7.3 Resources and Funding

Ongoing resources and funding are required for continued implementation of the MEP. Leveraging existing initiatives and resources, both internal and external to the City, is imperative. The City of Vaughan should continue to explore ways to leverage existing resources to ensure initiatives can be implemented to the fullest extent possible. Where possible, budget allocations for specific projects should be integrated with the lead department plans. Coordination should occur through the Policy Planning and Environmental Sustainability department. Other organizations, including non-profit, government and businesses, are at the forefront of the Actions and Opportunities identified in the MEP and will be responsible for resourcing and funding the actions they have agreed to help move forward.

Coordination and Administration Services

The City of Vaughan will continue its role in providing oversight for the implementation of the MEP. This includes the regular monitoring and reporting of progress and coordinating community partners and regular planning and working meetings. The City will coordinate and facilitate the stakeholder advisory group that should meet on a regular basis (4-6 times per year).

Seeking External Sources of Funding

The City of Vaughan, in partnership with community partners, should actively monitor and seek funding opportunities to help implement Actions and Opportunities outlined in the MEP.

7.4 Ongoing Tracking and Monitoring

Measuring and reporting provides an indication of progress, ensuring that the MEP goals and objectives are ultimately met. Reporting also demonstrates activities that contribute to achieving the vision of *Green Directions Vaughan*, identifies activities and initiatives that are contributing to the Plan's progress, recognizes partners, and further mobilizes the community.

Monitor Energy Use and GHG Emissions

Each year, GHG emissions for the Vaughan community will change as the MEP is implemented and as the population grows. GHG data will be catalogued by the City of Vaughan every five years through ICLEI Canada's PCP Milestone Tool. The tool provides a framework to quantify,

monitor and manage GHG emission data generated at the local level based on the methodology of the PCP program. It will be useful to analyze annual data and provide updates on GHG emissions for the year to better understand the effectiveness of new initiatives, and to identify areas that have improved and areas that require more attention. This will provide important information to the community committee for the purposes of work planning and prioritizing efforts.

Monitoring progress towards sustainability in Vaughan is conducted by measuring a set of 24 indicators. These quantitative indicators are a selected set of parameters related to the sustainability objectives of *Green Directions Vaughan* that measure the progress toward achieving a sustainable environment, vibrant community, and strong economy. Community greenhouse gas emissions are one of the 24 indicators, which are measured with the PCP Milestone Tool. As *Green Directions Vaughan* is updated, indicators relevant to measuring progress on implementation of the MEP should be integrated into the new framework. Once approved, the indicators should be reported annually through the established *Green Directions Vaughan* implementation reports.

7.5 Plan Renewal

In addition to ongoing monitoring and reporting, the actions and underlying assumptions of the MEP should be frequently examined to ensure that any major developments are integrated. The MEP will need to be flexible in order to adapt to the Vaughan community as it changes, especially considering the anticipated population growth. The MEP will be a “living document” that can be updated as new information becomes available. For example, new growth projections are expected to become available through York Region and the City in 2016. As new communities are developed and new ICI facilities are built in the community, assumptions on anticipated energy consumption should be incorporated into the MEP’s data modelling. Furthermore, as the energy landscape in Ontario is in a period of rapid change, where utilities formalize their conservation targets and programming, and the York Region Integrated Resource Plan is continuing to be developed, there may be further alignments that will need to be integrated into the MEP.

Accordingly, the Vaughan MEP should be refreshed in coordination with the ongoing review of *Green Directions Vaughan*. City Council and community members will be continuously informed on the progress of the plan and revisions will be made accordingly based on newly identified priorities and successes achieved. It is anticipated that the first renewal of *Green Directions Vaughan* will occur in 2016. Subsequent renewal of the MEP should occur in five year intervals, but may require more frequent revisions to recognize provincial and federal legislative changes as well as technological innovations.

7.6 Next Steps

The Actions and Opportunities need to be further developed through discussions with potential delivery agents. Collaborators will need to be identified at an early stage. We will also look to leverage and confirm funding and other resources, establishing the feasibility of the initiatives,

determining the level of community support, establishing a business case where necessary, and finalize the mechanisms for monitoring, evaluating and reporting on implementation.

In addition, once detailed data on floor space of non-residential buildings is available, allowing the development of a model of energy consumption in the non-residential sector, this report will be updated with the related analysis and energy maps.

Provincial changes to codes and standards and the effort of Local Distribution Companies through Conservation Demand Management (CDM) programs account for much of the estimated GHG emissions reductions identified in the Vaughan MEP. The City will identify the key areas for our municipal contribution to climate change mitigation by comprehensively investigating opportunities identified in this report. The following opportunities, in particular, are important to explore to reasonably estimate potential for reductions in both GHG emissions and peak energy demand:

- Deep residential energy retrofit using tools such as Local Improvement Charges;
- Reaching out to Vaughan businesses and directing them to an environmental leaders network such as the ClimateWise Business Network, Partners in Project Green and utility CDM programs;
- Feasibility for combined heat and power (CHP) specified in new community centres and as a retrofit in select institutional buildings to create resiliency hubs;
- Identifying municipal tools to contribute to the provincial and utility programs to further improve the conditions for uptake of solar photovoltaic and solar energy storage in the residential and employment sectors; and
- Identifying the appropriate municipal role in ongoing energy efficiency improvements for new construction.

In this way, a timeline can be presented for the Actions identified in Section 6 of this report for immediate (1-2 years), short-term (3-7 years) and longer term (8-20 years) outcomes. The Opportunities identified in the Vaughan MEP will be pursued generally to achieve longer term outcomes. However, efforts such as a Sustainable Neighbourhood Retrofit Pilot, rooftop solar PV uptake and promoting electric vehicle charging stations will be considered to achieve short-term outcomes.

Immediate Actions (1-2 years)

- The City will identify initiatives to increase the uptake of existing retrofit programs managed by PowerStream and Enbridge through communication of the Municipal Energy Plan and Green Directions Vaughan, as well as communication and outreach with the City's Economic Development team.
- The City will promote an environmental business leaders network, such as that based on Sustainability Co-Lab, which complements the programs of PowerStream and Partners in Project Green.

Short-Term Actions (3-7 years)

- The City will determine the best approach to implement a coordinated residential energy retrofit program to complement Provincial initiatives.

- Through the Secondary Plan process for New Community Areas, the City will identify the appropriate municipal role to leverage further GHG emissions reductions in ongoing energy efficiency improvements for new construction as part of Ontario Building Code revisions.
- Using the *Sustainability Performance Metrics for New Development* (Sustainability Metrics) and other planning tools, identify opportunities for improved energy efficiency and renewable energy generation in the IC&I sector.

Longer Term Actions (8-20 years)

- Reducing GHG emissions in the transportation sector through land use planning to create compact communities, promoting active transportation, and public transit enhancements reflect longer term outcomes advanced through the City's official Plan (VOP 2010) and related master plans (e.g. Transportation Master Plan; *Active Together*, the Recreation and Culture Master Plan; Pedestrian and Cycling Master Plan).

Glossary

Active Transportation - Active transportation is any form of human-powered transportation. It includes walking, cycling, wheeling, in-line skating, skateboarding, ice skating, etc. It can also involve combining modes such as walking/cycling with public transit. Source: Vaughan Transportation Master Plan 2013 , “A New Path”.

Climate Change - Climate change refers to a change in the state of the *climate* that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or *external forcings* such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in *land use*. Note that the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: ‘a change of *climate* which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural *climate variability* observed over comparable time periods’. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and *climate variability* attributable to natural causes. Source: Intergovernmental Panel on Climate Change 2014 Synthesis Report. IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.]

CO2 equivalent - Greenhouse gas emissions are also calculated in terms of how much CO₂ would be required to produce a similar warming effect. This is called the carbon dioxide equivalent (CO₂ eq) value and is calculated by multiplying the amount of the gas by its associated global warming potential (GWP).
(<http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=B710AE51-1>)

Community Energy Plan – In the York Region Official Plan (ROP 2010), Community Energy Plans set out a strategy to help the community reach goals of energy conservation, energy efficiency, and the reduction of greenhouse gas emissions that include:

- Passive solar gains through design;
- On-site generation and district energy options such as solar, wind, water, biomass, and geothermal energy; and
- Use of green and white roofs, greening to provide shade and light-coloured surface materials

Conservation Demand Management – Utility energy conservation programs are mandated by the Province and take the form of “Electricity Conservation and Demand Management” (CDM) and “Natural Gas Demand Side Management” (DSM). A 2014 directive from the

Minister of Energy to the Ontario Energy Board (OEB) directs the OEB to establish the policy framework and targets for the CDM and DSM programs.

Conservation First – With respect to the Long-Term Energy Plan (2013 LTEP), Conservation First emphasizes rate mitigation over major investments in generation or transmission to curb costs for ratepayers. Conservation will be the first resource to be considered. It is the cleanest and most cost-effective energy resource, and it offers consumers a way to reduce their electricity bills. The Ontario government intends to ensure that conservation will be considered before building new generation and transmission facilities, and will be the preferred choice wherever cost-effective.

With respect to the Growth Plan for the Greater Golden Horseshoe, section 4.2.4 supports a “culture of conservation”, including policies for energy conservation.

District Energy - A District Energy System (DES) may also be referred to as a Thermal Grid (providing either heating and/ or cooling), and may also be a provider of locally generated electricity supplies (called co-generation), use local sources of renewable fuels to power the system, and have local renewable energy storage capacity. Source: Natural Resources Canada. 2014. Stakeholder Engagement Guide – District Energy Systems. (<http://questcanada.org/rh/4eeb740da06fa3f42df9534a0348a097.pdf>)

Energy Intensity – Energy use normalized by building floor area, such as expressed in gigajoules per square metre.

Energy Planning District (EPD) – For the purposes of the Vaughan Municipal Energy Plan, the EPDs are the concession blocks used by Vaughan for land use planning purposes.

Gigajoules (GJ) – A joule (J) is an SI unit of energy or work. A gigajoule (GJ) is 10^9 joules. Standard conversions are as follows:
1 GJ = 277.78 kilowatt hours (kWh)
1 cubic meter of natural gas = 0.038 GJ (<http://www.nrcan.gc.ca/energy/natural-gas/5641>)

Global Warming Potential - A GWP is the time-integrated change in radiative forcing (effectiveness in absorbing outgoing infrared radiation) due to the instantaneous release of 1 kilogram (kg) of the gas expressed relative to the radiative forcing from the release of 1 kg of CO₂. The concept of global warming potentials has been developed to allow scientists and policy-makers to compare the ability of each greenhouse gas to trap heat in the atmosphere relative to CO₂. (<http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=B710AE51-1>)

Greenhouse Gas (GHG) - Gas that contributes to the capture of heat in the Earth’s atmosphere. Carbon dioxide is the most prominent GHG. It is released into the earth’s atmosphere as a result of the burning of fossil fuels such as coal, oil or natural gas. GHGs are widely

acknowledged as contributing to climate change. (Achieving Balance: Ontario's Long-Term Energy Plan. 2013)

HOT2000 - HOT2000 is an energy simulation and design tool for low-rise residential buildings. This software is widely used across Canada to support program, policy and regulatory development and implementation. HOT2000 is developed and managed by the Office of Energy Efficiency at Natural Resources Canada. It is the simulation engine for the EnerGuide Rating System for homes. In 2015, updates to the rating system resulted in a new version of HOT2000 and new complementary report generation software. HOT2000 software supports Natural Resources Canada's EnerGuide Rating System (ERS), ENERGY STAR for New Homes (ESNH) and R-2000 energy efficiency residential programs.

Local Improvement Charges - 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. O. Reg. 586/06 (Local Improvement Charges (Priority Lien Status) made under the Municipal Act, 2001, was amended by O. Reg. 322/12, and O. Reg. 596/06 (Local Improvement Charges (Priority Lien Status) made under the City of Toronto Act, 2006, was amended by O. Reg. 323/12. These amendments address:

- municipal flexibility to undertake different types of capital works as a local improvement, including, but not limited to renewable energy, energy efficiency and water conservation capital works;
- flexibility for municipalities to enter into agreements with willing private land owners to undertake local improvements on private property and recover the cost from owners; and,
- alternative methods of apportioning the costs of local improvements on private property beyond a charge based on frontage.

Long-Term Energy Plan – The Ministry of Energy Long-Term Energy Plan, *Achieving Balance* (the 2013 LTEP).

<http://www.powerauthority.on.ca/power-planning/long-term-energy-plan-2013>

Municipal Energy Plan – With regard to the Ministry of Energy, a Municipal Energy Plan (MEP) supports municipalities' efforts to better understand their local energy needs, identify opportunities for energy efficiency and clean energy, and develop plans to meet their goals. A MEP takes an integrated approach to energy planning by aligning energy, infrastructure and land use planning. MEPs will help municipalities:

- Assess the community's energy use and greenhouse gas (GHG) emissions;
- Identify opportunities for conserving energy, improving energy efficiency and reducing GHG emissions;
- Consider impact of future growth and options for local clean energy generation; and
- Support local economic development.

[\(http://www.energy.gov.on.ca/en/municipal-energy/\)](http://www.energy.gov.on.ca/en/municipal-energy/)

New Community Areas - In the York Region Official Plan (ROP 2010), “Lands added to the Urban Area through a Regional municipal comprehensive review, for community purposes including residential and population-related employment, beyond those designated as Urban Area at the date of approval of this Plan.” (Region Official Plan 2010, Page 143)

Regional Centres - In the York Region Official Plan (ROP 2010), Regional Centres are planned as the most important and intense concentrations of development in York Region. Regional Centres “will contain a wide range of uses and activities, and be the primary focal points for intensive development, that concentrates residential, employment, live-work, mobility, investment, and cultural and government functions” (Region Official Plan 2010, Page 69).

Renewable Natural Gas - Renewable natural gas (RNG), or biomethane, is a pipeline-quality gas that is fully interchangeable with conventional natural gas and thus can be used in natural gas vehicles. RNG is essentially biogas (the gaseous product of the decomposition of organic matter) that has been processed to purity standards. Like conventional natural gas, RNG can be used as a transportation fuel in the form of compressed natural gas (CNG) or liquefied natural gas (LNG).
(http://www.afdc.energy.gov/fuels/natural_gas_renewable.html)

Screening Tool for New Building Design - This tool allows the user to quickly estimate the energy performance of a proposed building design relative to the Model National Energy Code for Buildings (MNECB) and the rules established by Natural Resources Canada (NRCAN). By conducting this preliminary screening, the user can assess the impact of a single measure or a combination of measures to maximize the energy efficiency of your design.
(<http://www.screeningtool.ca/>)

Transportation Master Plan – The City of Vaughan Transportation Master Plan, “A New Path”, was completed in 2013.
(http://www.vaughan.ca/projects/projects_and_studies/transportation_master_plan/Pages/default.aspx)

York Region Integrated Regional Resource Plan - Regional system planning ensures a reliable supply of electricity to regions. It considers conservation, generation, transmission and distribution, and innovative resources. It is the link between provincial and local planning. The York Region sub-region includes the municipalities of Vaughan, Markham, Richmond Hill, Aurora, Newmarket, King, East Gwillimbury, Whitchurch-Stouffville and Georgina. Extensive urbanization in the last several years has meant that its electricity demand growth has been greater than the provincial average. Official growth plans for the region anticipate that strong growth in the area will continue into the future. As a result, there is a need for integrated planning to ensure that electricity supply can support the pace of development in the long term.

(<http://www.ieso.ca/Pages/Ontario%27s-Power-System/Regional-Planning/GTA-North/default.aspx>)

York Region Official Plan 2010 - The *York Region Official Plan 2010 (ROP 2010)* describes how York Region plans to accommodate future growth and development while meeting the needs of existing residents and businesses in the Region. It sets out directions and policies that guide economic, environmental and community planning decisions. The *ROP-2010* replaces the previous official plan approved in 1994.

Vaughan Energy Conservation and Demand Management Plan 2014 - Under the *Ontario Energy Conservation Leadership Act*, and specifically Ontario Regulation 397/11, municipalities and other public institutions were required to prepare and submit a five year energy management plan to the Ontario Ministry of Energy on July 1, 2014. Energy management plans must include an overview of energy consumption and greenhouse gas emissions for all corporate facilities as well as a description of previous, current and proposed energy conservation projects. The City's corporate "Energy Conservation Demand Management Plan" was approved by Council in June 2014 and submitted to the Province in accordance with regulatory requirements.

Vaughan Official Plan 2010 - The City of Vaughan Official Plan (VOP 2010) was the outcome of the City's integrated Growth Management Strategy. On September 7, 2010, Council adopted VOP 2010. It addresses all elements of effective, sustainable and successful city-building, while managing projected growth to 2031, and in conformity with the York Region Official Plan 2010.

(http://www.vaughan.ca/projects/policy_planning_projects/official_planning_2010/Pages/default.aspx)