CITY OF VAUGHAN

EXTRACT FROM COUNCIL MEETING MINUTES OF MARCH 22, 2016

Item 2, Report No. 14, of the Committee of the Whole (Working Session), which was adopted without amendment by the Council of the City of Vaughan on March 22, 2016.

2 CITY OF VAUGHAN DRAFT MUNICIPAL ENERGY PLAN (MEP)

The Committee of the Whole (Working Session) recommends:

1) That the recommendation contained in the following report of the Deputy City Manager, Planning & Growth Management and the Director of Policy Planning & Environmental Sustainability, dated March 7, 2016, be approved;

2) That the presentation by the Manager of Environmental Sustainability and Communication C1, presentation material titled "*City of Vaughan's Municipal Energy Plan*" dated March 7, 2016, be received;

3) That staff be directed to report back to a future Committee of the Whole (Working Session) meeting on the matter of air emissions along Highway 400 and other transportation corridors as part of the municipal comprehensive review and the Green Directions Vaughan process; and

4) That the deputation by Ms. Gloria Marsh, York Region Environmental Alliance, Dariole Drive, Richmond Hill, be received.

Recommendation

The Deputy City Manager, Planning & Growth Management and the Director of Policy Planning & Environmental Sustainability recommend:

1. That the draft version of the City of Vaughan's Municipal Energy Plan be received for information purposes and that any comment originating from this meeting be taken into consideration in the finalization of the Municipal Energy Plan (MEP); and

2. That this draft of the Municipal Energy Plan be circulated to the Stakeholder Advisory Group and City departments for review prior to bringing it forward to Committee of the Whole for final approval by June 2016.

Contribution to Sustainability

Leadership and action are core principles that guide the City's actions on sustainability. The Municipal Energy Plan, building on the Council–approved Community Climate Action Plan, is consistent with the priorities previously set by Council in *Green Directions Vaughan*, Community Sustainability Environmental Master Plan:

- Goal 1, Objective 1.2: To reduce greenhouse gas emissions through actions such as working with the community to implement the local action plan and undertaking energy conservation initiatives.

- Goal 2, Objective 2.3: To create a City with sustainable built form by considering recommendations outlined in the local action plan to integrate smart energy planning in new developments and retrofit opportunities.

Economic Impact

An Agreement between the City and the Province of Ontario, under the Municipal Energy Plan Program, is in effect as of July 21, 2014 to bring the City's Community Climate Action Plan (CCAP) into the Municipal Energy Plan (MEP) framework in three stages of work. The Province is

…/2

providing $54,840 to the City to undertake the project, which must be completed by July 21, 2016 under the terms of the Agreement. The City of Vaughan was one of the first of eight municipalities to receive funding to develop a MEP and will also be one of the first jurisdictions to make the transition from an existing Community Climate Action Plan into a Municipal Energy Plan.

The Ministry of Energy recently introduced a new funding stream to enhance existing energy plans that will be available to municipalities that have already developed a complete or partial Municipal Energy Plan, Climate Action Plan, or other energy plan. This funding is for enhancing an existing energy plan which could include updating utility or building data and/or creating new implementation plans or maps. Staff will be evaluating this program for future funding opportunities to ensure the MEP remains relevant as energy resources, needs, and targets change.

Communications Plan

During the development of the MEP, the City of Vaughan engaged in an outreach program with stakeholders at a number of levels to discuss the background and processes involved in developing the MEP. The City of Vaughan presented at the Clean Air Council's Clean Air Summit, as well as at several Clean Air Partnership regional meetings (the Clean Air Partnership is a collaborative network of 27 member municipalities from across the GTHA). The City also presented at the Ontario Energy Community of Practice symposium held at the Vaughan City Hall in 2014.

A Stakeholder Advisory Group (SAG) was established, including 35 organizations from a variety of sectors representing energy users and distributors, land use planning and development, buildings and built form, as well as transportation. A total of five SAG meetings were held throughout 2014-2016 to discuss goals, analysis, actions, targets, integration, and implementation aspects of the Plan.

The Policy Planning & Environmental Sustainability department will work closely with Corporate Communications on a news release announcing the Municipal Energy Plan and its key aspects, and the timing and content of any broader messaging for the community. The Environmental Sustainability section of the City of Vaughan's website will highlight the MEP and share community engagement opportunities. Additionally, progress achieved will be shared with the MEP Stakeholder Advisory Group and the City of Vaughan's strategic partners such as the Clean Air Partnership and Smart Commute. This is consistent with Goal 5 of Green Directions Vaughan "To be leaders in advocacy and education on sustainability issues" where "Vaughan is committed to sharing its successes with the community".

Working with the Office of Corporate Initiatives and Intergovernmental Relations, the MEP will be shared with Federal MPs and Provincial MPPs to ensure awareness of Vaughan's climate change initiatives as part of City of Vaughan and Region of York efforts to garner infrastructure funding to support retrofitting and resiliency initiatives aligned with Federal and Provincial priorities.

Purpose

The purpose of this report is to provide Council with an update on the progress being made with the Municipal Energy Plan and to seek input to inform the finalization of the plan.

Background - Analysis and Options

The Vaughan Community Climate Action Plan, 2014

As recommended in Green Directions Vaughan, Objective 1.2, the City of Vaughan aims to promote the reduction of greenhouse gas emissions in the City of Vaughan through actions such

as working with the community to develop a Greenhouse Gas Emission Community Climate Action Plan (CCAP) and an associated emission reduction target.

Staff undertook the preparation of a CCAP, which was approved by Council in early 2014. The CCAP was developed through a collaborative and stakeholder driven process that included a 40 member steering committee stakeholder group, a community forum, an on-line idea sharing platform, a community tweet-up and face-face community outreach at a community centre. The CCAP established a mission for climate change mitigation and identified specific actions and additional opportunities to reduce greenhouse gas (GHG) emissions at home, at work and as we move. It set a target for reducing community GHG emissions by 20% per capita below the 2006 baseline year by 2026. The CCAP is a commitment of the City's membership in the Partners for Climate Protection (PCP) program.

Transitioning the Community Climate Action Plan to a Municipal Energy Plan

In August 2013, the Ministry of Energy announced funding to support the development of Municipal Energy Plans. A Municipal Energy Plan (MEP) is a comprehensive long term plan to improve energy efficiency, reduce energy consumption and GHG emissions developed within the context of the built environment, land use planning, growth planning, and generation and transmission infrastructure. This presented the City with an opportunity to better understand local energy needs and consumption patterns from a geographical perspective and to align the CCAP with the Municipal Energy Planning framework. The City of Vaughan successfully secured funding from the Ministry of Energy in 2014 and proceeded to work with LURA Consulting to leverage the CCAP to develop a MEP.

The MEP Stakeholder Advisory Group (SAG) was established and sought the participation of the former CCAP Stakeholder Steering Committee to advise on the development of the MEP. The MEP SAG included 35 stakeholders from a variety of sectors representing energy users and distributors, land use planning and development, construction, as well as transportation. A total of five SAG meetings were held throughout 2014-2016 to discuss goals, analysis, actions, targets, integration, and implementation aspects of the Plan.

The draft of the MEP provides analyses to complement the efforts of the CCAP. The MEP presents Vaughan's energy consumption data in 2013, including electricity and natural gas consumption, while taking into account energy use by sector. This analysis was able to produce residential energy maps to spatially illustrate energy consumption patterns. The MEP provides GHG forecasts to 2031 and examines the implications of a business-as-usual approach for energy planning and consumption in Vaughan. Additionally, the MEP includes an economic analysis based on the approach developed by the City of London, Ontario, to illustrate the proportion of money spent on energy that stays within the City or is transferred to other parts of Canada or internationally.

The MEP incorporates the previously approved actions and opportunities that relate to 'At Home' (Residential), 'At Work' (Industrial, Commercial, and Institutional), and 'On the Move' (Transportation) that were identified in the CCAP to achieve energy and GHG reductions. However, the MEP introduces two new areas of focus, including 'For the Economy' and 'In Conversation'. 'For the Economy' will strive to stimulate economic development in the form of new businesses that focus on the energy sector and 'In Conversation' will aim to ensure that education, awareness, and behavior change programs instill a culture of conservation in the broader community.

The transition in Vaughan to a more service based/light industrial employment base and the Province's phase-out of coal power plants resulted in a per capita GHG emission reduction in 2013 that is lower than the target initially forecast in the CCAP for 2026. The actions identified in

the CCAP remain relevant for Vaughan to contribute to meeting global climate change mitigation targets and have only been slightly revised through the MEP. With a refined emission forecast identified in the MEP, Vaughan is able to set a target for a 22% per capita reduction in GHG emissions from the 2006 baseline by 2031 through the implementation of the updated actions and opportunities.

It is anticipated that GHG reductions in the Vaughan community will produce multiple quantifiable and qualitative economic, social and environmental benefits. As GHG emission reductions are often achieved through actions supporting energy efficiency and conservation, efforts in this area will provide energy cost savings to the public as well as to the commercial, institutional and industrial sectors as energy efficient technologies are applied and overall energy usage is reduced. The MEP examines in more detail the economic considerations of energy costs in Vaughan.

The City of Vaughan will continue to work closely with the SAG to solidify an implementation framework as well as monitoring and reporting procedures to track progress of the MEP. It is recommended that the MEP be flexible to adapt to the Vaughan community as it changes. The MEP will remain a "living document" that will consider changes such as population growth, new communities and industries, as well as a shifting policy context as energy planning in Ontario continues to make significant progress towards clean, reliable energy solutions. As such periodic updates will be necessary.

Next Steps

City staff will seek final input from the SAG on the draft Municipal Energy Plan after the March 7, 2016 meeting of the Committee of the Whole (Working Session). Any additional recommendations will be incorporated into a final MEP to recommend to Council for approval in May or June 2016 in order to meet the City's commitment in the Agreement with the Province.

Relationship to Term of Council Service Excellence Strategy Map (2014 – 2018)

This report is consistent with the Term of Council priority of continuing to cultivate an environmentally sustainable city as demonstrated by the previously approved CCAP. The MEP builds on the goals identified in the CCAP to work towards energy security, supporting local economic development, fostering a culture of social responsibility and sustainability, and identifying actions to reduce the community's energy consumption and GHG emissions.

Regional Implications

The York Region Official Plan (ROP 20210) requires the development 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).

The Municipal Energy Plan is intended to conform with the Regional Official Plan policies requiring the preparation of the municipal-wide energy plan.

By identifying impactful and cost effective actions to reduce greenhouse gas emissions throughout the community, Vaughan will demonstrate regional leadership in working to combat climate change and reducing energy consumption. The initiatives identified in the MEP have potential to positively impact the economic, social and environmental sustainability of the region.

Conclusion

The MEP is intended to replace the CCAP by incorporating the actions and opportunities that were previously identified in the Council-approved CCAP to reduce energy consumption and achieve GHG reduction targets. The draft MEP establishes a refined target for a 22% per capita reduction in GHG emissions from the 2006 baseline by 2031, which will result in a total GHG reduction of 459,939 tonnes/year.

The implementation of the identified actions and opportunities will require the efforts of many members of the Vaughan community. To be effective, the MEP must be embraced by the broader community and widely implemented. Therefore, the City of Vaughan will continue to liaise with the SAG to establish an implementation framework and monitor progress. By committing to working with the community to reduce energy and greenhouse gas emissions, the City of Vaughan will be able to demonstrate leadership as a strong environmental steward, working to improve community energy conservation to combat climate change at the local level.

Vaughan's Municipal Energy Plan provides a platform for more advanced opportunities and transformational targets in the future. The policy context is shifting as energy planning in Ontario continues to make significant progress towards clean, reliable energy solutions. Through the development of the Long-Term Energy Plan (LTEP), the Ontario government has committed to a "Conservation First" policy and an efficient, low energy intensive future. The Independent Electricity System Operator (IESO) continues to consult on the York Region Integrated Regional Resource Plan to examine energy generation, transmission, distribution and conservation options from a regional perspective. At the 2015 United Nations Climate Change Conference in Paris (COP21), 195 countries adopted the first-ever universal, legally binding global climate deal. The Municipal Energy Plan will help set Vaughan in the right direction to a smart energy future.

Therefore, it is recommended that this report be received for information purposes and that any resulting comments and input be considered for inclusion into the final draft of the Municipal Energy Plan.

Attachment

1. Preliminary Draft Municipal Energy Plan

Report prepared by:

Kailyn Smith, Sustainability Coordinator, x. 8941
Tony Iacobelli, Manager, Environmental Sustainability, x. 8630

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

C 1
COMMUNICATION
CW (WORKING SESSION)
MARCH 7/2016
ITEM - 2

City of Vaughan's Municipal Energy Plan

Committee of the Whole (Working Session) - March 7, 2016

Tony Iacobelli, Manager, Environmental Sustainability

Broader Context

LABEL
PARIS2015
COP21·CMP11

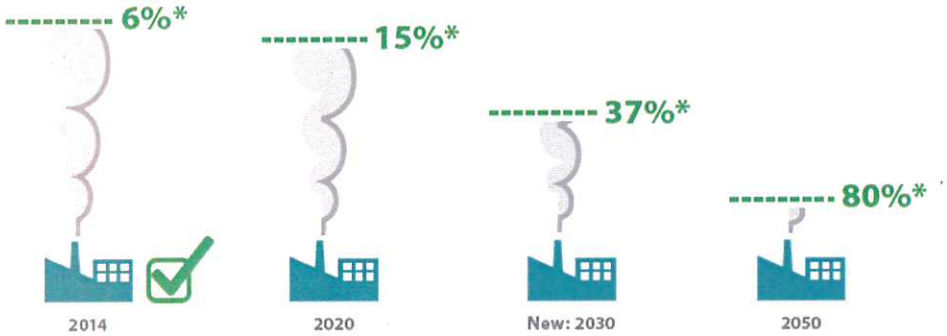
UNITED FOR CLIMATE ACTION
cop21.gouv.fr #COP21

CITIES FOR CLIMATE

Climate Summit for Local Leaders

DECEMBER 4TH 2015 - PARIS

Ontario's greenhouse gas reduction targets

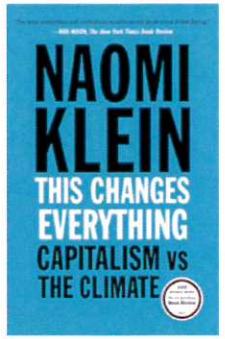


* below 1990 greenhouse gas emission levels

#ONclimate

Planning for Health, Prosperity and Growth in the Greater Golden Horseshoe: 2015-2041

Recommendations of the Advisory Panel on the Coordinated Review of the Growth Plan for the Greater Golden Horseshoe, the Greenbelt Plan, the Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan



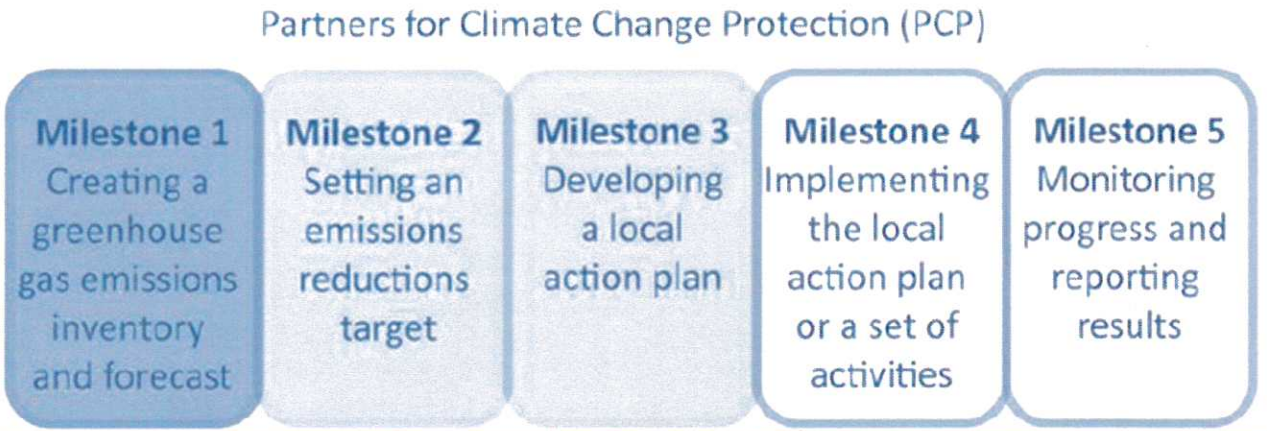
VAUGHAN

Purpose – Climate Change Mitigation

The Municipal Energy Plan (MEP) fulfills two priority functions:

- Completing Actions in Green Directions Vaughan relating to the City's commitment to Partners for Climate Protection (Actions 1.2.3, 1.2.4 and 1.2.5)

- Region Official Plan conformity requirements for Community Energy Plans



Acknowledgements

- Stakeholder Advisory Group
  - 40 members representing a variety of sectors in Vaughan and York region
  - PowerStream and Enbridge
- City staff
- Funders:
  - Ontario Ministry of Energy
  - Federation of Canadian Municipalities

VAUGHAN MEP
Municipal Energy Plan

VAUGHAN

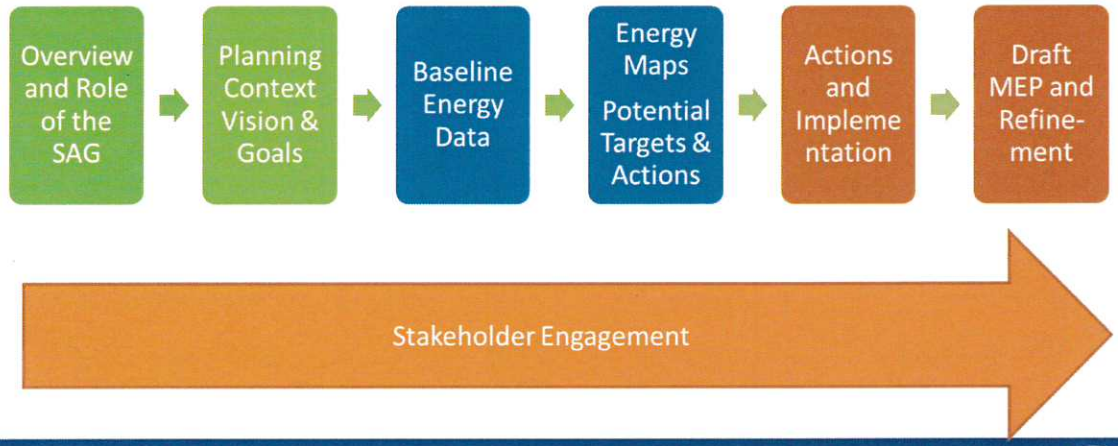
Creating a Municipal Energy Plan (MEP)

- Community Climate Action Plan (CCAP) approved by Council in 2014
  - Established a mission for climate change mitigation
  - Identified specific actions and additional opportunities for greenhouse gas (GHG) emissions reduction
- MEP was a natural next step following the development of the Community Climate Action Plan (CCAP)
- Vaughan one of the first 8 municipalities to receive funding from the MOE to develop an MEP

VAUGHAN MEP
Municipal Energy Plan

Key Elements of the MEP

- MEP includes:
  - Baseline assessment of energy consumption and spatial analysis
  - Clear goals for climate change mitigation
  - Defined targets for GHG emissions reduction across the City
  - Short and long term actions
  - Reference to ongoing policy initiatives (e.g. TMP) and actions that support the goals of the MEP



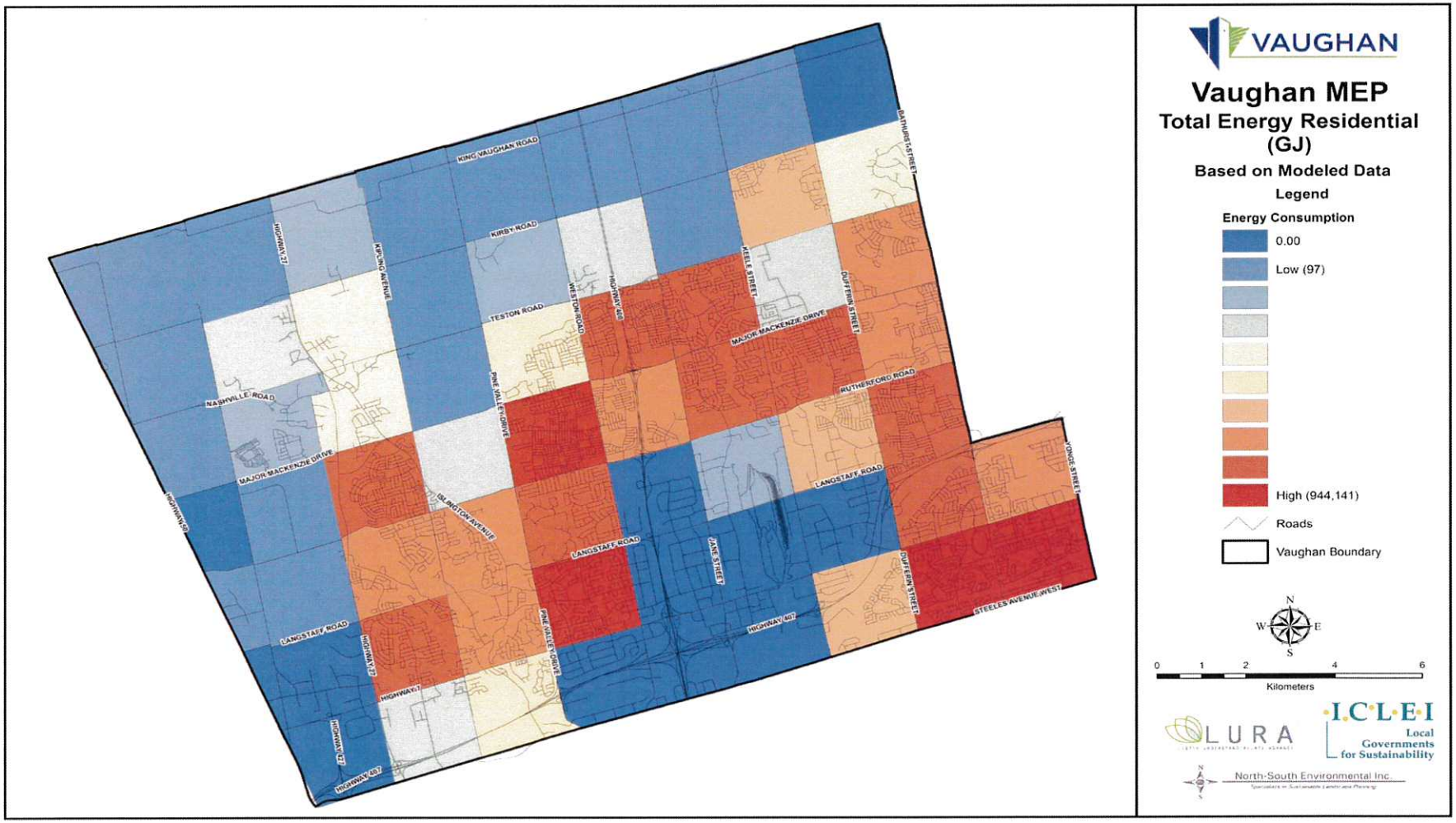
Aligning the CCAP & the MEP

- The MEP builds on the CCAP model and will effectively replace the CCAP as a living document for climate change mitigation and energy conservation in Vaughan

What's new in the MEP?

- Residential energy maps to spatially illustrate energy consumption
- Reprioritizes 'Actions' & 'Opportunities' from CCAP
- Quantifies energy inventories in approximate dollars spent
- MEP identifies additional areas of focus:
  - *For the Economy* (stimulate the green economy)
  - *In Conversation* (culture of conservation through education)

Example of Spatial Analysis



Based on natural gas and electricity consumption data for residential dwellings

Baselines and Forecasts

	2006	2013	2031 BAU Forecast	2031 with Actions
Energy Consumption (Millions of GJ)	30.8	36	48	
Per Capita Energy Consumption (GJ)	124	115		
GHG Emissions (Millions of tonnes)	1.7	1.58*	2.1	1.64
GHG Emissions Reduction Estimate (Tonnes)				459,900
Per Capita CO2 Emissions (Tonnes)	6.8	5.04*		3.9
Population	249,345	312,882	416,600	416,600

* Not including GHG emissions from waste.

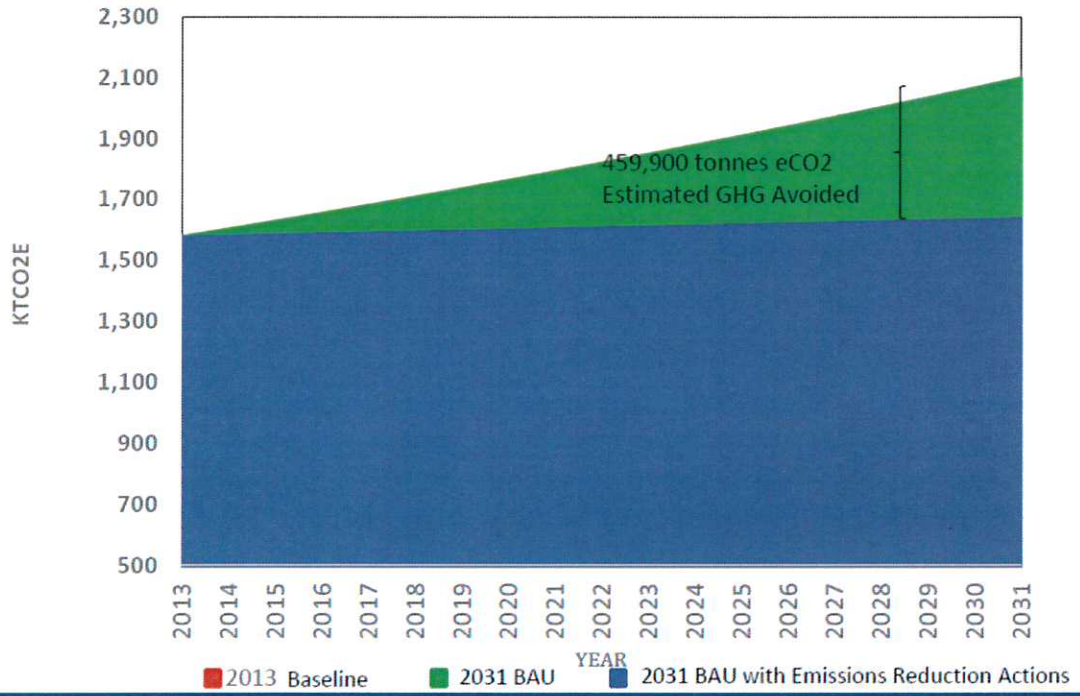
A New Reduction Target

CCAP Target

20% greenhouse gas reduction per capita below 2006 baseline by 2026.

MEP Target

22% greenhouse gas reduction per capita below the 2013 baseline by 2031.



Actions to meet our target

At Home, At Work, and On the Move

ACTION	GHG AVOIDANCE POTENTIAL (2031)
New Construction Requirements (Residential)	66, 800 eCO_2/year
Residential Energy Conservation & Efficiency Retrofit Program	13,700 eCO_2/year
Residential Waste Diversion	32, 000 eCO_2/year
New Construction Requirements for Commercial Buildings	121, 400 eCO_2/year
IC&I Energy Conservation and Efficiency Retrofit Program	64, 000 eCO_2/year
Environmental Leaders Network	-
Land Use Planning Policy	7,200 eCO_2/year
Active Transportation and TDM	66,000 eCO_2/year
Public Transit Enhancements	88,000 eCO_2/year

...additional '*Opportunities*' identified in the MEP

MEP Sets the Stage for Community Action

Ontario offers $100M for upgrading gas heaters

Financial incentives for energy efficiency to go to 37,000 of the province's 4 million households

The Canadian Press · Posted: Feb 04, 2016 6:08 PM ET | Last Updated: Feb 04, 2016 6:08 PM ET

Environment Minister Glen Murray and Deputy Premier Deb Matthews tour a Home Depot as part of an announcement about a new program for improving energy efficiency. (Grant Linton/CBC)

501 shares

Ontario announced a $100-million program Thursday to help homeowners upgrade their furnaces, water heaters and insulation, but did not provide a

City of Vaughan Corporate Conservation Demand Management Plan

- CDMP was approved by Council in June 2014
- CDMP identifies a target for a 10% overall reduction in energy consumption for facilities on per person served basis below 2011 baseline by year 2020
- Progress monitored by annual reporting in accordance with the Ontario Energy Conservation Leadership Act
- Initiatives led by Embedded Energy Manager position

Ongoing Improvements: A Living Document

City of Vaughan Role

- Work with utility partners to improve annual energy data collection
- Improve uptake of energy efficiency projects by PowerStream and Enbridge (and improve forecast of GHG emissions reductions from utility programs)
- Identify options for residential retrofitting (and be ready to take advantage of Provincial or Federal funding opportunities)
- Respond to any regulatory changes that may emerge as a result of the Provincial Plan Reviews

Ongoing Improvements: A Living Document

City of Vaughan Role

- Feasibility and GHG emissions reduction estimates for community hubs, including in Intensification areas (i.e. through combined heat and power or district energy)
- Better understanding of energy efficiency targets for new residential development (e.g. net zero energy buildings)
- Encourage energy efficiency of buildings above OBC
- Continue to plan compact communities and work with the Region to implement TDM measures to reduce GHG emissions from travel
- Conduct feasibility studies for district energy and WTE with the private sector (e.g. Keele Valley and Maple Industrial lands)

Next Steps

- Incorporate feedback from Council and SAG into final draft MEP document
- Circulate final draft MEP to SAG for final review
- Present MEP to Council – May 31, 2016 meeting of the Committee of the Whole for approval
- Meet the City's obligation under the funding agreement with the Province (July 2016 deadline)

COMMITTEE OF THE WHOLE (WORKING SESSION) MARCH 7, 2016

CITY OF VAUGHAN DRAFT MUNICIPAL ENERGY PLAN (MEP)

Recommendation

The Deputy City Manager, Planning & Growth Management and the Director of Policy Planning & Environmental Sustainability recommend:

1. That the draft version of the City of Vaughan's Municipal Energy Plan be received for information purposes and that any comment originating from this meeting be taken into consideration in the finalization of the Municipal Energy Plan (MEP); and

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- for each New Community Area (ROP 2010 policy 5.6.10).

The Municipal Energy Plan is intended to conform with the Regional Official Plan policies requiring the preparation of the municipal-wide energy plan.

By identifying impactful and cost effective actions to reduce greenhouse gas emissions throughout the community, Vaughan will demonstrate regional leadership in working to combat climate change and reducing energy consumption. The initiatives identified in the MEP have potential to positively impact the economic, social and environmental sustainability of the region.

Conclusion

The MEP is intended to replace the CCAP by incorporating the actions and opportunities that were previously identified in the Council-approved CCAP to reduce energy consumption and achieve GHG reduction targets. The draft MEP establishes a refined target for a 22% per capita reduction in GHG emissions from the 2006 baseline by 2031, which will result in a total GHG reduction of 459,939 tonnes/year.

The implementation of the identified actions and opportunities will require the efforts of many members of the Vaughan community. To be effective, the MEP must be embraced by the broader community and widely implemented. Therefore, the City of Vaughan will continue to liaise with the SAG to establish an implementation framework and monitor progress. By committing to working with the community to reduce energy and greenhouse gas emissions, the City of Vaughan will be able to demonstrate leadership as a strong environmental steward, working to improve community energy conservation to combat climate change at the local level.

Vaughan's Municipal Energy Plan provides a platform for more advanced opportunities and transformational targets in the future. The policy context is shifting as energy planning in Ontario continues to make significant progress towards clean, reliable energy solutions. Through the development of the Long-Term Energy Plan (LTEP), the Ontario government has committed to a "Conservation First" policy and an efficient, low energy intensive future. The Independent Electricity System Operator (IESO) continues to consult on the York Region Integrated Regional Resource Plan to examine energy generation, transmission, distribution and conservation options

from a regional perspective. At the 2015 United Nations Climate Change Conference in Paris (COP21), 195 countries adopted the first-ever universal, legally binding global climate deal. The Municipal Energy Plan will help set Vaughan in the right direction to a smart energy future.

Therefore, it is recommended that this report be received for information purposes and that any resulting comments and input be considered for inclusion into the final draft of the Municipal Energy Plan.

Attachments

1. Preliminary Draft Municipal Energy Plan

Report prepared by:

Kailyn Smith, Sustainability Coordinator, x. 8941
Tony Iacobelli, Manager, Environmental Sustainability, x. 8630

Respectfully submitted,

JOHN MACKENZIE
Deputy City Manager,
Planning & Growth Management

ROY MCQUILLIN
Director of Policy Planning &
Environmental Sustainability

/LM

PRELIMINARY DRAFT Municipal Energy Plan

Setting Direction for a Smart Energy Future

Prepared for review by City of Vaughan
City of Vaughan
January 30, 2016

LISTEN · UNDERSTAND · RELATE · ADVANCE

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Municipal Energy Plan Stakeholder Advisory Group

Lauren Bates, Smart Commute
Paula Bustard, SmartCentres
Jacqueline Candaras, DG Group Development
Kyle Catney York Region Transit
Kathleen Cea, PowerStream
Teresa Cline, Regional Municipality of York
Sandro Costa, Avacos Clean Energy
Lucy Cummings, Greening Sacred Spaces
Luisa Da Rocha, Independent Electricity System Operator
Bala Gnanam, BOMA Toronto
Gabriella Kalapos, Clean Air Partnership
Adrian Kawun, York Region Transit
Gerry Lynch, Cole Engineering
Rick Mangotich, Fieldgate Developments
Gloria Marsh, York Region Environmental Alliance
Doug McBoyle, Canada's Wonderland
Berne McIntyre, Toronto and Region Conservation
Julia McNally, Independent Electricity System Operator
Kyle Osborne, RioCan Real Estate
Jamie Paris, Enbridge Gas Distribution
Neetika Sathe, PowerStream
Dan Ruby, City of Vaughan
Derek Satnik, Mindscape Innovations Group
Pierre Schipper, York Region District School Board
Riaz Shaikh, PowerStream
John Sherin, PowerStream
Brian Shifman, Vaughan Chamber of Commerce
Tim Short, Enbridge Gas Distribution
Anna Sicilia, City of Vaughan
John Smiciklas, BOMA Canada
Bronwen Smith, Independent Electricity System Operator
Mary Sye, Enbridge Gas Distribution
Kim Taylor, Lormel Homes
Michael Tremayne, Enbridge Gas Distribution
Norm Vezina, York Catholic District School Board
Max Vossough, Liberty Development

City of Vaughan Project Staff

Tony Iacobelli, Manager of Environmental Sustainability
Chris Wolnik, Manager of Wastewater and Stormwater Services
Elizabeth Linley, Sustainability Coordinator – Energy
Kailyn Smith, Sustainability Coordinator

Lura Consulting

Susan Hall, Project Director
Peter Zerek, Project Manager

ICLEI Canada

Megan Meaney, Energy Advisor
Michael Dean, Climate and Energy Project Coordinator

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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 municipalities[1]:

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 consult with a working group to

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

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.

[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.

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.

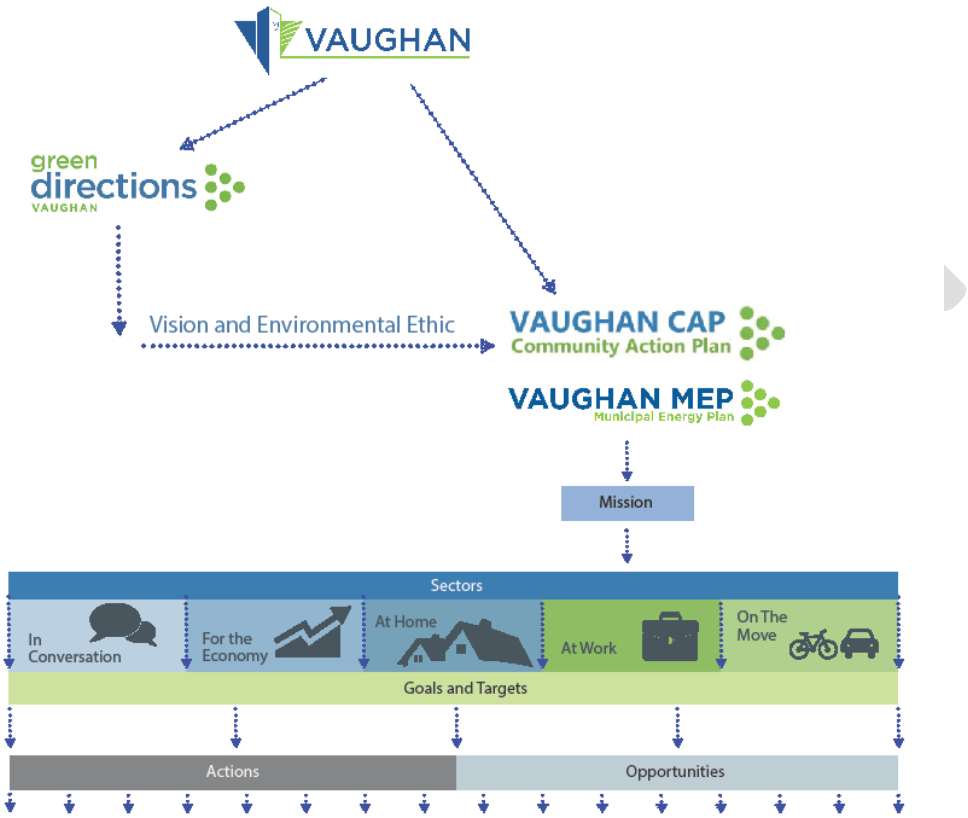

Figure 1: Alignment of CAP and MEP with Green Directions Vaughan

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.

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*.

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	• 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	• 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	• Present and discuss Vaughan's baseline, economic analysis

Meeting #	Date	Topics Covered
		and draft energy maps • Discuss alignment and integration with CCAP
4	November 5, 2015	• 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	• 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.

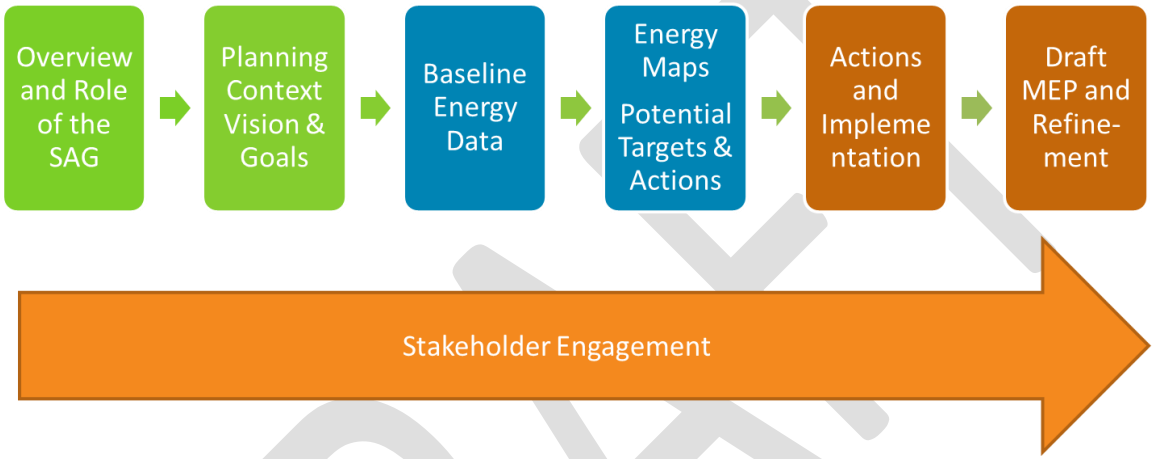

Figure 2: Vaughan Municipal Energy Plan Development Process

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*).

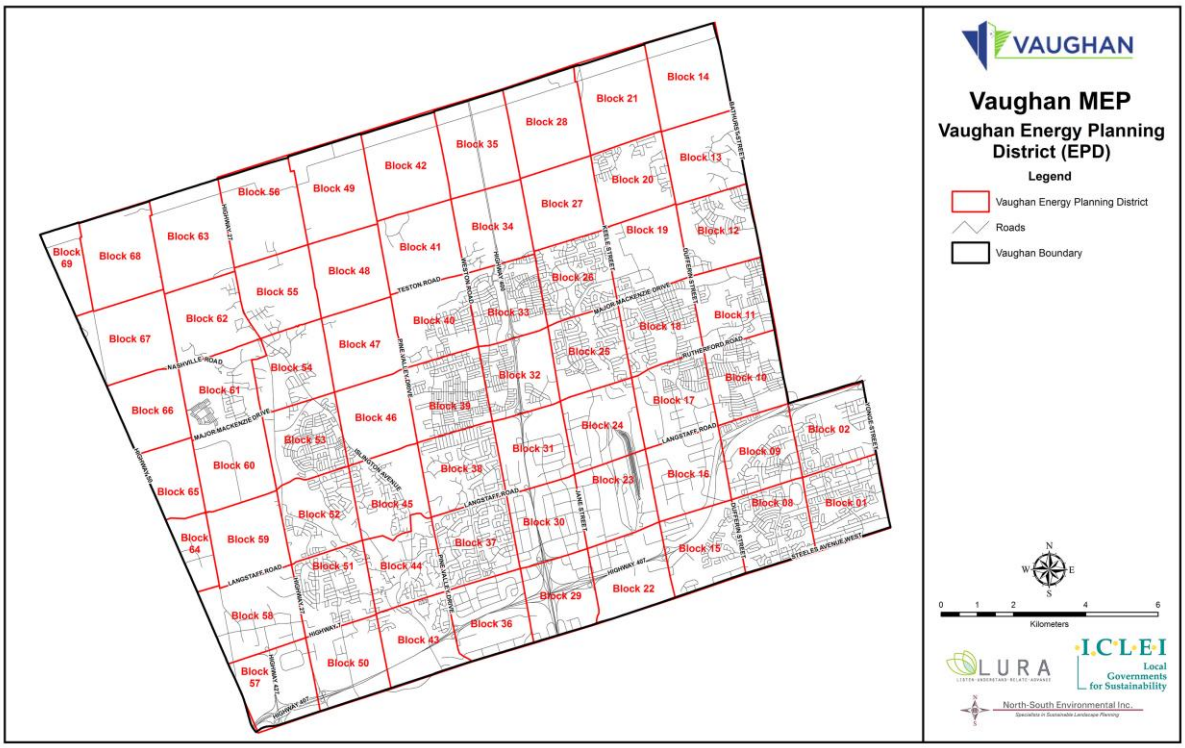

Figure 3: Energy Planning Districts

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 buildings[5]. 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 m^2) 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 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.

[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.

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) forecast was created to illustrate how Vaughan's energy use would evolve over the plan horizon of 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 system[6]. 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.
   - *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)

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

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 CO_2 equivalent[7]. This equates to 115 GJ and 5.04 tonnes of CO_2 equivalent on a per-capita basis in 2013.

At 152 GJ/household[8], Vaughan energy use per home[9] is higher than both the Canadian (105 GJ/household)[10] and Ontario averages (107 GJ/household). Residential energy consumption per m^2 of built floor space in Vaughan (0.50 GJ/m^2) is comparable with both the Canadian (0.56 GJ/m^2) and Ontario (0.52 GJ/m^2) 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/m^2.

[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 dwelling.

[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

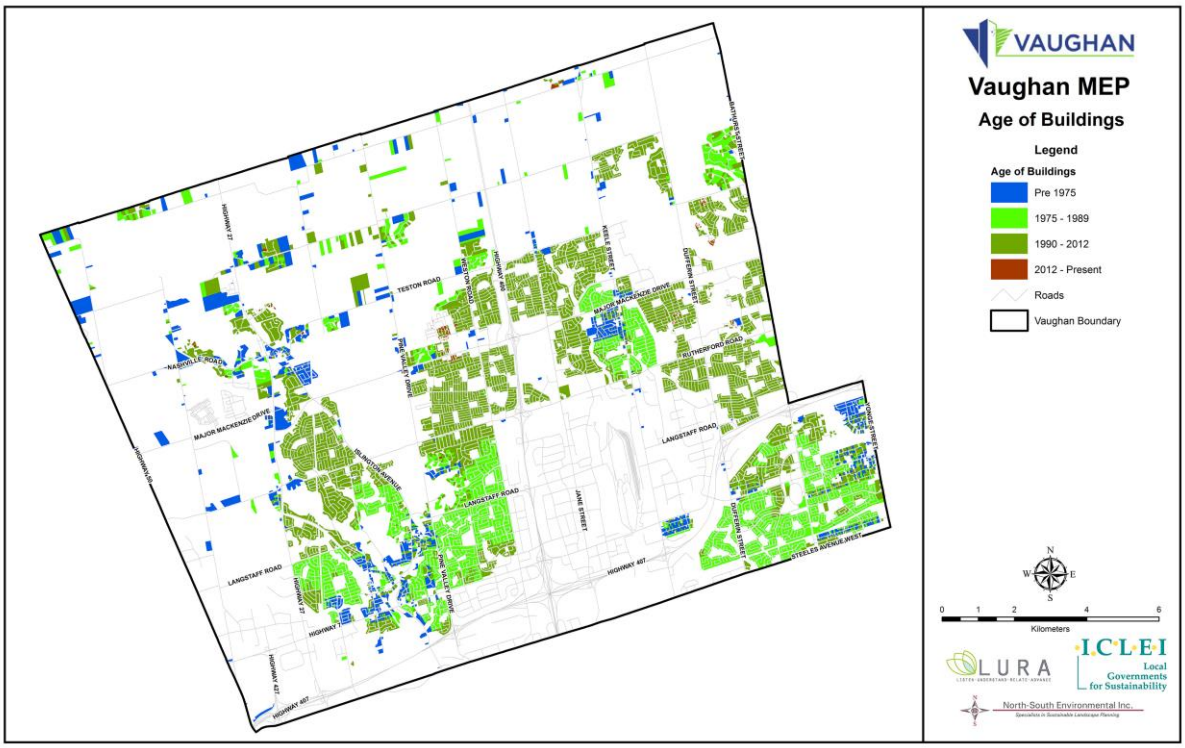

Figure 4: Housing Age

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 Canada[15], 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 m^2.[16] This compares to an average size of a new, single-detached house of 186 m^2 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)

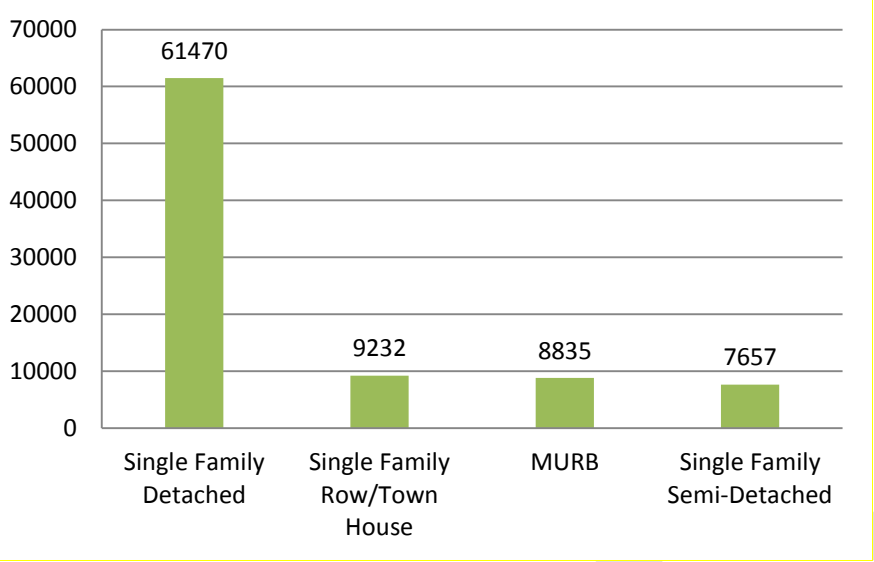

Figure 5: Vaughan Residential Building Type Profile (2013)[18]

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 household[19]. 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 sector[22] 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.

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%

[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.

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).

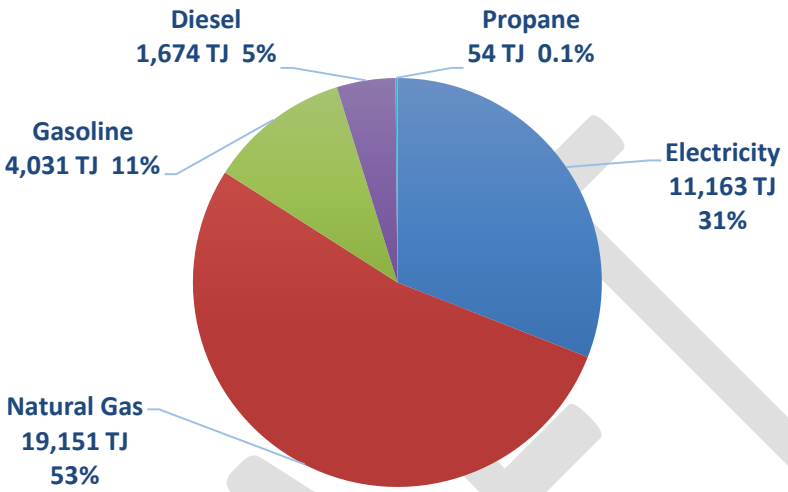

Figure 6: Energy Use by Source (2013)

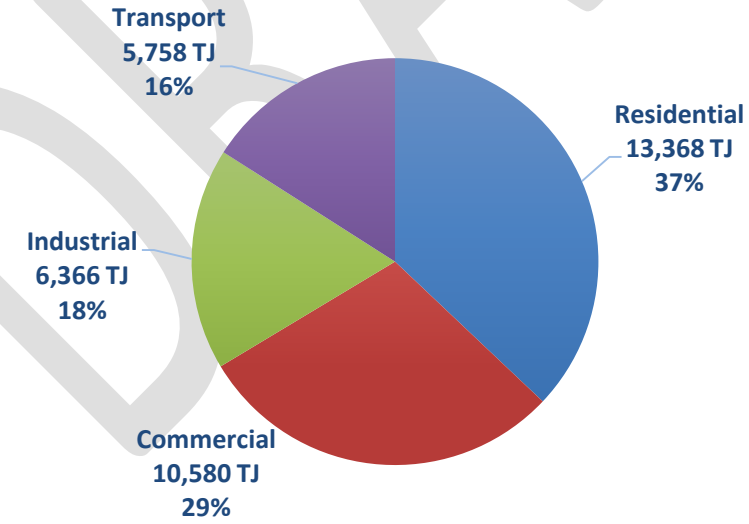

Figure 7: Energy Use by Sector (2013)

3.2.1 2013 Total Residential Energy Consumption (GJ)

In addition to the baseline energy study and economic analysis and forecasting, 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 1.5.1, 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 figures[24] 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).
Table *4*
This table shows that while there is only a 14% difference in total residential energy consumption between EPD1 and 39 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.

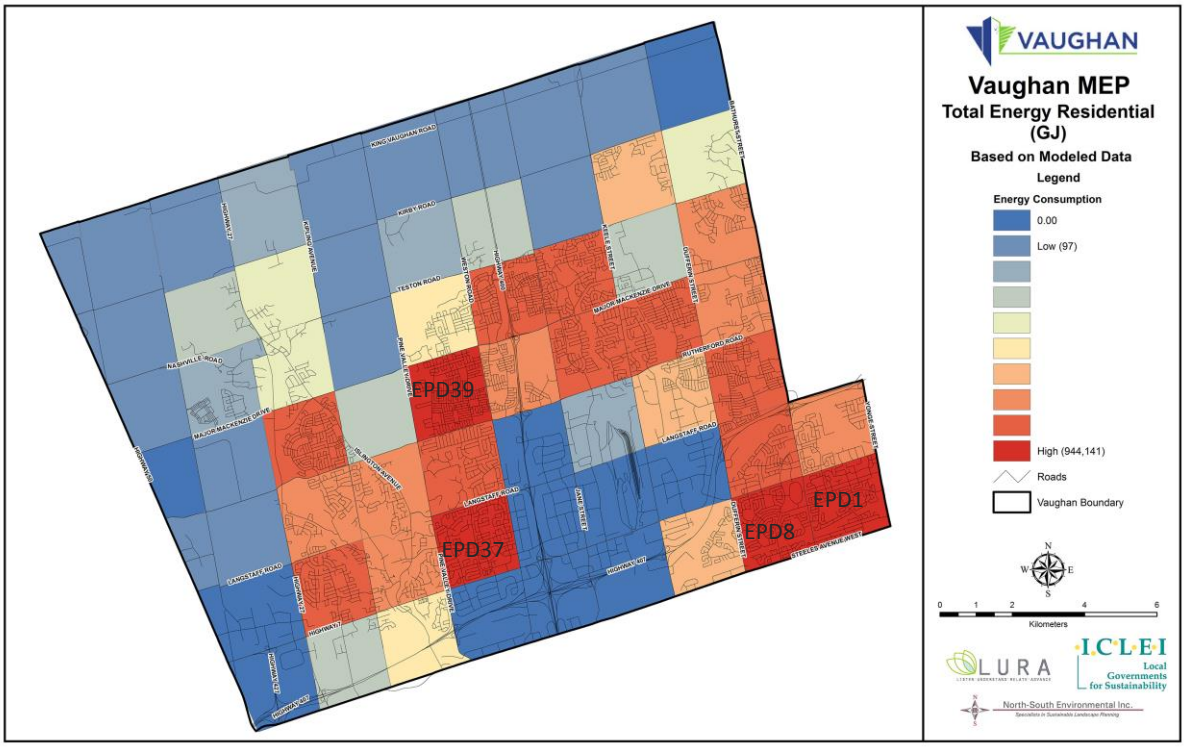

Figure 8: Total Residential Energy Consumption (GJ) (2013)

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.

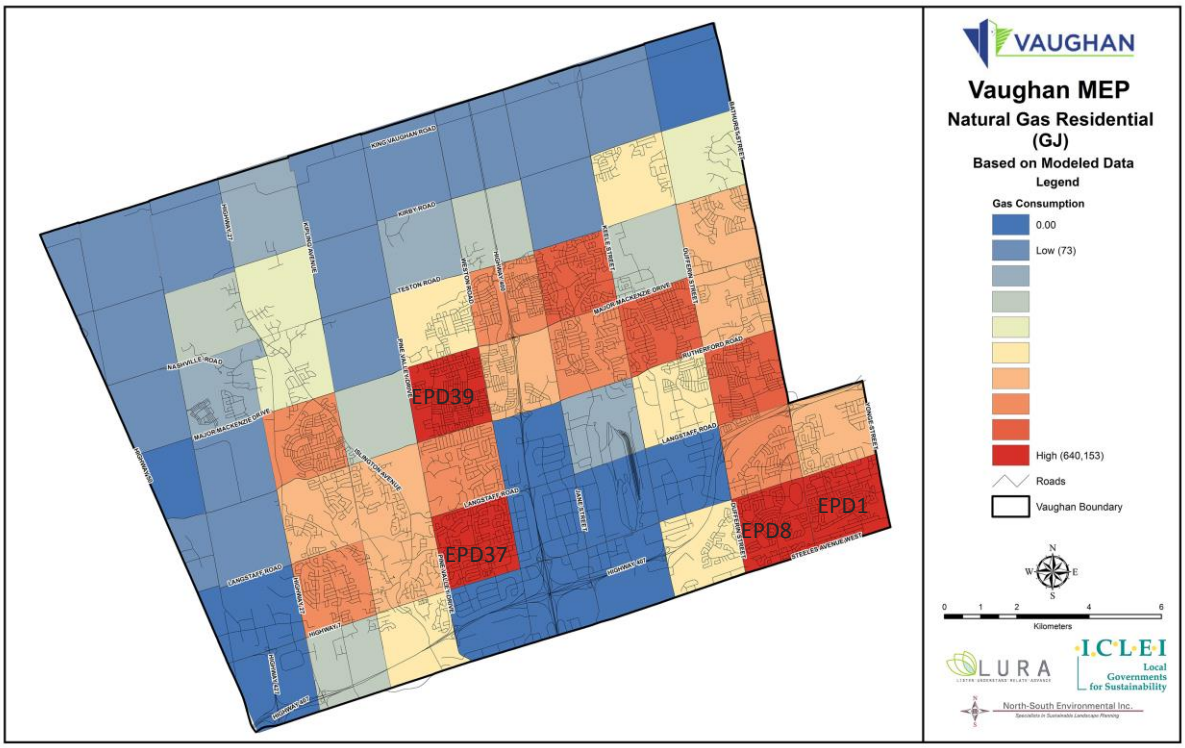

Figure 9: Residential Natural Gas Consumption (GJ) (2013)

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)

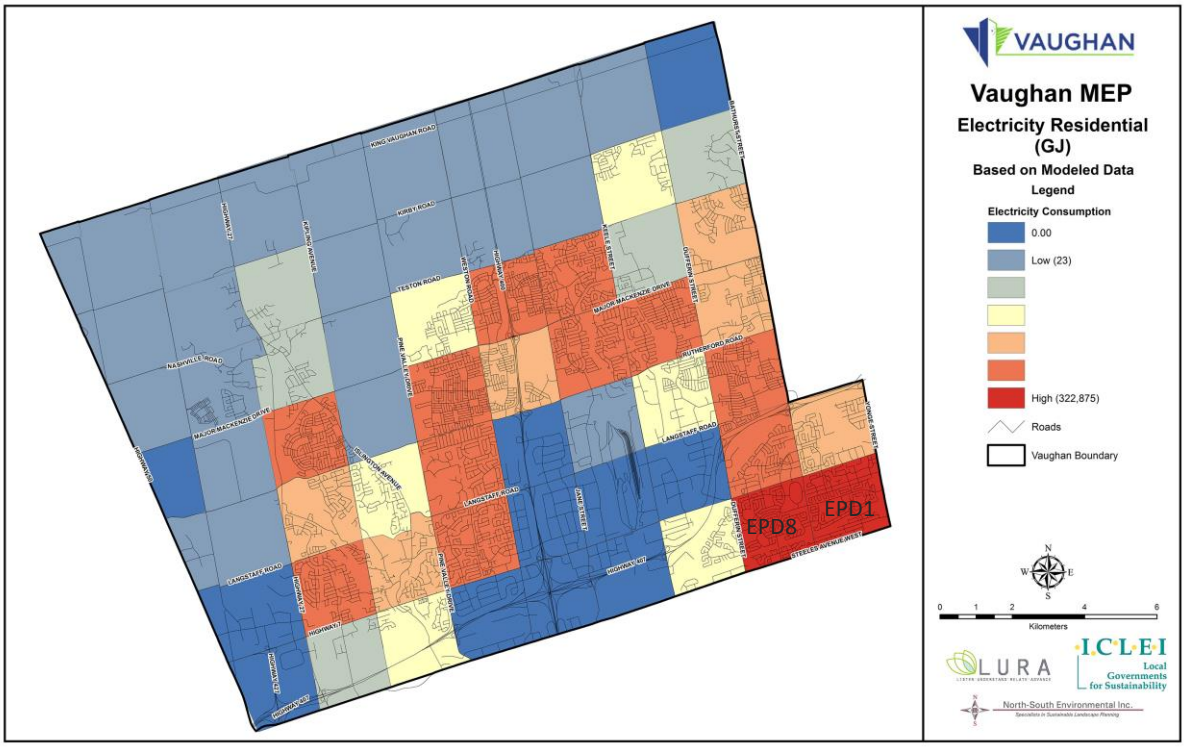

Figure 10: Residential Electricity Consumption (GJ) (2013)

Figure 10 illustrates residential electricity consumption in Vaughan. A large number of Energy Planning Districts[25] 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

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

machines and air conditioners. As seen in Table *6* below, not only are EPD1 and EPD8 districts 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/m^2 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.

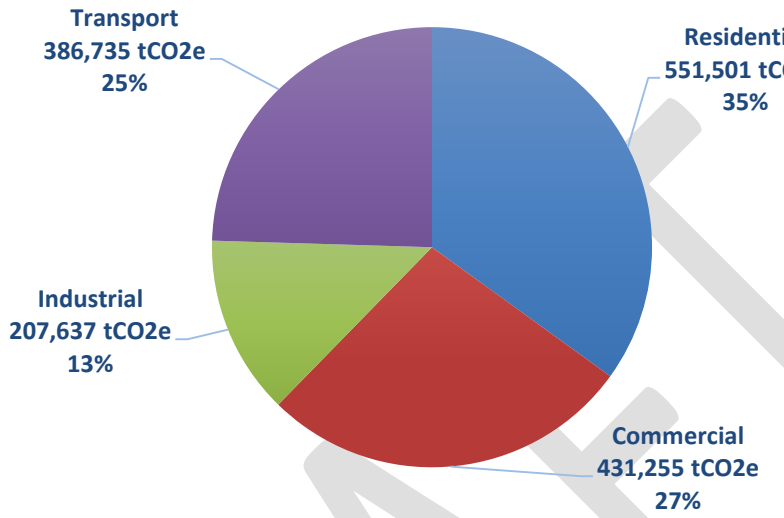

Figure 11: GHG Emissions by Sector (2013)

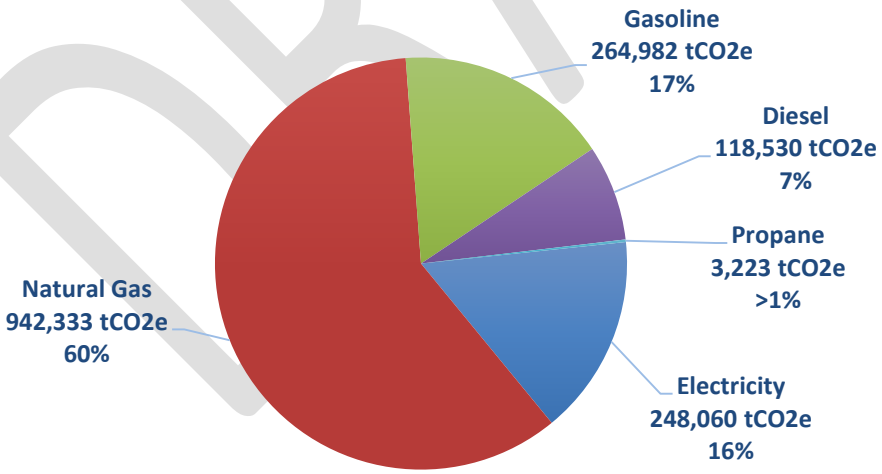

Figure 12: GHG Emissions by Source (2013)

In comparison to the CCAP figures (6.8 tonnes of CO_2 equivalent per capita), the MEP analysis indicates that Vaughan's GHG emissions are 5.04 tonnes of CO_2 equivalent[26] 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. The higher electricity total costs are likely due to several factors, including transmission system upgrades in the province, as well as a shift from cheap coal-fired generation to more expensive renewable power that has come as a result of the Ministry of Energy's Green Energy Act initiatives (e.g., the Feed-In-Tariff (FIT) and microFIT programs).[28]

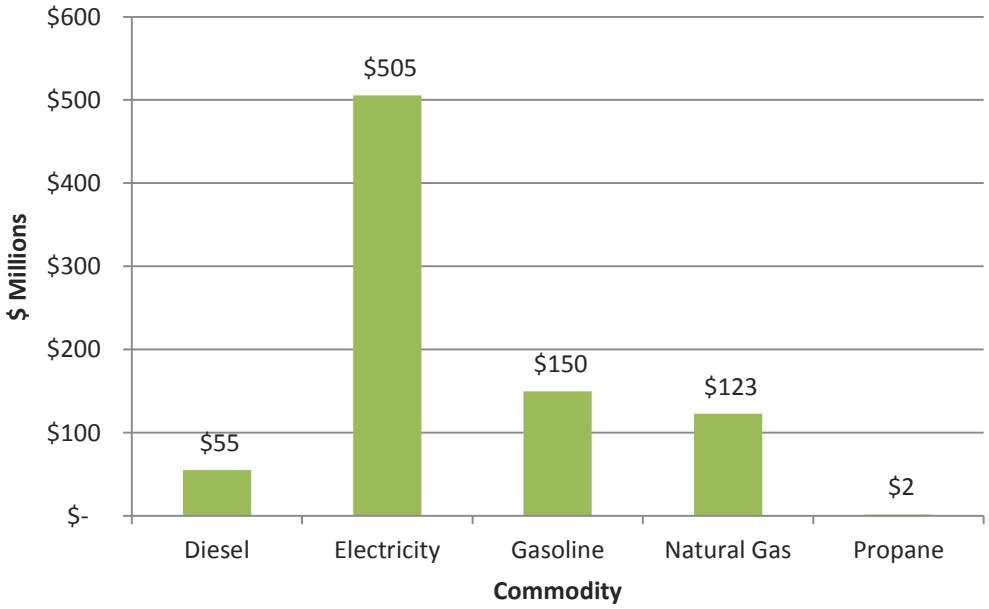

Figure 13: Energy Costs ($ Millions) (2013)

[26] CO_2 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.

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.

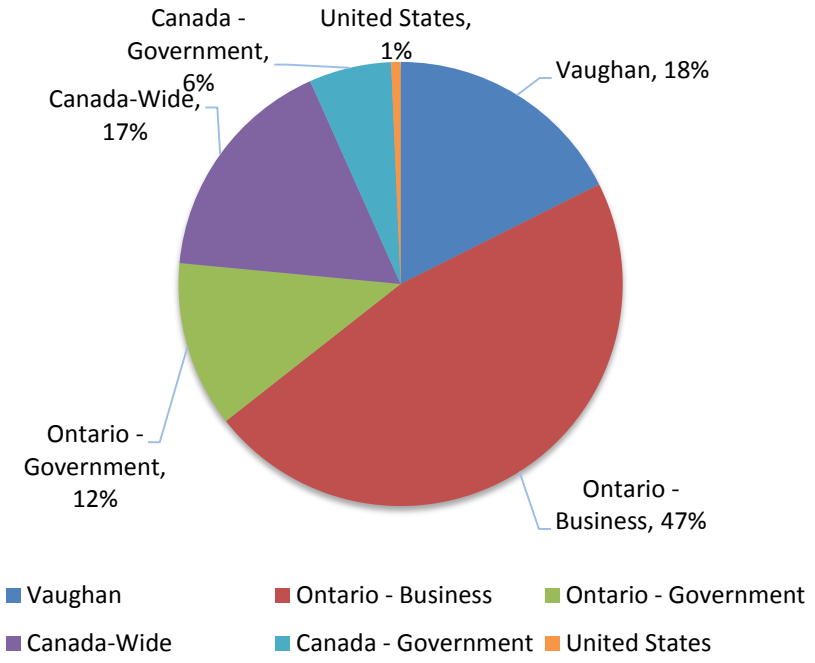

Figure 14: Vaughan's Energy Expenditure - Where Does the $ Go?

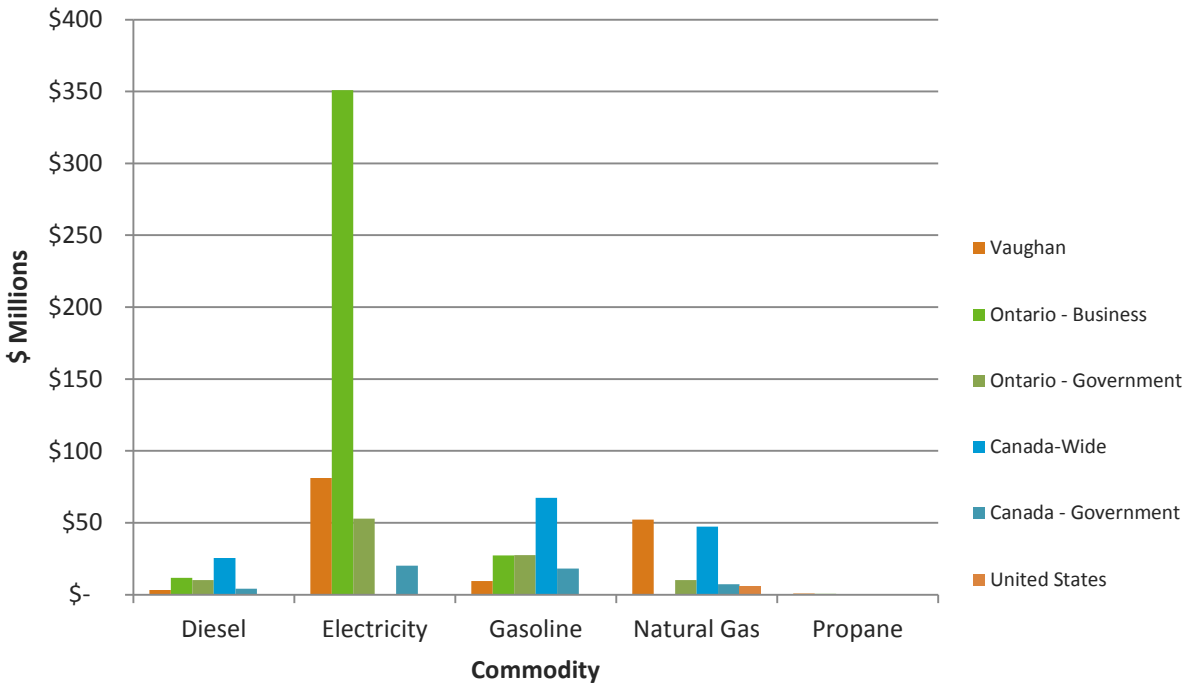

Figure 15: Vaughan's Energy Expenditure - by Commodity (2013)

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 2041[29]. 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) forecasting was conducted by sector and source from 2013 to 2031. BAU forecasting illustrates what the future will be under the assumption that there are no changes to building codes, new construction requirements, transit enhancements, conservation and efficiency retrofit programs and that no action is taken to address energy consumption as the population and employment continue to grow at expected rates.

[29] 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.

The figure below shows the modelled BAU total GHG forecasts using the 2006 baseline (CCAP) and the 2013 baseline (MEP). The process of developing an energy model forecast 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 11% lower GHG emissions forecast for the business-as-usual scenario than anticipated through the CCAP when using the current updated data. 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.

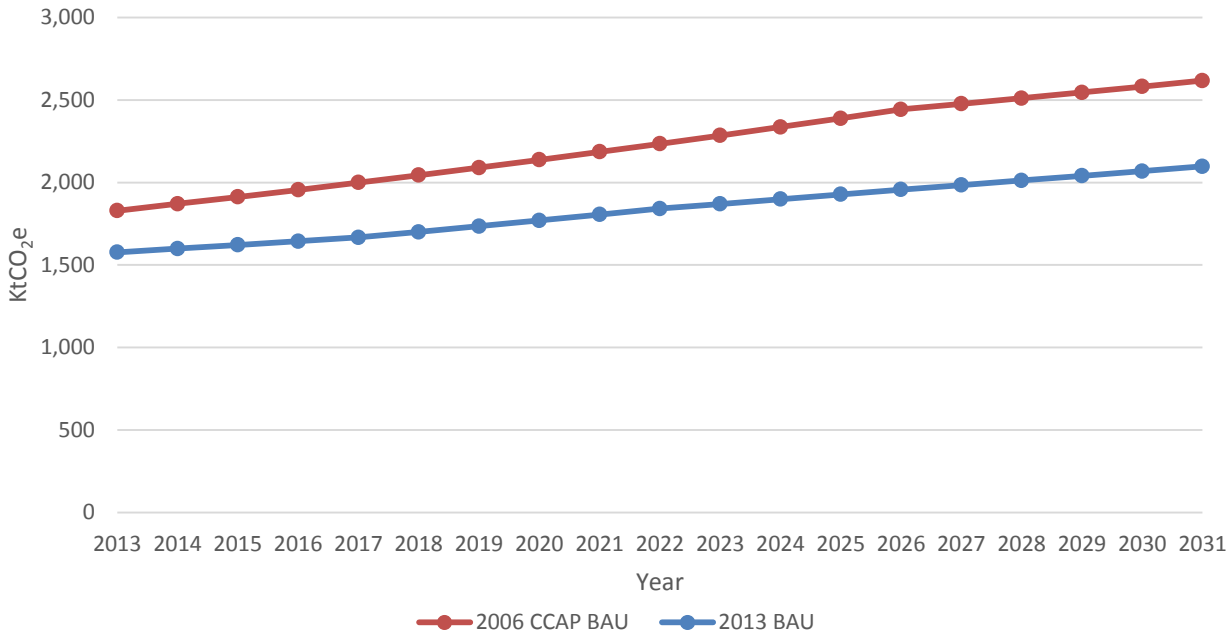

Figure 16: Comparison of 2006 and 2013 BAU Total GHG forecasts ($ktCO_2e$) (2013-2031)

Figure 17 below shows how overall energy consumption is expected to increase under the 2013 BAU forecast 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.

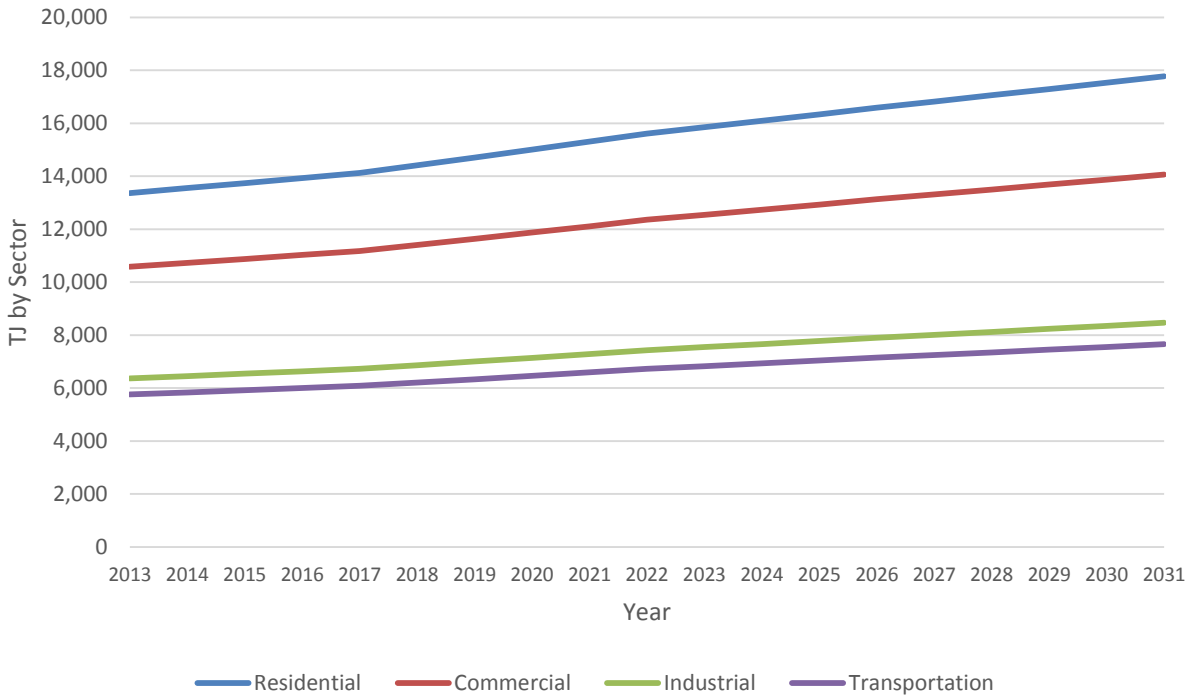

Figure 17: Business-As-Usual Forecast – Energy Consumption by Sector (2013-2031)

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

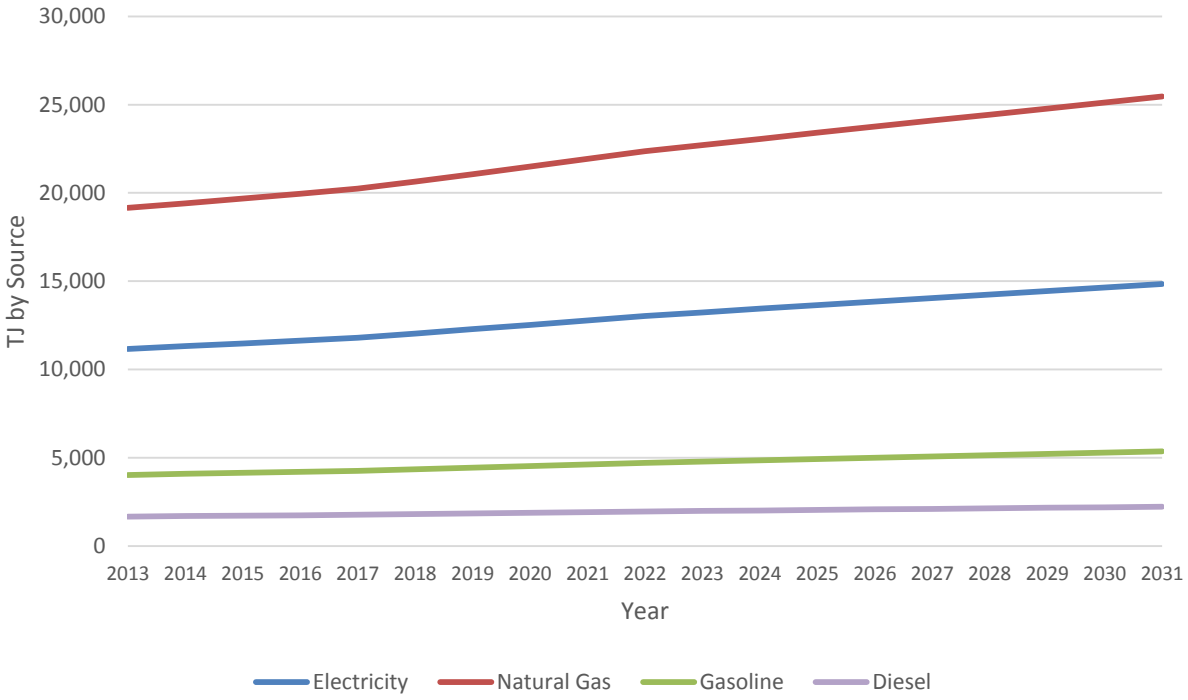

Figure 18: Business-As-Usual Forecast – Energy Consumption by Source (2013-2031)

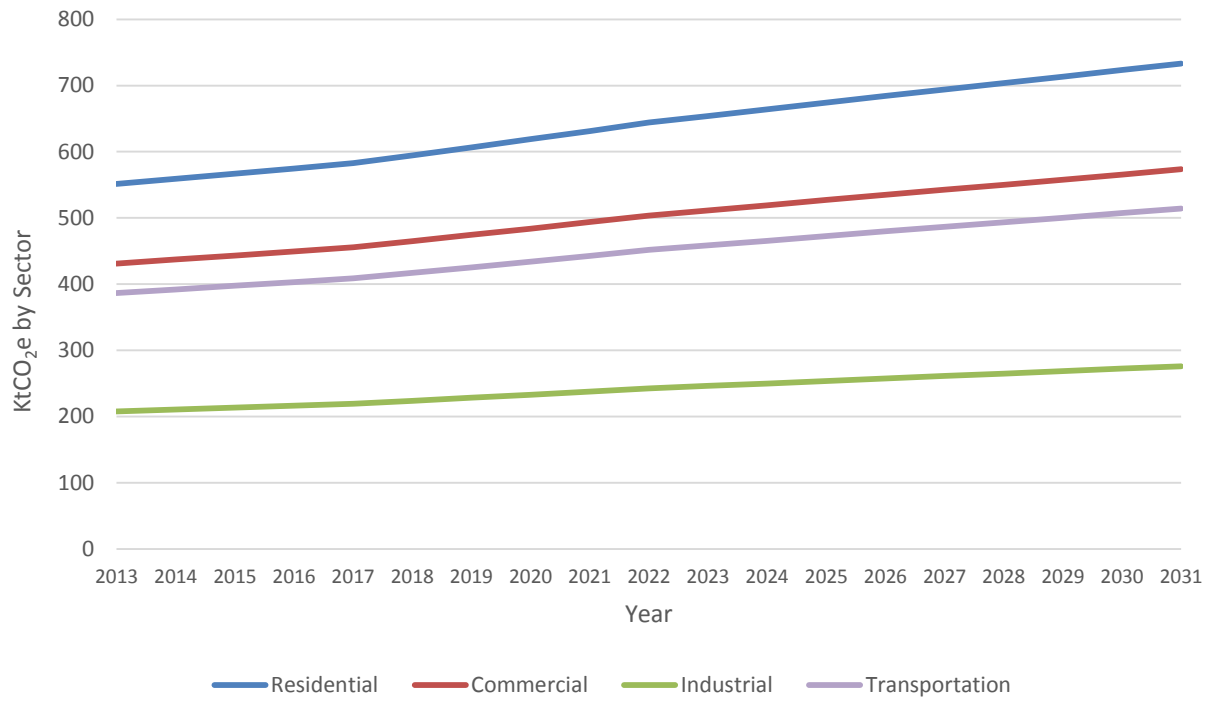

Figure 19: Business-As-Usual Forecast – Total GHG Emissions by Sector (2013-2031)

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, 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. Without action the Vaughan community is also contributing up to 2.1 million tonnes of CO_2 equivalent on an annual basis as global greenhouse gas emissions that impact our environment.

How Much is 2.1 Million Tonnes of CO_2 equivalent?

The same amount of CO_2 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.[30]

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".[31] Like Block 27, Block 41 will be primarily residential with a mix of housing types.

[30] https://www.vaughan.ca/projects/policy_planning_projects/Pages/New-Community-Area---Block-27.aspx
[31] 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.[32]

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 by 11% to a total of 2,097 ktCO_2e in 2031, providing the City with an opportunity to reassess its target for GHG emission reduction. Again there were 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 forecasts based on a strong dataset results in a GHG emissions target calculated as a 22% per capita reduction from the 2006 baseline by 2031 (equivalent to an absolute growth in GHG emissions of 3.8% above the 2006 baseline). This target is based on and will be achieved through implementation of the updated MEP Actions outlined in Section 6

[32] https://www.vaughan.ca/projects/community/Pages/Mackenzie-Vaughan-Hospital-.aspx

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 $ktCO_2e$ 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 indicate that the City of Vaughan is a willing and able partner to the province as it looks to achieve the targets set out in the Climate Change Strategy.

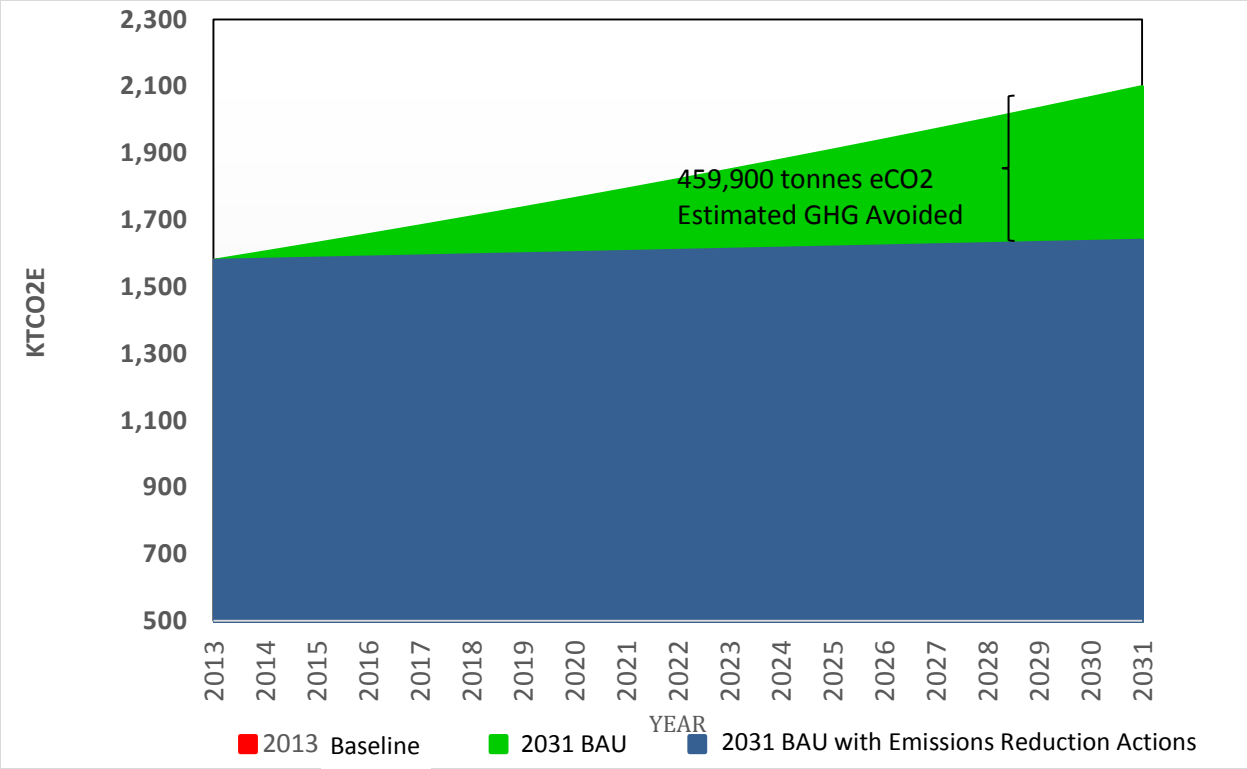

Figure 23: Updated GHG Reduction Potential - MEP Actions ($ktCO_2e$) (2013-2031)

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, 7 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 Buildings	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 construction in the residential sector through programs and incentives. Strategy 2: Ensure that residential development adheres to current Ontario Building Code. 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. Strategy 3: 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. The *Sustainability Metrics* and *Sustainable Community Development Guidelines*[33] 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. The Sustainability Metrics will inform the future City-Wide Urban Design Guidelines Manual project. The Sustainability Metrics is currently in the

[33] http://www.vaughan.ca/sustainabilitymetrics

	testing stage.
Residential Energy Conservation and Efficiency Retrofit Program	Strategy 4: 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. 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. 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.
Residential Waste Diversion	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 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; • 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.

Deep Residential Retrofit Program	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. Under this approach, deep energy retrofits have the potential to achieve much larger energy savings than conventional programs. 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.
District Energy	Facilitate the installation and use of district energy in energy planning districts where there is appropriate development density and thermal load. 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.

6.2 Actions and Opportunities At Work

Actions

New Construction Requirements for Commercial Buildings	Strategy 5: Encourage new commercial construction to be designed, built and ultimately operated with improved energy efficiency. PowerStream and Enbridge encourage energy efficiency for new construction in the commercial and industrial sectors through conservation management programs. Strategy 6: Implement the innovative Sustainability Metrics for use in the planning process. As described above, the *Measuring Sustainability of New Development* 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 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. 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.
IC&I Energy Conservation and Efficiency Retrofit Program	Strategy 7: Develop and implement coordinated conservation and efficiency retrofit program targeting existing operations to promote and increase participation in existing programs. 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. 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.
Environmental Leaders Network	Strategy 8: Establish a Vaughan-specific network of environmental leaders to demonstrate and encourage sustainability and climate action leadership amongst the Industrial, Commercial & Institutional sector. Program components could include: • 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 • Green Procurement Guide to assist local businesses to purchase environmentally friendly products. 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.

Opportunities

Eco-Business Zone	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. 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. Components of an Eco-Business Zone could include: • 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	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.

6.3 Actions and Opportunities On The Move

Actions

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. Section 8.5 of the Vaughan Official Plan (VOP 2010) includes policies to 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	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

Transportation Demand Management	moving Vaughan closer to achieving the goal of a more livable and sustainable community. The VOP Section 4 includes policies to support active transportation and TDM policies continue to include: • 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. In addition the Transportation Master Plan includes policies to: • 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. 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.
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. Transit network improvements continue to include: • Rapid transit expansion; • Improved access to GO regional transit service; • Designated Transit Priority Corridors; • Bus service expansion; and • Transit fare and service integration.

Electric Vehicle Charging Stations	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. There is an opportunity to facilitate installation of charging stations around the City for electric vehicles (e.g. work with businesses, utilities, etc.). 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. 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.

Opportunities

Anti-Idling Efforts	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.
Use of Alternative Fuels	Implement initiatives to promote and encourage the use of alternative fuels, such as: • 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) 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.

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			
New Construction Requirements for Residential Buildings Strategy 1: Encourage new residential buildings to be designed, built and ultimately operated using energy more efficiently. Strategy 2: Ensure that residential development adheres to current Ontario Building Code. Strategy 3: Implement the innovative Sustainability Metrics for use in the planning process. 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.	PowerStream and Enbridge City of Vaughan City of Vaughan* Development community (including: real estate developers, commercial developers, home builders, and architects/engineers)	York Region Partner municipalities Building industry and stakeholders	46,000	66,800	• Local air quality • Stormwater management • Water conservation • Natural heritage	• 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
Residential Energy Conservation and Efficiency Retrofit Program Strategy 4: 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. 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.	PowerStream and Enbridge	City of Vaughan IESO Canada Mortgage and Housing Corporation QUEST Renewable energy suppliers Community groups	4,000	13,700	• Local air quality • Stormwater management • Water conservation • Natural heritage	• 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
Residential Waste Diversion	York Region City of Vaughan	York Region Public Health Windfall Ecology Centre Earth Hour	32,000	32,000*	• Reduced waste/resources	• Reduced disposal costs • Cost savings in homes	York Region investment is $800,000/ year (for 2014-2018)	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			
		Vaughan Vaughan C.A.R.E.S. York Region Environmental Alliance Goodwill						
New Construction Requirements for Commercial Buildings Strategy 5: Encourage new commercial construction to be designed, built and ultimately operated with improved energy efficiency. Strategy 6: Implement the innovative Sustainability Metrics for use in the planning process.	PowerStream and Enbridge City of Vaughan	York Region Partner municipalities Development community Canada Green Building Council	166,000	121,400	• Local air quality • Stormwater management • Water conservation • Natural heritage	• Reduced business operating costs • Reduced labour and maintenance efforts • Strengthened green technology industry • Increased climate resiliency	Covered above in residential	Covered above in residential
IC&I Energy Conservation and Efficiency Retrofit Program Strategy 7: Develop and implement coordinated conservation and efficiency retrofit program targeting existing operations to promote and increase participation in existing programs. 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 reduce GHG emissions in Vaughan.	PowerStream and Enbridge IC&I sector	City of Vaughan IESO Community groups York Region Public Health	45,000	64,800	• Local air quality • Stormwater management • Water conservation • Natural heritage	• 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
Environmental Leaders Network Strategy 8: Establish a Vaughan-specific network of environmental leaders to demonstrate and encourage sustainability and climate action leadership amongst the Industrial, Commercial & Institutional sector.	Windfall Ecology Centre	City of Vaughan			• Local air quality • Energy conservation • Water conservation	• Reduced business operating costs • Improved corporate image • Increased access to learning opportunities and sharing of best practices		$6,000
Land Use Planning Policy Strategy 9: Continue to advance a smart community	City of Vaughan	York Region Metrolinx	7,200	7,200	• Local air quality	• More efficient use of land	Through Secondary	$500,000 to develop TMP

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			
energy system and foster energy conservation and efficiency through effective land use planning. 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.		York Region Public Health			• Natural heritage	• Increased physical activity • Stronger communities • Shorter commute times • Improved air quality • Reduced travel costs • Local economic development	Plans, Block Plans, TMP (Transportation Master Plan)	
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.	City of Vaughan York Region Metrolinx (and Smart Commute)	York Region Public Health Community groups IC&I sector	66,000	66,000	• Local air quality	• Increased physical activity • Reduced travel costs • Improved air quality	$80,000 (over past 8 years)	$80,000 (past 8 years)
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.	Metrolinx York Region City of Vaughan	York Region Public Health	88,000	88,000	• Local air quality	• 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 10 actions and 6 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.
- **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 leveraging 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.