DRAFT REPORT

PREPARED BY HEMSON AND LAURA TAYLOR DESIGNS FOR THE REGION OF PEEL

PEEL REGION SETTLEMENT AREA BOUNDARY EXPANSION STUDY

OPPORTUNITIES FOR CLIMATE CHANGE MITIGATION, ENERGY AND EMISSIONS REDUCTIONS

November 20, 2020

LTD

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Acronyms

DE	District Energy
DERs	Distributed Energy Resources
FSA	Focused Study Area
GHG	Greenhouse Gas Emissions
IESO	Independent Electricity System Operator
IPCC	Intergovernmental Panel on Climate Change
LDC	Local Distribution Companies
ROP	Regional Official Plan
Peel 2041+	Regional Official Plan Amendment (the current Municipal Comprehensive Review) to 2051
SABE	Settlement Area Boundary Expansion

GLOSSARY

Climate Change Adaptation The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.[1]

Climate Change Mitigation Human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs). This report also assesses human interventions to reduce the sources of other substances which may contribute directly or indirectly to limiting climate change, including, for example, the reduction of particulate matter emissions that can directly alter the radiation balance (e.g., black carbon) or measures that control emissions of carbon monoxide, nitrogen oxides, volatile organic compounds and other pollutants that can alter the concentration of tropospheric ozone which has an indirect effect on the climate.[2]

District Energy Systems District energy systems are a mature technology that use centralized heating plants, ideally from renewable sources, to heat or cool multiple buildings connected to a distribution network.[3]

Distributed Energy Resources DERs are decentralized sources of energy that provide electricity services to individual customers or to a local system. They are sited near customers and meet some or all immediate electric and power needs and are intended to reduce demand and provide supply to the larger distribution system. DERs involve the integration of a range technologies, which may include a heterogeneous combination of solar photovoltaic, wind power, cogeneration, renewable natural gas, energy storage, and electric vehicles. DERs have the potential to improve the sustainability of energy systems, by being able to make better use of renewable low-carbon energy resources, and improving system reliability and resiliency through the use of distributed and technologically diverse energy sources. DERs are anticipated to have greater ability to adapt to changing circumstances, and have the potential to offer greater control to consumers. DERs reflect the convergence of three major technological revolutions in the electricity sector over the

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[1] IPCC. (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change—Annex II.* Retrieved from https://www.ipcc.ch/site/assets/uploads/2019/01/SYRAR5-Glossary_en.pdf

[2] Ibid

[3] Region of Peel. (2019). *Region of Peel Climate Change Master Plan.* https://www.peelregion.ca/climate-energy/pdf/Climate-Change-Plan.pdf

past decade: the improved technical and economic performance of renewable energy sources; the emergence of advanced energy storage technologies; and the application of information technology and communications technologies to "smart grid" management and control.[4]

Energy Demand Energy is required to heat and cool buildings and to fuel motorized transportation. Energy demand refers to the total amount of demand from end uses on a particular energy system at each time of day, and will depend on factors such as climate, weather, industry, technology, the built environment, and local cultural behaviours.[5] Reducing energy demand is as important to reducing emissions as decarbonizing the energy supply. Energy consumption in buildings is influenced by climate, community design, building design, building systems efficiency (e.g., heating and air conditioning), and occupant behaviour.[6] Energy consumption through transportation is affected by the type of fuel and efficiency of private and public transit vehicles and the frequency and length of trips.

Energy Supply Systems that transform energy from a source (e.g., thermal, solar) to an end user (e.g., buildings and public infrastructure), including fuel switching, distributed energy resources, generation, etc.

Greenhouse Gas Emissions Emissions of greenhouse gases due to human activity cause global warming. Gases in the atmosphere such as water vapour, carbon dioxide, methane and nitrous oxide absorb infrared radiation and trap heat in the atmosphere, causing the "greenhouse effect"[7].

Low-Carbon Community A broad term that refers to a community with land use and development patterns that support a culture of conservation including energy conservation and efficiency as well as the use of renewable energy systems and low-carbon alternative energy systems. However, low-carbon refers to carbon emissions from fossil fuels and does not clearly encompass all types of GHG emissions. The concept of low-carbon is not intended to refer to quantified emissions reduction targets.

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[4] M. Winfield and A. Gelfant (2020) Distributed Energy Resource Development in Ontario: A Socio-Technical Transition in Progress? *Energy Regulation Quarterly* 7(4).

[5] N. Baker and K. Steemers (2000). *Energy and Environment in Architecture*. London: Taylor & Francis.

[6] C. E. Hoicka and J. MacArthur, J. (2019) The Infrastructure for Electricity: A Technical Overview, in *The Oxford Handbook of Energy Politics,* K. J. Hancock and J. E. Allison (eds.), Oxford University Press.

[7] IPCC. (2019). IPCC Updates Methodology for Greenhouse Gas Inventories. Retrieved from https://www.ipcc.ch/2019/05/13/ipcc-2019-refinement/

Net-Zero Community A net-zero energy emissions community is designed to minimize on-site emissions based on how it is used and constructed. A net-zero energy emissions community offsets energy-related emissions from buildings (electricity plug loads, space and water heating), transportation (excluding long-haul freight and personal travel outside of regional boundaries), and municipal services (e.g., water treatment and distribution, wastewater management and waste management) by producing onsite emissions-free renewable energy (such as solar and geothermal, and through district energy systems) or procuring renewable energy from off-site sources.

Net-Zero Energy Refers to buildings that consume no more energy than is produced on a given site.

Net-Zero Emissions Refers to buildings that produce onsite, or procure, carbon-free renewable energy in an amount to offset the annual carbon emissions associated with operations.

Net-Zero Ready Refers to buildings that are designed to be extremely energy efficient, with the goal of being net-zero at some point in the future when it makes financial sense to add renewable energy sources.[8] [9]

Settlement Area Boundary Expansion (SABE) Future urban area in Peel Region and the Town of Caledon that will accommodate anticipated regional population and employment growth based on a 2041 planning horizon.

[8] CMHC. (n.d.). Net-Zero Energy Housing. Retrieved from https://www.chba.ca/CHBADocs/CHBA/NZE/2018_CMHC-NZ.pdf

[9] District of Squamish. (n.d.). Energy Step Code. Retrieved from https://squamish.ca/business-and-development/home-land-and-property-development/energy-step-code/

1. INTRODUCTION & CONTEXT

Hemson Consulting has been retained by the Region of Peel to complete a Settlement Area Boundary Expansion (SABE) Study. The primary objective is to designate new urban lands needed to accommodate population and employment growth to 2041 in the Region of Peel.

Laura Taylor Designs (LTD) and Hemson Consulting were retained to complete a technical study focused on climate change, with specific focus on energy management and planning. This study is one of 13 technical studies that support planning for the expansion of Caledon's existing urban boundary. This purpose of this study is to develop a planning policy framework that supports energy planning in the new settlement area in Region of Peel and the Town of Caledon. The primary goal is to minimize new GHG emissions to mitigate climate change over the long term in both the SABE and the Region as a whole. The framework is being developed in the spirit of recommending policies that will enable the SABE to ultimately be a net-zero emissions community. The other technical studies each address climate change from their respective focus areas.

It is important to note that this study is being undertaken for the Region of Peel. Further analysis and refined land use planning policies will be developed by the Town of Caledon as part of subsequent stages in the planning process, including preparation of a secondary plan for the new urban expansion area. As background to this study, in this chapter we review the study area context, the current energy supply and distribution system in Ontario and Peel, the GHG emissions inventory and reduction targets in Peel.

A. FOCUSED STUDY AREA CONTEXT

For the purposes of Peel 2041+, a study area, known as the Focus Study Area (FSA), was defined (see Map 1). The FSA is located in southern Caledon. The FSA includes lands outside of existing settlement areas, i.e., Mayfield West and Bolton, and outside of designated environmental and agricultural lands in the provincial Greenbelt Plan. The FSA comprises all lands in which the SABE area or areas *could* occur as supported by the results of the detailed investigations. The early stages of the SABE process were predicated on the residential and non-residential growth forecasts to 2041 for the Region informed by Schedule 3 of the Growth Plan, 2019. However, the Province has since amended Schedule 3 and extended the planning horizon to 2051. This change increases the amount of land planned to be designated as part of the SABE process from 1,300 hectares to approximately 4,300 hectares. Preliminary forecasts assume that the SABE will need to accommodate additional population of 183,000 and additional employment of 67,700 by 2051. The size of

the FSA is approximately 8,000 hectares, which is almost twice the size of the total estimated land need of 4,300 hectares required to accommodate these forecasts.

As part of the SABE Study, a number of technical studies are being completed to support this overall assessment. Technical studies including the Transportation Assessment, Environmental Screening and Scoped Subwatershed Study, Agricultural Impact Assessment, Health Assessment, as well as this study contain climate change components and considerations that support the SABE work to address climate change adaptation and the reduction of greenhouse gas emissions. Note that all of the draft technical studies were released before Schedule 3 of the Growth Plan was amended.

This report was scoped as an additional study to specifically address energy planning and the opportunities and requirements for alternative and renewable energy systems to reduce greenhouse gas emissions and complements the climate change considerations being addressed in the other technical studies.

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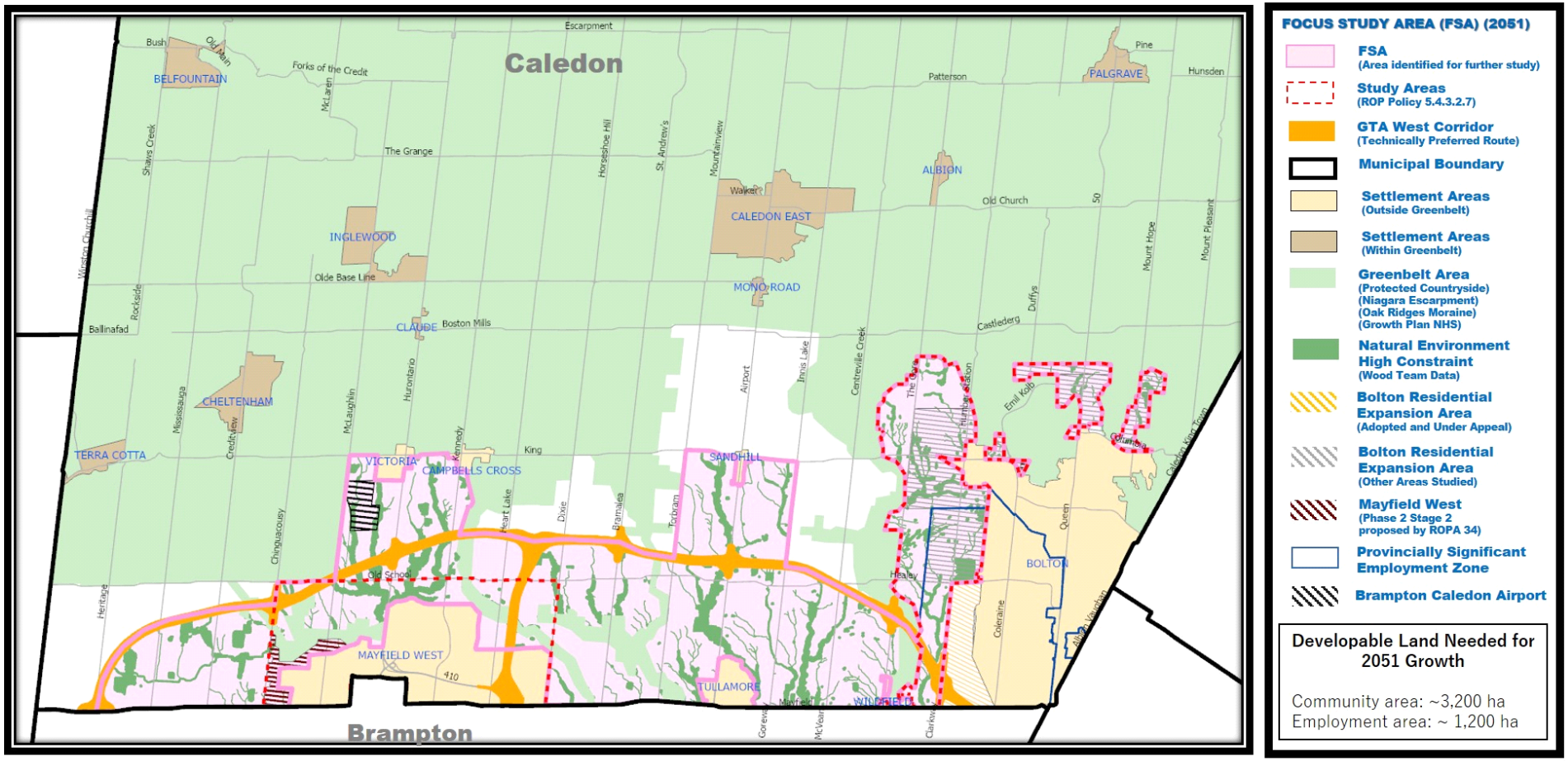

Disclaimer: This map has been developed for the Settlement Area Boundary Expansion (SABE) Study and represents a conceptual area for the SABE based on technical studies. For additional information, please refer to the technical studies at http://www.peelregion.ca/officialplan/review/focus-areas/settlement-area-boundary.asp

Note:

(1) There may be opportunities to expand rural settlements outside the FSA as part of the SABE Study.
(2) Other natural environmental constraints not identified on this map, including potential restoration lands, will be identified through further analysis and may further limit development
(3) ROP Policy 5.4.3.2.7 as it relates to the area surrounding Bolton is under appeal.
(4) The ~4,400 ha SABE is based on a draft land needs assessment which is under review.

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1 cm = 1 km

Map 1: FSA Map. Source: Hemson Consulting

B. ONTARIO AND REGION OF PEEL'S ENERGY SUPPLY

Ontario's energy system is complex. The Government of Ontario provides the overall policy direction for energy through legislation and regulates energy through an independent agency, the Ontario Energy Board (OEB). Energy is supplied to consumers through a series of different generators and transmission grids as well as utility and energy retailers that own and operate distribution systems.[10]

As identified in the *Community Emissions Reduction Planning: A Guide for Municipalities*, municipalities act as energy consumers through the operation of municipal buildings and fleet, as investors through infrastructure investments in clean energy systems and partnerships, and as influencers through land use planning policies in Official Plans.[11] Therefore, municipalities have a key role to play in Ontario's energy system.

As discussed in the following section, energy in the province is supplied by a range of sources including renewable (e.g., solar and hydro), nuclear, biofuel, and natural gas. With the elimination of coal-powered energy plants, natural gas is now one of the most significant contributors of GHG emissions. The availability of relatively low-cost gas options for heating buildings and water has made this energy source popular. When compared with same unit of electricity, natural gas produces nearly five times the amount of GHGs.[12] Moving away from intensive natural gas use would reduce GHG emissions.

i. Ontario's Energy Supply System

According to Independent Electricity System Operator (IESO), the crown corporation responsible for managing the Province's energy system including the wholesale energy markets, Ontario's energy supply has evolved drastically over the past few decades—transitioning from reliance on coal-powered energy plants to other sources such as wind, solar, bioenergy, hydroelectricity, and refurbished nuclear and natural gas-fired resources.

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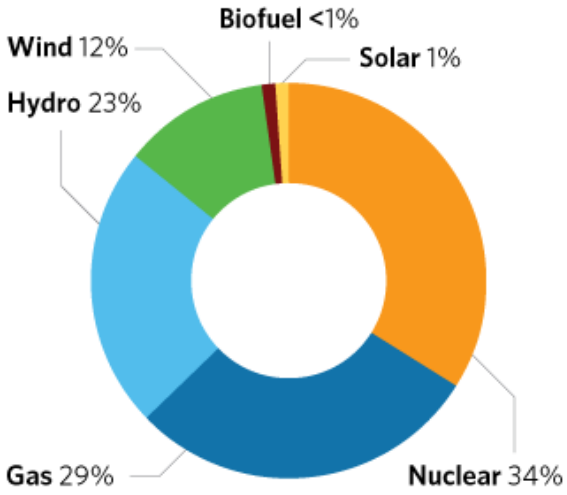
[10] OEB. (n.d.). *Ontario's Energy Sector.* Retrieved from https://www.oeb.ca/about-us/mission-and-mandate/ontarios-energy-sector

[11] Ministry of Environment and Climate Change. (2018). *Community Emissions Reduction Planning: A Guide for Municipalities*. Retrieved from https://prod-environmental-registry.s3.amazonaws.com/2018-04/Community%20Emissions%20Reduction%20Planning%20Guide.pdf

[12] Canada Energy Regulator. (2017). *Canada's Renewable Power Landscape 2017 – Energy Market Analysis*. Retrieved from https://www.cer-rec.gc.ca/en/data-analysis/energy-commodities/electricity/report/2017-canadian-renewable-power/canadas-renewable-power-landscape-2017-energy-market-analysis-ghg-emission.html#:~:text=There%20are%20no%20emissions%20during,coal%20at%2090.87g%2FMJ.

Ontario closed all of its coal-powered plants by 2014, and by 2017, 96% of the electricity generated in Ontario was estimated to be emissions-free.[13]

Figure 1 provides an overview of Ontario's current energy sources, with nuclear and hydroelectric having the most available generation capacity.[14] In contrast, Figure 2 summarizes the 2019 output by fuel type, which reflects actual energy consumption by source. Although gas represents 29% of Ontario's generation capacity, it fuels only 6% of the province's energy output.[15]



Nuclear	13,009 MW or 34%
Gas/Oil	11,270 MW or 29%
Hydro	9,065 MW or 23%
Wind	4,486 MW or 12%
Biofuel	295 MW or <1%
Solar	478 MW or 1%

Figure 1: Ontario's Generation Capacity. Source: IESO, 2020

[13] Ontario Ministry of Environment, Conservation and Parks. (2018). *Preserving and Protecting our Environment for Future Generations A Made-in-Ontario Environment Plan*.

[14] IESO. (2020). *Supply Overview – Transmission-Connected Generation*. http://www.ieso.ca/en/Power-Data/Supply-Overview/Transmission-Connected-Generation

[15] Ibid

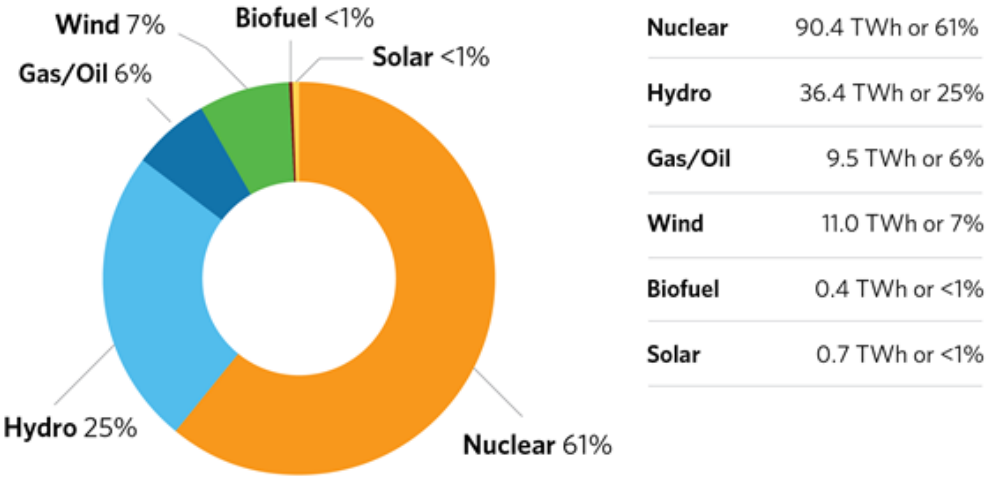


Figure 2: Ontario 2019 Output by Fuel Type. Source: IESO, 2020

While the Province has made significant progress in moving towards a greater reliance on emissions-free energy sources, significant environmental concerns are related to hydroelectric and nuclear power generation. Municipalities have a role in reducing GHG emissions by facilitating development of clean energy systems at the local level. For example, the Region of Peel has undertaken renewable energy generation projects ranging from combined heat and power generation at the Clarkson Wastewater Plant in Mississauga (where the plant generates renewable energy from burning biogas produced through the treatment process) to installing solar photovoltaic panels on roof tops of regional buildings.[16]

In the context of the SABE study, the Region of Peel has a unique opportunity to further support renewable energy systems, particularly as new settlement areas can be planned and designed from the ground up to ultimately be net-zero communities. If new Regional facilities are identified as being required in the SABE (e.g. a new wastewater treatment plant), these facilities should be designed to produce energy to support distributed energy systems.

ii. Current and Potential Energy Supply in Peel

Electricity in the Region of Peel is provided through a complex system of generation stations, transmission lines, and local distribution companies. Local distribution companies

[16] Region of Peel. (2019). *Energy Conservation and Demand Management Plan.* https://peelregion.ca/climate-energy/pdf/Energy_Conservation-and-Demand_Management_Plan.pdf

(LDCs) are responsible for providing safe and reliable power to residential and non-residential uses within a particular jurisdiction. In the Region, energy is provided by two companies: Alectra Utilities (formerly Enersource Hydro, Horizon Utilities, Hydro One Brampton, and PowerStream), which services Mississauga and Brampton, and Hydro One, which supplies energy to Caledon.[17] These service providers distribute energy generated from Ontario's energy system.

The IESO is in the process of developing the 2021 Greater Toronto Area (GTA) West Integrated Regional Resource Plan (IRRP). The study area includes the FSA in south Caledon and LDCs are involved in the study. Through the IRRP, the IESO is seeking opportunities to align community energy plans, community-based energy solutions, and other economic development plans, for implementation in the next 20 years. Conservation and demand management and DERs are being included.[18]

The IRRP includes the Northwest GTA Transmission Corridor Identification Study. While this is a separate initiative, connections to transformer and distribution sites within the SABE for future electricity supply will need to be identified and integrated with plans for DERs.

In addition to electricity, natural gas is a common energy source in Peel. The TransCanada natural gas pipeline runs east-west through north Brampton (just south of the Sandalwood Parkway). District energy systems today often produce steam or hot water by burning natural gas, achieving greater efficiencies than individual buildings, with the expectation that district energy systems would move to renewable energy sources when DERs are available.

To mitigate the effects of climate change, emissions must be reduced. The Region of Peel has made formidable progress in developing an inventory of emissions to better inform its climate change mitigation policies as well as establishing GHG reduction targets. These efforts are described in the next section.

[17] IESO. (n.d.). Find Your Local Distribution Company. Retrieved from http://www.ieso.ca/learn/ontario-power-system/overview-of-sector-roles/find-your-ldc

[18] IESO (2020) *Integrated Regional Resource Plan: Greater Toronto Area West*. Retrieved from: http://www.ieso.ca/Sector-Participants/Engagement-Initiatives/Engagements/Regional-Planning-Peel-Halton-Region

C. PEEL'S INVENTORY OF GREENHOUSE GAS EMISSIONS

By understanding the existing "baseline" conditions and the sources of emissions, the Region is better able to develop policies that support climate change mitigation objectives and develop emissions reduction targets. An inventory of GHG emissions was first completed by the Region in 1990 and was subsequently updated in 2006. Most recently, the Region completed a 2016 Peel Community Inventory update using the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC).

The 2016 GHG inventory shown in Figure 3 illustrates that stationary energy used by buildings have been the largest contributor of GHG emissions in the Region. Buildings require a significant amount of energy in order to operate, including cooling, heating, and lighting and generate high GHG emissions if energy is supplied by natural gas, especially through traditional energy distribution systems. Most buildings in Peel depend on natural gas for heating and electricity for other operations. Transportation is the second greatest cause of GHGs in Peel accounting for 39% of emissions.

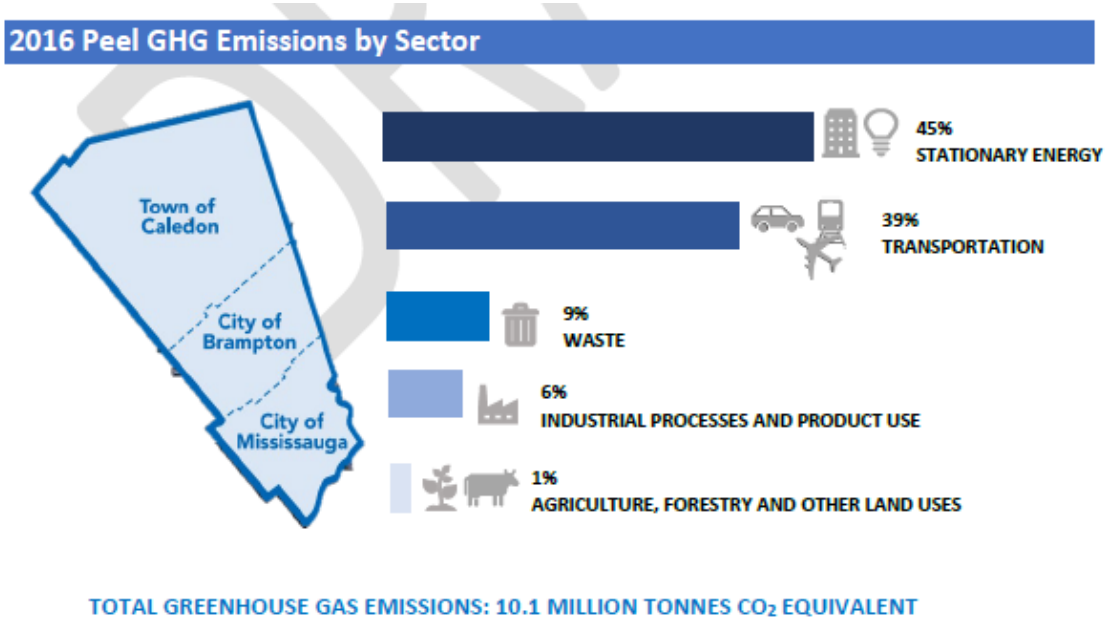


Figure 3: Region of Peel GHG Emissions by Sector (tonnes CO2e)
Source: Region of Peel (2020), 2016 Peel Community GHG Inventory Update

Figure 4 provides a comparison of GHG emissions in the Region from 1990 to 2016. As shown, total emissions have increased in the Region by 18% since 1990. However, emissions when measured on a per capita basis, have decreased by 38% over the same time period.

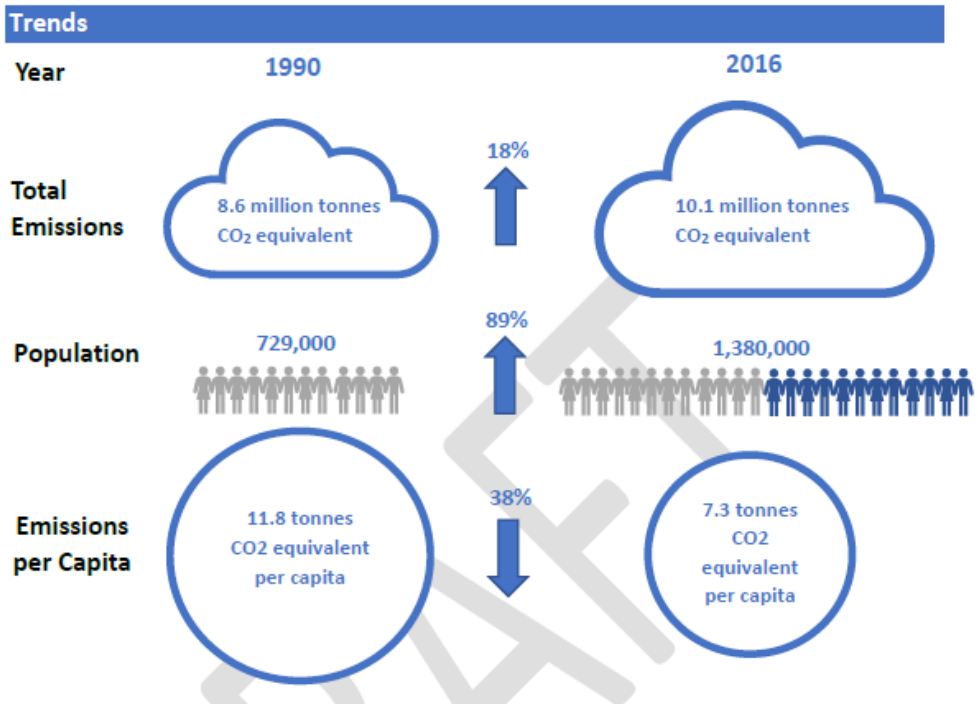


Figure 4: Region of Peel GHG Emissions by Sector (tonnes CO2e) Comparison of 1990 and 2016
Source: Region of Peel (2020), 2016 Peel Community GHG Inventory Update

D. PEEL'S TARGETS FOR EMISSIONS REDUCTION

The Region has identified two GHG emissions targets to help mitigate the impacts of climate change. The first is a community-based target which applies to all GHG sectors within the Region. A target of reducing GHG emissions 80% below 1990 levels by 2050 was endorsed by Council in 2011 and continues to be supported through current Regional policy objectives.[19] [20] For the purposes of this study, the Region's community-based target is referenced. The second GHG emissions target relates to corporate GHG emissions for municipally owned and operated buildings and infrastructure. The Council endorsed a target of reducing GHGs 45% below 2010 levels by 2030 for the purposes of developing internal policies.[21]

[19] Region of Peel. (2011). *Peel Climate Change Strategy.* https://www.caledon.ca/en/live/resources/peelclimatechangestrategy.pdf

[20] Region of Peel. (2018). *Region of Peel Climate Change Discussion Paper.* https://www.peelregion.ca/planning/officialplan/pdfs/climate-change-discussion-paper.pdf

[21] Region of Peel. (2019). *Region of Peel Climate Change Master Plan.* https://www.peelregion.ca/climate-energy/pdf/Climate-Change-Plan.pdf

As shown in Figure 4, emissions have continued to grow in Peel since 1990, not decreased. A trend that is likely to occur as a result of the Region's rapid population growth which has almost doubled from 730,000 to 1.4 million people in 2016, not including economic expansion in business and industry. With a forecast population of 1.97 million by 2041, meeting the target for emissions reduction will be a major challenge.

E. REPORT STRUCTURE

In this report, we next discuss community energy planning and the requirements of achieving net-zero, with a focus on the relevance to planning for the SABE.

In Chapter 3 we discuss the land use planning policy context for energy management in Peel, with a focus on the link between energy management and land use planning considerations, given the particular focus of this study on the Peel 2041+ planning policy framework to accommodate forecast population and employment growth, with the detailed policy review provided in Appendix A.

Chapter 4 describes lessons learned from a detailed review of case studies related to new low-carbon and/or net-zero communities, official plans/secondary plans, and district energy systems. The detailed review of these case studies is provided in Appendix B.

In Chapter 5, the role of the Region in energy management is discussed. Finally, Chapter 6 concludes with recommendations relating to principles to be used in selecting the configuration of the SABE, the Region's role in energy management, and a SABE future policy framework as it relates to the Town of Caledon's official plan and secondary plan process.

2. LAND USE PLANNING AND THE TRANSITION TO NET-ZERO

This study is prepared with the intention to support the development of a policy framework to facilitate the implementation of a net-zero communities in the Region. In addition to the planning policy framework, principles that achieve energy management objectives, including potential for district energy systems that facilitate the development of net-zero communities, are provided to identify the most appropriate area(s) for the SABE.

The Region's ability to create low-carbon communities while also striving to achieve net-zero emissions are also discussed. This includes an examination of energy supply options (e.g., generation, storage, distributed energy resources) as informed by a review of select case studies in other communities.

Although provincial legislation and policy frameworks do not require communities to achieve net-zero emissions, The Region of Peel has committed to promote energy conservation and maximize efficiencies as well as reduced GHG emissions. Recognizing that the SABE will be built out over the long-term, the goal of developing net-zero communities may not be realized immediately, but policies should be in place to allow this to occur over time. The potential for net-zero emissions is described in this section, recognizing that the Region may transition from low-carbon to net-zero over time.

A. COMMUNITY ENERGY PLANNING

Land use planning allows for the efficient management of land and resources, including energy. Community energy planning involves stakeholders and residents in the planning to shift to low-carbon and renewable energy sources,[22] and infrastructure needs to be integrated early on in the development process. At the Regional scale, plans and strategies to reduce energy use and GHG emissions are useful. Benefits of such plans include actions to support energy conservation and efficiencies within existing and new development areas, while reducing GHG emissions.

Traditionally, energy in Ontario has been provided through large-scale infrastructure systems. Electricity is generated by hydro and nuclear power and delivered by a one-way transmission and distribution system to local consumers. Natural gas is extracted and

[22] Susan Morrissey Wyse and Christina E. Hoicka (2019) "By and for local people": assessing the connection between local energy plans and community energy. *Local Environment* 24(9): 883 – 900.

delivered through long-distance pipelines and distributed to local consumers at the local level. The future of energy, however, seems to be in distributed energy resources (DERs), reducing reliance on Ontario's large-scale power system.

As demonstrated in Figure 5, DERs are decentralized sources of low-carbon energy, sited near energy consumers to meet electric and power needs. DERs involve the integration of a of range technologies, including solar photovoltaic, wind power, cogeneration, renewable natural gas, energy storage, and electric vehicles. Within the distributed network, stakeholders (from small-scale energy producers to businesses to condos to homeowners) act as either energy generators or consumers, depending upon their immediate energy needs and that of the system. Sustainable business models ensure long-term financial viability, and stable and reliable energy at the local community level.[23] To date, although considered to be a realistic model for future community energy, these energy clusters are largely pilot or demonstration projects and not the result of a coordinated approach to energy management at the community level.[24]

Locally produced and distributed energy resources including district energy systems and micro-utility partnerships provide the opportunity to create low-carbon and net-zero energy communities.[25] Planning for energy at the community level enables a phased approach to achieve lower carbon energy solutions, where district energy systems initially may be fuelled by natural gas but which can ultimately be transitioned to net-zero energy over time. Ideally these systems should be designed to be fuelled by renewable sources from the onset; however, this may not be feasible in some instances.

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[23] Mark Winfield and Amanda Gelfant (2020) Distributed Energy Resource Development in Ontario: A Socio-Technical Transition in Progress? *Energy Regulation Quarterly* 7(4).

[24] J. Lowitzsch, C. E. Hoicka, and F. J. van Tulder (2020) Renewable energy communities under the 2019 European Clean Energy Package—Governance model for the energy clusters of the future? *Renewable and Sustainable Energy Review* 122

[25] CEKAP (2017). *On the Path to Net-Zero Communities – Integrating Land Use and Energy Planning in Ontario Municipalities*. Retrieved from https://www.cekap.ca/resources/research-report-OCC_Full%20Report.pdf

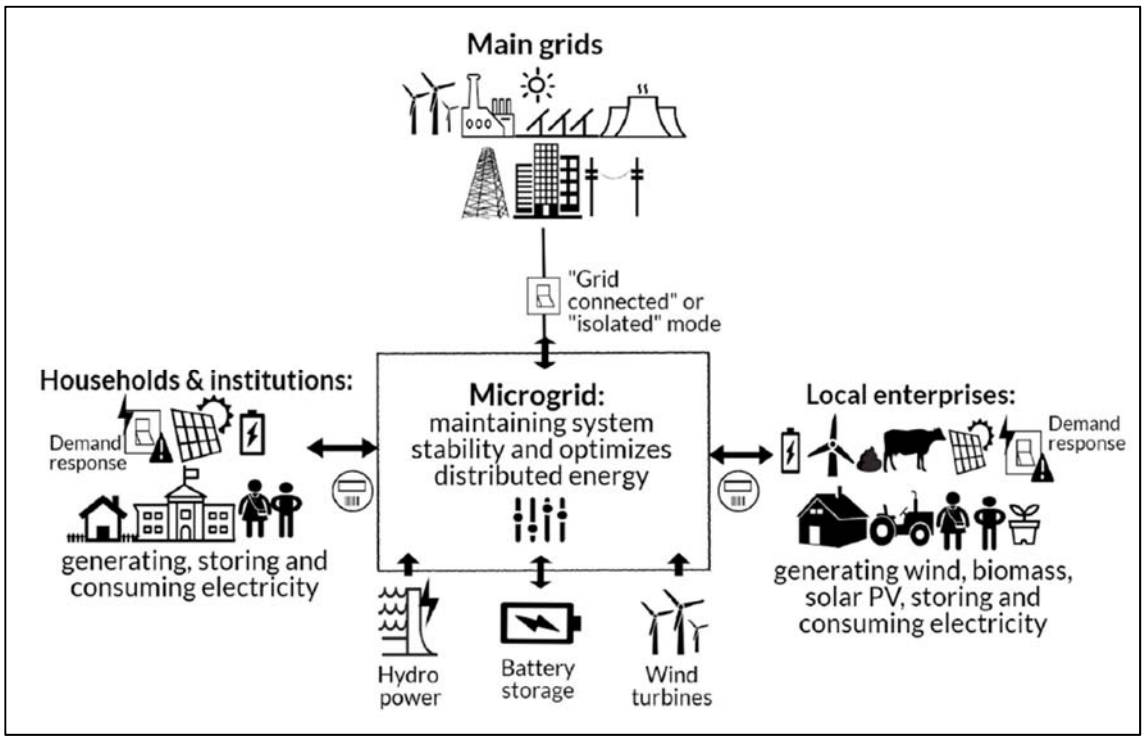

Figure 5: Distributed Energy Resources (with focus on renewable energy sources)

Source: J. Lowitzsch, C. E. Hoicka, and F. J. van Tulder (2020) Renewable energy communities under the 2019 European Clean Energy Package—Governance model for the energy clusters of the future? *Renewable and Sustainable Energy Review* 122

B. HOW IS NET-ZERO DEFINED?

The definition of net-zero can vary based on the scale at which it is applied, for example on a site scale to a specific development, a new community, or on a nation-wide basis. In simple terms, net-zero means that GHG emissions associated with particular operations are all but eliminated, where operations relate to buildings, infrastructure, or transportation.

For the purposes of this report, the definition of net-zero is defined below. Note that the definition does not address GHG emissions reductions from sequestration, including tree cover, green roofs, and natural heritage areas.

> **Net-Zero Community:** A net-zero energy emissions community is designed to minimize on-site emissions based on how it is used and constructed. A net-zero energy emissions community offsets energy-related emissions from buildings (electricity plug loads, space and water heating), transportation (excluding long-haul freight and personal travel outside of regional boundaries), and municipal services (e.g., water treatment and distribution, wastewater management and waste management) by producing within the community emissions-free renewable energy

(such as solar and geothermal, and through district energy systems) or procuring renewable energy from off-site sources.[26]

Recognizing that it is intended the SABE be a low-carbon community with the ultimately goal of transitioning to net-zero, for the purposes of this report, low-carbon is defined as:

> **Low-Carbon Community**. A broad term that refers to a community with land use and development patterns that support a culture of conservation including energy conservation and efficiency as well as the use of renewable energy systems and low-carbon alternative energy systems. However, low-carbon refers to carbon emissions from fossil fuels and does not clearly encompass all types of GHG emissions. The concept of low-carbon is not intended to refer to quantified emissions reduction targets.

C. WHAT DOES NET-ZERO MEAN FOR THE SABE?

In this report, we consider the connection between energy and emissions reductions and planning for a new urban expansion area, at the municipal level—both regional and lower-tier—keeping in mind that the literature on climate change mitigation conflates all kinds of interventions that various levels of government might make. Therefore, we identify in this report ways in which the Region can progress towards net-zero communities, both as a corporation responsible for delivering services and as a regional municipality responsible for implementing provincial land use planning policies with local municipalities and other partners.

We have focused on issues relevant to evaluating the options for the location of the SABE and recommendations for the land use planning policy framework to support the development of a low-carbon SABE, and ultimately as a net-zero community over the long-term.

Regarding the location of the SABE, ensuring the new urban area is contiguous with existing transit and alternative transportation networks is a key criterion from an emissions reduction perspective. Possible synergies of district and distributed energy systems with new residential areas and industrial-type uses in employment areas could also be a consideration, however, the profile of anticipated employment in Peel is in warehousing and distribution, which are not facilities generally associated with energy production. Given the

[26] See also, Karen Farbridge & Associates (n.d.) Retrieved from https://www.karenfarbridge.ca/urban-connector-blog/on-the-path-to-net-zero-communities

very local nature of distributed energy systems, the location of the SABE in this case seems to matter less than the planning framework development to ensure its implementation.

In the context of growth management, the challenge is to set the stage for net-zero community development. Both the Region and Caledon have studied emissions related to various types of land uses, where emissions from buildings and transportation are the biggest concern. The technical know-how is available to build alternative energy resources, but the paradigm shift is just beginning to move away from centralized power generation and distribution to community-scale distributed energy systems.

What can be done for the SABE? The planning framework needs to shape development that anticipates upcoming changes to green buildings through the Ontario Building Code, widespread adoption of electric vehicles, and inclusion of new technologies for on-site energy production. The role of the Region will be to work with Caledon, as well as Mississauga and Brampton, to set ambitious energy performance requirements for the SABE, and to encourage public and private sector partnerships (e.g., between real estate developers and energy developers) to make distributed energy systems viable. To be planned as a low-carbon community that may ultimately transition to a net-zero emissions community, the SABE secondary planning framework and its implementation through detailed planning and development review will be crucial.

3. LAND USE PLANNING POLICY CONTEXT

The existing land use planning framework has undergone significant changes in the past decade to support climate change mitigation and energy management. Increasing awareness of the role local governments can play in climate action is now clearly reflected in legislation and policy. Ontario, through the *Planning Act* and the Provincial Policy Statement and the provincial Growth Plan legislation, provides direction to the Region of Peel and its local municipalities in preparing their own policies and plans to guide development and change. As such, the Region of Peel's Official Plan and the Town of Caledon's Official Plan both include supportive policies for energy and emissions reductions.

A. ROBUST POLICY CONTEXT CONTINUES TO EMERGE

This study includes a detailed review of policies and plans for energy and emissions as the context for recommendations for the SABE. A detailed discussion and review of the policy framework is provided in Appendix A.

The Province of Ontario, through legislation, land use policies and plans, provides direction to the Region of Peel and its local municipalities in preparing their own policies and plans to guide development and change. Regional and local municipalities are required to address energy and emissions-related policy objectives identified by the Province. In the land use planning process, policies must be consistent with the requirements of the *Planning Act*, Provincial Policy Statement (PPS) and other Provincial land use plans, including the Growth Plan and the Greenbelt Plan.

Municipalities develop official plan policies and secondary plans that are consistent with provincial plans and policies. Official plans are informed by various master plans (e.g., infrastructure, green space and natural heritage, climate change, energy) and area-specific secondary plans, both of which may include design guidelines for building and community design. Official plan policies inform detailed and site-specific land use regulation through municipal zoning by-laws and implementation through the development application and review process, though plans of subdivision and site plan approvals.

The following table identifies the policies and documents reviewed:

Table 1: Review of Relevant Land Use Policies

PROVINCIAL LAND USE LEGISLATION AND PLANS	REGION OF PEEL	TOWN OF CALEDON	PROVINCIAL PLANS, PROTOCOLS AND GUIDELINES
Planning Act, 1990	Consolidated Official Plan, 2018	Town of Caledon Consolidated Official Plan, 2018	Made-in-Ontario Environment Plan, 2018
Provincial Policy Statement, 2020	Official Plan, Draft Environment Related Focus Area Policies, December 2019	Caledon Community Climate Action Plan, 2011	Community Emissions Reduction Planning: A Guide for Municipalities, 2018
Growth Plan, 2019	Climate Change Discussion Paper, 2018	Residential Energy Use Mapping and Forecasting Study, 2016	Mapping Opportunities for Renewable Energy: A Guidebook, 2019
Greenbelt Plan, 2019	Peel Climate Change Master Plan 2020–2030	Corporate GHG Framework 2019–2024	GPC Protocol: Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories
Green Energy Act, 2009 and Green Energy Repeal Act, 2019	2011/2012 Peel Community Climate Change Strategy	Renewable Energy Potential Study (underway)	
	Region of Peel Long Range Transportation Plan		

B. POLICY CONTEXT FOR ENERGY AND EMISSIONS PLANNING IN PEEL AND CALEDON

The following table summarizes the Region of Peel and Town of Caledon's relevant plans and policies as they relate to energy and GHG emissions. The table identifies: if the document applies to the municipality (corporation), community, or both; if policies and/or objectives related to energy conservation and efficiency are identified; if GHG emissions reduction targets are identified; if reference to land use planning is made; and finally, if the document has the ability to influence growth in a supportive or direct way.

Table 2: Region of Peel and Town of Caledon Relevant Plans and Policies

Document Title	Date	Corporate/ Community/ Both	Energy Conservation	Energy Efficiency	GHG Emissions Reduction	Land Use Planning	Ability to Influence Future Growth
Region of Peel							
Peel 2041+ Regional Official Plan Review	Underway	Both	Yes	Yes	Yes	Yes	Direct
Peel Climate Change Master Plan 2020–2030	2019	Corporate	Yes	Yes	Yes	Yes	Supportive
Region of Peel Consolidated Official Plan	2018	Both	Yes	Yes	Yes	Yes	Direct
Region of Peel Climate Change Discussion Paper	2018	Community	Yes	Yes	Yes	Yes	Supportive
2017 Energy Consumption and Greenhouse Gas Emission Report (PDF)	2017	Corporate	Yes	Yes	Yes	No	Supportive
2015-2035 Strategic Plan, 2018-2022 ToCP Build Environmental Resilience	2015/ 2018	Both	Yes	Yes	Yes	Yes	Direct
Peel Climate Change Strategy Plan	2011	Both	Yes	Yes	Yes	Yes	Direct

Table 2: Region of Peel and Town of Caledon Relevant Plans and Policies

Document Title	Date	Corporate/ Community/ Both	Energy Conservation	Energy Efficiency	GHG Emissions Reduction	Land Use Planning	Ability to Influence Future Growth
Town of Caledon							
Renewable Energy Potential Study	Underway						
Resilient Caledon Climate Change Plan	Underway	Both					
Town of Caledon Consolidated Official Plan	2018	Both	Yes	Yes	Yes	Yes	Direct
Caledon Community Climate Action Plan (currently being updated)	2011	Community	Yes	Yes	Yes	Yes	Direct
Town of Caledon Environmental Progress Action Plan Update	2014	Community	Yes	Yes	Yes	Yes	Direct
Caledon Residential Energy Use Mapping and Forecasting Study	2016	Community	Yes	Yes	Yes	Yes	Supportive
Town of Caledon Corporate GHG Framework 2019-2024	2018/ 2019	Corporate	Yes	Yes	Yes	No	Direct

C. POLICY CONTEXT SUPPORTS ENERGY AND EMISSIONS REDUCTIONS

The recognition of the need to act to mitigate climate change is reflected in efforts to reduce carbon emissions through eliminating fossil fuels as an energy source for heating and cooling buildings and for vehicles.

We recognize that Regional policy context already addresses many of the actions that support low-carbon communities. The following land use planning actions are within the purview of municipalities in accordance with current planning legislative and policy requirements.

- Integrate GHG emissions reduction targets and supportive policies and actions across official plans, secondary plans, and zoning by-laws. Such policies can be supported by climate change master plans, energy management plans, and GHG inventories, etc.
- Implementation of these policies and actions require appropriate studies to be submitted in support of block plans and other forms of development applications and approvals.
- Create policies that enable the development of district energy systems and creation of local energy supply, e.g., developing district energy design guidelines, supporting partnerships with local electricity distributors and developers.
- Ensure municipal council support throughout all stages of the process (e.g., policy development, strategic investments, direction for neighbourhood design).
- Engage with stakeholders (e.g., area municipalities, energy distributors and operations, private developers etc.) when developing policies and ensure “marketability” of the net-zero communities for perspective buyers.

4. CASE STUDIES: PLANNING THE TRANSITION

Municipal actions required to achieve low-carbon and net-zero emissions are described in this chapter and are discussed to identify lessons learned that may be applicable to Region of Peel. Case studies were identified based on a review of available literature and discussions with Regional staff. Emphasis was placed on land use policies that support community energy efficiencies and emissions reductions, rather than corporate policies.

Given the scope of this study, an analysis of green development standards is not included. Examples of such standards include the City of Toronto's Toronto Green Standard, the City of Brampton Sustainable Community Development Guidelines and related Sustainability Assessment Tool (SAT), and Caledon's Green Development Program, to name a few. Such policies are applied at later stages of the planning process such as secondary plan areas and the development application stage (e.g., site plan application). It is expected these policies will be addressed at the local municipal level following the adoption of Peel 2041+.

There is no "one size fits all approach" in creating policies that support low-carbon or net-zero communities. The unique needs of each jurisdiction in which objectives are created necessitate a unique set of policies, plans, consultation and potential business models to manage energy infrastructure. We have sought to identify those approaches that best fit with the local context of the Region of Peel and the SABE within the Town of Caledon.

To help better understand the policy and infrastructure needs to support energy and GHG emissions reduction targets, three types of case studies were examined: new low-carbon and/or net-zero communities, official plans/secondary plans, and district energy systems.

A. SUMMARY OF CASE STUDIES

The following provides a summary of the case studies examined as part of this analysis. The location, relevance to the SABE, and key findings are summarized in the following sections. A detailed assessment of each case study is provided in Appendix B.

i. New Low-Carbon and/or Net-Zero Emissions Communities

The following case studies examine policies and infrastructure needed to achieve low-carbon or net-zero emissions. Both the West 5 development located in the City of London and the Greenfield Demonstration site in the City of Kitchener provide examples of new communities constructed within designated greenfield areas that are intended to be low-

carbon or net-zero. In contrast, the City of Guelph Hart Village subdivision demonstrates how developers can participate in voluntary programs to reduce emissions and achieve higher energy efficiencies above the requirements of the building code.

Table 3: Low Carbon/Net Zero Emissions Case Studies

CASE STUDY	RELEVANCE TO SABE	KEY FINDINGS
London, Ontario – West 5	West 5 is a good example of a new greenfield community designed to have exceptional energy efficiency. This project has been well-studied is generally representative of the proposed SABE development scenario. Therefore, providing important insight for the Region.	▪ Consideration should be given to creating more standardized approaches and/or policies that prioritize sustainability—such as providing greater flexibility with zoning permissions. ▪ Design guidelines can conflict with sustainability objectives. ▪ Innovative net-zero initiatives should be supported. ▪ Provincial politics can negatively impact the ability to facilitate the development of a net-zero community.
Kitchener, Ontario – Greenfield Demonstration Site	The Greenfield Demonstration site is another example of a new greenfield community designed to be low-carbon and is intended transition to net-zero overtime. Similar to the majority of the lands within the FSA, the site is currently agricultural and is adjacent to significant natural heritage features. The site also has good access to the City's existing road network as well as connections with the provincial highway system.	▪ Supports importance of municipal access agreements, which allow private companies to have access to public rights-of-way. Such agreements should be structured to allow municipalities to retain ownership over public infrastructure while granting access to the district energy/utility provider. ▪ District energy systems are needed to achieve net-zero energy in high density developments as these buildings cannot be serviced solely by on-site renewables.

Table 3: Low Carbon/Net Zero Emissions Case Studies

CASE STUDY	RELEVANCE TO SABE	KEY FINDINGS
Guelph, Ontario – Hart Village	Hart Village demonstrates the importance of voluntary programs that support energy conservation and efficiencies above and beyond the Ontario Building Code. As municipalities do not have the authority to require building standards exceed the building code, Hart Village demonstrates the importance of voluntary programs and standards that can achieve GHG emissions reduction targets.	▪ Although the construction cost of net-zero homes is higher than conventional building code houses, the Terra View homes project demonstrates that reduced energy costs that can be saved over the long-term ▪ Importance of voluntary building design standards over and above the requirements of the current Building Code. ▪ To date, Terra View has designed homes in accordance with Energy Star, GreenHouse, Built Green and LEED standards.

ii. Official Plans and Secondary Plans

Official plans and secondary plans are important policy documents that guide land use planning. Policy support is required for net-zero communities, including renewable energy sources and district energy systems.

At the secondary plan level, which provides more detailed policies for a defined geographic area, policy direction with respect to site densities and design elements may be included. Case studies of official plan and secondary plan policies are demonstrated through the cities of Ottawa, Guelph, Toronto and the Town of Halton Hills in Ontario, the Cities of Vancouver and Victoria in British Columbia.

Table 4: Official Plan And Secondary Plan Case Studies

CASE STUDY	RELEVANCE TO SABE	KEY FINDINGS
Guelph, Ontario – Clair-Maltby	The Clair-Maltby Secondary Plan area provides a good example of how energy and utility policies can be	▪ Provides insight to the technical process needed to develop land use policies that support energy conservation and efficiencies as

Table 4: Official Plan And Secondary Plan Case Studies

CASE STUDY	RELEVANCE TO SABE	KEY FINDINGS
Secondary Plan	incorporated during the Secondary Plan process. Clair-Maltby is designed to be low-carbon, with the potential to become net-zero overtime. This process is likely representative of what the Town of Caledon will need to undertake in planning for the SABE.	well as reduced GHG emissions. ▪ The identification of community attributes, including land use mix, density targets, etc., demonstrates the importance of integrating energy and land use planning to achieve low-carbon and net-zero communities. Furthermore, energy modelling can help inform the development of preferred land use scenarios for a community
Halton Hills, Ontario – Vision Georgetown Secondary Plan	The Vision Georgetown Secondary Plan provides an example of land use planning policies and considerations needed to achieve energy efficiencies and conservation. Similar to the Clair-Maltby case study, the Vision Georgetown Secondary Plan provides insight to the Secondary Plan process to be completed by the Town of Caledon for the SABE.	▪ The importance of development standards in helping to achieve the policy objectives of Secondary Plans. For example, the policies within the Town's Green Development Standards could be further enhanced to achieve GHG emissions reduction targets.
Toronto, Ontario – Port Lands Planning Framework and Villiers Island Precinct Plan	The idea of requiring tertiary plans, like district plans, may be a good idea for Caledon to consider in implementing the SABE secondary plan as detailed requirements can be described.	▪ An energy strategy is a detailed requirement for Official Plan Amendments, Rezonings, and Plans of Subdivision where the proposal is larger than 20,000 m^2. In addition, a detailed consideration of energy was considered in detail at all stages of planning policy development. Perhaps the greatest lesson learned from

Table 4: Official Plan And Secondary Plan Case Studies

CASE STUDY	RELEVANCE TO SABE	KEY FINDINGS
		the City of Toronto Port Lands example is that the planning process is not linear. Goals and objectives for energy and emissions reductions must be considered consistently at all stages of the planning and decision-making process.
Victoria, British Columbia, Official Plan	The relevance to the SABE is that progressive policies related to community design.	▪ The applicability of the Victoria example is in the specificity of the policies with respect the variety of ways that energy conservation and renewable energy may be considered in official plans or secondary plans.
Ottawa, Ontario – Official Plan	The Energy Evolution Action Plan looks at the demand and supply as well as opportunities and challenges. Plans for district energy in the Barrhaven community of Ottawa and energy efficiency in Minto's Ampersand community are underway and may provide useful case studies when material becomes publicly available.	▪ The ability of the City's land use planning policies to achieve energy priorities and objectives have not yet been fully realized. ▪ This requires more specific policies be created.

iii. District Energy Systems

District energy systems provide heating, cooling or a combination of both to a network of buildings through a series of pipes (also known as a thermal grid), which are serviced by a

central plant or a series of miniplants. Such systems allow buildings to be provided with heating and cooling more efficiently than with traditional systems.

Table 5: District Energy System Case Studies

CASE STUDY	RELEVANCE TO SABE	KEY FINDINGS
Toronto, Ontario – Enwave Deep Lake Water Cooling	This case study provides an example of district energy infrastructure needs and the importance of partnerships to administer these systems.	▪ City of Toronto's agreement with Enwave shows the importance of partnering with an energy operator ▪ In late 2019, the Toronto City Council approved an Environmental Assessment to expand the current capacity of the DLWC supply, which will require a significant amount of capital investment. Capital costs associated with the district energy system expansion will be shared between the City of Toronto, Enwave and other upper levels of government.
Markham, Ontario – Markham District Energy	This case study provides an example of a natural gas district energy system. This example comments on the financial implications of building such a system	▪ Benefits to the City maintaining ownership over the systems. For example, as the City is the sole owner and operator, this allows greater control over the design process and ensures the community has access to the system. However, the development of district energy systems requires significant capital investment and associated funding. As such, municipalities may be limited in their ability to fund such projects and therefore require capital funding agreements with energy operators

Table 5: District Energy System Case Studies

CASE STUDY	RELEVANCE TO SABE	KEY FINDINGS
Toronto, Ontario – Mirvish Village, Creative Energy and Westbank	This provides an example of a developer who also acts as the operator of the district energy system. Similar arrangements may be possible in developing the SABE.	▪ Over time, customers of the district energy system will payback both the initial capital investment required to set-up the system and the ongoing operating costs associated with the fuel and maintenance of the system. This set-up will provide long-term cash flow benefits for the developer, making it a favourable business model.
North Vancouver, Vancouver – Lonsdale Energy (LEC)	This provides an example of how district energy systems can be expanded in phases to allow new development to connect to the system. This includes requiring developers to fund infrastructure needed to connect to the system	▪ The system was designed to use a variety of different fuel sources (such as natural gas) as well as renewable energy sources like solar. An interconnected miniplant system was selected instead of a central heating system to meet the unique energy needs of the planned development. ▪ Importance of creating a district energy system that addresses local needs

B. LAND USE PLANNING TOOLS

The analysis of the case studies has revealed several important land use tools that can help achieve energy conservation and efficiencies as well as reduced GHG emissions. The following provides commentary on tools available within the Province and identifies relevant case studies, where applicable. The following table describes how each land use planning tool can be used to achieve energy and/or GHG emissions reductions objectives.

Table 6: Land Use Planning Tools Case Studies

LAND USE TOOL	DESCRIPTION	CASE STUDY EXAMPLE
Official Plan	General land use policies that support low-carbon and/or net-zero communities and energy conservation and efficiency objectives.	**Ottawa, Ontario** ▪ Official Plan **Victoria, British Columbia** ▪ Official Plan
Secondary Plan	More detailed land use policies, for a defined geographic area, that supports low-carbon and/or net-zero communities and energy conservation and efficiency objectives.	**Guelph, Ontario** ▪ Clair-Maltby Secondary Plan, Energy and Other Utilities Study **Toronto, Ontario** ▪ Port Lands Planning Framework and Villiers Island Precinct Plan **Halton Hills, Ontario** ▪ Georgetown Secondary Plan
Design Guidelines	Provides guidance to the place, mass and orientation of buildings and infrastructure. Can include guidance on sustainable building design and material, as well was location and scale of on-site renewable energy.	**Halton Hills, Ontario** ▪ Georgetown Secondary Plan
Zoning By-law	Used to control the development of land within a community. May promote on-site renewables “as of right” while ensuring appropriate setbacks and potential land use conflicts.	**Toronto, Ontario** ▪ Zoning easement

Table 6: Land Use Planning Tools Case Studies

LAND USE TOOL	DESCRIPTION	CASE STUDY EXAMPLE
Community Improvement Plans	Allow municipalities to encourage the development of low-carbon or net-zero emissions through supportive planning policies and financial incentives.	This approach was recommended by the FCM and s2eTechnologies.[27]
Plan of Subdivision/ Site Plan	Developers must obtain approval from municipalities of plans and/or drawings of proposed development. The municipal approvals process could provide incentives for applications that achieve low-carbon and/or net-zero objectives.[28]	Although not explicitly required as part of the site plan approval process, the City of Guelph Hart Village case study highlights how voluntary standards may influence development applications.
Building Code	Specific set of standards applied to the construction of buildings and other structures.	All development in Ontario is required to meet the minimum requirements of the building code.
Voluntary Standards	Includes ENERGY STAR, GreenHouse, Built Green, LEED standards, Net Zero Ready	**Guelph, Ontario** ▪ Hart Village, Terra View Homes
Financial Incentives	Grant programs and fees rebates to encourage energy efficiencies (i.e. LEED), electric vehicles, on-site renewables	**Toronto, Ontario** ▪ Home Energy Loan Program

[27] FCM & S2E Technologies. (2019). Feasibility for Smart Energy Communities. Retrieved from https://s2etech.com/fcm-gmf/

[28] For example, the City of Toronto's Green Standard is a mandatory requirement of the planning approval process. Although required as part of the site plan/plan of subdivision approval process, it is difficult it enforce as non-compliance does not prevent the issuance of a building permit.

C. LESSONS LEARNED

Drawing on findings from the case studies, the following describes lessons learned for the facilitation of low-carbon and net-zero communities, particularly for single- and lower-tier municipalities. Many of these communities rely on district energy systems—as such, opportunity and constraints of these systems are also discussed.

Secondary plans include detailed policies for community and building design

- Green buildings are a significant part of energy and emissions reduction. It is very challenging for municipalities to enforce anything that is above the requirements of the building code. The City of Toronto Port Lands example includes detailed guidelines for building orientation and design, however, such guidelines would be negotiated with the builder. Therefore, engagement with development industry stakeholders is key.

- Land use planning policies at the Secondary Plan level should be informed by energy master plans and modelling. Such studies can be used to identify potential sites for district and distributed systems and ensure that future development is designed to achieve GHG emissions reductions targets.

Planning and transitioning to net-zero requires flexibility

- Flexibility is key in supporting energy and GHG reduction initiatives. Municipalities need to be able to support low-carbon development but also guide the design of communities that will transition to net-zero. District energy systems and on-site renewable energy should be contemplated generally at early stages of the planning process.

- Future integration of on-site renewables should be dealt with during the architectural and engineering design phases of buildings, including design standards. For example, design standards should support passive building design as well as building orientation that allows for solar energy infrastructure.

Energy management approaches differ depending upon planned densities

- Low-density developments can more easily achieve net-zero energy as these sites can accommodate on-site energy generation through solar power.[29]

- High-density developments mean dense energy loads that support district energy systems. As high-density sites cannot accommodate on-site renewable energy

[29] Ibid. (p. 204).

infrastructure (e.g., solar panels) at a scale to meet energy demand from those buildings, buildings need to rely on larger district energy systems. In instances where it is difficult to service communities using low-carbon or renewable energy sources, partnerships with off-site renewable energy providers should be explored.

- A net-zero community will need to include a variety of approaches.

Municipal leadership is required for low-carbon and net-zero communities

- Both upper and lower levels of government should support district energy systems and on-site renewables through land use planning policies, partnerships, and financial incentives.
- Identify, engage, and educate key stakeholders (the earlier the better) including builders, material suppliers, local leaders and municipal staff.
- Provide training to municipal staff on energy emissions and reductions. Ensure that there is regular review of the planning application and building approval processes to identify potential areas of concern (e.g., conflicting policies, challenges with internal approval processes, etc.) to make systematic improvements and streamline decision-making.
- Facilitate funding by upper levels of government to provide greater incentives to stakeholders.
- Collaboration by municipalities with energy partners has proven to be a successful business model for district energy systems.
- Municipalities should provide policy and/or financial incentives to facilitate low-carbon and net-zero buildings and infrastructure.

District energy systems play an important role in low-carbon and net-zero communities, but the feasibility of systems need to be carefully considered

- Recognizing the importance of district energy systems, the following opportunities and constraints have been identified below.

District Energy Opportunities	District Energy Constraints
• Municipalities can use the land use planning process to advance district energy systems • Renewable energy solutions offer long-term cost savings but significant upfront capital investment is required • District energy systems can be designed to meet the unique needs of the community	• Municipalities cannot require development on private land to connect to district energy systems • Requires significant capital investment that will be funded over a long-term budget horizon • Connecting existing buildings to district energy systems is complex (administratively and cost) • Requires "critical mass" in order to be cost competitive compared with conventional energy approaches

The lessons learned from the case studies in this chapter on new low-carbon and net-zero emissions communities, official plans and secondary planning policy, and district energy systems inform the study recommendations in Chapter 6.

5. Role of the Region of Peel in Energy Management

This section identifies opportunities for energy management by the Region. First, energy management in the context of regional policy is discussed, much of which is internally directed towards the Region as a corporation in planning for roads and other infrastructure. Then, we review how the Official Plan provides policies to guide others in the community in shaping the built and natural environment of the Region through development and conservation.

A. SHAPING NET-ZERO COMMUNITIES THROUGH THE REGIONAL OFFICIAL PLAN

Do the objectives and policies of the existing official plan provide external-facing guidance to reduce energy? The Region supports local municipalities of Caledon, Brampton and Mississauga and guides the development community, employers, and residents.

The ROP provides a land use planning framework to shape the built and natural environment in the Region. The existing ROP includes objectives and policies encouraging and promoting more sustainable energy and reducing emissions. Through Peel 2041+, the Region will strengthen these policies.

Emissions are greatest through transportation and buildings. The challenge is to translate these into issues for regional municipal land use planning to enable longer-term energy system transformation across the Region. We discuss policies related to regional corporate vs community considerations, urban structure, transportation system, and the natural environment below.

i. Energy and Regional Public Works Infrastructure

In thinking about energy management and land use planning, it is helpful to consider:

- Issues related to internal corporate policies and practice and,
- Issues related to the external influence the ROP has on other community actors.

From an energy and emissions reduction perspective, the policy approach and implementation approach are different. On the one hand, the Region is a municipal corporation seeking to improve energy efficiency and to conserve energy (and be fiscally

responsible) in their own operations and the ROP provides direction to the corporation. The Region can also directly engage with energy production and distribution, for instance developing partnerships in district and distributed energy and renewable energy projects.

The Region of Peel is already leading by example with respect to climate change initiatives through their own operations, for example by moving towards green buildings and vehicles. Energy efficiency and emissions reductions are planned for buildings and infrastructure owned and operated by the Region. The Region is responsible for many community services, such as childcare and seniors' day programs, long-term care facilities, emergency services, including paramedics and police, and the Peel Housing Corporation. The Region is responsible for waste management, water and wastewater treatment, and regional roads construction and operation. As a corporation, the Region is guided by policy in the Official Plan with respect to, for example, regional roads, water, wastewater, and natural systems.

The Region has prepared a Climate Change Master Plan (2019) that clearly sets out efficiencies and emissions reductions goals related to the Region's responsibilities as discussed in Appendix A. The analysis contained in this study supports the outcomes and activities set out in the Plan to ensure the Region prioritizes energy and emissions reductions from its operations and through infrastructure construction and maintenance across all areas identified in the Plan including: vehicle fleets for various services, as well as bricks-and-mortar facilities, through waste management and collection, waste processing facilities, and landfill sites.

ii. Energy and Regional Transportation Infrastructure

Given the critical importance of transportation choices for reducing energy use and emissions, the Regional role should be spelled out. This is particularly important given the rapid growth rate in the Region. Without intervention, and if historical travel patterns are maintained, the addition of the forecast population will result in many more vehicles on the road. Also, regional roads are higher-order roads with many demands put upon them. As the transportation sector is the largest contributor to GHG emissions in Ontario, designing regional roads to support net-zero communities is urgent. Clearly stating the policy choices could make all the difference down the road. The role of Regional roads should also be considered:

- What role do Regional roads play in compelling residents to leave their fossil-fuel burning vehicles at home? Residents use their cars for commuting, and daily and weekly trips for shopping and services.

- What role do Regional roads play in enabling a low-carbon approach to daily operations and goods movement by employers in the Region? The Region ensures a complete streets approach to road (re)design, construction, and maintenance that take seriously the experience of transit-users, pedestrians and cyclists as daily users and commuters on those roads.

The complete streets road design approach ensures the allocation of space within rights-of-way for bicycle lanes, pedestrian paths, transit rights of way, and aesthetics for cyclist and pedestrian comfort. Complete streets are recognized in the Growth Plan as a sustainable transportation strategy and the Region's Let's Move Peel: Long Range Transportation Plan (2019) identifies complete streets as a proposed policy direction (see Section 7.1).

iii. Energy and Regional Urban Structure

The key to reducing energy demand is in developing complete communities with compact urban form. The goal of complete communities encompasses many assumptions about the low-carbon lifestyles being envisioned. A key outcome of this goal from an emissions perspective relates to closing the distance between land uses to reduce the length of car trips and to make walking and cycling possible—reducing vehicle kilometres travelled is achieved through providing opportunities for people to live near where they work and planning to connect people to their desired destinations as represented by different land uses. Distinctions are made for urban and rural communities. But generally, the goal is to provide opportunities for people living in neighbourhoods to access goods and services with shorter trip distances, and by making those trips using alternative transportation.

Another key outcome of the complete communities policy from an energy perspective is to improve opportunities for community energy planning through district energy, distributed energy resources, smart grids, and renewables. We recommend the Region identify areas for district and distributed energy throughout the Region, both for existing communities and for the SABE. The link between energy and affordability/equity, and public health should be emphasized.

B. NATURAL ENVIRONMENT AND CARBON SEQUESTRATION

Natural areas sequester carbon. While most of the focus of energy planning is on greater efficiencies and conservation, regional land use planning policy should explicitly recognize the role that trees and other vegetation play in taking carbon out of the atmosphere. From a land-use perspective, conservation of greenspace is important.

Consideration should also be given to the potential for carbon sequestration by quantifying ecosystem services, and better substantiating the benefits for climate change mitigation of natural heritage system lands, urban parks and open spaces, and tree cover, especially within communities.

Parks and greenspaces are considered the "lungs of the city" because of the ability of trees and plants to produce oxygen and remove pollutants, including carbon dioxide, from the air. Trees directly remove carbon dioxide from the air and sequester carbon in their biomass. Notwithstanding climate change, trees improve air quality locally, especially near emission sources, such as roadways and parking lots. Trees and other plants reduce the urban heat island effect by shading indoor and outdoor spaces.

Large healthy trees remove more pollution from the air than small healthy trees, therefore the long-term protection of existing trees in urban areas, woodlots, and forests in the Region should be a priority. The natural heritage system designates for protection lands with tree cover and planning to ensure the protection of these lands is enhanced through the SABE process is important. However, policies for the protection of mature trees and woodlots outside of designated NHS lands and within future community areas is also necessary for both climate change mitigation and adaptation.[30]

C. RECONSIDERING THE REGION'S ROLE IN ENERGY MANAGEMENT

Investment in energy planning by the Region —including coordination, facilitation and partnership with energy producers—is an innovative approach that would shape the future urban structure. Local municipalities have begun the process of planning for district energy systems. The Region could leverage its influence to create a Region-wide plan for district energy, supporting local municipalities in seeking partnerships to create feasible systems for the production and distribution of energy. High level buy-in at the Regional level may help in terms of organizing governance and to overcome reluctance on the part of actors.

The Region should take the lead in studying the viability of renewable energy production, including locational and financial considerations. The energy supplied to Peel municipalities currently is "renewable" given that 96% of the electricity generated in Ontario as of 2017

[30] Nowak, D. J. (2020) Urban Trees, Air Quality and Human Health, Chapter Two in *Forests for Public Health*, C. Gallis and W. S. Shin (eds.), Cambridge Scholars Publishing; and Nowak, D. J. (2019) The Atmospheric System: Air Quality and Greenhouse Gases, Chapter 8 in *Understanding Urban Ecology: An Interdisciplinary Systems Approach*, M. H. Hall & S. B. Balogh (eds.), Springer.

was emissions-free but this does not adequately meet the requirements for local energy resiliency. For the longer-term, it is expected that a system that uses both external renewable energy and locally produced renewables is the most resilient.[31]

The regional level is appropriate for coordinating efforts around energy production. Through a district energy study, the Region should consider identifying areas for district energy throughout the Region, both for existing communities and for the SABE. District energy is compatible with higher density areas and areas of high energy demand. For example, Guelph's Clair-Maltby secondary plan study identifies residential, commercial, institutional, and industrial users as potential customers for district energy, for example, residential, apartment buildings three storeys and greater, subdivisions of 100 units per hectare, and for commercial, single large commercial buildings of 1,000 m^2 or greater, plus multi-unit buildings together.[32] A regionally-led energy production strategy would leverage the Region's approach to becoming a partner in energy production.

Another example includes the City of Brampton's Community Energy and Emissions Reductions Plan (CEERP) with Sheridan College. Future opportunities for partnerships with such projects should be considered by the Region.

The results of a region-wide district energy study could provide policy direction for the siting and implementation of district energy systems as part of land use designations at the local level. Such a study could:

- Identify energy planning districts and planning distributed energy / smart grid networks across the Region. Draw upon Brampton's Community Energy and Emissions Plan, where districts are being been modelled.[33]

- Address the siting of renewables within existing communities and new greenfield areas. Where the CEKAP study investigated utility-scale opportunities, community-scale installations should be investigated.

- Undertake the strategy through the Peel Climate Change Partnership (PCCP), a joint partnership of the Region's area municipalities and local Conservation Authorities,

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[31] CEKAP. (2017). *On the Path to Net-Zero Communities – Integrating Land Use and Energy Planning in Ontario Municipalities*. Retrieved from https://www.cekap.ca/resources/research-report-OCC_Full%20Report.pdf

[32] Amec Foster Wheeler. 2017. *Clair-Maltby Energy and Other Utilities Study: Background Report and Technical Work Plan (Phase 1)*. City of Guelph.

[33] Farbridge, Karen. 2020. Personal communication and https://www.karenfarbridge.ca/

which identified “low carbon district energy” as a future strategy in its 2020 Terms of Reference.

- Seek out opportunities to work with partners, including producers and distributors of natural gas and electricity, including Alectra (supplying electricity to Brampton and Mississauga) and HydroOne (Caledon), the Greater Toronto Airport Authority (with its own gas-fired plant)[34]

D. CONFLICTS BETWEEN CLIMATE CHANGE MITIGATION AND OTHER REGIONAL GOALS AND OBJECTIVES

In all official plans, policies are included to conform to provincial policy requirements and the best policies are ones where the priorities of the municipality are spelled out. However, in the case of energy and land use planning, several tensions are well-known and include the following:

- Between complete communities and community development, where the Provincial policy goal of “complete communities” as envisioned is laudable, especially in support of energy and emissions reductions goals, but where the conventional development process in urban expansion areas normally has residential development occurring long before full community and commercial services are provided, including transit. The Region could choose to shoulder upfront costs related to complete communities, including, for example, district energy and transit infrastructure. The Region should use policies related to the transformation from the current fossil-fuel based energy lifestyle to the future renewables-based lifestyle.

- Between current energy demands and low-carbon energy use, where skepticism about the shift to low-carbon lifestyles in suburban communities. For example, about a modal split on regional roads moving towards not only transit but cycling and walking.

- Between the built environment and individual choice, where emissions reduction comes as a result of change in residents’ and business’ behaviours and the structure of the built environment can only do so much. The success of a low-carbon future is not only through shaping the built environment but in the education of everyone in the Region as to the impacts of their everyday choices. For businesses, especially those that depend

[34] IESO (2020) Ontario’s Electricity System. http://ieso.ca/localContent/ontarioenergymap/index.html

on trucking, the choices are not so easy. Changes to the goods movement system across the province are beyond the scope of regional responsibility.

- Between initiatives to address energy and emissions reduction goals and fiscal considerations, including: capital expenditures, lifecycle asset management, development charges/community benefits. The transition to a low-carbon region requires upfront investment. More than other ways of accounting however, the long-term benefits of reduction in energy costs provides an overall cost saving.

- Between climate mitigation measures and adaptation goals, where compact city form can be at odds with ecological design and natural heritage systems planning. Green space is land consumptive and providing space within the developable areas of communities can be seen at odds with goals to otherwise reduce trip distances through compact urban form.

The extent to which these tensions can be recognized and addressed can go a long way to supporting policy implementation.

6. RECOMMENDATIONS

The purpose of the report is to provide a review of various approaches to achieving energy and emissions reductions through the land use planning policy and development process. This chapter gathers together recommendations for the SABE based on best practices and lessons learned about planning for the transition from high energy demand from fossil fuel energy sources towards net-zero communities based on energy conservation and efficiency in planning and design reliance on renewable energy sources, through community district energy and distributed energy networks. The first section summarizes principles for the SABE selection process. The second section suggests opportunities for the Region's role in energy planning and implementation. The third and final section identifies principles for the SABE policy and implementation framework.

A. SABE SELECTION PRINCIPLES

This study is one of many that will be used to determine the location of the SABE. From the perspective of energy and emissions reductions, the following principles related to transportation, natural heritage, and energy infrastructure should be considered when evaluating the SABE location.

Note that the future community structure and land use configurations will need to accommodate on-site renewables (i.e., solar panels), as well as district energy systems, however, these are not principles for the evaluation of the location of the SABE. Rather, these design requirements will be addressed through subsequent stages of the planning and building process.

Transportation

- Is the SABE a contiguous expansion of existing settlement areas to ensure that the new community will be interconnected with existing and planned alternative transportation infrastructure?
    - Is the SABE located near existing or planned transit infrastructure?
    - Is there a direct and clear connection between the expansion area and planned transit hubs?
    - Is the SABE located near existing or planned active transportation infrastructure?
    - Is the SABE connected to the Region's existing and proposed cycling network?
    - Is the SABE connected to the Region's existing and proposed pedestrian network?

- Does the SABE location allow for strong connectivity for daily activities and with employment opportunities within existing settlement areas in Caledon and/or Brampton?

Natural Heritage

- Does the SABE avoid existing natural areas within the FSA to improve air quality and sequester carbon?

Energy Infrastructure

- Are there constraints to accessing or integrating the SABE with the proposed IESO Northwest GTA transmission corridor? While community and district energy should be planned for the SABE, connection to the broad Ontario transmission network will be likely be required in the short term as the transition to net-zero is underway and then in the long term to ensure flexibility and reliability.

- Are there proposed public works or proposed industrial processes within the SABE that may be energy sources (e.g., energy sources from waste heat processes) for district energy systems?

B. REGION'S ROLE IN ENERGY PLANNING AND IMPLEMENTATION

The Region should clearly distinguish between those energy and emissions policies directed towards Regional corporate responsibilities and operations from those policies directed towards community energy and emissions and other external users of the official plan.

The Region should undertake a Regional Community Energy and Emissions Strategy to study the feasibility of renewable and alternative energy throughout the region. Through discussions with staff, it has been identified that the Region intends to undertake Energy and Emissions Reduction Management Plan for water/wastewater services. Undertaking such a plan should be coordinated with actions at the community-level. The Region's vision and leadership can better facilitate partnerships with communities and potential district and distributed energy investors and operators. High level buy-in at the Regional level may help in terms of organizing roles and responsibilities and to overcome reluctance on the part of some actors. Typically, these plans and strategies are considered the responsibility of local municipalities, but a broad, collaborative perspective is also needed to create an integrated and interconnected regional energy system within which local energy systems make sense. Such a Strategy might include the following actions:

- The Region work with energy providers to identify energy planning districts throughout Peel and plan a smart grid network(s) across the region.
- The Region and local area municipalities address the siting of renewables within existing communities and new greenfield areas. Where the CEKAP study investigated utility-scale opportunities[35], opportunities and barriers to community-scale installations should be investigated.
- The Region and local area municipalities work collaboratively to draw upon lessons from Brampton's Community Energy and Emissions Plan, where districts have been modelled.[36]
- The Region, in collaboration with the local area municipalities, broaden the engagement of the PCCP, which identified "low carbon district energy" as a future strategy in its 2020 Terms of Reference.

- The Region seek out opportunities to coordinate, facilitate or work with partners, including producers and distributors of natural gas and electricity, to support the use of renewable energy resources and alternative energy systems.

- For every Regional facility to be developed within the SABE, plan to derive all energy from renewable sources, including energy generation for use within the facility itself and, wherever possible, distribution to the community.

C. SABE FUTURE POLICY FRAMEWORK: ENERGY POLICY AND IMPLEMENTATION RECOMMENDATIONS

Much of the potential to implement energy and emissions reductions will be realized through planning for the SABE. Here we include options for the Town of Caledon to consider in secondary planning, including technical studies that may be required in advance of development.

a) SABE Secondary Plan Policy Framework

After the SABE location has been identified, the development of the secondary plan for the new urban area is a real opportunity to develop a climate positive planning framework, which optimizes the community for district energy and other forms of distributed energy.

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[35] CEKAP (2017). *On the Path to Net-Zero Communities – Integrating Land Use and Energy Planning in Ontario Municipalities*. Retrieved from https://www.cekap.ca/resources/research-report-OCC_Full%20Report.pdf

[36] *Farbridge, Karen. 2020. Personal communication and https://www.karenfarbridge.ca/*

- Develop a policy framework to facilitate the implementation of a net-zero community with the expectation that the transition will take place over the life of the plan.

- Set targets for future energy demand in the SABE to be met by renewable energy and set phased targets for emissions.

- Undertake community energy and GHG emissions planning that:

    - The SABE is planning to achieve a recommended minimum greenfield density of 65 persons and jobs per hectare, which will include development at densities sufficient to warrant district energy systems but also may include uses where renewables can be integrated on-site and within building design.
    - Designate potential areas for district energy and on-site renewables in the SABE. District energy through combined heat and power production is typically compatible with higher density areas and uses with high energy demand.

- Identify hierarchy of sites of potential energy production including heat recovery, geothermal, roof mounted and or ground mounted district solar, from larger-scale projects to smaller-scale installations, and from early-adoption to future expansion, considering a wide range of possible modes of production, and then incorporate these within the planned urban structure and policy framework. Caledon is currently undertaking a Renewable Energy Potential Study. The study will be used to identify theoretical sites for large scale renewable energy projects (e.g., ground-mount solar).

    - Include a policy to require easements or municipal access agreements to district energy plants and for the energy distribution network[37]
    - Integrate active renewable energy production facilities on-site

- Exploration of potential to attract private investment in district energy systems and distributed energy resources.

- Include policies for community and building design recognizing that buildings are one of the largest contributors to GHG emissions and has the greatest potential for emissions reduction:

    - Require sustainable community and building design to reduce the resource consumption, energy use, and carbon footprint of the built environment.

[37] FCM & S2E Technologies. (2019). Feasibility for Smart Energy Communities. Retrieved from https://s2etech.com/fcm-gmf/

- Consider offering flexibility with zoning permissions to allow developers to pursue sustainable development designs with minimal negotiations with the municipality.
- Zoning could include exemptions from setbacks for green building features, such as allowing solar collectors to project into building setback areas to exceed building height restrictions.

- Include energy and emissions in development review:

  Require applications for development in the SABE to include an energy study (e.g., an Energy Strategy as required by the City of Toronto or an Integrated Environmental Review as required by the City of Victoria). Requirements for the Energy Study could include:

  - Calculations of energy and emissions for the proposed development with baseline, higher performance, and near-zero emissions standards, taking into account energy conservation and demand reduction, low carbon solutions, and energy resilience.
  - Passive community and building design for energy conservation, including but not limited to, passive solar design, building orientation, ventilation, increased insulation.
  - Building materials to reduce urban heat island effect and energy expenditure, such as green roofs, cool roofs, and high-quality windows.
  - Consideration of potential energy sharing for all multi-building developments and/or with neighbouring existing/proposed developments.
  - Integration of active renewable energy production facilities on-site, including but not limited to energy sources such as geothermal energy, photovoltaic panels.
  - Consideration of opportunities to increase resiliency such as strategic back-up power capacity (for multi-unit residential buildings).
  - Inclusion of facilities and connections for recharge of electric-powered vehicles across all land uses.
  - Inclusion of connections for future on-site solar production.
  - Lighting within public areas (e.g., pedestrian and multi-use trails) to be powered via solar panels.
  - Consideration of building lifecycle and emissions potential over useful life of the building. If appropriate, other factors such as carbon pricing could be examined.

- Plan to minimize emissions from transportation:

  - Determine a planned mode share for the SABE.
  - Add policies with respect to future-proofing by being prepared for shift to electric vehicles and ensuring the built environment is ready with vehicle charging:

        - Plan for a network of electric vehicle charging stations.
        - All sites and buildings to be designed to be EV-ready

    - Plan for the shift to increased use of public transit and other forms of alternative transportation: ensure the built environment supports the use of public transit for commuting to work and school within Region and outside of the Region.

    - Ensure a complete streets approach to road (re)design, construction, and maintenance that takes seriously the experience of transit-users, pedestrians and cyclists as daily users and commuters on all roads within the community and connected to adjacent areas in the Town and Region, especially where roads and pathways intersect with the proposed GTA West highway corridor.

- Recognize the role of the natural environment in air quality:

    - Consider a forest management plan for the SABE to identify and protect woodlands and other existing trees to support energy efficiency and pollution abatement in new development, and including a long-term community tree canopy target to ensure adequate room for mature trees can be accommodated in new development.

ii. Town of Caledon Town-wide Official Plan Policies

Results of the analysis of energy and emissions reduction in the planning framework may apply to the Town of Caledon generally, beyond the secondary planning process. Recommendations include:

- Develop a Green Development Standard.

    - Such standard could require reduced energy loads, passive building designs and provide low carbon or renewable energy sources.

- Establish a definition of a net-zero community.

- Investigate the use of development charges and other finance tools, for example through a Community Improvement Plan, to support policy goals.

- Provide direction through the development and regular update of a Community Energy and Emissions Reduction Plan, drawing together existing work undertaken by the Town, that:

    - Includes an assessment of current energy use and mix in Caledon.

- Develops and maintains a comprehensive greenhouse gas inventory that measures, analyzes and reports on emission levels in the community and evaluates the progress toward reduction targets on a routine basis. The method and template for the inventory should be established by the Region for each of the local area municipalities to use.
- Models baseline energy use of built form and transportation within the desired range of choices for built form and transportation within Caledon.
- Considers the production of energy through a diverse range of choices on a community and site-scale basis.
- Considers energy in the residential and non-residential water supply and wastewater treatment.
- Recognizes the role of the natural heritage system and tree cover in carbon sequestration. By quantifying ecosystem services, other policies with respect to the benefits of natural heritage, parks, and tree cover can be supported.

- Continue and enhance partnerships with senior, regional and local governments, public agencies, community organizations, businesses and individuals for the efficient and effective coordination of energy and emissions reduction plans, policies and initiatives.

The recommendations from this report are intended to support the long-term development of the SABE as the Region of Peel and the Town of Caledon continue to plan for the transition to low-carbon and net-zero communities.

APPENDIX A:

POLICY CONTEXT

APPENDIX A: POLICY CONTEXT

Ontario, through legislation, land use policies and plans, provides direction to the Region of Peel and its local municipalities in preparing their own policies and plans to guide development and change. Municipalities are required to address energy and emissions-related policy objectives identified by the Province. In the land use planning process, policies must be consistent with the requirements of the *Planning Act*, Provincial Policy Statement (PPS) and other Provincial land use plans, including the Growth Plan and the Greenbelt Plan.

Figure 5 below provides a schematic representative of land use plans and policies in the Province. As shown, provincial policies and plans provide strategic land use policy direction. Upper and lower-tier municipalities create official plan policies that are consistent with provincial plans and policies. Official plans are informed by various master plans (e.g., infrastructure, green space and natural heritage, climate change) and area-specific secondary plans (which may include design guidelines, transit-oriented development guidelines). Together these inform detailed and site-specific land use regulation through municipal zoning by-laws and implementation through the development application and review process.

The following sections described relevant land use policies and plans with a focus on energy and emissions.

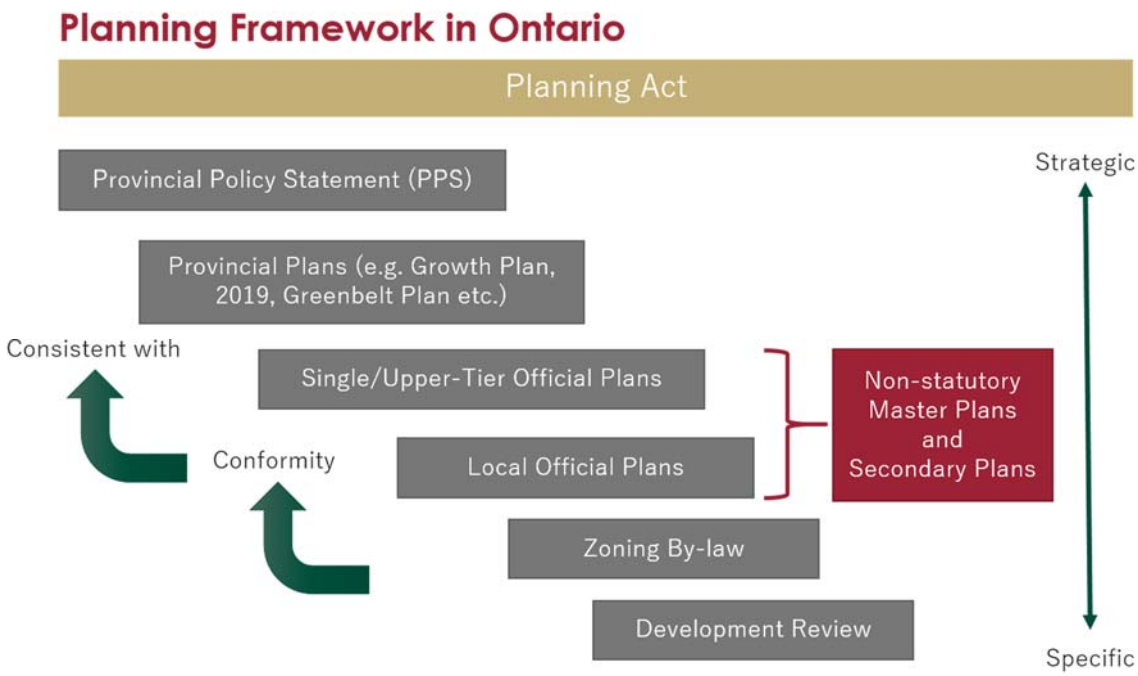

Figure 5: Planning Framework in Ontario. Source: Hemson Consulting

A. PROVINCIAL LAND USE LEGISLATION AND PLANS

i. Planning Act, 1990

The Planning Act (herein referred to as the "Act") is the central piece of legislation that guides land use planning in Ontario. Section 2 of the Act identifies matters of provincial interest and requires that the council of a municipality have regard to these matters when carrying out responsibilities required by the legislation. Climate change and energy are matters of Provincial interest.

Section 2(e) – Provincial Interest

Matters of provincial interest include *"the supply, efficient use and conservation of energy and water".*

Section 2(s) – Provincial Interest

"the mitigation of greenhouse gas emissions and adaptation to a changing climate"

Section 28(1)(7.1) - Community Improvement Plans

The Act allows municipalities to develop Community Improvement Plans (CIP) to facilitate the maintenance, rehabilitation, development and redevelopment of targeted areas. The establishment of a CIP allows a municipality to make grants, loans or tax/fee reductions to

facilitate a particular type of development. In accordance with section 28 of the Act, eligible costs include:

> *"...environmental site assessment, environmental remediation, development, redevelopment, construction and reconstruction of lands and buildings for rehabilitation purposes or for the provision of energy efficient uses, buildings, structures, works, improvements or facilities."* (section 28(7.1))

The *Planning Act* clearly establishes energy efficiency and conservation, and emissions reduction as part of the land use planning system.

ii. Provincial Policy Statement, 2020

The Provincial Policy Statement (PPS) provides provincial policy direction regarding matters such as land use, housing, environmental protection, agricultural lands, economic development and job creation, infrastructure and municipal servicing, and growth management. ROPA 2041 policies "shall be consistent with" the policies of the PPS.

Several sections of the PPS require planning authorities to consider climate change, air quality, ensure adequate energy supply, promote energy efficiencies and conservation, and minimize GHGs through efficient land use patterns. These policies are identified and briefly summarized below.

Section 1.1.3.2(e) – Settlement Areas
PPS provides direction relating to the treatment of land use patterns within settlement areas. Specifically, the policy requires that adverse impacts to air quality be minimized when planning for these areas.

Section 1.6.7.1 – Transportation Systems
PPS requires that energy efficient transportation systems should be provided to facilitate the movement of people and goods.

Section 1.6.11 – Energy Supply
Energy supply opportunities including *"electricity generation facilities and transmission and distribution systems, district energy, and renewable energy systems and alternative energy systems, to accommodate current and projected needs"* should be provided.

Section 1.7.1(j) – Long-Term Economic Prosperity
The long-term economic prosperity of municipalities should be supported by *"promoting energy conservation and providing opportunities for increased energy supply"*.

Section 1.8 – Energy Conservation, Air Quality and Climate Change

PPS states municipal planning authorities *"shall support energy conservation and efficiency, improved air quality, reduced greenhouse gas emissions, and preparing for the impacts of a changing climate through land use and development patterns",* which includes energy conservation and efficiencies through design interventions.

The guidance provided by the PPS clearly sets out policies in support of energy efficiency and conservation, and emissions reduction. The direction provided by the Province through the PPS directs the Region through its official plan to "promote" and "support" energy-related opportunities. The Region in declaring a "climate emergency" has already chosen to go beyond the minimum standards set by the PPS in terms of energy planning.

iii. Growth Plan for the Greater Golden Horseshoe, 2019

A Place to Grow: Growth Plan for the Greater Golden Horseshoe, 2019 (herein referred to as the "Growth Plan") is a provincial land use plan intended to be read in conjunction with the policy requirements of the PPS. However, if a conflict arises between these documents, the policies in the Growth Plan takes precedence. The Growth Plan provides specific policy direction for land use planning matters implemented by municipal Official Plans.

The Growth Plan has the intent, overall, of organizing the urban structure for the GGH into distinct areas to focus growth. Clearly, the link between climate change mitigation and the development of new communities is made through the Growth Plan. The concept of "complete communities" underpins the land use planning framework (Section 2.1). The complete communities planning approach is in sync with energy and emissions reduction by seeking to increase modal share of transit and active transportation (2.1) by concentrating everyday activities in full-service, mixed-use, higher-density areas, with the intent of reducing trip distances.

Energy use is linked to land use planning decisions throughout the Growth Plan. Infrastructure explicitly includes "electricity generation facilities, electricity transmission and distribution systems" giving the Region the policy direction to integrate district energy and renewable energy production into Peel 2041+.

The Region is forecast to grow substantially, which is why a new urban area is being planned under Peel 2041+. After considering opportunities to direct the future population and jobs to locate within existing cities and settlements areas in the Region, the land needs assessment concluded that more land will be needed in the future for places to live and work as the Region is required by the Growth Plan to plan for the number of people and jobs in the forecast.

We see an opportunity in the SABE process, however, for the Region to plan for a new net-zero community. The Growth Plan policies support aggressive planning to mitigate climate change through complete communities and integrated energy planning.

The following identifies sections of the Growth Plan that are relevant to climate change and energy management:

Section 2.2.1.4 Policies for Where and How to Grow: Managing Growth

f) mitigate and adapt to climate change impacts, improve resilience and reduce greenhouse gas emissions, and contribute to environmental sustainability

3.2.2 Policies for Infrastructure to Support Growth: Transportation & Moving People

The transportation system within the GGH will be planned and managed to:

2 c) *be sustainable and reduce greenhouse gas emissions by encouraging the most financially and environmentally appropriate mode for trip- making and supporting the use of zero- and low-emission vehicles*

3) *In the design, refurbishment, or reconstruction of the existing and planned street network, a complete streets approach will be adopted that ensures the needs and safety of all road users are considered and appropriately* [where complete streets are defined as: *Streets planned to balance the needs of all road users, including pedestrians, cyclists, transit-users, and motorists*]

Section 4.2.9 (b)(d)(e) – A Culture of Conservation
Municipal official plan policies and other strategies must support energy conservation objectives for existing buildings and planned developments (including municipal owned facilitates). More specifically, energy conservation will be achieved through:

> *i. identification of opportunities for conservation, energy efficiency and demand management, as well as district energy generation, renewable energy systems and alternative energy systems and distribution through community, municipal, and regional energy planning processes, and in the development of conservation and demand management plans;*
>
> *ii. land use patterns and urban design standards that support energy efficiency and demand reductions, and opportunities for alternative energy systems, including district energy systems; and*

iii. other conservation, energy efficiency and demand management techniques to use energy wisely as well as reduce consumption; (section 4.2.9(b))

Other conservation objectives include opportunities to harness energy created by waste (section 4.2.9(e)).

Section 4.2.10(2)(a) – Climate Change

In order to address the impacts of climate change, municipalities are encouraged to develop GHG emissions reduction strategies and improve resilience through land use and infrastructure planning (including energy infrastructure).

iv. Greenbelt Plan, 2019

The Natural Heritage System of the Protected Countryside in the Greenbelt Plan extends through the FSA along the tributaries of the West Humber River. The Greenbelt Plan provides permanent protection to the ecological and hydrological features, areas and functions within this area.

The climate change policies of the Protected Countryside (1.2.2.6) promote protection of the carbon sequestration potential of lands in the Natural Heritage System. Carbon storage is an ecosystem services provided by the Natural Heritage System (3.2.1).

Greenhouse gas emissions can be offset by carbon sinks found in the Greenbelt, which can include agricultural lands, green infrastructure and other natural areas (Section 1.1). In terms of Peel 2041+, the goal of net-zero communities may count carbon offsets provided by the Natural Heritage System. The Greenbelt Plan Area land use designations as well as the Region's natural heritage system is shown in Schedule D3 of the Region's 2018 ROP, shown in Figure 6.[38]

[38] The appealed version of Schedule D3 is used as it shows the Bolton Residential Expansion Area, which was adopted by Regional Council and is currently under appeal. For the purposes of the SABE analysis, these lands are not included in the 1,300 ha land need.

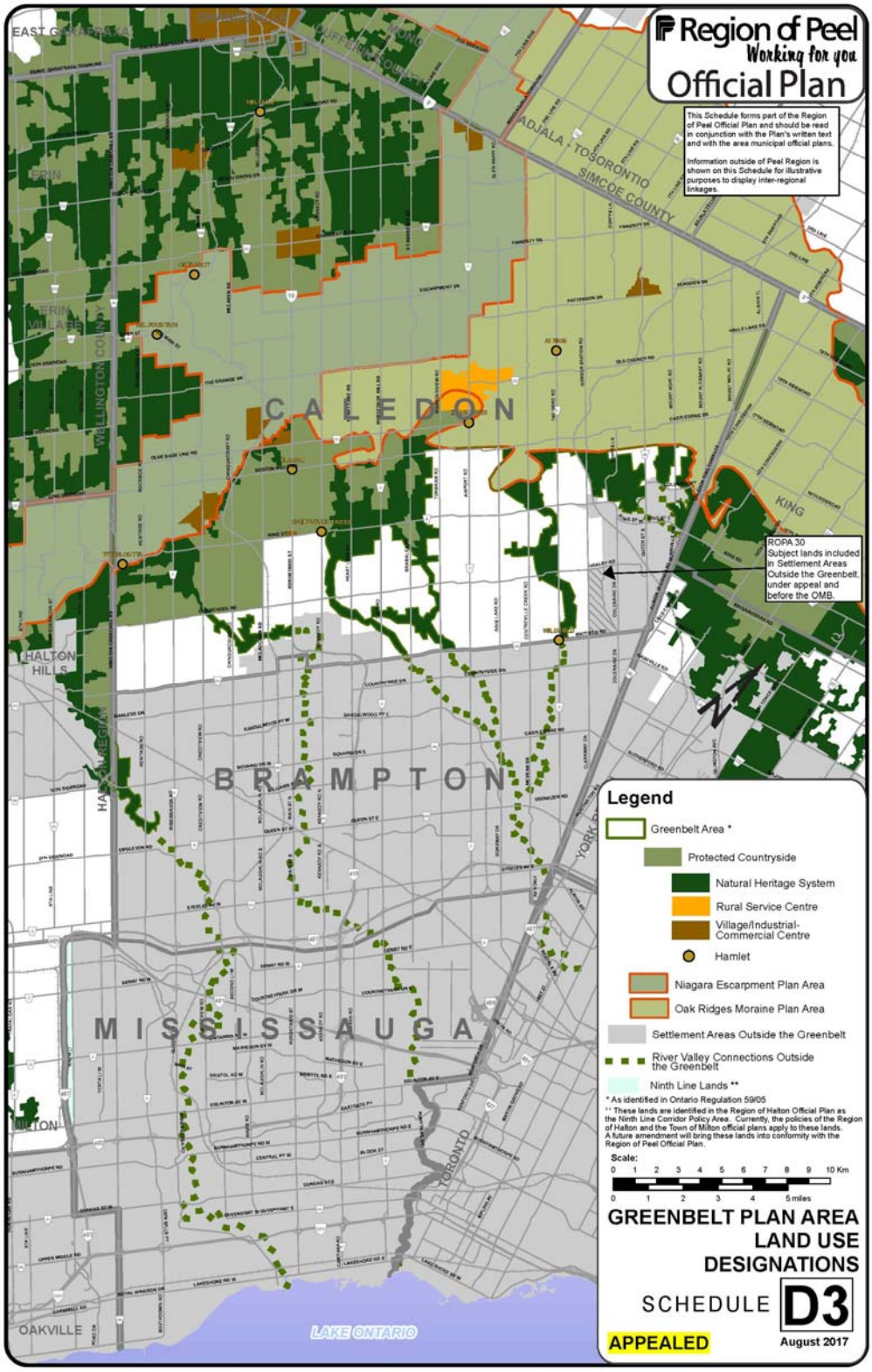

Figure 6: Peel 2018 ROP Greenbelt Plan Area Land Use Designations. Source: Region of Peel

v. Green Energy Act, 2009 and Green Energy Repeal Act, 2019:

In 2019 the *Green Energy Act, 2009* was repealed by the *Green Energy Repeal Act, 2019.* This resulted in changes to the Planning Act providing greater power to municipalities around the siting of renewable energy projects, including the power to reject proposed projects like wind turbines, the location of which is often contentious. As a result of these changes, municipalities now have the authority to implement policies for energy conservation and renewable energy in accordance with the PPS and the Growth Plan and may influence requirements for energy distributions. Public concerns relating to renewable energy projects (e.g., noise, water quality, flicker and other nuisances) will need to be addressed.

Peel 2041+ policies will have to address the Province's updated legislation. Section 3.7.2.16 of the Region's 2018 Consolidated Official Plan related to the location of renewable energy facilities will be especially important to guide Council in making decisions with respect to siting.

B. REGION OF PEEL

Land use planning in Peel is guided by Regional Official Plan policies. The Official Plan ensures growth is coordinated in a way that meets the needs of the community, guides how land may be developed and used, the location of major infrastructure investments, and provides a policy framework for other land use planning documents like zoning by-laws.

The objectives of the Region's current and proposed Official Plan policies are supported through discussion papers, master plans and strategies. These documents provide guidance on strategic actions to support future development in the Region. The following summarizes the Region's relevant plans and policies.

i. Region of Peel Consolidated Official Plan, 2018

The Region's Official Plan includes policies that support energy conservation and emission reductions through efficient land use patterns and infrastructure planning including transportation and renewable energy systems. The Official Plan policies are consistent with the PPS, Growth Plan and Greenbelt Plan.

It is important to note that in early December 2019, a staff report was brought forward to Regional Council containing the draft Peel 2041+ policies for Environmental, Agricultural

and Rural Systems.[39] The Region has initiated informal public consultation of these policies, which includes consultation with area municipalities. The draft policies propose changes to the current 2018 ROP including section 3.7 Energy Resources.

Findings from this study will be used to inform the Region's policy framework, including the policies brought forward as part of Peel 2041+. Chapter 7 of this study describes the SABE and Peel 2041+ recommendations. Draft Peel 2041+ policies are discussed in this section.

Section 3.7 – Energy Resources

Section 3.7 of the Region's Official Plan contains several energy and emissions objectives including promoting energy efficient land use and development patterns; reducing GHG emissions to develop healthier communities; and fostering a culture of conversion that supports energy conservation and reduced emissions from vehicles. A brief summary of these objectives and associated actions required to achieve those objectives are outlined below:

Policy	Summary of Description and Actions
Section 3.7.2.1 – 3.7.2.5 Energy Conservation	▪ Create appropriate land use and development patterns that are transit-supportive, site and building designs and promote opportunities for district energy. ▪ Encourage area municipalities to incorporate policies on energy efficient building and landscape design and construction practices into their Official Plans. Examples include maximizing the use of solar and wind energy. ▪ Achieve energy efficiencies through policies promoting creation of greenspaces (e.g., green roofs, white roofs, and the use of urban tree canopy). ▪ Promote energy conservation through public awareness and education initiatives as well as water conservation measures and stormwater management practices.
Section 3.7.2.6 – 3.7.2.10 Energy Efficiency Programs	Create programs to: ▪ Conserve energy and improve efficiency; ▪ Retrofit buildings, including buildings owned by the Region, and encourage local municipalities to do the same; ▪ Support district energy systems such as cogeneration and geothermal systems;

[39] Region of Peel. (2019). Draft Environmental Related Focus Area Policies. Retrieved from https://www.peelregion.ca/officialplan/review/pdf/draft-environment%20-related-focus-are-policies.pdf

Policy	Summary of Description and Actions
	▪ Use electric, hybrid and alternative fuel for Regional vehicles; ▪ Encourage local area municipalities to implement incentive programs that reward residents/employers for investing in energy efficient technologies, and reducing consumption.
Section 3.7.2.11 – 15 and 3.7.2.19 Energy Diversity	Investigate in collaboration with area municipalities and other organizations: ▪ The need, feasibility, implications and suitable locations for solar, wind, and bio-energy projects and to promote local clean energy generation. ▪ The need to permit the installation of individual generating systems as accessory structures to reduce on-site consumption of utility supplied power. Promote, in collaboration with area municipalities and other organizations, the following: ▪ Individual generating systems as accessory structures in appropriate locations, ▪ Alternative energy generation facilities in the Prime Agricultural Area and other suitable areas. Encourage area municipalities to: ▪ Include criteria in their official plans and zoning by-laws for evaluating alternative energy system proposals, including location and land use compatibility.
Section 3.7.2.16 – Location of Utility Corridors and Generation Plants	Work with area municipalities, the Province and other agencies: ▪ In planning for the future expansion and location of power supply services and communication systems servicing the Region. ▪ Strategic infrastructure study areas well in advance of development to accommodate load growth resulting from projected growth in the population and the economy. (Adopted ROPA 20) (currently under appeal). Encourage area municipalities in conjunction with the Region and energy providers: ▪ To identify in their official plans, utility corridors for the transmission of energy, communication and the movement of people and goods to meet current and projected needs.

Other relevant sections of the Region's Official Plan are described in the following table:

Policy	Summary of Description and Actions
Section 5.8 – Housing	▪ Objective is to promote energy conservation and energy efficiency in new and existing homes using supportive technologies.
Section 5.9 – Transportation	▪ General objectives are to create a sustainable transportation system, improving efficiencies and reducing emissions through public transit and active transportation. ▪ The link between the high volume of vehicle trips in and through the Region is addressed in 5.9.8 Environmental Impact
Section 6.5 – Energy from Waste	▪ Recover and maximize resources (e.g., energy) from the residual waste stream generated within the Region prior to final disposal. ▪ Monitor and evaluate technology developments and consider options for recovering energy from waste on an on-going basis. ▪ Consult with appropriate parties (e.g., Provincial agencies) prior to the expansion of an existing, or the development of a new, waste management facility that produces energy from renewable sources. ▪ Encourage similar policies be developed by area municipalities.
Section 7.7.2.15 – Regional Planning Initiatives	▪ Study jointly with area municipalities, the Province, hydro utilities and private power generating companies, the potential of broadening the role of the Region to own and/or operate district energy systems.

ii. Official Plan, Draft Environment Related Focus Area Policies, December 2019

The Region has released draft environmental Official Plan policies for consultation as part of the Peel 2041+ process. The Region has identified a goal of becoming a more resilient and low-carbon community. This goal is achieved through several objectives including supporting "the development of sustainable, low-carbon, compact, mixed-use, and transit supportive communities…" (2.2.3.2.1 Climate System).[40]

In particular, it is proposed that the Region support:

[40] Region of Peel. (2019). Official Plan Consolidation, Draft Environmental Policies. Retrieved from https://www.peelregion.ca/officialplan/review/pdf/draft-environment%20-related-focus-are-policies.pdf

> "energy conservation and efficiency and low-carbon energy alternatives in buildings and planned development through community energy and emissions reduction planning initiatives, the development of sustainable site and building design standards and guidelines, and through the development of alternative and renewable energy systems, including district energy systems" (3.6.2.3 Energy Conservation and Efficiency).

There is also policy support to achieve "net-zero carbon buildings":

> "direct the area municipalities to incorporate policies in their official plans to require sustainable site and building design and construction practices, including policies, guidelines and standards that encourage energy performance exceeding the Ontario Building Code, where possible, and that work toward the objective of achieving net-zero carbon buildings. The policies, guidelines and standards should incorporate a range of measures to promote energy conservation and efficiency, the installation of alternative and renewable energy systems, water conservation, and orienting buildings and planting vegetation to maximize the use of solar and wind energy." (3.6.2.4 Energy Conservation and Efficiency).

iii. Climate Change Discussion Paper, 2018

As part of the Region's current Peel 2041+ process, staff prepared a Climate Change Discussion Paper. This document provides a summary of the current and proposed Regional Official Plan policies related to climate change, including energy and emissions. Of particular relevance, the report identifies the Region's GHG emissions reduction target of 80% below 1990 levels by 2050.

Recommendations for land use planning actions that support energy conservation, efficiency and the reduction of GHG emissions are also described. Of particular relevance to the development of new greenfield lands is supporting the development of district energy systems, promoting renewable energy opportunities in new development and promoting the transition to low-carbon and/or electric vehicles. Through the promotion of district energy systems, coupled with policy which support building-scale renewable energy sources, this will allow the creation of low-carbon communities in new growth areas.

iv. Peel Climate Change Master Plan 2020–2030

Recently, the Region prepared a Climate Change Master Plan which provides strategic direction to Regional government to respond to climate change through a series of actions

and related activities to achieve desired outcomes. These outcomes largely align and build upon the outcomes of the Region's 2011/2012 Community Climate Change Strategy.

One of the primary outcomes identified in the Master Plan is to reduce emissions in Regional operations. Actions required to achieve this objective include the following:

These actions are particularly relevant in the SABE analysis as the Region's responsibilities with respect to new greenfield areas can be designed to incorporate these actions at early stages in the planning process.

v. 2011/2012 Peel Community Climate Change Strategy

The Region's 2011/2012 Community Climate Change Strategy was adopted by Council in 2011 and identified three outcomes to be achieved through six goals related to climate change activities, which included emissions reduction.

The primary goals of the Strategy were to prioritize and coordinate climate change actions administered by the Peel Climate Change Partnership (PCCP), a joint partnership of the Region's area municipalities and local Conservation Authorities. The objectives provided a foundation for other planning documents in the Region, including the recent Climate Change Master Plan.

The PCCP's three priority strategies are set out in the current Terms of Reference (2018-2022)[41] as follows:

- Low Carbon Communities Strategy – The electric vehicle changing station infrastructure network is being expanded (installation of 48 electric vehicle charging stations across 12 sites in Peel region over the next 18 months).
- Green/Natural Infrastructure Strategy – Tree planting in heat vulnerable neighbourhoods is being enhanced, including street tree planting and stewardship efforts in Caledon (Mayfield Rd/Hwy 50).
- Flood Resiliency Strategy – A new tool to determine the risk and return on investment of flood mitigation measures will be available to Partners and shared with other municipalities. The tool is in phased-development and prioritizes investments based on risk-mapping and opportunities to mitigate existing and increased flood risks due to climate change.

Future topics of interest for the PCCP include:

- Low carbon district energy
- Green Development Standards; and
- Financing mechanisms for building retrofits.

vi. Region of Peel Long Range Transportation Plan

Let's Move Peel, the Region's 2019 Long Range Transportation Plan, addresses the challenges of reducing emissions produced by transportation in Peel. The report describes the nature of the challenge with respect to current emissions levels and the need to reduce the modal share of cars to 50% by 2041 through transportation demand management and encouraging a wide variety of initiatives to promote active transportation which are outlined in the Sustainable Transportation Strategies, 2018. This is shown schematically in Figure 7 below.

As part of the Peel 2041+ transportation focus area, the transportation policies in the ROP are being updated.

[41] Regional Council Report, February 27, 2020, including February 14, 2020 Peel Climate Change Partnership Terms of Reference 2018–2022. Retrieved from: https://www.peelregion.ca/council/agendas/2020.asp

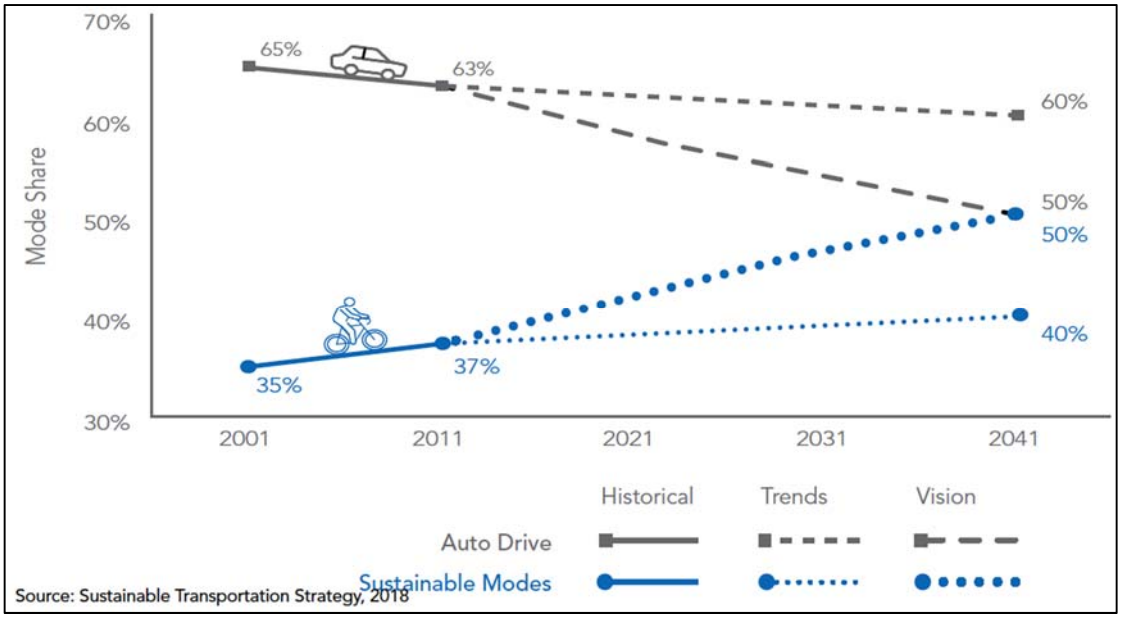

Figure 7: Mode Share "Vision" and "Trends" Target for Peel Region in 2041 (AM Peak Period)
Source: Peel Long Range Transportation Plan 2019, p. 33

Peel is serviced by three GO Transit lines, including 12 rail station stops. Trips that originate from Peel are largely self-contained, as over half of the trips that begin in and end in Peel (p. 15). Active transportation strategies from the Long Range Transportation Plan report include (p. 36):

1. Provide infrastructure that supports active transportation as a viable travel option;
2. Develop policies that facilitate active transportation; and
3. Build programs to promote and encourage walking or cycling as preferred modes

The Plan makes the case for the transition away from driving cars but does not estimate the potential impact of electric vehicles on emissions reductions.

C. TOWN OF CALEDON

While the Region's Official Plan is intended to provide broad strategic policy direction related to regional services and structure, the Town's Official Plan provides local strategic policy direction for land use planning. Similar to the Region, the Town is also in the process of completing an Official Plan update (referred to as the "Future Caledon" Official Plan

Review). The Town is currently in the "Information and Visioning" stage, with a new Official Plan anticipated to be completed and approved in 2022.[42]

We recognize that the Town is also in the process of updating its Community Climate Change Action Plan. It is expected that findings from this plan will influence future planning decisions by the Town, including the new SABE settlement area identified through ROPA 2041. Other important strategic plans related to energy and emissions include the Residential Energy Use Mapping and Forecasting Study, 2016 and Corporate GHG Framework 2019–2024. The Town has also made significant progress in identifying future renewable energy sources and is currently in the process of completing a Renewable Energy Potential Study.

i. Town of Caledon Consolidated Official Plan, 2018

The following table summarizes the relevant policies included in the Town's Official Plan as it relates to energy and emissions.

Policy	Summary of Description and Actions
Section 3.1.3.8 – Climate Change	▪ The Town may consider supporting Region of Peel energy-from-waste initiatives, which have the effect of reducing the reliance on traditional fossil fuel-based sources of energy and their associated greenhouse gas emissions, subject to local planning considerations such as land use compatibility and the protection of resources.
Section 3.1.3.9 – Conservation of Water and Energy	The Town shall: ▪ facilitate the conservation of water and energy through land use planning by exploring and implementing, as appropriate, progressive water and energy conservation, efficiency and re-use techniques through all levels of the development approvals process and through feasible innovative building designs. ▪ encourage proponents of new development to consider energy conservation measures derived by the planning and design for the orientation of streets and buildings to maximize exposure to the sun (passive solar energy), and green design for buildings. ▪ encourage proponents of new development to explore innovative land use patterns, building standards, transportation systems

[42] Town of Caledon. (n.d.). Future Caledon Official Plan Review. Retrieved from https://future.caledon.ca/official-plan-review

Policy	Summary of Description and Actions
	and urban design that will significantly reduce the overall demand for energy. ▪ collaborate with the Region of Peel and Conservation Authorities to work towards implementing the recommendations of completed watershed and sub-watershed plans, and other documents/strategies that address the conservation of energy and water.
Section 3.1.3.10 – Alternative Energy Systems	▪ The Town may consider supporting and promoting the development of alternative and renewable energy systems, subject to compatibility with surrounding land uses and consideration of the effect of the energy systems on the human and natural environment. The Town will: ▪ work with and participate in Region of Peel initiatives to promote alternative and renewable forms of energy and energy conservation practices, and develop criteria for evaluating the use of alternative and renewable energy systems having regards for their location, land use compatibility and potential impacts on human and natural environments. ▪ work with proponents of new development and redevelopment projects to promote compact, mixed-use neighbourhood development patterns that incorporate and enhance opportunities for the use of alternative and renewable energy systems, where appropriate, such as passive and active solar energy, geothermal, wind power, district heating systems and new technologies as they become available. ▪ consider developing and implementing green-building guidelines which, among other things, facilitate the incorporation of alternative and renewable energy systems into new buildings and through retrofits to existing buildings.

ii. Caledon Community Climate Action Plan, 2011

The Town's Community Climate Action Plan was completed in 2011 and is in the process of being updated. The plan was developed to support the Town's commitments as an active member of the Partners for Climate Protection (PCP) managed by the Federation of Canadian Municipalities. Recognizing that energy consumption significantly contributes to the Town's inventory of GHG emissions, the Plan identified actions and targets relating to energy efficiency and supply for residential and non-residential sectors.[43]

The actions identified in the Town's Community Climate Action Plan will help inform policy decisions to achieve energy conservation and efficiency as well as reduced GHG emissions. The development of such actions may also lend itself to the creation of enhanced urban design guidelines.

iii. Other Relevant Documents

The following table provides a brief summary of other documents that support the Town's energy conservation and efficiency objectives, including the GHG emissions reduction target.

Document	Key Findings
Residential Energy Use Mapping and Forecasting Study, 2016	▪ The report examined 3–4 scenarios which tested energy conservation and efficiency policy options. ▪ Sensitivity testing of the scenarios concluded that a 50% intensification target and having a unit mix of higher-medium to high-density resulted in significant reductions of energy use when compared to a base case scenario. Other policy areas that have a significant impact to reduce energy use include: retrofitting buildings constructed after 1990 with new technology to support energy efficiencies; the construction of new buildings that are connected to net-zero energy systems, and fuel switching houses that don't have access to natural gas to geothermal heating and cooling. ▪ The Discussions and Results in Section 3.4 of the report concluded that new greenfield areas (i.e., areas dominated by newer buildings with limited existing older building stock)

[43] Town of Caledon. (2011). *Climate Change Action Plan*. Retrieved from https://www.caledon.ca/en/townhall/resources/environment/CommunityClimateChangeActionPlan.pdf

Document	Key Findings
	would see the greatest reduction in energy use as policy changes could be introduced earlier on in the development process.
Corporate GHG Framework 2019–2024	▪ Building on the legislative requirement for municipalities to submit annual facility energy consumption and greenhouse gas (GHG) emissions data, the Town has developed a framework to further facilitate a reduction in GHG emissions. ▪ Consistent with the Region, the Town's largest contributor of GHGs relates to buildings and facilities. ▪ The overarching goal of the framework is to reduce the Town's corporate GHG emissions by an additional 24% by 2024. This will be achieved, in part, through high-performance energy targets for new buildings and energy efficiencies through retrofits.
Renewable Energy Potential Study (underway)	▪ The Town recently partnered with the University of Guelph to conduct a Renewable Energy Potential Study in accordance with the *Mapping Opportunities for Renewable Energy: A Guidebook*.[44] ▪ The study will be used to identify theoretical sites for large scale renewable energy projects (e.g., ground-mount solar) and comment on the policy, planning, technical, financial, and community feasibility of such projects. ▪ Recommendations will be used to identify opportunities and potential impacts of the renewable energy projects and land use planning impacts.

D. RELEVANT PROVINCIAL PLANS, PROTOCOLS AND GUIDELINES

In addition to local policies and plans, the Province of Ontario provides direction to municipalities through plans and guidelines. Other resources include a global protocol to develop GHG emission inventories. This information is useful to inform local energy and emissions policies.

[44]CEKAP. (2019). *Mapping Opportunities for Renewable Energy: A Guidebook*. Retrieved from https://www.cekap.ca/PDF/resources-mapping-opportunities-for-renewable-energy-a-guidebook.pdf

i. Made-in-Ontario Environment Plan, 2018

In late 2018, the Province released the *Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan*.[45] The Plan is intended to protect air as well as land and water resources, reduce waste, reduce GHG emissions and help communities prepare for climate change.

According to the Plan, *"about 75% of Ontario's greenhouse gas emissions come from using energy in our homes, buildings, vehicles and industry while 4% comes from waste"*. The transportation sector emit 38% of Ontario's GHG emissions largely due to the majority of vehicles use fossil fuels. This is compounded by Ontario's rapid growth rate which has resulted in additional vehicles added to the road network. In contrast, buildings represent 19% of Ontario's emissions. Changes to the Building Code are expected to reduce building emissions, particularly in new construction. For example, the current standards in the Building Code require that homes constructed after 2017 use 50% less energy than houses built prior to 2005. Importantly, existing building code standards are expected to be enhanced within the next 10-years as the Federal Government, as outlined in the Pan-Canadian Framework on Clean Growth and Climate Change, has committed to developing a net-zero energy ready building code by 2030.[46]

The importance of access to clean renewable energy sources is also recognized by the Province. The Plan will support low-carbon energy options (e.g., natural gas) as a preferred fuel source for homes, businesses and trucking industries.

While this Plan does not directly impact Peel 2041+, the strategic priorities generally support a low-carbon transition in Peel over the short and intermediate term. For example, Provincial program aimed to support energy efficiencies in existing homes will lower GHG emissions within existing settlement areas.

ii. Community Emissions Reduction Planning: A Guide for Municipalities, 2018

The Guide was prepared in 2018 by the former Ministry of Environment and Climate Change. It is intended to help municipalities develop energy and emissions plans that support provincial land-use planning policy objectives.

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[45] Ministry of Environment, Conservation and Parks. (2018). *A Made-in-Ontario Environment Plan*. Retrieved from https://prod-environmental-registry.s3.amazonaws.com/2018-11/EnvironmentPlan.pdf

[46] Government of Canada. (2016). *Pan-Canadian Framework on Clean Growth and Climate Change*. Retrieved from http://publications.gc.ca/collections/collection_2017/eccc/En4-294-2016-eng.pdf

Municipalities are described as having a pivotal role in reducing GHG emissions through land use planning and energy decisions. The Guide describes municipalities as energy consumers through the operation of municipal buildings and fleet, as investors through infrastructure investments in clean energy systems and partnerships, and as influencers through land use planning policies in Official Plans.

The Guide outlines six stages to a "low-carbon municipality" shown in Figure 8 below. The Region is well on its way through these steps, undertaking a collaborative effort through PCCP and in preparing the plans and strategies reviewed above.

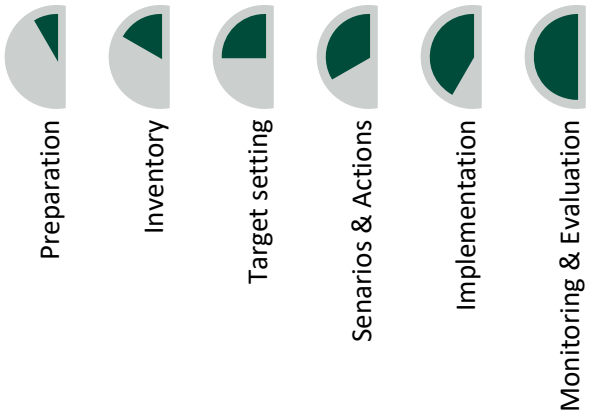

Figure 8: Six Stages to Low-Carbon Municipality, Source: Ministry of Environment and Climate Change

[does it adequately handle planning for new greenfield development that can be used here? Does the guide provide a framework that can be adapted or is there a need for more specific direction for planning greenfield development?]

iii. Mapping Opportunities for Renewable Energy: A Guidebook, 2019

This document provides guidance to municipalities on how to facilitate the transition from fossil-fuels to land-based renewable energy infrastructure including ground-mounted solar panels, wind farms and the incineration of biomass (e.g., corn stover, straw, and woody materials). The approach recognizes that these energy sources present opportunities as well as potential negative impacts.[47]

[47] CEKAP. (2019). Mapping opportunities for land-based renewable energy generation in Ontario: a guidebook for local planners and analysts. Retrieved from https://www.cekap.ca/PDF/resources-mapping-opportunities-for-renewable-energy-a-guidebook.pdf

The guidebook provides municipalities with necessary tools to educate and consult with the public on proposed renewable energy infrastructure projects. Examples of tools include an inventory of renewable energy infrastructure in Ontario, GIS model and MS-Excel templates to complete a detailed inventory, a public consultation framework, etc.

The guide uses the Region of Peel as a case study to provide examples of methods and outputs. The mapping shows opportunities for renewable wind and solar projects are limited to the northern edges of the regional municipality as the methodology distances infrastructure away from settled areas. For the SABE study, the methodology would have to be reconsidered to map the potential for smaller projects. However, southern Caledon is not identified as an area with high wind potential. As for the whole region, Caledon is on the low end of solar energy, requiring large areas for "utility scale" photovoltaics, which are not recommended for installation on prime agricultural land. The guidebook excludes existing urban areas and does not provide guidance for new greenfield communities.

iv. GPC Protocol: Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories

Globally, municipalities are heavy energy users and are responsible for 70% of all GHG emissions.[48] Creating an inventory of GHG emissions by sector allows municipalities to develop mitigation goals that reflect the unique circumstances of each community. Through data gathering, the performance of identified goals can be tracked and monitored over time.

The GPC Protocol provides a standard approach to inventory GHG emissions across municipalities. This includes identifying six sectors of stationary energy: transportation; waste; industrial processes and product uses; agriculture, forestry, and other land uses and other emissions related to municipal activities created outside of the municipal boundaries. The categorization of emissions allows for common reporting between different jurisdictions of lower- and upper-tier municipalities, provinces and national levels.

The protocol is currently being used by the Region to establish its *2016 Peel Community GHG Inventory Update*. Findings from the inventory will be used to inform future GHG emission reduction targets. However, from past inventories, both by the Region and the Town of Caledon, it is clear that a very aggressive approach will be needed.

[48] Greenhouse Gas Protocol. Retrieved from https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

APPENDIX B:

CASE STUDIES

APPENDIX B: CASE STUDIES

A. NEW LOW-CARBON AND/OR NET-ZERO EMISSIONS COMMUNITIES

The following case studies examine policies and infrastructure needed to achieve low-carbon or net-zero emissions. Both the West 5 development located in the City of London and the Greenfield Demonstration site in the City of Kitchener provide examples of new communities constructed within designated greenfield areas that are intended to be low-carbon or net-zero. In contrast, the City of Guelph Hart Village subdivision demonstrates how developers can participate in voluntary programs to reduce emissions and achieve higher energy efficiencies above the requirements of the building code.

i. London, Ontario – West 5

Relevance to SABE: West 5 is a good example of a new greenfield community designed to have exceptional energy efficiency. This project has been well-studied is generally representative of the proposed SABE development scenario. Therefore, providing important insight for the Region.

Description: West 5 is a new 28-hectare mixed-use greenfield development located in London, Ontario. The development has been designed from the ground-up to achieve net-zero energy meaning that the energy needs for buildings, transportation, and municipal services (including water and wastewater infrastructure as well as community facilities) are supplied by energy resources provided within the boundaries of the community. The development includes over 2,000 homes, 300,000 square feet of commercial space, and 100,000 square feet of office. The project is currently underway; however, some of the homes have already been constructed and are now occupied.

At the onset of the application process, the City did not have policies within its Official Plan to support the development of net-zero communities. This was rectified by the developer submitting a draft plan of subdivision that included amendments to the City's Official Plan and Zoning By-law. Subsequently, the OPA helped to inform new policies as part of the subsequent 2019 Official Plan update.[49] Section 717-744 of the City's Official Plan supports the development of a Green City Strategy including green jobs, mobility, development,

[49] City of London. (2019). The London Plan. Retrieved from https://www.london.ca/business/Planning-Development/Official-Plan/Pages/The-London-Plan-DL.aspx

infrastructure, energy and clean air, water and waste systems. Examples of such policies are provided below:

- **Green Development (section 729):** Wherever possible, new developments will be planned to be "future ready" to accommodate the future use of solar energy, electric vehicles, and (where applicable) district energy systems. Standards may be developed to require that neighbourhoods or individual buildings are developed to meet specific sustainability measures or standards.

- **Green Energy and Clean Air (section 737):** A Community Energy Action Plan may be prepared to form part of an overall strategy to implement more environmentally-friendly and affordable energy usage and enhance local air quality. This strategy will plan for and implement such things as energy conservation, energy efficient design, passive solar, strategic tree planting, waste heat utilization, and increased local, distributed production of energy through combined heat and power generation, solar thermal and photovoltaic, bioenergy and energy from waste.

- **Green Energy and Clean Air (section 738)** – District energy facilities and infrastructure, including expansion of existing district energy systems, will be encouraged for larger-scale redevelopment opportunities within the Primary Transit Area and Industrial Place Types.

- **Green Energy and Clean Air (Section 739)** – Large-scale (e.g. >500 kilowatt) wind turbines and solar energy facilities will be directed to locate in the Farmland Place Type, subject to the Green Energy and Green Economy Act. Smaller-scale roof-mounted and building integrated wind turbines and solar energy utilization will be installed in a fashion that is in conformity with the City Design policies of this Plan.

- **Green Energy and Clean Air (section 740)** - Opportunities for ground-sourced thermal energy use are encouraged in an effort to reduce overall energy production costs for redevelopment initiatives, including coordinated efforts to retrofit areas of urban neighbourhoods.

Key Findings: In 2019, the Federation of Canadian Municipalities (FCM) and S2E Technologies, completed an extensive case study review of the West 5 development.[50] The review identified several "lessons learned" including:

[50] FCM & S2E Technologies. (2019). Feasibility for Smart Energy Communities. Retrieved from https://s2etech.com/fcm-gmf/

- Consideration should be given to creating more standardized approaches and/or policies that prioritize sustainability—such as providing greater flexibility with zoning permissions—to allow developers to pursue sustainable development designs with minimal negotiations with the municipality.

- Design guidelines can conflict with sustainability objectives. In the West 5 example, urban design requirements for street-oriented buildings conflict with building orientation required for optimal solar panel arrangements (p. 145). Therefore, design should be used as guidelines, not policies, and applied at the appropriate scale (i.e., at the detailed architectural and/or engineering design phase).

- Innovative treatment of stormwater runoff should be supported. The developer of West 5 wanted to implement a net-zero water design that would allow for the site's water needs to "be met through the collection and appropriate treatment / management / use of rain water, and that this would also eliminate the need for otherwise typical stormwater management systems" (p. 146). However, this approach was not implemented as the City had already approved a more traditional approach and the approvals process for the net-zero water system would result in significant delays.

- Provincial politics can negatively impact the ability to facilitate the development of a net-zero community, particularly when it is constructed over a prolonged period of time. For example, the $377 million Green Ontario Fund rebate program introduced by the Ontario's Liberal government as an initiative to support sustainable building upgrades including the installation of solar PV and energy storage was later cancelled following the election of the Progressive Conservative Party.[51] As solar energy and related technologies can be influenced by provincial policies, this may lead a developer to avoid technologies that are at risk of losing political and funding support.

ii. Kitchener, Ontario – Greenfield Demonstration Site

Relevance to SABE: The Greenfield Demonstration site is another example of a new greenfield community designed to be low-carbon and is intended transition to net-zero overtime. Similar to the majority of the lands within the FSA, the site is currently agricultural and is adjacent to significant natural heritage features. The site also has good access to the City's existing road network as well as connections with the provincial highway system.

[51] Toronto Star. (June 20, 2018). Green Ontario cancellation leaves homeowners, industry scrambling. Retrieved from https://www.thestar.com/business/real_estate/2018/06/20/green-ontario-cancellation-leaves-homeowners-industry-scrambling.html

Description: The Greenfield Demonstration site is a 2.25-hectare piece of vacant agricultural land located in Kitchen's Designated Greenfield Area (DGA). The proposed development concept includes 460 residential units, approximately 11,250 m^2 of retail and approximately 4,350 m^2 of office space. As of 2019, the development was still in the conceptual master planning stage.

The development is supported by the objectives in Waterloo Region's Community Climate Change Action Plan, including the GHG emissions reductions targets for 2020.[52] The development will also be planned to reduce traffic, improve cycling infrastructure and ensure that adequate green space including parks.

Preliminary design concepts include achieving a low-carbon community while designing buildings to be "net-zero ready". A combined heat and power (CHP) district energy plant supplied by natural gas and on-site solar power is planned. Over time, an expansion of the CHP plant is planned to meet energy demands of future phases of community development with the expectation that natural gas would be replaced by syngas or renewable gas from biomass.[53]

Of importance, the infrastructure required to support the proposed district energy system will require access to the public right-of-way. Such access requires legal agreements between the City and the utility operator, which can be challenging.

Key Findings: FCM and S2E Technologies completed an extensive review of the proposed Greenfield Demonstration site. Findings from the review identified the importance of municipal access agreements, which allow private companies to have access to public rights-of-way, stating that such agreements should be structured to allow municipalities to retain ownership over public infrastructure while granting access to the district energy/utility provider. In particular, the analysis also noted that district energy systems are needed to achieve net-zero energy in high density developments as these buildings cannot be serviced solely by on-site renewables.

[52] Waterloo Region. (2013). A Climate Action Plan for Waterloo Region. Retrieved from https://climateactionwr.ca/wp-content/uploads/2019/12/ClimateActionPlanWaterlooRegion_Full_Nov2013.pdf

[53] FCM & S2E Technologies. (2019). Feasibility for Smart Energy Communities. Retrieved from https://s2etech.com/fcm-gmf/

iii. Guelph, Ontario – Hart Village

Relevance to SABE: Hart Village demonstrates the importance of voluntary programs that support energy conservation and efficiencies above and beyond the Ontario Building Code. As municipalities do not have the authority to require that building standards exceed the building code, Hart Village demonstrates the important of bottom-up policies and standards that can achieve GHG emissions reduction targets.

Description: Terra View Homes is a residential home builder in the City of Guelph. The builder's most recent project is Hart Village, a new residential 60-unit subdivision of single-detached homes located within the southern area of the City.

The homes in Hart Village are designed to be "net zero ready" meaning that all elements and construction material achieve maximum energy efficiency (e.g., insulation, extremely airtight). However, homes are not outfitted with photovoltaic systems from the onset—these are installed following occupancy of the unit if desired by the homeowner and are done so at an additional cost.

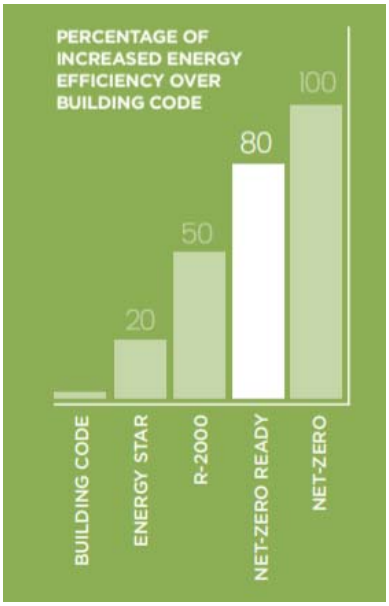

Figure 9: Net-Zero Ready Homes Energy Consumption Source: Terra View Homes

As shown in Figure 9, as a result of the design process and building material, "net zero ready" homes are 80% more energy efficient than homes constructed under the current requirements of the Building Code.[54] Such efficiencies are achieved through reduced heat loss; increased insulation values; less water wastage; heat recovery of exhausted air and waste water. Homes are designed to accommodate solar panels but are not included at the time of building construction. This allows "net-zero" to be achieved at a later point.

Key Findings: It is anticipated that by 2030, the Building Code will require all new development to be net-zero. In the interim, it is largely up to developers to construct such buildings. Although the construction cost of net-zero homes is higher than conventional homes built to current code standards,[55] the Terra View homes project demonstrates that reduced energy costs that can be saved over the long term.

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[54] Terra View Homes. (n.d.). Zero Compromise. Retrieved from http://www.terra-view.com/wp-content/uploads/2020/01/zerocompromise.pdf

[55] CEKAP (2017). *On the Path to Net-Zero Communities – Integrating Land Use and Energy Planning in Ontario Municipalities*. Retrieved from https://www.cekap.ca/resources/research-report-OCC_Full%20Report.pdf

Terra View Homes is an example of a developer who participates in voluntary building design standards which are over and above the requirements of the current Building Code. To date, Terra View has designed homes in accordance with Energy Star, GreenHouse, Built Green and LEED standards.

B. OFFICIAL PLANS AND SECONDARY PLANS

Official plans and secondary plans are important policy documents that guide land use planning. Policy support is required for net-zero communities, including renewable energy sources and district energy systems. At the secondary plan level, which provides more detailed policies for a defined geographic area, policy direction with respect to site densities and design elements may be included. Case studies of official plan and secondary plan policies are demonstrated through the cities of Ottawa, Guelph, Toronto and the Town of Halton Hills in Ontario, the Cities of Vancouver and Victoria in British Columbia.

i. Guelph, Ontario – Clair-Maltby Secondary Plan

Relevance to SABE: The Clair-Maltby Secondary Plan area provides a good example of how energy and utility policies can be incorporated during the Secondary Plan process. Clair-Maltby is designed to be low-carbon, with the potential to become net-zero overtime. This process is likely representative of what the Town of Caledon will need to undertake in planning for the SABE.

Description: Clair-Maltby is a planned 415 hectare low-carbon greenfield development in the City of Guelph. The City is currently in the process of developing the Secondary Plan for the new community, with completion anticipated in 2020.[56]

The Secondary Plan policies were informed by a series of reports including:

- Comprehensive Environmental Impact Study Characterization Report
- Water/Wastewater Servicing Study/Work Plan
- Stormwater Management Work Plan
- Phase 1 Energy and Other Utilities Study, and others.

The Energy and Other Utilities Study was guided by the objective to reduce energy use and GHGs as part of the Secondary Plan process—this included an examination of energy

[56] Amec Foster Wheeler. (2017). Clair-Maltby – Energy and Other Utilities Study – Background Report and Technical Work Plan (Phase 1). Retrieved from https://guelph.ca/wp-content/uploads/Energy-and-other-Utilities-Study-Component_Phase-1-Final-Updated.pdf

efficiency and management of the built environment and associated infrastructure, alternative clean energy sources, green transportation, and water conservation and efficiency.

The study involves two phases. Phase 1 Study was to assess City's current private and public energy consumption and usage available through Statistics Canada as well as to estimate GHG emissions to provide a baseline assessment. Phase 1 Study has been completed and identified several energy priorities to be further explored through Phase 2, which is currently underway.

Phase 1 included an analysis of natural gas and electricity consumption by sector (residential and non-residential) as well as a discussion of energy use by building age and type as informed by provincial-wide data. The analysis found that newer buildings age 1996 or later use less energy per square metre of heated area than existing buildings. Emphasis on the importance of public transit to reduce GHG emissions was also identified.

Key priority energy/water conservation and efficiency, and energy management-related action items were identified and will be studied further as part of Phase 2. Conclusions from the Phase 2 report will inform policies in the Clair-Maltby Master Environmental Servicing Plan and Secondary Plan, that will implement recommended measures to reduce energy impact and GHG emissions.

Phase 1 concluded with a terms of reference and technical work plan for Phase 2. The Phase 2 technical work plan is to be informed by the following community attributes identified in Phase 1:

- **Land use mix** – A mix of land uses, including affordable rental housing.
- **Density targets** – A minimum density target of 50 persons and jobs per hectare and public transit-supportive densities.
- **Land use patterns** – ensure patterns support viability for district energy implementation – includes consideration for underground infrastructure (e.g., heating and cooling pipes) needed to support a district energy system.
- **Site design** – ensure support for alternate modes of transportation (e.g., transit, cycling facilities, multi-modal transit etc.).
- **Reduced carbon footprint** – reduced energy and water consumption and reduced carbon footprint.
- **Renewable energy sources** – energy demand created on the site is met to some degree from alternative/renewable energy sources including biomass and solar panels on buildings.

- **Energy efficient infrastructure** – smart metering infrastructure for water and energy usage.
- **Zero emission vehicles** – increase adoption of zero-emissions vehicles (e.g., ensure there are adequate charging stations)

The technical work plan for Phase 2 will also include energy and emission scenario mapping informed by the above noted community attributes. Energy modelling will include a "business-as-usual" scenario related to the proposed community land uses and related transportation use and water consumption. This will be compared to a higher energy efficiency scenario which include building construction adhering to voluntary energy standards (e.g. ENERGY STAR and Net Zero Ready) and increased use of zero-emissions vehicles by the community. This exercise will inform the ultimate preferred community structure.

Key findings: From a policy perspective, the Clair-Maltby Secondary Plan provides insight to the technical process needed to develop land use policies that support energy conservation and efficiencies as well as reduced GHG emissions. The identification of community attributes, including land use mix, density targets, etc., demonstrates the importance of integrating energy and land use planning to achieve low-carbon and net-zero communities. Furthermore, energy modelling can help inform the development of preferred land use scenarios for a community.

ii. Halton Hills, Ontario – Vision Georgetown Secondary Plan

Relevance to SABE: The Vision Georgetown Secondary Plan provides an example of land use planning policies and considerations needed to achieve energy efficiencies and conservation. Similar to the Clair-Maltby case study, the Vision Georgetown Secondary Plan provides insight to the Secondary Plan process to be completed by the Town of Caledon for the SABE.

Description: In 2018, the Town of Halton Hills adopted Official Plan Amendment No. 32 Vision for the Georgetown Secondary Plan area, a 404-hectare agricultural site, which will accommodate 19,000 persons and 1,700 jobs beginning in 2021.[57]

Section 7 of the Plan outlined sustainable development objectives to be applied in developing and redeveloping land. This included compliance with the Town's Green Development Standards, which apply to all forms of the development in the Town and are

[57] Town of Halton Hills. (2018). By-law No. 2018-0048 – Vision Georgetown Secondary Plan. Retrieved from https://hub.haltonhills.ca/dept/PI/Website%20Documents/Final%20OPA%2032.pdf

used to advance policy objectives of the Town's Official Plan and relevant master plans (e.g., Green Plan, Cycling Master Plan, Community Sustainability Strategy, Community Energy Plan, Corporate Sustainable Building Policy etc.) and include energy reduction targets.

Section 7.3.3 of the secondary plan describes "Energy Efficiency and Production" requirements, which include examining the feasibility of establishing a combined heat and power plant and encouraging new developments to incorporate active and passive building design elements to reduce energy demand and ensure efficiencies. In order to achieve energy efficiencies and reductions, the Plan proposes the following:

- Municipal investment in programs and partnerships to promote energy efficiency and design.
- Passive building design and construction.
- Integrate renewable energy technologies into buildings while not detracting from the public realm.
- Showcase renewable energy production to promote their use and incorporate into building designs, where possible.
- Integrate active renewable energy production facilities on-site.
- Energy use reduction in accordance with Halton Hills Green Standards.
- Use building materials that reduce urban heat island effect and energy expenditure.
- Lighting within public areas (e.g., pedestrian and multi-use trails) should be powered via solar panels.
- Consider other energy sources such as "earth source" energy, passive solar design, building orientation, ventilation, increased insulation, photovoltaic panels, green roofs, cool roofs, and high-quality windows.

The Energy Masterplan, examined the feasibility of developing a district energy system in the Secondary Plan area, the technology needed to reduce the carbon footprint of development, and financial considerations. These considerations are as follows:[58]

- In order to assess how to best supply district energy to the area using a combined heat and power plant, three scenarios were developed. Scenario one was based on supplying district energy to the entirety of the site, scenario two assumed district energy would only supply medium-high density developments, and scenario three explored a small district energy system which would supply a small number of high-density units. The

[58] Arup Canada Inc. (2018). Town of Halton Hills, Vision Georgetown, Energy Masterplan. Retrieved from https://www.haltonhills.ca/visiongeorgetown/pdf/20180705_Vision%20Georgetown%20Energy%20Masterplan%20Revision.pdf

report recommended that the combined heat and power plant be sized to accommodate scenario three high-density demand based on cost implications.

- To assess technological needs, scenarios for net-zero emissions were developed based on varying sizes of district energy systems and levels of on-site solar renewables: moderate, aggressive, and reaching. The report concluded that the Town would likely use a combination of the scenarios recognizing that certain technologies may be needed to bridge the gap between scenarios in the future. The most viable strategies were moderate and reaching. Strategies deemed not viable included: wind turbines, anaerobic/biogas digester, waste-to-energy plant and wastewater heat as they required significant infrastructure investment.

- This is a very good report that reviews all the different types of alternative energy available and considers the alternatives based on the local context, including geography, policy context, and current level of energy use. However, the report did not indicate the need to secondary planning policy to support development of the preferred scenario.

- From a financial standpoint, the report recommended that the Town track available incentives and grants; undertake a financing strategy to ensure that the proposed system can be paid for; and explore partnerships with third party capital sources.

Key findings: Interestingly, a comparison of the emissions scenarios to the Town's Green Development Standards, shown in Figure 10 below, suggests that the standards should be further amended in order to achieve "moderate" GHG reductions.

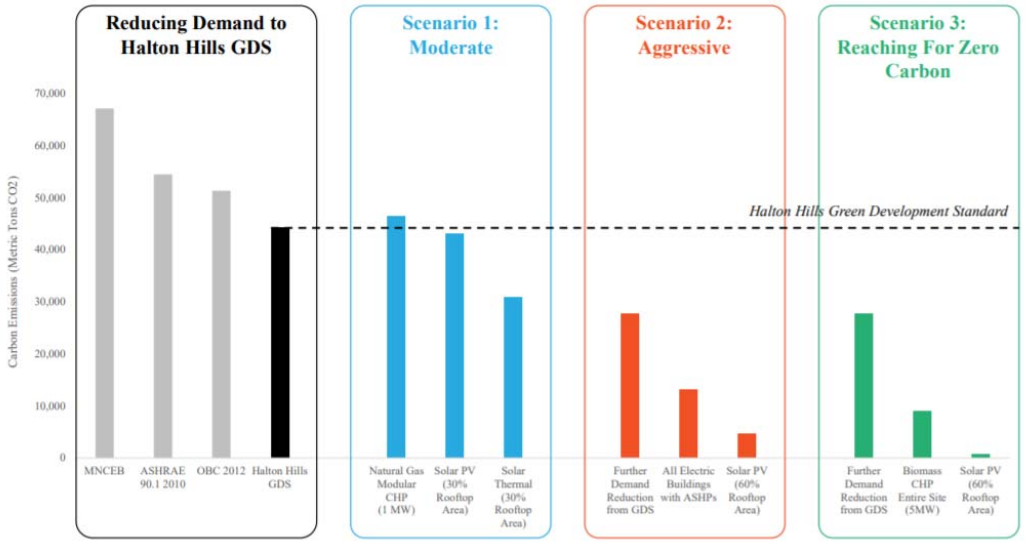

Figure 10: Carbon Emissions Waterfall Diagram. Source: Halton Hills Vision Georgetown Energy Masterplan

This case study stresses the importance of development standards in helping to achieve the policy objectives of Secondary Plans. For example, the policies within the Town's Green Development Standards could be further enhanced to achieve GHG emissions reduction targets.

iii. Toronto, Ontario – Port Lands Planning Framework and Villiers Island Precinct Plan

Relevance to SABE: The idea of requiring tertiary plans, like district plans, may be a good idea for Caledon to consider in implementing the SABE secondary plan as detailed requirements can be described. Note that the Port Lands Energy Plan is discussed in the district energy systems section (C) below.

Description: The City of Toronto Port Lands Planning Framework was adopted by Council in 2017. The Villiers Island Precinct Plan was developed along with proposed amendments to the Central Waterfront Secondary Plan.

Central Waterfront Secondary Plan includes in its Implementation strategy (2.2), the requirement for the preparation of precinct plans in advance of rezoning. Precinct plans are to include:

- "a comprehensive set of environmental performance standards for public and private infrastructure, buildings, and activities including, but not limited to, energy efficiency,

reduction of CO2 emissions, water conservation, clean air and waste (reduction, reuse and recycling)" (2.2 vii); and

- "urban design provisions dealing with the unique microclimatic conditions of the waterfront, quality of waterfront streets, the public realm, urban plazas, parks, schools, other community services and facilities, and signage" (ix)

In preparing the Villiers Island Precinct Plan, "Waterfront Toronto undertook a study – the Villiers Island Climate Positive Assessment – to compare the emissions profile of the current Minimum Green Building Requirements with a typical Toronto development (a 23% improvement) and described how Villiers Island could reduce local GHG emissions by a further 77% to reach Climate Positive status" (p. 60). They estimate that "By optimizing the neighbourhood design, and ensuring that buildings are designed passively in accordance with the Port Lands Planning Framework, Villiers Island can reduce heating demand over 95% compared to typical Toronto development" (p. 60).[59]

The Villiers Island Precinct Plan has some of the most detailed policy requirements related to energy and emissions reductions, and so are included here:

12.3 Passive design approaches and low-impact site design employed in a development will include:

12.3.1 Providing an efficient building shape, location and orientation while continuing to ensure excellent sunlight conditions in the public realm;

12.3.2 Incorporating shading strategies or devices applied to south and west facades to reduce the solar heat gain in the summer and reduce cooling loads;

12.3.3 Minimizing the ratio of windows on a façade. Windows should not exceed 50% of a façade and a minimum sill height should be provided unless otherwise demonstrated through achieving passive design;

12.3.4 Utilizing advanced windows, such as triple glazed windows, to minimize heat loss;

12.3.5 Minimize incidences of thermal-bridging that create pathways for heat to move from the inside of a building to the outside. Approaches could include continuous insulation, thermally-broken balconies and careful window detailing; and

12.3.6 Retaining stormwater on site through naturalized, low impact approaches both at grade and on rooftops and to the extent possible in an urbanized context.

[59] Urban Strategies (2017) Villiers Island Precinct Plan. Prepared for the City of Toronto and Waterfront Toronto, September. Retrieved from: https://portlandsto.ca/

12.4 Passive design approaches and other measures that will be encouraged in development, or required should legislation enable such elements, include:

12.4.1 Providing high levels of insulation and thermal mass performance to minimize heat loss through the selection and use of appropriate building materials;

12.4.2 Enabling natural ventilation (such as operable windows) where possible and in consideration of any receptor mitigation required to ensure compatibility with industrial operations;

12.4.3 Providing dedicated car share parking spaces, autonomous vehicles and electric vehicle (EV) infrastructure;

12.4.4 Providing on-site renewable energy, such as solar photovoltaics (PV) and other low- carbon on-site energy generation and back-up power, while ensuring residential amenity and greening potential

12.4.5 Ensuring a high level of airtightness to minimize heat loss from air infiltration.

12.5 Linear infrastructure and energy production facilities needed to support the introduction of a low-carbon thermal network or electrical microgrid and intelligent city infrastructure will be protected for and/or incorporated in the design of buildings, parks and open spaces, streets, fixed bridges and/or municipal servicing during precinct planning, Phase 3 of the Municipal Class Environmental process for streets and municipal servicing and/or at detailed design.

12.6 The following will be incorporated into the design of streets where technically feasible:

12.6.1 locations for bike parking, and in particular, at transit stops and major destinations;

12.6.2 the provision of dedicated, on-street electric vehicle parking and charging stations;
12.6.3 the provision of dedicated, on-street car-share parking locations.

12.7 The Port Lands is an area with a convergence of energy generating infrastructure. Any new power plants developed in the Port Lands to either replace existing facilities or to provide additional power will be encouraged to utilize renewable energy sources and to support achieving the long-term net zero energy district objective and will be required to go through the site plan approval process.

In the zoning by-law emerging from the Port Lands planning process, "district heating and cooling plant" and any other type of infrastructure, such as a biogas digester in a rural zone, are to be listed as permitted uses. Also, bicycle parking spaces (short and long-term), not only in residential and mixed-use areas, but for employment uses as well.

The City is in the process of developing urban design guidelines for the Port Lands area, and uses the language of "future forward" to describe a core principle of urban design in the area: "integrating natural elements, biodiverse landscapes, green and low impact infrastructure, and passive building design to create a future forward and climate positive modern creative employment district."[60]

Finally, the Port Lands approach is undertaken with the expectation that builders will complete a City of Toronto development application checklist, which includes the completion of a detailed Energy Strategy as follows:

- Official Plan policy 3.4.18 states that "innovative energy producing options, sustainable design and construction practices…will be supported and encouraged in new development … through: d) advanced energy conservation and efficiency technologies and processes that contribute towards an energy neutral built environment".

The Energy Strategy data is used to inform the City's community energy and emissions targets. The Energy Strategy applies to new development including residential, non-residential and/or mixed use and may apply to industrial development:

- with a total gross floor area of 20,000 square metres or more; or
- within a Community Energy Plan area approved by Council

Undertaking an Energy Strategy at the application stage for a Plan of Subdivision, Official Plan or Zoning Bylaw Amendment facilitates the following key outcomes:

- Opportunity to site buildings to take advantage of existing or proposed energy infrastructure, energy capture and/or solar orientation at the conceptual design stage.
- Consideration of potential energy sharing for multi-building development and/or neighbouring existing/proposed developments.
- Consideration of opportunities to increase resiliency such as strategic back-up power capacity (for multi-unit residential buildings).

[60] City of Toronto (2020) Production, Interactive and Creative (PIC) Core Urban Design Guidelines. Presentation to Film, Television and Digital Media Advisory Board, February 3.

- Identification of innovative solutions to reduce energy consumption in new construction and retrofit of existing buildings (if part of new development).
- Exploration of potential to attract private investment in energy sharing systems.

The Energy Strategy is to have three main sections:

Section 1: Towards Zero Emissions Development

The Energy Strategy is to calculate energy and emissions from the proposed development based on baseline, higher performance, and near-zero emissions (in accordance with the City's Toronto Green Standard). The scenarios should include opportunities for super-efficient building envelopes and building-scale renewables, as well as opportunities for shared energy services (i.e. low-carbon thermal energy networks)

The Strategy is to consider the following

a. Energy Conservation and Demand Reduction

Identify and evaluate opportunities to achieve very low energy use intensities (EUIs) and reduced energy demands, through:

- Building orientation and solar controls; thermal effectiveness of the building envelope; daylighting design strategies; and
- High efficiency mechanical systems (e.g. efficient HVAC systems, heat recovery, lighting solutions).

b. Low-Carbon Solutions

Identify and evaluate opportunities for low-carbon energy solutions on-site (i.e. within the proposed development site), and off-site through connection to nearby existing or planned buildings and infrastructure. This can include, but is not limited to:

- Renewables, such as rooftop solar PV, geo-exchange in a nearby park, and heat recovery from sewer lines;
- High efficiency combined heat and power (CHP);
- Connection to an existing thermal network;
- Rough-in for a future connection to nearby existing/in-development thermal energy networks (i.e. "district energy-ready"); and
- A new thermal network connecting several planned developments in an area.

For multi-building (i.e. campus-type) proposals, identify and evaluate opportunities for shared energy solutions that include, but are not limited to:

- Thermal energy distribution networks (i.e. piping) to connect buildings;
- Shared mechanical room(s) for heating and cooling equipment;
- Large-scale renewables such as lake water cooling, biomass, sewer heat and other means of waste heat recovery;
- High efficiency CHP;
- Thermal energy storage;
- Shared backup power system(s) for multiple buildings; and
- Micro-grid(s) with the ability to island from the electrical grid.

Section 2: Energy Resilience

Identify and evaluate opportunities for backup power systems that will improve the resilience of buildings to area-wide power outages, especially for multi-unit residential buildings. This includes meeting all emergency power (life safety) requirements, as well as providing for 72 hours (at a minimum):

- Domestic water (hot and cold);
- Elevator service; and
- Space heating, lighting and receptacle power to the central common area/amenity space/lobby, where applicable.

Section 3: Analysis, Preferred Scenario, and Recommendations

- a. Calculate energy consumption, demand, and emissions for the proposed development according to the three scenarios. Include in calculations the energy performance of existing buildings (if any are part of the development site) using available utility data.
- b. Estimate the contribution(s) of the identified on-site and off-site low-carbon solutions towards achieving zero emissions.
- c. Based on the completed analysis, state the preferred scenario and conclude with recommendations and next steps to facilitate implementation. Establish the overall value proposition(s).

Key findings: The Energy Report is a detailed requirement for development applications. However, to respond to the climate emergency a detailed consideration of energy in new development. Perhaps the greatest lesson learned from the City of Toronto Port Lands example is that the planning process is not linear. Goals and objectives for energy and emissions reductions must be considered consistently at all stages of the planning and decision-making process.

iv. Victoria, British Columbia, Official Plan

Relevance to SABE: The relevance to the SABE is that progressive policies related to community design.

Description: The City of Victoria's Official Plan includes a broad Land Management and Development objective, "develop to densities capable of supporting economically viable renewable district energy systems" (6.d).[61]

The Plan goes beyond a complete communities approach used in Ontario official plans to include a policy to distribute the planned population in terms of the number of people who are to be within walking distance of a mixed-use core or centre area (6.a), which is a quantifiable target for otherwise broad complete and walkable community goals.

The Official Plan includes a section on Climate Change and Energy, including specific policies for Energy Resiliency, Renewable Energy and for Building Performance, as follows:

Under Climate Change and Energy Resiliency:
12.4 Continue to promote the reduction of community greenhouse gas emissions, through:

12.4.1 Compact land use patterns such as walkable and complete centres and villages
12.4.2 Transit-oriented development; and,

12.4.3 Networks and amenities for cyclists, pedestrians and other forms of personal mobility

Under Renewable Energy:
12.12 Support and enable the feasibility of renewable energy on a distributed basis or at district scale through objectives and policies for land management and development in this plan, that:

12.12.1. Encourage large-scale mixed-use development with adequate density to support district energy systems, and where energy demand is diverse; and,

12.12.2. Consider all available tools and incentives that could enable and support on-site renewable technology and district energy systems.

Under Building Performance:
12.17 Continue to support and enable the private development of green buildings, subject to development control and building regulation, with features that may include but are not limited to:

12.17.1 Alternative transportation facilities
12.17.2 Sustainable landscaping
12.17.3 Building retention and re-use
12.17.4 Passive building systems

[61] City of Victoria. (2012). Official Community Plan (Council adoption 2012; Office Consolidation February 27, 2020). Retrieved from: https://www.victoria.ca/EN/main/residents/community-planning/official-community-plan.html

12.17.5 Energy efficiency technology
12.17.6 On-site renewable energy technology
12.17.7 District renewable energy systems; and
12.17.8 Efficient plumbing fixtures and systems.

12.19 Encourage new developments that are designed to adapt to future sustainable technologies for solar thermal, district energy systems and grey water reclamation fully aligned with the BC Building Code

Finally, under Section 19 Plan Administration, district energy feasibility studies are required.

Key findings: The applicability of the Victoria example is in the specificity of the policies with respect the variety of ways that energy conservation and renewable energy may be considered in official plans or secondary plans.

v. Ottawa, Ontario – Official Plan

Relevance to SABE: Energy evolution action plan looks at the demand side and the supply side as well as opportunities and challenges. Plans for district energy in the Barrhaven community of Ottawa and energy efficiency in Minto's Ampersand community are underway and may provide useful case studies when material becomes publicly available.

Description: The City of Ottawa has committed "to add a strong energy lens through which all growth and development activities across the city are considered"[62]. The inclusion of design objectives in the Official Plan is interesting, as well as the requirement for an Integrated Environmental Review, including energy considerations, to be submitted as part of the development application process.

In its current Official Plan, the City of Ottawa identifies energy as an issue throughout its official plan in its Strategic Directions and in policies for development review. Strategic Directions policies are included under Air Quality and Climate Change (2.4.1) and under Designing Ottawa (2.5.1) including a list of seven "Design Objectives" where #7 is "To maximize energy-efficiency and promote sustainable design to reduce the resource consumption, energy use, and carbon footprint of the built environment."[63]

[62] City of Ottawa (2019) Energy Discussion Paper, New Official Plan. Planning, Infrastructure, and Economic Development Department, p. 19

[63] City of Ottawa (2003) Official Plan, Adopted 2003, Office Consolidation 2018.

In policies directing the review of development applications, an Integrated Environmental Review (4.7.1) is required, including consideration of policies for "Energy Conservation Through Design".

Council adopted, as a "term of council" priority in 2015, the development and implementation of a renewable energy transition strategy, called Energy Evolution.[64] The City has developed an Energy Evolution action plan consisting of two reports, "Pathway Study on Solar Power in Ottawa" (Leidos) and "Pathway Study on Demand Side Management and Energy Storage in Ottawa" (Sustainability Solutions Group). However, neither suggests specific strategies related to land use policy or development review. As part of the Official Plan review process, Ottawa has also prepared an Energy Discussion paper, which commits to adding a "strong energy lens" but does not include specific policy suggestions.

Key findings: The ability of the City's land use planning policies to achieve energy priorities and objectives have not yet been fully realized. Thus, this requires that more specific policies be created.

C. DISTRICT ENERGY SYSTEMS

District energy systems provide heating, cooling or a combination of both to a network of buildings through a series of pipes (also known as a thermal grid), which are serviced by a central plant or a series of miniplants. Such systems allow buildings to be provided with heating and cooling more efficiently than with traditional systems.

Due to their high energy efficiency, district energy systems are commonly found in low-carbon or net-zero communities, particularly where there is a presence of high-density developments. Such systems can provide energy within a redevelopment area—such as the Port Lands and Mirvish Village neighbourhoods in the City of Toronto—or within a broader geographic area like the City of North Vancouver. As demonstrated by the case studies, the implementation of district energy systems requires innovative partnerships between municipalities, developers, energy providers, and other organizations.

[64] City of Ottawa (2019) Energy Discussion Paper, New Official Plan. Planning, Infrastructure, and Economic Development Department.

i. Toronto, Ontario – Enwave Deep Lake Water Cooling

Relevance to SABE: This case study provides an example of district energy infrastructure needs and the importance of partnerships to administer these systems.

Description: Over 80 buildings in the Downtown core of the City of Toronto are cooled using water from Lake Ontario. This system, referred to as Deep Lake Water Cooling (DLWC) is provided through a District Energy System operated by the City of Toronto and Enwave Energy Corporation.[65] Since 2002, the City and Enwave have maintained an Energy Transfer Agreement (ETA) allowing the City's drinking water system to provide cooling energy through heat exchanges to buildings.

Key findings: Although opportunities to use DLWC energy supply have limited use in Peel's non-lake adjacent municipalities (e.g., Caledon and Brampton), the City of Toronto's agreement with Enwave shows the importance of partnering with an energy operator. In late 2019, the Toronto City Council approved an Environmental Assessment to expand the current capacity of the DLWC supply, which will require a significant amount of capital investment. Capital costs associated with the district energy system expansion will be shared between the City of Toronto, Enwave and other upper levels of government.

ii. Markham, Ontario – Markham District Energy

Relevance to SABE: This case study provides an example of a natural gas district energy system. This example comments on the financial implications of building such a system.

Description: Markham District Energy provides district energy to two major areas in the City: Markham Centre and Cornell Centre. The district energy system is owned and operated by the City and is powered by a combined heat and power (CHP) system fueled by natural gas. Thermal storage, energy transfer stations and distribution systems are also used. The system has done an excellent job to ensure service reliability for its customers (including the local hospital) as it operates independently from the broader electrical grid.

Key findings: Markham District Energy has acknowledged there are benefits to the City maintaining ownership over the systems. For example, as the City is the sole owner and operator, this allows greater control over the design process and ensures the community has access to the system. However, the development of district energy systems requires significant capital investment and associated funding. As such, municipalities may be

[65] City of Toronto. (2020). Deep Lake Water Cooling Supply Expansion. Retrieved from https://www.toronto.ca/community-people/get-involved/public-consultations/infrastructure-projects/deep-lake-water-cooling-expansion-study/

limited in their ability to fund such projects and therefore require capital funding agreements with energy operators.

iii. Toronto, Ontario – Port Lands

Relevance to SABE: This case study demonstrates that partnerships with energy providers can provide important expertise and capital infrastructure investment to support the creation of district energy systems.

Description: While the Port Lands in the City of Toronto may seem to be far removed from the potential comparability to a new greenfield settlement area in Caledon, there may be lessons learned from the structure of the planning process and the level of detail that the City has considered in shaping the future redevelopment of the unique port. The Port Lands is being transformed from a heavy industrial employment district, with few community-type uses to a vibrant mixed-use extension of the City's downtown. "Climate positive" policies and implementation tools are baked into the City's planning approach to the Port Lands.

The Port Lands is 356-hectare urban renewal site located along Toronto's waterfront. The planning framework approved by City Council supports the development of a net zero energy district meaning that "no more energy is consumed than is supplied by non-fossil fuel sources".[66] To achieve this, the framework noted that energy generation at both the building and district scales is required.

- **Building-scale** renewable energy includes solar, heat recovery and biogas systems, and micro-wind turbines.
- **District-scale** renewable energy can include district heating and cooling facilities or combined heat power facilities.

Key findings: In support of the net-zero community objective, the City has developed an Energy Plan for the Port Lands[67]. The Plan outlines specific interventions needed to achieve net-zero emissions. Such interventions include building- and district-scale renewable energy solutions as well as supportive low-carbon transportation, conservation and recycling of water and wastewater, and solid waste diversion.

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[66] Waterfront Toronto. (2017). Port Lands Planning Framework. Retrieved from https://www.waterfrontoronto.ca/nbe/wcm/connect/waterfront/97811a5f-e98b-4216-a84c-df454f876065/Port%20Lands%20Planning%20Framework_AODA%20-%20reduced.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=97811a5f-e98b-4216-a84c-df454f876065

[67] City of Toronto Environment and Energy Division. (2017). Port Lands Energy Plan: Guidelines for a Net Zero District. Retrieved from: https://portlandsto.ca/wp-content/uploads/Port+Lands+Energy+Plan_Sep+2017.pdf

Since 2002, the City of Toronto has maintained an Energy Transfer Agreement with Enwave—a district energy provider—to supply Deep Lake Water Cooling (DLWC) supply to buildings in the downtown core. It is proposed that a new district energy system be created for the Port Lands and operated by Enwave who will provide capital investment needed for the project.

iv. Toronto, Ontario – Mirvish Village, Creative Energy and Westbank

Relevance to SABE: This provides an example of a developer who also acts as the operator of the district energy system. Similar arrangements may be possible in developing the SABE.

Description: Mirvish Village is a major redevelopment site located at the intersection of Bloor and Bathurst Street in Toronto. Westbank, the proponent, has proposed 5-acre mixed-use development with a significant amount of purpose-built rental. Energy will be provided to the development by Creative Energy, a district energy provider, through a district energy system that uses a natural gas-fired combined heat power (CHP) plant, and supported by a microgrid, a thermal grid and solar generation.

Key findings: The project is somewhat unique as Creative Energy is also owned by the developer Westbank. Overtime, customers of the district energy system will payback both the initial capital investment required to set-up the system and the ongoing operating costs associated with the fuel and maintenance of the system. This set-up will provide long-term cash flow benefits for the developer, making it a favourable business model.

v. North Vancouver, Vancouver – Lonsdale Energy (LEC)

Relevance to SABE: This case study provides an example of how district energy systems can be expanded in phases to allow new development to connect to the system. This includes requiring developers to fund infrastructure needed to connect to the system.

Description: Three areas within the City of North Vancouver – Lower Lonsdale, Central Lonsdale, and Marine Harbourside – are supported by a district energy system. The system is provided by a local energy utility, Lonsdale Energy, which is owned, governed and regulated by the City. The systems include six miniplants which use:

> *"a combination of high efficiency natural gas boilers, ground source heat pumps, heat recovery from building cooling, and solar thermal panels to heat hot water. The hot water is circulated through a series of underground insulated pipes, providing energy for heating and hot water to residences and businesses within the supply*

areas. The now-used water is re-circulated back into the mini-plants, where the process of re-heating and circulating begins again".[68]

The City's district energy system has received numerous awards including the Province of British Columbia's Green City Award and the Community Energy Association's Climate and Energy Action Award.

The City of North Vancouver has stated the system's success is attributed to:

- The development of a Hydronic Heat Energy Service Bylaw which requires developers to construct infrastructure needed to connect to the system.
- Consultation and collaboration with development industry stakeholders as some of the systems miniplants were to be located within proposed buildings.
- Strong partnerships between internal municipal departments and the Federation of Canadian Municipalities (FCM) who provided grant funding and low interest loans for the project.[69]

Key findings: Importantly, the system was designed to use a variety of different fuel sources (such as natural gas) as well as renewable energy sources like solar. An interconnected miniplant system was selected instead of a central heating system to meet the unique energy needs of the planned development.

The policies within the City's Official Community Plan supports the LEC. Goal 8.1 of the Plan is to "provide the community with public infrastructure that protects the natural environment at an affordable cost" (pg. 73)[70], which includes supporting the initiatives of the LEC. This case study confirms the importance of creating a district energy system that addresses local needs.

[68] City of North Vancouver. (n.d.) Lonsdale Energy (LEC)- LEC Innovation. Retrieved from https://www.cnv.org/city-services/lonsdale-energy

[69] City of North Vancouver. (2009). District Heating in North Vancouver. Retrieved from http://civicinfo.bc.ca/practices_innovations/district_heating--north_vancouver--2009.pdf

[70] City of North Vancouver. (2014). Official Community Plan. Retrieved from https://www.cnv.org/your-government/official-community-plan