



On the path to net-zero communities: integrating land use and energy planning in Ontario municipalities

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Community Energy Knowledge Action Partnership (CEKAP)

A project of the Ontario Climate Consortium (OCC)

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About the Community Energy Knowledge Action Partnership (CEKAP)

The Community Energy Knowledge-Action Partnership (CEKAP) was established in spring 2016 as a project of the Ontario Climate Consortium (OCC) with a *Partnership Development Grant* from the Social Sciences and Humanities Research Council of Canada (SSHRC). Combining strengths from Canadian universities, local and regional governance partners and civil society organizations across three provinces, CEKAP's overall goal is to improve thought and practice around community energy planning. CEKAP's research program is building from the principles of 'community engaged scholarship'. In this model, the non-academic community provides direct input into the research agenda: i.e., establishing core challenges that can be met with research (the big picture), articulating key themes (the research programs), and then identifying clear and timely research initiatives (the research projects). Input from non-academic partners is considered by the academic research team in light of existing resources and expertise to formulate near term research objectives (1-3 years) as well as a longer-term research plan (5-10 years).

About the Ontario Climate Consortium

The Ontario Climate Consortium is a network of academic institutions and local and regional governance partners that provides independent advice, research and analysis to support the development and implementation of policies that enable adaptation to the changing climate and the transition to a low carbon society. The OCC Secretariat, based within the Toronto and Region Conservation Authority (TRCA), leverages the wide-ranging expertise of our academic members to provide an evidence base for Ontario provincial and municipal government policy making through timely and objective research. Researchers in four of Ontario's leading Universities are members of the OCC: McMaster University, University of Guelph, Western University, and York University.

Executive Summary

Context

The Government of Ontario has set a 2050 target to reduce greenhouse gas emissions by 80 per cent below 1990 levels. De-commissioning coal-fired electricity generators across the province was a major step toward this goal. Attention must now focus on the building (heating), industrial, and transport sectors, which are almost entirely reliant on carbon-intensive fossil fuels. Among these sectors, buildings will likely need to experience relatively deeper reductions in order to compensate for sectors where emissions reductions may be more challenging (e.g. industrial process-related emissions; long-range freight transportation; air travel). Therefore a net-zero carbon building sector by mid-century is seen as a critical piece of the climate action puzzle in Ontario.

The most cost-effective pathway to a net zero building sector involves highly energy efficient buildings combined with an integrated community-based approach of district energy systems (thermal networks and electricity micro-grids). Developing these net-zero communities requires strategic system-level interventions. The building practices, technologies, and user interface of a net-zero community are all disruptive to status-quo. Furthermore, the traditional role of the local electricity distribution company (LDC) is called into question. Provincial legislation and regulations, municipal land-use planning policies, by-laws and operational practices (e.g. engineering and building standards), energy regulations, utility practices, development industry business models and suppliers will all need to co-evolve. This suggests a critical role for the planning system at all scales.

There are some promising trends. Through the Ontario Climate Change Action Plan (2016-2020) and proposed changes to the Growth Plan for the Greater Golden Horseshoe, the Ontario government has begun to establish the policy framework for net zero buildings and communities. Meanwhile, municipalities hold a range of policy levers that can influence emissions across the building sector, particularly for new developments. How these existing and emerging policy levers are used will determine whether we are successful in the drive to net zero communities. Success has been modest to date. While many Ontario municipalities have had climate and GHG plans in place for many years, low carbon project development and implementation at the community-scale has lagged and emissions trends aren't aligned with achieving Ontario's 2050 target.

Project objective and methodology

The purpose of this research is to evaluate the role of planning and planning policies in facilitating net-zero developments at the local level. Through a case study approach that looked at five developments, each in a different Ontario municipality, this report builds understanding of the conditions that lead to successful net-zero community developments, and helps to establish greater awareness of the technical and business cases for policy and business model

innovation. Furthermore, the research provides an assessment of how ‘net-zero’ concepts are discussed and treated within and across provincial-level planning policies.

Net zero definitions

While there is growing recognition of the need for net zero buildings and communities, there are no commonly accepted definitions of what net zero is. As such, the concept of ‘net-zero’ is often molded to ‘fit the hand of the user’, which leads to increased risk of ‘greenwashing’ which undermines public policy objectives. For the purposes of developing a workable and practical definition that aligns with municipal land use planning and policy frameworks, there are at least four dimensions to consider:

1. **Priorities:** is the focus on energy, carbon, or the full suite of greenhouse gas emissions?
2. **Scale:** is the focus on individual buildings, or on the community-scale?
3. **Scope:** which activities and sectors should be included in the net zero calculus?
4. **Boundaries:** should offsets or renewable energy credits generated by activities outside of the building or community boundaries be eligible for inclusion in the net zero calculus?

Based on a review of Ontario municipal land use and energy planning frameworks, the following is suggested as practical definition that focuses on energy-related carbon emissions, and is aligned with the municipal sphere of influence:

Net-Zero Energy Emissions Community (NZEEC)

In the context of municipal and regional planning, a net-zero energy emissions community is highly efficient in terms of energy needed to meet demand for: 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). Energy demand is met by sustainable zero GHG emission sources, ideally generated within community boundaries.

Alignment between this suggested definition and the four dimensions presented above is shown in table 1 below

Dimension	Focus	Rationale
Priorities	Energy-related GHG emissions	<ul style="list-style-type: none"> • Municipal/community-scale emissions inventories are dominated by energy-related emissions in the buildings and transportation sectors. • CH₄ emissions in waste and wastewater sectors are addressed through bioenergy pathways • Municipalities have limited control over non-energy related emissions in agriculture and industry sectors
Scale	Community-scale	<ul style="list-style-type: none"> • Integrated community-scale energy systems offer opportunities for economies of scale and resilience
Scope	Built environment,	<ul style="list-style-type: none"> • Focuses on major sources of community-scale

	transportation (excluding inter-regional), and municipal services	emissions, as well as sectors where municipal land use planning policy can influence trends
Boundaries	<ul style="list-style-type: none"> Limited use of offsets; source-based emissions accounting (i.e. inclusion of electricity transmission and distribution related emissions) exclusion of embodied energy in materials 	<ul style="list-style-type: none"> Focus emissions reduction efforts within the community Focus on activities over which municipal policy can influence

Table 1 Net zero definitions - proposed foci along key dimensions

On the path to net zero: key lessons learned from case studies

Provincial enabling roles

- **Continue to set the context for municipal ambition on climate action and net zero communities** – complementary amendments to the Ontario Building Code, Municipal Act, Planning Act, and the Growth Plan are required to mainstream net zero policy objectives into land use and energy planning framework for municipalities. Alternative regulatory and market frameworks to enable LDCs to act as platforms for energy services, including generation and storage, are needed.
- **Enable municipal/community level implementation through regulatory policy tools** - consider introducing a tiered approach in the building code that enables municipalities to require higher than minimum code levels of energy performance in new building development. Municipal authority to establish mandatory connection by-laws in areas suitable for district energy is needed.
- **Revise energy planning and regulatory framework to enable innovation in Local Distribution Company (LDC) business models** – LDCs are struggling to stay relevant in the era of disruptive innovation in energy systems (e.g. distributed energy technologies, storage, and EVs). Policy and regulatory barriers limit their ability to serve as generators, and as aggregators of distributed energy assets. Policy innovation is needed to support LDCs ability to develop economically viable district energy networks in areas slated for growth.
- **Enable municipal/community level implementation through fiscal policy tools** – Seed capital for low carbon district energy systems is needed. Funding for demonstrations and pilot projects of innovative development approaches is needed to build awareness of technical and economic feasibility.
- **Engage in multi-level collaboration, particularly in context of major urban redevelopment projects, to enable innovation** - multi-level government collaborations, particularly in the context of major urban redevelopment projects, can set the context for policy alignment and innovation. Consider leveraging Infrastructure Ontario land dispositions to require private developers to innovate towards net zero community building.

- **Support research and development, workforce training and skills development related to net zero community construction** - support workforce training and certification programs that build capacity for net zero community planning and development and address the lack of talent and practical experience in the contracting industry.

Municipal enabling roles

- **Create a supportive high-level policy context** – Integrate energy and climate into Official Plans; create Community Energy and/or Climate Action plans to support OP implementation. Clarify roles of upper vs lower tier in the regional municipal governance context
- **Use authority provided by Planning Act and Municipal Act to incent low carbon and net zero development** - The Planning Act provides municipalities with authority to mandate sustainable urban design through site plan approvals, however only a few innovator municipalities are using this authority.
- **Use major redevelopment area opportunities (e.g. Brownfields) to create a test-bed for policy and technology innovation** - Former industrial areas, often located close to urban centres, provide an opportunity for revitalization of vacant or underutilized employment areas. Developing new low/zero carbon districts can attract innovative knowledge industries and talent.
- **Support/enable champions in both political and staff (i.e. technical) ranks** - . Political leadership on municipal Council is needed to establish local ambition on climate and energy and to build key relationships between industry innovators, public institutions, and the broader community. Municipal energy managers, staff level technical champions, are able to break down intra-municipal silos and engage with energy stakeholders in the community.
- **Where LDCs are municipally-owned, support business model innovation** – Several of the case studies provided examples of specialized local energy companies (e.g. Hydro Ottawa, London Hydro, and Enwave) partnering with the private sector to develop community-scale low carbon energy generation and distribution networks. These partnerships need support from municipalities to scale-up.

Development industry role

- **Engage early and often with key municipal government and energy stakeholders** - By putting the net zero vision forward early in the development process, and aligning the business case with existing municipal and provincial policy objectives, developers can build a base of support which enables flexibility in policy and business model innovation
- **Demonstrate the marketability of net zero communities and alignment with housing affordability agenda** - net zero homes and net zero communities can save homeowners and tenants money in the long-run through reduced energy costs. Demonstrations are needed to build public awareness.
- **Demonstrate alternative governance models for implementing district heat and district electricity partnering with municipalities and local utilities** – In the absence

of a supportive energy planning framework for district energy solutions, engage with municipalities and LDCs to establish public-private partnerships to implement community-scale micro-utilities.

Emerging Research Directions

How will the regulatory framework for local distribution companies need to evolve to support them taking a key role in Ontario's transition to net zero communities? -

Transitioning the traditional LDC business model towards a micro-grid network coordinator, and district energy system developer, requires overcoming challenges related to financial constraints, regulatory barriers, business processes and corporate culture. Collaboration between LDCs, third party energy providers, and energy solutions vendors can help achieve cost effective deployment, as has been shown in the case studies presented in this report.

What Provincial and municipal policies, tools and process changes are proving effective in engaging energy decision makers in land use planning decisions, and vice versa? -

Understanding what provincial and municipal policies, tools and process changes are proving effective in engaging energy decision-makers in land use planning and development, and vice versa, along with a comparative analysis of best practice in other national and international jurisdictions, would support the transition to net zero carbon communities.

How can municipalities best leverage existing policy tools to support low carbon and net zero community transitions? Research is needed to understand (1) how existing (and proposed) municipal policy tools can be used to support energy transitions and (2) what barriers are preventing their uptake and implementation by municipalities. This research could lead to the development of a low carbon/net zero policy toolkit or guidance document for municipalities, including template by-laws to facilitate policy implementation.

What is the municipal role in the transition to zero carbon transportation? - Research to better understand the role that municipal policy interventions can play in encouraging fuel substitution (e.g. from gasoline/diesel to electricity and biofuels) within communities is needed. Understanding (1) what policy levers might be available, and (2) what their impact might be in terms of emissions reductions, would help build the municipal policy toolkit to address the most important sector for climate action.

Introduction

Municipalities are essential partners in achieving Ontario's legislated greenhouse gas (GHG) reduction target of 80% below 1990 levels by 2050. In addition to their direct control over emissions resulting from municipal operations, municipalities have jurisdiction and authority over land use planning and permitting processes, and urban design through zoning and ordinances. These powers give municipalities' indirect influence over emissions from buildings and transportation which are two of Ontario's largest sources, and are arguably the most critical areas for action to achieve Ontario's 2050 target of 80 percent below 1990 levels. Municipalities are also well-positioned to lead outreach and education efforts on climate change mitigation with citizens and the private sector.

The review of the provincial land use planning framework for the Greater Golden Horseshoe (GGH) area has identified an opportunity to address gaps regarding climate change mitigation. Proposed policy to address these gaps includes a new section in the Proposed Growth Plan, 2016 that would require municipalities to develop climate change strategies and targets that support provincial targets and reflect consideration of the goal of *net-zero communities*. The Proposed Growth Plan definition for *net-zero communities* are those that "...meet their energy demand through low-carbon or carbon-free forms of energy and offset, preferably locally, any releases of greenhouse gas emissions that cannot be eliminated..."¹ In addition, the Ontario Government has proposed complementary policies under the *Planning Act*, and the *Municipal Act, 2001* that clarifies the power of municipalities to establish by-laws addressing climate change mitigation and to participate in long-term planning for energy use.

The Proposed Growth Plan and related land use and municipal policy frameworks have linkages to the province's Climate Change Action Plan, 2016 (CCAP). Specifically, CCAP indicates under the *Land-Use Planning* theme that the Province will propose amendments to Ontario's Planning Act to make climate change a provincial interest, and to make climate change mandatory in municipal official plans. The Government has since proposed these amendments under Bill 68 – Modernizing Ontario's Municipal Legislation Act, 2017². CCAP also commits \$250-300 million in funding to support municipalities with the implementation of community energy and climate action plans.³

With these significant forthcoming changes to land use planning and municipal legislation in Ontario, there is a need for knowledge development and capacity building that supports municipal governments and helps to ensure successful implementation of the proposed policies regarding the development of net zero communities. Capacity is needed to understand (i) what are the appropriate pathways (e.g. technological, policy frameworks, business models, and stakeholder partnerships) to net-zero communities within a given local municipal context and (ii)

¹ Government of Ontario (2016). *Proposed Growth Plan for the Greater Golden Horseshoe*. Page 76.

² Government of Ontario (2017). *Bill 68, Modernizing Ontario's Municipal Legislation Act, 2017. Status at time of writing – second reading*.

³ Government of Ontario (2016). *Climate Change Action Plan*. Page 71.

what tools, policies or incentives are available to municipal governments to accelerate development of low carbon and net zero communities.

Project Objectives and Methodology

The overall objective of this project is to advance net-zero energy and carbon policy, planning and development in Ontario municipalities. Key questions this research seeks to answer are:

1. What are practical definitions for net zero communities that can be operationalized through municipal land use planning policy?
2. How can the Province of Ontario enable local governments and the development industry to advance net zero community building?
3. How can local governments support net zero community building?
4. How can the development industry advance net zero community building?

To answer these questions the Team has employed a mixed methods approach. To develop practical net zero definitions that can be applied in the Ontario municipal context, the Team conducted an extensive review of domestic and international literature and policy for a conceptual perspective on what is meant by 'net zero communities' as well as to highlight inconsistencies. This conceptual review was complemented by an in-depth review of the current and proposed Ontario land use and energy planning framework to develop a practical definition of 'net-zero' upon which meaningful municipal and regional land-use policies can be developed.

Concurrently, the team analyzed a set of five community development projects, each within a different Ontario municipality, that have been planned to achieve deep emissions reductions, with aspirations of net zero carbon or energy. The set of five communities includes a mix of greenfields and brownfields, as well as technology approaches (e.g. district-scale energy, on-site building energy technologies). The team employed a case study approach to research in which detailed consideration to the context surrounding each of the five community developments has been given. In each case, the Team has analyzed and documented existing publicly available municipal land use policies and by-laws that influenced the community development under study. The Team reviewed municipal Official Plans, Secondary Plans, community energy and/or climate action plans, and documented policies that support the development of net-zero communities. The Team also consulted municipal council meeting minutes that document deliberations surrounding case study developments, as well as secondary sources such as news articles and social media (i.e. blogs).

Following this desktop review and documentation of the municipal policy context surrounding the case study development project, the Team conducted a series of interviews with individuals from relevant stakeholder groups, including municipal staff (planning, energy), private sector (real estate developers, energy consultants), and other public sector agencies (large institutions and public land development corporations). These interviews were designed to validate preliminary findings from the desktop scan, and to gather additional information from a variety of perspectives on how and whether the case study project precipitated the development of new policies, approaches or tools, as well as any challenges or barriers faced by stakeholders in moving forward with the low or net-zero carbon development (including citizen opposition, if any, and how that was managed).

In documenting the situation and context surrounding each case study development, the Team sought to identify and distil lessons learned that could benefit other Ontario municipalities seeking to encourage land owners and real estate developers to build low and net zero communities as part of the implementation of their climate action plans.

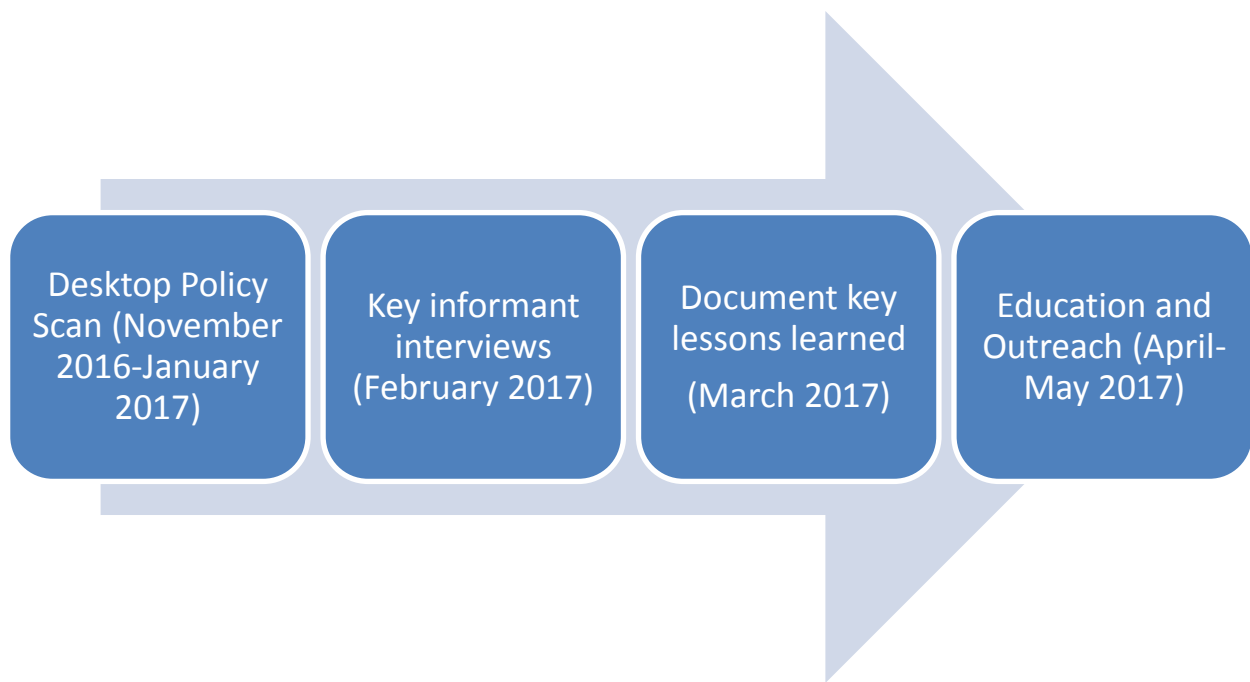


Figure 1 High-level project methodology and timeline

'Net-Zero Communities': Getting the Definition Right (or at least consistent)

As provincial policy aims to develop consensus around the need for 'net-zero communities' across government, industry, and the public at large, finding common ground on terminology is still a challenge. The term 'net zero community' is often used – incorrectly – interchangeably when referring to net-zero *carbon* and net-zero *energy* communities, especially as the 'net-zero energy building' concept has become a reality and is extended to communities. And the criteria and accounting principles which underpin the 'net-zero communities' concept can differ widely – e.g., the extent to which GHG offsets are a credible means of achieving the net-zero goal; or whether or not emissions/energy from transportation should be counted. Lack of clarity and consensus on these issues may encourage greenwashing marketing approaches and, perhaps more importantly, inhibits the development of effective policy or stakeholder mobilization toward the goal of net-zero communities.

The purpose of this section is to support policy discussions as they work toward a common understanding of 'net-zero communities'. The document is written in two parts. First, we discuss 'net-zero community' from a conceptual perspective, drawing together a wide range of literature (as summarized in the [Appendices](#)) to develop a theoretical definition and to highlight key sources of confusion in the way net-zero is defined and operationalized. We make suggestions for a practical definition of 'net-zero' upon which meaningful municipal and regional land-use policies can be developed. Second, we summarize the way in which the net-zero concept has been approach in Ontario's provincial planning system.

1. The 'net-zero' concept: from theory to practice

The concept of 'net-zero' is based on simple accounting procedures. All energy consumption or GHG emissions generating activities within a given geographic area are counted on the left side of the ledger, and all of the energy production or carbon sequestration activities are counted on the right side of the ledger. Combined, the result is a net of '0'; a zero-sum balance indicating

NET-ZERO ENERGY LEDGER			
Energy consumed		Energy Produced	
Heat		Heat	
(+)	Residential	Renewable fuels	(-)
(+)	Commercial	Direct renewable heat	(-)
(+)	Industrial		
Electricity		Electricity	
(+)	Residential	Renewable fuels	(-)
(+)	Commercial	Direct renewable electricity	(-)
(+)	Industrial		
Transport		Transport	
(+)	Individual	Renewable fuels	(-)
(+)	Commercial	Direct renewable electricity	(-)
100	Sub-total		Sub-total 100
Energy consumed – Energy produced = 0			

Benefits:

- Enhanced energy security
- More local economic development
- Greater certainty in cost of energy
- More efficient energy services
- Implies emissions reductions

NET-ZERO CARBON LEDGER			
Greenhouse Gases Emitted		Greenhouse Gases Sequestered	
(+)	Electricity Generation	Conservation areas	(-)
(+)	Heating	Urban forests	(-)
(+)	Transport	Agriculture	(-)
(+)	Agriculture	Carbon capture and storage	(-)
(+)	Other	Other	(-)
100	Sub-total		Sub-total 100
GHG emitted – GHG sequestered = 0			

Benefits:

- Mitigates climate change
- Encourages more green / open spaces
- Improves local air quality
- Implies more local, renewable energy and its benefits
- Implies more efficient, less costly energy services

significant environmental and economic benefits (see Figure 1).

Figure 2: The net-zero concept is based on simple accounting principles that aim to offset entirely energy use (left ledger above) or carbon emissions (right ledger above), depending on priorities. The benefits are high, but the path to net-zero is complicated.

In theory, then, the concept can be defined in one of two ways:

Net-Zero Carbon Community (NZCC)

Definition: A clearly delineated and defined area in which the totality of carbon emissions from buildings, industrial and commercial activities, transport, services (e.g., water and waste management) and social activities (e.g., recreational activities such as swimming pools) are sequestered with active carbon sinks within, or created by investments made within, those boundaries. Maximum carbon sequestration occurs within the predefined area, but may need to be offset through the development of additional active carbon sinks outside of the community boundaries by way of some credit trading system. *Related terms from literature: Carbon Neutral Building, Net-Zero Carbon Building, Low Carbon Building, Carbon Neutral Community, Low Carbon Community, Community Carbon Footprint, Net-Zero Neighbourhood*

Net-Zero Energy Community (NZEC)

Definition: A clearly delineated and defined area in which the totality of energy needs for buildings, industrial and commercial activity, transport, and services (e.g., water and waste management) and social activities (e.g., recreational activities such as swimming pools) are met with energy resources recovered within, or through energy systems created by investments made within, those boundaries. Maximum energy production occurs within the predefined area, but may need to be offset through the development of additional active carbon sinks outside of the community boundaries by way of some credit trading system. *Related terms from literature: Energy Neutral Building, Net-Zero Energy Building, Low Carbon Building, Low Carbon Community, Net-Zero Energy Neighbourhood*

In practical application, however, there are no accepted standards to help make determinations about what should be counted. As such, the concept of net-zero is often molded to ‘fit the hand of the user’, adapted to particular socioeconomic and policy contexts. Based on an extensive review of definitions across academic literature, non-academic literature, and policy documents (summarized in the appendices to this document), there are at least four dimensions across which definitions and accounting procedures will vary:

1. *Priorities of the accounting procedure.* Proponents are often unclear about whether they are referring to ‘net zero carbon’ or ‘net zero energy’, or both. ‘Net-zero energy’ is not interchangeable with ‘net-zero carbon’. Although it is generally implied that ‘net-zero energy’, and especially any offsets associated with achieving that goal, are derived from renewable or low-carbon sources that is not necessarily the case.
2. *Scale of the accounting procedure.* Scale refers to the resolution of the accounting procedure and the level at which the ‘net-zero’ goal is expected to be achieved. The first

distinction here is whether or not accounting is conducted at the scale of individual buildings, or for a larger community. Where 'community' is the preferred scale, the question then becomes one of delineating 'community' (e.g., by 'community' do we mean a neighbourhood? an entire city?).

3. *Scope of the accounting procedure.* Scope refers to the *kinds* of activities that are included in the concept of net-zero; i.e., how comprehensive is the ledger? Although 'net zero' implies a balance of zero after all sources and sinks are accounted for, there are differences across proponents about the activities that ought to be counted. Reconsider Figure 1A: should transport-related energy consumption and carbon emissions be included, or should we focus on heat and electricity in buildings, industry, and community services such as street lighting and waste management? Should embodied energy or carbon in construction materials be included in the accounting procedure? Are we targeting residential activities, or are we including commercial, institutional and industrial as well?
4. *Boundaries of the accounting procedure.* Boundaries define the activities that are or are not counted simply as a function of geography. There are three sub-dimensions here, one that pertains the right side of the ledger and two which pertain to the left side of the ledger:
 - a. *Offsets (e.g., carbon credits or renewable energy credits):* Offsets represent a set of activities beyond the boundary of the community that are still counted on the right side of the ledger. Where offsets are permitted, decisions need to be made about what proportion of energy use or emissions are eligible for offsetting, and under what conditions an offset might replace a local activity. This is akin to the kinds of decisions that governments are making as they establish markets for carbon credits.
 - b. *Embodied energy:* In theory, physical infrastructure and other products in the community required energy in their production and were imported into the community. These energy and emissions costs may be considered as a 'left side ledger' activity.
 - c. *Energy transportation and distribution losses:* There are implications on right side ledger sub-totals when counting activities at the source or at the site. Energy systems experience some loss between source and site (e.g., between electricity generator and final consumer as heat in line losses; or between fuel supplier and heat generator as methane leakage). If energy or carbon emissions are counted only at the site, these losses may not be considered. If counted at the source, the right side of the ledger will increase.

Achieving 'net zero' in its purest form is aspirational. In reality, the process by which we might achieve some version of net-zero will take time, and very careful interventions into a co-evolving social, technological, economic, and regulatory landscape. Any practical definition of 'net-zero community' must be clear on how it is treating the dimensions described above.

Toward a practical definition of 'net-zero'

In the context of municipal and regional planning, key criteria by which to set a definition of 'net zero community' are as follows:

- **On priorities:** Focus on energy-related GHG emissions, as they dominate municipal/community scale inventories. Methane emissions in municipal waste and wastewater sectors are addressed through bioenergy pathways
- **On scale:** Net-zero goals should be applied to communities rather than individual buildings for the purposes of aligning policy with deep GHG reductions by mid-century. While a building may be a *part* of a net-zero system, buildings are not the only facet of human life that produce carbon or consume energy. Buildings form part of the web of built and natural infrastructure, and human relations, which define a community. This suggests that business plans and technology solutions that operate at the building level should be evaluated in terms of their ability to contribute to system-wide net-zero (e.g., through load balancing, which implies that they should be connected to the system rather than isolated).
- **On scope:** Align with municipal sphere of influence (or, the sphere of influence consistent with a given order of government) when making decisions on the activities that will be accounted to define 'net-zero'. For those activities not included, leverage institutional capacity to the furthest extent possible to achieve 'near net-zero' or to become 'net-zero ready'. Notably, municipal governments have limited ability to manage the transport sector, particularly heavy freight. This is a provincial level conversation at least, where regional transit systems can be best managed. Municipalities, on the other hand, can work to become 'net-zero ready' in terms of personal automobiles and freight by supporting low-carbon fueling infrastructure, and 'near-net zero' in terms of enhancing active transport and purchasing low carbon service vehicle fleets.
- **On boundaries:** Focus on operational emissions, and exclude upstream emissions embodied in materials used within the community. Carbon offsets or energy credits will need to be considered on a limited basis to address remaining sources of emissions. However it is important to establish very clear criteria under which offsets can be used to meet any regulatory requirements that may have been established.

Based on a review of Ontario municipal land use and energy planning frameworks, the following is suggested as practical definition that focuses on energy-related carbon emissions, and is aligned with the municipal sphere of influence:

Net-Zero Energy Emissions Community (NZEEC)

In the context of municipal and regional planning, a net-zero energy emissions community is highly efficient in terms of energy needed to meet demand for: 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). Energy demand is met by sustainable zero GHG emission sources, ideally generated within community boundaries.

The ‘net-zero’ concept in Ontario’s planning policy framework

The purpose of this part of the research is to review how the concept of ‘net-zero’ has been defined and approached within Ontario’s land-use planning system. This will improve our understanding of the larger regulatory framework within which municipal land-use plans operate, and the extent of interconnections across the provincial land-use planning system and the provincial energy planning system. Core components of Ontario’s planning policy framework are depicted in Figure 2. Given the scope of this study, we focus here on how the concept of ‘net-zero community’ is incorporated into Ontario’s land-use planning framework, as summarized below in Table 1. It is important to note that the regional land-use plans identified here are undergoing an extensive coordinated land-use planning review, much of which centers on how the land-use planning system will respond to Ontario’s climate change strategy. Indeed, Ontario’s Climate Change Action Plan seems to be an emerging linchpin to make crucial ties between Ontario’s energy planning system and Ontario’s land-use planning system (see Figure 2).

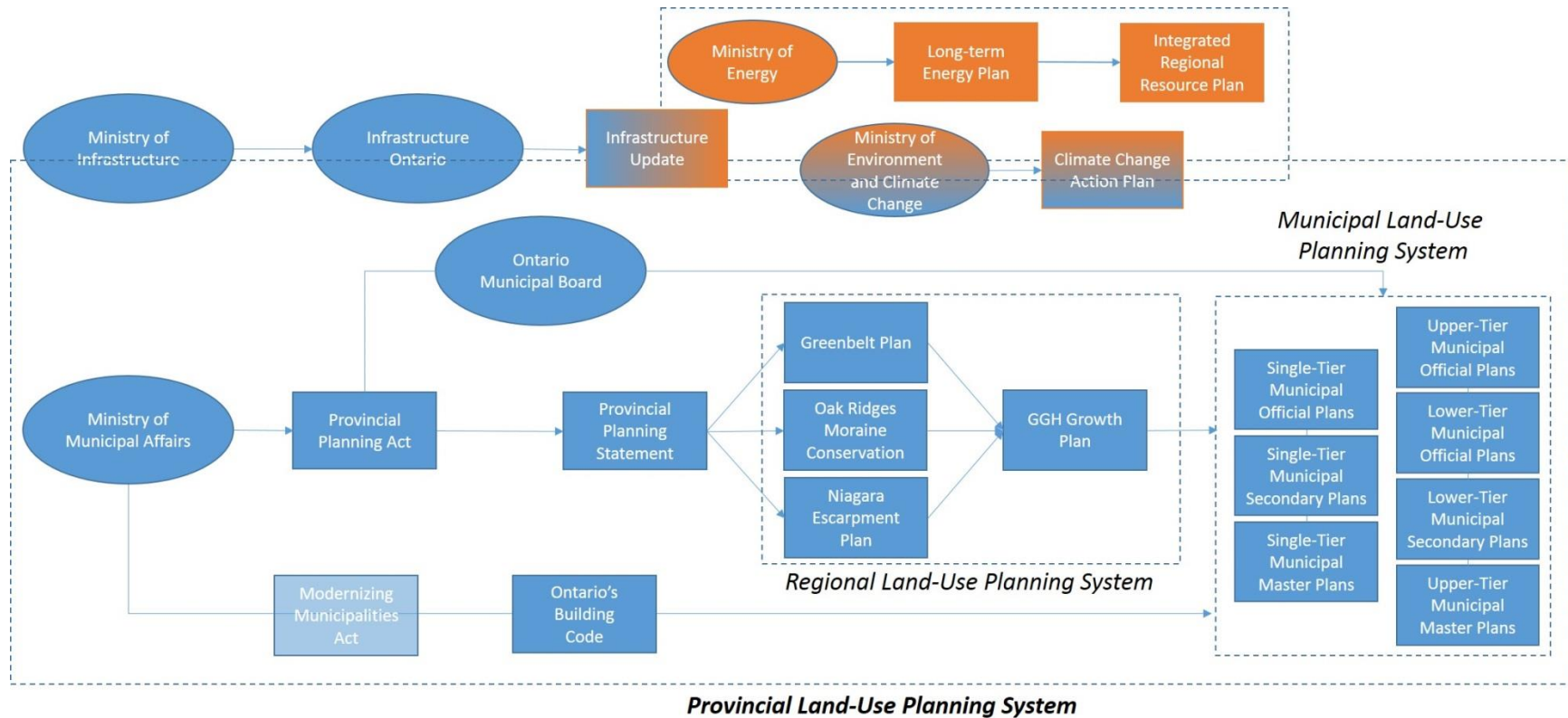


Figure 3: A mental map of Ontario's land-use planning policy framework and energy planning policy framework, showing how core components are related to each other. Apart from the fact that growth forecasts are shared across the two systems there are few hard linkages (as discussed below), although recent emphasis on green infrastructure and the Climate Change Action Plan are beginning to bring these worlds together. The 'Modernizing Municipalities Act' is shown with transparency because it has not yet been enacted.

A coordinated review of Ontario's regional land-use plans recognized the crucial role to be played by the land-use planning framework in meeting Ontario's climate change strategy, especially as it relates to emissions reductions in the transportation, industrial, and building sectors. In fact, the review makes explicit mention of 'net-zero communities', defining them as "communities [that] use low-carbon or carbon-free sources of energy and offset the release of any greenhouse gas emissions they produce". Albeit incomplete, and far from engaging all of the dimensions reviewed above, this is the closest to a succinct and explicit definition of 'net-zero' to be found in the documents that constitute Ontario's planning policy framework. Clearly, the stated priority around net-zero relates to GHG rather than energy. In contrast to the planning framework, however, Ontario's CCAP focuses on 'buildings' rather than 'communities', indicating a disconnect in the scale at which 'net-zero' is being considered and approached.

While the 2014 Provincial Policy Statement (PPS) predates recent provincial direction in this area, it does however, mention the need to encourage more renewable energy generation, which is a marked shift in the land-use planning sphere from one that focuses on planning for efficiency improvements (consumption) to one that also focuses on generation. However there is not clear direction for municipalities on how to plan for more generation. Given that generation activities are land-intensive at local scales and, as we have seen in fierce debates over wind-turbine siting, dramatically alter local landscapes, there is a clear need to better integrate energy planning with land-use planning at a practical level, to follow through on policy statements.

Many of the Provincial regional land use plans emphasize the role of conservation lands, open spaces and parks and sensitive areas, natural heritage systems, and agricultural systems that have already been established. Although these assets are indeed critical, the additionality requirement for best-practices in sequestration is called into question. Furthermore, the sequestration potential in the land base in populated urban and rural parts of Ontario is likely insufficient to fully offset anthropogenic GHG emissions emanating from these regions, without a strong focus on preservation of remaining carbon sinks, and the deployment of zero emissions energy technologies

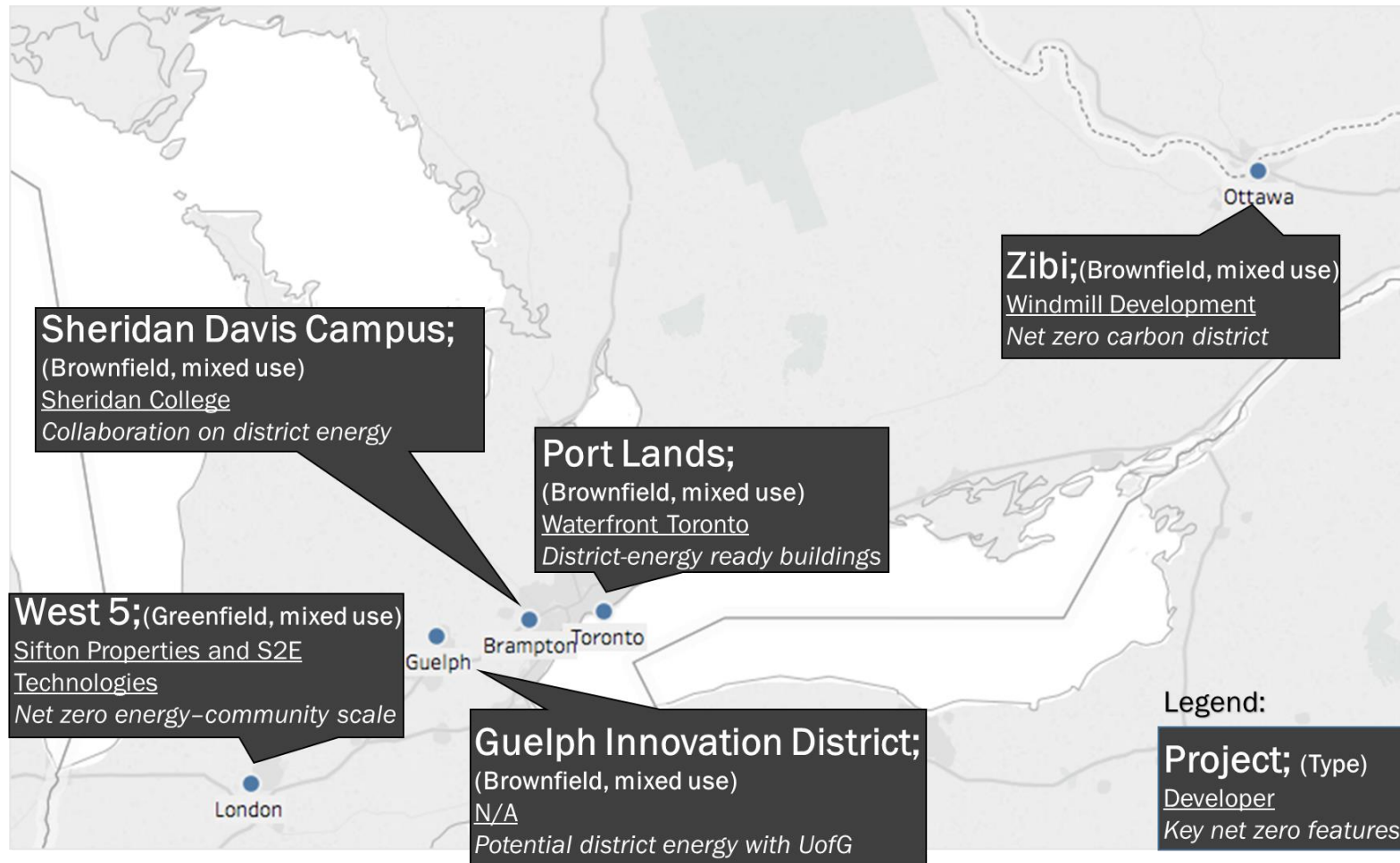
Two major changes to the planning policy framework include the Infrastructure Update and potential updates to Ontario's municipal legislation (Bill 68 – Modernizing Ontario's Municipal Legislation Act, 1st reading November 16, 2016). Through a Green Investment Fund and investments into green infrastructure, the Infrastructure Update brings resources to help reduce energy consumption and expand carbon sequestration opportunities within built-up areas (e.g., through green roofs). Meanwhile, the Provincial Government is also establishing the regulatory framework around carbon offsets related to its Carbon Market, which is another potential source of revenue that could incentivize an expansion of land used for carbon sequestration purposes. Proposed changes to Ontario's municipal legislation through Bill 68 will give municipalities additional flexibility to pass by-laws addressing new building, while also providing municipalities with the authority to require the incorporation of green infrastructure into development proposals. Perhaps most importantly, the Bill will result in an amendment to the Planning Act to add 'mitigation of greenhouse gas emission and adaptation to climate change' as an area of Provincial Interest.

Provincial Documents	Key aspects of its 'net zero' definition	Left-side ledger support: Emissions / Energy Consumption	Right-side ledger support: Sequestration / Energy Production
Climate Change Action Plan (CCAP)	Emphasis on carbon at the housing level, as in the "Near Net Zero Housing Initiative"	<ul style="list-style-type: none"> • Efficiency of large buildings (multi-tenant residential, hospitals etc) • Electric vehicles and public transit • Building code changes 	<ul style="list-style-type: none"> • Local emissions reductions plans • Tree planting and grassland conservation • General support for low-carbon energy initiatives
Provincial Planning Statement (PPS)	No direct mention	<ul style="list-style-type: none"> • Tasks planning authorities to maximize efficiency gains, especially for transport • Supports intensification and a mix of land uses to build complete communities 	<ul style="list-style-type: none"> • Tasks planning authorities to maximize opportunities for renewable generation • Also for conservation and maximum vegetation cover
Proposed Growth Plan for the Greater Golden Horseshoe (GGH)	Emphasis on carbon at the community scale, using low-carbon and carbon-free methods of generation. Supports offsets for GHG emissions that cannot be eliminated, but prefers local offsets.	<ul style="list-style-type: none"> • Encourages district energy to be incorporated into planning process and other land-use patterns that maximize efficiency • Encourages public transit with dedicated right-of-way 	<ul style="list-style-type: none"> • Mention of energy from waste • Use water resource systems, natural heritage systems, and agricultural systems as carbon sinks
Proposed Greenbelt Plan	Same as GGH definition	<ul style="list-style-type: none"> • includes settlement areas policy that supports achievement of complete communities and achieving net-zero 	<ul style="list-style-type: none"> • Establishes greenbelt as a region of 'green infrastructure'
Proposed Niagara Escarpment Plan	Same as GGH definition	<ul style="list-style-type: none"> • Emphasizes accessibility of public transit and safety of active transportation • Where development is permitted, promotes efficiency and conservation 	<ul style="list-style-type: none"> • Encourages maximization of renewables • Discusses importance of its Parks and Open Spaces System as a carbon sink, and aims to form develop a new trail

			policy to ensure the continued protection of the system.
Proposed Oak Ridges Moraine Conservation Plan	No clear definition but seems consistent with Proposed Growth Plan for GGH	<ul style="list-style-type: none"> • settlement areas have an objective of ensuring that development takes place in a manner that reduces GHG emissions • applications for infrastructure development have to demonstrate that GHG emissions reductions and climate change adaptation impacts have been assessed Emphasizes access to public transit and active transit 	<ul style="list-style-type: none"> • Natural Core Areas, at which very limited new resource management is permitted, noted as being important carbon sinks
Infrastructure Plan Update	No direct mention	<ul style="list-style-type: none"> • Green Investment Fund to support retrofits for energy efficiency of major institutions (schools, hospitals) 	<ul style="list-style-type: none"> • Green Investment Fund to support retrofits for renewable energy generation at major institutions (schools, hospitals) • Supporting green infrastructure that will use natural elements to perform ecosystem services (e.g., carbon sequestration)

Table 2: A summary of how net-zero is defined and approached within Ontario's land-use planning policy framework

Case study map



Cross-cutting lessons learned across case study municipalities

How can the Province of Ontario enable local governments and the development industry to advance net zero community building?

Continue to set the context for municipal ambition on climate action and net zero communities

The Province has set a high bar for collective action on climate change in Ontario through ambitious GHG reduction targets and strategic alliances with other leading sub-national jurisdictions in North America (California and Quebec). This approach frames the policy context that Ontario municipalities have been contributing to over the last two decades. Several Ontario municipalities were early members of the Partners for Climate Protection, a joint initiative of the Federation of Canadian Municipalities and ICLEI – Local Governments for Sustainability.

Ontario municipalities have largely followed the province's lead in terms of level of ambition via GHG targets. The province has begun to take steps towards establishing net zero objectives for the building sector, including a net zero objective for new small buildings by 2030 at the latest. The province has established an objective for net zero communities under the proposed Growth Plan and has indicated that energy-efficiency standards in the building code will reach net-zero levels by 2030, with initial changes coming as early as 2020.

Segmenting the high-level ambition into province-wide sector specific targets and action plans is a critical next step to support municipalities by providing context to local and regional action plans.

Enable municipal/community level implementation through regulatory policy tools

In addition to the top-down policy framework for net-zero provided by the Growth Plan, Building Code, and Municipal Act, there is a role for the province to enable municipalities to innovate through bottom-up policy development. Programs such as the Toronto Green Standard and Brampton Sustainability Checklist (developed in collaboration with Richmond Hill and the City of Vaughan) provide examples of municipal leadership that supports net zero ambitions; however their application is limited to Site Plan and Plans of Subdivision authority provided to municipalities under the Planning Act. Municipalities have no authority to require that developers go beyond minimum building code in terms of energy performance of new development. Innovators in the development industry would like to see their hard work to achieve site-specific changes in development standards institutionalized.

The province could consider introducing a tiered approach in the building code, essentially enabling municipalities to require higher than minimum code levels of energy performance in new building development. While there is a risk here that an uneven or complex playing field might result from varying energy performance levels from municipality to municipality, it would certainly support the ratcheting up of building codes over time (leading towards net zero) by

demonstrating successful application of higher than minimum code requirements in certain areas. Alternatively, the Province could establish a regional scale building code (i.e. one that applies to the Greater Toronto Area or the Greater Golden Horseshoe).

Revise energy planning and regulatory framework to enable innovation in Local Distribution Company (LDC) business models

Community-based district energy systems (both thermal networks and electricity micro-grids) face regulatory barriers and policy-induced economic barriers which are constraining investment. For example, under current regulations Local Distribution Companies (LDCs) are limited in their ability to establish district energy networks, and to function as aggregators of distributed energy generation and storage resources. New district energy systems are possible within master planned communities like the London's West 5 and Ottawa Zibi case studies, but are difficult to retrofit into existing developments. Policy innovation is needed to support low carbon district energy networks in areas slated for growth. Existing rules around the participation of combined heat and power (CHP) projects in electricity markets may present additional barriers. Microgrids integrating distributed renewable energy sources and energy storage resources are an emerging possibility, but institutional and policy frameworks for the coordination and integration of these resources are still being formulated. Municipal authority to establish mandatory connection by-laws in areas suitable for district energy is needed, and provincial regulations that restrict the ability of LDCs to act as energy generators and aggregators (e.g. to function as "Fully Integrated Network Orchestrators" (FINOs) need to be revisited.

Enable municipal/community level implementation through fiscal policy tools

In addition to regulatory tools, the Province should continue to build the fiscal policy toolkit to support net zero energy infrastructure. We found evidence that provincial seed capital is a critical element to getting capital intensive district energy infrastructure into the ground. The Brampton Case study provides a positive example, where Sheridan College was able to leverage provincial and federal funding through the Post-Secondary Institutions Strategic Investment Fund. However we also found cases where the withdrawal of provincial seed capital resulted in missed opportunities for net zero community building (see the Toronto Port Lands case study). Funding channeled through the Climate Change Solutions Deployment Corporation could be a useful fiscal tool to support development of municipal district energy networks (both thermal and microgrid applications).

In addition to infrastructure capital for community-based low carbon energy systems, there is a role for senior levels of government to provide funding for municipalities to apply to innovative approaches being brought forward by the development industry that align with municipal policy aspirations, but need to be tested in a risk-free environment. For example, in the West 5 development in London the developer brought forward an innovative low impact development solution for onsite stormwater management that avoided the need for a traditional approach to stormwater management in a suburban context (e.g. large stormwater retention pond). Were it not for the strong support from the municipality, the developer would have been required to

implement the traditional system (more expensive, poorer outcomes) alongside the innovative system (less money, better outcomes) to satisfy concerns of the municipal inspector. Understandably, developers are not prepared to do this. Upfront risk capital provided by senior levels of government for innovative sustainable development practices would help establish the feasibility and benefits of things like community-based district energy and micro-grid systems.

Engage in multi-level collaboration, particularly in context of major urban redevelopment projects, to enable innovation.

Our research also identified a role for the province to collaborate with municipalities' on-the-ground to build net zero communities. We have found evidence to suggest that multi-level collaborations, particularly in the context of major urban redevelopment projects, can set the context for policy alignment and innovation. Waterfront Toronto provides a good example from our case studies, as does the Joint Design Review panel in Ottawa/Gatineau which facilitated the Zibi development. The Guelph Innovation District (GID) provides a near-term opportunity for such a collaborative approach to net zero community building. A net zero carbon goal has been established by the municipality in the GID Secondary Plan. The Province of Ontario is the primary property owner in the district. The Province of Ontario has the opportunity to leverage their land asset to enable innovation in net zero community building.

Support research and development, workforce training and skills development related to net zero community construction.

Finally, there is an important role for the province to support workforce training and certification programs that build capacity for net zero community planning and development. The London West 5 case study provides a good example, where industry innovators were able to leverage the MITACS accelerate program to build a team of graduate level students in a wide range of disciplines to help create the integrated energy design concept for the West 5 community. The Brampton Sheridan college case study provides another example. There, provincial investment in the District Energy Centre, which is housed in a new Skilled Trades Building on campus, will be used as an educational tool for engineering technology programs, as well as a training facility for the numerous trades programs delivered at Sheridan. This investment helps to address a key barrier identified in our case studies– the lack of talent with practical experience to meet growing demand for net zero community building.

How can local governments support net zero community building?

Create a supportive high-level policy context

Official Plans across all municipalities studied refer to the need to address climate change by reducing greenhouse gases, and include policies addressing energy efficiency and low carbon energy supply. All municipalities studied also had a related implementation plan, in the form of a Climate Change Plan or a Community Energy Plan, which provide additional context including specific GHG targets as well as actions that the city intends to implement in collaboration with stakeholders.

These high-level, city-wide policy documents provide the basis to support land use and energy-related policies for particular districts, neighbourhoods and sites through secondary plans, zoning by-laws and site plan approvals. That work is ongoing and will be strengthened by a more comprehensive provincial policy context.

In the regional municipal context where upper-tier planning policy interacts with lower-tier planning policy, attention needs to be paid to how best to align Official Plans, Master Plans and related infrastructure and land use planning documents to support successful development of low carbon and net zero communities.

Use authority provided by Planning Act and Municipal Act to incent low carbon and net zero development

The Planning Act provides municipalities with authority to mandate sustainable urban design through site plan approvals. The City of Toronto has leveraged this authority to require developers to meet energy efficiency standards through exterior site design elements. The municipality of Brampton has followed suit with its Sustainability Checklist for new development. All municipalities in Ontario have the power to require new development to meet sustainability (and energy) standards, including energy efficient design, through the site plan approval but few are taking advantage of it at this time.

An outcome of the West Five project has been the partnership of the City of London with S2E Technologies and three other municipalities (Waterloo, Kitchener, Kingston) to identify municipal policies and programs which help or hinder developers from pursuing net zero energy development and what existing tools can be used to incent low carbon and net zero development.

Use major redevelopment area opportunities (e.g. Brownfields) to create a test-bed for policy and technology innovation.

Our case studies provide several examples of municipalities taking advantage major redevelopment projects to go beyond status quo development policy and practice. Toronto Port Lands, Ottawa Zibi, and Guelph Innovation District all provide examples of this practice. Former industrial areas, often located close to urban centres, provide an opportunity for revitalization of vacant or underutilized employment areas to suit the needs of emerging innovative businesses, such as ICT, media, education and health. Building sustainable net zero communities through policy innovation that supports low carbon technology deployment can help to attract global talent needed to support creative industries in the knowledge economy. The Toronto Port Lands area is a great example, where there is an express interest by the municipality in fostering a film and media industry cluster in the area. The implementation of scale projects of this nature can be an effective intervention to accelerate the transition to low carbon community building.

Support micro-utility partnerships between local electricity distribution companies (LDCs) and private sector developers

The historical relationship between municipal governments and electricity and gas utilities has been limited to: 1) utility support for municipal corporate conservation initiatives and; 2) municipalities periodically providing planning data, upon request, regarding future growth and development plans.

Several of the case studies in this report show how innovative partnerships between LDCs and developers supporting the development of district energy and micro-grid networks. These developments represent innovation in the energy industry in response to the disruption being caused by advancements distributed energy technologies (e.g. solar PV, battery storage, smart grids) that threaten the traditional business model of city-wide electricity distribution. Where LDCs are owned by municipal governments, support should be given for experimentation with public-private partnerships around the development of low carbon energy networks.

Support/enable champions in both political and staff (i.e. technical) ranks

In all of the case studies municipal council support was seen as critical for successful implementation of low carbon/net zero policy. Council support is needed throughout all phases of net zero community development, from high-level visioning to specific direction for a given neighbourhood. As an example, in Toronto Mayor David Miller's leadership in championing the development of the City of Toronto's Climate Change Action Plan in 2007 was seen as providing inspiration and impetus for municipal staff to continue planning and policy development towards net zero objectives in the Port Lands area. Council-level support re-emerged in 2014 when local councilor Paula Fletcher put forward a motion requesting staff to develop guidelines for net zero energy in the Port Lands. Political champions help establish legitimacy for staff-level planning efforts, and generate buy-in and resources for the implementation process. In London, the West Five project was identified as a corporate strategic priority by Council and therefore the senior administration.

While a critical part of the recipe, political champions need to be complemented by municipal staff champions with the knowledge, skills and collaboration capacity to support inter-sectoral collaboration and policy innovation. In most of the case studies the presence of municipal staff dedicated to corporate and/or community wide energy management was a critical factor. They played a key role in coordinating the conversations between municipal departments such as Planning and Development, Buildings, and Economic Development, as well as with external stakeholders such as developers, and major institutions. They facilitated the complex decision making and engagement needed to move net zero community projects forward and in doing so served to bring the worlds of the land use planner and energy developers closer together.

How can the development industry advance net zero community building?

Engage early and often with key municipal government and energy stakeholders

In the case studies where the net zero vision was led by a private sector developer (London and Ottawa), proactive and ongoing engagement with municipal government staff, elected officials

and the local distribution company was seen as a critical success factor. By putting the net zero vision forward early in the development process, and aligning the business case with existing municipal and provincial policy objectives, developers were able to build a strong base of support which led to flexibility in policy (zoning by-laws, site plan approvals, building permits) that enabled business model innovation (e.g. neighbourhood micro-utilities in both London West 5 and Ottawa Zibi).

This was also true in the bottom up approach taken by Sheridan College. Early engagement of stakeholders (e.g. building operators and finance) was key to achieving buy-in for the campus vision.

Demonstrate the marketability of net zero communities and alignment with housing affordability agenda

While it is true that the upfront cost of a net zero home is higher than a conventional new build the case studies support the idea that net zero homes and net zero communities can save homeowners and tenants money in the long-run through reduced energy costs. Net zero communities offer the advantage of economy of scale through district heat - i.e. thermal grids, and district electricity - i.e. microgrids, system. Leading Ontario land and energy developers such as Sifton and S2E Technologies (London West 5), and Windmill (Ottawa Zibi) are demonstrating this in the market today.

Demonstrate alternative governance models for implementing district heat and district electricity partnering with municipalities and local utilities.

District heat and district electricity (i.e. microgrid) systems support net zero carbon goals by facilitating the sharing of energy within a community. However, several unresolved governance issues challenge implementation (e.g. who pays, who owns, who operates). Leading Ontario land energy developers are demonstrating new public-private partnership approaches to implementing these systems.

Emerging research directions

How will the regulatory framework for local distribution companies need to evolve to support them taking a key role in Ontario's transition to net zero communities?

The historical relationship between municipal governments and electricity and gas utilities has been limited to: 1) utility support for municipal corporate conservation initiatives and; 2) municipalities periodically providing planning data, upon request, regarding future growth and development plans.

Moving forward Ontario's LDCs, many of which are owned by municipal governments, can play a key role in the development of net zero communities, but are constrained by the regulatory framework in their ability to act as generators and aggregators of distributed energy resources (DERs). LDCs can control and integrate low carbon energy sources within their distribution territory, helping to balance loads and grid reliability. They can also leverage diverse sources of capital to build and operate district energy systems, potentially in partnership with private sector developers.

Transitioning the traditional LDC business model towards a micro-grid network coordinator, and district energy system developer, requires overcoming challenges related to financial constraints, regulatory barriers, business processes and corporate culture. Collaboration between LDCs, municipalities, third party energy providers, and energy solutions vendors can help achieve cost effective deployment, as has been shown in the case studies presented in this report.

Further research to understand the nature of these barriers, and approaches to overcoming them, could help to accelerate the transition to net zero communities.

What Provincial and municipal policies, tools and process changes are proving effective in engaging energy decision makers in land use planning decisions, and vice versa?

Ontario's Proposed Growth Plan and related land use and municipal policy frameworks have linkages to the province's Climate Change Action Plan (CCAP). Specifically, under the CCAP, the Province will propose amendments to Ontario's Planning Act to make climate change a provincial interest, and to make climate change mandatory in municipal official plans. In addition, the Ontario Government has proposed complementary policies under the Municipal Act, 2001 that will clarify the power of municipalities to establish by-laws addressing climate change mitigation. The Municipal Energy Plan program supports the development of community GHG and energy inventories, targets and reduction strategies.

The IESO has amended the Integrated Regional Resource Planning process to ensure municipal governments are consulted as stakeholders. In addition, Ontario's Long-Term Energy Plan is currently being updated to align with the Climate Change Action Plan. Specifically, the Minister of Energy has been mandated to ensure regional and community energy plans are considered in energy decision making.

Integrating energy and urban planning at the community and project scale is necessary to achieve net zero carbon communities. Yet, energy decisions have been made in isolation of virtually all municipal services, for over a century. Both worlds have strongly entrenched business practices that are a barrier to integrated planning and decision making and achieving provincial goals.

Understanding what provincial and municipal policies, tools and process changes are proving effective in engaging energy decision-makers in land use planning and development, and vice versa, along with a comparative analysis of best practice in other national and international jurisdictions, would support the transition to net zero carbon communities. Furthermore, understanding how best to align land use and infrastructure planning policies in the regional municipal context where there is a tiered governance framework (e.g. upper-tier regional municipalities and lower-tier local municipalities) remains a knowledge gap. This is critical given the hierarchical manner with which conformity to Provincial land use plans is achieved.

How can municipalities best leverage existing policy tools to support low carbon and net zero community transitions?

Urban design standards, exercised through municipal approvals of site plans and plans of subdivision, can influence on total energy consumption and GHG emissions over the life of a building or community. While all municipalities have authority under the Planning Act to encourage and require sustainable urban design (e.g. Green Development Standards), only a handful are using this authority. Similarly, changes to the Municipal Act in 2012 granted authority to municipalities to implement local improvement charges to encourage energy efficiency retrofits and renewable energy, however few have taken advantage of this.

Research is needed to understand (1) how existing (and proposed) municipal policy tools can be used to support energy transitions and (2) what barriers are preventing their uptake and implementation by municipalities. This research could lead to the development of a low carbon/net zero policy toolkit or guidance document for municipalities, including template by-laws to facilitate policy implementation.

What is the municipal role in the transition to zero carbon transportation?

Research to better understand the role that municipal policy interventions can play in encouraging fuel substitution (e.g. from gasoline/diesel to electricity/biofuels) within communities is needed. The longer-term (e.g. 2050 timeframe) transition to net-zero communities will require a significant focus on the transportation sector, which is the largest source of GHG emissions in Ontario municipalities.

Transportation policies that are within the city's jurisdiction often focus on transportation infrastructure expansion and intensification near transit stations and along transit corridors. While these policies encourage mode shifting from personal automobile to public transit, they do not change the fuels used in private vehicles. Absent additional policy, substantial emissions will remain in the transportation sector from gasoline and diesel vehicles. Complicating this picture

is the considerable uncertainty as to the potential impact of autonomous vehicles and vehicle sharing technologies on transportation emissions. Also to consider are the implications of transitioning from the existing transportation fuel distribution system to an entirely new transportation energy distribution system for municipal policies and land use planning.

Interventions such as transitioning municipal fleets, and building out electric vehicle charging infrastructure will be needed. Parking policies (e.g. restricting use of city-controlled parking spaces to low and/or zero-emissions vehicles) may play a role in the future, as might road tolls and congestion charges. Understanding (1) what the impacts of disruptive technologies might be on transportation emissions (2) what municipal policy levers are available, and (3) what their impact might be in terms of emissions reductions, would help build the municipal policy toolkit to address the most important sector for climate action.

Case Study #1: London's West Five Community – Building a Net Zero Energy Community

Municipal Snapshot⁴

Municipal name	City of London
Municipal Status	Single tier
Area	420.57 km ²
Population (2006 census)	352,395
Population (2010 census)	366,151
Growth rate	3.9%
Within Greater Golden Horseshoe	No

Project Snapshot⁵

Developer	Sifton Properties
Energy partner	S2E Technologies
Definition	Net Zero Energy
Status	First office building and ~90 rental townhouses in 2017
Site area	28 hectares
Number & type of residential units	~2000 units (townhomes, apartments and condos)
Commercial and office space	32,500 m ²
Gross residential density	71 units per hectare
Landscaped open space	Designed around a central park and trail system
Building heights	2 to 12 stories (heights exceeding twelve stories may be

⁴ List of municipalities in Ontario. (2017) Retrieved from https://en.wikipedia.org/wiki/List_of_municipalities_in_Ontario

⁵ Welcome to West Five. (2015). Retrieved from <http://www.questcanada.org/files/download/9e1bc3e6335cd95>

	permitted at key locations)
Pre-development use	Agriculture; vacant greenfield
Certification	Pursuing Net-Zero certifications for buildings and the community from the Canadian Home Builders Association
Sustainability framework	Customized
Key energy features	Beyond-code energy efficiency, solar PV, electric vehicle charging, potential for district energy
Key water features	Green roofs, high-efficiency appliances, rainwater collection
Grants	MITACS, Scientific Research and Experimental Development Tax Incentive (SRED)

Context

Description of municipality

With an estimated population of 381,000 the City of London is the fifth largest municipality in Ontario. While not within the Growth Plan for the Greater Golden Horseshoe, Council has endorsed a population projection of 544,700 residents by 2031.

Located in the heart of some of the most agriculturally-productive farmland in Ontario, the City developed around an economic base of food and beverage-processing, which continues to be a major focus of the local economy (e.g. Labatt Breweries). Once a major manufacturing centre in Southwestern Ontario, economic restructuring has meant that public sector institutions (universities, colleges and hospitals) are now a more important employment base for the City's economy, as are the growing information communication technologies (ICT) and digital media sectors.⁶

Over the past 40 years, London has largely grown outwards through urban sprawl, consuming large amounts of prime agricultural land.⁷ Today, the City sees economic transition towards sustainable planning and economic development as a path towards prosperity. The 2016 Official Plan – The London Plan – establishes a strategic direction for London to “become one of the greenest cities in Canada”, and in so doing sets the groundwork for a *Green City Strategy* that will chart a path towards the City having a smaller per capita ecological footprint than most cities in the Canada.⁸

Of interest, London built Canada's first district energy system in 1880. This system has since grown to serve most of the downtown core.

Municipal Policy Framework

As the work to complete the West Five plan and planning application was underway, the City of London was simultaneously updating its municipal policy framework. The new policy framework better supports net zero energy development.

A new official plan was approved in 2016. The London Plan, as it is called, was developed after an extensive two-year conversation (ReThink London, 2012/2013)⁹. The London Plan sets the broad policy framework for sustainable development in the City. It recognizes the critical importance of a compact built form to minimizing or reversing growth in the City's infrastructure gap, improving health outcomes in the context of an aging population, and for protecting remaining prime agricultural land within its municipal boundary. It sets strategic directions for the City, including that London becomes one of the greenest Cities in Canada.

⁶ Digital Creative. (2017). Retrieved from <http://www.ledc.com/digital-creative>

⁷ Statistics Canada. (2016, March). Retrieved from <http://www.statcan.gc.ca/daily-quotidien/160322/dq160322a-eng.htm>

⁸ The London Plan. (2016, June). Retrieved from <http://www.london.ca/business/Planning-Development/Official-Plan/Documents/London-Plan-Final-July2016-spreads-reduced.pdf>

⁹ The London Plan. (2016). Retrieved from <http://www.thelondonplan.ca/>

Specific policies within the new official plan provide support for the creation of a Green Strategy as well as a Community Energy Action Plan to support more environmentally-friendly and affordable energy usage and to enhance local air quality¹⁰. This includes 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, district energy, ground-sourced thermal energy, solar thermal and photovoltaic, bioenergy and energy from waste.¹¹ The new official plan also encourages new policy tools for energy efficiency and renewable energy, such as Local Improvement Charges for energy retrofits, and incentive mechanisms for sustainability within the development approvals process.

Description of project

West Five is a 28-hectare greenfield property located in the northwest of the City of London. The lands are part of the surrounding larger RiverBend Community of new and planned residential development.

The lands that comprise the RiverBend Community were annexed into the city boundaries in 1993. Community planning commenced in the mid to late 1990s to establish the use designations for the newly-annexed lands. These early plans contemplated a conventional suburban development form reflecting the market realities of the day. With time, demand for mid-rise and high-rise developments increased. Land use plans for the area began to intensify but around a traditional arterial road pattern.

In the mid-2000s, Sifton Properties began development of a new vision for the West Five lands as a walkable, mixed-use community. These plans were put on hold after the market crash of 2008 but were renewed again a few years later.

Today, West Five has been planned as a complete community including a mixture of office, retail, residential and public open spaces. The community is to be a model of “smart” community design incorporating significant energy saving and renewable energy initiatives to achieve net zero energy. The design is pedestrian-oriented and has numerous green spaces, including a central park.

The first net zero energy office building and 90 townhouses will be completed in 2017. The project is expected to take 10 to 15 years to complete.

Rationale for selecting as a case study

The West Five development was chosen as a case study due to (1) developer’s stated aspirations to build a net zero energy community and (2) municipal planning policy interventions to support the development.

¹⁰ City Building Policies. (2016, July). Retrieved from <http://www.london.ca/business/Planning-Development/Official-Plan/Documents/City-Building-Policies-LP-July-2016-Spreads.pdf>

¹¹ Ibid.

Existing policy/tools at time of planning application

City of London Official Plan

The official plan, at the time of the West Five application, had been approved in 1989. While there had been amendments along the way, it did not include any energy-related policies¹².

RiverBend South Secondary Plan¹³

In 2014, Sifton Properties brought forward a new Secondary Plan for the RiverBend South Community. The new vision was based on a complete community with a range of housing choices, healthy living and active transportation, the integration of greenspaces and the natural environment, and environmental sustainability. The RiverBend South Secondary Plan now forms part of The London Plan, the City's new official plan.

The Secondary Plan included several energy-related objectives for achieving the principle of environmental sustainability including encouraging encouraging ENERGY STAR^{®14}, LEED^{®15} and other green standard buildings, the use of renewable and alternative energy sources, where feasible, and active transportation.

Community Energy Action Plan (2014-2018)¹⁶

The City's first Community Energy Action Program, funded partly through the Federation of Canadian Municipalities' Green Municipal Fund, was approved in 2014.

The plan sets greenhouse gas (GHG) reduction goals for London that are consistent with provincial targets:

- 6 percent reduction in total GHG emissions from 1990 levels by 2014,
- 15 percent reduction in total GHG emissions from 1990 levels by 2020,
- 80 percent reduction in total GHG emissions from 1990 levels by 2050.

The plan also establishes a range of sector-specific measurable goals with respect to energy demand and low carbon energy supply. In addition to setting out strategic actions for the City to implement to 2018, the plan identifies specific actions that key stakeholders from both the public and private sector have agreed to implement as part of London's Community Energy Action Plan. This makes London's CEP a unique blend of action and authority between government, non-government, and private sector stakeholders.

¹² London's Official Plan. (2014). Retrieved from <https://www.london.ca/business/Planning-Development/Official-Plan/Pages/OfficialPlanDocument.aspx>

¹³ Riverbend South Secondary Plan. (2014, August). Retrieved from <https://www.london.ca/business/Planning-Development/secondary-plans/Documents/RBS-Secondary-Plan-April-2014.pdf>

¹⁴ Energy Star for New Homes. (2016). Retrieved from <http://www.nrcan.gc.ca/energy/efficiency/housing/new-homes/5057>

¹⁵ LEED: The International Mark of Excellence. (2016). Retrieved from http://www.cagbc.org/CAGBC/LEED/CAGBC/Programs/LEED/Going_green_with_LEE.aspx?hkey=54c44792-442b-450a-a286-4aa710bf5c64

¹⁶ Community Energy Action Plan. (2014, July). Retrieved from <https://www.london.ca/residents/Environment/Energy/Documents/Community%20Energy%20Plan.pdf>

Of relevance to this case study are actions that the London Home Builders Association has committed to in order to support improved energy efficiency in new single family housing stock. The LBHA has committed to work with the City to determine whether a 15 percent energy reduction in residential energy use per person is a high target or is in fact achievable. It has also committed to conduct education and outreach to its members and the broader contractor community in London regarding low carbon energy technologies.

The Community Energy Action Plan informed the development of The London Plan, the new official plan for the City.

Policy amendments precipitated by the planning application

Application for Approval of Draft Plan of Subdivision/Official Plan and Zoning By-law Amendments

In 2015, an application for approval of draft plan of subdivision and official plan and zoning by-law amendments was submitted by Sifton Properties to the City of London. All planning approvals for West Five, including site plan, were received in 2016.

The purpose of the planning application was to permit the development of a mixed-use community consisting of commercial, office and medium and high density residential uses. The special policy for the area supported and promoted sustainable and renewable energy initiatives, including solar electricity generation, district heating, ecologically efficient transportation systems, and green infrastructure technology. Consideration of the need for alternative development standards for streets, utilities and infrastructure was also included.

"West Five is intended to be a showcase of sustainable design and development. The goal is to achieve net zero annual energy usage to the extent feasible through various design considerations...The City will encourage and facilitate opportunities for partnerships, incentives and funding opportunities that assist in implementing sustainability initiatives, and may consider alternative development standards for streets, utilities and infrastructure ".¹⁷

Emerging policy/tools precipitated by the development

An outcome of the West Five project has been the partnership of the City of London with S2E Technologies and three other municipalities (Waterloo, Kitchener, Kingston) to identify municipal policies and programs which help or hinder developers from pursuing net zero energy development.¹⁸ The project will consider 8 potential project sites (2 in each municipality). Investigations will also consider financing (e.g. business models and incentives) and technology barriers. The project has been funded, in part, by the Federation of Canadian Municipalities' Green Municipal Fund and final results are expected later in 2017.

¹⁷ Policies for Specific Areas. (n.d.). Retrieved from <http://www.london.ca/business/Planning-Development/zoning-by-law/Documents/Chapter-10.pdf>

¹⁸ The results of this research were not available for this case study.

Enabling Federal and/or Provincial interventions

Funding has been sought from several places over the years including: Federation of Canadian Municipalities Green Municipal Fund, Sustainable Development Technology Corporation (SDTC), and Individual Research Assistance Program (IRAP). Scientific Research and Experimental Development (SR&ED) tax credits and MITACS assisted with achieving the net zero energy goals. MITACS accelerate program was used extensively to develop a team of highly qualified graduate students (PhD and Masters level) to support the development of the project feasibility study.

Stakeholder Perspectives

Municipal perspective

Building champions and support through community and stakeholder engagement

The vision and goals for the project were communicated to key senior administrative and operational municipal staff from across the corporation (e.g. building, planning, engineering) well in advance of the planning application. In doing so, the developer built strong administrative support for the project – it became a strategic corporate priority. Senior management support was instrumental in ensuring many road blocks were addressed particularly related to alternative development standards. This level of engagement of senior management was not “business as usual” and important given the new standards and technologies being proposed.

The project was also well supported politically given the alignment with Council’s strategic plan (2014-2018) and The London Plan. Several members of London City Council had campaigned on the “green” community vision that had emerged from ReThink London.

Sifton Properties also held numerous community meetings in advance of the application which was considered a best practice. There was overall support for the sustainability aspects of the development and more traditional concerns were raised (e.g. impact of parking, traffic volumes).

The role of innovators

In an ideal world, a municipality would include climate change and energy policy objectives in their Official Plan first. These policies would then inform the development of Secondary Plans and implementing Master Plans - e.g., a community energy plan. However, in practice, opportunities to update planning tools are taken when they arise. This was certainly the case in London as the municipality worked to align several policy documents as they developed their new official plan – The London Plan. This has created a more positive policy environment for future net zero energy projects.

In the case of this project the sustainable vision for the project came from the private-sector. Development innovators play an important role in driving change in municipal policies, standards and processes.

While there have been other London industry innovators, the West Five project is pushing the envelope. This will continue to challenge the municipality to respond to new technologies and alternative development standards.

Flexibility

Greater flexibility was sought by the developer, through the zoning by-law amendment, to support the sustainability goals. Greater flexibility was also sought in the approvals process i.e. the approvals for draft plan of subdivision and site plan were completed simultaneously. In the same way an integrated design process was required to best achieve the project's sustainability goals, a coordinated and integrated development approvals process was also necessary.

Municipal energy resources

The Environmental Programs division, responsible the Community Energy Action Plan, has worked closely with London developers and homebuilders for many years to promote energy efficiency. A collaboration on the London Energy Efficiency Project in the latter part of the last decade promoted the uptake of new energy technologies at the individual building scale.

The Environmental Programs division has served to “connect the dots” between different stakeholders including developers, homebuilders, building inspectors and technology providers as well as intra-municipal stakeholders. This municipal resource, which sits outside of the regulatory world, has been important in providing a platform for nurturing net zero energy home and community building in London. The project to examine barriers to net zero community building is a natural evolution of this earlier work.

Developer perspectives

Vision

The net zero energy vision for the West Five project has been led by Sifton Properties and S2E Technologies; it preceded any energy policies in the official plan. Developing goals for sustainability, including net zero energy, at the beginning of the design process was important for success.

Stakeholder and Community Engagement

Engaging early and often is considered a best practice to build necessary support in the community and among stakeholders for something new.

Engagement of stakeholders was also a core strategy to mitigate the risks associated with an innovative project. For instance, significant time was invested in educating municipal building inspectors about the new energy technologies that they would be dealing with at inspection. Delays at inspection can have significant consequences for a project.

Collaboration is essential, among all stakeholders, to support net zero energy communities. If the government is looking to accelerate the transition to net zero homes it has two choices: 1) regulate, but this can be confrontational or 2) work collaboratively with the industry to change the way communities are built.

Feasibility Study

In 2013, S2E Technologies began work on a feasibility study for sustainable urban living. The feasibility study considered many aspects of sustainability including new technologies to reduce carbon footprint. The feasibility study also tested the response of the market to net zero communities (see comments below).

Over 90 researchers were engaged in the feasibility study. S2E Technologies raised all the funding to conduct the feasibility study which was, naturally, highly attractive to Sifton Properties. The role of post-secondary institutions, and research, have played an important role in moving forward on net zero energy community design and business models.

A key outcome of the feasibility study was the development of a financing model that would support West Five achieving net zero energy at very little, or no cost, to the builder or the home buyers. The financing model was based on the development of a micro-utility through a partnership between Sifton, S2E and London Hydro. The micro-utility will provide efficient energy services to the community while externalizing the incremental capital cost of achieving net zero energy from the developer's perspective.

The feasibility study played an instrumental role in securing corporate support at Sifton Properties to accept the additional risks inherent in building a net zero community.

Integrated Design

The leadership of both Sifton Properties and S2E Technologies converged in a timely way. The vision to develop West Five as a complete community created the right conditions to pursue net zero energy. Sifton Properties engaged an architect to lead the development of the master plan concept for the community. S2E Technologies, as the energy developer, was at the table from the beginning of the design process and the findings of the feasibility study were integrated into the community plan.

Local energy infrastructure

New local energy infrastructure is key to achieving the energy goals.

District electricity – i.e., micro-grids, will manage electricity produced within the community. Net metering will sell any excess electricity generated to the grid. Electricity generation is solar PV although combined heat and power may be considered in the future. District heat will be considered as higher density phases of the development come on line. However, the energy efficiency being achieved in lower density developments – e.g., townhouses, means heat loads will be insufficient to support district heat. The first office building has been built to be district energy ready but will be heated with best available technology today; air-sourced heat pumps distributing heat through VRF (Variable Refrigerant Flow). The town-homes will be heated individually with small air-sourced heat pumps.

S2E Technologies, Sifton Properties and London Hydro have entered a joint partnership to develop the micro-utility. It will provide energy services to the community. The micro-utility may

also play a role in promoting resident and tenant behaviour that supports the energy goals for the community.

The risks of being an innovator

Being an innovator in the development sector comes with considerable risks. These risks can be a deterrent for many in the development industry. For Sifton Properties and S2E Technologies, West Five has also been about making a difference and leaving a legacy.

New approaches invariably cause delays and add costs to the development approvals process. This can be the case even with municipal policy in place. There is often a lack of alignment between planning policies, and the practices and standards used by municipal engineers and building services. Several strategies were used to mitigate this risk. Key municipal stakeholders were brought together early in the process to raise awareness of the project and build strategic support for making it work. The City also appointed an internal champion, from the Economic Department, for the project whose role was to “oil the machine” and help break down silos within the municipality. While these strategies helped, approvals for alternative development standards were still challenging and, in some cases, not possible.

London Hydro’s regulatory environment is also making implementation challenging despite strong support by the CEO for the micro-utility. The current regulatory framework presents many barriers to optimizing the use of distributed energy resources.

To accelerate net zero energy community buildings, governments, at all levels, could do more to support innovators, helping to mitigate their risks.

The ability to attract experienced talent - i.e., individuals who have hands-on experience building net zero energy homes and communities, is also emerging as a challenge.

Cost of land

There is a concern that escalating land costs will be a barrier to net zero energy communities already come with extra costs. Sifton Properties has owned the West Five lands for many decades so land costs were relatively low for this project. The municipality has expressed interest in seeing a “West Five” development in the downtown but land prices would be too prohibitive.

Marketability

While there is high market acceptance of detached homes and townhouses in the London market, changing demographics are increasing the demand for a more urban lifestyle. However, there is a concern that the experience of urban living promised in the marketing of West Five will take many years to achieve.

Prices also need to be competitive with the market. The development of a micro-utility enabled the business model but also brought marketing challenges because this approach to supplying energy is new to the Ontario market. The first townhouses are strategically rentals to provide greater control over the homes during the early testing of systems.

There are positive impressions associated with the term “net zero” but it will not be the primary marketing message for the development. Research found that the term “smart” had the potential to engage broader cross-section of the market. People are able to define “smart” in many ways.

Lessons learned and replicability

- Articulating a vision for sustainability early helped; engaging early and often built support in the community and helped to educate stakeholders.
- Political and administrative champions are important; assigning an internal municipal champion can also help to address barriers.
- Research institutions are playing a key role in advancing sustainable technologies and designing new business models. Government support through programs like MITACS provide an essential pipeline of highly qualified professionals to support innovation in the energy space.
- More work is required to align aspirational planning policies with operational practices and standards; greater collaboration between local government and industry innovators is recommended; and governments can help reduce their risks.
- Integrated community design is essential to achieving net zero energy goals; energy developers need to be engaged early in the design process.
- Starting with rentals allows the builder greater control over energy systems in the early testing phase.
- The recruitment of experienced talent by the private sector is a potential challenge.
- Municipal energy resources can help nurture a positive environment for net zero energy building
- Governments wanting to accelerate the development of net zero energy communities and other innovative development approaches will need to support innovators and help mitigate their risks

Case Study #2: Guelph Innovation District – Development of a Net Zero Carbon Secondary Plan

Municipal Snapshot¹⁹

Municipal name	City of Guelph
Municipal Status	Single tier
Land area	86.72 km ²
Population (2006 census)	114,943
Population (2011 census)	121,688
Growth rate	5.9%
Population density per km ²	1,395.4
Within Greater Golden Horseshoe	Yes
Updated 2031 Places to Grow Population Target ²⁰	177,000

Project Snapshot²¹

Project Name	Guelph Innovation District (GID)
Definition	Net Zero Carbon
Status	Secondary Plan
Site area	Approximately 436 hectares
Estimated residential population	4400
Minimum gross residential and employment density target	90 persons and jobs combined per hectare
Maximum height	Ranges from 2 to 10 stories
Non-residential units	Land uses permit mixed-use (e.g. office,

¹⁹ List of municipalities in Ontario. (2017). Retrieved from https://en.wikipedia.org/wiki/List_of_municipalities_in_Ontario

²⁰ Places to Grow. (2013, June). Retrieved from <https://www.placestogrow.ca/content/ggh/2013-06-10-Growth-Plan-for-the-GGH-EN.pdf>

²¹ Envision Guelph. (2013). Retrieved from <http://guelph.ca/wp-content/uploads/finalOPA48-withdecision1.pdf>

commercial, entertainment, research and development, institutional, educational and live-work)

Pre-development use

Former provincial correctional facility; Guelph Turfgrass Institute and agroforestry research

Grants

Federation of Canadian Municipalities Green Municipal Fund²²

Context

Description of municipality

The City of Guelph has a long commitment to the principles of sustainability. In November 1990, Guelph City Council approved the development of a green plan for the city. In April 1992, Guelph City Council officially delegated the task of community consultation to the Guelph Round Table on the Environment and Economy, a multi-stakeholder community association²³. The Guelph Round Table also coordinated the writing of the document using multi-sectoral writing groups and an editor to produce the final document. The Guelph Green Plan was adopted by Guelph City Council in 1994. The plan included targets for the reduction of greenhouse gas (GHG) pollution. In 2001, the City of Guelph was recognized for its work in advancing sustainability through the implementation of the Guelph Green Plan by the Federation of Canadian Municipalities (FCM)²⁴.

Today, the strategic goals in the municipality's Official Plan are focused on sustainability and support the quadruple bottom line – ecological, social, cultural and economic – in decision making.²⁵

The Guelph community also has a long history of engagement in local decision making. For example, more than 1000 residents participated in the development of the Guelph Green Plan²⁶. In 2003, over 1000 residents participated in the development of eight *SmartGuelph* principles to inform the sustainable growth and development of the community.

²² City of Guelph. (2011, June). Retrieved from <http://guelph.ca/2011/06/fcms-green-municipal-fund-supports-the-city-of-guelphs-creation-of-a-secondary-plan-for-the-guelph-innovation-district/>

²³ The Guelph Round Table on the Environment and Economy. (1998). ISBN: 0-88955-488-9

²⁴ Federation of Canadian Municipalities. (2015). Retrieved from <http://www.fcm.ca/home/awards/fcm-sustainable-communities-awards/past-winners/2001-winners/2001-planning-co-winner-2.htm>

²⁵ The City of Guelph. (2015). Retrieved from <http://guelph.ca/wp-content/uploads/OPConsolidation-September2014.pdf>

²⁶ The Guelph Round Table on the Environment and Economy. (1998). ISBN: 0-88955-488-9

Municipal Policy Framework

In 2004, several local civic leaders came together to lead the development of a community energy plan (CEP) to improve how energy was used and managed in Guelph. In May of 2005, Guelph City Council approved preliminary terms for a CEP and their participation in this community consortium to create a CEP²⁷. Council also directed that the CEP be integrated into the municipal growth strategy. At the time, the municipality was anticipating the need to update its Official Plan to bring it into conformity with the Places to Grow Act (2005) and the Growth Plan for the Greater Golden Horseshoe (2006). The Guelph CEP was unanimously adopted by Guelph City Council in 2007²⁸. The plan set an overall goal to reduce per capita energy consumption and greenhouse gas emissions by 50% and 60%, respectively over 25 years. These targets were incorporated into Guelph's Official Plan through Official Plan Amendment (OPA) 48.²⁹ The City of Guelph is currently undertaking a comprehensive 10-year review of the CEP.

Description of project

The Guelph Innovation District (GID) area comprises 436 hectares straddling the Eramosa River in the east-side of the municipality. Most the lands are owned by the Province of Ontario who is positioning the lands for disposition by Infrastructure Ontario. Historically, the lands were the used as a provincial correctional institute. The jail was closed in 2001 and the lands have been largely unused since then. Most of the original buildings on the jail site remain and the property is a brownfield. The Wellington Detention Centre, which was also located on provincially-owned lands, was demolished in 2007. Some of the provincially-owned lands have been leased to the Guelph Turfgrass Institute and the University of Guelph for research purposes in recent years.

The GID area falls within the built boundary of the Growth Plan for the Greater Golden Horseshoe and was identified as an important redevelopment opportunity for the municipality to meet its population and employment targets without annexing new lands into the municipality.

Planning work began as early as 2005 and culminated in a secondary plan (Official Plan Amendment 54) in 2014. OPA 54 has been appealed to the Ontario Municipal Board and awaits final approval. A Board order was issued on March 6, 2015 approving portions of OPA 54.³⁰ The appeal is unrelated to the net-zero carbon vision for the lands.

OPA 54 calls for a compact, mixed-use community. Once built, it is expected that the district will be home to close to 6,650 people and 8,650 jobs by 2031. Residents will be housed in primarily medium and high density (townhouses, apartments), mixed use and a limited supply of low density (single and semi-detached housing forms). The GID will serve predominately as the home of innovative, sustainable employment uses with an adjacent urban village connecting residential and compatible employment uses. Considerable parts of the lands are to be protected as natural and cultural heritage.

²⁷ City of Guelph: Planning, Environment and Transportation Committee Report. (2005).

²⁸ City of Guelph. (2007, April). Retrieved from http://guelph.ca/wp-content/uploads/report_communityEnergyInitiative.pdf

²⁹ Envision Guelph. (2013). Retrieved from <http://guelph.ca/wp-content/uploads/finalOPA48-withdecision1.pdf>

³⁰ City of Guelph. (2016). Retrieved from <http://guelph.ca/plans-and-strategies/guelph-innovation-district-york-district-lands/>

Rationale for selecting as a case study

Guelph is an example of a municipality that has integrated climate change and energy policies into their Official Plan providing a supportive municipal policy environment for net zero carbon community building. The GID was also identified as a potential mixed-use scale project for the development of an integrated energy master plan to advance the goals and objectives of the Guelph CEP. The objectives and policies in the GID Secondary Plan reflect this policy recommendation and establishes a net zero carbon vision for the redevelopment of these lands.

Existing policy/tools at time of planning application

There currently isn't an active development application for the GID. However, the Province of Ontario, as the majority landowner has begun the process to declare the lands surplus to their needs and to place them on the open market. The following policies, however, will inform a future development application.

Community Energy Plan³¹

The CEP recommends identifying mixed-use scale projects for integrated energy master plans to advance the goals and objectives of the CEP. The GID was identified as a potential scale project in the CEP. The Guelph CEP goes beyond end-use energy conservation and efficiency (e.g. homes, buildings, industry and transport) and the uptake of renewable energy (e.g. solar PV). The plan also proposes to improve the overall efficiency of the energy system, by promoting community energy (e.g. district energy, and combined heat and power), as well as the city, by promoting sustainable urban design.

District Energy Strategic Plan³²

A District Energy Strategic Plan was developed as an enabling strategy for the CEP. It identified the GID as a potential candidate for district energy especially given its proximity to the University of Guelph's district energy system.

Official Plan³³

Energy and climate change objectives and policies were integrated into the municipality's Official Plan through OPA 48 (see Appendix 1). These include the targets for energy consumption and greenhouse gas emissions established in the CEP. The Official Plan includes objectives to reduce energy use in the City, encourage local generation through renewable and alternative energy systems and facilitate district energy.

³¹ City of Guelph. (2007, April). Retrieved from http://guelph.ca/wp-content/uploads/report_communityEnergyInitiative.pdf

³² Envida Community Energy. (2013). Retrieved from http://www.envida.ca/en/developingSustainableEnergy/resources/DISTRICT_ENERGY/District_Energy_Strategic_Plan_for_the_City_of_Guelph_-_Website.pdf

³³ Envision Guelph. (2013). Retrieved from <http://guelph.ca/wp-content/uploads/finalOPA48-withdecision1.pdf>

Official Plan Amendment (OPA) 54³⁴

The GID Secondary Plan was integrated into the municipality's Official Plan through OPA 54. OPA 54 includes additional energy policies (see Appendix 2) supporting the net zero carbon vision for these lands.

OPA 54 promotes energy efficiency, renewable energy sources, and an integrated energy distribution system for these lands. If parts of the land are identified as potential for district energy, OPA 54 includes a policy that will require new development to be district energy ready subject to the City establishing District Energy Ready Guidelines. OPA 54 also suggests, where a district energy system has been established or is planned, a new development will be encouraged and may be required to connect. New municipal buildings will connect to such a system. Also included is a commitment on the part of the City to work with Guelph Hydro, and appropriate partners on the development of a district energy system for the GID if such a system is feasible for the GID.

OPA 54 includes policy objectives for water conservation and efficiency, low impact development, and the reuse of waste by-products. Water efficiency measures, including greywater reuse and rainwater harvesting, are encouraged. A target of 250 litres per day, per employee, is proposed for the new ICI development. Low Impact Development (LID) measures are encouraged to minimize stormwater run-off and recharge ground water. Achieving pre-development standards to maintain the hydrological cycle of the area post-development are also encouraged.

OPA 54 also includes a principle to establish a multi-modal pedestrian-focused mobility system that is designed to prioritize pedestrians, cyclists and transit users over drivers by incorporating alternative development standards (e.g. larger rights-of-way for pedestrians and cyclists) and providing an extensive pedestrian and cycling network with direct, safe travel routes, and convenient, affordable transit service which is integrated with the rest of the City.

Policy amendments precipitated by the planning application

A planning application has not been submitted for this district. However, new planning tools were included in OPA 48 to support energy and climate policy goals. These tools will also support the net zero carbon vision for the GID. These tools include the ability to require a Sustainability Checklist, District Energy Feasibility Study, Renewable Energy Feasibility Study, Water Conservation Efficiency Study, and/or Energy Conservation Efficiency Study as part of a development application.

Emerging policy/tools precipitated by the development

The Province of Ontario has initiated the process to dispose of some or all the lands they own within the GID. The objective of Infrastructure Ontario is to dispose of the lands to the highest bidder, subject to acceptable terms and conditions, and at fair market value. Guelph City Council is advocating that the Province of Ontario proceed with a Request for Proposals (RFP)

³⁴ City of Guelph. (n.d.). Retrieved from http://guelph.ca/wp-content/uploads/14_24_Attachment-2-GID-Amendment-OPA-54-Final.pdf

process as it would better result in achieving joint City/Provincial growth, environmental and economic development goals while still maintaining a competitive bid process.³⁵

Enabling Federal and/or Provincial interventions

Guelph Hydro Inc. participated in a community energy planning mission in 2003, organized by Natural Resource Canada and FCM, that was instrumental in catalyzing local interest in community energy planning. Funding from the FCM Green Municipal Fund supported both the development of the Guelph CEP and the GID secondary plan. Higher densities promoted in the Growth Plan for the Greater Golden Horseshoe are more conducive to supporting CEP strategies for district thermal.

Stakeholder Perspectives

Municipal perspectives

Strategic Leadership

Strategic municipal leadership, both political and administrative, was identified as an important success factor to achieve a net zero carbon vision for the GID in the absence of provincial legislation. However, the lack of a provincial and/or private-sector champions is a concern moving forward. Frequent turnover of key contacts at the provincial level has made maintaining momentum for the redevelopment of these lands as a net zero carbon community challenging for the municipality.

Stakeholder and Community Engagement

There has been extensive stakeholder and community engagement by the municipality and the province which has helped build strong support for the vision for the GID.

Policy Integration

In an ideal world, a municipality would include climate change and energy policy objectives in their Official Plan as a first step. These policies would then inform the development of Secondary Plans. The development of Master Plans, that define policy implementation, would follow - e.g., Community Energy Plan (CEP), Climate Change Strategy, Integrated Energy Master Plan. However, planning practice is iterative in nature and it is important to maintain documents in alignment with updates occurring in a logical sequence so that they can inform each other as appropriate.

As one of the first communities to embrace a municipal role in local energy planning, Guelph developed their CEP first and then began the task to integrate energy policies into their Official Plan. This work was done as they brought their local growth strategy into compliance with the Growth Plan for the Greater Golden Horseshoe. The GID Secondary Plan was also developed while this Official Plan update was underway which made the work of municipal planners more challenging and time-consuming.

³⁵ City of Guelph Council Agenda. (2016, December). Retrieved from http://guelph.ca/wp-content/uploads/council_agenda_121916.pdf

In 2014, the Provincial Policy Statement (PPS) was updated to include several new energy and climate policies.³⁶ Guelph had strategically joined a municipal coalition to advocate for these changes to build a more enabling provincial policy framework.

Integration in Guelph also meant more than including CEP policies into the Official Plan. It also meant understanding the connections between growth, energy and economic development.

The Province of Ontario was very supportive for most of the GID Secondary Plan work, including the GID vision in an early Expression of Interest to the private sector. A Memorandum of Understanding was also developed between the City of Guelph and the Province of Ontario to support the vision.

Per respondents, the City of Guelph has been less successful in engaging the Province on how the lands will be sold. The City would like to see the lands sold by issuing a Request for Proposals that includes conditions to achieve multiple objectives for climate change, job creation and innovation. An RFP process may be more attractive to industry innovators who can bring environmental, economic and social value as well as dollars. However, Infrastructure Ontario's usual practice is to proceed to the market with a closed bid auction. Industry innovators may be less likely to participate and/or be successful in a closed bid auction given the inherent risks associated with building a net zero carbon community.

Municipal Energy Resources

The creation of a position to implement the CEP (i.e. Manager, Community Energy Strategy) meant that energy issues were represented during the policy planning process.

Business as Usual

The GID Secondary Plan includes the aspiration to “showcase a new approach to planning, designing and developing urban spaces”. This has meant challenging business as usual (BAU) practices. Resistance has been met from some stakeholders, both inside and outside local government.

As the primary property owner within the GID, Infrastructure Ontario (IO), on behalf of the provincial government, pushed back against the proposed residential density, and the energy and environmental performance objectives for the lands. With respect to residential density, they felt a lower density would be more marketable despite being counter to Places to Grow. Regarding the energy and environmental goals, they believed a premium would be associated with them in the market place. Overall, they expressed concern that the GID Secondary Plan would be viewed as a liability by the private sector and the sale of the provincial lands would not be maximized. During the public consultation, some traditional suburban developers expressed

³⁶ The PPS is the statement of the government's policies on land use planning. It applies province-wide and provides clear policy direction on land use planning to promote strong communities, a strong economy, and a clean and healthy environment.

similar concerns regarding the market acceptability of the proposed energy and environment performance objectives.

Local political support, as well as that of senior municipal administrators, was essential to hold the net zero carbon vision for the district. However, language was softened in the final document to appease IO and recognize limited provincial legislation to enforce the energy performance objectives e.g. district energy was encouraged but not required in the Secondary Plan.

Per respondents, recent market testing suggests there is a willingness to build on the site in accordance with the Secondary Plan. However, there continues to be a lack of alignment between the Province's Long-term Infrastructure Plan, specifically the process to dispose of surplus lands, and the Climate Change Action Plan. The City of Guelph has proposed that IO issue a Request for Proposal (RFP), rather than a Closed Bid Auction, to sell the GID lands. An RFP would include conditions to support the implementation of the Secondary Plan. The perceived risks associated with a Closed Bid Auction include a successful bidder: 1) speculating on the land and not proceeding with redevelopment, or 2) undermining the GID Secondary Plan through planning amendments and appeals to the Ontario Municipal Board (OMB). An RFP process has a better opportunity to attract innovators in the development industry.

Initially, some alternative development standards, to achieve certain policy objectives (e.g. more non-automotive standards such as green, walkable spaces and decreased automotive-friendly standards such as large roadways), were not a priority for municipal engineers and consequently could not be included in the Secondary Plan. However, this engineering view is changing as new approaches become more mainstream.

Mainstreaming of climate change and community energy planning in land use planning

Guelph municipal planners led the mainstreaming climate change and energy policies into land use planning in Guelph. Ongoing work is required to operationalize these policies throughout the development approvals process.

Meanwhile, the lack of compliance tools to assess applications on their energy performance remains a concern to achieving the GID Secondary Plan. This makes the job of municipal planners more challenging without triggering an OMB challenge by the applicant. In the absence of compliance tools, planners must rely on encouragement, good will and innovators.

Local energy infrastructure

District heat and district electricity (i.e. microgrid) systems support net zero carbon as they facilitate the sharing of energy within the community. However, several unresolved governance issues challenge implementation (e.g. who pays, who owns, who operates). The role of the Local Distribution Company (LDC) is not clear. Municipalities are well-equipped to fulfill their traditional role in preparing land for development, like building roads, laying sewers and putting up street lights, but they lack the necessary standards and financing tools (e.g. Development Charges) to support the development of alternative local energy infrastructure. Industrial

partners and/or provincial infrastructure funding are considered necessary. The province can play an important role in reducing the risk for private-sector innovators.

Lessons learned and replicability

- Political and administrative champions are key to promoting low carbon communities particularly in the absence of enabling provincial legislation.
- Stakeholder and community engagement is important to building broad-based support.
- Consider using major redevelopment projects (e.g. brownfields) to create a living laboratory to demonstrate the success of innovative policies.
- The provincial government should consider policy changes that would mandate Infrastructure Ontario to dispose of surplus assets using an RFP process based on criteria that are consistent with local planning policies, where those local planning policies are more progressive on climate change goals than provincial policies.
- Municipal energy resources are important to ensure energy and climate change issues are represented.
- Further mainstreaming of climate change into provincial planning legislation will make it easier for more municipalities to embrace low carbon community building.
- Municipalities need additional tools (e.g. regulatory, financial and business tools) and standards (e.g. compliance) to support the implementation of climate change and energy policies and successfully defend energy performance objectives at the OMB.
- Communities need new business models for district energy – both district electricity – i.e., microgrids, and district heat – i.e., thermal utilities.
- Low carbon community building represents a considerable departure from business as usual and will require considerable collaboration, both within and outside local government, for success.

Case Study #3: Brampton Sheridan College Davis Campus District Energy Centre– Partnering Across Boundaries

Municipal Snapshot³⁷

Municipal name	City of Brampton
Municipal Status	Lower-tier
Area	266.71 km ²
Population (2006 census)	433,806
Population (2011 census)	523,911
Growth rate	20.8%
Within Greater Golden Horseshoe	Yes
2031 Places to Grow Population Target	727,000 ³⁸

Project Snapshot

Developer	Sheridan College, Davis Campus
Key development partners	City of Brampton, Province of Ontario, Government of Canada
Definition	N/A – not aiming for net-zero
Status	Funding from senior levels of Government announced in Fall 2016
Sustainability framework	<i>Integrated Energy and Climate Master Plan</i>
Key energy features	District energy expansion
Grants	Funding from Federal Government and Post-Secondary Institutions Strategic Investment Fund

³⁷ Statistics Canada. (2016, September). Retrieved from <https://www12.statcan.gc.ca/census-recensement/2011/as-sa/fogs-spg/Facts-csd-eng.cfm?LANG=Eng&GK=CSD&GC=3521010>

³⁸ Region of Peel. (n.d.). Retrieved from <https://www.peelregion.ca/planning/pdc/data/forecasts/population-2006-2031.htm>

Context

Description of municipality

The City of Brampton is a lower-tier suburban municipality located in the Regional Municipality of Peel. Brampton's population (2016) is estimated at over 600,000, making Brampton the fourth largest city in Ontario and ninth largest in Canada. Brampton is also one of the fastest growing municipalities, having grown by 20.8% between 2006 and 2011.

Brampton has a diversified employment base, including automotive (Chrysler), ICT (Rogers Communications), food and beverage (headquarters of Loblaws and Maple Lodge Farms), as well as transportation and logistics (Canadian Tire corporate distribution centre). Brampton is also home to large public institutions, including Sheridan College's Davis Campus and the Brampton Civic Hospital.

Largely auto-dependent, the City of Brampton has made some strides towards the development and improvement of its public transit system. Between 2010 and 2014 Brampton created and expanded its ZUM transit system which connects the City with employment hubs elsewhere in Peel as well as Vaughan and the City of Toronto. In 2015, the Province of Ontario announced funding for the Hurontario Light Rail Transit project along Hurontario Street from Port Credit in Mississauga to Steeles Avenue in Brampton. Construction on this \$1.6 billion project is expected to start in 2018.

Municipal Policy Framework

In June 2010, Brampton City Council adopted The City's Growth Plan Official Plan Amendment (GPOPA) to conform to the Provincial Growth Plan for the Greater Golden Horseshoe.³⁹ This amendment enhances the City's sustainable planning framework by better defining elements of sustainable communities, and recognizing the preparation and management of strategic documents, such as environmental master plans and sustainable development guidelines, to guide both development and municipal decisions to ensure that the City's land use planning is sustainable.

The Official Plan generally supports the development of mixed-use, transit-oriented, and compact communities and promotes sustainable management practices and green building design standards (with reference to LEED). Official Plan general policies also support a green economic development strategy promoting green businesses and "eco-business zones", such as the one located in the Pearson Airport employment area.⁴⁰

Description of project

Through the "Partnering Across Boundaries: Bringing Global Leadership to Academic-Municipal Collaboration on District Energy" project, Sheridan College is moving forward with a major investment to refurbish the existing district energy system at its Davis Campus in Brampton, and

³⁹ City of Brampton. (2015, September). Retrieved from http://www.brampton.ca/EN/Business/planning-development/policies-master-plans/Documents/Sept2015_Consolidated_OP.pdf

⁴⁰ Toronto Pearson. (n.d.). Retrieved from <https://www.torontopearson.com/en/aboutpearson/environment/projectgreen/#>

extend the system beyond the campus's borders. In its initial expansion phase, the project aims to supply heating to the adjacent South Fletcher's Sportsplex and Community Centre, run by the City of Brampton as well as proposed new privately-owned high-rise residential buildings to be built near the site. Through this investment, the Sheridan Davis campus intends to become an initial "anchor" or "node" for a district energy system in Brampton. Given the proximity of the campus to the terminus of the Brampton LRT at Hurontario and Steeles Ave (1km distance), there are likely to be additional opportunities to connect new development in the area to the system, assuming that governance, policy and financial challenges can be overcome. .

South Fletcher's Sportsplex and Community Centre is a 15,666 m² facility which hosts 4 ice rinks, and an Olympic-sized pool. It also contains multi-purpose rooms for community events, and a branch of the Brampton public library. The facility is more than 20 years old and therefore much of the energy infrastructure is nearing the end of its useful life. In terms of energy use the facility consumed 4,769,900 kwh of electricity and 592,849 m² of natural gas in 2014. Total annual energy costs at the facility are more than \$1 million per year. The 1300 tonnes of GHG emissions resulting from this energy use rank the facility among the top 10 emitters amongst municipal indoor recreational facilities in Ontario.⁴¹

By connecting this facility to Sheridan's campus district energy system, there are opportunities for significant energy use and GHG reductions. The Project is an implementation action that has emerged from Sheridan College's Integrated Energy and Climate Master Plan (IECMP).⁴² Through the IECMP Sheridan has established energy conservation (50%) and greenhouse gas reduction (60%) goals for 2030 relative to a 2010 baseline. The IECMP also establishes Sheridan's goal of becoming a role model for other post-secondary institutions in terms of demonstrating the business case for the development and implementation of low carbon energy technologies.

Rationale for selecting as a case study

This project provides an example of institutional leadership in the broader public sector on energy and climate issues, and a model for leveraging existing public sector institutional complexes (e.g. universities, colleges, hospitals) located within Ontario municipalities to anchor the development and expansion of a district energy network. These large institutions provide an anchor for district energy investments, guaranteeing sufficient heat and electricity demand over time to justify the upfront investment. Through partnerships with host municipalities, university and college campuses in municipalities across the Greater Golden Horseshoe can serve as nodes for the expansion of district energy into neighbouring areas, including residential, commercial and institutional land uses.

⁴¹ 2014 energy and GHG data reported to Government of Ontario.

⁴² Sheridan College. (2013, June). Retrieved from https://www.sheridancollege.ca/~media/Files/Sheridan%20College/About/Sustainability/sheridan_iecmpfinalreport_public_v2.pdf

Existing policy/tools

City of Brampton and Region of Peel Official Plans⁴³

Both Brampton's and the Region of Peel's OP policies provide support for sustainable development practices such as mixed-use compact and transit-oriented development, and specifically support the use of renewable and district energy systems in the City.

At the upper-tier level, the Official Plan for the Region of Peel includes objectives addressing energy and climate through land use planning, low carbon energy systems and conservation.⁴⁴ OP policies support energy demand management initiatives by area municipalities, including promotion of opportunities for district energy systems. OP policies encourage area municipalities to incorporate into their OP's policies on energy efficiency, district energy, renewable energy, low carbon vehicles, and building retrofits.⁴⁵

Brampton's OP policies also refer to ambitions of creating a long-term energy plan for the City's downtown.

The Official Plan also includes policies specific to energy and climate, not limited to the following:

- 4.6.15.2.3: The City will endeavour to protect and enhance air quality and contribute to energy conservation through implementing a sustainable planning framework which promotes...green urban and building design standards, and the use of alternative or renewable energy and district energy systems.
- 4.6.15.2.5 Given that the City intends to develop a long term energy plan for the City's Downtown, future proposals in the downtown may be required to submit studies that show how they contribute to the operation of the plan.

City of Brampton Environmental Master Plan⁴⁶

Brampton's Environmental Master Plan (2014) establishes an objective of increasing the use of low carbon energy resources to support GHG reductions in the City (goal 5). The Plan sets out actions to support achievement of this objective, such as:

- Develop OP policies requiring new development applications to submit an energy plan detailing reduction targets and strategies
- Prepare a feasibility study for district energy in Brampton's Central Area
- Develop a Community Energy Plan that features local action plans focused on high-energy use areas
- Energy management and renewable energy strategy for city-owned facilities

⁴³ City of Brampton. (2015, September). Retrieved from http://www.brampton.ca/EN/Business/planning-development/policies-master-plans/Documents/Sept2015_Consolidated_OP.pdf

⁴⁴ Region of Peel. (2014, October). Retrieved from https://www.peelregion.ca/planning/officialplan/pdfs/ROP_Consolidation_October_2014.pdf

⁴⁵ Ibid.

⁴⁶ City of Brampton. (2014, May). Retrieved from http://www.brampton.ca/EN/Business/planning-development/projects-studies/Documents/Environmental%20Master%20Plan/Final%20Documents/Brampton%20IAP_11_10_2014.pdf

Region of Peel Climate Change Strategy⁴⁷

Peel's Climate Change Strategy sets a long-term GHG reduction target of 80% below 1990 levels by 2050. With respect to low/zero carbon communities, the Strategy includes an action to "prepare a joint feasibility study to determine how to optimize the use of alternative energy sources through community energy planning and through pilots of district energy systems in Peel.

City of Brampton Sustainable Community Development Guidelines (SCDG)⁴⁸

The SCDG's are a framework of performance indicators and targets for new development in the City of Brampton that apply to all Secondary Plan, Block Plan, draft plan of subdivisions and site plans. These guidelines have been incorporated into the City's Development Design Guidelines. New developments are required to meet a minimum threshold for approval by the City.

For Secondary Plans Areas, the guidelines recommend that consideration for energy conservation, renewable energy be included, and that opportunities for integrated energy systems such as district energy be outlined.

At the Block Plan level, the guidelines recommend provision of low carbon community energy systems where feasible, and encourage new commercial industrial and institutional developments to such systems. The guidelines also recommend consideration of energy demand management opportunities, including on-site renewable energy systems and passive solar.

With respect to draft plan of subdivision and site plans, the guidelines again encourage new ICI developments to connect to district energy facilities, and recommend consideration of constructing all new low and medium density residential development to be "solar ready". The guidelines furthermore recommend, where feasible, that community energy systems be integrated into new subdivisions and site plans, and that consideration be given to the purchase of renewable energy for local utilities.

Sheridan College Integrated Energy and Climate Master Plan (IECMP)

Sheridan College's IECMP sets ambitious energy and GHG reduction targets for the institution. The Plan sees reinvestment in the College's existing district energy systems at the Brampton and Oakville campuses as a major element of the Plan. The reinvestment provides an opportunity for the college to work with its local municipal partners to extend these existing systems outside of the campus borders and thereby support broader energy conservation and GHG reduction efforts at the community-wide scale.

Sheridan is constructing a fully-integrated, college-wide network using global best practice. Their goal is to demonstrate that off-the-shelf design and expertise, found in leading

⁴⁷ Peel Region. (2011, June). Retrieved from <https://www.peelregion.ca/planning/climatechange/reports/pdf/climate-change-strat-rep.pdf>

⁴⁸ City of Brampton. (2013, September). Retrieved from <https://www.brampton.ca/EN/Business/planning-development/guidelines-manuals/Documents/SCDG.pdf>

jurisdictions, can be used to build an effective district energy system in Canada. They have found technical implementation is not the key barrier, but rather development of an effective business case founded on realistic pricing. Sheridan is developing a living training laboratory to address common barriers to district energy, such as conflicting information from various consultants and “custom built” projects that result in substantially higher project costs in Canada and by being a role model for how district energy can be done successfully in Canada. Sheridan worked with the City of Guelph and other municipal partners to develop a Strategic Implementation Network (SIN), comprising leading global practitioners, to assist its team with the design, development, construction and implementation of the network.⁴⁹

Policy amendments precipitated by the planning application

None as of yet. This project is proceeding in advance of municipal planning policy for district energy in the area – e.g., a district energy feasibility study.

Emerging policy/tools precipitated by the development

None as of yet but anticipated should the municipal project proceed.

Enabling Federal and/or Provincial interventions

This \$21.4m project is supported financially by the Federal Government through its *Post-Secondary Institutions Strategic Investment Fund* (\$9.9m), the Provincial Government (\$2.2m), with the remainder coming from Sheridan College itself.⁵⁰

Stakeholder Perspectives

Developer perspectives

Alignment: municipal and institutional strategic mandates

Sheridan College, as a public academic institution, has a strategic mandate to support economic and social development by collaborating with municipalities, communities and industries on applied research and educational programming.⁵¹ Sheridan’s collaborations with municipalities across its three campuses in Brampton, Oakville, and Mississauga, are seen as an institutional strength that contributes to the revitalization of local industries and communities while supporting experiential learning opportunities for learners through its partnerships.

This strategic mandate allows the college to make investments in new technologies and infrastructure that support advanced learning outcomes for students. Unlike a private developer, which often looks for short-term payback (3-5 years) on capital investment and is reluctant to apply new technologies, academic institutions like Sheridan are in a position to accept longer-term paybacks (10-15 years) on investments in innovative technologies that align

⁴⁹ Partnering Across Boundaries: Bringing Global Leadership to Academic-Municipal Collaboration on District Energy. (2016).

⁵⁰ Sheridan. (2016, October). Retrieved from <https://www.sheridancollege.ca/news-and-events/news/canada-and-ontario-invest-millions-in-district-energy-project-at-sheridan.aspx>

⁵¹ Sheridan College Strategic Mandate Agreement. (2014). Retrieved from <http://www.tcu.gov.on.ca/pepg/publications/vision/SheridanAgreement.pdf>

with their strategic mandate. Sheridan's District Energy Centre will be located in the Skilled Trades Centre (STC) on the Davis campus, and surrounded by glass, providing an opportunity for skilled trades students to see first-hand how a low carbon energy network functions.

This alignment with the College's strategic mandate is further reinforced by a strong economic and environmental rationale associated with the project. The Davis Campus's existing district energy system is relatively inefficient with the primary and secondary systems competing and the infrastructure and connections in need of upgrading. Investment in a modern district energy system will result in significant long-term cost savings and GHG emissions reductions for the college, helping achieve targets set out in its Integrated Energy and Climate Master Plan (IECMP). Sheridan's Integrated Energy and Climate Master Plan framework and the additional components of the district energy project present a major contribution to creating a pathway to a net zero emissions campus.

This project also aligns with the City of Brampton's strategic mandate to drive energy conservation at municipally owned facilities like South Fletcher's Sportsplex, as outlined in the City's strategic plan and Environmental Master Plan, and Brampton's Conservation and Demand Management (CDM) plan,⁵² developed to comply with provincial legislation.⁵³

Alignment: capital planning timelines

In addition to the alignment in strategic mandates, this project also presents fortuitous alignment in capital planning timelines between institutional, municipal, and private sector stakeholders in the area surrounding Sheridan's Davis campus. Sheridan College's IECMP had identified refurbishment of the district energy system at Davis campus as a strategic opportunity, and capital planning to move the project forward had begun in early 2016. At the same time, City staff was beginning to explore capital upgrades at the South Fletcher Sportsplex to renew aging energy infrastructure at the facility and drive energy conservation, and private sector developers were proposing new high-rise residential buildings to the west of the campus. Whereas the typical business-as-usual approach at the facility and the new buildings would be to house mechanical equipment in each individual building, the aligned timing with Sheridan college's planning process means that both will be designed to be "district energy ready",⁵⁴ which opens the opportunity for catalytic and collaborative investment to drive low carbon energy innovation that supports the shift to net-zero communities in Ontario.

Low carbon leadership- top-down and bottom-up

At the municipal-level there is high-level awareness that low carbon thinking is needed in future planning. The Region of Peel has established GHG reduction targets for 2020 and 2050, and both the Region and the City have Official Plan policies that broadly support low carbon supply and energy conservation. Brampton's Environmental Master Plan serves as the City's GHG

⁵² City of Brampton. (2014, July). Retrieved from <https://www.brampton.ca/EN/City-Hall/OpenGov/Open-Information/Energy-Consumption-Reports/Brampton%20CDM%20Plan%202014-2019.pdf>

⁵³ Government of Ontario. (2011, August). Retrieved from <https://www.ontario.ca/laws/regulation/r11397>

⁵⁴ Key technology requirements often include hydronic heating (i.e. a central heating system that utilizes hot water) within the building, adequate space, and piping a right-of-way external to the building to connect to the district energy system.

mitigation action plan, and the City has invested in numerous actions that will result in GHG emissions reductions at both the municipal corporate-level, and the community-wide scale.

In addition to this top-down leadership from municipal governments, this project provides an example of bottom-up leadership from a major institutional stakeholder in the City and Region. As an institutional actor with significant capital investment, and consolidated decision-making authority, Sheridan College is positioned to take on a leadership role on low carbon energy action in Brampton and Peel. By proving the business case for district energy technology, and spearheading inter-sectoral collaboration to develop a viable governance model, Sheridan is acting as a catalyst for climate action at the municipal scale and serves as a model for other post-secondary institutions in Ontario to follow.

Technology isn't the barrier – governance, ownership and finance is

District energy is a global best practice that has been employed for decades in progressive European cities. District energy serves more than 10% of total heat demand in continental Europe, a number that rises to 50% in some Northern European nations. European cities in a northern climate (such as Copenhagen, Helsinki, and a large part of the Ruhr Valley) are moving toward carbon-neutrality from buildings by expanding their district heating networks and using lower carbon fuels. While the technology is proven, the biggest barriers to deployment in the Ontario context are related to questions of financing, ownership and governance.⁵⁵

This project provides an opportunity to explore the governance and financing issues associated with district energy. Sheridan College can move forward with the project in partnership with the municipality, providing a living lab to demonstrate potential governance and financial models for municipalized district energy networks.

Municipal Support

Sheridan College engaged early in the planning process with senior administrators and elected officials at the City of Brampton to make them aware of their capital plans, and seek support for the idea of expanding system beyond campus boundaries. Given that the City of Brampton has high-level policy supporting district energy, the College found receptive ears at both the political and administrative level. This support has been instrumental in moving the conversation forward with the adjacent facility, as well as with the neighbouring private sector developer.

Municipal perspective

Strategic Leadership

Strategic leadership by the College was identified as an important success factor for this project. Sheridan College staff took on a comprehensive stakeholder engagement effort to seek alignment in planning and investment timelines. This proactive engagement was credited in deferring planned capital upgrades at the Sportsplex that would have precluded collaboration

⁵⁵ Environmental Commissioner of Ontario (2013). *Municipal District Energy Systems: Charting a Path to Greener Heating and Cooling*. <https://media.assets.eco.on.ca/archive/2015/03/2012-Energy.1.pdf>

with the college and diverting that capital to enable interconnection with the district energy system,

Planning objectives

There is high-level support for district energy in the municipal planning policy framework, however no plan or budget to support the roll-out in the City. While The Secondary Plan for the area has no policy to require district energy connection, site plan application review could require a DE feasibility study be completed.

Regulations and approvals

Council approval is required for this expansion beyond campus boundaries to move forward. Thus far Council has permitted City staff to undertake due diligence and has provided a letter of support to continue discussions on feasibility and financial impacts.⁵⁶ Once complete, Council will evaluate the feasibility study being jointly prepared by the college and the City, and if it supported the project, would direct staff to set aside budget and undertake site plan application and submit a building permit application. It is anticipated that a capital funding submission to Council will occur in 2017.

Municipal energy resources

The creation of an Energy Manager position within the City has created opportunities for intra-municipal coordination between departments (planning, engineering, building) that didn't exist previously. This is seen as a major catalyst for moving the district energy conversation forward within the City. It also meant that the municipality had the internal resources to engage effectively with Sheridan College.

In addition the City has created an Environment section that is charged with implementing the City's Environmental Master Plan throughout the corporation and with external partners including the Region of Peel, Conservation Authorities, neighbouring local municipalities, businesses, non-profits and utilities.

Lessons learned and replicability

- Academic institutions can be an important champion for low carbon investment at the municipal scale. They have a strategic mandate for innovation and sustainability, tend to have a geographically concentrated presence, and are able to leverage provincial and federal funding for investment in campus capital upgrades with a view to long-term benefits.
- Given that existing district energy systems on academic campuses are typically outdated and in need of refurbishment, there is an opportunity to explore on a province-wide basis the feasibility of leveraging refurbishment to expanded systems to adjacent facilities or communities with sufficient heat demand load.
- Employing global best practice, technologies and practitioners can advance the development of district energy in Canada.

⁵⁶ City of Brampton. (2016, May). Retrieved from https://www.brampton.ca/EN/City-Hall/meetings-agendas/Community%20%20Public%20Services%20Committee/20160518cpssc_Agenda.pdf

- Top-down municipal climate policy needs to be complemented by bottom-up commitments by major institutional and private sector stakeholders within communities to direct capital investment towards achieving low carbon objectives.
- Inter-sectoral engagement can uncover opportunities to align capital planning timelines to support mutual objectives for low carbon supply and energy conservation.
- The lack of a clear provincial policy framework supporting municipal district energy is constraining investment. Questions surrounding capital cost recovery models in the absence of an ability for municipalities to require interconnection to district energy in approving of plans of subdivision, site plans and development permits.
- The presence of a dedicated municipal energy manager position in the City has helped to create the space for conversations necessary for inter-sectoral collaboration to succeed.

Case Study #4: Toronto Port Lands Acceleration Initiative

2. Toronto Case Study Snapshots

Municipal Snapshot

Municipal name	City of Toronto
Municipal Status	Single tier
Area	630.2 km ²
Population (2006 census)	2,503,281
Population (2010 census)	2,615,060
Growth rate	4.5%
Within Greater Golden Horseshoe	Yes
2031 Places to Grow Population Target	3,190,000

Project Snapshot

Project	Portlands Acceleration Initiative
Developer	Waterfront Toronto
Key development partners	City of Toronto, Toronto and Region Conservation Authority, Government of Ontario, Government of Canada
Definition	<i>Zero net energy import</i>
Status	Majority brownfields; mixed ownership with majority municipally-owned
Site area	356 hectares
Number and type of residential units	TBD – Portlands will include mixed-use residential areas alongside industrial uses. A residential population between 17,500 to 25,000 residents is envisioned.

Floor area	2,000,000 m ² , 50% of which would be residential
Gross residential density	Between 200 and 250 persons and jobs combined per hectare
Non-residential units	Land uses permit mixed-use, with film studios, and port operations co-existing with existing industrial land uses.
Pre-development use	Industrial and brownfield sites
Sustainability framework	C 40 Climate Positive Development Program ⁵⁷
Key energy features	<ul style="list-style-type: none"> • Provisions for district thermal energy network are being planned, including easements for a district thermal energy network • Heat recovery from local power generation (Portlands Energy Centre, and Cement facilities) • Deep Lake water cooling • Aggressive energy use intensity standards for new buildings within district
Key water features	Reduced water use to address water/wastewater energy use and emissions

Context

Description of municipality

The City of Toronto has a long history of leadership on climate change dating back to 1988 when the City hosted the first international conference to launch the issue onto the global policy agenda. The 1988 conference, “Our Changing Atmosphere: Implications for Global Security,” hosted by the Government of Canada, proposed the first specific initial target for a global reduction in the emission of carbon dioxide – 20% below 1988 levels by 2005.⁵⁸ Not long after, in 1991, Toronto City Council voted to establish the Toronto Atmospheric Fund with a \$23 million endowment and a mandate to finance urban solutions to the climate crisis.⁵⁹

A few years later in 1996 the City created the Better Buildings Partnership as a City-to-business program to assist building owners, managers and developers with financing to achieve energy efficiency goals. As of December 2016, the BBP program had stimulated more than \$1 billion in investment and generated estimated carbon emission reductions of 690,000 tonnes.⁶⁰

⁵⁷ C40 Cities. (2017). Retrieved from <http://www.c40.org/networks/climate-positive-development-program>

⁵⁸ University of Prince Edward Island. (2013, July). Retrieved from <http://projects.upei.ca/climate/2013/07/02/reflections-on-the-toronto-conference-25-years-later/>

⁵⁹ The Atmospheric Fund. (2017). Retrieved from <http://taf.ca/about-us/#taf-timeline>

⁶⁰ City of Toronto. (2016, December). Retrieved from <http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=1556136696f85410VgnVCM10000071d60f89RCRD>

Additional initiatives, such as development of a Deep Lake Water Cooling system serving the downtown core, and policies such as the Toronto Green Standard, have put Toronto at the forefront of the global city movement to reduce GHG emissions.⁶¹

The City's first Climate Change Action Plan was released in 2007 which set GHG reduction targets for 2012, 2020 and 2050.⁶² Toronto's long-term target of 80% below 1990 levels by 2050 remains consistent with the Province of Ontario's GHG reduction target. More recently, in 2016, the City launched the TransformTO initiative with the goal of engaging citizens in co-creating a strategy to achieve Toronto's 2020 emissions reduction target (30% below 1990 levels) and 2050 target.⁶³ TransformTO included GHG emissions modelling scenarios for current policy, as well as potential future policy options. A report on short-term strategies, adopted by Toronto City Council on December 13, 2016 includes recommendations supporting the transition to net-zero buildings and communities.⁶⁴

Municipal Policy Framework

The City of Toronto recognizes that the current policy framework at the municipal, provincial and federal level is insufficient to achieve 2020 and 2050 emissions reduction targets. Through the TransformTO initiative, the City of Toronto commissioned technical modelling and comprehensive community stakeholder consultation to assess strategies for bridging the 8.7 million tonne gap between projected GHG emissions in 2050 and the 80% reduction target.⁶⁵ With respect to the building sector, the TransformTO effort has identified the following strategies as essential to achieving Toronto's 2050 GHG reduction targets:

- (1) Elevate the energy performance of new buildings towards net-zero energy through continual periodic updates to the Toronto Green Standard;
- (2) Advanced community energy planning in all new major development and revitalization areas;
- (3) District-scale thermal energy solutions;
- (4) A long-term renewable energy strategy.

Description of project

Toronto's Port Lands area comprises 356 hectares that stretches along the eastern portion of the City's downtown Waterfront. The majority of lands in the area are publicly owned by agencies at all three levels of government. Historically the area was an active industrial port with significant manufacturing and distribution capacity built up to support war efforts in the early half of the 20th century. While some industrial capacity remains in the area, there are large

⁶¹ C40 Cities. (2017). <http://www.c40.org/cities/toronto>

⁶² City of Toronto. (2017). Retrieved from <http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=4e4c295f69db1410VgnVCM10000071d60f89RCRD&vgnextchannel=a201fbfa98491410VgnVCM10000071d60f89RCRD>

⁶³ TransformTO. (2017). Retrieved from

<http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=ba07f60f4adaf410VgnVCM10000071d60f89RCRD>

⁶⁴ Toronto Staff Report. (2016, November). Retrieved from

<http://www.toronto.ca/legdocs/mmis/2016/pe/bgrd/backgroundfile-98039.pdf>

⁶⁵ TransformTO. (2017). Retrieved from

<http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=ba07f60f4adaf410VgnVCM10000071d60f89RCRD>

amounts of vacant and underutilized lands that have been contaminated by decades of industrial use. Given the proximity to Toronto's booming downtown core, this area will be redeveloped over the coming 30-50 years from largely post-industrial brownfields to a mixed-use residential, commercial and industrial area, with a considerable focus on creative industries (esp. film), while maintaining remaining port and industrial uses. Upon completion, there is projected to be over 2,000,000 million m² of gross floor area (residential, commercial and institutional) and between 17,500 to 25,000 residents and 25,000 to 30,000 employees.

Revitalization of Toronto's Port Lands area has long been viewed as an opportunity to demonstrate innovation in environmental sustainability, and low carbon energy practices in particular. Indeed, as far back as 2003 the policy direction for the Port Lands area supported an "integrated energy concept" which was designed to achieve low carbon energy self-sufficiency for the Waterfront and Port Lands area of the City through high energy efficiency at the building-scale, and district energy technology (and supportive policy) at the neighbourhood scale.⁶⁶ More recently, in July 2014 Toronto City Council directed staff to report on guidelines for achieving "net zero energy import" in the Port Lands.

Within the Port Lands, planning in the Lower Don Lands area is most advanced. The Lower Don Lands - a 125 hectare area that runs from the Parliament Street Slip east to the Don Roadway and from the rail corridor south to the Ship Channel. The Lower Don Lands is one of 17 founding projects of the global C40 Climate Positive Development Program, which supports the development of projects that seek to meet a "climate positive" emissions target of net-negative operational greenhouse gas (GHG) emissions. Precinct-level planning in the Lower Don Lands area is proceeding, with the Keating Channel Plan having been released in 2010, and the Villiers Island Precinct Plan currently in development.

District energy networks have long been seen as critical for achieving net zero ambitions in the Waterfront and Port Lands context. In 2007, District Energy was seen as a core part of Waterfront Toronto's sustainability strategy for the waterfront and Port Lands areas. At the time, WT's energy master plan proposed one large district energy plant in each of the Eastern Bay Front and the West Don Lands areas. With the objective of implementing a district energy system at the outset of development in the area, Waterfront Toronto partners (Federal Government, Province of Ontario, and the City of Toronto) each committed cash to support the district energy strategy. The total proposed budget ranged from \$100m to \$150m.

By January 2008 the Board of Waterfront Toronto had decided to exit the district energy strategy after the Province of Ontario indicated it would not move forward with its portion of the funding and removed the Pan Am Athletes Village development from the proposed district energy network. This decision diminished the potential for Waterfront Toronto to be able to deliver the system cost-effectively.⁶⁷ Waterfront Toronto attempted to transfer ownership to a private sector entity who would assume the risk associated with project development and

⁶⁶ Waterfront Scan & Environmental Improvement Strategy Study. (2003, March). Retrieved from http://www1.toronto.ca/city_of_toronto/waterfront_secretariat/files/pdf/ch_5-energy.pdf

⁶⁷ City of Toronto. (2015, June). Retrieved from <http://www.toronto.ca/legdocs/mmis/2015/ex/bgrd/backgroundfile-81764.pdf>

implementation. Waterfront Toronto's efforts to find a 3rd party private sector investor in the district energy system were not successful because prospective private sector buyers had little interest in buying an asset with near-term negative cash flows and long-term debt obligations. Furthermore, the phased development model in the Waterfront area created uncertainty as to the payback period for the investment.

By 2009, aspects of Waterfront Toronto's district energy plan were salvaged when Enwave agreed to sponsor the development of a building-scale district energy system in the Corus Corporation headquarters which has been planned to interconnect with the adjacent George Brown campus. Additional plans are still in play for district energy in the Eastern Bayfront area, as well as expansion of the Corus building DE plant.

Rationale for selecting as a case study

The Port Lands area forms part of the largest urban renewal project in North America, and one of the most significant waterfront revitalization projects in the world. With respect to net-zero carbon ambitions, the Lower Don Lands area, including the Keating Channel and Villiers Island, is one of the founding projects of the global C40 Climate Positive Development Program, which supports projects aiming to meet a net-zero (or net-negative) GHG emissions target. Given the scale and ambition of the Port Lands district, it represents an opportunity to study innovation at the intersection of land use and energy policy in Ontario.

Existing policy/tools

City-wide policies and tools

Official Plan

The City of Toronto's Official Plan contains a number of policies supporting the transition to low carbon and net-zero buildings and communities. These include broad support for the deployment of renewable and district energy systems (3.4.18), the inclusion of low carbon energy systems as eligible community benefits contributions by developers to enable higher height and/or density under section 37 of the Planning Act (5.1.1.6m).

Additional OP policy support for low carbon energy is provided under the recently approved Official Plan Amendment (OPA 262) which provides policy support for initiatives that "contribute towards an energy neutral built environment".⁶⁸ OPA 262 furthermore integrates new policy for secondary plans in urban growth centres and regeneration areas (which includes the Port Lands area) that requires an assessment of opportunities for district scale low carbon energy solutions through community energy planning (2.2.2).

Finally, OPA 262 has introduced requirements for developers to prepare an Energy Strategy in association with OPAs, zoning by-law amendments or Plan of Subdivision applications for large development proposals (over 20,000 m²) or for development within a Council-approved

⁶⁸ City of Toronto. (2015, November). Retrieved from <http://www1.toronto.ca/City%20Of%20Toronto/City%20Planning/Environment/Files/pdf/ESA/OPA%20262%20Environmental%20Policies%20and%20Designation%20of%20ESA%20Areas%20BL%20No.%201158-2015.pdf>

Community Energy Plan area. The purpose of the Energy Strategy is the early identification of opportunities to integrate local energy solutions that are efficient, low carbon and resilient.⁶⁹

Toronto Green Standard (TGS)⁷⁰

The TGS is a tool to implement the broader environmental policies of the Official Plan. The TGS is a two-tier set of sustainability performance measures for new building construction in the City of Toronto. Tier 1 is required for new construction, and sets a performance standard of a minimum 15% energy efficiency improvement over the Ontario Building Code (OBC). Tier 2 is a higher, voluntary standard of performance that sets a minimum 25% energy efficiency improvement over the OBC. Developers that achieve the tier 2 standard are eligible to receive a partial refund on Development Charges paid to the City. Energy efficiency standards are one of more than 20 sustainability themes addressed in the TGS.

The TGS was first introduced in 2006 on a voluntary basis. In 2010, tier 1 standards were made mandatory based on Site Plan Control powers in the Planning Act, dealing with the sustainable design of the exterior of buildings and sustainable design elements in the adjacent right-of-way.

Green Roof By-law⁷¹

The City of Toronto was the first jurisdiction in North America to adopt a by-law requiring green roofs on new commercial, institutional, industrial, and residential development with a minimum Gross Floor Area of 2,000m². The green roof coverage requirement is graduated, ranging from 20-60 per cent of Available Roof Space. The by-law was adopted by Toronto City Council in May 2009, under the authority of Section 108 of the City of Toronto Act, and expanded to include new industrial development in 2012.

Energy Strategy Terms of Reference⁷²

This document sets out the required content for an Energy Strategy prepared to comply with Official Plan policy (Schedule 3). The Strategy must identify how the new development might achieve net zero on both an emissions and energy basis through efficient design and low carbon energy systems (building-scale renewables, and district energy).

District Energy Ready Design Guidelines⁷³

Complementing the requirements for an Energy Strategy (see above), this guideline provides information to building developers on design approaches to being district-energy ready. The intent of these guidelines is to ensure that future connection to a district energy system is not precluded by initial building design.

⁶⁹ City of Toronto. (2016, July). Retrieved from http://www1.toronto.ca/static_files/CityPlanning/PDF/energy-strategy.pdf

⁷⁰ City of Toronto. (2017). Retrieved from <http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=f85552cc66061410VgnVCM10000071d60f89RCRD>

⁷¹ City of Toronto. (2017). Retrieved from <http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=3a7a036318061410VgnVCM10000071d60f89RCRD>

⁷² City of Toronto. (2016, July). Retrieved from http://www1.toronto.ca/static_files/CityPlanning/PDF/energy-strategy.pdf

⁷³ City of Toronto. (2016, October). Retrieved from http://www1.toronto.ca/City%20Of%20Toronto/Environment%20and%20Energy/Programs%20for%20Businesses/BBP/PDFs/District%20Energy%20Ready%20Guideline_October%202016.pdf

Policy/tools specific to Port Lands area

Central Waterfront Secondary Plan⁷⁴

The Secondary Plan governing development in the Port Lands area requires that Precinct Implementation Strategies 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)”.

Waterfront Toronto Minimum Green Building Requirements (MGBR)⁷⁵

The MGBR apply to all new building projects within the Port Lands area and support the development of advanced, high energy performance buildings. The requirements leverage the Leadership in Energy and Environmental Design (LEED) standard, requiring that all new buildings achieve Gold Certification. Most notably in terms of transitioning to net-zero communities, new buildings are required to:

1. Energy efficiency: achieve 50% energy cost savings relative to the Model National Energy Code
2. On-site Renewable Energy: 3% of annual consumption, on a cost basis
3. District energy: design and construct buildings to be “district energy ready”

Keating Channel Precinct Plan⁷⁶

As the first neighbourhood to be developed within the Lower Don Lands portion of the Toronto waterfront, the Keating Channel Precinct will be a leading model for achieving carbon neutrality on a district-scale. The Precinct plan refers to a centralized district energy system as an essential element of achieving this objective.

Policy amendments precipitated by the Project

Zoning by-law (438-36) amendment (By-law No.1174-2010)⁷⁷

Zoning by-law amendment permits below-ground district energy systems within Commercial Residential zones of the Keating Channel West District.

The zoning by-law amendment also encourages land owners within certain areas of the district to strive for higher levels of sustainable performance through post construction Energy Modelling which confirms that the City’s Tier 2 Toronto Green standard has been met, as well as LEED Canada Gold for new construction and major renovations.

⁷⁴ Toronto City Council. (2003). Retrieved from <http://www.toronto.ca/legdocs/2003/agendas/council/cc030414/plt5rpt/cl001.pdf>

⁷⁵ Waterfront Toronto (2012). Retrieved from: http://waterfronttoronto.ca/nbe/wcm/connect/waterfront/21691f61-b2dc-4d59-a1d2-0e3fc92b2218/mgbr_v2_august_2012_1.pdf?MOD=AJPERES

⁷⁶ Keating Channel Precinct Plan. (2010, May). Retrieved from http://www.waterfronttoronto.ca/nbe/wcm/connect/waterfront/048f2525-b645-473b-a5f3-74d9b2bb1ebe/keating_channel_precinct_plan___may_2010_40_mb_1.pdf?MOD=AJPERES&CACHEID=048f2525-b645-473b-a5f3-74d9b2bb1ebe

⁷⁷ City of Toronto. (2010). Retrieved from <http://www.toronto.ca/legdocs/bylaws/2010/law1174.pdf>

Finally, the Zoning Bylaw amendment, through use of the Holding provision, works together with Section 37 requirements to secure connection of all buildings to a district energy system and/or on-site renewable energy sources, if available at costs comparable to other energy sources, through the Section 37 Agreement, which is registered on title.

Stakeholder Perspectives

Developer perspectives

Mandate alignment enables collaboration

This project presents somewhat of a unique case in that the developer, Waterfront Toronto, is a publicly-owned entity with a legislated mandate to implement a land use development plan in an environmentally responsible manner.⁷⁸ Waterfront Toronto has developed a Sustainability Framework to implement this mandate, and partnered with the C40 Climate Positive Development Program to set a context for objectives related to land use and energy themes in the Lower Don Lands portion of the Port Lands and Waterfront area.⁷⁹

The legislated mandate of Waterfront Toronto aligns with the City of Toronto's climate change mandate. This high-level policy alignment has opened opportunities for collaboration between staff with the Port Lands area seen as a living laboratory for policy innovation. Co-evolution of Waterfront Toronto's minimum Green Building Requirements and the City's Green Standard provides a good example of this. The former is a more aggressive standard, applied to publically owned property. An update to version 3.0 of the Toronto Green Standard is expected to go to Council for approval in 2017, which will map out a plan for getting to zero emissions by 2050 to meet the City's target.

Still trying to cracking the chicken and egg problem of capital investment in district energy systems

In ongoing work as part of the Villiers Island Precinct Plan⁸⁰, Waterfront Toronto conducted a sustainability audit, using a Carbon Tool developed by Waterfront Toronto to determine whether the plan supported the Corporation's objectives related to the C40 Climate Positive Development Program. The audit found that, while the plan would likely achieve 20-30% reductions in GHGs relative to a business-as-usual development, achieving net-zero (or net-negative emissions) would require the implementation of precinct-wide district energy and community energy planning solutions powered by renewable energy sources.

As was learned through Waterfront Toronto's previous experience with district energy the financial model requires significant upfront investment. Energy developers are unlikely to invest at the scale required without some level of certainty as to return on investment over time. This requires some upfront certainty that there will be sufficient density (population and employment) to justify investment in district energy. At sufficient density the energy (heat and electricity)

⁷⁸ Government of Ontario. (2002). Retrieved from <https://www.ontario.ca/laws/statute/02t28>

⁷⁹ C40 Cities. (2017). Retrieved from <http://www.c40.org/networks/climate-positive-development-program>

⁸⁰ Portlands Acceleration Initiative. (2013). Retrieved from <http://www.portlandsconsultation.ca/node/18>

demand within the precinct would spread the capital cost over a larger number of consumers, improving the business case for investment. Furthermore, mandatory connection within the precinct would guarantee sufficient demand to recover capital costs with adequate return on capital. While falling short of mandating connection, by requiring a district energy feasibility study for new development in the Precinct, Zoning by-law amendment (438-36) is an important step towards building the business case for district energy in the precinct.

Role of Local Energy Companies

The Port Lands case study provides an example of the role that specialized local energy companies like Enwave can play in providing expertise and capital needed to build district energy systems and micro-utilities. Were it not for Enwave's intervention or micro-utilities, in scaling-up district energy systems.

Although District Energy was at the heart of the master plan for the redevelopment of the Waterfront and Port Lands area, a lack of public capital compromised Waterfront Toronto's ability to realize the vision for a truly district-wide energy system. Enwave was able to bring capital and expertise to revive District Energy in the Waterfront. Enwave engaged in four month legal negotiations between Build Toronto, Waterfront Toronto, Corus Entertainment and the new building owners. Enwave plans to procure another DE system for the new George Brown College building adjacent to Corus Entertainment. By the end of 2018, the East Bay Front DE system will have 9 buildings connected with 2 remotely operated state-of-the-art DE plants.

Net-zero market leadership is emerging

Waterfront Toronto indicated that the sustainability framework and branding that has been created in the area, along with increasing consumer demand for sustainable buildings, have spurred private sector innovation and market leadership regarding net-zero energy. The NetZed suite in Aqualina, the first residential building under construction in East Bayside Precinct, was developed through Tower Labs – a collaboration between Tridel and MaRS to accelerate the adoption of green building products and services.⁸¹ The net zero energy dwelling (NetZED) is a single suite penthouse unit that will contain its own independent mechanical and electrical systems, along with unique building materials to reduce heating and cooling loads. All of the home's high performance energy consuming equipment (heating, cooling, lighting, power and hot water) will be powered by electricity supplied by a dedicated photovoltaic and solar thermal system (a method of converting solar energy into direct current electricity) installed on the roof of the building and owned by the netZED's future buyer.⁸²

Municipal perspectives

Strategic Political Leadership

Strategic political leadership was identified as an important success factor for integrating net zero energy objectives for the Port Lands area in the absence of provincial legislation. Mayor

⁸¹ Tower Labs. (2017). Retrieved from <http://towerlabs.org/portfolio/netzed/>

⁸² Palamarchuk, A. (2016, March). Retrieved from <http://blog.waterfronttoronto.ca/nbe/portal/wt/home/blog-home/posts/net-zero-energy-dwelling-on-the-waterfront>

David Miller's championing development of the City's 2007 Climate Change Action Plan, and his insistence that absolute GHG reduction targets be included was seen as a catalyst for current efforts to define pathways to net zero at a district and city-wide scale. More recently, Councilor Paula Fletcher, whose ward encompasses the Port Lands area, led a City Council motion to (1) establish net zero as a policy objective for the area and (2) direct city staff to report on guidelines for achieving this objective. The Port Lands Energy Plan, currently in development, will set out a pathway towards net zero energy import for the entire district. A rigorous and measurable triple bottom line is important to transcend political and administrative changes.

Bottom-up Policy Innovation

This case study provides an example of bottom-up policy innovation. The Port Lands area is seen as a living laboratory for policy and technology innovation, with the enhanced authority provided by Waterfront Toronto enabling the testing of new approaches that have since made their way into City of Toronto policy. Similarly the City of Toronto, as a result of unique powers provided under the City of Toronto Act, has been able to develop new policy approaches – such as the Standard Green Roof By-Law – that other municipalities will soon be in a position to implement as a result of proposed changes to the *Municipal Act* and the *Planning Act*, as part of Bill 68 – Modernizing Ontario's Municipal Legislation Act.⁸³

Intra-municipal coordination

The bureaucracy within a large City like Toronto inevitably results in administrative siloes. Staff spoken to as part of this study have indicated that there has been some successful collaboration across City departments for achieving low carbon energy objectives. For example, the Toronto Green Standard has been an instrumental tool for bringing together different departments, including Planning, Parks and Forestry, Water, Buildings, and Energy & Environment, to define what sustainable development looks like in a new construction context and set policy collaboratively.

Furthermore, the presence of a dedicated energy and environment division within the City bureaucracy is seen as providing critical expertise and capacity for engagement across the siloes of Planning and Building, enabling the development and implementation of new requirements for an Energy Strategy in large developments as part of the site plan approvals process, and for development of Community Energy Plan areas with enhanced policy, such as the Port Lands.

Use tools provided under the Planning Act

The City of Toronto has been able to make sustainable site design mandatory through the Toronto Green Standard by applying criteria to the Site Plan drawings, which is a legally-binding document. This approach has limitations in that the building code establishes what is required for developers in terms of mechanical systems, and other internal building components. The City currently has no authority to require energy efficiency and low carbon supply through the

⁸³ Legislative Assembly of Ontario. (2016). Retrieved from http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&BillID=4374

building permit approvals. There is an expectation that 2017 updates to the Ontario Building Code (OBC) will support municipalities with the development of net zero communities:

“The government intends to update the Building Code with long-term energy efficiency targets for new net zero carbon emission small buildings that will come into effect by 2030 at the latest, and consult on initial changes that will be effective by 2020. Ontario will consult on how to best achieve these targets through Building Code improvements.”⁸⁴

Lessons learned and replicability

- Political champions are essential for setting the high-level policy context for net zero communities (e.g. establishing GHG targets, and sponsoring city-wide plans). Staff-level champions, at multiple points within the bureaucracy, are essential for moving forward the detailed planning and implementation to realize high-level political objectives.
- Sustained investment in policy development and implementation over time is critical to building capacity, weathering political and administrative changes and mainstreaming climate change and energy issues in land use planning.
- Consider using major redevelopment projects (e.g. brownfields) to create a living laboratory to demonstrate the success of innovative policies. Community improvement plans (CIP) for brownfield redevelopment sites can be used as an instrument in this regard.
- It is critical for municipalities at all levels to translate their aspirational objectives for low carbon city-building into actionable policy and tools. This means starting with a strong understanding municipal authority under existing provincial legislation, and how that translates into scoping an appropriate role for the City government relative to other public and private sector stakeholders (e.g. developers). It furthermore means developing a clearer understanding of the alternative pathways to achieving high-level policy objectives, and their trade-offs in terms of economic, social and environmental impacts.
- Seed capital is critical to move large district energy systems forward. There may be a role for the Province’s proposed Climate Change Solutions Development Corporation⁸⁵ to provide seed capital to support the development of municipal district energy systems on a precinct-scale.
- Municipalities have an important role to play in bottom-up policy innovation. Just as the Province of Ontario developed innovative policies, such as the coal phase-out, that have since made their way into Federal Government policy, municipal government approaches such as the Toronto Atmospheric Fund (TAF) have now made their way into Provincial Government policy.
- When leading on innovative municipal policy ventures, it is important that proposals be made robust to various political perspectives. In the case of Toronto’s push to develop district energy systems, the rationale for policy innovation is supported by low carbon policy objectives, as well as economic and social objectives to enable growth in an area adjacent to the downtown core that lacks sufficient transmission grid capacity to

⁸⁴ Climate Change Action Plan. (2016). Retrieved from <https://www.ontario.ca/page/climate-change-action-plan>

⁸⁵ Development Corporations Act. (2017). Retrieved from http://www.downloads.ene.gov.on.ca/envision/env_reg/er/012-9270.pdf

otherwise enable that growth. And, given anticipated energy cost increases over time, district energy systems can save money for building owners and operators. With a robust environmental, economic and financial case, support from across the political spectrum is easier to obtain.

Case Study #5 – Ottawa Zibi

Municipal Snapshot

Municipal name	Ottawa
Municipal Status	Single-tier
Area	2,796 sq. km
Population (2006 census)	812,129 ⁸⁶
Population (2011 census)	883,391
Growth rate	7.9% ⁸⁷
Within Greater Golden Horseshoe	No

Project Snapshot

Project Name	Zibi
Developer	Windmill Development Group and Dream Unlimited Corp
Key development partners	City of Ottawa, City of Gatineau, & the National Capital Commission
Definition	Net zero carbon (NZC)
Status	Redevelopment of former industrial lands
Site area	149,734 m ² - Project is in two municipalities: Ottawa (13 acres) & Gatineau (24 acres)
Number and type of residential units	1200 residential units (townhouses, condominiums, & apartments)
Floor area	92,900 m ² is proposed including approximately 1200 residential units, 6900 m ² of retail and 9500 m ² of office
Market Price	~ \$ 262,808 - \$806,157
Landscaped open space	Public and private parks: cumulative area approximately 15,300 m ² representing an area greater than 20% of total lands. ⁸⁸
Maximum height	Ranges from 2 to 15 stories
Parking	2955 underground parking spaces are proposed
Non-residential units	Land uses permit mixed-use (e.g. office, commercial, hotel, retail, and live-work)
Pre-development use	Domtar Lands – Industrial
Certification	Buildings designed to LEED platinum standards
Sustainability framework	One Planet Living

⁸⁶ List of municipalities in Ontario. (2017) Retrieved from https://en.wikipedia.org/wiki/List_of_municipalities_in_Ontario

⁸⁷ City of Ottawa. (2017). Retrieved from <http://ottawa.ca/en/city-hall/budget-and-taxes/financial-reports-and-statements/long-range-financial-plans/long-range-6>

⁸⁸ Ontario Municipal Board. (2015, November). Retrieved from <http://www.windmilldevelopments.com/wp-content/uploads/2015/11/OMBCasePL141340-NOV-17-2015.pdf>

Key energy features	District energy system, heat capture system, ultra-efficient appliances & smart devices, electric car charging stations, optimized building passive heating and cooling, solar generation, ultra-efficient building envelopes. ⁸⁹
Key water features	Water metering w/ high visibility; 125L/person/day target by 2020; eliminate potable water use in landscaping; net-zero export of pollutants via storm-water outflow goal. ⁹⁰
Other sustainability features	Promoting sustainable food (e.g. home garden space, increased access to local foods, and rooftop bee keeping); transport (e.g. bike share program & active transportation design) + zero waste goal (only 2% to landfill through various strategies)

Context

Description of municipality

Over the years, the City of Ottawa has updated its environmental strategy to address new and persistent economic, social and environmental challenges presented by our changing environment. In 1991, the City of Ottawa joined the *Partners for Climate Protection* program⁹¹ — one of the first municipalities in Canada to participate. The program committed the city to reduce its corporate GHG emissions. In 1995, Ottawa's City Council approved the *Corporate Plan for Greenhouse Gas Reduction*. The plan consisted of five program components and two corporate policies focused on achieving an internal GHG reduction target of 20% by 2005.⁹² In October 2003, the City of Ottawa's *20/20 Environmental Strategy* was approved as part of the city's Growth Management Strategy. The strategy aimed to provide the city with a sustainability blueprint based on four goals: A Green City; Development in Harmony with the Environment; A Focus on Walking, Cycling and Transit; and Clean Air, Water and Earth. On September 28, 2005, progress continued as City Council approved the *Green Building Policy for the Construction of Corporate Buildings*. This policy was based on LEED certification and utilizes Smart Energy programs to reduce energy consumption. The city also developed a green building promotion program to encourage private developers to consider energy saving strategies. Many of these programs and policies were captured in the City of Ottawa's 2007 report, *Getting Greener: On the Path of Sustainability - Directory of Environmental Initiatives*. The document was released by the city's Environment Working Group as step towards updating the city's environmental strategy.⁹³

⁸⁹ Bioregional. (2015, April). Retrieved from http://www.bioregional.com/wp-content/uploads/2015/06/Zibi-One-Planet-Action-Plan_2015.pdf

⁹⁰ Ibid.

⁹¹ Federation of Canadian Municipalities. (2017, January). Retrieved from <http://www.fcm.ca/home/programs/partners-for-climate-protection.htm>

⁹² Corporate Plan for Greenhouse Gas Reduction Second Annual Progress Report. (1997). Retrieved from <http://www.csaregistry.ca/registry/out/C1121-03APR98-RPT.PDF>

⁹³ Planning and Environment Committee. (2009, July). Retrieved from <http://ottawa.ca/calendar/ottawa/citycouncil/ec/2009/08-25/18-ACS2009-ICS-CSS-0029%20-%20Environmental%20Strategy.htm>

Municipal Policy Framework

In 2012, the City of Ottawa partnered with the City of Gatineau and the NCC to develop three plans focused on steering the National Capital Region towards a more sustainable and prosperous future. The *Choosing our Future* initiative is designed to achieve multiple goals, e.g., enhanced economic prosperity and environmental health via the **Sustainability and Resilience** plan, the **Energy and Emissions** plan, and the **Risk Prevention and Mitigation** plan. Together the documents provide a common framework for future decision-making, planning processes and policy development. The *Energy and Emissions Plan*, or Community Energy Plan (CEP), was developed to provide greater depth to the issues of energy demand and greenhouse gas emissions (GHG). The document provides strategies to increase renewable energy integration in the region, as well as comprehensive energy conservation strategies to mitigate GHG emissions in multiple sectors.⁹⁴ The plan also commits the City to “look for opportunities to develop a Net Zero Block as a pilot project in a partnership with municipal, federal, and private partners”.⁹⁵ On May 28th, 2014, Ottawa city council approved an updated *Air Quality and Climate Change Management Plan*, a framework that provides a 20-year mitigation and adaptation strategy on climate change. The plan targets a reduction in per capita GHG emissions by 20% between 2012 and 2024.⁹⁶

The City of Ottawa is currently drafting a new renewable energy transition strategy called *Energy Evolution* (EE). This draft document was developed by a diverse group of stakeholders consisting of approximately 100 contributors from more than 50 organizations.⁹⁷ The plan is set to seek endorsement before council in 2017. EE’s vision is simple and straightforward: *Ottawa is a thriving city powered by clean, renewable energy*. The strategy seeks to propel Ottawa towards a fossil-free future by reducing energy use through conservation and efficiency; increasing the supply of renewable energy through local and regional production; and prioritizing the procurement of clean, renewable energy.⁹⁸

Description of project

Zibi is proposed as a 15-hectare mixed-use master planned community consisting of 13 development blocks straddling Ottawa ON and Gatineau QC. This redevelopment of the Chaudière area and Albert Islands will include 1200 residential units (townhouses, condominiums, & apartments), combined with commercial, retail and park space spread out over eight districts. Community gardens, bio-swales, electric car charging stations, dedicated bike lanes, and a district energy system are a few key sustainability features. The adaptive reuse of heritage buildings is also planned to decrease waste and material required, and maintain the properties’ heritage value. The community will be connected via a network of pedestrian friendly shared streets (narrow right-of-way), which prioritize sustainable and active

⁹⁴ Framing Our Future: Energy and Emissions. (2012). Retrieved from http://ottawa.ca/calendar/ottawa/citycouncil/ec/2012/02-21/03-Documents%20-%20CoF_Energy%20Plan_FINAL%5B1%5D.pdf

⁹⁵ Ibid.

⁹⁶ City of Ottawa. (2014). Retrieved from <http://ottawa.ca/en/city-hall/planning-and-development/official-plan-and-master-plans/air-quality-and-climate-change>

⁹⁷ Chernushenko, D. (2016, September). Retrieved from <http://capitalward.ca/index.php/columns/1680-ottawa-feeling-the-heat-must-seize-the-moment>

⁹⁸ Ibid.

transport over vehicles. The community is promoted as a transit oriented, socially engaging community that is situated close to the Ottawa and Gatineau downtown cores.⁹⁹

Zibi developers—Windmill Development Group and Dream Unlimited Corp—are committed to the *One Planet Action Plan*, a set of sustainability goals that is far more ambitious than the industry's standard LEED rating system. This includes a commitment to zero waste, sustainable transport, and NZC. There will be no fossil fuel energy supplies onsite except as backup to a renewable supply.

Rationale for selecting as a case study

The City of Ottawa's CEP commits the City to look for opportunities to develop a Net Zero Block as a pilot project in a partnership with municipal, federal, and private partners. The Zibi project represents a realization of this commitment. It was chosen because it is promised "to be one of the most socially sustainable, environmentally-friendly and innovative developments in Canada," and is referred to as a "world-class prototype for 21st Century design and development."¹⁰⁰ Moreover, the project is committed to achieving zero carbon through the *One Planet Action Plan*.

Existing policy/tools at time of planning application

Official Plan (OP)

The OP is just one of several municipal plans designed to contribute to environmental quality throughout the City of Ottawa. The OP addresses environmental issues in multiple sections. The following were integrated into the municipality's Official Plan through OPA 76 (2011)¹⁰¹:

2.4 – Maintaining Environmental Integrity: the OP protects and enhances environmental quality by improving air quality and reducing greenhouse gas emissions

2.4.1 – Air Quality and Climate Change (AQCC): The objectives presented in the OP aim to reduce GHG emissions in the development and building sector and provide measures to adapt to the effects of climate change.

For greater detail of the enabling policies associated with each objective, see Appendix.

2.5.1 – Urban Design and Compatibility: Maximizing energy-efficiency and promoting sustainable design to reduce resource consumption, energy use, and carbon footprint of the built environment are the objectives goals.

Principles of design should:

⁹⁹ Ontario Municipal Board. (2015, November). Retrieved from <http://www.windmilldevelopments.com/wp-content/uploads/2015/11/OMBCasePL141340-NOV-17-2015.pdf>

¹⁰⁰ Zibi. (2017). Retrieved from <http://www.zibi.ca/sustainability/>

¹⁰¹ City of Ottawa. (2003, May). Retrieved from <http://ottawa.ca/en/city-hall/planning-and-development/official-plan-and-master-plans/official-plan/volume-1-official-7>

- Orient development to maximize opportunities for passive solar gain, natural ventilation, and use energy efficient development forms and building measures.
- Consider use of renewable energy and alternative energy systems.
- Utilize green building technologies and rating systems such as Leadership in Energy and Environmental Design (LEED).¹⁰²

Air Quality and Climate Change Management Plan (AQCCMP)

The AQCCMP was approved by Ottawa City Council on May 28th, 2014. The document is a 20-year framework to guide the city in climate change mitigation and adaptation strategies. The new plan builds on the *Choosing our Future* Energy and Emissions plan by setting guiding principles, goals, objectives, and an updated GHG target (per capita reduction of 20% from 2012 emissions by 2024). The following mitigation goals are outlined in the plan:

Mitigation: (1) reduce energy demand; (2) reduce dependence on fossil fuels; (3) reduce other sources of GHG emissions (e.g. landfills and sewage treatment plants); (4) reduce other sources of air borne pollution; (5) improve carbon capture and storage (e.g. protecting forests and wetlands that capture carbon).¹⁰³

2012 Green Building Promotion Program

In April, 2009, the City of Ottawa approved the pilot Green Building Promotion Program (GBPP) with aims to increase and support green building projects throughout the city. The program had multiple objectives: (1) build an integrated approvals process and understanding of green building projects among development review staff; (2) promote green building in the City of Ottawa; and (3) recommend a green building projects program to the City of Ottawa which promotes and assists building projects and integrated green design processes.¹⁰⁴ Mitigating climate change through the promotion of reduced energy use and CO2 emissions is another key objective.¹⁰⁵ In 2012, the project became permanent.

Planning Primer Program

To support and improve the planning process, a *Planning Primer Program* was developed by the City of Ottawa's Planning and Infrastructure Department.¹⁰⁶ The program consists of educational programs to help residents, e.g., community representatives and developers, understand the land-use planning process better to mitigate confusion and increase efficiency and effectiveness. This knowledge is also key towards achieving flexibility in zoning-by-law, an important factor in net zero community development.

Choosing our Future initiative:

¹⁰² Ibid.

¹⁰³ City of Ottawa. (2014). Retrieved from <http://ottawa.ca/en/city-hall/planning-and-development/official-plan-and-master-plans/air-quality-and-climate-change>

¹⁰⁴ City of Ottawa. (2012). Retrieved from http://ottawa.ca/calendar/ottawa/citycouncil/occ/2012/07-11/pec/15%20-%20ACS2012-PAI-PGM-0127_Green%20Building_DOC%201.pdf

¹⁰⁵ Ibid.

¹⁰⁶ The Planning Primer Program. (2014). Retrieved from <http://fca-fac.ca/wp-content/uploads/2014/11/Primer.pdf>

The *Choose our Future* initiative consists of three integrated and long-term plans that deliver a vision for a sustainable future. With a focus on net zero communities, the Energy and Emissions Plan is of particular importance:

Energy and Emissions plan: This CEP was produced to lead the region on a common path towards a more sustainable energy future that reduces fossil fuel reliance and GHG emissions. The plan presents three persuasive reasons for action: (1) energy security, (2) climate security, and (3) integrated security. The plan also provides strategic direction that encourages the use of high performance buildings and sustainable mobility, promotes low carbon and renewable energy supply, and manages growth and development, materials, and solid waste.¹⁰⁷

Policy amendments precipitated by the planning application

In April 2014, the development applications for the proposed Zibi project were submitted. A Zoning By-law Amendment and Stage 1 Site Plan Control application were included. Shortly after, an Official Plan Amendment—initiated by the City of Ottawa—was also entered to address proposed site policy.

On October 8, 2014, the proposed amendments were adopted by Ottawa City Council as by-laws 2014-396 (OPA 143) and 2014-395. Under the Central Area Secondary Plan (Schedule Q), the Zoning By-law Amendment (2014-395) changed zoning from “Parks and Open Space subzone” to “Mixed-Use Downtown Zone.”¹⁰⁸

OPA 143: Designates lands as “Central Area”, allowing for mixed uses. “City Council has established land use designations and policies for Chaudière and Albert Islands to provide direction for the future development of the Islands as part of the larger Zibi development.”¹⁰⁹

Section 1.11.5: new language added to guide the vision and principles of Island development. Eight development principles added to Master Plan.

Section 1.11.7: Land use policies added for the islands to guide transformation into “a world-class, sustainable, complete community.”

Section 1.11.8: On-site heritage resource policies added. This includes a planned Heritage Interpretive Plan to celebrate Algonquin history and culture, historic rights-of-way streets, and rules mandating new additions or construction near heritage sites to be “in harmony” with existing historical structures.

¹⁰⁷ Framing Our Future: Energy and Emissions. (2012). Retrieved from http://ottawa.ca/calendar/ottawa/citycouncil/ec/2012/02-21/03-Documents%20-%20CoF_Energy%20Plan_FINAL%5B1%5D.pdf

¹⁰⁸ Fotenn. (2015, August). Retrieved from http://webcast.ottawa.ca/plan/All_Image%20Referencing_Site%20Plan%20Application_Image%20Reference_D07-12-15-0158%20Zibi%201A%20-%20Planning%20Rationale.PDF

¹⁰⁹ Ibid.

Emerging policy/tools precipitated by the development

A joint design review panel process—consisting of representatives from the City of Ottawa Urban Design Review Panel, the City of Gatineau, and the National Capital Commission (NCC) Design Review Panel—was created to simplify the approval process for Zibi initiatives. The process placed a conscious lens on the place-making attributes of the proposed project.

On major municipally planned initiatives, the City of Ottawa is encouraging the industry to engage with the local community to build early buy-in before official applications are submitted. Windmill invested significant time and resources conducting community engagement initiatives via consultations with stakeholders before applying.

Enabling Federal and/or Provincial interventions

The NCC mandate is focused on the planning and development of the Capital Region. On July 7, 2014, the Commission entered into a Memorandum of Understanding with Zibi developers *Windmill Development Group*¹¹⁰ to ensure that:

1. Public benefits are provided, e.g., improved connectivity and new public parks;
2. On-going consultations (with inclusive approach) continue between Algonquin communities, the NCC, and developers;
3. Capital interests and principles are integrated into the project; and
4. The principles lead to land transactions.¹¹¹

Furthermore, a land transfer—between the NCC and the Windmill Development Group—of Chaudiere and Albert Islands is in development. The NCC's board of directors unanimously approved the Zibi project in January 2015.¹¹²

Stakeholder Perspectives

Municipal Perspective

Collaborative approach built key allies

The most common theme to arise in this case study was the importance of early collaboration and engagement with key stakeholders. Windmill Developments used a collaborative approach to build key allies throughout the public, private, and voluntary sectors. Engaging with senior administration and political leadership led to strong project support early in the planning process.

Due to the success of this approach, the City of Ottawa suggests this strategy be utilized for similar major infill developments. Early discussions on development principles should be initiated to build a primary understanding of how an area could be reinvigorated before planning

¹¹⁰ Kitigan Zibi Anishinabeg. (2015, November). Retrieved from http://www.kzadmin.com/Flyers/885_Flyer_26112015.pdf

¹¹¹ National Capital Commission. (2016, September). Retrieved from http://www.ncc-ccn.gc.ca/sites/default/files/pubs/7_-_zibi_update_presentation_-_en.pdf

¹¹² Chianello, J. (2015, January). Retrieved from <http://ottawacitizen.com/news/local-news/0121-ncc>

applications are submitted. The project should then evolve through a collaborative engagement process, with the project vision consistently reinforced throughout.

Joint Urban Design Review Panel Process

Due to the development's unique location situated on a municipal boundary with federal lands, Zibi was subject to three separate approval processes from the City of Ottawa, the City of Gatineau, and the NCC. To increase the efficiency and effectiveness of the process, a joint urban design review panel (JUDRP) was formed to assess the concept master plan. The panel provided comments on land-use mix, view corridors of national symbols, massing and height of buildings, and the public realm strategy.¹¹³ This cooperation and collaboration helped to (1) ensure a common and shared interest for public benefits were pursued as a key outcome, and (2) expedite the approval process. Due to the success of the JUDRP, it is recommended this joint process be utilized on similar projects when collaborating with neighbouring municipalities.

Flexibility to support integrated solutions

When planning large-scale projects, flexibility was identified as an important component to policy design and development. Integrating flexibility into policy direction helps to mitigate future problems and allows for project evolution, an important aspect when seeking NZC. Zoning changes focused on building a directional policy framework would allow for change to happen more efficiently. A framework that is directional instead of specific allows for answers to be identified over time as opposed to immediately.

The evolution of planning and policy

Emerging concepts such as net zero community have forced an evolution in planning to place a higher emphasis on understanding the function of the public realm and how it contributes to the experience of life in the city. Focusing efforts first to understand the places and spaces within the built environment is a strategy more commonly utilized in planning today. Once achieved, a proposed area development can then help to create, define, or redefine those places and spaces.

During our research it was suggested that the implementation of NZC could be streamlined through the amalgamation of best practices and lessons learned into policy development and approval processes. For example, there may be a limited knowledge base for certain technologies within municipalities, which can lead to difficulties during the approval process. Deep water source cooling (DWSC) is one example. DWSC can significantly reduce power consumption in buildings—a major contributor to GHG emissions—but inadequate awareness of the technology, combined with a deficiency in past project tracking and knowledge retention, act as barriers to its application.

To assist and encourage aggressive decarbonization goals, regulatory bodies should attempt to decrease barriers for developers when pursuing NZC.

¹¹³ National Capital Commission. (2015, January). Retrieved from http://www.ncc-ccn.gc.ca/sites/default/files/pubs/2014-p43e_-_windmill_proposal_for_the_development_of_chaudieres_and_albert_islands_and_the_north_shore_of_the_ottawa_river_the_domtar_lands.pdf

Developer Perspective

Vision

The vision for Zibi was established early by Windmill Developments through a collaborative engagement process. Setting an aspirational vision early enabled flexibility and helped to build support from key municipal stakeholders and consultants; furthermore, it increased the ability to strengthen the project strategy, which is essential for the goal of NZC.

One Planet Living framework

Zibi's *One Planet Action Plan* guides the project towards its ambitious energy and environmental goals through ten sustainability principles. The framework was chosen for two overarching reasons:

1. One Planet Living (OPL) incorporates social impact. Various social indicators rate the development's success in achieving different factors, including the health and happiness of residents. Focus is placed on long-term human behavioural change, as this was found to have significant impact on overall sustainability including energy consumption; and
2. OPL allows for flexibility based on site conditions. For example, water conservation is not a pressing issue for the Zibi development because it is situated next to the Ottawa river. OPL's process-driven, flexible framework allows the focus to shift towards issues of greater relevance, such as energy conservation and renewable energy integration. In both aspects, OPL is preferred over LEED certification as an overall framework. LEED is prescriptive (e.g. point rating system is the same regardless of differing factors, such as environmental conditions) making OPL the preferred model for this project. In support of OPL, LEED certification will be pursued for multiple on-site buildings.

Net Zero Carbon: One key OPL goal is NZC. A low-carbon energy strategy was developed with the assistance of Hydro Ottawa and MaRS Cleantech—an advanced energy centre based in Toronto, ON. An integrated energy system was designed to incorporate “automated buildings, energy storage, electric vehicle sharing, energy efficiency programs, and demand response to enable on-site renewable energy.”¹¹⁴ An Energy Innovation Design Charette—featuring a host of innovators and industry experts—was held to further develop innovative low-carbon energy concepts. The session provided eighteen creative ideas, including an *Energy Innovative District* to “showcase and test next-generation clean technologies from Canadian entrepreneurs.”¹¹⁵

Role of Local Energy Companies

A partnership between Windmill Developments and Hydro Ottawa was formed to create an on-site micro-utility. The micro-utility will deliver district thermal, district electricity, and hot water to residential and commercial buildings at Zibi. Potential energy sources include geothermal, biomass, sewage waste heat recovery, and heating and cooling from the Ottawa river. This public-private partnership represents an innovation in business model for municipally-owned

¹¹⁴ Rocky Mountain Institute. (2016). Retrieved from http://www.rmi.org/elab_accelerator_2016_zibi_ottawa_zero_carbon_community

¹¹⁵ MaRS Cleantech. (2015, July). Retrieved from <https://www.marsdd.com/wp-content/uploads/2015/07/AEC-MaRS-Hydro-Ottawa-Energy-Innovation-Design-Charette.pdf>

Local Distribution Companies (LDCs) who are struggling to stay relevant in this disruptive era of distributed energy generation.

Marketability

Market attractiveness for an innovative, net zero community in the Ottawa region is encouraging. The demand for a low energy lifestyle has increased due to a growing public concern over climate change. Additionally, demographic trends for the region show steady population growth, strong employment gains, and low interest rates.¹¹⁶ These are encouraging signs. Marketing consumer benefits associated to living in a NZC increases property attractiveness and further enhances market potential.

However, research suggests there are significant marketing barriers associated with leading-edge developments. Uncertainty amongst consumers is one example. This barrier mitigates wide-scale adoption and deployment of similar low-impact community projects. Although interest and acceptance are growing rapidly for green initiatives, many consumers are still not prepared to pay a premium for sustainability. Reliability is another concern. A NZC project may be viewed by consumers as untested and high-risk, but fortunately these barriers can be mitigated.

For Zibi, these concerns are reduced by demonstrating (1) the key benefits to sustainable living, for example, health improvements due to pedestrian-friendly design, and (2) that no additional costs are associated with residing in this NZC community.

Achieving NZC at market rates is one of the primary challenges facing Zibi. Fortunately for the development, the site possesses unique characteristics, which make this goal possible. Capital expenditures will be significantly reduced through the provision of (1) district thermal via existing on-site district energy (DE) infrastructure, and (2) existing on-site renewable energy technology, including six run-of-the-river hydroelectric facilities. Maximizing solar gain through street design—east-west pattern—also contributes to the projects ability to achieve NZC without increasing costs. These low cost (and low carbon) energy supply options lower long-term operating costs for prospective buyers, and hence enhance marketability in an era of rising energy costs.

The partnership with Ottawa Hydro on the micro-utility assisted with marketability and consumer trust given the strength of the LDC brand.

Stakeholder and community engagement

Windmill utilized a collaborative engagement process as its core strategy to build early buy-in and support from a complex set of community and political stakeholders. Providing opportunities for early involvement in the plan-making process, and continually throughout, encouraged a host of citizen groups and community members (e.g. heritage and cultural advocates) to participate. Providing multiple venues to listen and respond to community interests, visions, and concerns was deemed a successful strategy amongst a diverse group of stakeholders. Citizen engagement is credited with building a more diverse and inclusive Zibi master plan. In fact, over

¹¹⁶ City of Ottawa. (2017). Retrieved from <http://ottawa.ca/en/city-hall/budget-and-taxes/financial-reports-and-statements/long-range-financial-plans/long-range-6>

900 community members attended one public meeting to provide feedback on the land's proposed design principles.¹¹⁷

Windmill's early engagement with First Nations representatives, the NCC, the City of Ottawa, and the City of Gatineau were essential steps towards moving this project forward.

Local energy infrastructure opportunities and challenges

Zibi's ability to achieve a zero carbon footprint by 2020 will require a district-wide energy system powered by on and off-site renewable energy generation. Unfortunately, DE systems often face typical challenges such as high upfront capital costs and rights of way, but due to the location's former status as an industrial site, three main areas are still equipped with DE infrastructure. A network of underground, insulated pipe and pipe-line bridges exist and are linked to a central steam boiling room; therefore, up-front capital costs will be heavily mitigated. Further challenges include sub-metering expenses, and the operation and maintenance of the system in a cost-effective manner.

Consumer testing was completed to understand the level of consumer acceptance regarding a Hydro Ottawa supported DE system—and the results were very positive. The partnership was shown to increase consumer support and deliver benefits to both parties. The developer benefited from the utility's internal strengths and capabilities (e.g. customer relationships), and the utility benefited from the opportunity to (1) demonstrate energy saving initiatives, (2) heighten consumer engagement, and (3) adapt to changes in the local distribution company (LDC) model (e.g., sub-metering, solar generation, etc.). Increased resource efficiency, distribution, and Wi-Fi opportunities are also possible. Being a solution provider is a major driver for Hydro Ottawa.

Enabling federal interventions

To assess the practicality of a development at the former Domtar industrial brownfield site, Windmill Developments applied for and received a Federation of Canadian Municipalities grant through the *Green Municipal Fund* (GMF) to partially fund a feasibility study. Private developers can access GMF funding if the municipality supports the proposed project. Although the City of Ottawa is not a partner in the development, the municipality has shown widespread support for the project through political leadership and administration.

In addition, Windmill Developments has applied for the Quebec Hydro grant, *Urban Sustainable Development*. If secured, the grant would be used to offset costs associated with on-site electricity use.

A Natural Resources Canada grant application was also submitted, which, if received, would help to fund a biomass solution to meet peak demand when waste heat from the neighbouring industrial supplier is insufficient, or when the facility is shutdown.

Lessons learned and replicability

- Early and ongoing stakeholder engagement & collaboration key

¹¹⁷ Windmill Developments. (2014, April). Retrieved from <http://www.windmilldevelopments.com/2014/04/windmill-submits-rezoning-application-windmill-envoie-sa-demande-de-changement-de-zonage/>

- Integrating energy needs early enabled flexibility and assisted the evolution of the policy and planning changes required to achieve energy goals (e.g. right-of-way agreements).
- The One Planet Living Framework is a highly ambitious energy and environmental strategy that can assist municipalities achieve net zero carbon.
- Joint urban design review panel process highly beneficial when working in collaboration with neighbouring municipalities.
- Overly prescriptive government policies can discourage low-carbon energy initiatives.
- Key stakeholder collaborations provide mutually beneficial opportunities, e.g., diversified business models. The micro-utility partnership between Hydro Ottawa and Windmill Developments is an example.
- Set vision early and reinforce through collaborative engagement process. This strategy also increases flexibility and mitigates resource waste.
- Political and community goodwill highly beneficial. Seek early support and endorsements.
- Municipalities should incorporate best practices and lessons learned into policy development and approval processes.
- Innovative energy supply options, combined with highly efficient buildings, can enable cost competitive net zero communities in some real estate markets

Appendix - Net Zero – Glossary of Terms

Net-Zero Carbon Building		
Term (identified by source)	Definition	Source
Zero Carbon Building	<ul style="list-style-type: none"> Zero carbon homes emit net zero carbon dioxide from all energy use during operation (does not include emissions during construction of home) Excludes "embodied carbon," carbon resulting from activities of the household like transportation and consumption of goods Focuses on energy consumed by powering electronics, heating water, and indoor temperature regulation 	Williams, J. (2012). <i>Zero carbon homes: A road map</i> . Abingdon, Oxon ; New York: EarthScan.
Carbon Neutral	<ul style="list-style-type: none"> Includes operational energy carbon emissions (from building use), embodied carbon emissions from construction, and carbon emissions related to transportation energy intensity of project. Carbon is used to mean carbon dioxide equivalent greenhouse gases 	Hootman, T. (2013). <i>Net-zero energy design: A guide for commercial architecture</i> . New Jersey: John Wiley & Sons, Inc.
Net Zero Carbon Building	<ul style="list-style-type: none"> Building produces at least as much carbon-free energy per year as it consumes, with electricity generated from on-site or off-site renewable sources, including nuclear power Disadvantage: policy wording can result in over-dependence on offsets, rather than reduction of emissions, UK policy allows 50% of carbon emissions in a zero carbon building to be from purchased off-site offsets 	Kilbert, C. J., Fard, M. M. (2012). <i>Differentiating among low-energy, low-carbon and net-zero-energy building strategies for policy formulation</i> . Building Research & Information. 40:5, 625-637.
Zero Carbon Building	<ul style="list-style-type: none"> Building produces at least as much carbon-free energy per year as it consumes, with electricity generated from on-site or off-site renewable sources, including nuclear power Disadvantage: policy wording can result in over-dependence on offsets, rather than reduction of emissions, UK policy allows 50% of carbon emissions in a zero carbon building to be from purchased off-site offsets 	Kilbert, C. J., Fard, M. M. (2012). <i>Differentiating among low-energy, low-carbon and net-zero-energy building strategies for policy formulation</i> . Building Research & Information. 40:5, 625-637.
Zero Carbon Building	<ul style="list-style-type: none"> Building does not use energy resulting in carbon dioxide emissions over the course of a year Carbon-neutral or -positive, produce enough carbon dioxide free energy to supply themselves with energy 	Kapsalaki, M., Leal, V. (2011). Recent progress on net zero energy buildings. <i>Advances in Building Energy Research</i> , 5(1), 129-162.

Net-Zero Energy Building		
Term (identified by source)	Definition	Source
Net Zero Energy Housing	<ul style="list-style-type: none"> A home that produces and returns as much energy to the grid as it uses Net zero houses can be off-grid- producing all their own energy and storing it in batteries for low-generation hours, or grid-tied- drawing on and feeding into the power grid While focus is on energy, this definition also states that a net-zero house cannot emit carbon dioxide 	Friedman, A. (2013). <i>Innovative houses: Concepts for sustainable living</i> . London: Laurence King Publishing Ltd.
Net Zero Energy Housing	<ul style="list-style-type: none"> A house that uses net zero energy during operation (does not include energy use during construction of house) 	Williams, J. (2012). <i>Zero carbon homes: A road map</i> . Abingdon, Oxon ; New York: EarthScan.
Net Zero Energy Building	<ul style="list-style-type: none"> Non-renewable energy source may be used, but over the course of a year must enough renewable energy must be generated to offset or exceed the use of non-renewable sources An operational goal, over the course of the year, including seasonal variation 	Hootman, T. (2013). <i>Net-zero energy design: A guide for commercial architecture</i> . New Jersey: John Wiley & Sons, Inc.
Net Zero Site Energy Building	<ul style="list-style-type: none"> Building produces at least as much renewable energy as it uses over a year Most commonly used and understood definition, uses a literal boundary within which all energy use is used to calculated, reflects what would be recorded on a meter and does not need additional factors to calculate Can be the most difficult of four definitions to achieve, and therefore a good standard 	Hootman, T. (2013). <i>Net-zero energy design: A guide for commercial architecture</i> . New Jersey: John Wiley & Sons, Inc.

Net Zero Source Energy Building	<ul style="list-style-type: none"> • Building produces or purchases at least as much renewable energy as it uses over the course of a year, when accounted at the energy source • Includes factors related to providing energy to a site (ex. the losses resulting from generating and transporting energy from a coal-fired grid-based plant to the building) • More complete picture of energy use, but involves determining and applying each energy source used to the site value 	Hootman, T. (2013). <i>Net-zero energy design: A guide for commercial architecture</i> . New Jersey: John Wiley & Sons, Inc.
Net Zero Energy Emissions Building	<ul style="list-style-type: none"> • Building produces or purchases enough emissions-free renewable energy to offset emissions from all energy used in building over the course of a year • Emissions measured in form of carbon-equivalent GHG emissions related to the energy use of a building, carbon emission factor applied to site energy use for each energy/fuel source used for the project- renewable generation can be used to offset fossil fuel emissions • Quantifies GHG emissions from building operational energy 	Hootman, T. (2013). <i>Net-zero energy design: A guide for commercial architecture</i> . New Jersey: John Wiley & Sons, Inc.
Net-Zero Energy Cost Building	<ul style="list-style-type: none"> • Building receives at least as much financial credit for renewable energy as it is charged by the utility for energy and energy services over the course of a year • Rate structure for energy use, peak demand charges, fees, taxes, value credited by utility for renewable energy exported to grid must all be tracked 	Hootman, T. (2013). <i>Net-zero energy design: A guide for commercial architecture</i> . New Jersey: John Wiley & Sons, Inc.
Net Zero Source Energy	<ul style="list-style-type: none"> • Building produces at least as much energy as it consumes per year, when accounted for at source 	Kilbert, C. J., Fard, M. M. (2012). <i>Differentiating among low-energy, low-carbon and net-zero-energy building strategies for policy formulation</i> . BuildingResearch & Information. 40:5, 625-637.
Net-Zero Energy Cost	<ul style="list-style-type: none"> • Building receives at least as much annual revenue from the utility for on-site energy exported into the grid as it pays to the utility (or utilities) for energy 	Kilbert, C. J., Fard, M. M. (2012). <i>Differentiating among low-energy, low-carbon and net-zero-energy building strategies for policy formulation</i> . BuildingResearch & Information. 40:5, 625-637.
Net-Zero Energy Emissions	<ul style="list-style-type: none"> • Building produces at least as much emissions-free renewable energy in a year as it uses from emissions-producing sources 	Kilbert, C. J., Fard, M. M. (2012). <i>Differentiating among low-energy, low-carbon and net-zero-energy building strategies for policy formulation</i> . BuildingResearch & Information. 40:5, 625-637.
Net Zero Site Energy	<ul style="list-style-type: none"> • Building produces at least as much energy as it uses per year, when accounted for at site 	Kapsalaki, M., Leal, V. (2011). Recent progress on net zero energy buildings. <i>Advances in Building Energy Research</i> , 5(1), 129-162.
Net Zero Source Energy	<ul style="list-style-type: none"> • Building produces at least as much energy as it uses per year, when accounted for at source • Includes primary energy used to generate and deliver energy to site, calculated using imported and exported energy multiplied by appropriate site-to-source conversion multipliers 	Kapsalaki, M., Leal, V. (2011). Recent progress on net zero energy buildings. <i>Advances in Building Energy Research</i> , 5(1), 129-162.
Net Zero Energy Cost	<ul style="list-style-type: none"> • Amount of money utility pays building owner for energy exports to grid is equal to or greater than the amount the owner pays the utility for energy services and energy used per year 	Kapsalaki, M., Leal, V. (2011). Recent progress on net zero energy buildings. <i>Advances in Building Energy Research</i> , 5(1), 129-162.
Net Zero Energy Emissions	<ul style="list-style-type: none"> • Building produces at least as much emissions-free renewable energy per year as it uses from emissions producing energy sources. 	Kapsalaki, M., Leal, V. (2011). Recent progress on net zero energy buildings. <i>Advances in Building Energy Research</i> , 5(1), 129-162.
Net Zero Energy Building	<ul style="list-style-type: none"> • Building that, over the course of a year, are neutral, deliver as much energy to the supply grid as they use from the grid • Does not need fossil fuels for heating, cooling, lighting, other energy uses, although they may sometimes draw energy from the grid 	Kapsalaki, M., Leal, V. (2011). Recent progress on net zero energy buildings. <i>Advances in Building Energy Research</i> , 5(1), 129-162.
Zero Stand-alone Building	<ul style="list-style-type: none"> • Building does not require connection to grid (or does so only as backup), can autonomously supply themselves with energy and have capacity to store energy for night-time or winter use 	Kapsalaki, M., Leal, V. (2011). Recent progress on net zero energy buildings. <i>Advances in Building Energy Research</i> , 5(1), 129-162.
Plus Energy Building	<ul style="list-style-type: none"> • Building delivers more energy to supply system than it uses (over the year, produces more energy than it consumes) 	Kapsalaki, M., Leal, V. (2011). Recent progress on net zero energy buildings. <i>Advances in Building Energy Research</i> , 5(1), 129-162.
Net Zero Site	<ul style="list-style-type: none"> • Produces at least as much energy as it uses in a year, when accounted for at 	Torcellini, P., Pless, S., Deru, M.,

Energy Building	site	Crawley, D. 2006. <i>Zero Energy Buildings: A Critical Look at the Definition</i> . Paper presented at the ACEEE Summer Study, Pacific Grove, California. Retrieved from http://www.nrel.gov/docs/fy06osti/39833.pdf
Net Zero Source Energy Building	<ul style="list-style-type: none"> • Produces at least as much energy as it consumes per year, accounted for at source, referring to the primary energy used to generate and deliver energy to site, calculated imported and exported energy multiplied by appropriate site-to-source conversion multipliers 	Torcellini, P., Pless, S., Deru, M., Crawley, D. 2006. <i>Zero Energy Buildings: A Critical Look at the Definition</i> . Paper presented at the ACEEE Summer Study, Pacific Grove, California. Retrieved from http://www.nrel.gov/docs/fy06osti/39833.pdf
Net Zero Energy Cost Building	<ul style="list-style-type: none"> • Amount of money utility pays building owner for energy exports to grid is equal to or greater than the amount the owner pays the utility for energy services and energy used per year 	Torcellini, P., Pless, S., Deru, M., Crawley, D. 2006. <i>Zero Energy Buildings: A Critical Look at the Definition</i> . Paper presented at the ACEEE Summer Study, Pacific Grove, California. Retrieved from http://www.nrel.gov/docs/fy06osti/39833.pdf
Net Zero Emissions Building	<ul style="list-style-type: none"> • Produces at least as much emissions-free renewable energy as it consumes from emissions produce energy sources 	Torcellini, P., Pless, S., Deru, M., Crawley, D. 2006. <i>Zero Energy Buildings: A Critical Look at the Definition</i> . Paper presented at the ACEEE Summer Study, Pacific Grove, California. Retrieved from http://www.nrel.gov/docs/fy06osti/39833.pdf

Net-Zero Carbon Community		
Term (identified by source)	Definition	Source
Net Zero Community	<ul style="list-style-type: none"> • Encompasses three emission scope levels: internal (scope 1), core-external emissions (scope 2), and non-core external emissions (scope 3) • Internal and core-external are encompassed when determining whether a community is considered Net Zero Carbon or not • Community defined both by geographic boundaries and by connection with broader regions by exchange of materials, energy, and information. When categorising, a community is categorised geographically and temporally, with clearly defined emissions activities for which a community should be held responsible. 	Kennedy, S. & Sgouridis, S. (2011). Rigorous classification and carbon accounting principles for low and Zero Carbon Cities. <i>Energy Policy</i> , 39(9), 5259-5268.
Strictly Zero Carbon Community	<ul style="list-style-type: none"> • No carbon emitted within Scope 1 (internal) and Scope 2 (core-external), neither balancing nor offsets allowed • Very rigid technological constraints on city performance, from power generation of transport, if boundaries are too broad, this is rendered impossible- a city would essentially have to be entirely self-sufficient as imports would result in some emissions 	Kennedy, S. & Sgouridis, S. (2011). Rigorous classification and carbon accounting principles for low and Zero Carbon Cities. <i>Energy Policy</i> , 39(9), 5259-5268.
Net-Zero Carbon Community	<ul style="list-style-type: none"> • No carbon emitted within Scope 1, emissions within Scope 2 balanced through export of low or zero carbon goods, internal or external sequestration, or import substitution of Scope 3 emissions (ex. Incentivizing of avoidance of Scope 3 emissions) • Goal to preserve some of the strict structure of the Strictly Zero Carbon label (no emissions within Scope 1), while allowing balancing for Scope 2 emissions 	Kennedy, S. & Sgouridis, S. (2011). Rigorous classification and carbon accounting principles for low and Zero Carbon Cities. <i>Energy Policy</i> , 39(9), 5259-5268.
Carbon Neutral Community	<ul style="list-style-type: none"> • Any Scope 1 and Scope 2 emissions are managed through offsets from third parties that lie outside the city's boundaries • Inherently requires not innovation, but to offset a large area's emissions without innovation would be very expensive 	Kennedy, S. & Sgouridis, S. (2011). Rigorous classification and carbon accounting principles for low and Zero Carbon Cities. <i>Energy Policy</i> , 39(9), 5259-5268.
Low Carbon Community	<ul style="list-style-type: none"> • Emissions under Scopes 1, 2, and 3 reduced when compared to baseline reference to regional climate and land use characteristics of development 	Kennedy, S. & Sgouridis, S. (2011). Rigorous classification and carbon accounting principles for low and Zero

Carbon Cities. *Energy Policy*, 39(9), 5259-5268.

Net-Zero Carbon Community: Collected Applicable Definitions		
Term (identified by source)	Definition	Source
--None Found--		