

Climate Leadership Plan

December 13, 2021



Climate Leadership – It's ours to demonstrate

A Message from Mayor Bryan Paterson

May 7, 2019 was an important day for City Council. It was the day that we gathered around a table to agree on five strategic priorities that would guide our work for the next four years. The first priority listed: demonstrate leadership on climate action.

It was your priority, you had elected and entrusted us to make it a reality, and so we wasted no time getting to work. No one could have foreseen that less than one year later COVID-19 would bring our world to a standstill. The pandemic forced us to reevaluate what was important to us: personally, professionally, and as a community.

We went back to you, and we asked the question: are these still your strategic priorities? You answered loud and clear: yes.

And so, as we continued to monitor, manage, and respond to a public health crisis, efforts to demonstrate leadership on climate action also remained at the forefront of our minds and work.

The Climate Leadership Plan, currently before you, is evidence of that commitment. It is our roadmap to reach carbon neutrality no later than 2040. The ambitious target is not the only thing that sets this plan apart. This Climate Leadership Plan is one of the first of its kind in Canada because it combines tactics to adapt to a changing climate with ones to mitigate future impacts by reducing greenhouse gas emissions.

Its authors and collaborators (this includes you!) have looked at climate change through the lenses of economic stimulus; equity, diversity and inclusion; emerging technologies; and community priorities.

On behalf of City Council, I am proud to formally present the Climate Leadership Plan to you, as reader and resident.

It will guide the City of Kingston, and it is my sincere hope that it inspires you to take climate action.

Land Acknowledgement

The City of Kingston is on the traditional homeland of the Anishinaabe, Haudenosaunee and the Huron-Wendat, and thanks these nations for their care and stewardship over this shared land. Today, the City is committed to working with Indigenous peoples and all residents to pursue a united path of reconciliation.

How to Read this Plan

This section outlines the structure and key elements of the Climate Leadership Plan. The Plan consists of one vision, nine objectives and 51 actions. Objectives and actions are grouped into four sectors, in line with Kingston's Community Greenhouse Gas (GHG) Inventory.

- Buildings and Energy Production
- Waste
- Transportation
- Food and Forestry

Each sector includes one or more objective(s), which are high level goals that Kingston is striving for to achieve the Plan's vision. Objectives can be thought of as the main "chapters" of the Plan. To achieve each objective, a number of short term and long term actions are identified. Some actions are to be led by the City, some will be led by community partners and some are collaborative across multiple partners.

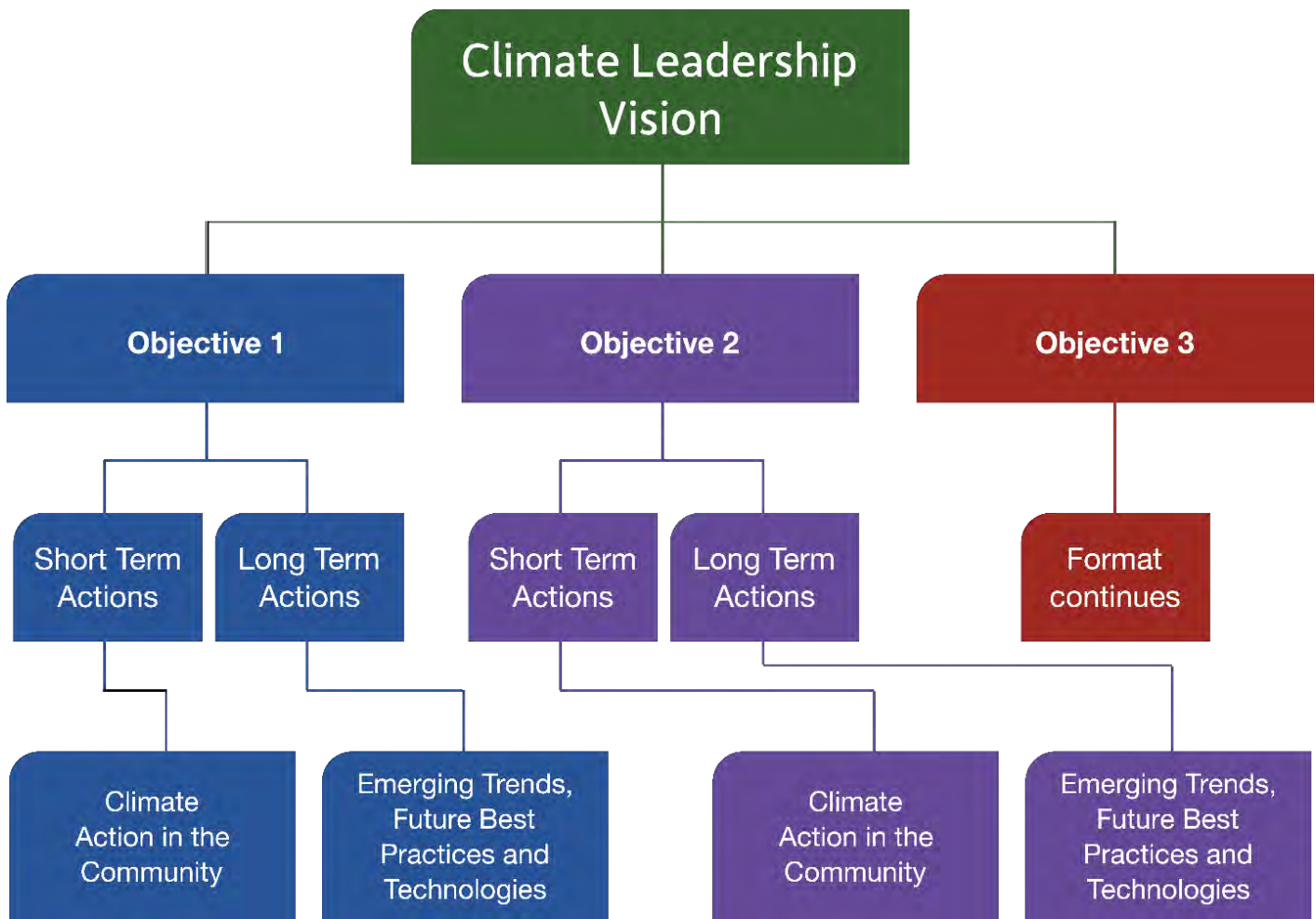
- Short term: Actions to be implemented in the next 1-5 years
- Long term: Actions to be implemented in the next 6-20 years

Each objective also includes two additional sections: Climate Action in the Community and Emerging Trends, Future Best Practices and Technologies. The former profiles community organizations, institutions and businesses demonstrating climate leadership in Kingston through various existing initiatives. The latter explores new concepts, tools and ideas at the forefront of the low carbon transition for cities around the world. These Emerging Trends are designed to provide inspiration for initiatives that could be considered in future updates to the CLP as the technology or practice is mainstreamed.

Each objective also includes a What we Heard page that has quotes and results from business and community surveys that occurred over the course of the CLP development.

The final objective relates to Climate Adaptation and Resilience. General recommendations are included in this section, along with a framework to support further study of risk and vulnerabilities and adaptation planning in the community.

The chart on the following page illustrates how the Climate Leadership Plan is structured.



Community Profiles

Two Community Profiles sections within the Plan (on pages 13 and 25) summarize potential changes in Kingston’s key emissions drivers between 2018 and 2040 based on modelling completed during the development of the Plan. The data in the Community Profile sidebars is explained below:

Population

Kingston’s total population includes both residents and students. The city’s population is projected to grow by 0.5% per year based on City of Kingston Population, Housing and Employment Growth Forecast, 2016 to 2046, Base Case (March 2019).

Carbon Emissions per Capita

Represents the average emissions per person based on the City’s adjusted* 2018 Community GHG Inventory and modelling completed to forecast 2040 emissions. The 2040 value incorporates annual population growth as outlined above, as well as impacts of climate change and changes in Ontario’s electricity grid emission factor.

Building Energy from Fossil Fuels

Summarizes the percentage of total energy consumption within the Buildings sector that is supplied by fossil fuels based on the City’s adjusted 2018 Community GHG Inventory and modelling completed to forecast 2040 energy use and associated emissions. The 2040 value incorporates both

retrofits of existing buildings as well as projected new construction to meet Kingston's growing population.

Annual Energy Cost per Capita

Represents the average energy cost per person based on the City's adjusted 2018 Community GHG Inventory and modelling completed to forecast 2040 energy use and associated emissions.

Adjustments were made to the 2018 Community Inventory to reflect new building sector energy data provided by utilities during development of the CLP. The 2040 value incorporates annual population growth as outlined above, as well as new construction and travel within the community associated with a growing population.

Transportation Mode Share

Summarizes the percentage of total trips taken using each potential mode of transportation: active transportation (i.e. walking and bicycling), transit and personal vehicle. The 2018 mode share reflects the 2015 Transportation Master Plan base case, while 2040 mode share reflects the targets outlined in that plan. The 2018 Work from Home percentage is taken from Statistics Canada's 2016 Census for Kingston.

Waste Diversion

The City monitors its residential waste diversion rate on an annual basis. Commercial waste is privately contracted and therefore cannot be tracked. The 2040 diversion rate reflects a feasible increase above Council's current target of 65% diversion.

Trees

Summarizes the total area of tree canopy as well as individual trees in parks and boulevards, as tracked by the City. Several tree planting and afforestation initiatives are planned or underway which are expected to increase this area by 2040.

Quick Facts

Quick Facts sections are also presented for each objective. The data in the Quick Facts section is explained below:

Annual Community Emission Reduction

This value represents the community emission reduction in 2040 compared to the 2011 baseline, resulting from implementing the new actions in the CLP. Additional reductions will also come from existing programs and ongoing improvements in equipment and vehicle efficiency.

Emission Reduction Potential Per Person

Summarizes the Annual Emissions Reduction (above) as of 2040 based on Kingston's future population, including projected annual population growth of 0.5%.

Annual Energy Cost Savings

Outlines the community-wide energy cost change as of 2040 (in 2018 dollars) based on new actions in the CLP. In 2018, Kingston's annual energy expenditure was more than \$500 million per year

across the community. Under the 2040 Carbon Reduction pathway, the annual energy expenditure is projected to be only \$319 million (in 2018 dollars).

Number of Jobs

Represents the number of additional job creation by 2040 due to new building-related investments in retrofits, local renewable energy generation, and increased production of local food.

A more detailed summary of the emissions modelling completed during development of the CLP, including key assumptions and data sources, is provided in the Mitigation Technical Appendix.

Contributors

The Kingston Climate Leadership Plan was prepared with the support of City of Kingston staff, Council, and Corporate Management Team. The City of Kingston is grateful to the Mitigation and Adaptation Teams and Community Advisory Group who provided invaluable knowledge and insight throughout this project. We also thank all of the residents who spoke with City staff, who provided input through and attended meetings and workshops throughout the Plan's development. As the City moves forward with implementation, we look forward to further collaboration.

The City of Kingston gratefully acknowledges contributions from:

350.org, Algonquin & Lakeshore Catholic District School Board, Cataraqui Region Conservation Authority, CaraCo Development Corporation, City of Kingston (all departments), City of Kingston Rural Advisory Committee, Conseil des écoles publiques de l'Est de l'Ontario, Conseil des écoles catholiques du Centre-Est, Department of National Defence, Defense Construction Canada, Downtown Kingston Business Improvement Area, Enbridge, Greater Kingston Chamber of Commerce, Habitat for Humanity, Hydro One, INVISTA, Kingston, Frontenac, Lennox and Addington Public Health, Kingston Climate Hub, Kingston Coalition for Active Transportation, Kingston Construction Association, Kingston Economic Development Corporation, Kingston Field Naturalists, Kingston Hydro, Limestone District School Board, Li-Cycle, Loving Spoonful, Martha's Table, Maureen Buchanan, Ontario Federation of Agriculture, Queen's University, Sisters of Providence of St. Vincent de Paul, St. Lawrence College, Sun Harvest, Sustainable Kingston, SWITCH, Tourism Kingston, United Way Kingston, Frontenac, Lennox, and Addington, Utilities Kingston, and Wintergreen Renewable Energy Co-operative.

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Key Terms

- **Business as Planned Scenario:** Evaluates the GHG impact of external influences such as emission factors and climate change, changes to the efficiency standards for buildings, equipment and vehicles, low-to-moderate adoption rates for new technology such as electric vehicles and community and City actions that are already in the process of being implemented.
- **Carbon Neutrality:** The outcome of a person, organization, business, or community avoiding or offsetting as many greenhouse gas emissions from the environment as it produces.
- **Climate Change Adaptation:** Adjusting to actual and expected future climate by taking measures that reduce climate-related risks and vulnerabilities to people, infrastructure, economy, and natural systems.
- **Cleantech:** Describes the technology and business sectors which include clean energy, environmental and sustainable products and services.
- **Climate Change Impact:** An outcome or response that results from climate change trends or hazards. Climate change impacts manifest differently in social, natural, economic and built infrastructure systems. Examples of impacts include power outages caused by severe storms, basement flooding due to heavy precipitation, or increased instances of pests damaging trees and crops, driven by warmer temperatures.
- **Climate Hazard:** The potential occurrence of a climate change driven physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.
- **Climate Change Mitigation:** Reducing and avoiding emissions of greenhouse gases into the atmosphere to limit the magnitude of future climate impacts.
- **C40 Cities Climate Action Planning Framework:** The Climate Action Planning Framework was developed in 2018 to support cities in developing climate action plans that are aligned with the objectives of the Paris Agreement. It provides a flexible and iterative framework that can be followed to ensure collaborative, inclusive and transformational strategies to reduce emissions and build resilience.
- **Decarbonization:** The process of reducing carbon emissions through efficiency improvements and switching to non-fossil fuel sources of energy.

- **Emission Factor:** The average amount of greenhouse gases discharged into the atmosphere for a specific unit of energy consumed or other activity. Emission factors are typically reported in units of carbon dioxide equivalent based on the relative impact of each gas released, summarized as global warming potential (GWP). They are used to calculate emissions from direct combustion of specific fossil fuels, use of purchased electricity, heat or steam, and extraction, production, transportation and disposal of materials.
- **Greenhouse Gas (GHG):** Any of the various gaseous compounds (such as carbon dioxide or methane) that absorb infrared radiation, trap heat in the atmosphere, and contribute to the greenhouse effect.
- **Low Carbon Resilience (LCR):** Represents a shared goal of reducing climate change impacts while also building resilience over time. LCR actions seek to reduce emissions while also managing vulnerability to climate impacts.
- **Natural Step Framework:** A peer reviewed framework which sets out the system conditions for the sustainability of human activities on earth. The Framework allows users to understand the 'unsustainability' of their context and develop a shared vision and action plan for addressing sustainability challenges.
- **Net Zero Energy:** The outcome of a highly energy efficient building that generates as much energy as it uses or procures to meet or exceed the annual energy consumption of its operations.
- **Net Zero Carbon:** Minimizing carbon-based energy consumption through building design strategies and on-site renewable energy generation.
- **Upstream Emissions:** Indirect emissions associated with producing, processing and transporting oil, natural gas and other fuel sources.

Kingston Climate Action Vision

Since 2009, the City of Kingston has been working ambitiously to be Canada's most sustainable city. The City has spent the last decade advancing plans and programs to guide the community towards this goal. The 2014 Climate Action Plan represented a significant first step towards defining community actions to reduce carbon emissions and build resilience in the face of climate change. In 2019, the City of Kingston became the first municipality in Ontario to declare climate change an emergency requiring an urgent strategic response.

Demonstrating leadership on climate action has been identified as one of the City's five strategic priorities, led by the newly formed Climate Leadership Division.

The Climate Leadership Plan builds upon and renews the vision generated in 2014 through community engagement conducted for the City's first Climate Action Plan. The Plan's vision is:

"Kingston is an innovative carbon neutral city that continues to work collaboratively with community partners to achieve climate leadership.

Kingston is a healthy and resilient community and is able to mitigate the risks and benefit from the opportunities presented by a changing climate.

Kingston has a thriving low-carbon economy that is compatible with being a sustainable community with a high quality of life."

Recent Community Profile (2018)

Emissions data from 2018 and 2019 was used as a baseline to develop the actions and objectives for the Climate Leadership Plan. The list below provides an overview of energy use and emissions sources in Kingston in 2018. These metrics are explained in more detail at in the How to Read this Report section at the beginning of this report.

- Kingston averaged 7.9 tonnes of carbon emissions per capita.
- Approximately 67% of building energy came from fossil fuels.
- Energy cost per capita was \$3,600.
- As the main mode of transportation, 14% of Kingston used active transportation, 5% used transit, 81% used personal automobiles, 0.4% used electric vehicles. Approximately 6% of employees teleworked as of 2018.
- Waste diversion was 60%.
- Kingston had 280,000 trees, 14,000 hectares of forested area, and 10,000 hectares of agricultural area.

About the Climate Leadership Plan

Building on the work already completed by the City, this Climate Leadership Plan (CLP) is an integrated corporate and community climate change management strategy.

The Climate Leadership Plan assesses the likely impact of ongoing initiatives, and outlines objectives and actions to chart a path to achieve the **City's target of carbon neutrality by 2040**. Throughout this Plan, the economic benefits of the transition to a low carbon society are acknowledged, and opportunities for economic development and community prosperity are highlighted. The CLP also identifies key climate change risks and vulnerabilities, providing guidance on opportunities and adaptation measures to make Kingston more resilient to changing climate conditions and extreme weather. The Plan promotes collaborative action including the City and community partners, recognizing that local stakeholders are important contributors to this plan, due to their ability to drive significant GHG reductions across their buildings and fleets.

Strategic Framework

A CLP Strategic Framework was created to connect the underlying community drivers to the City's long-term vision. The CLP is intended to foster transformational change by engaging community leaders and the public on priority actions to bridge the gap between the current state and where the community wants to be in future. It brings together the vision from the 2014 Climate Action Plan and Council's Strategic Priorities and is aligned with the Natural Step's framework for Integrated Community Sustainability Planning. The CLP is supported by detailed technical analysis of Kingston's GHG reduction pathway to support the City's decision-making and future

development of specific implementation plans, training materials, community charters and ongoing outreach programs.

Current Context (Drivers)

- **Emissions Reduction:** Absence of a clearly defined path to reach carbon neutrality for both corporate and community emissions.
- **Community Action:** Some stakeholders capable of making significant emissions reductions are yet to be engaged in community climate and energy planning efforts within Kingston.
- **Low Carbon Economy:** Climate action and renewable energy is still seen by many as being in conflict and / or in competition with economic development and prosperity.
- **Resilience:** Decision-makers lack evidence of locally specific climate risks and adaptation priorities necessary to build resilience to changing climate conditions and extreme weather.

Kingston Climate Leadership Plan (Analysis)

- Identify strategic and tactical measures to meet targets over the next 20 years. Outline short and long-term actions that align with City and community priorities as well as anticipated changes in technology and energy policy.
- Engage other community leaders who have the authority over assets to develop partnerships and highlight contributing actions within their control and applicable to their emissions sector.
- Highlight the economic value of key mitigation actions, including increased local economic activity, job creation and locally owned energy generation.
- Prioritize climate risks to critical municipal infrastructure and services. Provide guidance on risk assessments and adaptation planning frameworks which can

be applied by community organizations, institutions and businesses to adapt to climate change.

Next Steps and Implementation

- City-led policy and implementation plan including timelines, budget, and resourcing requirements and funding sources.
- Community implementation of non-municipal actions and initiatives. Continued collaboration and mutual support amongst stakeholders involved in developing the CLP.
- Marketing and outreach to demonstrate opportunities to improve local resource efficiency, energy independence, and cleantech investment to add value to the Kingston economy.
- Businesses and community organizations undertake climate risk assessments and develop adaptation action plans specific to their operations, assets, and stakeholders.

Monitoring (Indicators & Reporting Tools)

- Emissions Reduction and Community Action: By 2040, local emissions have been reduced by 80-100% compared to 2011 levels. Additional monitoring tools measure progress towards key implementation milestones and interim targets, such as transportation mode share.
- Low Carbon Economy: Annual reporting on community energy consumption to gross domestic product, locally owned energy generation and number of cleantech jobs.
- Resilience: Top risks to municipal assets and services are regularly reassessed (every ~5 years). Community organizations and business monitor and manage climate risk and resilience initiatives.

Relevant City Plans

The City of Kingston has been actively working to reduce GHG emissions and adapt to climate change through various policies, programs and plans. Recent initiatives were analyzed as part of the CLP to determine the emission reduction impact of work done to date, and to identify gaps and new opportunities. Highlights from City plans and programs that have driven climate action at the City are described below.

Kingston Strategic Plan (2019-2022)

The Strategic Plan Outlines Council's visions and goals for 2019-2022. Goals are grouped into five strategic priorities, which include demonstrating leadership on climate action; increasing housing affordability; improving walkability, roads and transportation; strengthening economic development opportunities; and fostering healthy citizens and vibrant spaces. The Strategic Plan defines specific actions, measurable targets and clear timelines to achieve each priority. In particular, it defines a target to reduce 2018 corporate GHG emissions 15% by 2022 and 100% by 2040 through retrofits, carbon offsets and other measures.

Highlights

- **Buildings:** The Strategic Plan outlines a commitment to create a residential retrofit program, which launched in 2021. Strategic Plan commitments also include a new build net-zero policy and incentive program, which was developed in 2020/2021. Housing intensification policies will result in 12,000 new units by 2050, including 3,045 affordable housing units, 120 secondary units and a tiny home pilot.
- **Transportation:** Through its support of the Active Transportation Master Plan and Road Safety Plan, the City will foster a culture of active transportation through infrastructure and program development to

create an integrated citywide active transportation network, develop neighbourhood-level connections, and implement active route to school programming. Electrification of the municipal fleet will be pursued, including the purchase of additional electric buses and light duty fleet vehicles. The purchase of up to 3 electric ice resurfacing machines is also planned.

- **Waste:** Organic waste collection will be increased by focusing on pilot programs at schools and multi-unit residential buildings. The City is targeting a 5% increase in its waste diversion rate by 2025, from the current rate of 60% to 65%.
- **Food and forestry:** Food security will be promoted through farmers markets, farm to table programs, community gardens and edible forests. The City plants trees annually as part of a goal to double the tree canopy. The neighbourhood tree planting program contributes to this goal. The tree canopy will be increased through planting 7,850 trees by 2022.

Municipal Energy Study (2018)

The Municipal Energy Study identifies strategic long-term objectives to reduce community emissions from energy use, expand local energy generation and enhance community prosperity. Developed through scenario modelling and stakeholder engagement, the Municipal Energy Study outlines a recommended trajectory to achieve a 50% reduction in community emissions by 2041 through actions in the buildings and transportation sectors.

Municipal Energy Study (2018) Continued

Highlights

- **Buildings:** Recommendations include developing an approach for net zero energy new development, expanding conservation and demand management programs and developing incentive programs for retrofits and renewables. Supporting actions include assessing the feasibility of district energy and biogas production and expanding initiatives such as Sustainable Kingston's Green Economy Program and energy performance labelling of municipal buildings.
- **Transportation:** Recommendations include exploring a "Nodes and Corridors" model that promotes sustainable urban growth through active transportation and strategic densification. Further actions include expanding electric vehicles and charging infrastructure and increasing the availability of alternative transportation fuels.

Kingston Climate Action Plan (2014)

The Kingston Climate Action Plan Community presented community emissions and existing and potential community-led actions to achieve a 15% reduction from 2011 levels by 2020 and 30% by 2030.

Highlights

- **Buildings:** Reduction measures included incentives for energy retrofits, energy audits at the time of purchase or sale and local energy generation.
- **Transportation:** Actions included increasing active transportation and transit, increasing fuel efficiency of local fleets and changing driving practices.
- **Waste:** Reduction measures included increasing diversion of organics from landfill.

Other Relevant Policies, Plans and Initiatives

Other relevant plans and policies at the municipal and provincial level that were considered for the Climate Leadership Plan Development are outlined below.

Municipal Studies and Plans

- Municipal Green Building Policy (2017)
- Kingston's Urban Forest Management Plan (2011)
- Climate Change and City of Kingston: Impacts Risks, Opportunities and Priorities Study (2014)
- Kingston Transportation Master Plan (2015)
- City of Kingston Drought Protection Strategy (2015)
- City of Kingston Commercial Land Review (2016)
- City of Kingston's Official Plan (2010)
- Walk 'n Roll City of Kingston Active Transportation Master Plan and Implementation Plan (2018)
- Kingston's Electric Vehicle Strategy (2018)
- City of Kingston 2018 Corporate GHG Inventory (2019)
- Kingston Biosolids and Biogas Master Plan (2019)
- Population, Housing & Employment Growth Forecast, 2016 to 2046, Final Report (2019)
- Strategic Plan 2019 Year-End Update (2019)
- Working Group on Climate Action Report (2019)
- Facilities Management & Construction Services Energy and Asset Management Plan (2019-2026)

- Facilities Management & Construction Services Net Zero Energy by 2040 Plan (2021-2040)
- City of Kingston Energy Conservation and Demand Management Plan for Municipal Buildings (2019 – 2024)
- City of Kingston 2019 Community GHG Inventory (2020)

Local Community Initiatives

- Queen's Climate Action Plan (2016)
- Observed Conditions & Regulated Outflows in 2017, Causes of the 2019 High Water Event and Causes of the 2017 High Water Event
- Cataraqui Region Watershed Report Card (2018)
- Get Ready Kingston: Personal Emergency Preparedness Guide
- #YGK Climate Action Resources
- St. Lawrence College GHG Targets and Reports (2018)
- Annual Climate Change Symposium Reports
- Sustainable Kingston Annual Reports (2018 & 2019)

Provincial and National Initiatives

- Federal Portfolio Clean Electricity and Carbon Neutral Commitments (2019)
- 2020 Provincial Policy Statement
- Green Economy Leader Program
- Global Covenant of Mayors Canada Showcase Cities Initiative (2019-2020)
- Assessment of the Impacts of Climate Change on the Great Lakes Report (2020)

- Federal Clean Fuel Standard
- Canada Greener Homes Grant (2021)
- 2025 Federal Fuel Economy Standards

Plan Development

The process of developing Kingston's Climate Leadership Plan is consistent with C40 Cities Climate Action Planning Framework. It is a globally recognized framework which sets out the essential components of a climate action plan to deliver a low-carbon resilience strategy consistent with (at a minimum) the objectives of the Paris Climate Agreement.

Guiding Principles

The Climate Leadership Plan incorporates the three core components of an effective plan outlined by the C40 Cities Climate Action Planning Framework:

- **Commitment and collaboration:** The commitment to engage community and government stakeholders in understanding climate risks and developing emissions reduction actions.
- **Challenges and opportunities:** Ensuring the plan considers baseline and existing conditions, and then evaluates future risks and opportunities for adaptation and mitigation.
- **Acceleration and implementation:** To support effective implementation, actions in

the plan should be prioritized and include consideration for monitoring and evaluation.

Plan Development Steps

The Climate Leadership Plan was developed following the steps below.

- **Understand:** Current emissions sources, existing plans and programs. Identify climate and weather impacts in Kingston.
- **Assess:** Evaluate potential emission reduction approaches with input from community; evaluate climate risks and vulnerabilities
- **Prioritize and refine:** Work with City and community on a list of actionable, impactful emission reduction measures
- **Plan:** Document GHG reduction objectives, actions, and implementation. Highlight top climate risks and next steps for adaptation.
- **Implement:** The Short Term Action Summary at the back of this report clarifies roles and timelines for City actions. The Adaptation Framework also supports community adaptation to climate risks.

Community Engagement

More than 950 community members helped shape the Climate Leadership Plan. Over the course of the Climate Leadership Plan development, the City conducted several public engagement initiatives to gather input from the community on climate action priorities.

Engagement undertaken as part of the CLP process is summarized below and described in detail in a What We Heard Report.

Adaptation and Mitigation Technical Teams

- **+40** City Staff and local experts were brought together to form Mitigation and Adaptation Technical Teams. The teams provided diverse sector perspectives on how Kingston is affected by climate change and gave feedback on actions to reduce emissions across businesses, institutions, and the community.
- The Mitigation Technical Team included City staff and Utilities Kingston, community leaders such as Sustainable Kingston, and representatives from businesses and institutions including Queen's University, St. Lawrence College, CFB Kingston, INVISTA, local developers, and others. Three Mitigation Technical Team meetings were held over the course of the CLP development. The first meeting was held in July 2020 to review preliminary emissions modelling by sector, to collect feedback on Kingston's current community initiatives and to identify any new initiatives to bridge the gap to carbon neutrality by 2040. The second meeting was held in October 2020 to provide an update on the CLP development, including a detailed inventory of emissions across sectors and updated

modelling results, and to further refine actions to reduce emissions. The third meeting was held in May 2021 to present an overview of the CLP's draft objectives and actions and discuss how the City and partners could implement the CLP actions.

- The Adaptation Technical Team included City staff and Utilities Kingston, KFL&A Public Health, Cataraqui Conservation Authority and community representatives including United Way, Frontenac Federation of Agriculture and Kingston Field Naturalists. Three Adaptation Technical Team meetings were held over the course of the CLP development. The first meeting was held in July 2020 to discuss climate change projections and climate impacts in Kingston. The second meeting was held in October 2020 to provide an update on the CLP and to discuss the Vulnerability Assessment process and findings. The third meeting was held in March 2021 and focused on assessing risk consequence for climate change impacts.

Community Advisory Group

- A Community Advisory Group (CAG) made up of 19 stakeholders was established to include representatives of key groups that could support outreach and implementation of the plan within the community. The CAG provided insight into community sentiment, outreach strategies and the direction of the CLP. The Community Advisory Group was engaged on two separate occasions, December 2020 and August 2021 to receive updates on CLP development and provide feedback on community outreach.

Community Members

- **+630** residents and local businesses took part in four surveys over the course of

the CLP development process. The surveys included a Climate Change Impact survey, a Visioning survey, one Greenhouse Gas Mitigation surveys for residents one and businesses. The surveys were offered online, in print and through the phone, and gathered invaluable information about climate risks experienced by residents, climate action work completed to date, and the community's priorities for climate action and programs.

- **+20** Coffee Conversations, hosted by the City, were held to facilitate one-on-one discussions with key sector leaders and stakeholders to fill knowledge gaps and inform the actions in the CLP. The Coffee Conversations included discussions with eight leaders in the Energy & Buildings

sector to discuss renewable electricity generation and storage, and thirteen leaders in the Agriculture sector to discuss local food.

- **+100** participants registered for, viewed or attended the online Public Open House was held in September 2021 to introduce and present the final draft CLP to a wide public audience and provide an opportunity to ask questions and submit additional feedback.
- **+180** respondents provided feedback on the draft Climate Leadership Plan Summary Report through an online survey, via email, phone or through the Public Open House.



Climate Leadership in Municipal Operations

In 2018, corporate emissions from the City's municipal operations totaled just over 22,000 tonnes, a decrease of 12% since 2011. The City's 2019-2022 Strategic Plan targets a 15% reduction in emissions from municipal operations by 2022 compared to 2018 levels, and carbon neutrality no later than 2040 (Figure 1). The City's corporate emissions represent less than 2% of Kingston's overall community emissions, highlighting the necessity for collaboration between the City and the community to achieve broader reductions.

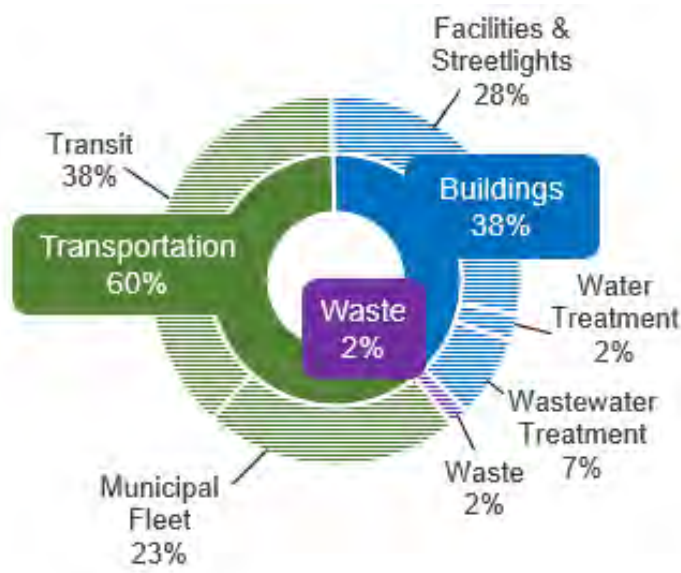


Figure 1: Corporate Emissions Inventory (2018)

Short Term Actions

The three largest municipal emissions sources are transit, facilities, and other fleet vehicles, as summarized in the diagram above. Retrofits of City buildings are a priority and are expected to contribute a 2-3% reduction in emissions by 2022. The purchase of electric transit and light duty fleet vehicles will contribute a further 7% reduction. Remaining emissions reductions will be achieved through purchase of carbon offsets and biodiesel for City buses. Near- and net zero energy new builds have also been constructed. The Kingston Fire and Rescue

Maintenance Garage is designed to produce all of its energy consumption from solar PV while the Kingston East Community Centre has been designed to achieve an 86% emissions reduction compared to a design meeting the Ontario Building Code. The new Community Centre will include both geothermal and solar photovoltaic systems, as well as other advanced building design features.

The City's Facilities Management and Construction Services department has developed and is implementing the Energy and Asset Management plan outlining specific actions to achieve at least 15% reduction in emissions from municipal facilities by 2026, while saving over \$500,000 in utility costs, without the purchase of carbon offsets. This plan targets boiler replacements, ventilation control, building automation system upgrades and heat recovery, along with deep energy retrofits and energy studies of 60 of the most energy intensive facilities, accounting for 80% of municipal facility emissions. These studies will provide specific implementation steps, budget estimates, conceptual designs for energy retrofit measures that will reduce facilities GHG emissions by 80%-100% by 2040. The studies will transition the EAMP into the Facilities Net Zero Energy by 2040 (NZE40) Plan, which will pull together the current asset renewal strategy, capital budget, operating budgets, while maintaining service delivery. The NZE40 will be the guiding document that ensures municipal facilities achieve Net Zero Energy by 2040, without overburdening the capital budgets.

Purchase of additional electric buses is also planned, with low-carbon biodiesel used for remaining buses. Adoption of low carbon municipal fleet vehicles either for new or replacement needs is also occurring whenever

applicable electric vehicle options are available while meeting operational requirements.

Long Term Actions

To achieve its corporate emissions targets by 2040, the City will need to take significant action including deeper retrofits of existing buildings, switching fossil fuel heating systems to electric options, generating renewable electricity and continuing its commitment to biodiesel procurement and fleet electrification. The City will be challenged to achieve its reductions goals as Kingston's population grows, causing increasing demand for water and wastewater services and transit infrastructure. While expansion of these essential services will help reduce community wide emissions, particularly through transit

services, the City's own emissions could increase.

To balance the impact of population growth, actions that encourage businesses and residents to reduce their use of municipally supplied water use may help. The City's recent work from home policy may also support a decreased need for municipal office space, as fewer staff members commute to work on a daily basis.

Once all feasible mitigation actions are implemented by the City, municipal buildings and vehicles will still use energy to provide services to the community. Purchasing clean energy or carbon offsets may be required for the City to achieve carbon neutrality by 2040.

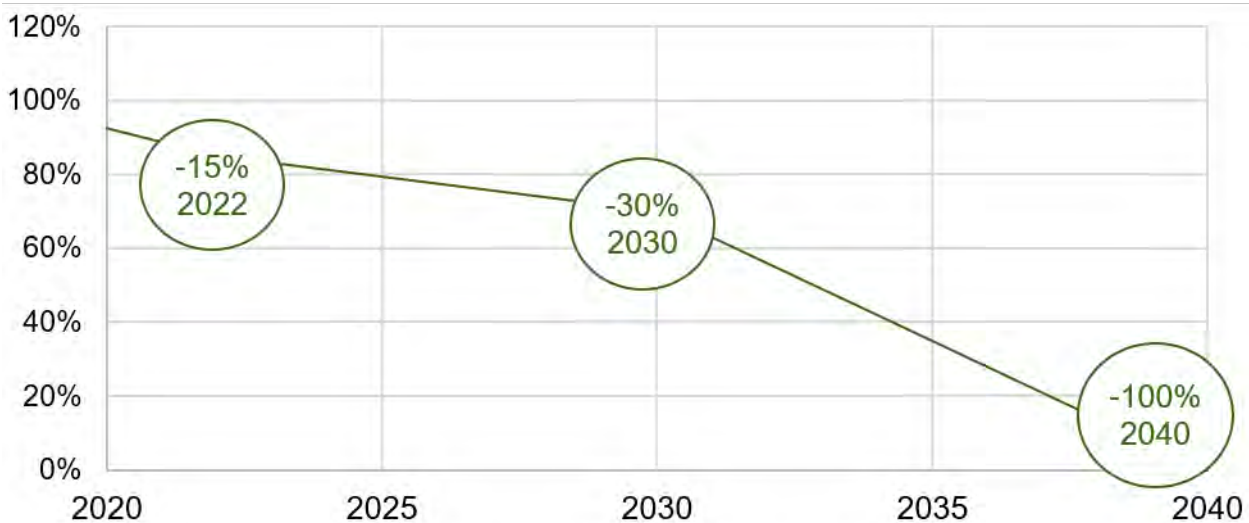


Figure 2: Corporate Emissions Targets

Kingston's Carbon Reduction Pathway

Current Community Emissions

As a member of the Federation of Canadian Municipalities' Partners for Climate Protection program since 2004, the City of Kingston regularly reports community and corporate GHG emissions to monitor progress toward its emission reduction targets. The most recent community inventory, incorporating data for 2018, reports 1.21 million tonnes of carbon emissions over four sectors. As shown below, the two largest sources of community emissions are buildings and transportation.

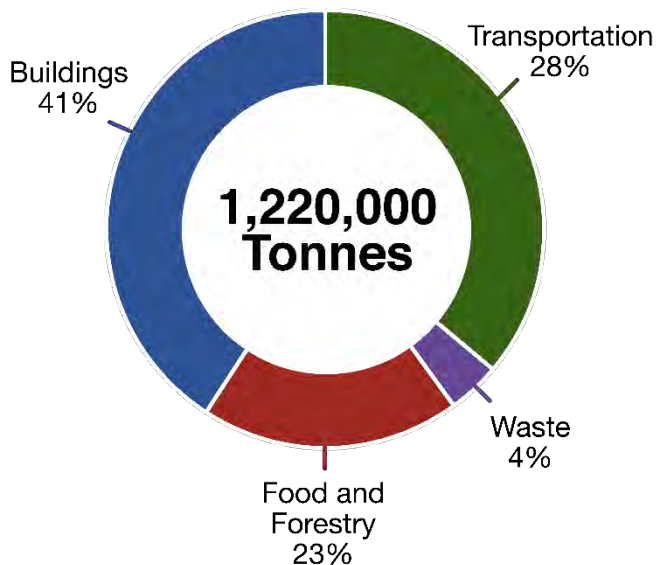


Figure 3: 2018 Community Emissions by Sector

Community emissions in 2018 were 6% lower than in 2011. The reduction is primarily a result of a significant decrease in the emissions associated with electricity supply in Ontario (due to the removal of coal), which reduced building sector emissions by 16%. Conversely, population growth has increased emissions from food transportation in the food and forestry sector by almost 9%.

Community Emissions Targets

The 2014 Kingston Climate Action Plan set targets of reducing community emissions 15% below 2011 baseline levels by 2020 and 30% by 2030. Through the Climate Leadership Plan,

the City of Kingston aspires to extend its aspiration of carbon neutrality across the corporation and the community by 2040. The short-, medium- and long-term community targets can be summarized as follows:



Figure 4: Community Emission Reduction Targets

Emissions Trends

Based on current trends and existing community initiatives, Kingston is projected to maintain a downward trend in emissions. Modelling shows a decrease in emissions for Kingston despite the challenges of a growth-based economy and the forecasted increase in the emissions intensity of electricity in Ontario. Kingston's emissions could decline 30% by 2040 even without further community action as electric vehicles and more efficient building components become available, and federal policies such as the Clean Fuel Standard and the 2030 Net-Zero Energy Ready Model Building Code are enacted.

As temperatures continue to rise, building heating demand will also decrease in winter although cooling demand is expected to increase with more days expected over 30 degrees Celsius.

There are several municipal programs that are currently under development have the potential to reduce emissions even further. These include the Active Transportation Master Plan, the Density by Design - Kingston's Mid-Rise and Tall Building Policy, the Biogas Master Plan, the Kingston Home Energy Retrofit Program (KHERP), Facilities Net Zero Energy by 2040 Plan and a Green Standard Community Improvement Plan.

While the impacts of these initiatives could be significant, new action will also be needed to further decrease emissions towards achieving carbon neutrality.

Future Community Profile (2040)

Modelling was completed for initiatives under development, external influences (such as provincial or federal policy changes) and new actions in the CLP. The list below summarizes some of the main emissions drivers in Kingston in 2040. Readers can note the change in emissions drivers from 2018 by referring back to page 12. These metrics are explained in more detail at in the How to Read this Report section at the beginning of this report.

- The population in 2040 will be an estimated 172,000.
- Kingston will average an estimated 2.6 tonnes of carbon emissions per capita.
- Approximately 42% of building energy will come from fossil fuels.
- Energy cost per capita is estimated as \$1,900.
- As the main mode of transportation, 20% of Kingston will use active transportation, 15% will use transit, 65% will use personal automobiles, 90% will be electric vehicles. Approximately 18% of employees teleworked as of 2018.
- Waste diversion is estimated to be 70%.

- Kingston will have an estimated 320,000 trees, 17,000 hectares of forested area, and 10,000 hectares of agricultural area.

Emissions Reduction

The opportunities with the greatest potential to further reduce Kingston's emissions are widespread adoption of electric vehicles, energy retrofits of existing buildings and switching fossil fuel-based industrial processes to low carbon energy sources. Supporting local food systems and planning for more residents to be within walking or cycling distance of their daily needs through land use and transportation infrastructure changes are also fundamental to community success. The objectives developed for this Climate Leadership Plan formalize these and other opportunities with the dual aims of informing the City's future policies and programs in the City and motivating effective community action.

Through implementing the CLP's objectives, the forecasted carbon reduction pathway for Kingston projects a 64% reduction in community emissions by 2040 compared to 2011 levels. Additional emission reduction opportunities will be identified and implemented in future iterations of the Plan to achieve carbon neutrality.

The reduction potential in each sector of Kingston's GHG inventory is summarized as a colored wedge in Figure 5 (following page), relative to the 30% overall decline anticipated in the business-as-planned scenario. Buildings and transportation sectors (in blue and green, respectively) will contribute the vast majority of emissions reduction across the community, in line with their significance within the current community inventory.

Interim targets on a five-year cycle are also highlighted in Figure 5 beginning in 2025. By 2030, Kingston is projected to meet its 30% reduction target, with reductions of 45% and

65% anticipated for 2035 and 2040 respectively. Remaining emissions reductions to achieve carbon neutrality can be achieved through a mix of future technologies, shifts in provincial energy policy, and other sources, as shown in the dark grey wedge.

By 2040, the successful implementation of actions identified within the Climate Leadership Plan will have eliminated nearly 15 million tonnes of cumulative carbon emissions from being released into the atmosphere. Annual community emissions will decrease from

1,290,000 tonnes to 470,000 tonnes by 2040. Community resilience will be supported by local renewable generation of more than 12% of total energy used within the community, backup energy storage provided by electric vehicles, and strengthened local food systems. More than a third of trips will be made by transit or active transportation, promoting community health and well-being, and the tree canopy will have been significantly expanded to provide biodiversity, resilience, and emissions reduction benefits.

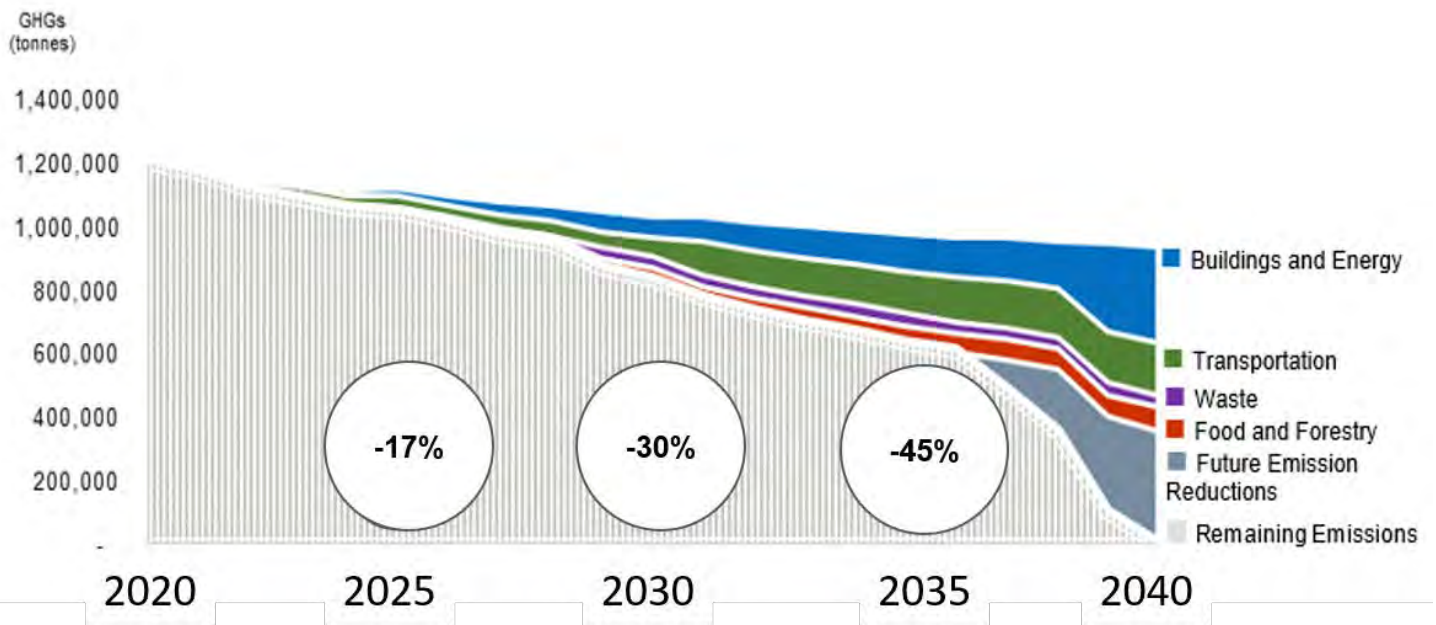


Figure 5: Carbon Reduction Pathway Sector Overview

Fast-tracking the implementation of actions listed in this Climate Leadership Plan has the potential to shift the interim targets. For instance, increasing the pace at which industrial processes shift to low carbon fuels could lead to steeper and faster reductions in community emissions. The impact of such an action can be seen in the increased magnitude of the blue buildings and energy wedge in 2038. As Kingston continues its climate leadership, regular review of assumptions and emissions reduction opportunities will be vital to identify next steps. Regular review will ensure that the Climate Leadership Plan is a

consistently relevant resource and will move this important work forward.

The extensive modeling completed during the development of the Climate Leadership Plan highlights the reality that even the farthest-reaching transformation of Kingston's buildings, transportation and food systems cannot fully balance energy demand (and related emissions) with local renewable generation. Climate plans issued by all levels of government recognize the necessary role of external and future-focused solutions, including purchasing renewable energy produced outside of Kingston, carbon offsets, or

emerging carbon sequestration technologies. Regular review of the Climate Leadership Plan is recommended on a five-year cycle to identify these and other local opportunities to reduce emissions as technology advances and community action evolves over time.

Quick Facts

By implementing the actions in the Climate Leadership Plan, Kingston will achieve:

- -547,000 of annual community emission reduction.
- Annual emission reduction per person of 4,400 kg.
- Annual community energy cost savings of \$197,000,000.
- 4,000 jobs created from the actions in the Plan.
- Climate resilience benefits including renewable backup power, reduced energy costs, equitable clean energy, resilient local food systems, healthier and active communities, and healthier environments.

Kingston's Changing Climate

The effects of climate change are already being felt in Kingston, driven by the increasing use of fossil fuels over previous centuries. Emissions from past decades will continue to influence our climate (particularly emissions from the first 20 years of this century). In turn, we are “locked in” to additional climate changes in the coming decades, even if we stopped emitting GHG's completely tomorrow.

Future projections show that climate impacts will become even more frequent and intense as global emissions have continued to rise in recent decades. While the focus of this Climate Leadership Plan is to transition away from fossil fuel emissions, climate adaptation is essential to manage the unavoidable and ensure the community is resilient to current and future climate risks. Climate projections for the 2050s are summarized below.

Increasing average temperatures

The historical average annual temperature is around 7°C. It is expected to increase to nearly 12°C by the 2050s, an increase of up to 4°C.

More frequent hot days (temperatures +30°C)

Projections show the number of days per year over 30°C could increase from 6 per year to 48 per year by the 2050s.

Changing freeze-thaw cycles

Freeze-thaw cycles are expected to decrease from 68 per year to around 56 per year by the 2050s. Freeze-thaw cycles will be more concentrated during fewer months as they are expected to occur more frequently in winter and less often during fall and spring.

Increasing average precipitation

Annual precipitation could increase by up to 10% from the historical average. Precipitation is increasing in all seasons except summer.

Increase in heavy rainfall

Historically, Kingston has experienced approximately 8 days per year with more than 20mm of rain in a day. This may increase to 10 days per year by the 2050s. Rainfall is also expected to become more intense. Historically, a severe 1-hour storm with a 50-year return period would result in 42mm/hr rainfall. By the 2050s, Kingston could see an additional +10mm/hr for a similar storm event.

Strong wind gusts

Wind gusts over 90km/h may increase by 15% by the 2050s.

More lightning impacts

Lightning is projected to increase by 12% per degree of global warming. By 2080, there may be up to 50% more lightning impacts compared to today.

Climate Leadership: Making an Impact

Adaptation and Resilience

While global emissions are beyond the City's control, Kingston can play its part as leaders in community emissions reduction and adaptation to climate change. For example, the City is already implementing several long-term projects to embed climate change within asset management, improve aging and vulnerable infrastructure, and addressing erosion and flood risk of downtown hotspots and shorelines with support from the Disaster Mitigation Adaptation Fund.

As the population grows and the climate continues to change, ensuring that City assets and services can continue to serve the community in future climate conditions is of utmost priority. The City will implement physical measures to adapt and protect existing vulnerable infrastructure, and explore procedural adaptation such as modifying

operations and how maintenance can proactively address climate risks such as shifting freeze-thaw cycles and erosion.

Above all, enhancing City decision-making to consider climate risks and resilience in all projects and processes will cause the greatest long-term reduction of climate risks to municipal infrastructure and services. This is a long-term effort that includes staff education, climate-informed asset management, incorporating climate hazards in emergency management and increasing community resilience through development and urban planning policies. At the community scale, collaborative efforts to educate and support local organizations, businesses, and residents in understanding and managing climate impacts is also vital to protect public health, safety and business continuity. As the City implements the Climate Leadership Plan, designing a low carbon society that is also climate resilient is the most streamlined and effective way to help enable Kingston to thrive in our future climate.



Low Carbon Resilience

Working to reduce emissions while also adapting to climate change is an international best practice for municipalities and provides many co-benefits and opportunities for innovation. This approach, sometimes called Low Carbon Resilience (LCR), is based on the notion that adaptation and mitigation share the goal of reducing climate change impacts and designing a resilient community that is not dependent on fossil fuels.

The Climate Leadership Plan takes an LCR approach, which can guide Kingston towards adaptive measures that align with emissions reductions targets. Shown in the diagram below, understanding Kingston's climate-related risks and vulnerabilities ensure that the actions in the Climate Leadership Plan have a positive effect on local resilience.

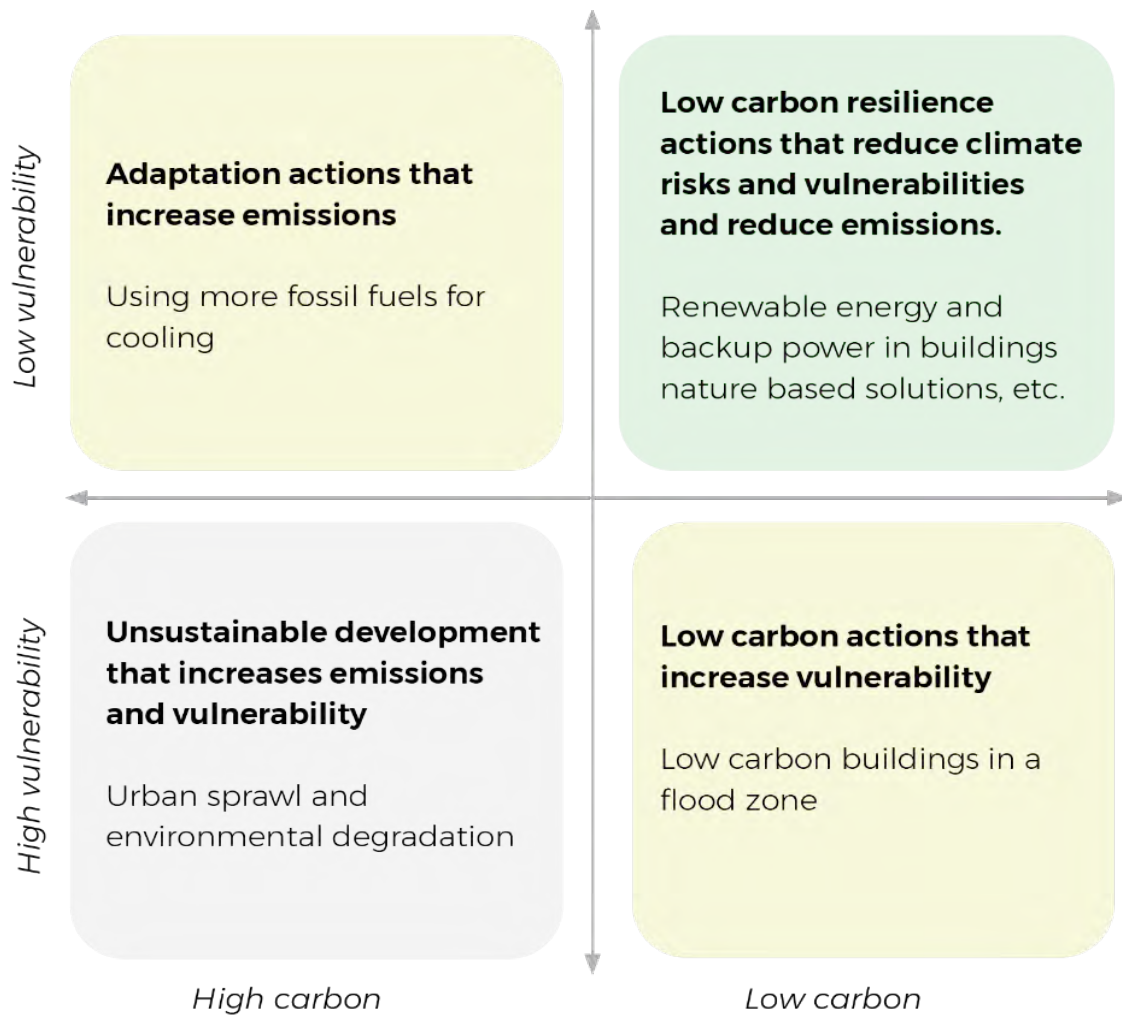


Figure 6: Low Carbon Resilience adapted from Low Carbon resilience Interventions Case Studies at the Building Neighbourhood and Community Levels by Adaptation to Climate Change Team-SFU, October 2019

Climate Leadership Plan Objectives

Buildings and Energy Production

1. Accelerate local production of renewable and low carbon energy and energy storage.
2. Support Kingston residents to invest in low carbon retrofits for their homes.
3. Partner with Kingston businesses to retrofit and fuel-switch existing commercial buildings.
4. Demonstrate leadership by making all municipal facilities Net Zero Energy by 2040, where feasible, and work with all levels of government to reduce emissions from other publicly owned buildings.
5. Advance the adoption of net zero ready new construction ahead of the release of requirements expected in national building and energy codes in 2030.

Waste

6. Produce renewable natural gas locally from waste sources and encourage adoption of other low carbon fuels.

Transportation

7. Develop active transportation connections and foster transit-oriented development to encourage a shift to sustainable modes and a reduced reliance on personal vehicle use.
8. Transition to electric- and renewably-powered personal, municipal and commercial motorized vehicles.

Food and Forestry

9. Improve the vibrancy of the local food system to help reduce dependence on high carbon imported food.

Climate Change Adaptation and Resilience

10. Proactively manage climate-related impacts to municipal critical infrastructure and services, and support community organizations and businesses in assessing and reducing their own climate risks.

Buildings and Energy Production



Buildings and Energy Production

Where we are Today: Building Sector Emissions Trends

In 2018, the building sector represented more than 42% of Kingston's total community emissions, as summarized in Figure 7. Within this sector, one family homes were responsible for the largest share of emissions, followed by industrial, institutional and commercial office and retail buildings. Municipal buildings and multi-unit residential buildings were relatively small sources of emissions.

Since 2011, emissions from Kingston's buildings have declined by 15%. Although natural gas consumption across the City has increased by 13%, electricity use has dropped. Emissions associated with electricity have also been reduced by an astonishing 75% due to the closure of Ontario's coal-fired electricity generation facilities in 2014. However, current provincial energy policy forecasts an increase in the emissions from electricity supply as aging nuclear infrastructure is replaced with natural gas generation. Without further action to support new sources of clean electricity production, or advocacy efforts to shift provincial energy policy, most of the gains made since 2011 could be lost.

Emissions Sources: Buildings and Energy

Annual electricity and natural gas consumption data are provided by Utilities Kingston, Enbridge, and Hydro One. Fuel oil and propane data is derived from Statistics Canada's Energy and Supply report.

More than 90% of 2018 building GHG emissions result from on-site combustion of fossil fuels for heating and industrial uses.

In 2018, 10% of emissions from buildings were the result of upstream emissions generated during the production of electricity.

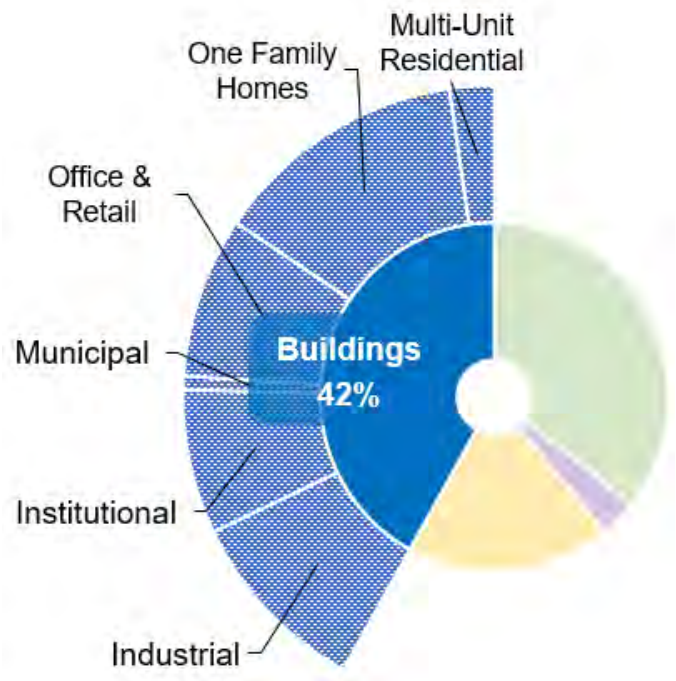


Figure 7: 2018 Community Inventory by Building Type

What We Heard: Buildings and Energy Production

What We Heard – Public Survey

- Nearly 40% of respondents identified that a lack of financial incentives to upgrade their home is a barrier to making home energy efficiency improvements.
- More than 25% of respondents were unsure about available financial incentives for home energy retrofits.
- The majority of respondents indicated they plan to track their energy use more closely over the next 3 years.

What We Heard – Business Survey

- More than 70% of respondents have switched to LED lighting in their businesses.
- More than 50% of respondents have completed commercial retrofits to their buildings through installing more efficient equipment.

“I have made upgrades to my home including, insulation, sealing, replaced windows and a blower style energy audit. I plan to do radon mitigation, switch to heat pump clothes dryer, replace gas furnace with geexchange heat pump (if practical) with integrated domestic water heating and take a second run at installing solar panels, hopefully in the form of solar roofing tiles.”

– Survey Respondent

Buildings and Energy Production

Key Objectives

- 1 Accelerate local production of renewable and low carbon energy and energy storage.
- 2 Support Kingston residents to invest in low carbon retrofits for their homes.
- 3 Partner with Kingston businesses to retrofit and fuel-switch existing commercial buildings.
- 4 Demonstrate leadership by making all municipal facilities Net Zero Energy by 2040, where feasible, and work with all levels of government to reduce emissions from other publicly owned buildings.
- 5 Advance the adoption of net zero ready new construction ahead of the release of requirements expected in national building and energy codes in 2030.



Buildings and Energy Production

Where We Want to Go

By 2040, Kingston's buildings will need to rely on low carbon sources of energy for heating and industrial processes. Emerging technologies such as cold climate heat pumps, the hydrogen economy and the increasing availability of renewable natural gas will each play a role in this energy transition. As the cost of solar energy production and energy storage continues to drop worldwide, Kingston has the opportunity to become a hub for local renewable energy production.

Buildings must also become more efficient through improved insulation, windows, appliances and equipment, as well as through better design using advanced building science in new construction. Efficient buildings tend to be more adaptable to climate impacts such as rapid changes in temperature and extreme heat and can provide access to renewable back up power sources for critical uses. Together, retrofits of homes, businesses and institutional facilities, combined with clean renewable energy have the potential to achieve a nearly 30% reduction in Kingston's emissions by 2040. This potential is shown as a blue wedge in the figure below, which summarizes the impact of community action on Kingston's buildings-related emissions, as compared to the business as planned scenario. Interim 5-year targets relative to 2011 emissions from buildings are also indicated starting in 2025.

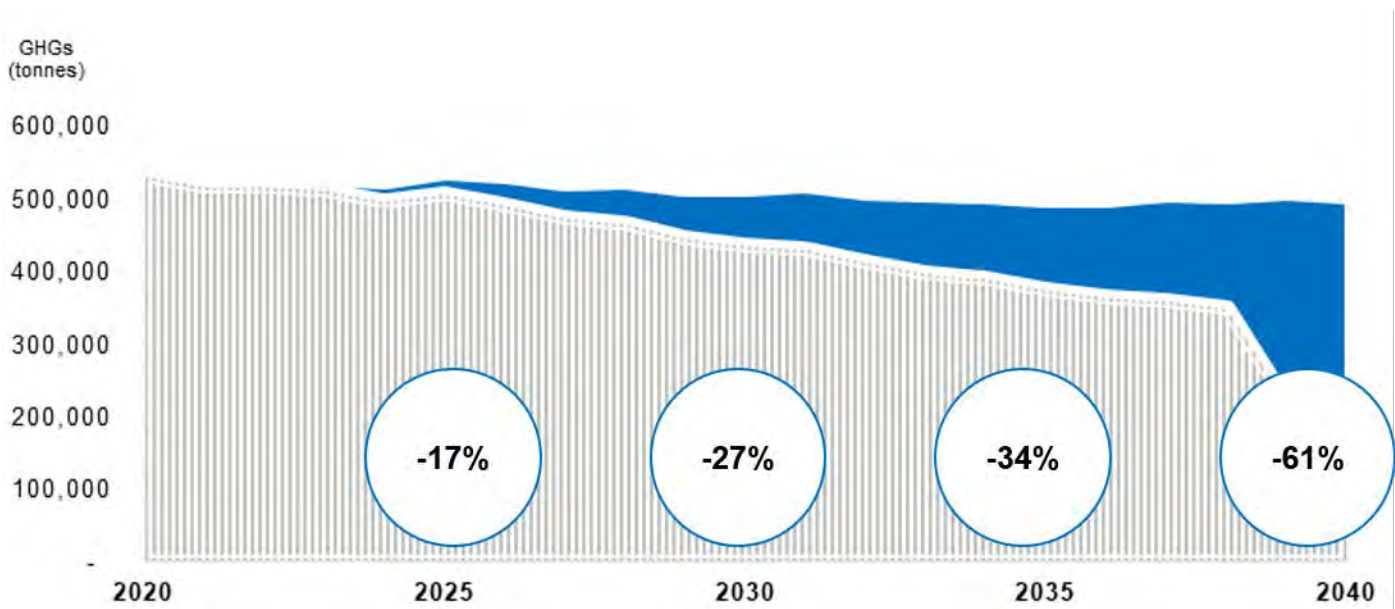


Figure 8: Carbon Reduction Pathway: Building Sector

Existing Community Action

Several important community initiatives are already underway in this sector. Federal investment will eliminate emissions from Kingston's federal penitentiaries and military buildings, while Queen's University and St. Lawrence College have committed to climate action with defined carbon reduction targets. INVISTA has recently implemented a unique effluent treatment, in partnership with Utilities Kingston, which has reduced emissions by more than 4,000 tonnes annually.

The City is working to finalize the Facilities Net Zero Energy 2040 Plan and the Kingston Home Energy Retrofit Program (KHERP) to provide low interest loans, along with other financial and technical support, to enable accelerated residential energy efficiency retrofits, and to incentivize high performance new construction through the Green Standard Community Improvement Plan (CIP)



Buildings and Energy Production

Opportunities

- **Federal Clean Fuel Standards:** The federal government is developing standards to reduce emissions from fossil fuels by 10-12% between 2022 and 2030.
- **Building Code Changes:** The 2021 National Energy Code for Buildings will present performance tiers that authorities having jurisdiction, such as municipalities, can voluntarily adopt to progress towards a net zero energy ready level of performance by 2030. The National Building Code (NBC) update in 2025 will also include requirements for energy efficiency in buildings.
- **Increasing Temperatures:** As the climate warms, buildings will use less fossil fuel for heating and more electricity for cooling. By 2050, the Climate Atlas of Canada projects that heating degree days will decrease by approximately 7% and cooling degree days will rise by more than 25% in the Kingston region.
- **New Technology, Lower Costs:** Emerging technology such as cold climate heat pumps and hydrogen fuel cells can offer lower carbon ways to power buildings,

while lower costs for solar PV and energy storage are improving their payback.

Barriers

- **Provincial Electricity Grid:** As previously described, Ontario's future electricity generation mix is likely to include more natural gas plants to meet peak demand, increasing emissions from electricity starting in 2025.
- **Population Growth:** As Kingston's population grows, building floor area and resulting energy use and emissions will increase.
- **Pace of Change:** 20% of building stock may not undergo any retrofit in a 20-year window, and 4% of remaining building stock will need to be retrofitted each year to reach emission reduction targets.
- **Provincial Net Metering Policies:** Existing provincial energy policy only allows renewable electricity to be used directly by the generator, limiting opportunities for community-scale production or power purchase agreements for third-party owned generation equipment.

Buildings and Energy Production: Renewable Electricity Generation and Storage

1. Accelerate local production of renewable and low carbon energy and energy storage.

Short Term Actions: Implementation within the next 1-5 years

- 1.1 Seek out new partnerships to inform the community of available sustainable energy resources and financing options, while continuing to work in collaboration with groups, like Sustainable Kingston.
- 1.2 Advocate for provincial support and policy for virtual and community-level net metering arrangements.
- 1.3 Install photovoltaics on all new municipal buildings where feasible and explore options for solar photovoltaics during roof replacements or other major renovations of municipal facilities.
- 1.4 Develop partnerships to accelerate local academic and commercial cleantech research into renewable and low-carbon energy and storage technologies.

Long Term Actions: Implementation within the next 6-20 years

- 1.5 Explore opportunities for new community-owned renewable energy projects and organizations, including solar energy co-operatives.
- 1.6 Monitor changes to the Independent Electricity System Operator (IESO) demand response and capacity auctions, which provide opportunities to contribute to dynamic grid management in support of distributed energy generation.

Quick Facts

- 36,000t of annual community emission reduction
- 210 kg of emission reduction potential per person
- Co-benefits and resilience impacts include positive contribution to the power grid, access to backup power

Buildings and Energy Production

1. Accelerate local production of renewable and low carbon energy and energy storage.

Short Term Actions: Implementation within the next 1-5 years

1.1. Seek out new partnerships to inform the community of available sustainable energy resources and financing options, while continuing to work in collaboration with groups, like sustainable Kingston.

Residents and businesses may not be aware of the business case for solar and other renewable energy systems, where to turn for installation, or the regulatory process to connect new supply to the grid. An education and engagement program can reduce these barriers to uptake and increase the pace of developing new renewable generation facilities within the community.

The largest barrier to widespread adoption of renewable energy systems is cost. Several major banks and other financial institutions offer low-interest green loans for residential renewable energy systems. Residents can also take advantage of new incentives for solar arrays available from the federal government's Greener Home Grant. More flexible ownership models are also available involving third party suppliers who install and own geothermal or rooftop solar PV equipment while providing consistent lease payments or a share of energy revenue to the property owner.

- City Lead: Business, Environment & Projects
- Community Partners: Sustainable Kingston, SWITCH, Construction and Real Estate Association, Residents, Businesses, Enbridge, Solar Leasing Companies

1.2 Advocate for provincial support and policy for virtual and community-level net metering arrangements.

Net metering is a utility billing mechanism that would offer credits to residents and business customers who are generating excess renewable energy and sending it back to the grid.

In late 2020, the Ministry of Energy proposed amendments to the Net Metering Regulation to support demonstration projects for community distributed energy net-metering generation. If successful, it is expected that further regulatory changes would be required to allow broader application of the community net-metering and more flexible ownership models for renewable energy systems. These policy shifts are critical to support large renewable energy installations where production exceeds associated building energy use.

- City Lead: Business, Environment & Projects
- Community Partners: SWITCH, Provincial Government

1.3 Install photovoltaics on all new municipal buildings where feasible and explore options for solar photovoltaics during roof replacements or other major renovations of municipal facilities.

The City is committed to achieving net zero energy for all of its new construction projects. As part of this commitment, renewable energy systems will be integrated into all new municipal buildings wherever feasible. Solar photovoltaics will also be installed on suitable existing municipal facilities at the time of roof replacement.

- City Lead: Corporate Services

1.4 Develop partnerships to accelerate local academic and commercial cleantech research into renewable and low-carbon energy and storage technologies.

Kingston is already well-positioned as a cleantech hub, including cleantech accelerator projects at Queen's University's Innovation Park and Kingston Economic Development Corporation's (KEDCO) relationships with global and national startup partners. Further action to encourage academic and commercial clean tech research will promote local economic development while driving innovative solutions related to renewable energy and energy storage.

In addition to cleantech, the City of Kingston has also committed to exploring other opportunities to reduce environmental impacts locally, such as environmentally sustainable burial practices.

- City Lead: Business, Environment & Projects
- Community Leads: SWITCH, KEDCO, St. Lawrence College, Queens University, Royal Military College of Canada.

Climate Leadership in the Community

1. Accelerate local production of renewable and low carbon energy and energy storage

Community Profile: SWITCH

SWITCH is a network of businesses, research and educational institutions, public sector participants, energy professionals, students and community volunteers dedicated to making Southeastern Ontario a leading centre in sustainable energy.

SWITCH has been incorporated since 2002 with roots in earlier Kingston Economic Development Corporation (KEDCO) discussions on attracting alternative energy businesses to the Kingston region. It has provided monthly open meetings since 2004 at various locations throughout Kingston. SWITCH members have followed the progression of sustainable energy development across the province, including microFIT and FIT contracting, numerous home energy retrofit programs, trends in solar and wind energy technology, and initiatives to promote the electrification of transit and transportation.

Between 2006 and 2017, SWITCH employed an Executive Director who coordinated numerous educational programs and the implementation of renewable energy funding initiatives. This was

capped off between 2011 and 2017 when SWITCH hosted bi-annual conferences on Green Profit (supporting business opportunities) and Managing Energy (supporting conservation and energy efficiency). The events brought in regional and national speakers and helped raise the profile of Kingston as a leader in sustainability, while promoting economic opportunities in the region.

SWITCH has been consulted by local and provincial governments on policy and implementations strategies to promote the transition to sustainable energy generation and use.

The organization's goals are to develop the economic opportunities of sustainable energy through new technology adoption, education and training, networking and advocacy. The strength of SWITCH is its Board of passionate volunteers and its members, who have been early adopters on lowering GHG emissions for nearly 20 years.



Buildings and Energy Production

1. Accelerate local production of renewable and low carbon energy and energy storage

Long Term Actions: Implementation within the next 6-20 years

1.5 Explore opportunities for new community-owned renewable energy projects and organizations, including solar energy co-operatives.

In future years, amendments to provincial energy regulations are expected, which will allow more flexible ownership models for renewable energy systems. These changes can encourage expansion of local solar installations through community net-metering projects integrating multiple accounts and locations.

- City Lead: Business, Environment & Projects
- Community Partners: SWITCH, KEDCO, Residents, Wintergreen Renewable Energy Co-operative

1.6 Monitor changes to the Independent Electricity System Operator (IESO) demand response and capacity auctions, which provide opportunities to contribute to dynamic grid management in support of distributed energy generation.

As heating systems and vehicles are transitioned to low carbon electric technology, demand on Ontario's electricity grid could significantly increase. To avoid an increase in emissions from new natural gas peaking plants, careful grid stewardship will be required to better match peak demand to baseload hydro and nuclear supply and variable renewable energy production.

Dynamic grid management opportunities presented by capacity auctions, smart grid technology, greater support and allowance for distributed energy resources and the battery storage potential presented by widespread adoption of electric vehicles can help to reduce the need for new fossil fuel electricity generation.

- Community Leads: Utilities Kingston, Hydro One, Provincial Government

Buildings and Energy Production

Emerging Trends, Future Best Practices and Technologies

Guidelines for Community Sharing of Benefits

What It Is

Community benefit sharing guidelines aim to ensure more equitable distribution of financial and other benefits from utility-scale renewable energy projects. Large-scale renewable projects typically have unequal impacts on local landscape and land value, positively rewarding some landowners while negatively impacting surrounding neighbours and community. Community benefit sharing guidelines help to ensure the project generates positive social and community outcomes more broadly.

How It Works

Benefit sharing may take the form of directing project funds into local grants, scholarships or sponsorships. It might also include options for community co-investment or in-kind support. Near neighbours of the project are typically offered more specific benefits than the broader

community. Quality community engagement is necessary to develop a comprehensive arrangement that both strengthens local economic resilience and develops required social license for renewable energy projects.

Who's Leading the Way

A wind farm on Henvey Inlet First Nation land in Ontario demonstrates that collaboration between industry partners and Indigenous communities can succeed. The 300 MW project, which began operating in 2019, is the largest single-phase wind project in Ontario, generating enough clean, renewable energy to power about 100,000 Ontario homes. Co-owned by the community's subsidiary Nigig Power Corporation and Pattern Canada, the approximately 180 residents that live on the reserve expect to receive more than \$10 million in annual income from the project.

Buildings and Energy Production: Existing Residential Buildings

2. Support Kingston residents to invest in low carbon retrofits for their homes.

Short Term Actions: Implementation within the next 1-5 years

- 2.1 Once available, promote the Kingston Home Energy Retrofit Program (KHERP) that will provide low-interest financing and incentives, energy audits and other decision-support tools to owners of one-family homes.
- 2.2 Work with local utilities to develop financing and rental programs for low carbon home heating and cooling equipment.
- 2.3 Partner with St. Lawrence College and other education providers to encourage continued integration of advanced energy efficiency curriculum into skilled trades programs.
- 2.4 Advocate that Ontario enact legislation that requires home energy performance and energy costs to be disclosed at the time of sale.

Long Term Actions: Implementation within the next 6-20 years

- 2.5 Assess the feasibility of extending the Kingston Home Energy Retrofit Program to multi-unit residential buildings (MURBs) and institutionally- owned residential dwellings and affordable housing units.

Quick Facts

- 57,000 tonnes of annual community emission reduction
- 330 kg emission reduction potential per person
- Co-benefits and resilience impacts include community education, job creation, improved heating and cooling and access to backup power

Buildings and Energy Production

2. Support Kingston residents to invest in low carbon retrofits for their homes.

Short Term Actions: Implementation within the next 1-5 years

2.1 Once available, promote the Kingston Home Energy Retrofit Program (KHERP) that will provide low-interest financing and incentives, energy audits and other decision-support tools to owners of one-family homes.

The KHERP is designed to help Kingston residents reduce their energy usage and associated greenhouse gas emissions at home. With residents spending a collective \$100 million on home energy costs annually, having more households involved means more money saved in the community. Residents can also take advantage of new energy efficiency funding available from the federal government's Greener Homes Grant.

The KHERP will also include communications and education on the benefits of fuel switching (i.e. converting fossil fuel heating systems to electric options such as heat pumps). The emissions and financial benefits are particularly strong when compared to propane and fuel oil heating systems. Fuel switching from natural gas may result in a small annual increase in utility costs, unless paired with additional opportunities to reduce home energy consumption. Marketing should also include information on the climate resilience and health co-benefits associated with improving the thermal comfort of homes.

- City Lead: Business, Environment & Projects
- Community Partners: Residents, Utilities, Federal Government, Red Squirrel Conservation Services, St. Lawrence College, Sustainable Kingston

2.2 Work with local utilities to develop financing and rental programs for low carbon home heating and cooling equipment.

Utilities across Canada are helping to drive market transformation by offering residents flexible financing and rental programs for new low carbon equipment. The City and community partners can help customers connect with local contractors to gather competitive quotes, with equipment cost and installation handled through on-bill financing where payments are added directly to their utility bill. This action should complement and support the Kingston Home Energy Retrofit Program (KHERP), with the aim of developing a long-term rental program for those households who cannot afford the upfront cost of equipment purchases.

- City Lead: Business, Environment & Projects
- Community Partners: Residents, Utilities, Multi-Unit Residential Buildings (MURB) Owners and/or Managers

Buildings and Energy Production

2. Support Kingston residents to invest in low carbon retrofits for their homes.

Short Term Actions: Implementation within the next 1-5 years (Continued)

2.3 Partner with St. Lawrence College and other education providers to encourage continued integration of advanced energy efficiency curriculum into skilled trades programs.

While there is a high demand for apprenticeships and waitlists for trades programs, the industry faces a shortage of skilled technicians and an aging workforce. St. Lawrence College has been successfully delivering its Low Carbon Building Skills (LCBS) training program since 2018. Continuing to deliver and expand this type of program will help build industry capacity and increase the number of skilled trades workers that are well-prepared to construct low carbon buildings.

- City Lead: Business, Environment & Projects
- Community Partners: St. Lawrence College

2.4 Advocate that Ontario enact legislation that requires home energy performance and energy costs to be disclosed at the time of sale.

Time of sale (TOS) disclosure requires that sellers share information on utility costs, energy audit and assessment results, and energy efficiency features with prospective buyers. This transparency can help sellers to highlight positive aspects of their property and help buyers to be more informed about their investment, while also creating a positive cycle that drives residential housing to become more energy efficient. Using Natural Resources Canada's EnerGuide Rating System can help provide this information based on a Home Energy Assessment conducted by a Registered Energy Advisor.

- City Lead: Business, Environment & Projects
- Community Partners: Provincial Government, Red Squirrel Conservation Services

Climate Leadership in the Community

2. Support Kingston residents to invest in low carbon retrofits for their homes.

Community Profile: Home Energy Conservation Services

Sustainable Kingston non-profit organization that works to support the Kingston community in achieving its vision of becoming Canada's most sustainable city. Sustainable Kingston events include the Kingston Climate Change Symposium, Pitch-In Kingston, and the Evening of Recognition. Sustainable Kingston now helps homeowners, businesses, and organizations in Eastern Ontario to reduce their environmental impact through energy and water conservation.

The Home Energy Conservation Services will stem from the former Red Squirrel Conservation Services, Kingston's first provider of home energy audits, which helped people identify energy-saving opportunities in their house. It first began offering audits in the mid-2000s, when the federal and Ontario governments introduced financial incentives for homeowners who purchased more energy-efficient furnaces, insulation, and windows. Thousands of people upgraded their homes and received incentives for doing it; furnace, window, and insulations companies sold their products; and contractors were kept busy installing everything. Best of all, the programs and upgrades prevented thousands of tonnes of greenhouse gases from entering the atmosphere. Economically and environmentally, the programs were a win-win.

In June 2021, the federal government introduced the Greener Homes program, which complements the existing Home Efficiency Rebate program offered by Enbridge. The City of Kingston is also planning to launch its own

program in the near future, the Kingston Home Energy Retrofit Program (KHERP). As a result, homeowners in Kingston now have multiple opportunities to make their homes more energy-efficient and save money in the process. As a local non-profit provider of home energy audits, Sustainable Kingston will be in the forefront of these efforts.



Buildings and Energy Production

2. Support Kingston residents to invest in low carbon retrofits for their homes.

Long Term Actions: Implementation within the next 6-20 years

2.5 Assess the feasibility of extending the Kingston Home Energy Retrofit Program to multi-unit residential buildings (MURBs), institutionally-owned residential dwellings and affordable housing units.

Currently, the Kingston Home Energy Retrofit Program focuses on property owners of one family homes, which represents almost 60% of the housing supply in Kingston. Broadening the scope of the retrofit program will help to drive emissions reductions and increase resilience across different housing types, allowing more owners and renters to benefit from home retrofit opportunities.

- City Lead: Business, Environment & Projects
- Community Partners: Residents, Utilities, Queen's University, MURB Owners and/or Managers, CFB Kingston, Kingston Home Based Housing, Town Homes Kingston

Buildings and Energy Production

Emerging Trends, Future Best Practices and Technologies

Bundled Retrofit Program

What It Is

Reducing emissions in existing buildings is more difficult than in new construction. For one-family homes, challenges include the complexity of the retrofit process, the upfront cost of implementing energy efficient retrofits, and a general lack of coordinated services for residential customers. One potential strategy to overcome this barrier is energy retrofit bundling, where packages of energy efficiency measures or technologies are bundled together for implementation across multiple buildings.

How It Works

Retrofit bundles can be offered by a municipality, utility, or commercial aggregator who develop and offer packages of energy conservation measures for similar buildings, designed to lower costs and improve uptake by homeowners. These programs help to reduce the complexity and inconvenience of the retrofit process by identifying a common point of contact for information and support throughout the retrofit process. By coupling retrofit measures together,

these programs seek to address several potential market transformation barriers by providing information, increasing market demand, and aligning equipment end-of-life periods to maximize efficiency.

Who's Leading the Way

Retrofit bundling programs are gaining in popularity across North America. The City of Northampton, Massachusetts was an early adopter with its Heat Smart program, while Fort Collins, Colorado has introduced Efficiency Works. In Canada, the City of Vancouver and Township of Langley have been working with BC Hydro to develop a retrofit bundle pathway that can be piloted across select municipalities. The Canadian Infrastructure Bank (CIB) has also acknowledged the importance of multi-building retrofits and has developed a financing stream specifically for bundled commercial retrofit measures. The CIB has indicated that municipalities can act as aggregators of projects within a community, which could stimulate collaborative approaches at a local level.

Buildings and Energy Production: Existing Commercial Buildings

3. Partner with Kingston businesses to retrofit and fuel-switch existing commercial buildings.

Short Term Actions: Implementation within the next 1-5 years

- 3.1 Deliver an education program that informs commercial building owners of the costs and benefits of fuel switching, deep carbon retrofits, building commissioning and available incentives and financing options. Develop and foster partnerships to promote and pilot new fuel switching programs within Kingston, including Enbridge's geothermal retrofit program and upcoming programs from Hydro One.
- 3.2 Promote local training programs that develop qualified energy professionals who can deliver audits and feasibility studies to businesses in Kingston.
- 3.3 Advocate that Ontario be an early adopter of a national retrofit building code, once available.

Long Term Actions: Implementation within the next 6-20 years

- 3.4 Streamline permitting and approvals, including adapting permitting fees for renovations that target significant emissions reductions. Also explore options for a rental licensing program to incentivize energy efficiency in targeted sectors.
- 3.5 Encourage partnerships to offer coordination services for deep carbon retrofits to help building owners select qualified designers and contractors and verify post-construction performance.

Quick Facts

- 31,000 tonnes of annual community emission reduction
- 180 kg emission reduction potential per person
- Co-benefits and resilience impacts including job creation, reduced energy cost, renewable backup power and more equitable access to clean energy.

Buildings and Energy Production

3. Partner with Kingston businesses to retrofit and fuel-switch existing commercial buildings.

Short Term Actions: Implementation within the next 1-5 years

3.1 Deliver an education program that informs commercial building owners of the costs and benefits of fuel switching, deep carbon retrofits, building commissioning and available incentives and financing options.

Low carbon building retrofits can be costly and complex. Consumer education is a relatively low-cost way to increase market demand for retrofits.

An effective education program will assist building owners and managers in understanding retrofit options, capital and operating cost impacts, design requirements and optimal phasing of this work across their buildings and portfolios. Incentive and financing programs such as those offered by Save on Energy and the Canadian Infrastructure Bank can address financial barriers for businesses wanting to implement energy efficiency and renewable energy projects. Long-term energy cost savings also help to fund the retrofit.

- City Lead: Business, Environment & Projects, Community Services
- Community Partners: Chamber of Commerce, Sustainable Kingston, Businesses, Utilities, Kingston Economic Development Corporation, Canadian Infrastructure Bank, SWITCH

3.2 Promote local training programs that develop qualified energy professionals who can deliver audits and feasibility studies to businesses in Kingston.

Knowledgeable designers, engineers, and energy professionals are vital to inform owners and building managers of the options and costs for building retrofits and energy efficiency upgrades. Capacity-building through local programs and industry associations will expand the pool of expertise available to guide successful auditing and feasibility projects.

- City Lead: Business, Environment & Projects
- Community Partners: St. Lawrence College, Queen's University, Red Squirrel Conservation Services

3.3 Advocate that Ontario be an early adopter of a national retrofit building code, once available.

The federal government has prioritized the support of existing building retrofits through a range of strategies, including supporting the development of a national model building and energy code for existing buildings by 2022 to be adopted by the provinces and territories. Ontario can show leadership and encourage emissions reductions across the province by implementing new standards as they emerge.

- City Lead: Business, Environment & Projects, Community Services
- Community Partners: Provincial Government

Climate Leadership in the Community

3. Partner with Kingston businesses to retrofit and fuel-switch existing commercial buildings.

Community Profile: St. Lawrence College's Low Carbon Building Skills Trainings

St. Lawrence College is an integral part of the economic life and social fabric of Eastern Ontario, with campuses in Kingston, Brockville, and Cornwall. St. Lawrence College consistently ranks as one of Ontario's leading community colleges, preparing students for the global economy with relevant, practical, and experiential learning opportunities.

Offering over 100 full-time programs, St. Lawrence College is a close-knit community of 10,000 full-time students and more than 100,000 alumni. Sustainability is a key component of the College's strategic plan, which is dedicated to sustainable programming and operations. All new builds and retrofits are planned to be carbon neutral.

The Energy Systems Engineering Technician and Technology, Wind Turbine Technician and Environmental Technician programs are part of the College's mainstream programming. Low Carbon building skills modules have been developed and incorporated into the building trades programs. Energy House 2.0 was developed and built with student participation as a low carbon integrated unit and is a key component of the Energy Systems Engineering Technician and Technology program.

Working closely with partners and the City of Kingston, St. Lawrence College is continually evolving its programs to meet the needs of the

future and promote Kingston as a low carbon community.



Buildings and Energy Production

3. Partner with Kingston businesses to retrofit and fuel-switch existing commercial buildings.

Long Term Actions: Implementation within the next 6-20 years

3.4 Streamline permitting and approvals, including adapting permitting fees for renovations that target significant emissions reductions. Also explore options for a rental licensing program to incentivize energy efficiency in targeted sectors.

Overly complicated and restrictive permitting requirements can hamper efforts to reduce emissions. It is important that Kingston establish a simple and low-cost approval process for energy efficiency upgrades. Where feasible, permit fees can also be tied to the emissions impact of the project to motivate deeper, more integrated retrofits. As rental buildings tend to consume more energy than owner-occupied buildings, rental efficiency programs can also help to ensure that necessary upgrades are implemented, allowing tenants to benefit from lower utility costs.

- City Leads: Community Services
- Community Partner: Businesses

3.5 Encourage partnerships to offer coordination services for deep carbon retrofits to help building owners select qualified designers and contractors and verify post-construction performance.

As owners and managers undertake more extensive retrofits of their buildings, coordination services can provide a one-stop resource where they can find information, ask questions, and access expert advice and implementation services. Such a coordination center should be designed and implemented through partnerships between industry associations that are already developing and delivering related retrofit projects. Through the coordination center, program uptake and the impact of the deep carbon retrofits should be tracked in a centralized place for monitoring and reporting.

- Community Partner: Kingston Construction Association, Chamber of Commerce, Sustainable Kingston, KEDCO

Buildings and Energy Production

Emerging Trends, Future Best Practices and Technologies

Emissions Performance Targets for Existing Buildings

What It Is

Voluntary emissions performance targets have become more popular as cities work to incentive emissions reduction in existing buildings. However, research shows that voluntary measures are not driving down emissions from existing buildings at the rate and scale needed to meet ambitious climate targets. Though supportive programs and incentives have been around for decades, they have not yet led to major emissions reductions in any jurisdiction. As a result, a growing number of cities are starting to consider mandatory performance targets to drive emissions reductions in existing buildings.

How It Works

Building performance standards typically consist of two main components. The first is benchmarking, reporting and disclosure, where building owners are required to track and submit information on their building's energy and emissions performance on an annual basis. Reporting can then be coupled with a set of performance thresholds, where owners must meet an emissions performance target depending on building type.

These targets are generally easily achievable in the beginning to give the industry time to adapt, then increase in stringency over time.

Compliance pathways can be flexible and designed to reward good practices rather than punish building owners. For example, building owners may be asked to either meet the performance threshold, undertake a minimum number of retrofit measures, or elect to pay a fine.

Who's Leading the Way

While many jurisdictions have introduced mandatory benchmarking initiatives, building performance standards for existing buildings are only starting to emerge in North America. Key examples include Washington, DC (Building Energy Performance Standard), St. Louis, Missouri (Building Performance Standard), and the State of Washington (Clean Buildings Bill). New York City has adopted a very ambitious policy and applies specific GHG reduction targets for 2024, 2030, and 2050. Vancouver and Toronto are also working to implement emissions caps for existing buildings within the next few years.

Buildings and Energy Production: Existing Municipal and Institutional Buildings

4. Demonstrate leadership by making all municipal facilities Net Zero Energy by 2040, where feasible, and work with all levels of government to reduce emissions from other publicly owned buildings.

Short Term Actions: Implementation within the next 1-5 years

- 4.1 Retrofit City facilities to reduce emissions 15% by 2026 from 2018 levels and develop the Net Zero Energy 2040 strategy to be incorporated with the Energy and Asset Management Plan (EAMP) strategy.
- 4.2 Incorporate innovative approaches to guide retrofit initiatives at heritage buildings wherever feasible.
- 4.3 Advocate that Ontario adopt emissions targets for provincial buildings and invest in retrofits to reduce emissions from K-12 schools and healthcare facilities.
- 4.4 Engage with the federal government to develop a data-sharing plan for clean electricity purchases on behalf of Kingston's federally-owned facilities.

Long Term Actions: Implementation within the next 6-20 years

- 4.5 Implement the Facilities Net Zero Energy 2040 Plan to achieve Net Zero Energy in all municipal facilities by 2040.
- 4.6 Explore opportunities to support the development of a zero carbon district heating system serving the Queen's University campus and the Kingston Health Sciences Centre.
- 4.7 Work with federal partners as they implement emissions reductions projects at federally-owned buildings within Kingston.

Quick Facts

- 73,000 tonnes of annual community emission reduction
- 420 kg of emission reduction potential per person
- Co-benefits and resilience impacts include reduced energy cost, positive contribution to the power grid, renewable backup power

Buildings and Energy Production

4. Demonstrate leadership by making all municipal facilities Net Zero Energy by 2040, where feasible, and work with all levels of government to reduce emissions from other publicly owned buildings.

Short Term Actions: Implementation within the next 1-5 years

4.1 Retrofit City facilities to reduce emissions 15% by 2026 from 2018 levels and develop the Net Zero Energy 2040 strategy to be incorporated with the Energy and Asset Management Plan (EAMP) strategy.

The City has developed the Energy and Asset Management Plan which is being transitioned into the Net Zero Energy 2040 (NZE40) plan. The NZE40 will blend all capital and asset renewal plans into one guiding document that will ensure all municipal facilities are Net Zero Energy by 2040. The NZE40 will have a strategic roadmap for each facility including capital costs, operation impacts, a GHG emission reductions, carbon shadow pricing, and will include climate adaptation and mitigation strategies during retrofits. Life cycle cost assessments of retrofit alternatives will ensure that business cases consider maintenance and operations costs as well as carbon reduction.

The City will continue to use RETScreen Expert Portfolio Manager to create energy models for all municipal facilities that are heated or cooled by 2025, and for all other municipal facilities by 2030. Use of Energy Star Portfolio Manager to certify large municipal

facilities as Energy Star Certified will also be explored by 2026.

- City Lead: Corporate Services

4.2 Incorporate innovative approaches to guide retrofit initiatives at heritage buildings wherever feasible.

The unique history of Kingston is illustrated by its many heritage properties, many of which are important publicly owned community assets. Heritage buildings also tend to face greater physical risks due to climate impacts such as storms, flooding and heat. Heritage buildings warrant special consideration of retrofit and adaptation actions that can achieve emissions reductions within the framework established by the Heritage Act Ontario. The federal government's ongoing rehabilitation of the Centre Block of Parliament and other iconic historic buildings may showcase new opportunities, as these projects target carbon neutrality as well as preservation.

Climate risks and adaptation options should be proactively considered, as heritage buildings tend to be more vulnerable due to age and design.

- City Lead: Corporate Services

Buildings and Energy Production

4. Demonstrate leadership by making all municipal facilities Net Zero Energy by 2040, where feasible, and work with all levels of government to reduce emissions from other publicly owned buildings.

Short Term Actions: Implementation within the next 1-5 years (Continued)

4.3 Advocate that Ontario adopt emissions targets for provincial buildings and invest in retrofits to reduce emissions from K-12 schools and healthcare facilities.

Ontario's public sector organizations are currently required to publish annual reports on energy use and GHG emissions and develop conservation plans. The Province can strengthen this approach and show further leadership by adopting relevant emissions reduction targets and rolling out energy efficiency upgrades across key building types.

- City Lead: Business, Environment & Projects
- Community Partners: Provincial Government

4.4 Engage with the federal government to develop a data-sharing plan for clean electricity purchases on behalf of Kingston's federally-owned facilities.

The federal government has committed to purchasing 100% clean electricity for its facilities by 2022. A data-sharing plan will help to track the emissions reductions associated with the renewable energy certificates and power purchase agreements for Kingston's federally-owned penitentiaries and military facilities. The data can be included in ongoing community emissions inventory analysis as City staff monitor progress towards achieving reduction targets.

- City Lead: Business, Environment & Projects
- Community Partners: CFB Kingston, Correctional Services Canada

Climate Leadership in the Community

4. Demonstrate leadership by making all municipal facilities Net Zero Energy by 2040, where feasible, and work with all levels of government to reduce emissions from other publicly owned buildings.

Community Profile: CFB Kingston Retrofit Pilots

The Canadian Forces Base (CFB) Kingston provides support services for lodger units that enable them to focus on the important work of the Canadian Armed Forces, domestically and overseas. The Real Property Operations detachment at CFB Kingston is committed to maintaining and modernizing the Base's building portfolio. Key initiatives related to climate change include:

“Green Heat” Retrofit of 70-Year-Old Building

- CFB Kingston will be conducting a study to remove a building from the aging central heating plant and install a low carbon heating system. This system will be monitored closely for two years to assess its performance and repeatability.
- Target GHG Savings: 539 Tonnes eqCO₂/year
- Estimated Cost: \$7.5 – \$8.5 million

GHG Reduction Project

- CFB Kingston is seeking to reduce greenhouse gas emissions through the installation of low carbon heat systems at six buildings that currently rely on steam from the aging central heating plant. They are currently exploring options, including separate heat pumps or a small district heating system.
- Target GHG Savings: 1800 tonnes eqCO₂/year
- Estimated Cost: \$11.5 – \$12.5 million

Kingston Energy Performance Contract

- The Real Property Operations detachment is looking to reduce utility bills and GHG production at CFB Kingston through the implementation of more efficient lighting, HVAC, controls, building envelope, and recommissioning throughout the Base. The project will also include renewable energy generation through a 600kW photovoltaic power plant and is designed to reduce strain on the Ontario energy grid through peak shaving methods including battery storage. Construction is scheduled for completion in 2024.
- Target GHG Savings: 5865 tonnes eqCO₂/year
- Estimated Cost: \$86.8 million



Climate Leadership in the Community

4. Demonstrate leadership by making all municipal facilities Net Zero Energy by 2040, where feasible, and work with all levels of government to reduce emissions from other publicly owned buildings.

Community Profile: Kingston Fire and Rescue Maintenance Garage

The City of Kingston has completed the construction of the new Kingston Fire and Rescue Maintenance Garage, and the building is now ready for occupancy. The facility is extremely energy efficient, uses innovative materials & designs, and offers the latest technologies for vehicle maintenance.

The mechanical heating, cooling and ventilation systems are fully electric, eliminating significant GHG emissions. LED lighting is used throughout the facility, along with

advanced controls which ensure a safe environment to work, while maximizing energy efficiency.

A large ground mounted solar system will be installed as the final phase of the project, meaning that 100% of the energy requirements will be generated on-site -making the new garage the City's first Net-Zero Energy facility. This initiative aligns with Council's priorities to demonstrate leadership on climate action and exceeds the current Green Building policy.



Buildings and Energy Production

4. Demonstrate leadership by making all municipal facilities Net Zero Energy by 2040, where feasible, and work with all levels of government to reduce emissions from other publicly owned buildings.

Long Term Actions: Implementation within the next 6-20 years

4.5 Implement the Facilities Net Zero Energy 2040 Plan to achieve Net Zero Energy in all municipal facilities by 2040.

Kingston will lead by example by implementing the Facilities Net Zero Energy by 2040 Plan being developed in 2021. This plan will blend current capital projects, asset renewal plans, electrical system upgrades, deep energy retrofits, and engagement with local utilities to make necessary upgrades to the electrical grid to enable fuel switching.

- City Leads: Corporate Services, Utilities Kingston
- Community Partners: Utilities

4.6 Explore opportunities to support the development of a zero carbon district heating system serving the Queen's University campus and the Kingston Health Sciences Centre.

Much of the energy on the Queen's campus is supplied by a central heating plant that distributes steam from natural gas boilers through old underground lines, resulting in significant energy loss. Transitioning to a district energy system (DES) represents an opportunity for emissions reductions and cost savings, especially if low carbon energy sources are used. Work is already underway to modernize the western portion of campus, which will help to inform future projects.

- City Lead: Community Services, Business, Environment & Projects, Utilities Kingston
- Community Partners: Queen's University

Buildings and Energy Production

4. Demonstrate leadership by making all municipal facilities Net Zero Energy by 2040, where feasible, and work with all levels of government to reduce emissions from other publicly owned buildings.

Long Term Actions: Implementation within the next 6-20 years

4.7 Work with federal partners as they implement emissions reductions projects at federally-owned buildings within Kingston.

The Greening Government Strategy outlines commitments to reduce emissions for federal crown-owned buildings, fleet and procurement 40% by 2025 and 90% by 2050. Action at the federal level will support emissions reduction projections for Kingston's penitentiaries and CFB Kingston. In addition, the former Kingston Penitentiary site will be redeveloped into a sustainable destination with significant emissions reduction potential. Kingston City Council has endorsed a vision for the future of the former Kingston Penitentiary and the Portsmouth Olympic Harbour that features housing and businesses, recreation, and tourism.

Major redevelopment projects like this offer a unique opportunity to implement leading edge building strategies and showcase low carbon innovation. This site also represents an opportunity for emissions reductions through expansion of its adjacent district energy facility. Allocating space and including appropriate piping for district energy supply to any new development within the site can facilitate cost-effective upgrades to low carbon district heating options, including geo-exchange in the future.

- City Leads: Community Services
- Community Partners: Canada Lands Company, Correctional Services Canada, CFB Kingston

Buildings and Energy Production

Emerging Trends, Future Best Practices and Technologies

Virtual Net Metering

What It Is

Renewable energy production is rapidly increasing across Canada, from small rooftop solar panels to larger solar arrays and wind farms. That said, not everyone who wants to use renewable energy is in a position to do so, perhaps because they rent their property or have limited space or lack access to upfront capital. Virtual net metering is a financing mechanism that can help people overcome barriers and enable participation in the green energy economy.

Virtual net metering is typically linked to large solar projects, so is often called 'community solar'. Essentially, virtual net metering and community solar allow participants to save money, lower their carbon footprints, and support the development of future renewable energy projects, all without installing a single piece of equipment.

How It Works

Virtual net metering allows owners of large buildings and campuses with limited rooftop area to claim on-bill credit for renewable energy generated outside of their site area. It also lets consumers buy into or subscribe to a renewable energy system that is developing or already established, often through a co-operative model. Because they 'virtually' own a portion of the equipment, consumers receive a percentage of the energy that the system produces. For example, if a subscriber owns 10% of the equipment at the project, they would receive a

credit for 10% of the production of renewable energy and have these credits automatically applied to future utility bills. These arrangements generally offer a great deal of flexibility, allowing adjustments as home energy use changes and enabling easy transfers to new properties.

Who's Leading the Way

Municipalities, utilities, and other organizations have launched a variety of small and large virtual net metering projects in recent years, with many more on the way. The City of Nelson in British Columbia introduced Canada's first community-owned solar garden in 2017. The project attracted great interest and had to be expanded after it was oversubscribed, with an eventual size of 60kW and almost 250 solar panels. At a larger scale, the Ottawa Renewable Energy Co-operative (OREC) allows members to invest in renewable energy projects across its large portfolio, which currently includes more than 20 solar arrays and will be expanded with wind turbines. OREC works in partnership with schools, institutions, municipalities, and businesses throughout the region and is helping to strengthen Ontario's green energy economy. Canada's Ministry of Energy and Ontario's IESO are now looking to develop additional virtual net metering demonstration projects to help build on this momentum.

Buildings and Energy Production: New Builds

5. Advance the adoption of net zero ready new construction ahead of the release of requirements expected in national building and energy codes in 2030.

Short Term Actions: Implementation within the next 1-5 years

- 5.1 Promote the City's existing Green Standard Community Improvement Plan, which incentivizes low carbon new buildings, the Savings by Design and Commercial Custom New Construction programs both offered by Enbridge Gas, as well as third party distributed generation systems. Include these incentives in an education campaign for developers highlighting the business case for low carbon new construction of offices, condominiums and one-family homes.
- 5.2 Train the City's building inspectors in emerging construction techniques for highly energy efficient buildings.
- 5.3 Enhance design policies for mid-rise and tall buildings to improve building efficiency, promote multimodal lifestyles not dependent on personal automobiles, and increase overall livability.

Long Term Actions: Implementation within the next 6-20 years

- 5.4 Advocate that Ontario be an early adopter of national net zero ready new construction building and energy codes as they are developed.
- 5.5 Work with planners and developers to explore the feasibility of low carbon infill development.
- 5.6 Integrate embodied carbon assessments into local new construction incentive programs to encourage understanding of life cycle carbon impacts from materials selection.

Quick Facts

- 1,000 tonnes of annual community emission reduction
- 6kg of emission reduction potential per person
- Co-benefits and resilience impacts include livable communities, job creation, attractive to residents

Buildings and Energy Production

5. Advance the adoption of net zero ready new construction ahead of the release of requirements expected in national building and energy codes in 2030.

Short Term Actions: Implementation within the next 1-5 years

5.1 Promote the City’s existing Green Standard Community Improvement Plan, which incentivizes low carbon new buildings, the Savings by Design and Commercial Custom New Construction programs both offered by Enbridge Gas, as well as third party distributed generation systems. Include these incentives in an education campaign for developers highlighting the business case for low carbon new construction of offices, condominiums and one-family homes.

Builders and developers in Kingston have a range of incentives to choose from when looking to construct low carbon new buildings, with new offerings from the City and utilities. In addition, third-party owned renewable energy systems, such as geothermal loops or microgrids, can save property owners, building users, or tenants significant upfront capital by providing energy services through a long-term purchase agreement, typically over 20-30 years. This third-party provider owns and operates the energy producing asset and essentially becomes a micro utility that sells to the end user at a specific rate. To maximize local leadership in the building sector, it will be important to promote all available supports for low carbon new construction when articulating the business case for striving towards achieving net zero carbon building

performance. While cost premiums do exist, they are often dependent on factors such as approach to design and experience of the team, and this gap will lessen as industry capacity continues to grow.

- City Lead: Business, Environment & Projects, Community Services
- Community Partners: Businesses, Developers, Kingston Construction Association (KCA), Kingston Home Builders Association (KHBA), Utilities

5.2 Train the City’s building inspectors in emerging construction techniques for highly energy efficient buildings.

City building inspectors have a strong foundation in building systems and code requirements that impact energy efficiency. However, they may benefit from more specific training to understand the implications of emerging products, design standards, and equipment that can reduce energy consumption well below current code. It is also important that City planners and policymakers are aware of low carbon, energy efficient buildings and development best practices as the City’s plans and policies are updated in the future.

- City Lead: Community Services, Business, Environment & Projects

Buildings and Energy Production

5. Advance the adoption of net zero ready new construction ahead of the release of requirements expected in national building and energy codes in 2030.

Short Term Actions: Implementation within the next 1-5 years (Continued)

5.3 Enhance design policies for mid-rise and tall buildings to improve building efficiency, promote multimodal lifestyles not dependent on personal automobiles and increase overall livability.

Through its design policies, the City can promote new buildings that reduce emissions and foster stronger community connections through transit and active transportation. High-performance buildings are also better for

occupants, with greater thermal and acoustic comfort and improved air quality, which can have a positive effect on the full spectrum of wellness and resilience, including physical, mental, emotional and social health.

- City Lead: Community Services
- Community Partners: Developers, Property owners

Climate Leadership in the Community

5. Advance the adoption of net zero ready new construction ahead of the release of requirements expected in national building and energy codes in 2030.

Community Profile: Habitat for Humanity

Driven by the vision that everyone needs a decent place to live, Habitat for Humanity in the Kingston area partners with families and individuals to offer a hand up to build or improve a place they can call home. Habitat homeowners help build their own homes alongside volunteers and then pay an affordable mortgage. Through financial support, volunteering, or adding a voice to support affordable housing, everyone can help families achieve the strength, stability, and self-reliance for themselves.

Since Habitat for Humanity partners with people who have lower incomes, they include as many cost-saving elements as they can at the time of construction. They ensure that the building envelope is tight, limit thermal breaks by

insulating well, and install energy efficient appliances in the home.

Habitat for Humanity is starting work on construction of four townhomes where they are aiming to decrease greenhouse gas emissions by a minimum of 25% below the emissions of a design complying with the current Ontario Building Code. They are partnering with Lafarge Canada to use newly developed EcoPact low carbon concrete for the foundation of these homes and with the City of Kingston with assistance through the Community Climate Action Fund to install air-source heat pumps in each of the four homes. Habitat is thankful for these partnerships that will help to offset the additional costs of these environmental initiatives.



Buildings and Energy Production

5. Advance the adoption of net zero ready new construction ahead of the release of requirements expected in national building and energy codes in 2030.

Long Term Actions: Implementation within the next 6-20 years

5.4 Advocate that Ontario be an early adopter of national net zero ready new construction building and energy codes as they are developed.

Codes Canada publishes two model codes that set minimum standards for energy efficiency in buildings: the National Energy Code for Buildings (NECB) and the National Building Code (NBC). To ensure energy efficient building practices, the federal government has committed to introducing a net zero energy ready model code by 2030, while also outlining a voluntary pathway that can be introduced ahead of time. By choosing to adopt net zero ready building standards before they become the minimum requirement, the Province of Ontario can help municipalities to stay ahead of the curve and show leadership on a national scale.

- City Leads: Business, Environment & Projects
- Community Partners: Provincial Government

5.5 Work with planners and developers to explore the feasibility of low carbon infill development.

Infill development on vacant and underdeveloped sites provides an opportunity

to add density throughout Kingston, avoiding sprawl while maintaining the unique character of neighbourhoods. By encouraging appropriately-sited infill, the City can promote connected, low carbon communities that better serve residents.

- City Lead: Business, Environment & Projects, Community Services
- Community Partners: Developers, Utilities

5.6 Integrate embodied carbon assessments into local new construction incentive programs to encourage understanding of life cycle carbon impacts from materials selection.

The construction industry has made significant progress on reducing carbon from building operations but is just beginning to address embodied carbon (the carbon released over the life of a construction material, from manufacturing, transportation, and installation through to disposal). Fortunately, embodied carbon impacts can be assessed and improved through life cycle assessments (LCAs) supported by environmental product declarations (EPDs).

- City Leads: Business, Environment & Projects, Community Services
- Community Partners: Developers

Buildings and Energy Production

Emerging Trends, Future Best Practices and Technologies

Setting the Standard for Local Construction

What It Is

Municipalities are accelerating the pace of low carbon new construction by incentivizing and requiring high-performance buildings. On a national and international scale, the City of Toronto is leading the way on setting sustainable design standards for new private and City-owned developments through the Toronto Green Standard (TGS). Buildings account for more than half of GHG emissions in Toronto, and so the TGS includes stepped targets to achieve zero emissions buildings by 2030 and meet city-wide GHG reduction targets by 2050, guided by the Zero Emissions Buildings Framework.

How It Works

First introduced in 2006 as a voluntary initiative for new development, the TGS has gone through regular updates on a four-year cycle, with Version 4 approved by Council in July 2021. It consists of four tiers of performance for different criteria, each with supporting guidelines. Tier 1 is mandatory for new projects, while developers can earn incentives for meeting the higher Tiers. Version 4 of the TGS includes updated energy efficiency and GHG reduction targets, and introduced consideration of the embodied emissions of construction materials.

The TGS is designed to not only reduce carbon emissions, but also to offer a range of health, wellness, and economic co-benefits for the people of Toronto. It includes measures to increase building resilience to changing climate conditions, as well as targets for electric vehicle parking, stormwater management, and planting on site to support pollinators and biodiversity.

Who's Leading the Way

The TGS has already resulted in 169,000 tonnes of avoided emissions annually, and recent updates put the Toronto on track to avoid more than 5.43 metric tonnes of emissions between 2010 and 2050. The City is also leading by example by requiring that all municipal buildings be designed to meet net zero emissions beginning in 2022. Other bold municipal policies on reducing emissions in new construction include the City of Vancouver's Zero Emissions Building Plan, San Francisco's Green Building Code, and New York City's Local Law, 32 that requires that all new buildings are built to an energy stretch code.

Waste



Waste

Where we are Today: Waste Sector Emissions Trends

In 2018, decomposition of organic waste represented only 4% of Kingston's total community emissions. Wastewater produces the largest share of these emissions, while residential landfill is a minor additional source. Emissions from waste and wastewater have declined by 1% since 2011. However, this is an important sector as the main GHG emission is methane, which is 25 times more potent than carbon dioxide in terms of impacting climate change.

Emissions Sources: Waste

GHG emissions result from decomposition of organic matter in landfilled residential waste and during treatment of wastewater. Annual residential landfill waste and wastewater flow volumes are tracked by the City.

Waste collected from the institutional, commercial and industrial sector is not included in the community emissions inventory.



Figure 9: 2018 Community Inventory by Waste Type

What We Heard: Waste

What We Heard – Public Survey

- Almost all (97%) survey respondents use their blue/grey bin; 76% of respondents use the green bin; and 34% also compost at home.
- The survey found that 43% of respondents would like to try to cut their waste by reducing single-use plastics and buying more locally grown produce.

What We Heard – Business Survey

- The majority of respondents would like to switch to products and practices that produce less waste within the next three years.

“Provide citizens with more information about where waste and recycling go and how they are actually processed. A more rigorous recycling sorting system could be implemented at the household level that might lower costs and improve what actually gets recycled.”

– Survey Respondent

Waste

Key Objectives

- 6 Produce renewable natural gas locally from waste sources and encourage adoption of other low carbon fuels.



Waste

Where We Want to Go

Local production of biogas -- or renewable natural gas -- from organic waste and wastewater is a key emissions reduction strategy for the City. Projected for implementation by 2029, the biogas facility would capture methane currently flared during wastewater treatment and would additionally be capable of turning source-separated organics from the Green Bin and agricultural waste into renewable energy sources. To fully benefit the community, the biogas produced by the plant could be locally purchased, further offsetting natural gas currently used for heating and industrial processes. Increasing diversion of organic waste from landfill through the Green Bin program will further increase the inputs needed to produce biogas. The CLP modeling suggests a 70% diversion rate by 2040, an increase of 10% from today's levels.

Together, biogas production and waste diversion have the potential to reduce Kingston's emissions 3% by 2040 compared to 2011. This potential is shown as a purple wedge in the figure below, which summarizes the impact of community action on Kingston's waste-related emissions, as compared to the business as planned scenario. Note that the scale of the chart varies between sectors: although the significance of biogas production in 2029 relative to the baseline emissions for this sector is clear, biogas has a small impact (3%) on overall community emissions. However, cumulatively, local biogas production and use as renewable natural gas could reduce over 300,000 tonnes between 2029 and 2040. Interim 5-year targets relative to 2011 emissions from waste are also indicated starting in 2025.

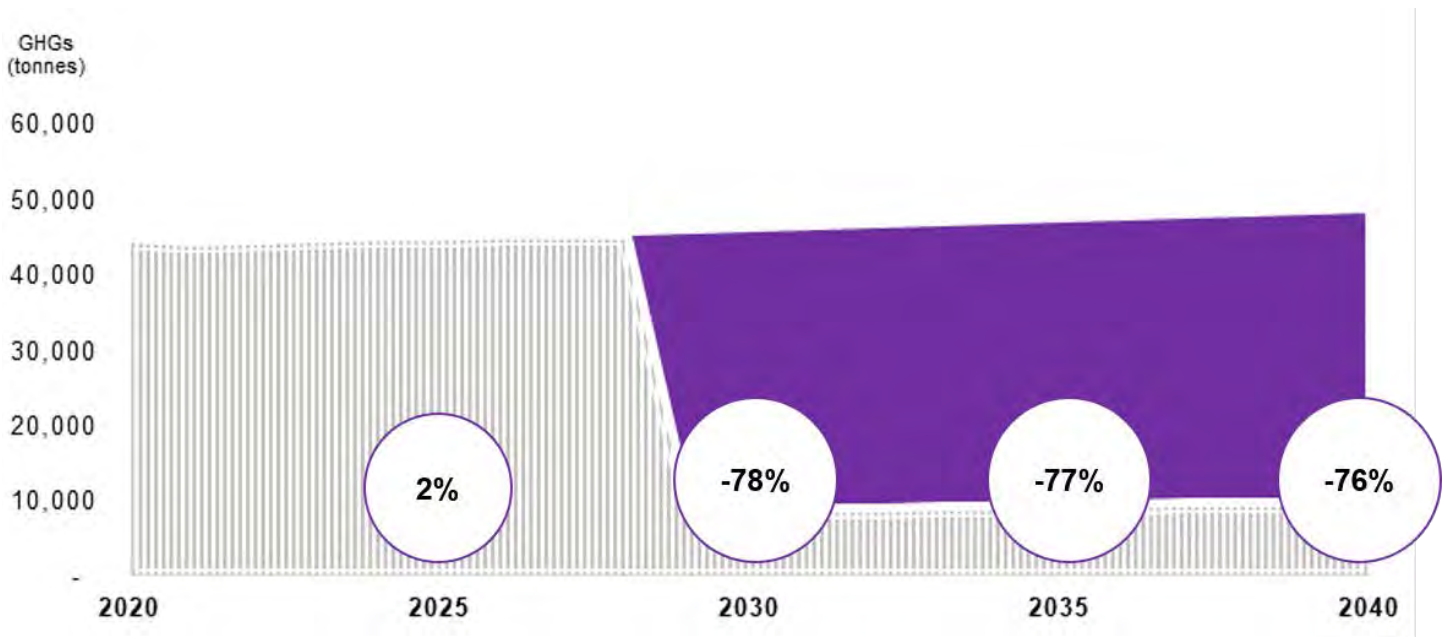


Figure 10: Carbon Reduction Pathway: Waste Sector

Existing Community Action

The Kingston Biosolids and Biogas Master Plan recommends the development of an integrated biosolids and source-separated organics processing facility capable of producing renewable natural gas (RNG) from wastewater, organic material from the Green Bin program, and other commercial sources. In 2018, INVISTA also began implementation of a sewer water discharge management partnership with Utilities Kingston that reduced emissions by more than 4,000 tonnes.

The City is working to expand the Green Bin collection to multi-unit residential buildings and schools, and further changes to the City's Integrated Waste Management Plan are being developed. These existing actions will support the City's target of achieving a 65% waste diversion rate by 2025, an increase in 5% from the current rate of 60%.

Opportunities

- **Increasing Demand for Low Carbon Fuels:** Renewable natural gas is expected to play a key role in the federal government's Clean Fuel Standard as well as the decarbonization plans of major industries and real estate portfolios. Overall, demand for RNG is expected to significantly outpace supply, presenting Kingston with an opportunity to consider

expanding local production of RNG in the long-term, using other types and sources of organic material, such as agricultural and food processing waste.

Barriers

- **Population Growth:** If Kingston does not develop its biogas plant, emission from wastewater and landfilled waste will continue to grow as the population of the City continues to increase.



Waste: Biogas and Alternative Fuels

6. Produce renewable natural gas locally from waste sources and encourage adoption of other low carbon fuels.

Short Term Actions: Implementation within the next 1-5 years

- 6.1 Develop infrastructure to locally produce renewable natural gas (RNG) as outlined in the City's Biogas Master Plan. Identify a local partner interested in purchasing RNG to retain environmental benefits within Kingston.
- 6.2 Increase diversion of organic waste through expansion of the City's Green Bin program.
- 6.3 Continue to procure biodiesel for the City's transit bus fleet during its transition to low carbon transit vehicles and explore feasibility of increasing to B50 or B100 in the interim.
- 6.4 Advocate for provincial regulations that enable tracking of industrial, commercial and institutional waste at the municipal boundary level.

Long Term Actions: Implementation within the next 6-20 years

- 6.5 Encourage the industrial sector to accelerate its switch to renewable energy for process loads through purchase of renewable natural gas or use of green hydrogen.

Quick Facts

- 145,000 tonnes of annual community emissions reduction
- 840 kg of emission reduction potential per person
- Co-benefits and resilience impacts include reduced pollution, improved waste diversion and locally produced renewable energy

Waste

6. Produce renewable natural gas locally from waste sources and encourage adoption of other low carbon fuels.

Short Term Actions: Implementation within the next 1-5 years

6.1 Develop infrastructure to locally produce renewable natural gas (RNG) as outlined in the City's Biogas Master Plan. Identify a local partner interested in purchasing RNG to retain environmental benefits within Kingston.

Renewable natural gas (i.e. biogas) is a renewable energy source produced from the decomposition of organic matter by anaerobic bacteria. It can be substituted for conventional natural gas and distributed through existing pipelines. The City's Biogas Master Plan identifies potential sites to produce RNG from both wastewater and source separated organics collected through the Green Bin program. Agricultural waste, commercial food waste and municipal organic waste collected from surrounding communities could further bolster production and position Kingston as a local leader for renewable energy.

- City Lead: Transportation & Public Works, Utilities Kingston

6.2 Increase diversion of organic waste through expansion of the City's Green Bin program.

A large portion of organic waste in Kingston is sent to the landfill. There it decays to produce methane, a highly potent greenhouse gas. Increasing the amount of food waste that is diverted will help to curb emissions, save space in the landfill, and contribute to local production of renewable natural gas. This organic material is also a valuable potential input to biogas production.

- City Lead: Transportation & Public Works
- Community Partners: Residents

6.3 Continue to procure biodiesel for the City's transit bus fleet during its transition to low carbon transit vehicles and explore feasibility of increasing to B50 or B100 in the interim.

Biodiesel is a substitute for petroleum diesel fuel that is made from primarily organic materials such as plant oils and animal fats. It is renewable, biodegradable, and has lower emissions compared to its petroleum equivalent. The City already uses biodiesel to fuel some larger vehicles and will continue to do so while transitioning to a low carbon fleet. B100 is made of 100 percent vegetable or biological sources and has the lowest emissions of all biodiesel blends, but would likely require engine modifications.

- City Lead: Transportation & Public Works

6.4 Advocate for provincial regulations that enable tracking of industrial, commercial and institutional waste at the municipal boundary level.

Waste from the industrial, commercial and institutional (ICI) sector is typically handled by private contractors for disposal. As a result, there is limited data available on ICI waste volumes and trends, and proactively managing these waste streams is challenging. Advocating for better tracking at the provincial level will help all municipalities to manage waste the waste generated within their communities, whether collected through the residential or commercial stream. This could also help identify quantities of potential feedstocks to local biogas production and other energy from waste opportunities.

- City Lead: Business, Environment, and Projects
- Community Partners: Provincial Government, Businesses, Institutions, Industry

Climate Leadership in the Community

6. Produce renewable natural gas locally from waste sources and encourage adoption of other low carbon fuels.

Community Profile: INVISTA's Sewer Discharge Partnership with Utilities Kingston and the City

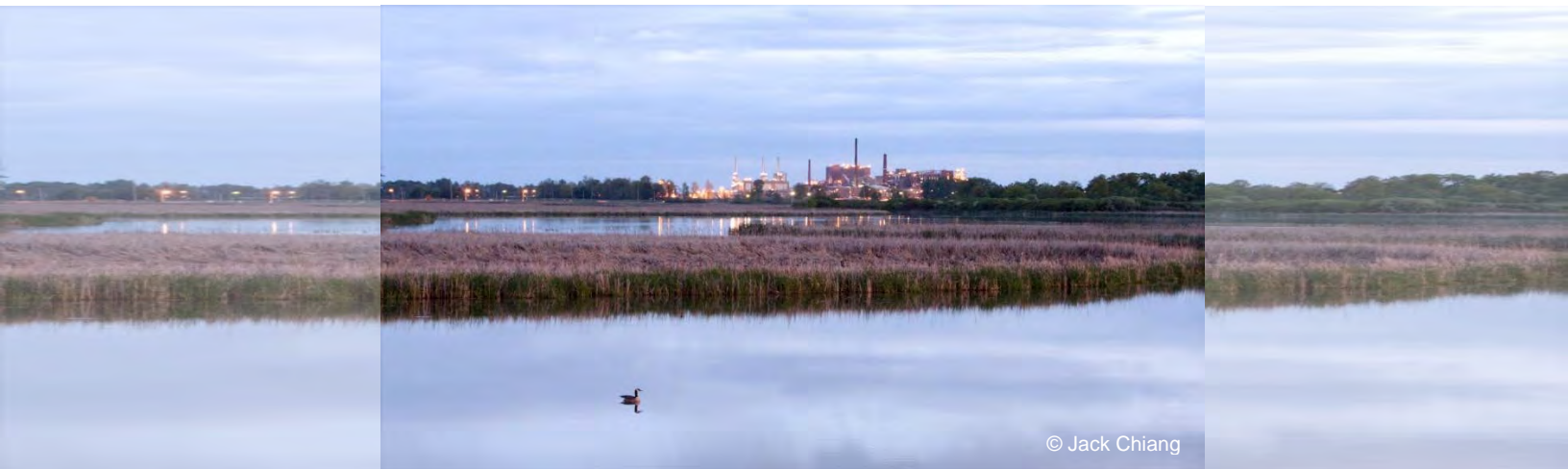
Operating in Kingston since 1942, INVISTA was Canada's first nylon plant and continues to manufacture innovative nylon products to this day.

INVISTA believes that to succeed in a rapidly changing future, there is a need to discover and develop opportunities that create value for not only customers, but for society. They put this into practice using a principle called virtuous cycles of mutual benefit, rooted in making strong, preferred partnerships in the community.

In 2018, INVISTA recognized an opportunity to partner with the City of Kingston and Utilities Kingston to optimize the process for the management of sewer water discharge at the Kingston plant. The three parties worked closely together to understand INVISTA's capabilities

and restraints, then chartered a mutually beneficial path forward. Through this solution, INVISTA has been able to eliminate an energy intensive process and use new technologies to ensure that water is managed appropriately before it reaches the City's treatment facility.

This solution reduces INVISTA Kingston Site greenhouse gas emissions by over 4,000 tonnes of CO₂, or approximately 2% of Kingston's total 2020 community GHG reduction target. INVISTA benefits from reduced energy consumption and reduced costs, and the environment benefits from reduced carbon emissions. This initiative also helps Utilities Kingston and the City move closer to meeting their emission reduction goals without incurring additional costs. Working together on this opportunity has been a win for all three organizations and Kingstonians overall.



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Climate Leadership in the Community

6. Produce renewable natural gas locally from waste sources and encourage adoption of other low carbon fuels.

Long Term Actions: Implementation within the next 6-20 years

6.5 Encourage the industrial sector to accelerate the switch to renewable energy for process loads through purchase of renewable natural gas or use of hydrogen.

Industrial processes account for a large share of Kingston's emissions. By utilizing renewable natural gas, and looking towards new opportunities such as hydrogen, these organizations can reduce their own corporate emissions and contribute to the development of a local clean fuel economy. Although the current market cost of renewable natural gas presents an economic barrier, these costs should be regularly reviewed as new supply becomes available. Industrial sectors who currently pay a carbon tax may also benefit from using lower carbon fuels which could offset their cost premiums. The federal Carbon backstop price is set to increase from \$50 per tonne in 2022 up to \$170 per tonne by 2030.

- City Lead: Business, Environment & Projects
- Community Partners: KEDCO, Utilities Kingston, Queens University, St. Lawrence College

Waste

Emerging Trends, Future Best Practices and Technologies

Hydrogen Fuel Cells

What It Is

Hydrogen is an abundant natural element. It acts as an energy carrier that, when consumed in a fuel cell, gives off only water, electricity, and heat. Given this property, it holds immense potential as a sustainable fuel. Once produced, hydrogen can be distributed either as a gas or as a liquid. Currently, the main uses for hydrogen in Ontario are in refineries and fertilizer production. However, hydrogen can also serve as an alternative or complement to fossil fuels, and can be used even for high-temperature process loads that cannot readily switch to an all-electric energy source.

How It Works

A fuel cell is an electrochemical power generation device that combines fuel with oxygen from air to produce electricity. They are similar to batteries, but they do not run down or need recharging. They produce electricity and heat as long as a fuel, like hydrogen, is supplied.

It is important to note is not all hydrogen fuel is clean. Green hydrogen is produced using renewable energy, which is highly preferable, while blue hydrogen is produced using natural gas with carbon capture use and storage. Grey hydrogen is produced using natural gas without carbon capture and brown hydrogen comes from coal and other fossil fuels, so their use should be limited.

Fuel cells offer a wide range of benefits compared to traditional power generation – they are fuel-efficient, virtually noiseless, and produce virtually no emissions when paired with a clean fuel source.

Who's Leading the Way

Leading countries have started to consider how hydrogen technologies can be used to meet ambitious greenhouse gas emissions reduction targets. In Canada, the federal government released the Hydrogen Strategy for Canada in late 2020 to establish a pathway for increased production of clean hydrogen at a national scale. This plan is designed to spur investment and guide strategic partnerships to decarbonize fuel in power generation, freight, transportation, and manufacturing.

Transportation



Transportation

Transportation Sector Emissions Trends: Where we are Today

In 2018, the transportation sector represented 36% of Kingston's total community emissions. Based on the current emissions inventory methodology, passenger vehicles produce the majority of these emissions, which are tracked through annual reporting of retail fuel sales. Currently, less than 1% of passenger vehicles in Kingston are electric. As data is not available for privately-fueled commercial and fleet vehicles, emissions from transportation are likely significantly higher than reported in past community inventories, as the wedge assigned to commercial vehicles in Figure 11 is notably undersized. In addition to passenger and commercial transportation, municipal transit and fleet vehicles also produce a small share of emissions, as does aviation.

Since 2011, emissions from transportation have increased by 3%, somewhat less than Kingston's population increase over this time period. A combination of improved fuel efficiency and higher mode shares for active transportation and transit are likely responsible for minimizing the emissions increase in this sector.

Emissions Sources: Transportation

GHG emissions result from combustion of fossil fuels by gasoline and diesel passenger vehicles, including the City's bus fleet. Annual retail fuel sales are tracked by the City. In 2018, 0.4% of Kingston's cars were electric vehicles (EVs). Their electricity use is not monitored separately from general electricity consumption counted in the building sector.

Commercial vehicles are largely excluded from the community inventory, as data on private fuel sales is not currently available.

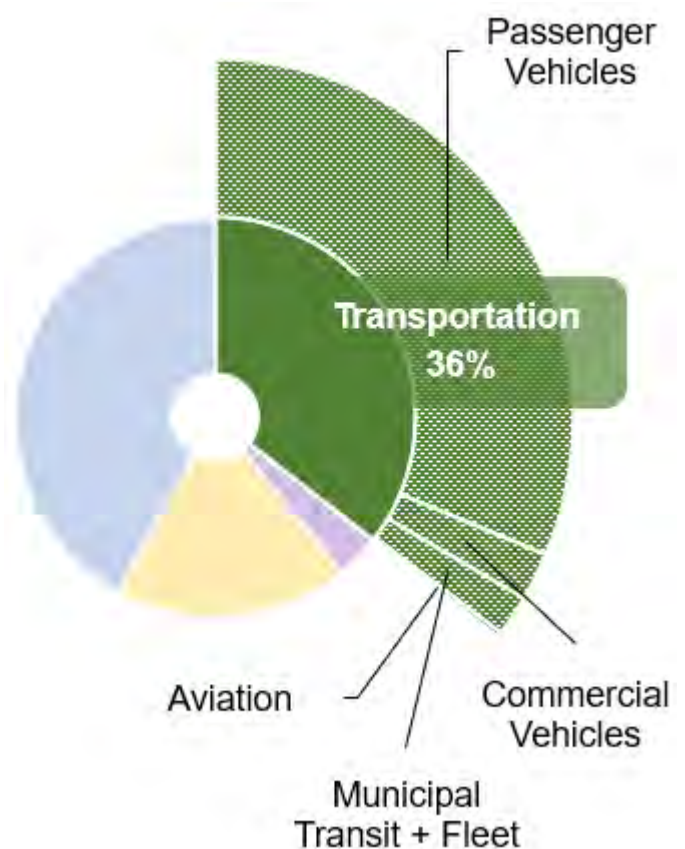


Figure 11: 2018 Community Inventory by Vehicle Type

What We Heard: Transportation

What We Heard – Public Survey

- Approximately 64% of respondents would like to increase their walking and cycling (active transportation) to reduce transportation-related emissions.
- Almost half (46%) of respondents identified that in the future they are interested in purchasing an electric vehicle as a main action to reduce transportation-related emissions.
- Approximately 42% of respondents indicated that efficient use of time is a barrier preventing them from carpooling and using public transit or active transportation modes (e.g., walking, cycling).
- More than half (58%) of respondents indicated that if they were to purchase a personal vehicle, they would be interested in purchasing an electric vehicle, with 13% of respondents identifying cost as a barrier to purchase.

What We Heard – Business Survey

- Approximately 43% of respondents indicated that they would like to implement EV charging stations at their business in the next three years.

“In the long term it would be good to find ways to embed more physical workplaces (offices, etc.) and corner stores into suburban residential neighbourhoods so that people won't have to drive to get to work or pick up a litre of milk.”

– Survey Respondent

Transportation

Key Objectives

- 7 Develop active transportation connections and foster transit-oriented development to encourage a shift to sustainable modes and a reduced reliance on personal vehicle use.
- 8 Transition to electric- and renewably-powered personal, municipal and commercial motorized vehicles.



Transportation

Where We Want to Go

Urban design and planning policy have a significant influence on transportation emissions and community climate resilience. To achieve the emissions reduction goals of the CLP, increasing walkable neighbourhoods which support active modes of transportation is imperative. Transit-oriented densities, appropriately sited along transit corridors and transit nodes, are a priority. Connected and transit-oriented communities also tend to be more resilient, since residents do not need to rely on one mode of transportation and can better access resources and support to prepare for and respond to climate impacts. Density by Design, Kingston's Mid-Rise and Tall Building Policy will guide the development of buildings of more than four storeys in height, in strategic locations within the urban boundary. To reduce daily commuting requirements, the shift to work from home driven by COVID-19 should be sustained as much as possible.

For Kingston to reach its GHG reduction targets, gasoline and diesel-powered vehicles need to be replaced such as with electrically powered models. Electric Vehicles (EVs) offer a range of benefits over conventional vehicles, including economic benefits (e.g. lower operational and maintenance costs), environmental benefits (reduced GHG emissions), and health benefits such as reduced air and noise pollution. With modifications, electric car batteries could also provide a backup energy source for homes during power outages, and storage points for excess solar power during times of peak production. The ongoing commitment of automakers to electrify their new vehicles over the next 10-15 years, autonomous vehicles, plus new micro-mobility options will further advance this transition.

The links between buildings and transportation emissions will further blur as vehicle charging takes place at home and is not separately metered from general building use. Remote work also calls for balance between buildings and transportation sectors, as reduced commuting leads to increased heating and cooling demand as people work from home during the day. Improved building efficiency and low-carbon sources of energy will become even more important as homes serve additional functions.

Together, increased adoption of active transportation, working from home, and electric vehicles have the potential to contribute to a 30% reduction in Kingston's emissions by 2040. This potential is shown as a green wedge in the figure below, which summarizes the impact of community action on Kingston's transportation-related emissions compared to the business as planned scenario. Interim 5-year targets relative to the 2011 emissions from vehicle travel are also indicated starting in 2025.

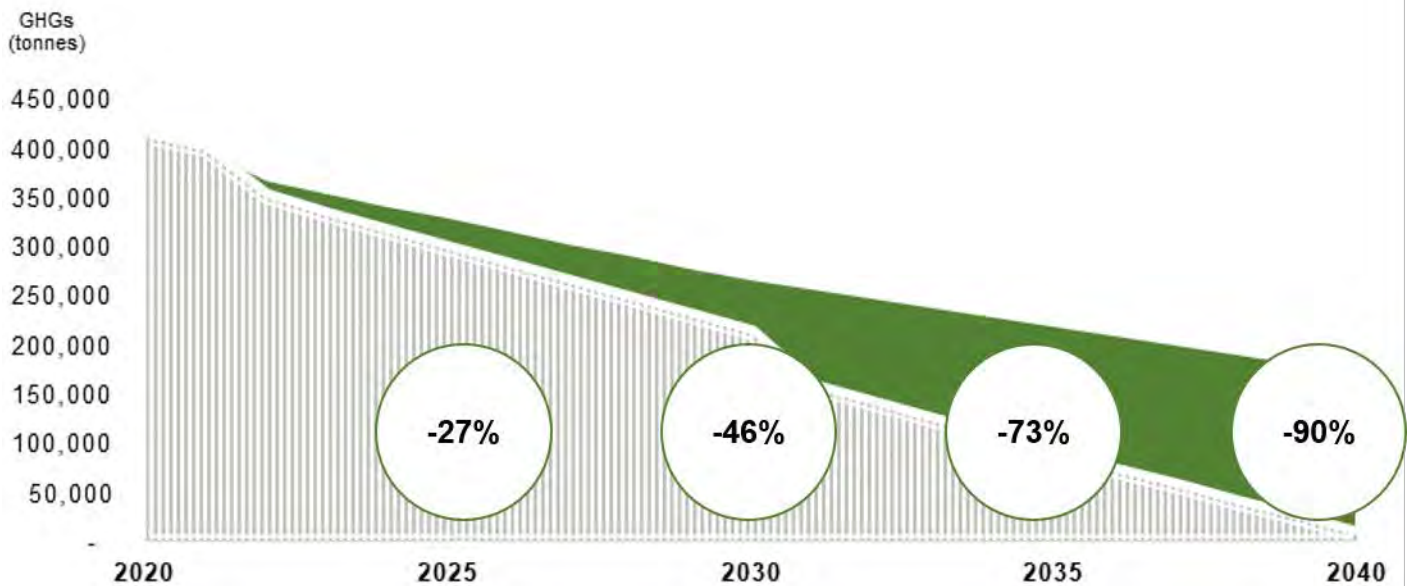


Figure 12: Carbon Reduction Pathway: Transportation Sector

Existing Community Action

The Mid-Rise and Tall Buildings Policy (also known as Density by Design) will guide development of buildings of more than four storeys in height in targeted locations. Well-connected, mixed-use locations that are serviced by public transit, walking and biking infrastructure will be prioritized for higher residential density, increasing the City’s housing supply while avoiding the negative impacts of urban sprawl.

Walk ‘n Roll, the City of Kingston’s Active Transportation Master Plan, outlines how Kingston can achieve 20% active transportation and 15% transit mode shares by 2034. The associated Implementation Plan documents specific infrastructure and safety improvements to be completed between 2019 and 2023.

The City has been making Kingston an EV friendly community for the past 5 years. A major EV charging strategy saw the City install approximately 40 public EV charging stations including some Level 3 units providing fast charging in under an hour. Other businesses and institutions have also added charging stations throughout the city. Since 2011, over 500 EVs and plug-in hybrid EVs have been registered within Kingston. Currently, the focus is on electrifying the City’s fleet. In 2020, the City purchased two electric buses, several municipal light duty EVs, and three electric ice resurfacing machines. By 2040, 100% of Kingston’s transit fleet will be electric. Until existing diesel buses are ready to be retired, the City will continue to purchase biodiesel as an interim emissions reduction strategy.

Opportunities

- **Electric Vehicles (EVs):** Mainstream car manufacturers are increasingly showcasing plans for new electric vehicle options over the next few years, with several committing to full transition to electric-only offerings by 2030. Technology is improving battery capacity and driving range, and a circular approach to battery recycling to reduce raw material requirements is emerging in Kingston with Li-Cycle, who reclaims valuable metals and other materials from spent batteries (learn more on page 100).
- **Remote Work:** The COVID-19 pandemic initiated a sudden shift to remote work for many businesses. Survey results show that more than 60% of workers in Kingston expect to continue to work remotely full or part-time once the pandemic ends.
- **Vehicle Fuel Efficiency Standards:** Federal regulations for light duty vehicles are expected to improve the fuel economy of new cars by approximately 40% between 2011 and 2025.
- **Zoning and Parking Policy:** Zoning bylaws and parking regulations can help incentivize car sharing, electric vehicle use, or promote alternative modes of transportation, as long as viable options for safe and efficient travel are available. In June 2021, the City's Department of Planning Services published a discussion paper highlighting the important role that parking regulation plays in reaching key City goals including emissions reduction, social equity, and infrastructure costs. These goals will inform approaches to how parking is regulated in the City's upcoming new Zoning Bylaw.

Barriers

- **Provincial Electricity Grid:** As previously described, Ontario's future electricity generation mix is likely to include more natural gas power plants to meet peak demand, increasing emissions for several years from electricity starting in 2025. Although the emissions intensity of electric vehicles will remain less than fossil fuel vehicles, electrification of vehicles further magnifies the impact of provincial energy policy on community emissions.
- **Population Growth:** Without careful attention to implementing intensification strategies, transit and active transportation plans, increased population could lead to an expansion of the city's carbon footprint and increased vehicles on the road, resulting in higher energy use and emissions for transportation.
- **Access to Charging Stations:** Switching to an EV is difficult if the necessary charging infrastructure is not available. People living in multi-unit residential buildings may not be able to install chargers at home. Public chargers are increasingly available but are not yet as widespread as fossil fuel refueling stations.
- **Availability of Commercial & Heavy Civil EVs:** Although electric options are increasingly available for medium duty commercial vehicles, including delivery vans, options for waste collection trucks and other heavy civil vehicles are expected to remain limited in the short and medium term. Government incentives are also typically not available for these vehicle classes.

Transportation: Reduce Car Dependence

7. Develop active transportation connections and foster transit-oriented development to encourage a shift to sustainable modes and a reduced reliance on personal vehicle use.

Short Term Actions: Implementation within the next 1-5 years

- 7.1 Continue to implement the Active Transportation Master Plan (ATMP), creating an integrated city-wide active transportation network, neighbourhood-level connections, and programming and policy initiatives that foster a culture of active transportation.
- 7.2 Develop Official Plan policies and bylaws that focus new residential growth in dense, walkable locations that are well connected to transit. Reduce parking requirements for new residential and non-residential development along transit corridors and nodes, and promote car-sharing infrastructure that utilizes electric vehicle charging stations.
- 7.3 Implementing the 5-year transit planning cycle, continue to increase transit ridership through discounted transit passes, addition of express routes, reviewing 'gaps' in the transit system, and other system improvements.
- 7.4 Promote the success of the City's remote work (telework) policy and encourage other organizations to maintain remote learning and working opportunities developed during the COVID-19 pandemic.

Long Term Actions: Implementation within the next 6-20 years

- 7.5 Promote 15-minute city concepts that allow appropriately located and denser residential and commercial development within existing built up areas.
- 7.6 Encourage micro-mobility sharing solutions (i.e. small, speed-limited vehicles such as e-bikes and e-scooters) aimed at facilitating a shift away from single-occupancy automobile trips.
- 7.7 Develop partnerships to extend opportunities to work and learn from home to rural residents. Advocate for investment in Kingston from the federal government's Universal Broadband Fund, which promises to connect all Canadians to high-speed internet by 2030.

Quick Facts

- 220,000 tonnes of annual community emission reduction
- 1,300 kg of emission reduction potential per person
- Co-benefits and resilience impacts include health, connected communities and equitable access to multimodal transit

Transportation

7. Develop active transportation connections and foster transit-oriented development to encourage a shift to sustainable modes and a reduced reliance on personal vehicle use.

Short Term Actions: Implementation within the next 1-5 years

7.1 Continue to implement the Active Transportation Master Plan (ATMP), creating an integrated city-wide active transportation network, neighbourhood-level connections, and programming and policy initiatives that foster a culture of active transportation.

Key components of the ATMP include establishing priority routes for active transportation connections across the City of Kingston and supporting infrastructure that promotes convenience and safety. This includes the installation of pedestrian crossings, intersection upgrades to promote cycling connections, and the construction of new sidewalks, multi-use pathways, in-boulevard trails, cycle tracks, separated cycling lanes and paved shoulders. Policy and program plans include school travel planning programs, the development of an active transportation wayfinding program, and education and promotion of active transportation options. The City's Active Transportation Implementation Plan outlines specific improvements and projects to be completed between 2019 and 2023.

- City Lead: Transportation & Public Works
- Community Partners: Residents, Businesses, Sustainable Kingston

7.2 Develop Official Plan policies and bylaws that focus new residential growth in dense, walkable locations that are well connected to transit. Reduce parking requirements for new residential and non-residential development along transit corridors and nodes, and promote car-sharing infrastructure that utilizes electric vehicle charging stations.

Complete communities bring together a mix of residential and non-residential uses, facilitating public transit and active transportation. Potential policy levers include density requirements, street frontage design guidelines that foster a vibrant experience for pedestrians, and requirements for infrastructure to support walking and rolling. Although parking requirements typically designed to ensure that new residents have a dedicated space for their vehicle, the need for parking spaces can decrease as development is targeted for areas that support active transportation and transit. Reducing parking requirements can lower development costs, free up space for additional housing and potentially reduce the cost of units.

- City Lead: Community Services, Transportation & Public Works
- Community Partners: Developers

Transportation

7. Develop active transportation connections and foster transit-oriented development to encourage a shift to sustainable modes and a reduced reliance on personal vehicle use.

Short Term Actions: Implementation within the next 1-5 years (continued)

7.3 Implementing the 5-year transit planning cycle, continue to increase transit ridership through discounted transit passes, addition of express routes, reviewing ‘gaps’ in the transit system, and other system improvements.

Strong transit ridership is foundational to reducing emissions from private vehicles in Kingston. The City can help to promote transit use by providing frequent, reliable services that gets people where they need to go, complemented with convenient ticketing and route planning technology. Consider amenities around transit stations and stops (weather protection, cycling racks, making sure ped/cycling routes connect to transit, etc.). Strong relationships have been created between Kingston Transit and community partners that will be vital to support implementation.

- City Lead: Transportation & Public Works

7.4 Promote the success of the City’s remote work (telework) policy and encourage other organizations to maintain remote learning and working opportunities developed during the COVID-19 pandemic.

While remote technologies have existed for years, the COVID-19 pandemic has accelerated the trend towards telecommuting. This resulted in a reduction of global carbon emissions in 2020. To avoid a rebound in emissions, encourage employers to continue to embrace and support remote work. Some companies and organizations may also welcome the change as they start to save money by maintaining smaller offices.

- City Lead: Business, Environment & Projects
- Community Partners: Residents, Sustainable Kingston Businesses



Climate Leadership in the Community

7. Develop active transportation connections and foster transit-oriented development to encourage a shift to sustainable modes and a reduced reliance on personal vehicle use.

Community Profile: Kingston Coalition for Active Transportation (KCAT)

Kingston Coalition for Active Transportation (KCAT) was established in April 2008 and has since worked to facilitate the increase of active transportation in Kingston. Their main area of focus is policy and planning with the City of Kingston to make sure City policies and practices align with the Official Plan in all areas related to transportation.

Kingston, like many cities in North America, was traditionally designed to prioritize privately owned automobiles to move freely across the city, with minimal congestion, and park anywhere. Since 2010, Kingston's Official Plan has begun to reverse this car-centric focus and make Active Transportation (AT) the most convenient, safe and efficient solution for most transportation needs, especially trips less than 3-5 km. This is necessary for reducing GHG emissions and improving public health, both physical and mental, through activity.

With the Active Transportation Master Plan prepared in 2018, the City has the blueprint to allow Kingston to become a pedestrian and bicycle friendly community. In 2020, as a response to public health restrictions related to the pandemic, KCAT organized and

implemented a "Quiet Streets" pilot that successfully showed how Kingstonians can navigate their neighbourhoods to get to amenities and services they need.

Building on that success, KCAT will be implementing pilots of "School Streets" and "Play Streets" to further illustrate how streets can be made safer and more available to everyone, not just car owners. KCAT will also continue to work with passionate City staff and elected officials to improve the Downtown Business District to make it more attractive to pedestrians and bicyclists.



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Transportation

7. Develop active transportation connections and foster transit-oriented development to encourage a shift to sustainable modes and a reduced reliance on personal vehicle use.

Long Term Actions: Implementation within the next 6-20 years

7.5 Promote 15-minute city concepts that allow appropriately located and denser residential and commercial development within existing built up areas.

A 15-minute city is one where residents can meet most, if not all, of their daily needs within a short walk or roll from their home, without needing to get in the car. Adding density can help build resilience and social capital by improving access to resources and creating more connected communities where people can thrive.

- City Lead: Community Services
- Community Partners: Residents, Businesses

7.6 Encourage micro-mobility sharing solutions (i.e., small, speed-limited vehicles such as e-bikes and e-scooters) aimed at facilitating a shift away from single-occupancy automobile trips.

Micro-mobility refers to small, speed-limited vehicles that can use both traditional bike and pedestrian infrastructure, as well as travel on roadways. They are useful for short to medium trips including the “last mile” connection to transit services, and are well-suited to shared use. Micro-mobility also helps increase resilience by offering different methods to move around, reducing dependence on a single mode of transport. Adoption can be supported by providing safe, convenient, complete routes and hubs for clustering the available vehicles in strategic locations.

- City Lead: Transportation & Public Works

7.7 Develop partnerships to extend opportunities to work and learn from home to rural residents. Advocate for investment in Kingston from the federal government’s Universal Broadband Fund, which promises to connect all Canadians to high-speed internet by 2030.

While working to create a low carbon, resilient Kingston, it is important to ensure that residents and businesses outside the urban core also have high-quality and reliable online service. High-speed internet access is essential for everybody regardless of where they live, so that they can work from home, participate in online education and access online medical services. Advocacy is needed to gain attention for internet improvements needed within the Kingston area, as federal investment in broadband infrastructure continues.

- City Lead: Community Services
- Community Partners: Federal Government, Internet Services Providers, Residents

Transportation

Emerging Trends, Future Best Practices and Technologies

Converting Unused Office Space to Housing

What It Is

The COVID-19 pandemic has shown that many office-based staff can work productively and collaboratively without being in the same physical location. Although a partial return to in-person office work is expected at a minimum, many businesses and organizations are re-evaluating their space requirements. Increased commercial vacancies may result. Newly available space presents a unique opportunity to simultaneously solve multiple community challenges by converting unused space to housing. Avoiding the need for demolition and providing a new source of housing stock both reduce the need for new construction using virgin materials, and the high embodied carbon impacts that can result.

How It Works

The office buildings at greatest risk of long-term vacancy are those that are aging and technologically obsolete. While their interiors may need a major overhaul, the existing structure and building envelope can often be retained even as the interior floor plan is re-envisioned. Creative design solutions to support high-quality residential layouts may be required to address limited availability of daylight and exterior views in commercial

buildings with deep floor plates. One solution can be to maintain a mixed-use approach, with one portion of the building preserved for offices and the other portion used for new housing units. It is also important to evaluate climate risks to these buildings, to avoid safety hazards for occupants and to manage damage or degradation caused by climate impacts.

Who's Leading the Way

Alberta's metropolitan centres started to see increasing commercial vacancy rates prior to COVID-19 due to the flagging oil economy, and property owners have already found creative solutions. In Edmonton, the first office-to-residential conversion took place at 'e11even,' an early 1980s building that was left vacant after the departure of a long-term tenant. This whole-building vacancy allowed for immediate interior demolition as there was no need to wait for multiple leases to expire. In less than a year, the owner converted 500,000 square feet of unused office space into 177 rental suites in a prime location, and saved 50,000 tonnes of demolition material compared to building new.

Transportation: Electric Vehicles

8. Transition to electric- and renewably-powered personal, municipal and commercial motorized vehicles.

Short Term Actions: Implementation within the next 1-5 years

- 8.1 Monitor charging demand and expand the City's existing network of electric vehicle charging stations. Explore partnerships for sharing of charging infrastructure for large local commercial fleets.
- 8.2 Encourage local car dealerships to offer electric vehicles to test drive and ensure that repair services are widely available. Hold annual or semi-annual community EV test drive days.
- 8.3 Work with the Taxi Commission to develop minimum EV requirements for taxi and ride-share fleets.
- 8.4 Explore and encourage a comprehensive car-sharing program in Kingston.
- 8.5 Work with Utilities Kingston and Hydro One to develop a leasing program for charging infrastructure for commercial vehicle fleets. Include low-interest loans for purchase of home smart chargers through the Kingston Home Energy Retrofit Program.

Long Term Actions: Implementation within the next 6-20 years

- 8.6 Update the City's Electric Vehicle Strategy to include new municipal policies to encourage adoption of electric vehicles.
- 8.7 Prioritize electrification of the City's bus fleet and Solid Waste Collection fleet, aiming for complete transition by 2040.
- 8.8 As commercial electric vehicles become more widely available, explore group procurement for multiple commercial partners.
- 8.9 Advocate that Ontario ban the sale of gas-powered cars by no later than 2035.

Quick Facts

- 220,000 tonnes of annual community emission reduction
- 1,300 kg of emission reduction potential per person
- Co-benefits and resilience impacts include widespread access to EV's and charging stations, job creation and cleaner air

Transportation

8. Transition to electric- and renewably-powered personal, municipal and commercial motorized vehicles.

Short Term Actions: Implementation within the next 1-5 years

8.1 Monitor charging demand and expand the City's existing network of electric vehicle charging stations. Explore partnerships for sharing of charging infrastructure for large local commercial fleets.

The City of Kingston owns and operates 42 Level 2 and two Level 3 public EV charging stations. There are currently another 66 Level 2 and 18 Level 3 public EV stations operated by other organizations within the City. Availability will only continue to grow, helped by initiatives such as the federal Zero Emission Vehicle Infrastructure Program. Public charging options are particularly important for those without a private garage or driveway, including renters and condo dwellers, who may need to charge in shared parking lots. Public chargers also help increase resilience in the event of localized power outages. Infrastructure sharing arrangements can help to decrease cost barriers and provide an incentive for commercial fleets to switch to electric vehicles.

- City Lead: Business, Environment & Projects, Transportation & Public Works, Corporate Services
- Community Partners: Commercial Fleet Operators, Couriers, Heavy Equipment Operators, Transportation Companies

8.2 Work with Utilities Kingston and Hydro One to develop a leasing program for charging infrastructure for commercial vehicle fleets. Include low-interest loans for purchase of home smart chargers through the Kingston Home Energy Retrofit Program.

Reducing the initial cost barrier of electric vehicle charging infrastructure will help to expand EV adoption for both residents and commercial users. Financing of charging infrastructure for commercial vehicle fleets can help to target vehicles with high annual mileage, which are responsible for a higher share of emissions. Equipping more residents with home charging stations will also improve climate resilience by providing access to a back up power source and building redundancy into the network.

- City Lead: Business, Environment & Projects
- Community Partners: Residents, Utilities, Commercial Fleet Operators, Couriers, Heavy Equipment Operators, Transportation Companies

Transportation

8. Transition to electric- and renewably-powered personal, municipal and commercial motorized vehicles.

Short Term Actions: Implementation within the next 1-5 years (continued)

8.3 Encourage local car dealerships to offer electric vehicles to test drive and ensure that repair services are widely available. Hold annual or semi-annual community EV test drive days.

With electric vehicles being relatively new to most people, it is important that they have an opportunity to go for a test drive and get a feel for the technology. Local dealerships can help to promote EV adoption by keeping show cars in stock, and community EV test drive days (in partnership with Plug 'N Drive) can also offer opportunities for residents to trial a larger number of EV models. The Electric Vehicle Discovery Centre in North York also has various makes and models available for consumers to try out.

- City Lead: Business, Environment & Projects
- Community Partners: Sustainable Kingston, Businesses

8.4 Work with the Taxi Commission to develop minimum EV requirements for taxi and ride-share fleets.

The first commercial EV introduced to the market was the Bersey electric cab in 1897 and the electric taxi is starting to grow in popularity once again. Taxi fleets and shared vehicle operators are well-positioned to take advantage of electrification, as these vehicles are generally used for short trips and have time

for regular charging. Electrification also works well with ride-hailing apps and optimization of taxi service strategies.

- City Lead: Business, Environment & Projects, Community Services
- Community Partners: Taxi Commission, Taxi Operators, Kingston Economic Development Corporation

8.5 Explore and encourage a comprehensive car-sharing program in Kingston.

The development of a comprehensive car sharing program in Kingston has the potential to reduce automobile usage (as discretionary trips are more often avoided or changed to trips by alternative mode), reduce GHG emissions and increase the usage of alternative modes of transportation such as active transportation or public transit for other trips. Car sharing programs in other cities also often have EVs in their fleet of vehicles. Such programs should also be designed with equity and resilience in mind. The car-sharing program should provide improved flexibility and access to vehicles to help the community prepare and respond to climate impacts.

- City Lead: Community Services, Transportation & Public Works, Business, Environment & Projects

Climate Leadership in the Community

8. Transition to electric- and renewably-powered personal, municipal and commercial motorized vehicles.

Community Profile: Li-Cycle

Li-Cycle is North America's largest lithium-ion (Li-ion) battery resource recycling company, focused on extracting the valuable materials found inside end-of-life batteries and then returning these critical materials back into the supply chain. With recycling facilities in Kingston, Rochester, and soon Arizona – and more planned around the globe – Li-Cycle has created a closed-loop, domestically-sourced Li-ion battery supply chain.

Using a two-step process, the company's Spoke & Hub Technologies offer minimal environmental impact, including zero wastewater, no direct emissions, and no landfill. In the decade ahead, the use of Li-ion batteries is expected to grow substantially alongside the widespread adoption of electric vehicles (EV) and battery energy storage.

Part of Li-Cycle's global plan is to strategically capture as much of the EV and energy storage battery waste as possible. Some of the expected battery waste includes battery manufacturing scrap, where 5-10% of production can end up as waste, which was highlighted in Li-Cycle's recent partnership announcement with Ultium Cells LLC.

Another recent partnership with Renewance put the spotlight on recycling solutions for energy storage, where Li-Cycle will help ensure the battery materials used in energy storage also remain in the supply chain. As the world becomes increasingly reliant on electrification, Li-Cycle is positioned to provide the planet with a circular economy solution for all Li-ion batteries, enabling a truly sustainable clean energy transformation.



Transportation

8. Transition to electric- and renewably-powered personal, municipal and commercial motorized vehicles.

Long Term Actions: Implementation within the next 6-20 years

8.6 Update the City's Electric Vehicle Strategy to include new municipal policies to encourage adoption of electric vehicles.

To help encourage transportation electrification, the City of Kingston can offer perks to EV drivers and modify zoning requirements to increase the availability of residential and commercial charging stations. Other potential strategies include preferred parking spaces, reduced parking fees, permission to use bus and taxi lanes, and exemption from congestion charges that apply to gas-powered vehicles.

- City Lead: Transportation & Public Works, Business, Environment & Projects

8.7 Prioritize electrification of the City's bus fleet and Solid Waste Collection fleet, aiming for complete transition by 2040.

The City has already purchased two electric buses, three electric ice resurfacing machines, and several electric passenger vehicles, and will continue to adopt low carbon fleet vehicles as replacement is required. The commercial availability of electric medium- and heavy-duty vehicles is also rapidly increasing, enabling future conversion of other vehicle types. There is already a viable option for most of these vehicles, which is only increasing as the technology improves.

- City Lead: Transportation & Public Works, Corporate Services

8.8 As commercial electric vehicles become more widely available, explore group procurement for multiple commercial partners.

Large electric vehicles, including buses and waste management fleets, are a major investment. The City has the opportunity to join forces with other municipalities or related agencies (e.g. Association of Municipalities of Ontario, Clean Air Partnership) to achieve better economies of scale and availability of supply through its existing relationships with industry-specific groups and cooperative purchasing programs such as those offered by Metrolinx and Sourcewell Municipal Procurement. These programs can offer an opportunity to use a larger combined purchasing power to engage with manufacturers and explore the business case for coordinating bulk purchase programs for fleet vehicles, advancing adoption to support the climate goals of other local businesses and organizations.

- City Lead: Transportation & Public Works
- Community Partners: Businesses, Institutions

Transportation

8. Transition to electric- and renewably-powered personal, municipal and commercial motorized vehicles.

Long Term Actions: Implementation within the next 6-20 years

8.9 Advocate that Ontario ban the sale of gas-powered cars by no later than 2035.

Leading automakers are already rolling out new electric options and many have plans to fully convert their available models by 2030.

Limiting the sale of conventional vehicles sends a powerful message that the transition to EVs is a climate priority, while giving the industry ample time to adapt. In taking this step, Ontario would join a growing number of jurisdictions leading the way on electric vehicles, including BC, Quebec, and California.

- City Lead: Business, Environment & Projects
- Community Partners: Provincial Government



Transportation

Emerging Trends, Future Best Practices and Technologies

Market Outlook for Electric Vehicles

What It Is

Momentum around electric vehicles is rapidly building, due in large part to the falling cost of the technology, supportive government policies and incentives, and increased consumer familiarity with the technology. According to the International Energy Agency (IEA), in 2019 the global EV fleet reached a total of 7.2 million vehicles, an increase of more than two million vehicles over the previous year. Automakers are starting to take notice and making significant climate commitments to reduce pollution and deliver the vehicles their customers are looking for.

How It Works

Tesla has been a household name for electric vehicles for years, and it is not uncommon to see a Chevrolet Bolt or Toyota Prius quietly driving by. We are now seeing automakers that have long been associated with internal combustion engines starting to make the switch and developing low emissions offerings. General Motors, the largest automaker in North America, has committed to carbon neutrality in products and operations by 2040, with plans to launch 30 EVs globally by the end of 2025. Ford has set a target to be carbon neutral by 2050 and will invest \$22 billion in electrification through 2025. Volvo has also set a target of carbon neutral by 2040 and plans to sell only battery electric vehicles by 2030.

Who's Leading the Way

Government regulation plays a large role in market transformation, alongside corporate leadership and changing consumer demands. With respect to electric vehicles, countries around the world are introducing bold

regulations to help automakers plan their next steps. Norway aims to become the world's first country to end the sale of cars with internal combustion engines, setting a 2025 deadline. Britain will ban the sale of new cars and vans that use fossil fuels starting in 2030, five years earlier than previously planned. In Canada, Quebec will limit sales of vehicles powered by fossil fuels starting in 2035, while British Columbia has introduced a phased approach through its Zero-Emission Vehicles Act (ZEVA) that requires dealerships to sell or lease an increasing percentage of electric vehicles before a ban comes into effect in 2040.

The autonomous vehicle (AVs) revolution is also continuing to gain momentum in Ontario, where leading tech and automotive companies are improving technologies to support self-driving capabilities and AV transportation as a service. The Province of Ontario, Metrolinx, and the City of Toronto has been piloting AV programs in recent years.

Food and Forestry



Food and Forestry

Food and Forestry Sector Emissions Trends: Where We Are Today

In 2018, food and agricultural sources represented 19% of Kingston’s total community emissions. Transportation of food into the city generates the most emissions, and livestock and tillage are small contributors as well. Since 2011, emissions from food and agriculture have increased by 9%. The increase is tied to population growth, as emissions from transportation of food are estimated based on a combination of number of people and the relative share of imported versus local food. The current estimate is that 2% of food consumed in Kingston is locally produced. Forests provide approximately 30,000 tonnes of annual carbon storage against overall community emissions of more than 1.2 million tonnes. Figure 14 below more clearly indicates the role of forest carbon storage within the emissions profile of this sector.

Emission Sources: Food and Forestry

GHG emissions result from transportation of food into the city and farm activities such as tillage and raising livestock. Land use and livestock information is provided in StatsCan’s

census data. Estimates for food miles are generated based on current population and standard assumptions for the weight of food consumed per year. The amount of local food is currently not tracked and has been estimated as 2%. No data is currently collected on the impact of operating agricultural vehicles or equipment nor on the use of nitrogen-based fertilizers – all of which cause GHG emissions. Forests and individual trees provide carbon storage. The City tracks forested areas as well as individual trees in City parks and street.



Figure 13: 2018 Emissions from Food and Forestry

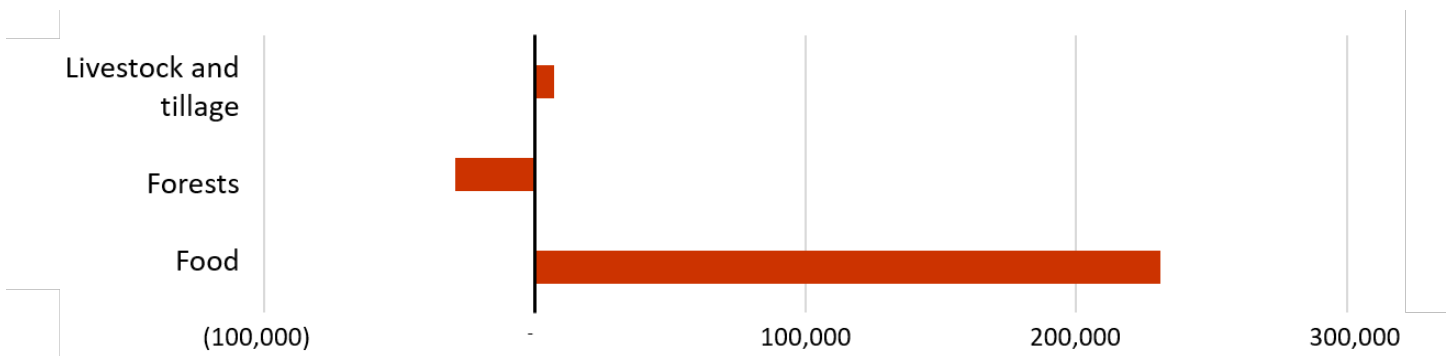


Figure 14: Carbon Sources vs Storage

What We Heard: Food and Forestry

What We Heard – Public Survey

- Three quarters of respondents are interested in local food.
- One third of respondents identified high cost of purchase as a barrier to buying local food grown in Ontario.
- Almost 30% of respondents indicated that there is a lack of variety and availability of food grown in Ontario.
- Large chain groceries should carry more local food, require no plastic wrapping or plastic carrier bags.

What We Heard – Coffee Chats

- Incentives for farmers to produce cover crops is needed to aid in carbon sequestration and promotion of no till farming.
- We need to ensure farmers' markets are vibrant and successful in the community. Promotion of local food markets is required to let people know where to buy local food and what is in season.

“In this changing world, **we should become more dependent on local food systems**, but these are the same systems that are **more impacted by extreme heat and climate change.**”

– Survey Respondent

Food and Forestry

Key Objectives

- 9 Improve the vibrancy of the local food system to help reduce dependence on high carbon imported food.



Food and Forestry

Where We Want to Go

Of the four sectors in Kingston's community inventory, food and forests emissions are the most challenging to address, as global food transportation systems are beyond community influence. To reduce emissions in this sector, Kingston will need to strengthen its local food systems. Farm-to-table initiatives, expansion of community gardens and farmer's markets, and encouraging large institutions to adopt local food targets and programs will all play a role in increasing consumption of local food. Local food offers many community benefits beyond emissions reduction: resiliency of food supply, improved access to nutritious and plant-based food, and support for the local economy and agricultural jobs.

The general electrification of transport will contribute to a decline in emissions, particularly when paired with cleaner electricity grids along major transportation routes. Expanding the city's forested area will also reduce emissions, improve community resilience to extreme heat and provide habitat for local species.

Increased local food consumption and afforestation have the potential to contribute an estimated 2% reduction in Kingston's total community emissions by 2040, and 14% reduction within this specific sector. Reduction potential is shown as an orange wedge in the figure below, which summarizes the impact of community action on Kingston's food and forest emissions compared to the business as planned scenario. Interim 5-year targets relative to the 2011 emissions from this sector also indicated starting in 2025.

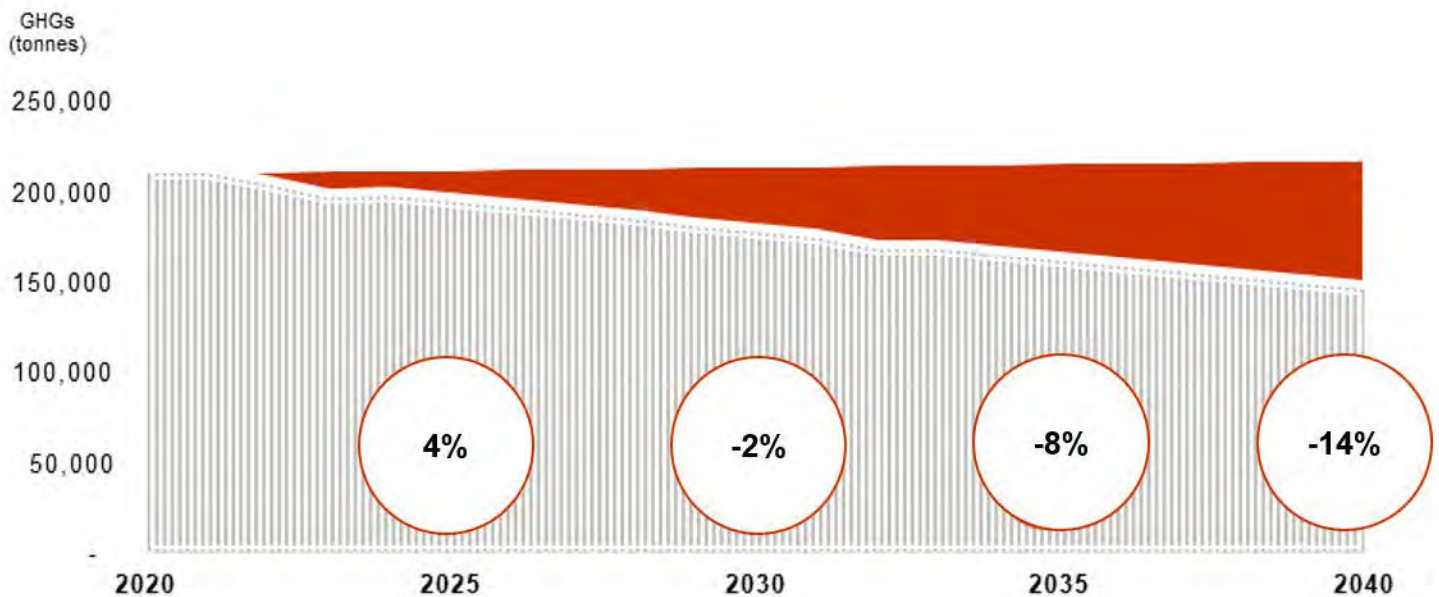


Figure 15: Carbon Reduction Pathway: Food and Forestry Sector

Existing Community Action

The City is developing new zoning regulations and guidelines to streamline licensing and infrastructure for farmers markets, community gardens and edible forests. Improved access to and support for farm-to-table initiatives and street food are also being pursued.

The City has completed planting of 1500 new trees, with a further commitment to increase the tree canopy by a total of 7,850 trees by 2022. The Cataraqui Region Conservation Authority also offers a tree planting program for rural landowners in partnership with the Forests Ontario 50 Million Tree Program.

Queen's University has developed a local food program, working with local wholesalers to incorporate in-season local produce into dining hall and retail food offerings. Leftover food is also donated to local organizations to reduce food waste and support community members facing food insecurity.

Opportunities

- Electric Vehicles (EVs): As electric delivery vans, long-distance transport trucks, and other commercial vehicles become increasingly available, the emissions associated with imported food will decline locally and globally.

Barriers

- Population Growth: As Kingston's population grows, more food is imported and consumed, increasing emissions related to transportation of food.



Food and Forestry: Local Food

9. Improve the vibrancy of the local food system to help reduce the dependence on high carbon imported food.

Short Term Actions: Implementation within the next 1-5 years

- 9.1 Develop a local food strategy and education program in line with the City's Culinary Strategy, including support for farm-to-table initiatives and food recovery programs. Develop municipal guidelines for farmers markets, community gardens, apiaries, and edible forests.
- 9.2 Further reduce emissions from transportation of food by encouraging the development of an electric delivery van sharing program.
- 9.3 Engage with farmers markets, agricultural producers and restaurants to track local food purchases. Create and update estimates for the embodied carbon footprint of common retail food products based on their sources.

Long Term Actions: Implementation within the next 6-20 years

- 9.4 Engage with hospitals and other major institutions providing food services to set targets for local food and food recovery.

Quick Facts

- 11,000 tonnes of annual community emission reduction
- \$18 million of annual economic activity and local food sales
- Co-benefits and resilience impacts include resilient agricultural systems, more equitable food systems and improved food security

Food and Forestry

9. Improve the vibrancy of the local food system to help reduce the dependence on high carbon imported food.

Short Term Actions: Implementation within the next 1-5 years

9.1 Develop a local food strategy and education program in line with the City's Culinary Strategy, including support for farm-to-table initiatives and food recovery programs. Develop municipal guidelines for farmers markets, community gardens, apiaries, and edible forests.

A strong local food system contributes to a healthy, equitable society, local economic development and community climate resilience. Building demand for local food and strengthening related initiatives is key to developing a strong local food network. Providing residents with various means to grow, share and sell local food also reduces emissions. Offering training and guidance through recreation centres and community partners will increase community understanding of the benefits and techniques for local food production and consumption, as well as plant-based alternatives. Kingston has a wide variety of farms, and restaurants that support local producers and are proud of the high quality of ingredients that they can offer. New City policy will also support a number of community gardens and expand availability and access. Ensuring that food is equitably distributed across the community and avoiding waste are also vital components of a strong local food system.

- City Lead: Business, Environment & Projects, Tourism Kingston
- Community Partners: Downtown Kingston, KFL&A Public Health, KFL&A Food Policy Council, Loving Spoonful, Sustainable Kingston, Residents, Farmers

9.2 Further reduce emissions from transportation of food by encouraging the development of a local electric delivery van sharing program.

Transportation of food accounts the majority of food and forestry emissions in Kingston's community GHG inventory, as most of the food consumed locally is produced elsewhere and transported over great distances. Utilizing electric vehicles throughout the supply chain, including shared delivery vans for local food, will help to decrease emissions on a local and global scale. The City's community GHG inventory should also account for the reduced emissions intensity of imported food over time as transportation system electrify.

- City Lead: Business, Environment & Projects
- Community Partners: Sustainable Kingston, Kingston Chamber of Commerce, Farmers, Businesses

Food and Forestry

9. Improve the vibrancy of the local food system to help reduce the dependence on high carbon imported food.

Short Term Actions Implementation within the next 1-5 years (continued)

9.3 Engage with farmers markets, agricultural producers and restaurants to track local food purchases. Create and update estimates for the embodied carbon footprint of common retail food products based on their sources.

The actual amount of locally produced food consumed by Kingston residents is difficult to track. Working with farmers and major buyers and sellers of local food to develop better tracking processes is important to monitor the success of and potential gaps in Kingston's agricultural initiatives. Educating residents on the carbon footprint of available food options can also help with informed decision-making

about purchases. Beyond transportation, the full carbon footprint of food products accounts for land use change, farming and animal feed, processing, packing and retail. Encouraging agricultural producers to adopt electric equipment and processes can help to reduce the carbon footprint of our food.

- City Lead: Business, Environment & Projects
- Community Partners: Farmers, Businesses, Queen's University, Kingston Frontenac Lennox and Addington Public Health

Climate Leadership in the Community

9. Improve the vibrancy of the local food system to help reduce the dependence on high carbon imported food.

Community Profile: Loving Spoonful

Loving Spoonful connects people in Kingston with good food. Working toward a healthier, more connected community, they provide programs and champion policies affecting food security, poverty, social inclusion, and community health.

Loving Spoonful's Urban Agriculture program is working to get Kingston growing. To build a more just food system, there is a need to tremendously increase the amount of food produced locally. There is enormous untapped potential for food production within the City of Kingston. Urban Agriculture can build community, empower individuals with skill-sharing, and connect more people to fresh local food.

Loving Spoonful is contracted by the City of Kingston to convene the Kingston Community Gardens Network (KCGN), a network of over 30 community gardens on both private and municipal lands throughout the Kingston area. The KCGN now includes 14 allotment gardens,

14 collective gardens, 5 food forests, and 7 non-food gardens.

Loving Spoonful is working to expand the KCGN and create other urban agriculture opportunities including training gardens and an urban community farm. There is a lot of vacant land within the City, and increasingly landowners are interested in seeing their properties used for food production. By connecting landowners with the right people and resources, Loving Spoonful helps make that happen.



Food and Forestry

9. Improve the vibrancy of the local food system to help reduce the dependence on high carbon imported food.

Long Term Actions: Implementation within the next 6-20 years

9.4 Engage with hospitals and other major institutions, including providing food services to set targets for local food and food recovery.

With many mouths to feed, large institutions can play a major role in the local food economy and reducing food waste. Providing healthy, appetizing meals incorporating highly nutritious local produce helps to reduce unfinished food while supporting the local economy. Tracking annual bulk purchases is important to ensure that targets are met, and that the economic and

environmental benefits of new local food programs can be communicated to residents.

- City Lead: Business, Environment & Projects
- Community Partners: Queens University, Kingston Health Sciences Centre, Hotel Dieu Hospital, St. Lawrence College, Royal Military College of Canada, Colins Bay Institution, Joyceville Institution, Sustainable Kingston



Climate Change Adaptation And Resilience



Climate Change Adaptation and Resilience

Climate Change Impacts: Where we are Today

To better understand how climate change will affect Kingston, a Baseline Vulnerability and Risk Assessment was completed. Current climate change impacts affecting Kingston include:

- Emerald Ash Border has affected hundreds of trees in Kingston. Infestations have resulted in more hazard trees which are susceptible to damage especially during strong winds and storms.
- In 2016, Kingston experienced the driest summer on record since the 1880s.
- Kingston experienced prolonged periods of high temperatures in the 30° range in the summers of 2019 and 2020, with demand for cooling made more complex due to COVID-19 causing limited indoor cooling spaces available.

The purpose of the Vulnerability and Risk Assessment was to understand how the climate is changing, and to provide high level direction for reducing climate impacts to municipal infrastructure and services. The Vulnerability and Risk Assessment also included the creation of a framework to support the City, local businesses and community organizations in undertaking climate risk assessments and identifying adaptation measures relevant to their sector, operations and assets. The full results of the vulnerability and risk assessment can be found in the Baseline Vulnerability and Risk Assessment Report and are summarized here.

Priority Climate Impacts

Impacts were prioritized based on multiple factors: present-day vulnerabilities of built

systems, the natural environment and people; the potential severity of consequences; and the urgency that adaptation interventions are needed. Many of the climate impacts require more detailed investigation by the infrastructure owners or service providers to fully understand the effects on specific sites, services and operations. Some of the priority climate impacts for the City and the community are summarized below.

Higher temperatures and increasing precipitation

- Increased damage to built and natural assets. Effects on heritage trees and heritage buildings tend to be more severe due to the age and condition of the assets. Maintenance, repairs and adaptation measures also tend to be more expensive and complex for heritage assets.
- Increase in invasive species and pests causing damage and stress on natural areas.
- Increase in vector-borne disease cases (such as Lyme disease).
- Reduced lifecycle of buildings and transportation assets from premature degradation related to the impact from weathering. More maintenance may be required to address wear and tear from heat and warmer temperatures, heavy precipitation, and shifting timing of freeze-thaw cycles.

Opportunities associated with warmer temperatures

Warmer temperatures can also generate opportunities in Kingston. However, opportunities must be approached with climate

and environmental considerations in mind, as not to counter-act the objectives of the Climate Leadership Plan. Examples of opportunities include:

- Longer construction season.
- Longer summer recreation and tourism season.
- Decreased energy demand for energy for heating in winter months, supporting emissions reduction and energy cost savings.

Extreme heat and dry conditions in summer

- Increase in heat-related health risks, especially for vulnerable groups such as elderly, youth, and low income individuals.
- Higher demand for cooling, greenspace and outdoor recreation (especially waterfront activities). When coupled with other climate-related such as dry conditions, reduced water quality and heat stress on natural areas and parks, managing higher demand may be challenging.
- Increase in temperature and water-related stress on parks, trees, gardens and vegetation.
- Power outages due to grid overload during heat waves.
- Increased heat stress causing damage or loss of crops and livestock.

Higher temperatures and changing freeze-thaw cycles in winter

- Power outages caused by winter precipitation or freeze-thaw.
- Water main breaks due to freeze-thaw cycles and rapid winter temperature changes.

- Rapid snow melt causing greater demand on drainage systems and risk of winter flooding.

More frequent and intense precipitation and flooding

- Increase in frequency and magnitude of combined sewer overflows.
- Increase in road and culvert washouts, particularly in older areas of the City and in the downtown core.
- Increased runoff and risk of pollution or contamination caused by flooding.
- High water levels leading to flooding, and damage or closure of waterfront areas.

Recent Rainfall Events and Future Projections

- In October 2019, 52.4mm of rain fell over a 24 hour period, causing flooding and road washouts. The return period for this intensity of rainfall was historically one in five years. In the future, a comparable rain event can be expected more than once a year.
- Above-average precipitation in the Lake Ontario-St. Lawrence basin contributed to record breaking inflows into Lake Ontario in both 2017 and 2019. This amount of rain received is expected to become over 3 times more likely in the future.

More frequent and intense severe weather events (e.g. storms)

- Higher demand on emergency response and community support services.
- Risk of disruption of municipal services including transit and active transportation infrastructure, water and wastewater treatment processes and telecommunications networks.

treatment processes and telecommunications networks.

- Erosion and/or destabilization of riverbanks and shoreline, affecting waterfront parks, amenities, properties and marine infrastructure.

- Damage to infrastructure and property due to severe weather (e.g., wind, storm activity) and flooding.
- Increase in damage and/or disruption to business continuity, offices, industrial and commercial processes.
- Greater risk of power outages.

Climate Change Adaptation and Resilience

What We Heard – Public Survey

- Higher temperatures and extreme heat were identified as the priority climate hazards by 62% of survey respondents.
- Survey respondents identified heat-related impacts that they experienced. The following impacts were identified most frequently: higher cooling costs in summer, reduced winter recreation opportunities, and challenging growing conditions for farming, gardens and crops and dry conditions causing stress on vegetation and habitats.
- More than half (56%) of survey respondents indicated that they had experienced or observed road washouts and flooding of parks, trails and recreational areas. An additional 49% indicated that they had experienced or observed basement flooding.

“Climate change vulnerabilities and resilience are not distributed equally, it is important to consider support for vulnerable individuals – such as those facing food insecurity, insufficient housing, outdoor workers, those who rely on public and active transportation.”

- Survey Respondent

Climate Change Adaptation and Resilience

Where We Want to Go

The Vulnerability and Risk Assessment resulted in a range of considerations that the City of Kingston can use to adapt critical municipal infrastructure and services. Recommendations and more detailed descriptions of how the City can address priority climate risks can be found in the Baseline Vulnerability and Risk Assessment Report. Highlights of best practices for reducing climate risk to municipal infrastructure and services are outlined below.

Asset-specific Adaptation

Engineering assessments can help protect the City's most vulnerable infrastructure. Aging or heritage buildings, stormwater and sewer infrastructure, shoreline assets and transportation routes in critical transportation corridors may be prioritized. Detailed infrastructure assessments such as the Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol developed by Engineers Canada measure how climate variables will affect each component of an asset or system, so that risk reduction interventions can prevent excessive damage or failure over time.

Afforestation and Increasing Tree Canopy

Trees offer many benefits, and afforestation (establishing a forest on land not previously forested) is an important part of addressing climate change. Trees absorb and store carbon that would otherwise be emitted into the atmosphere. They release oxygen which is essential for the health of people and ecosystems. Trees also provide several climate

resilience benefits. They provide essential habitat for Kingston's wildlife, shade and cool the city, reduce and filter rainwater runoff, and help prevent erosion. The City plants trees annually and plans to double the tree canopy, such as through the neighbourhood tree planting program. Continued tree planting of diverse tree species can build ecological and social resilience and support the reduction of carbon from the atmosphere.

Identify opportunities to Protect and Increase Green Infrastructure

Green infrastructure (such as greenspaces bioswales, trees, rain gardens, green roofs, etc.) provides ample benefits for community health and wellness, climate resilience and emissions reduction. Protecting green spaces and ecologically valuable areas such as wetlands is important to maintain ecological resilience and biodiversity in Kingston. Further, green infrastructure can help reduce rainwater runoff and flood risk, provide natural cooling and shading, and provide mental and physical health benefits for community. Natural assets can also help purify air and absorb and store carbon.

Geospatial Mapping of Risks and Vulnerabilities

Climate risk hotspots can be more easily managed by creating a geospatial database of risks to municipally owned and operated critical assets. Risk maps are considered best practice for targeting climate resilience interventions, and have been developed in cities such as

Metro Vancouver, Montreal, Calgary and Edmonton.

Climate Assessments for Capital Projects

As future development and infrastructure is planned, the City can explore stronger requirements to ensure climate risk and GHG emissions are evaluated for major projects and investments. For example, The City of Calgary has developed GHG and Climate Resilience Assessment templates for capital infrastructure projects similar to Infrastructure Canada's Climate Lens.

Climate Change in Asset Management

Ontario Regulation 588/17 requires that climate change considerations are included in municipal asset management planning. Measuring and costing the impact of climate change on an asset's lifecycle is challenging, with no universally accepted methodology. Despite this, municipalities in Ontario such as the Regional Municipality of Peel, City of Toronto, and the Town of Halton Hills are advancing projects to incorporate future climate projections into lifecycle planning and costing.

Incorporate Climate Hazard Preparedness into Emergency Management

The Sendai Framework for Disaster Risk Reduction is a global framework that guides countries in managing risk and building resilience to all hazards, including climate change. Disaster Risk Reduction is identified as a means to adapt to climate change within the Sendai Framework, and is also referenced in other global agreements in which Canada is participating, including the Paris Climate

Agreement and the United Nations Sustainable Development Goals.

To prevent and reduce the consequences of climate-related hazards, the City must plan for localized climate impacts such as power outages, flooding and disruptions to access routes. These impacts may occur simultaneously and in various places across Kingston, having cascading consequences across the community.

Best practice is to ensure emergency response and continuity plans address current and future climate risks and consider both concurrent risks and cumulative impacts.

Integrating Climate Thinking into Municipal Decision-Making and Governance

Municipalities across Canada are developing a "climate lens" to embed climate change into municipal decision-making processes. The intent is to formalize and normalize climate change into everyday processes, much like the finance or human resources processes we are accustomed to. A "climate lens" can take shape as policy or guidance on assessing climate risks and GHG emissions within planning policy, development projects, infrastructure investments, and all City plans, programs and initiatives. Reports to Council may be requested, among other accountability tools. Municipalities such as London, Windsor, Montreal, Victoria and Calgary are working to implement requirements in community planning, infrastructure planning and investment decisions to address climate across citywide business and decision-making. The Canadian Infrastructure Bank utilizes a climate lens policy which requires applicants to address mitigation and adaptation risks in their proposals.

Climate Change Adaptation and Resilience

Where We Want to Go

Community Climate Adaptation and Resilience Framework

Climate leadership is a collaborative effort that requires community organizations and businesses to understand and manage their climate risks. To support Kingston's organizations and businesses in measuring and managing climate impacts, a simple framework for Vulnerability and Risk Assessments and adaptation planning has been included in this Climate Leadership Plan. The framework is consistent with ICLEI Canada's Building Adaptive and Resilient Communities (BARC) Program and the C40 Climate Change Risks Assessment Guidance, both leading frameworks for adaptation in North American communities. The framework is also consistent with the climate risk assessment approach outlined in ISO Standard 31000 for Risk Management, can be aligned with Hazard Identification and Risk Assessment (HIRA), and can meet the requirements of the Global Covenant of Mayors (GCoM). Resources including templates for vulnerability and risk assessments and climate projections web sources are included in the

Baseline Vulnerability and Risk Assessment Report.

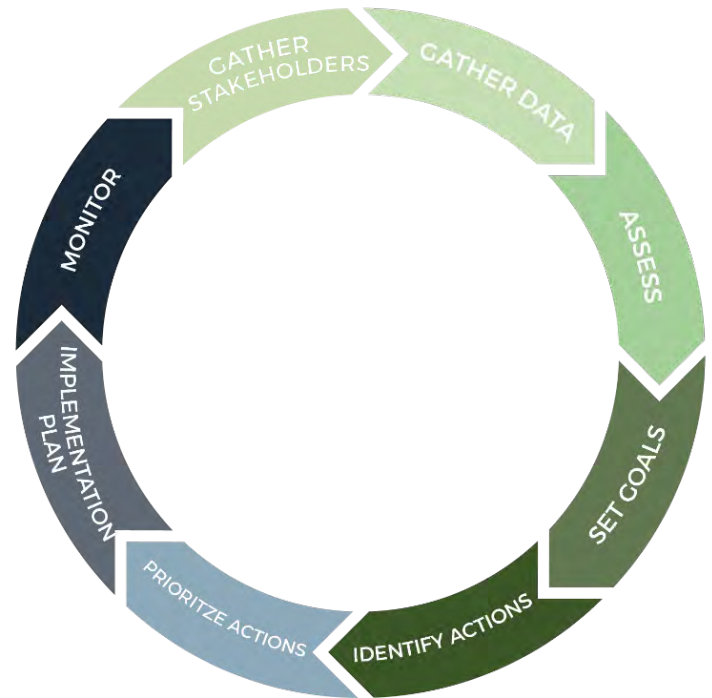


Figure 16: Adaptation and Resilience Framework

Principles of Climate Adaptation and Resilience Planning

- Low carbon resilience: Where possible take a Low Carbon Resilience approach, positioning climate vulnerabilities and risks in the context of the societal transition away from fossil fuels. Doing so helps identify risks that could result from GHG reduction actions and helps ensure that your adaptation solutions do not work against your emissions reductions efforts.
- Collaborative: Climate change affects infrastructure, people, financial systems and the natural environment. Including perspectives from all facets of an organization and representatives from different areas of the business and community ensures that climate risks are captured holistically. Engaging these different stakeholders in the planning process is a vital part of ensuring solutions are developed by working together.
- Grounded in Equity: Climate change impacts different people, places and sectors unequally. Those that are disadvantaged by institutions and systems due to mobility status, gender, income, race, identity, location etc. tend to be most vulnerable to climate change impacts. Identifying and including the voices that are most vulnerable to climate change impacts will help make sure that resilience measures are targeted where support is most needed.
- Iterative: Climate change impacts and future climate conditions will continue to change. Your level of resilience will evolve as the economy shifts and as communities grow and change. It is important to re-evaluate risks and progress on adaptation every few years to determine what has changed, what has been successful, and where improvement is needed.



Community Adaptation and Resilience Framework

Identify stakeholders to be involved in the process

Identify the stakeholders that may be affected by climate impacts. Also identify those who have a role in reducing climate risks and adaptation decision making and invite them to be part of the adaptation planning process

Gather climate projections and other relevant data

Determine what information you need to inform your vulnerability and risk assessment. Data needs will depend on the level of detail intended to be addressed within your assessment. At a minimum, you can find future climate projections and historical data in your region online (resources shared in the Baseline Vulnerability and Risk Assessment Report). Other helpful data can include flood maps, asset maps, information on the condition, location and age of assets, operations and maintenance logs and records from past weather events.

Assess vulnerabilities and risks

Determine whether a high level or detailed vulnerability and risk assessment would be most useful for your specific need or project. There are several tools available to assess vulnerability and risks depending on the level of detail (best practices, tools and resources are identified in the Baseline Vulnerability and Risk Assessment Report). At a minimum, the vulnerability and risk assessment should address the following questions:

- How is the climate changing in your region? What climate-related impacts could occur?
- Who and what may be affected by climate impacts (climate exposure)?
- How often might the climate impacts occur, now and in the future?

- How sensitive is the organization/asset/system to harm or damage from the climate impact?
- What is the current capacity to cope or adapt?
- How severe would the consequences be if the impact were to occur today?

The results of the vulnerability and risk assessment should be a list of priority climate risks or impacts.

Resources to support risk assessments include ICLEI's Building Adaptive Resilient Communities framework which provides a holistic, qualitative approach. ISO Standards 31000 and 1409x also provide high level, flexible guidelines for vulnerability and risk assessments. For more detailed infrastructure assessments on a singular piece of infrastructure, methods such as the PIEVC Protocol, developed by Engineers Canada, assess climate-infrastructure interactions throughout every component of an asset (i.e. all interior and exterior parts of a building or tangible process).

Identify adaptation and resilience goals and objectives

Identify a variety of actions and solutions that can reduce priority risks and vulnerabilities. There may also be opportunities (positive impacts) that require planning to fully realize. Actions range from policy or regulation, physical or technical solutions, or changes to operational or procedural processes. There are several resources available to help identify adaptation actions depending on the context and top risks identified (see the Baseline Vulnerability and Risk Assessment Report for more details).

You may consider a set of criteria to help with prioritizing actions. Use criteria such as feasibility, cost, human resources, emissions reduction co-benefits, alignment with other policy or plans, number of climate impacts addressed,

and urgency of decision (e.g. if action is required immediately to prevent lock-in of a long-lasting decision such as land use or infrastructure design).

Identify and prioritize adaptation actions

Identify a variety of actions and solutions that can reduce priority risks and vulnerabilities. There may also be opportunities (positive impacts) that require planning to fully realize. Actions range from policy or regulation, physical or technical solutions, or changes to operational or procedural processes. There are several resources available to help identify adaptation actions depending on the context and top risks identified (see the Baseline Vulnerability and Risk Assessment Report for more details).

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Establish monitoring and implementation plans

Assign a lead department or individual for each action and identify supporting partners. Create an implementation table which includes key information for each action such as roles and responsibilities, timing of the action and priority level. For each action, consider how you will measure progress. Identify indicators that will help measure the change in risk and/or resilience resulting from the actions identified (see the Baseline Vulnerability and Risk Assessment Report for more).

Re-assess and Iterate

Determine when you will re-evaluate climate risks and vulnerabilities and update your adaptation actions. Best practice is to update adaptation plans approximately every 5-7 years.

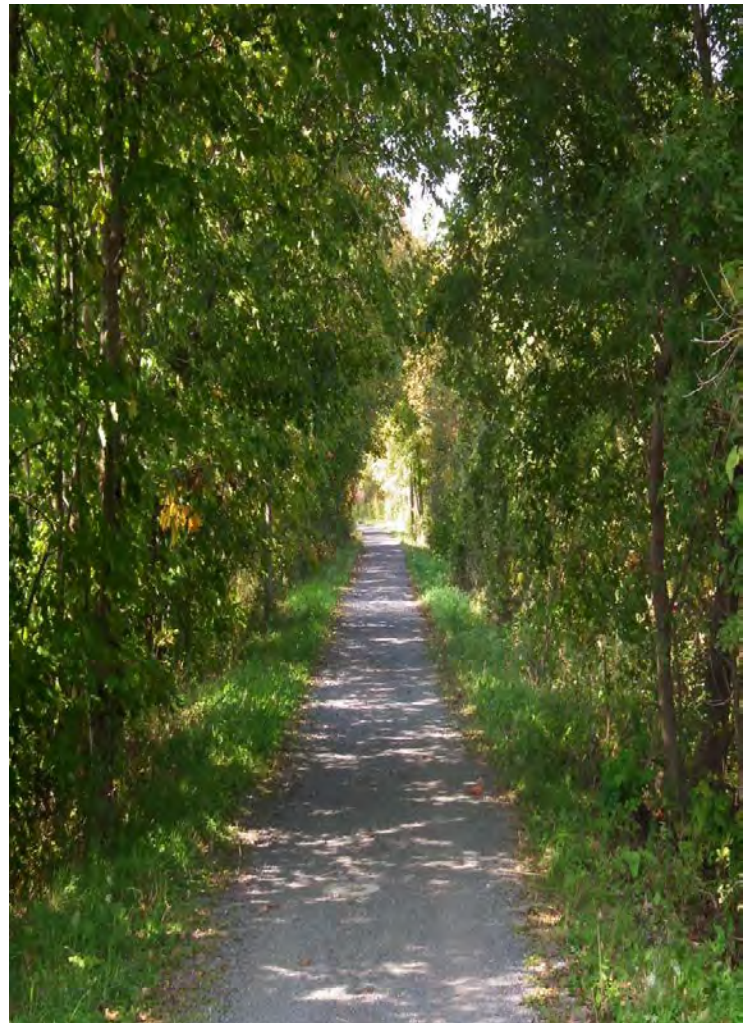
Monitoring and Implementation

Regularly reviewing emissions reduction achievements and the status of actions outlined in this plan will be vital to maintain the success of the Climate Leadership Plan over time. Public reporting of results also encourages accountability and identifying opportunities for corrective action. Specific monitoring tools and actions to advance climate leadership in Kingston and ensure this Plan remains a consistently relevant resource include:

Emissions Reduction

- **Annual Community and Corporate GHG Inventories:** Annual inventories consistently quantify Kingston's community emissions and emissions from municipal operations, allowing accurate and timely comparison to established targets and the 2011 baseline.
- **Annual Progress Report and Five-Year Climate Leadership Plan Review:** Each short-term action in this plan has been assigned to a City division or associated with a community lead, consolidated in the Short Term Action Summary in the following section. An annual progress report summarizing the current status of each action will help to ensure that significant milestones are achieved over time. Periodic review and update of the Climate Leadership Plan is also recommended to address new opportunities for community action, recalibrate targets and timelines and respond to new policy directions provided by other levels of government.
- **Carbon Budget:** A carbon budget is the cumulative amount of emissions permitted over a period of time (e.g., annually, every five years) to keep within a certain global temperature change threshold (2 degrees or 1.5 degrees) to avoid the catastrophic impacts of climate change. A carbon budget encourages early action to reduce emissions, rather than waiting for a target year far in the future. It works much like a bank account with an annual spending allowance. Kingston has reviewed several carbon budget scenarios and is now well-positioned to establish a formal approach to help prioritize key actions, in line with other early municipal adopters such as the City of Edmonton and several others considering this approach, including Halifax, Toronto and Ottawa.
- **Electric Vehicle and Local Food Emissions Tracking:** The City of Kingston tracks the number of Electric Vehicles and Plug-in Hybrid Electric Vehicles registered in Kingston. However, as EVs are more widely adopted and charging occurs at home, it will become increasingly difficult to track transportation emissions separately from building energy use. Progress in both sectors will therefore be difficult to monitor. New data sources such as online surveys, aggregated telematics reports and smart charging networks that monitor energy consumption will be important to consider as transformation in this sector accelerates. Some EV chargers are metered separately and can be used to make estimates of stationary electricity consumption used for transportation.
- A similarly robust inventory methodology will be required to track emissions from transportation of food, as local food systems expand and global supply chains shift to electric transport. Working with academics, farmers markets, local producers and large institutional buyers can help measure total dollars spent on local food purchases each year.

- **Climate Lens:** A climate lens is a decision-making framework used to embed climate considerations throughout infrastructure, policy and investment decisions. Climate lenses can be designed in different ways, including policy, guidance, templates or approval frameworks. At a minimum, climate lenses should require the assessment and disclosure of GHG emissions and climate risks to capital and business planning and asset management. Incorporating a shadow carbon price into financial assessments is another option to make the environmental impacts of higher emissions more visible and linked to decision-making on costs. Canadian cities such as Ottawa, London, Calgary, Toronto, Victoria are all in the process of creating municipal climate lens frameworks.
- **Climate Adaptation and Resilience**
- **Evolving Climate Impacts and Risks:** As Kingston's climate continues to change and the city transitions to a low carbon society, updating future climate projections and redoing the Vulnerability and Risk Assessment is recommended approximately every five years. The City can utilize tools such as the Climate Atlas of Canada, community risk mapping exercises, and public surveys to update data on local risks and vulnerabilities. Understanding how climate change and extreme weather are evolving and impacting Kingston's infrastructure, environment, economy and community is vital to ensure future emissions reduction actions are both low carbon and climate resilient.
- **Tracking Community Climate Preparedness:** A strategic objective of the CLP is to build the capacity of community organizations and businesses to understand and manage their climate risks. Sustained engagement with community partners (leveraging members of the Adaptation Technical Team) can help the City measure progress on community-wide adaptation efforts and determine where education or support may be needed.



Short Term Actions Summary

The section below summarizes the short-term actions to be led by the City and Community Partners between 2022 and 2027.

Buildings and Energy Production

Objective 1: Accelerate local production of renewable and low carbon energy and energy storage.

1.1 Seek out new partnerships to inform the community of available sustainable energy resources and financing options, while continuing to work in collaboration with groups, like Sustainable Kingston (page 40).

- City Lead: Business, Environment & Projects
- Community Partners: Sustainable Kingston, SWITCH, Construction and Real Estate Association, Residents, Businesses, Enbridge, Solar Leasing Companies

1.2 Advocate for provincial support and policy for virtual and community-level net metering arrangements (page 40).

- City Lead: Business, Environment & Projects
- Community Partners: SWITCH, Provincial Government

1.3 Install photovoltaics on all new municipal buildings where feasible, and explore options for solar photovoltaics during roof replacements or other major renovations of municipal facilities (page 41).

- City Lead: Corporate Services
- Community Partners: N/A

1.4 Develop partnerships to accelerate local academic and commercial cleantech research into renewable and low-carbon energy and storage technologies (page 41).

- City Lead: Business, Environment & Projects
- Community Partners: SWITCH, KEDCO, St. Lawrence College, Queens University, Royal Military College of Canada

Objective 2: Support Kingston residents to invest in low carbon retrofits for their homes

2.1 Once available, promote the Kingston Home Energy Retrofit Program (KHERP) that will provide low-interest financing and incentives, energy audits and other decision-support tools to owners of one-family homes (page 46).

- City Lead: Business, Environment & Projects
- Community Partners: Residents, Utilities, Federal Government, Red Squirrel Conservation Services, St. Lawrence College Sustainable Kingston.

2.2 Work with local utilities to develop financing and rental programs for low carbon home heating and cooling equipment (page 46).

- City Lead: Business, Environment & Projects
- Community Partners: Residents, Utilities, Multi-Unit Residential Buildings (MURB) Owners and/or Managers

2.3 Partner with St. Lawrence College and other education providers to encourage continued integration of advanced energy efficiency curriculum into skilled trades programs (page 47).

- City Lead: Business, Environment & Projects
- Community Partners: St. Lawrence College

2.4 Advocate that Ontario enact legislation that requires home energy performance and energy costs to be disclosed at the time of sale (page 47).

- City Lead: Business, Environment & Projects
- Community Partners: Provincial Government, Red Squirrel Conservation Services

Objective 3: Partner with Kingston businesses to retrofit and fuel-switch existing commercial buildings.

3.1 Deliver an education program that informs commercial building owners of the costs and benefits of fuel switching, deep carbon retrofits, building commissioning and available incentives and financing options. Develop and foster partnerships to promote and pilot new fuel switching programs within Kingston, including Enbridge's geothermal retrofit program and upcoming programs from Hydro One (page 52).

- City Lead: Business, Environment & Projects, Community Services
- Community Partners: Chamber of Commerce, Sustainable Kingston Businesses, Utilities, Kingston Economic Development Corporation, Canadian Infrastructure Bank, SWITCH

3.2 Promote local training programs that develop qualified energy professionals who can deliver audits and feasibility studies to businesses in Kingston (page 52).

- City Lead: Business, Environment & Projects
- Community Partners: St. Lawrence College, Queen's University, Red Squirrel Conservation Services

3.3 Advocate that Ontario be an early adopter of a national retrofit building code, once available (page 52).

- City Lead: Business, Environment & Projects, Community Services
- Community Partners: Provincial Government

Objective 4: Demonstrate leadership by making all municipal facilities Net Zero Energy by 2040, where feasible, and work with all levels of government to reduce emissions from other publicly owned buildings.

4.1 Retrofit City facilities to reduce emissions 15% by 2026 from 2018 levels, and develop the Net Zero Energy 2040 strategy to be incorporated with the Energy and Asset Management Plan (EAMP) strategy (page 57).

- City Lead: Corporate Services
- Community Partners: N/A

4.2 Incorporate innovative approaches to guide retrofit initiatives at heritage buildings wherever feasible. (page 57).

- City Lead: Corporate Services
- Community Partners: N/A

4.3 Advocate that Ontario adopt emissions targets for provincial buildings and invest in retrofits to reduce emissions from K-12 schools and healthcare facilities (page 58).

- City Lead: Business, Environment & Projects
- Community Partners: Provincial Government

4.4 Engage with the federal government to develop a data-sharing plan for clean electricity purchases on behalf of Kingston's federally-owned facilities (page 58).

- City Lead: Business, Environment & Projects
- Community Partners: CFB Kingston, Correctional Services Canada

Objective 5: Advance the adoption of net zero ready new construction ahead of the release of requirements expected in national building and energy codes in 2030

5.1 Promote the City's existing Green Standard Community Improvement Plan, which incentivizes low carbon new buildings, the Savings by Design and Commercial Custom New Construction programs both offered by Enbridge Gas, as well as third party distributed generation systems. Include these incentives in an education campaign for developers highlighting the business case for low carbon new construction of offices, condominiums and one-family homes (page 65).

- City Lead: Business, Environment & Projects, Community Services
- Community Partners: Businesses, Developers, Kingston Construction Association (KCA), Kingston Home Builders Association (KHBA), Utilities.

5.2 Train the City's building inspectors in emerging construction techniques for highly energy efficient buildings (page 65).

- City Lead: Community Services, Business, Environment & Projects
- Community Partners: N/A

5.3 Enhance design policies for mid-rise and tall buildings to improve building efficiency, promote multimodal lifestyles not dependent on personal automobiles and increase overall livability (page 66).

- City Lead: Community Services
- Community Partners: Developers. Property Owners

Waste

Objective 6: Produce renewable natural gas locally from waste sources and encourage adoption of other low carbon fuels.

6.1 Develop infrastructure to locally produce renewable natural gas (RNG) as outlined in the City's Biogas Master Plan. Identify a local partner interested in purchasing RNG to retain environmental benefits within Kingston (page 77).

- City Lead: Transportation & Public Works
- Community Partners: Utilities Kingston

6.2 Increase diversion of organic waste through expansion of the City's Green Bin program (page 77).

- City Lead: Transportation & Public Works
- Community Partners: Residents

6.3 Continue to procure biodiesel for the City's transit bus fleet during its transition to low carbon transit vehicles and explore feasibility of increasing to B50 or B100 in the interim (page 77).

- City Lead: Transportation & Public Works
- Community Partners: N/A

6.4 Advocate for provincial regulations that enable tracking of industrial, commercial and institutional waste at the municipal boundary level (page 77).

- City Lead: Business, Environment, and Projects
- Community Partners: Provincial Government, Businesses, Institutions, Industry

Transportation

Objective 7: Develop active transportation connections and foster transit-oriented development to encourage a shift to sustainable modes and a reduced reliance on personal vehicle use.

7.1 Continue to implement the Active Transportation Master Plan (ATMP), creating an integrated city-wide active transportation network, neighbourhood-level connections, and programming and policy initiatives that foster a culture of active transportation (page 90).

- City Lead: Transportation & Public Works
- Community Partners: Residents, Businesses, Sustainable Kingston

7.2 Develop Official Plan policies and bylaws that focus new residential growth in dense, walkable locations that are well connected to transit. Reduce parking requirements for new residential and non-residential development along transit corridors and nodes, and promote car-sharing infrastructure that utilizes electric vehicle charging stations (page 90).

- City Lead: Community Services, Transportation & Public Works
- Community Partners: Developers

7.3 Implementing the 5-year transit planning cycle, continue to increase transit ridership through discounted transit passes, addition of express routes, reviewing 'gaps' in the transit system, and other system improvements (page 91).

- City Lead: Transportation & Public Works
- Community Partners: N/A

7.4 Promote the success of the City's remote work (telework) policy and encourage other organizations to maintain remote learning and working opportunities developed during the COVID-19 pandemic (page 91).

- City Lead: Business, Environment, and Projects
- Community Partners: Residents, Sustainable Kingston Businesses

Objective 8: Transition to electric and renewably-powered personal, municipal and commercial motorized vehicles.

8.1 Monitor charging demand and expand the City's existing network of electric vehicle charging stations. Explore partnerships for sharing of charging infrastructure for large local commercial fleets (page 96).

- City Lead: Business, Environment & Projects, Transportation & Public Works, Corporate Services
- Community Partners: Commercial Fleet Operators, Couriers, Heavy Equipment Operators, Transportation Companies

8.2 Work with Utilities Kingston and Hydro One to develop a leasing program for charging infrastructure for commercial vehicle fleets. Include low-interest loans for purchase of home smart chargers through the Kingston Home Energy Retrofit Program (page 96).

- City Lead: Business, Environment & Projects
- Community Partners: Residents, Utilities, Commercial Fleet Operators, Couriers, Heavy Equipment Operators, Transportation Companies

8.3 Encourage local car dealerships to offer electric vehicles to test drive and ensure that repair services are widely available. Hold annual or semi-annual community EV test drive days (page 97).

- City Lead: Business, Environment & Projects
- Community Partners: Sustainable Kingston, Businesses

8.4 Work with the Taxi Commission to develop minimum EV requirements for taxi and ride-share fleets (page 97).

- City Lead: Business, Environment & Projects, Community Services
- Community Partners: Taxi Commission, Taxi Operators, Kingston Economic Development Corporation

8.5 Explore and encourage a comprehensive car-sharing program in Kingston (page 97).

- City Lead: Community Services, Transportation & Public Works, Business, Environment & Projects
- Community Partners: N/A

Food and Forestry

Objective 9: Improve the vibrancy of the local food system to help reduce dependence on high carbon imported food.

9.1 Develop a local food strategy and education program in line with the City's Culinary Strategy, including support for farm-to-table initiatives and food recovery programs. Develop municipal guidelines for farmers markets, community gardens, apiaries, and edible forests. (page 109).

- City Lead: Business, Environment & Projects, Tourism Kingston
- Community Partners: Downtown Kingston, KFL&A Public Health, KFL&A Food Policy Council, Loving Spoonful, Sustainable Kingston Residents, Farmers

9.2 Further reduce emissions from transportation of food by encouraging the development of an electric delivery van sharing program. (page 109).

- City Lead: Business, Environment & Projects
- Community Partners: Sustainable Kingston, Kingston Chamber of Commerce, Farmers, Businesses

9.3 Engage with farmers markets, agricultural producers and restaurants to track local food purchases. Create and update estimates for the embodied carbon footprint of common retail food products based on their sources. (page 110).

- City Lead: Business, Environment & Projects
- Community Partners: Farmers, Businesses, Queen's University, Kingston Frontenac Lennox and Addington Public Health

