EB-2020-0293

ENBRIDGE ST. LAURENT PIPELINE

EVIDENCE OF

MICHAEL FLETCHER AND DANIEL DICAIRE

Sponsored by:

City of Ottawa
Pollution Probe
School Energy Coalition

January 17, 2022

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DIRECT EVIDENCE OF MICHAEL FLETCHER AND DANIEL DICAIRE

Q. Mr. Fletcher, can you please describe your position and role with City of Ottawa?

Michael Fletcher: My CV is included in the written materials filed, at page 10. I am currently the Climate Change and Resiliency Project Manager at City of Ottawa, and previously I was the Building Engineering and Energy Management Project Manager at City of Ottawa. In my current and previous roles at City of Ottawa, I was the lead project manager for the development of City of Ottawa's renewable energy and climate change mitigation strategy. In addition, I have firsthand experience dealing with retrofitting and energy efficiency programs at City of Ottawa. I have a B.Sc. from the University of Guelph.

Q. Mr. Dicaire, can you please describe your position and role with Ottawa Community Housing?

Daniel Dicaire: My CV is included in the written materials filed, at page 12. I am currently the Energy & Sustainability Manager at Ottawa Community Housing. In my current role, I am responsible for developing the strategy for OCH to achieve the 2040 GHG reduction goals and ensuring OCH's compliance with its new development standards for sustainability. I have a Masters in Chemical Engineering, and I have AEE certifications as an Energy Manager and a Measurement and Verification Professional. I am a P.Eng. in Ontario.

Q. What is the purpose of your evidence in this proceeding?

Mr. Fletcher: While we both have expertise in our fields, our evidence here is not based on our expert opinions. Our role is to provide the Ontario Energy Board with information on the plans by major gas users in Ottawa to reduce their GHG emissions, and in order to do so to reduce their reliance on natural gas to a fraction of their current levels.

I am in a position to discuss the reductions in gas use planned by the City of Ottawa directly in its many facilities, and the programs the City is offering and will offer in the future to assist residents and business to reduce their use of natural gas. I am also responsible to the City for coordinating with the Federal government and others who have similar gas reduction plans, so I am aware of many of those plans.

Mr. Dicaire: I am in a position to discuss the reductions in gas use planned by Ottawa Community Housing, one of the larger users of natural gas for space and water heating in the City.

Being the second-largest housing provider in Ontario, OCH provides approximately 15,000 homes to about 32,000 tenants, including seniors, parents, children, couples,

singles and persons with special needs, within many communities across the City of Ottawa. OCH is also the largest social housing provider in Ottawa and manages 80% of the City's social housing portfolio.

Q. Mr. Fletcher, let's start with you. Can you please describe the plans of the City of Ottawa to reduce GHG emissions and in the process reduce the use of fossil fuels?

Mr. Fletcher: The City's Energy Evolution program, which is included in the filed materials at page 80, was passed unanimously by Ottawa City Council in October of 2020. It aims to reduce corporate city of Ottawa emissions to zero by 2040 and community wide emissions – that is, emissions from all entities within the City of Ottawa - to zero by 2050.

Translating those GHG reduction targets to natural gas usage reductions means that, by 2050, renewable natural gas is expected to provide approximately 12% of the city's energy requirements, versus the 50% which is provided by fossil derived natural gas currently.[1]

District Heating Systems

The City, part of the National Capital Region, acts in concert with the Federal Government's GHG reduction plan in the National Capital Region. Specifically, the Energy Services Acquisition Program (ESAP), sponsored by Public Services and Procurement Canada, is modernizing the District Energy System (DES), which provides heating services to over 80 buildings and cooling services to 67 buildings in the National Capital Region, accommodating more than 55,000 occupants. The modernization of the downtown Federal district heating system will eliminate the vast majority of natural gas use on this system.[2] The ESAP plans to reduce GHG emissions in the National Capital Region to 35% of 2005 baseline by 2025 and to less than 10% by 2030. Most prominent in these changes is the Cliff St heating and cooling plant, which is located in the St. Laurent area. At this location, conversion of the heating systems from steam to hot water is projected to reduce GHG emissions by 87% by 2025, with almost all of this reduction coming from reductions in natural gas use. As such, the implementation of the ESAP will materially reduce natural gas use in the St. Laurent pipeline area.

Low GHG emission buildings and Retrofitting Programs

The sector that carries the biggest share of the reduction burden is buildings operated by the City of Ottawa or in the Ottawa community in general, which historically relied on gas supplied by pipelines as their primary source of energy for space and water heating.

[1] Figure 9 and Figure 10 of Energy Evolution, p. 121.
[2] PSPC Presentation, p. 184.

GHG reduction programs are already in action. The following table is a reproduction of Table 15 from Energy Evolution, which shows the programs that are already or will be undertaken from 2020 to 2025 in the building sector. More importantly, GHG reduction programs have already achieved noticeable results, at least in the context of corporate City of Ottawa reductions. Between 2012 and 2020, corporate emissions decreased by 43%, already exceeding the short-term target to reduce emissions by 30 per cent below 2012 baseline levels by 2025. (Figure 6, P20-21 of CCMP).

The near-term reductions in emissions for the period 2020-25 include the following:

Project Description	Project Metrics	Cumulative GHG Reduction
Residential Building Retrofit Accelerator Program to accelerate residential, multi-unit residential, and commercial and institutional building retrofits through marketing, information and financial mechanism	• 17% of existing residential buildings renovated or replaced • 20% of existing residential buildings transition to heat pumps • 10% of domestic hot water heating transitions to non-emitting sources	22% (222 kt CO2 e)
Commercial Building Retrofit Accelerator Program to accelerate multi-unit residential, commercial, industrial, and institutional building retrofits through marketing, information and financial mechanisms	• 15% of existing commercial buildings renovated or replaced • 20% of existing commercial buildings transition to heat pumps • 10% of domestic hot water heating transition to non emitting sources	18% (175 kt CO2 e)
Building Retrofits through Local Improvement Charge Program to accelerate and finance deep energy retrofits of buildings through the local improvement charge mechanism	Embedded within the residential and commercial building retrofit accelerator programs	

Energy Community Improvement Plans to incentivize superior energy performance and deep energy retrofits using tax grants	Embedded within the residential and commercial building retrofit accelerator program	
Community Building Heating Strategy to address infrastructure and utility requirements for new ways of heating buildings	30% drop in GHG intensity of federal district energy system	9% (92 kt CO2 e)
Municipal Buildings Renewal and Retroft Program to achieve higher building energy performance improvements in municipal owned buildings	Ramping towards having 27% of municipal buildings net zero by 2030	1% (12 kt CO2 e)
Update to Municipal Green Building Policy to align with corporate GHG reduction targets	Embedded within the Municipal Buildings Renewal and Retrofit Program	
High-Performance Development Standard to improve building design and construction across the community and support an industry-wide transition of new buildings to net zero emissions ready by 2030	Ramping towards all new buildings being net zero energy by 2030	6% (59 kt CO2 e)

In long run the City of Ottawa has identified and adopted 39 GHG reduction programs in order to achieve the 100% reduction objective. Among the top five actions include retrofitting residential buildings, which includes retrofitting pre- and post-1980 homes, low rise residential and apartment building heat pumps buildings, and retrofitting commercial buildings, which includes retrofitting commercial, office, residential buildings and commercial building heat pumps.[3]

[3] Table 13, p 29, Energy Evolution

The City Buildings Renewal and Deep Retrofit program calls for renewals and deep retrofits of city buildings, which will reduce thermal energy demand by 60 to 70% and replace most existing gas heating systems with heat pumps. Participating facilities of this program in the St. Laurent area will potentially result in 4,161,477 m^3 annual natural gas reduction. Included at page 183 of the attached materials is a list of buildings subject to this program and relevant to the St. Laurent area, as well as their annual total potential reduction in natural gas use.

One of the largest users of natural gas in this list is the OC Transpo bus garage facilities. Those facilities use a significant amount of natural gas due to the need to vent diesel fumes from the garages. The City is transitioning to an all-electric bus fleet, with the result that natural gas use in these facilities will drop to a fraction of its current level, and eventually to zero.

The overview for the City Buildings Renewal program was approved as part of the Energy Evolution program in October 2020, and it includes a costing and resource estimate. Currently a draft of a charter to launch this program has been completed, and a pilot deep retrofit on one city building has been started. The pilot is making use of funding from Infrastructure Canada's Green and Inclusive Buildings program, and plans to continue to make use of this funding to leverage City finances.

The City's building sector programs are also acting in concert with the Federal Government's Greening Government Strategy. The government has committed to very low GHG emissions in buildings under its Greening Government Strategy.[4] In the area served by the St. Laurent pipeline, this will impact the RCMP headquarters, the National Research Council campus on Montreal Road, as well as the buildings and grounds of the Governor General's estate. Crown corporations in this area such as the Aviation Museum and the Via Rail Station on Tremblay Road are also recommended to follow the Greening Government Strategy.

The City also currently provides financial incentives to residents to participate in energy efficiency programs. The Better Loan Homes program is run by the city of Ottawa, and allows city residents to make energy improvements including insulation, windows and heat pump installation on their homes, and recoups the loans on residential property tax bills. The program was launched in late November 2021 and already has over 250 applications.[5]

Lastly, the City of Ottawa has also applied for and received COVID stimulus funding, which will be used to improve energy the performance of city buildings. Related to gas consumption, we will be installing ultra-high-performance windows as part of this

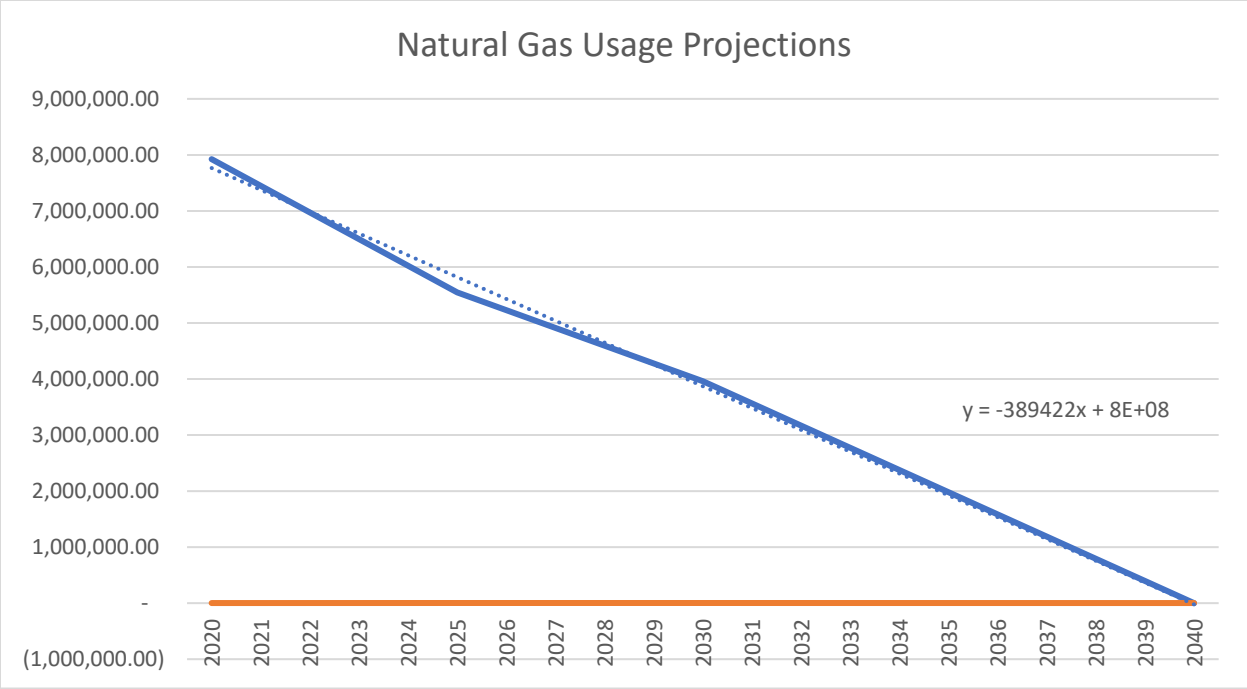
[4] https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/strategy.html#toc3-1
[5] p.22 Climate Change Master Plan

project. This will see the thermal resistance value of windows increase from a typical value of R-2.5 to R-11 or greater in the area served by the St. Laurent pipeline. The sites involved include Ottawa City Hall and the Overbrook Community Center.

Q. Mr. Dicaire, can you please describe the plans of Ottawa Community Housing to reduce GHG emissions and in the process reduce the use of fossil fuels?

Mr. Dicaire: As a subsidiary of the City of Ottawa, OCH is committed to the City's Climate Change Master Plan and the City's 100% GHG reduction goal in 2040. OCH has adopted a strategy similar to the City's building sector programs to achieve its zero emission goal: i.e. deep retrofitting and phasing out of natural gas energy equipment in OCH buildings. The Board of Directors of OCH has approved its plan to achieve zero GHG emission in 2040. OCH continues to secure resources from our community partners and government fundings. At this point, programs responsible for 25% of our GHG reduction targets have already been funded.

Within the area serviced by the St. Laurent Pipeline, OCH operates 78 buildings consisting of 5,974 units. The total current consumption of natural gas by these units is 7,924,281, and OCH expects to reduce that to zero by 2040 through aggressive implementation of its current plan.



Q. Mr. Fletcher, back to you. We see here a letter in your materials (at page 211) from Bruyere Continuing Care. Can you describe that for the Board?

Mr. Fletcher: Bruyere Continuing Care is a healthcare organization with three sites providing continuing care, palliative care, and other health care and assisted living services to almost a thousand patients/residents at any given time. They have more than 875,000 square feet of space under their management, more than two thousand staff and six hundred volunteers. They are a major natural gas user for space and water heating. In their letter, they confirm that they are onside with the City's plans to reduce emissions and reduce natural gas use.

Bruyere is just one example of many organizations that are actively reducing their reliance on fossil fuels. The University of Ottawa is another such organization. I am aware that their GHG and fossil fuel reduction plans, while still evolving, are in line with the targets and directions of the City. Many office, institutional and industrial landlords and other building owners in the City are also implementing such plans.

Part of my job is to co-ordinate with these other organizations to ensure that, together, we will reduce and eventually eliminate our reliance on fossil fuels, particularly for space and water heating, and make the City of Ottawa net zero by 2050.

This is admittedly not easy, as can be seen when you look at the details of the City's plans. There are places where we don't know what the specific solution will be, or we know the possible solutions but not how to finance the cost. On the other hand, it is the City's plan to get there anyway, and over the past decade we have demonstrated that we can meet and exceed the goals we have set, despite the challenges.

Q. Mr. Fletcher and Mr. Dicaire, do you have anything further to add?

Mr. Fletcher: No.

Mr. Dicaire: No.

MICHAEL FLETCHER

PROFILE

A resourceful and results-oriented professional with 30 years of success in progressively more challenging roles in process industries and asset management. Effective leadership and managerial abilities supported by strong communications, problem solving, analytical and decision-making skills. Solid experience in championing change, integrating technology into operations, and reduction of all consumables. Expertise in four types of fermentation. Bilingual, English and French.

EMPLOYMENT HISTORY

CITY OF OTTAWA, Ottawa, Ontario Sept 2012- Current

Project Manager, Climate Change and Resiliency (From April 2019)

- Technical leader in the development of the City of Ottawa's renewable energy and climate change mitigation strategy

Project Manager, Building Engineering and Energy Management (Until April 2019)

- Benchmark and audit city facilities for energy and water efficiency. Audits are done cooperatively with facility staff.
- Leading energy retrofit projects involving lighting, boilers, control and HVAC. Ensure proper commissioning that includes training of facilities staff, realization of planned benefits
- Managing all City of Ottawa electrical accounts (1340 in total). Maintain an account checking system. Working with Hydro Ottawa on a project to introduce bulk e-billing.
- Currently leading projects in electrical demand response and the monitoring of City remote sites in rural Ottawa.

IOGEN CORPORATION, Ottawa, Ontario 2003-May 2012

Senior Manager Utilities and Engineering 2010 to 2012.

Led utility and project teams in the Iogen Ottawa plant.

- Championed energy conservation activities resulting in over $300k in utility savings in the 2012 fiscal year – this was ahead of target and represented a 12% savings.
- Led two new product introductions in the enzyme plant. The introductions involved new equipment (commissioning of solid / liquid centrifuges) and new operating procedures.
- Led initiatives to increase the reliability of plant services. Reduced forced outages over 50% through continuous improvement and expansion of the maintenance PM program.
- Managed a wide variety of plant projects, in safety, utilities and process. Developed a chiller system upgrade proposal that minimized capital expenditure while ensuring excellent energy conservation results. Obtained $86,000 in conservation incentives for Iogen.

Manager, Operational Readiness – March 2009 - 2010

Worked in a small team with the operations director, business systems analyst and project HR manager to target a fault free start-up of the first commercial plant.

- Developed plans for energy purchasing and sales (plans called for power exports).
- Employed Shell and Iogen management systems to ensure that a prospective Saskatchewan cellulose ethanol plant and an Ottawa enzyme plant would be ready on the start up date.
- Reviewed plant designs for safety using Shell level of protection (LOPA) analysis. Led plant reliability and turn around modeling.
- Developed manpower and training plans, and design packages in multi-disciplinary teams.

Enzyme Plant Manager – March 2008 - March 2009

Responsible for: utilities, operators, (16 employees), enzyme production planning, warehousing and logistics, and process engineering

- Changed production planning to move electrical consumption into lower price periods.
- Engaged with the Ministry of Labour. Updated lockout and permit to work procedures.

Assistant Plant Manager – 2007, 2008

Led all production planning, maintenance, process engineering and capital projects up to two million dollars in the plant.

- Planned and implemented a rush two million dollar capital investment required to increase enzyme plant capacity. The installation factor for the project was kept below two in a brownfield installation. Project safety and operator buy-in exceeded expectations.
- Implemented a program to divert enzyme plant solid waste to farm based anaerobic digesters.

Ethanol Operations Manager 2006-2008

Led the operators team (20 employees) and the ethanol plant process engineers

- Made changes to the fermentation area to align its operations to the plans for a commercial plant. Installed the first hybrid nozzle / bowl opening centrifuge in North America.
- Resolved a persistent ethanol quality problem unique to cellulose ethanol.

Supervisor, Plant Process Engineering – 2003 – 2006

Led a team of eight process engineers responsible for various unit operations in the enzyme and ethanol plants

- Implemented an engineering management of change procedure to enhance process safety
- Active participant or leader in all cross – functional technical teams.
- Led a project to introduce a toll produced enzyme product to the plant. Project aspects included regulatory approval, equipment changes, client business relationship and cost accounting.
- Commissioned the fermentation and distillation areas. Resolved contamination issues.

EDUCATION / PROFESSIONAL DEVELOPMENT

- Bachelor of Science in Agriculture. Major in Microbiology, Minor in Food Science. University of Guelph - 1988

Professional and technical development:

- Leadership through Team Building and Business Analysis courses - York University, Schulich School of Business
- "Communicate with Power", Media training course – McLoughlin Media
- Supervisory Development Program – University of Guelph extension education
- Dupont safety course and several Industry Accident Prevention Association courses
- Past President – Master Brewers Association of Canada

Daniel Dicaire

P.Eng, C.E.M., C.M.V.P. WELL AP

CERTIFICATION	EDUCATION	PUBLICATIONS	AWARDS
AEE Certified Energy Manager **AEE Certified Measurement and Verification Professional** **WELL Accredited Professional** **Professional Engineers Ontario** **Canadian Passive House Institute: Passive House Designer Course**	**M.A.Sc. Chemical Engineering,** Solar Thermal Energy Storage, University of Ottawa - 2008-2010 **B.A.Sc. Chemical Engineering,** Environmental Engineering Specialization, *summa cum laude*, University of Ottawa - 2003-2007 **Entrepreneurship Edge** - OCRI 2009	"Wireless Heating Management System and Tenant Usage Behavior in Bulk-Metered Apartment Buildings: A Case Study" *ASHREA* (Jan 2017) "Save Energy and Extend Building Life— Window and Balcony Door Replacements" *CMHC* (Dec 2016) **LANGUAGES** **English (Fluent)** **French (Fluent)**	**Ottawa Community Housing Net-Zero PEER Pilot - Clean50 Top Project 2022** **2020 Young Energy Professional of the Year for Canada -** Association of Energy Engineers **Clean50 Emerging Leaders Award 2016**

Relevant Work Experience

Manager, Energy & Sustainability, Ottawa Community Housing (OCH), Mar. 2018 – Present

OCH 2040 Climate Change Compliance Plan (for existing buildings)

- Analyzing utility and greenhouse gas (GHG) inventory of 17M sqft portfolio on annual basis
- Developing portfolio compliance strategy to meet net-zero GHG emissions by 2040
- Developing capital strategy to achieve 25% GHG (7,800 tons) & utility reduction targets
- Applying to CMHC to secure $220M of funding for the next 8 years of capital planning
- Developing strategy for $750M of funding to address 75% (22,000 tons) of emissions

OCH Sustainable Development Plan (for new buildings)

- Developed guiding principles of sustainability for OCH's developments, including Passive House standard, WELL Building Standard, and Zero Carbon Standard
- Managing implementation of sustainability standards during concept design, design development, and construction phases
- Managed sustainability standards and Passive House requirements for:
    - 1290 Coldrey (WELL Standard) - 40,000 sqft
    - 811 Gladstone - 130,000 sft
    - 715 Mikinak (CaGBC Zero Carbon w/ campus district utility) - 300,000 sqft
    - In design - 818 Gladstone (campus district utility) - 250,000 sqft
    - In design - 933 Gladstone (district energy system) - 350,000 sqft

Presland Net-Zero Energy Retrofit

- Lead research project with NRCan to retrofit a 4 unit block of townhomes to net-zero energy and GHG emissions. Foundation, exterior walls and roof were over-cladded with prefabricated insulated panels to achieve EnerPHit retrofit standard
- Managed mechanical contractors to retrofit natural gas equipment with air-source heat-pumps
- Time Lapse Video of Project: 211110 Final Timelapse with Energuide.mp4
- Managed electrical contractor to upgrade system and install 34.8 kW solar PV array.

Energy & Sustainability Officer, Ottawa Community Housing – June 2010 – Mar. 2018

OCH Sustainability Framework

- Developed and lead the implementation of OCH's Green Plan (2011-2015) and OCH's Eco2Plan
- Managed the Green Fund annual plan and budget, which has grown from $1M (2010) to over $5M (2018), while providing $1-$2M of annual endowment for various sustainability initiatives
- Secured over $14M of grants, incentives, and in-kind work
- Supported Capital Planning with additional applications for over $35M of grants (REI, SHARP, SHAIP)
- Managed sustainability projects leading to over $45M of cumulative utility savings

Implementation of OCH's Utility Management System (Energy Cap)

- Lead implementation of EnergyCap to manage OCH's $23M of annual utility costs
- Implemented a bill import automation process for over 7,000 monthly utility bills that were previously manually entered
- Facilitated an interdepartmental team (Tenant Services, IT, Finance, Asset Management) to develop a scope of work and tender documents

Implementation of Renewable Energy Initiative 500kW of solar photovoltaic generation

- Lead the restructuring of OCH's Renewable Energy Initiative project and secured $3.7M of funding
- Supported and coached the project managers throughout the implementation of 300 kW of solar array across 32 sites
- Partnered with HydroOttawa and SPARQ to have 200kW of solar arrays donated and managed the implementation across 3 sites
- Developed and implemented ongoing monitoring and maintenance for $4.5M of solar assets, which generate over $350K of revenue annually

Portfolio-wide in-suite plumbing retrofit (15,000 units)

- Coordinated implementation of the retrofit in over 15,000 units and ensured all parts were recycled
- Developed maintenance and warranty protocols across multiple districts for 10 years of free parts
- Reduced OCH's water consumption by 40% by retrofitting plumbing fixtures: 1.6M m^3 of water annually (approx. $6M)

Portfolio-wide LED lighting retrofit

- Identified hazardous chemical risk and improper disposal practices that were a liability for OCH
- Planned multi-year roll-out and managed installation schedule of 30,000 fixtures
- Developed maintenance and warranty protocols across multiple districts for 5 years of free parts
    - Reduced consumption by 4.6 GWh of electricity saved annually (approx. $600,000)

Recent Conference Presentation Experience

- Canadian Consulting Engineering Better Buildings PodCast: Prefabricated Panels for Energy-Efficient Building Envelopes
- Net-Zero and Deep Energy Retrofits in Community Housing
  Federation of Canadian Municipalities - 2020 Sustainable Communities Conference
- The Passive House Path to Affordability
  Ontario Not-For-Profit Housing Association - 2019 Regeneration Forum
- Energy Efficiency Strategy for New Social Housing (Re)Developments
  Association of Energy Engineers - 2019 World Energy Engineering Congress

Leadership, Collaboration, and Team Building Experience

- Energy Management Program Advisory Committee (PAC) at Algonquin College Centre for Construction Excellence (ACCE)
- Chief Returning Officer, Civic Institute of Professional Personnel; 2016-2018
- Joint Health and Safety Representative, Civic Institute of Professional Personnel, 2015-2018

SUBJECT: Climate Change Master Plan - Annual Greenhouse Gas Inventories and Status Update

File Number ACS2021-PIE-EDP-0039

Report to Standing Committee on Environmental Protection, Water and Waste Management on 19 October 2021

and Council 27 October 2021

Submitted on October 7, 2021 by Don Herweyer, Director, Economic Development and Long Range Planning

Contact Person: Jennifer Brown, Project Manager – Environmental Programs, Planning, Infrastructure, and Economic Development Department

613-580-2424 ext 27914, jennifer.brown1@ottawa.ca

Ward: CITY WIDE / À L'ÉCHELLE DE LA VILLE

OBJET : Plan directeur sur les changements climatiques – Inventaires annuels des émissions de gaz à effet de serre et rapport d'étape

Dossier : ACS2021-PIE-EDP-0039

Rapport au Comité permanent de la protection de l'environnement, de l'eau et de la gestion des déchets

le 19 octobre 2021

et au Conseil le 27 octobre 2021

Soumis le [6 octobre 2021 par Don Herweyer, Directeur, Développement économiqueet Planification à long terme, Direction générale de la planification, de l'infrastructure et du développement économique

Personne ressource : Jennifer Brown, Développement économique et Planification à long terme

613-580-2424, 27914, jennifer.brown1@ottawa.ca

Quartier : CITY WIDE / À L'ÉCHELLE DE LA VILLE

REPORT RECOMMENDATIONS

That the Standing Committee on Environmental Protection, Water and Waste Management recommend that Council:

1. **Receive the annual status update on the Climate Change Master Plan, including the 2020 greenhouse gas emissions inventories attached as Document 1 and updates on the Climate Change Master Plan eight priority actions as summarized in this report; and**

2. **Approve that the 2020 Hydro Ottawa dividend surplus of $800,000 be used to fund the proposed spending plan attached as Document 3 and summarized in this report.**

RECOMMANDATIONS DU RAPPORT

Que le Comité permanent de la protection de l'environnement, de l'eau et de la gestion des déchets recommande ce qui suit au Conseil :

1. **prendre connaissance du compte rendu de situation annuel relatif au Plan directeur sur les changements climatiques, notamment les inventaires des émissions de gaz à effet de serre de 2020 reproduits dans le document 1 et les comptes rendus sur les huit mesures prioritaires selon le résumé de ce rapport; et**

2. **approuver l'utilisation de l'excédent des dividendes d'Hydro Ottawa de 2020, qui s'élève à 800 000 $, aux fins du financement du plan de dépenses proposé dans le document 3 ci-joint et résumé dans le présent rapport.**

EXECUTIVE SUMMARY

Assumption and Analysis

This report includes:

- Results of the 2020 community and corporate greenhouse gas (GHG) inventories
- Annual status update on the Climate Change Master Plan's eight priorities
- A spending plan of $800,000 for the 2020 Hydro Ottawa dividend surplus funds

In January 2020, Council approved the Climate Change Master Plan, the overarching framework for how Ottawa will mitigate and adapt to climate change over the coming

decades. As part of the approved plan, staff committed to providing an annual update on the climate change framework that includes the latest GHG inventories and how Ottawa is tracking towards achieving the GHG emission reduction targets, and a status update on the eight priorities. The eight priorities are:

1. Implement Energy Evolution: Ottawa's Community Energy Transition Strategy.
2. Undertake a climate vulnerability assessment and develop a Climate Resiliency Strategy.
3. Apply a climate lens to the new Official Plan and its supporting documents.
4. Apply a climate lens to asset management and capital projects.
5. Explore the feasibility of setting corporate carbon budgets, including piloting them in a small portion of the organization.
6. Explore carbon sequestration methods and the role of green infrastructure.
7. Encourage private action through education, direct and indirect incentives, municipal support, and advocacy for support of individuals and private organizations by senior levels of government.
8. Develop a governance framework to build corporate and community capacity, align priorities, and share accountability in tackling climate change.

The last Climate Change Master Plan update was received by Council in January 2021.

Progress towards achieving the GHG emission reduction targets

The latest community and corporate inventories are for the 2020 calendar year. Community inventories track emissions from activities taking place within the geographic boundaries of the City of Ottawa. Corporate inventories track emissions under municipal operational control within the corporate organizational structure.

Between 2012 and 2020, community emissions decreased 15 per cent (Figure 1) and per capita emissions decreased from 7.1 tCO_2e per person in 2012 to 5.6 tCO_2e per person in 2020. Historically, this decline in emissions has been attributable to the provincial phase out of coal plants and a significant reduction in emissions from electricity generation and consumption. However, starting in 2020, the COVID-19 pandemic also played a significant role in reducing GHG emissions, particularly within the transportation sector which saw a 30 per cent drop in gasoline fuel use between

2019 and 2020. Roughly 90 per cent of community emissions are attributable to the buildings (primarily for building heating) and transportation sectors, a trend that has been consistent since 2012, and natural gas consumption was the largest contributing source of emissions.

In order to meet Ottawa's short term and mid-term targets to reduce emissions by 43 per cent by 2025 and 63 per cent by 2030, respectively, the community will need to reduce emissions by 5 to 6 per cent a year over the next five to ten years. It is expected that the drop in community emissions due to the COVID-19 pandemic will not be sustained once the virus is under control and that emissions will rebound if there are no additional actions or investments to achieving Ottawa's GHG emission reduction targets. In 2020, Council approved new GHG reduction targets and Energy Evolution, the action and investment framework for achieving these targets. Staff have been working on developing and launching plans, policies, and programs that will directly impact or influence emission reductions; however, given that Energy Evolution was only approved one year ago and that many of these policies, programs, and plans are still in development, it will take time for these initiatives to have an effect. Staff do not expect to see a significant reduction in the next two to three GHG inventories, particularly on the community side. This is due to the number, scale and complexity of the projects required to achieve Council's targets, as well as factors outside the City's control, including policy decisions by senior levels of government and the availability of funding and market solutions. Staff will continue to report on how Ottawa is tracking towards community and corporate GHG reduction targets and provide status updates on the Climate Change Master Plan including initiatives to reduce emissions in the community and within municipal operations.

Corporate emissions decreased 43 per cent between 2012 and 2020, currently exceeding the short-term target to reduce emissions 30 per cent below 2012 baseline levels by 2025. This decrease in emissions remains primarily due to the significant decline in emissions in the solid waste sector which can be attributed to the considerable efficiencies made at the Trail Road Waste Facility. The remaining emission reductions can be attributable to a decrease in fuel consumption within fleet, specifically transit fleet which saw a 20 per cent drop in diesel fuel consumption from busses between 2019 and 2020, and a reduction in emissions from facilities. The largest contributing sector to total corporate emissions was transit fleet, which accounted for 44 per cent of the total (although emissions did decline in the transit fleet from 2019). Directly related, diesel consumption was the largest contributing source of emissions, accounting for 51 per cent of total corporate emissions. Given the planned

acquisition of electric buses and energy efficiency improvements to City facilities in the coming years, staff expect that the corporation will stay on track and meet the 2025 target.

Status Update on the Climate Change Master Plan Priorities

Key achievements that supported the advancement of the Climate Change Master Plan priorities since the last update in January 2021 include:

- Climate considerations embedded throughout the New Official Plan, Master Plans (including the Parks and Recreation Master Plan that was approved by Council in September 2021), and Asset Management Plans for water, wastewater, stormwater, and transportation.
- Council approved purchasing up to 450 zero emission buses by 2027 and transitioning to a fully zero emission bus fleet by 2036 (based on funding availability and operational needs).
- Council approved the Better Homes Ottawa – Loan Program whereby homeowners can access financing to pay for home energy improvements and help reduce GHG emissions (program to launch fall 2021).
- Council received Phase 2 of the Solid Waste Master Plan and approved the Plan's vision statement, guiding principles and goals which support the City's Climate Change Master Plan and associated priorities.
- The City has installed a Level 2 charging station at the renovated Lois Kemp Arena (Blackburn), is installing 12 double-headed Level 2 charging stations in the right-of-way across the city and will install a 150 kW charging station at Bob MacQuarrie Recreation Complex.
- The climate vulnerability and risk assessment is underway in collaboration with internal and external stakeholders. More than 100 potential climate impacts are being assessed across a range of sectors and for key City assets such as the drinking water and wastewater treatment plants.
- A new Climate Implications section has been added to the standard report template to demonstrate how climate change issues have been considered in the development of the project, policy, program, or plan.

- Significant funding in external loans and grants was committed to support climate change mitigation efforts, including funding for zero emission buses and for the Better Homes Ottawa – Loan Program. Four additional funding applications and nine letters of support were submitted (decisions pending) to encourage private action

Staff will continue to work towards achieving the eight priorities under the Climate Change Master Plan and the following reports are anticipated to be tabled at Committee and Council before the end of 2022.

- High-Performance Development Standard
- Corporate Green Building Policy Update
- Personal Electric Vehicle Strategy
- Corporate Electric Vehicle Policy Update
- Update to Municipal Green Fleet Plan
- Draft Solid Waste Master Plan
- Part 1 of Transportation Master Plan Update (Policy)
- Carbon Accounting Tool Framework
- Climate Vulnerability and Risk Assessment
- Asset Management Plans for core infrastructure (water, wastewater, stormwater, and transportation) with consideration given to climate implications

2020 Hydro Ottawa dividend surplus spending plan

Document 3 includes a spending plan for $800,000 to be funded through the 2020 Hydro Ottawa dividend surplus funds. The spending plan proposes funding to support 6 of 20 Energy Evolution priority projects, leverage federal and provincial funds where possible, and implement energy efficiency,conservation, and renewable energy generation projects.

Financial Implications

Recommendation 1: There are no direct financial implications associated with receiving the status update.

Recommendation 2: Funds are available from the 2020 Hydro Ottawa dividend surplus. Pending Council approval of the proposed spending plan, budget authority of $800,000 will be added to 908880 Energy Evolution, 100 per cent funded from the dividend surplus.

Public Consultation/Input

No public consultation was required for this status update report. Public consultation will be incorporated into each of the relevant projects, where applicable.

RÉSUMÉ

Hypothèse et analyse

Le présent rapport comprend :

- les inventaires des émissions de GES communautaires et municipales de 2020
- le rapport d'étape annuel sur les huit mesures prioritaires du Plan directeur sur les changements climatiques
- un plan de dépenses de 800 000 $ provenant de l'excédent des dividendes de 2020 d'Hydro Ottawa

En janvier 2020, le Conseil a approuvé le Plan directeur sur les changements climatiques, un cadre général orientant les efforts que déploiera Ottawa pour atténuer les effets des changements climatiques et s'y adapter au cours des prochaines décennies. À cette occasion, le personnel s'est engagé à présenter un rapport d'étape annuel sur ce cadre, rapport devant comprendre les plus récents inventaires des GES et indiquer les progrès d'Ottawa relativement aux cibles de réduction des émissions de GES, ainsi qu'un rapport d'étape sur les huit mesures prioritaires suivantes :

1. Mettre en œuvre la stratégie « Évolution énergétique : la stratégie de la collectivité d'Ottawa pour la transition énergétique ».
2. Mener une évaluation de la vulnérabilité climatique et mettre au point la Stratégie de la résilience climatique.
3. Appliquer l'optique des changements climatiques au nouveau Plan officiel de la Ville et à ses documents complémentaires.
4. Appliquer l'optique des changements climatiques à la gestion des biens et aux projets d'immobilisation.

5. Étudier la faisabilité d'établir des budgets carbone pour la municipalité, y compris leur mise à l'essai dans une partie restreinte de l'organisation.

6. Examiner des méthodes de séquestration du carbone et le rôle des infrastructures vertes.

7. Encourager les initiatives privées par l'éducation, les mesures incitatives directes et indirectes, le soutien municipal et la défense du soutien des individus et des organisations privées par les paliers supérieurs de gouvernement.

8. Définir une structure de gouvernance afin de renforcer la capacité de la municipalité et de la collectivité à faire face aux changements climatiques, d'harmoniser les priorités des divers intervenants et de partager la responsabilité.

La dernière mise à jour du Plan directeur sur les changements climatiques a été transmise au Conseil en janvier 2021.

Progrès dans l'atteinte des cibles de réduction des émissions de GES

Les plus récents inventaires des émissions de GES communautaires et municipales se rapportent à l'année civile 2020. Les inventaires communautaires permettent de faire le suivi des émissions issues des activités réalisées à l'intérieur des limites géographiques de la ville d'Ottawa. Les inventaires municipaux servent à suivre les émissions relevant du contrôle opérationnel d'une municipalité au sein de la structure organisationnelle municipale.

Entre 2012 et 2020, les émissions communautaires ont chuté de 15 pour cent (figure 1) et celles par habitant ont diminué de 7,1 tonnes d'éq. CO_2 par personne en 2012 à 5,6 tonnes d'éq. CO_2 par personne en 2020. Historiquement, cette baisse des émissions est attribuable à la fermeture, dans l'ensemble de la province, des usines de charbon, ainsi qu'à une réduction importante des émissions causées par la production et la consommation d'électricité. À partir de 2020 cependant, la pandémie de COVID-19 a joué un rôle important dans la réduction des émissions de GES, en particulier dans le secteur du transport, qui a enregistré une baisse de 30 pour cent de l'utilisation d'essence entre 2019 et 2020. Environ 90 pour cent des émissions communautaires sont imputables aux secteurs des bâtiments (essentiellement pour le chauffage) et des transports, une tendance qui se maintient depuis 2012, la consommation de gaz naturel étant la plus grande *source* d'émissions de GES.

Quant aux émissions municipales, elles ont diminué de 43 pour cent de 2012 à 2020, une baisse qui dépasse actuellement l'objectif à court terme (d'ici 2025) de réduire ce type d'émissions de 30 pour cent par rapport aux valeurs de référence de 2012. La principale cause de la baisse des émissions demeure la diminution marquée des émissions générées par le secteur des déchets solides, que l'on peut attribuer aux importants gains d'efficacité réalisés à la décharge contrôlée du chemin Trail. Les autres réductions d'émissions peuvent être attribuables à la baisse de la consommation de carburant par le parc automobile, plus particulièrement le transport en commun, qui a enregistré une baisse de 20 pour cent de consommation de carburant diesel par les autobus en 2019 et 2020, et à une réduction des émissions provenant des installations. Le parc automobile est le secteur contribuant le plus aux émissions municipales, représentant 44 pour cent des émissions totales (malgré une baisse des émissions provenant du transport en commun depuis 2019). Directement liée au parc automobile, la consommation de carburant diesel s'avère la principale source d'émissions de GES, représentant 51 pour cent de toutes les émissions municipales. Les émissions municipales ont représenté environ quatre pour cent de toutes les émissions communautaires en 2020.

Dans les années qui viennent, on s'attend à ce que la baisse des émissions communautaires attribuable à la pandémie de COVID-19 ne se poursuive pas lorsque le virus sera sous contrôle, et que les émissions repartiront à la hausse sans mesure ou investissement supplémentaire pour atteindre l'objectif d'Ottawa en matière de réduction des émissions de GES. En 2020, le Conseil a approuvé de nouveaux objectifs et le plan d'action et d'investissement Évolution énergétique, qui devrait permettre d'atteindre ces objectifs. Le personnel de la Ville a travaillé à l'élaboration et à la mise en place de plans, de politiques et de programmes qui auront une incidence ou une influence directe sur la réduction des émissions; mais puisque Évolution énergétique a été approuvé voilà à peine un an et que bon nombre de ces politiques, programmes et plans sont toujours en cours d'élaboration, il faudra encore patienter pour constater les effets de ces initiatives. Le personnel ne prévoit aucune réduction significative au cours de deux ou trois prochains inventaires des émissions de GES, en particulier les émissions communautaires. Cela s'explique par le nombre, l'échelle et la complexité des projets nécessaires pour atteindre les objectifs du Conseil, et par des facteurs échappant au contrôle de la Ville, comme les décisions stratégiques prises par les paliers supérieurs du gouvernement et la disponibilité de fonds et de solutions de marché. Le personnel entend continuer de rendre compte du suivi que la Ville d'Ottawa fait des objectifs de réduction des émissions communautaires et municipales de GES, et de fournir des rapports d'étapes sur le Plan directeur sur les changements

climatiques, notamment sur les initiatives mises en place pour réduire les émissions dans la collectivité et dans le cadre des opérations municipales.

Rapport d'étape sur les mesures prioritaires du Plan directeur sur les changements climatiques

Voici les principales réalisations qui ont favorisé les mesures prioritaires du Plan directeur sur les changements climatiques **depuis la dernière mise à jour datant de janvier 2021 :**

- Considérations d'ordre climatique intégrées dans le nouveau Plan officiel, les plans directeurs (notamment le Plan directeur des parcs et des loisirs approuvé par le Conseil en septembre 2021) et les plans de gestion des actifs visant l'eau, les eaux usées, les eaux pluviales et le transport.

- Le Conseil a approuvé l'achat d'autobus à émission zéro, dont le nombre pourrait atteindre 450 d'ici à 2027, et la transition vers un parc d'autobus entièrement à émission zéro d'ici à 2036 (en fonction des fonds disponibles et des besoins opérationnels).

- Le Conseil a approuvé le programme de prêts pour la mise en valeur des habitations, qui permet aux propriétaires d'avoir accès à un financement qui les aidera à payer les améliorations énergétiques de leur logement et à réduire les émissions de gaz à effet de serre (programme lancé à l'automne 2021).

- Le Conseil a reçu la Phase 2 du Plan directeur de la gestion des déchets solides et a approuvé l'énoncé de la *vision*, les principes directeurs et les objectifs qui soutiennent le Plan directeur sur les changements climatiques de la Ville et les priorités qui y sont associées.

- La Ville a installé une borne de recharge de niveau 2 à l'aréna Lois-Kemp (Blackburn), récemment rénové, installe actuellement 12 bornes de recharge doubles de niveau 2 dans des emprises un peu partout en ville et compte installer une borne de recharge de 150 kW au Complexe récréatif Bob-MacQuarrie.

- La vulnérabilité climatique et l'évaluation des risques est en cours, en collaboration avec des intervenants internes et externes. Plus d'une centaine d'incidences possibles sur le climat, qui toucheraient divers secteurs et des

infrastructure municipales importantes, comme les installations d'eau potable et d'épuration des eaux usées, sont en cours d'évaluation.

- Une nouvelle section consacrée aux répercussions climatiques a été ajoutée au modèle de rapport type, afin de démontrer comment les enjeux du changement climatique ont été pris en compte dans l'élaboration du projet, de la politique, du programme ou du plan dont fait l'objet le rapport.
- Un financement important de prêts et de subventions externes a été attribué pour soutenir les efforts d'atténuation du changement climatique, y compris le financement des autobus à émission zéro et celui du programme de prêts pour la mise en valeur des habitations. Quatre autres demandes de financement et neuf lettres de soutien ont été présentées (les décisions sont attendues) pour encourager les initiatives privées.

Le personnel continuera de travailler à l'atteinte des huit mesures prioritaires du Plan directeur sur les changements climatiques, et les prochains rapports devraient être soumis au Comité et au Conseil d'ici la fin de 2022.

- Norme d'aménagement d'immeubles à haut rendement énergétique
- Mise à jour de la Politique de la Ville sur les bâtiments écologiques
- Stratégie sur les véhicules électriques personnels
- Mise à jour de la Politique de la Ville sur les véhicules électriques
- Mise à jour du *Plan* vert du parc de véhicules municipaux
- Version provisoire du Plan directeur de la gestion des déchets solides
- Partie 1 de la mise à jour du Plan directeur des transports (politique)
- Cadre de l'outil de comptabilisation du carbone
- Vulnérabilité climatique et gestion des risques
- Plans de gestion des actifs pour les principales infrastructures (eau, eaux usées, eaux pluviales et transport), compte tenu des répercussions climatiques

Plan d'investissement de l'excédent des dividendes d'Hydro Ottawa de 2020

Le document 3 contient un plan de dépenses de 800 000 $, financé à même l'excédent des dividendes de 2020 d'Hydro Ottawa. Ce plan prévoit un appui à six des 20 projets prioritaires d'Évolution de l'énergie, une intégration du financement fédéral et provincial lorsque c'est possible, et la mise en œuvre de projets d'efficacité énergétique, de conservation d'énergie et de production d'énergie renouvelable.

Répercussions financières

Recommandation 1: Aucune répercussion financière directe n'est associée à la réception de la mise à jour.

Recommandation 2: Les fonds proviendront de l'excédent des dividendes de 2020 d'Hydro Ottawa. Sous réserve de l'approbation par le Conseil du plan de dépenses proposé, une autorisation budgétaire de 800 000 $ sera ajoutée à Évolution énergétique 908880, montant entièrement financé par l'excédent des dividendes.

Consultation et commentaires du public

Aucune consultation publique n'était requise pour le présent rapport d'étape. Une consultation publique sera prévue pour chaque projet pertinent, le cas échéant.

BACKGROUND

In April 2019, City Council approved a motion to declare a climate emergency (ACS2019-CCS-ENV-0005) which included the following directions to Council and staff:

1. Officially declare a climate emergency for the purposes of naming, framing, and deepening our commitment to protecting our economy, our eco systems, and our community from climate change.

2. Establish a Council Sponsors Group comprised of representatives from the Standing Committee on Environmental Protection, Water and Waste Management, Planning Committee, Transportation Committee, Transit Commission, the Ottawa Board of Health, and the Councillor Liaison of the Environmental Stewardship Advisory Committee.

3. Direct City staff to include the following in the review and update of the Air Quality and Climate Change Management Plan (AQCCMP):

a) An analysis of how the AQCCMP's long term target to reduce GHG emissions 80 per cent below 2012 levels by 2050 compares to the IPCC's targets for limiting global warming to 1.5ºC

b) Midterm (2030) corporate and community GHG emission reduction targets

c) Climate Change mitigation and adaptation priorities for next five years (2019-2024) to embed climate change considerations across all elements of City business.

4. Direct City staff to include the following in the Energy Evolution Final Report:

   a) Status update of Energy Evolution Phase 1 actions

   b) New concrete actions and resource implications (staff and financial) to achieve GHG emission reduction targets

   c) Use an equity and inclusion lens in the prioritization of actions

   d) Funding and savings options for the City when implementing emission reductions

5. Direct City staff to report back, within the 2019 calendar year, on a spending plan for the Hydro Ottawa dividends surplus that would help reduce community and corporate GHG emissions beyond the scope of the City's current climate targets while also saving money.

6. Direct City staff to complete a vulnerability assessment and develop a climate resiliency strategy to reduce the impacts of a changing climate.

7. Recognize climate change as a strategic priority in the City's Strategic Plan and accompanying budget directions for the remaining Term of Council.

8. Work with senior levels of government to accelerate ambition and action to meet the urgency of climate change and provide additional resources for municipalities and the public to reduce their GHG emissions and build resiliency to climate impacts.

In January 2020, Council approved the Climate Change Master Plan, which included setting new short, mid, and long-term GHG emission reduction targets (ACS2019-PIE-EDP-0053).

In June 2020, Council received the climate projections for the National Capital Region (ACS2020-PIE-EDP-0014), which provided a comprehensive analysis of future climate conditions in the National Capital Region to 2100. The report includes projected changes in temperature, rainfall, snow, wind, and extreme events such as freezing rain, tornadoes, and storms. It is the first phase in a three-phase process. The next phase is to undertake climate vulnerability and risk assessments (Phase 2) followed by the development of an Adaptation and Resiliency Strategy and Plan (Phase 3). The climate projections will also inform the development of the Official Plan, Master Plans and Asset Management Plans.

In October 2020, Council unanimously approved the final strategy for Energy Evolution: Ottawa's Community Energy Transition Strategy. Energy Evolution provides a framework for achieving Council's target to reduce community greenhouse gas emissions by 100 per cent by 2050 and corporate greenhouse gas emissions by 100 per cent by 2040. Council also approved the spending plan for the 2019 Hydro Ottawa dividend surplus of $2.6 million to support Energy Evolution projects (ACS2020-PIE-EDP-0036).

In December 2020, Council approved that the standard Council and Committee report template be amended to include optional sections for Climate Implications, that the next Long Range Financial Plans consider the affordability of raising the debt limit for projects in Energy Evolution that either generate income or savings to the City and the results of this analysis and that the Climate Change and Resiliency Section Manager of the Planning, Infrastructure and Economic Development department's climate change participate in the development of the Long Range Financial Plans to help identify new funding mechanisms for Energy Evolution initiatives required by the Corporation as per the Climate Change Master Plan, to meet the 100 percent emissions reduction scenario.

In January 2021, Council received the annual status update on the Climate Change Master Plan, including the community and corporate 2019 greenhouse gas emissions inventories and updates on the Climate Change Master Plan eight priority actions (ACS2020-PIE-EDP-0043).

DISCUSSION

Recommendation #1: Receive the annual status update on the Climate Change Master Plan, including the 2020 GHG emissions inventories attached as Document 1 and updates on the eight priority actions as summarized in this report;

In January 2020, Council approved the Climate Change Master Plan, the overarching framework for how Ottawa will mitigate and adapt to climate change over the coming decades. It has a vision to take unprecedented, collective action that transitions Ottawa to a clean, renewable, and resilient city by 2050. The Plan sets guiding principles, goals, GHG emission reduction targets, and eight priority actions for the next five years (2020-2025) that can be embedded into City business. The eight priority actions are:

1. Implement Energy Evolution: Ottawa's Community Energy Transition Strategy.
2. Undertake a climate vulnerability assessment and develop a Climate Resiliency Strategy.
3. Apply a climate lens to the new Official Plan and its supporting documents.
4. Apply a climate lens to asset management and capital projects.
5. Explore the feasibility of setting corporate carbon budgets, including piloting them in a small portion of the organization.
6. Explore carbon sequestration methods and the role of green infrastructure.
7. Encourage private action through education, direct and indirect incentives, municipal support, and advocacy for support of individuals and private organizations by senior levels of government.
8. Develop a governance framework to build corporate and community capacity, align priorities, and share accountability in tackling climate change.

As part of the approved plan, staff committed to providing an annual update on the climate change framework that includes:

- Annual GHG community and corporate inventories
- An assessment of how Ottawa is tracking towards community and corporate targets
- An update on the Climate Change Master Plan priorities

- Recommendations, as required, to advance the Climate Change Master Plan priorities
- New budget pressures, if required.

The last Climate Change Master Plan update was received by Council in January 2021 (ACS2020-PIE-EDP-0043).

ANNUAL COMMUNITY AND CORPORATE GHG EMISSION INVENTORIES

As part of the Climate Change Master Plan, Council approved short, mid, and long-term GHG emission reduction targets to reduce community emissions by 100 per cent by 2050 and corporate emissions by 100 per cent by 2040 (Figures 1 and 2). These targets align with the Intergovernmental Panel on Climate Change's target to limit global warming increases to 1.5 degrees Celsius.

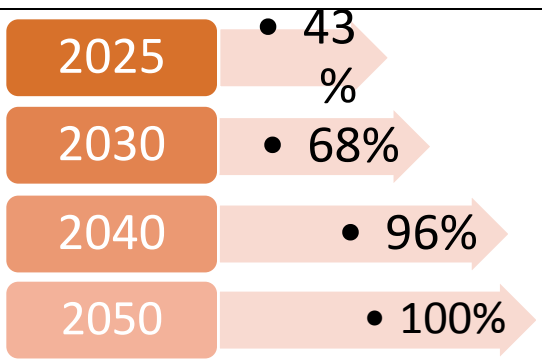


Figure 1: Short, Mid and Long-term Community Targets to Reach 100% by 2050 Target

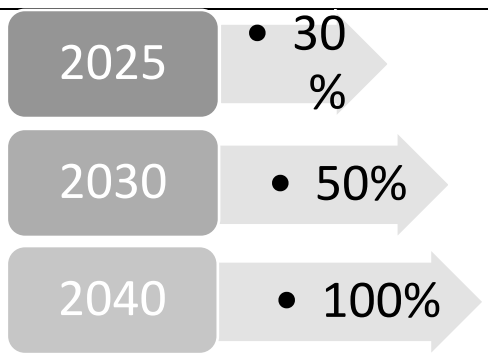


Figure 2: Short, Mid and Long-term Corporate Targets to Reach 100% by 2040 Target

GHG inventories provide a snapshot of energy use and associated emissions over a given period within the buildings, transportation, waste, and agriculture sectors. Emissions are reported in tonnes of equivalent carbon dioxide emissions (tonnes of CO_2e), which are calculated based on carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions. Inventories follow the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, which offers a consistent and robust accounting methodology that allows for comparison around the world. They are based on five principles to represent a true account of emissions: relevance, completeness, consistency, transparency, and accuracy.

The City of Ottawa undertakes two types of greenhouse gas (GHG) emissions inventories on an annual basis: community inventories and corporate inventories. The latest inventory results are for the 2020 calendar year and further inventory details can be found in Document 1.

Community inventories track emissions associated with activities within the geographic boundaries of Ottawa and are broken down into four sectors:

a) Buildings – includes emissions from residential, commercial, institutional, and industrial sectors

b) Transportation – includes emissions from on-road, aviation, railway, and off-road transportation

c) Waste – includes emissions from solid waste and wastewater treatment

d) Agriculture – includes emissions from crop production and livestock operations

Corporate inventories are used to track emissions under municipal operational control within the corporate organizational structure and are broken down into four sectors:

- Facilities – includes buildings, streetlights, and traffic lights
- Fleet – includes municipal, transit, and police fleets
- Solid waste – includes emissions from the Trail Road Waste Facility and Nepean landfill
- Wastewater – includes emissions from the treatment of wastewater at Robert O. Pickard Environmental Centre

COVID-19

In 2020, COVID-19 had global, national, and local impacts on all aspects of society, impacting everything from personal commutes to the amount of energy consumed in buildings to manufacturing of goods. Data shows that after rising steadily for decades, global emissions dropped by 6.4 per cent in 2020. However, while there was a sharp decline early in the pandemic due to lockdowns, global and local emissions rose as economic activity began to recover.[1] In comparison, a United Nations Environment

[1] Tollefson, Jeff. "COVID curbed carbon emissions in 2020 — but not by much". *Nature.* 589, 343 (2021) https://www.nature.com/articles/d41586-021-00090-3

Programme report projected that global emissions need to fall by 7.6 per cent per year between 2020 and 2030 to avoid missing the global target to limit global warming to 1.5 degrees Celsius.[2] The 2020 global emissions drop from COVID-19 fell short of this target.

How Ottawa is tracking towards community and corporate targets

a) Community inventory

Between 2012 and 2020, community emissions decreased 15 per cent (Figure 3) and per capita emissions decreased from 7.1 tCO_2e per person in 2012 to 5.6 tCO_2e per person in 2020. Historically, this decline in emissions has been attributable to the provincial phase out of coal plants and a significant reduction in emissions from electricity generation and consumption. However, starting in 2020, the COVID-19 pandemic also played a significant role in reducing GHG emissions, particularly within the transportation sector which saw a 30 per cent drop in gasoline fuel consumption between 2019 and 2020. This is likely due to a large portion of Ottawa residents that were required to either work or learn from home as well as an increase in on-line activities which replaced the need for physical travel.

Roughly 90 per cent of community emissions are attributable to the buildings (primarily for building heating) and transportation sectors, a trend that has been consistent since 2012. Waste and agriculture sectors make up the other roughly 10 per cent of emissions (Figure 4). Natural gas consumption was the largest contributing source of emissions, accounting for 38 per cent of total community emissions. Gasoline and diesel consumption were the second and third largest contributors, accounting for 21 per cent and 12 per cent, respectively (Figure 5).

In order to meet Ottawa's short term and mid-term targets to reduce emissions by 43 per cent by 2025 and 68 per cent by 2030, respectively, the community will need to reduce emissions by 5 to 6 per cent a year over the next five to ten years. It is expected that the drop in community emissions due to the COVID-19 pandemic will not be sustained once the virus is under control and that emissions will rebound if there are no additional actions or investments to achieving Ottawa's GHG emission reduction targets. In 2020, Council approved new GHG reduction targets and Energy Evolution, the action and investment framework for achieving these targets. Staff have been

[2] United Nations Climate Change. (2019 Nov 26). *Cut Global Emissions by 7.6 Percent Every Year for Next Decade to Meet 1.5℃ Paris Target – UN Report.* https://unfccc.int/news/cut-global-emissions-by-76-percent-every-year-for-next-decade-to-meet-15degc-paris-target-un-report

working on developing and launching plans, policies, and programs that will directly impact or influence emission reductions; however, given that Energy Evolution was only approved one year ago and that many of these policies, programs, and plans are still in development, it will take time for these initiatives to have an effect. Staff do not expect to see a significant reduction in the next two to three GHG inventories, particularly on the community side. This is due to the number, scale and complexity of the projects required to achieve Council's targets, as well as factors outside the City's control, including policy decisions by senior levels of government and the availability of funding and market solutions. Staff will continue to report on how Ottawa is tracking towards community and corporate GHG reduction targets and provide status updates on the Climate Change Master Plan including initiatives to reduce emissions in both the community and within municipal operations.

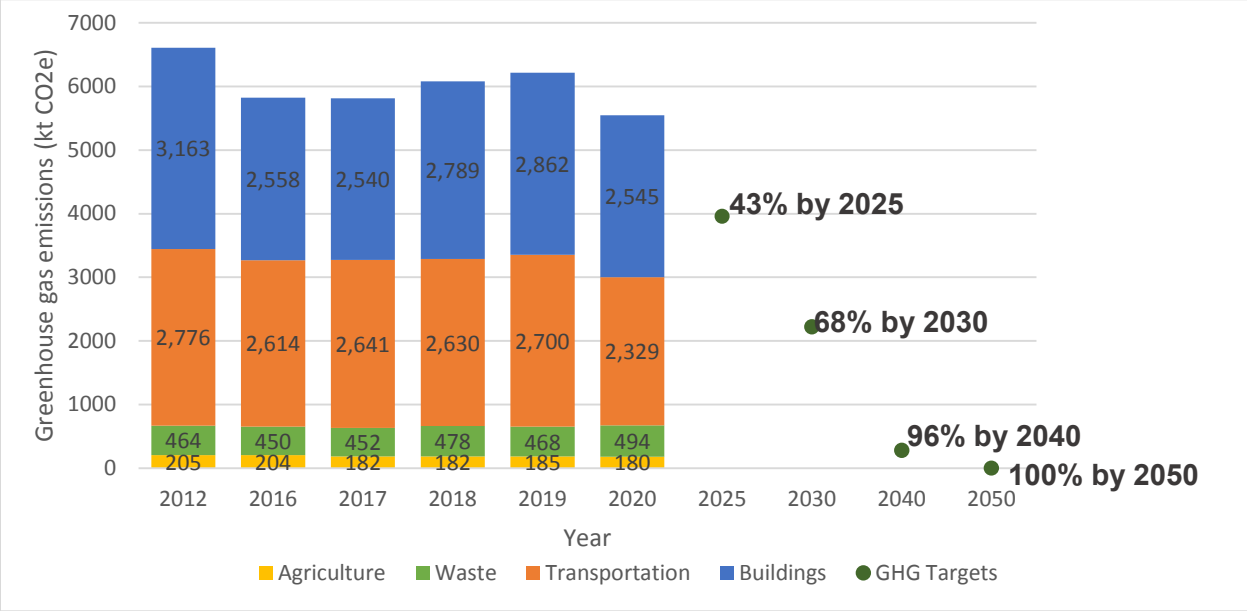


Figure 3: Annual Community GHG Emissions by Sector, 2012 and 2016-2020

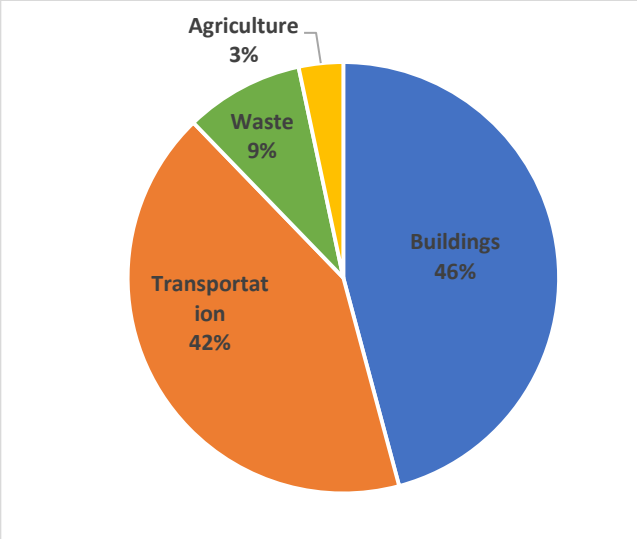


Figure 4: Community GHG Emissions by Sector (2020)

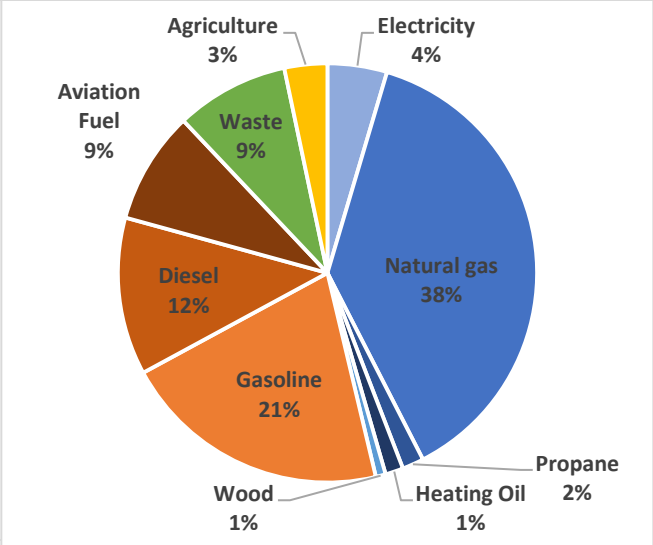


Figure 5: Community GHG Emissions by Source (2020)

b) Corporate inventory

Between 2012 and 2020, corporate emissions decreased by 43 per cent, currently exceeding the short-term target to reduce emissions by 30 per cent below 2012 baseline levels by 2025 (Figure 6). This decrease in emissions remains primarily due to the significant decline in emissions in the solid waste sector, of which 32 per cent of the 43 per cent total reduction can be attributed to the considerable efficiencies made at the Trail Road Waste Facility. The remaining emission reductions can be attributable to a decrease in fuel consumption within fleet, specifically transit fleet which saw a 20 per cent drop in bus diesel fuel consumption between 2019 and 2020, and a reduction in emissions from facilities.

Similar to previous inventory years, the largest contributing sector to total corporate emissions was the transit fleet sub-sector, accounting for 44 per cent of total corporate emissions (Figure 7). Directly related, diesel consumption was the largest contributing emission source, accounting for 51 per cent of total corporate emissions (Figure 8). Corporate emissions accounted for roughly 4 per cent of total community emissions in 2020.

Given the planned acquisition of electric buses and energy efficiency improvements to City facilities in the coming years, staff expect that the corporation will stay on track and meet the 2025 target.

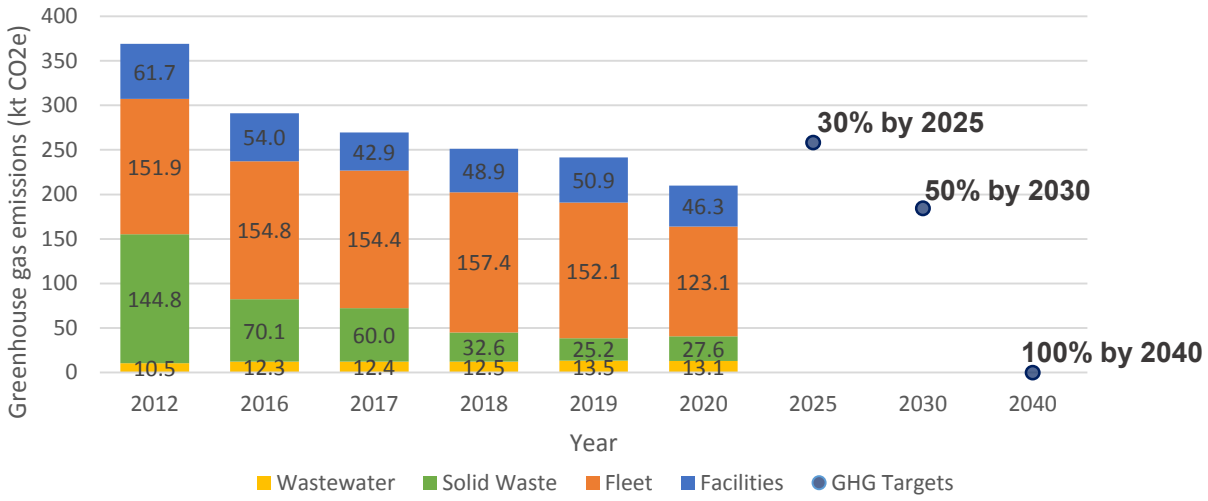


Figure 6: Annual Corporate GHG Emissions by Sector (2012 and 2016-2020)

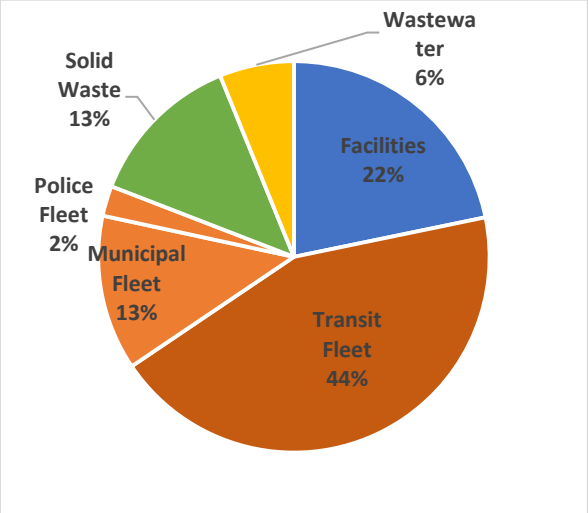


Figure 7: Corporate GHG Emissions by Sector (2020)

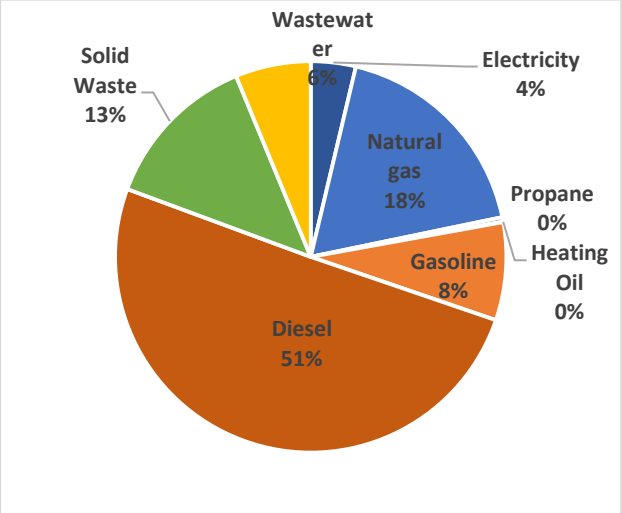


Figure 8: Corporate GHG Emissions by Source (2020)

UPDATE ON CLIMATE CHANGE MASTER PLAN PRIORITIES

The following provides an update on each of the eight priorities under the Climate Change Master Plan since the last update in January 2021 and next steps.

1. Implement Energy Evolution: Ottawa's Community Energy Transition Strategy

Energy Evolution: Ottawa's Community Energy Transition Strategy sets the framework for what it will take for Ottawa to meet the Council approved long-term targets to reduce

community GHG emissions by 100 per cent by 2050 and corporate GHG emissions by 100 per cent by 2040. A comprehensive energy, emissions and finance model was used to identify what it will take to achieve Council approved targets in five key sectors: Land Use and Growth Management, Buildings (New and Existing), Transportation, Waste and Renewable Natural Gas, and Electricity. To accelerate action and investment towards achieving the GHG targets, Energy Evolution identified 20 projects to be undertaken by 2025 within these five sectors.

Progress to date:

- For a status update summary of the 20 projects supporting Energy Evolution, including project milestones, next steps, and timelines, refer to Document 2 of this report.
- Climate change mitigation policies were embedded throughout the Official Plan. For more details, refer to the status update for Priority #3 of the Climate Change Master Plan.
- General climate change education and outreach included presentations to 12 community organizations which attracted 1,100 attendees, over 75 social media posts, and three feature stories on Ottawa.ca focused on private action. Since Energy Evolution was approved by Council in October 2020, significant funding in external grants and loans have been committed. For more details, refer to the status update for Priority #7 of the Climate Change Master Plan.
- Key project achievements in the buildings sector include:
    - Better Homes Ottawa - Loan Program: In July 2021, Council approved the Better Homes Loan - Ottawa Program whereby homeowners can access financing to pay for home energy improvements and help reduce GHG emissions. The program will launch in fall 2021.
    - Better Buildings Ottawa Strategy: In October 2021, Committee and Council received the proposed Better Buildings Ottawa Strategy to accelerate the retrofits of existing industrial, commercial, institutional, and multi-unit buildings.[3]

[3] The report had not yet been tabled at Committee and Council at the time of writing of this report.

- Energy efficiencies at municipal buildings: The City transitioned to electrified heating at Fitzroy Harbour Community Centre, Nepean Sportsplex Halls C, D, and E, and Fire Station #72 in Cumberland by replacing the existing heating systems with cold climate heat pumps. Additionally, the City is dispatching electric boilers in real time at municipal facilities with large electrical accounts when the hourly electricity price is lower than natural gas to displace a large portion of natural gas used for heating purposes.

- Key project achievements in the transportation sector include:
  - Zero Emission Buses for OC Transpo (ACS2021-TSD-TS-0009): In June 2021, Council approved a transition plan that included acquiring up to 450 zero emission buses by 2027 and moving to a fully zero emission bus fleet by 2036 (based on funding availability and operational needs). The first four battery-electric buses will be operational by the end of 2021, with the acquisition of an additional 74 battery-electric buses included in OC Transpo's 2022 capital budget.
  - Electric vehicle charging stations: The City has installed a Level 2 charging station at the renovated Lois Kemp Arena (Blackburn), is installing 12 double-headed Level 2 charging stations in the right-of-way across the city and will install a 150 kW charging station at Bob MacQuarrie Recreation Complex.

- Key project achievements in the waste sector include:
  - Solid Waste Master Plan (ACS2021-PWE-SWS-0003): In June 2021, Council received Phase 2 of the Solid Waste Master Plan and approved the Plan's vision statement, guiding principles and goals, which support the City's Climate Change Master Plan and associated priorities.
  - ROPEC Biogas Optimization Study: In September 2021, the City completed an extensive study of feedstocks and technologies to explore increasing biogas production and consider its potential uses at ROPEC and prioritizing the prospective uses of biogas in the future.

- Key project achievements in the electricity sector include:
  - Staff provided feedback or submitted letters to the Ministry of Energy, the Ontario Energy Board, and Independent Electricity Systems Operator on a range of issues including Ontario's long-term energy planning framework, the

hydrogen strategy white paper, community net metering, distributed energy resources, and the phase out of natural gas electricity generation in Ontario

- Council approval for the City of Ottawa to request that the Government of Ontario develop and implement a plan to phase-out gas-fired electricity generation by 2030, lift the prohibition of third-party ownership of net metering assets and develop a framework for virtual net metering

- Staff shared the Energy Evolution modelling work through the CityInSight tool on ottawa.ca/energyevolution for the community to better understand the projected emissions for Ottawa and allow the data to be manipulated for the community's own analysis and research.

Next steps:

- Energy Evolution projects will be continue being developed with input from staff, stakeholders, and the public, and brought to the appropriate future Standing Committee and Council for approval, as required.
- Reports that are anticipated to go to Committee and Council before the end of Q2 in 2022 include:
  - Update to Municipal Green Fleet Plan
  - High-Performance Development Standard
  - Corporate Green Building Policy Update
  - Personal Electric Vehicle Strategy
  - Corporate Electric Vehicle Policy Update
  - Draft Solid Waste Master Plan
  - Part 1 of Transportation Master Plan Update (Policy)
- Staff will continue to carry-out and monitor the Better Homes Loan Program and the Better Buildings Ottawa Program
- Staff will continue to apply for external sources of funding.
- Staff will participate in the development of the City's Long Range Financial Plans to identify new funding mechanisms for Energy Evolution initiatives

- Staff will continue work with senior levels of government to accelerate ambition and action to meet the urgency of climate change and provide additional resources for municipalities and the public to reduce their GHG emissions and build resiliency to climate impacts

- Staff will develop Key Performance Indicators to further track progress being made to achieve Ottawa's GHG reduction targets.

- Staff will continue to provide department specific presentations on Energy Evolution to support on-going alignment of priorities, work plan, and budgets across the corporation

2. Undertake a climate vulnerability assessment and develop a Climate Resiliency Strategy

The purpose of the Climate Resiliency Strategy is to assess how Ottawa is vulnerable to climate change and identify strategies to mitigate the greatest risks. The strategy will assess and mitigate climate risks to Ottawa's community, infrastructure, environment, and economy. It will be developed in close coordination with internal and external stakeholders to align and integrate with initiatives such as the Official Plan and Master Plans, Hazard Assessment Mitigation and Prevention, climate and health vulnerability plan and Comprehensive Asset Management.

Progress to date:

- The climate vulnerability and risk assessment is underway in collaboration with internal and external stakeholders. More than 100 potential climate impacts are being assessed across a range of sectors.

- Thirteen internal working groups have been established with more than 120 staff from across the corporation to assess risks. An external working group of about 50 community partners and stakeholders has been established to share expertise on climate risks and adaptation strategies.

- An Engage Ottawa page was launched in March 2021 to share information on Ottawa's future climate and seek input on risks and opportunities. By August 31, 450 residents, businesses and organizations had completed surveys.

- Detailed risk assessments are underway for water, wastewater and stormwater services and assets, including the drinking water and wastewater treatment plants, to inform the Infrastructure Master Plan.

- Detailed assessments of the health risks of extreme heat are being completed by Ottawa Public Health. Urban heat island mapping has been posted to City and OPH websites. These maps were used to inform draft Official Plan policies.

Next steps:

- Complete the climate risk assessment and integrate findings from water services risk assessments.
- Continue to share relevant climate information publicly, including additional flood hazard mapping and supporting information (in coordination with Infrastructure Services).
- Project timelines have been revised due to the scope of the project and complexity of internal and external engagement. The vulnerability and risk assessment is planned to be completed by early 2022 with a report to Committee and Council by Q2 2022. The Climate Resiliency Strategy and Action Plan will be developed by Q2 2023.
- A "learning while doing approach" is being adopted to address immediate risks while the comprehensive strategy is being developed. For example, flood response plans are in place for the two water purification plants and projects are being identified for possible submission to federal funding opportunities.

3. Apply a climate lens to the new Official Plan and its supporting documents

The Official Plan provides a vision for the future growth of the city and a policy framework to guide the city's physical development. The plan's vision is for Ottawa to grow to be the most liveable mid-sized city in North America. To achieve this vision, Ottawa must be an energy conscious city where people can live, work, and play in all future climate conditions. The Official Plan is an essential tool to meet climate change objectives through land use planning, urban design, regulatory practice, building design and environmental protection.

Updates to the Transportation Master Plan, Infrastructure Master Plan, Urban Forest and Greenspace Master Plan, Parks and Recreation Facilities Master Plan, Solid Waste Master Plan and the Development Charges By-law are to align with the policy directions set out in the new Official Plan and Council's greenhouse gas emissions reduction targets.

Progress to date:

- The November 2020 draft Official Plan was revised following public and stakeholder consultation and the updated Official Plan was posted on the Official Plan's Engage Ottawa page in August 2021. Policies to mitigate and adapt to climate change are embedded throughout the plan as a cross cutting issue.
- Policies in the draft Official Plan align with the City's intent to support a sustained transition away from fossil fuels toward a low carbon economy and fulfil both community and corporate greenhouse gas emissions reduction targets as well as identify climate risks and adaptation strategies.
- In response to climate change, the Official Plan includes eight primary goals: three related to mitigation, four related to adaptation and one which influences both mitigation and adaptation. They include:

  Mitigation

  1. Plan a compact and connected City
  2. Prioritize a shift to energy efficient transportation modes
  3. Enable the use of local renewable energy sources

  Adaptation

  4. Reduce the urban heat island effect and help protect the vulnerable from extreme heat
  5. Build resilience to future flood risks and increased stormwater runoff
  6. Protect trees, wetlands and other natural areas and use nature-based solutions
  7. Enable sustainable local food production

  Mitigation and Adaptation

  8. Apply sustainable and resilient site and building design as part of development
- The Parks and Recreation Master Plan was presented to Committee in September 2021 and considers climate adaptation and mitigation. The Solid Waste, Infrastructure, Transportation, and Urban Parks and Greenspace Master Plans continue to consider ways to meet greenhouse gas targets and build resiliency to future climate conditions.

Next Steps:

- The Official Plan is expected to be considered by Joint Planning / Agricultural and Rural Affairs Committee and City Council in October 2021.
- If Council adopts the Official Plan, it will be submitted to the Minister of Municipal Affairs and Housing for approval.
- Staff will continue working on the High Performance Development Standard, one of the implementation tools proposed to advance sustainable and resilient design practices in new development and bring a report to committee for consideration.
- Staff will continue to integrate climate considerations into the development of Master Plans.

4. Apply a climate lens to asset management and capital projects

The Comprehensive Asset Management (CAM) program guides the management of the City's assets. Risk management and asset resiliency are already core principles of asset management. Further integrating climate considerations into CAM will enable climate change to be considered alongside additional challenges such as aging infrastructure, growth, and limited resources. This project will examine ways to embed climate change considerations into the management of existing assets, the design of new capital projects, and current City asset management policies and practices. It supports the City to meet provincial regulation (O. Reg 588/17) which requires municipalities to commit to considering climate change in asset management planning and better positions the City to respond to external funding opportunities.

Progress to date:

- An updated Comprehensive Asset Management Policy was approved by Council in May 2021 and refers to the targets and actions in the Climate Change Master Plan. The Comprehensive Asset Management Policy reflects a commitment to consider climate change in asset management systems and processes.
- Council also received a framework for developing Asset Management Plans that includes guidance on including climate change considerations as part of risk assessment, and how climate change could potentially affect assets and levels of service in future.

- Asset Management Plans (AMPs) for core services (water, wastewater, stormwater, and transportation) are being developed to meet the 2022 regulatory deadline.
- The inter-departmental approach to identifying climate risks and opportunities for the initial set of AMPs enables further assessment to be done through the development of Master Plans and the Climate Resiliency Strategy.

Next Steps:

- Asset Management Plans for core infrastructure (water, wastewater, stormwater, and transportation) continue to be developed to meet the 2022 provincial deadline, with AMPs for all other City assets to follow by 2024.
- Additional analysis of mitigation and adaptation strategies will be integrated into subsequent Asset Management Plans, Master Plans, and the Climate Resiliency Strategy.
- A climate lens will also be applied to the upcoming update of the City's Strategic Asset Management Plan, which is scheduled to begin in 2022.

5. Explore the feasibility of setting corporate carbon budgets, including piloting them in a small portion of the organization

To prevent dangerous levels of global warming, scientists have determined that there is a finite amount of carbon dioxide that can be emitted into the atmosphere. This is the global carbon budget. The latest science data indicates that to limit global warming to 1.5ºC, the world has a strict global carbon budget of 420 gigatonnes of carbon dioxide equivalent (CO_2e).

Around the world, more and more cities are adopting or exploring the implementation of a carbon budget to support projects that reduce GHG emissions and can be applied to both city-wide and corporate emissions. Developing a carbon budget for Ottawa would involve establishing a local emissions budget and making decisions about how we "spend" our corporate GHG budget within that context. Corporately, a carbon budget could be embedded within the financial budgetary framework. For a carbon budget in Ottawa to be successful, an implementation and monitoring framework would be required.

Progress to date:

- As a first step in developing a carbon budget framework, staff are developing a carbon accounting tool with a shadow carbon price in collaboration with other Canadian municipalities.
- The tool will help staff embed climate considerations within City business, including project development, procurement processes, the Climate Implications section of Committee reports, Long-Range Financial Plans, and Asset Management Plans.
- A funding application has been submitted to the Federation of Canadian Municipalities to develop the tool.

Next steps:

- Staff will develop and pilot the carbon accounting tool within the corporation in early 2022.
- Staff will bring forward a report to Committee and Council later in 2022 with recommendations on how the carbon accounting tool and the shadow carbon price can be embedded in City business.

6. Explore carbon sequestration methods and the role of green infrastructure

Carbon sequestration is the process through which forestry, agricultural, and wetlands practices capture carbon dioxide caused by activities such as burning fossil fuels and stores it over the long-term. It does not replace the need for action to mitigate climate change and transition off fossil fuels; rather, it complements it. The value of carbon sequestration was identified in both the City's Urban Forest Management Plan and the Significant Woodlands Policy. Additionally, understanding and quantifying the climate benefits of trees, forests and wetlands will support the justification for the active management of the City's forests and wetlands.

To help better understand the potential for carbon sequestration in Ottawa, a number of initiatives should be undertaken. These include:

- Inventorying forests as carbon sinks
- Monitoring and evaluating changes in carbon in agricultural soils
- Mapping wetlands as functioning carbon sinks

- Exploring carbon market options

Progress to date:

- Staff have adjusted their work plan to reflect competing priorities
- Staff are keeping apprised of carbon sequestration accounting best practices
- Tree inventory for wooded urban parks underway
- Completion of city-wide canopy cover data collection and preliminary analysis

Next Steps:

- Staff have been working to complete the recommendations of the first management period of the Urban Forest Management Plan by the end of 2021.
- Staff will include exploring carbon sequestration as part of the second management period of the Urban Forest Management Plan to be initiated in 2022.

7. Encourage private action through education, direct and indirect incentives, municipal support, and advocacy for support of individuals and private organizations by senior levels of government

To mobilize climate mitigation and adaption actions across all sectors, the City of Ottawa is playing a leadership and coordinating role in:

- Climate education that helps people understand the causes and implications of climate change, the actions we can take now to reduce emissions and build resilience against a changing climate, and the benefits in doing so
- Leveraging other resources where feasible
- Communicating what resources are available
- Recommending, advocating for, and promoting incentives to catalyze action (e.g., utility rebates, home protection grants, etc.)
- Assessing municipal tools to support action (e.g., High-Performance Building Standards, Local Improvement Charges, Community Improvement Plans, etc.)

- Setting policies and procedures that facilitate a shift to low carbon and resilient future (e.g., through the Official Plan and other Master Plans)

Progress to date:

- Communications and outreach initiatives:
    - Developed and implemented an annual climate change communications and engagement plan to support private action and the roll out of community focused Energy Evolution and climate resiliency projects.
    - Circulated a monthly climate change newsletter with over 6,000 subscribers that features climate change news, engagement opportunities and events.
    - General climate change education and outreach included presentations to 12 community organizations which attracted over 1,100 attendees, over 75 social media posts on City and Ottawa Public Health channels, and three feature stories on ottawa.ca focused on private action.
    - Energy Evolution education and outreach included a joint public presentation with Public Works and Environmental Services for Earth Day, a public presentation on Home Energy Audits in collaboration with SmartNet Alliance and a presentation on the Energy Evolution CityInSight dashboard. These events attracted over 360 attendees and have over 500 views of the recordings available on YouTube.
    - Participated in Earth Day Canada's EcoHack-a-City initiative to brainstorm how to accelerate electric vehicle adoption in Ottawa. It included a public panel discussion with over 90 attendees and design thinking training for City staff and 12 local organizations. It resulted in two collaborative funding submissions to the Natural Resources Canada's Zero Emission Vehicle Awareness Raising Initiative.
    - Consultation for the Climate Resiliency Strategy included an Engage Ottawa page to educate residents, business, institutions, and organizations about Ottawa's changing climate and gather feedback; to date it has attracted over 3,000 views and 450 survey responses.
    - Consultation for Better Homes Ottawa - Loan Program and Better Buildings Ottawa on Engage Ottawa has attracted almost 3,000 page views and 200 survey responses to-date. This City also, partnered with EnviroCentre to

launch the Better Homes Loan Program and the Better Homes Ottawa website, a comprehensive resource for residents to help plan their home energy efficiency retrofit.

- An information session in February 2021 about climate change policies in the Draft Official Plan attracted over 160 attendees and the recording has been watched over 1,000 times.
- Sponsored EnviroCentre's Green Drive Week which featured a daily speaker series, pop up electric vehicle demos and virtual car tours.
- Launched Rain Ready Ottawa, an education and incentive program to support homeowners to manage rainwater on their property

- Funding initiatives:
  - Significant loan from Canada Infrastructure Bank and grant from Infrastructure Canada committed to purchase up to 450 electric buses by 2027 (ACS2021-TSD-TS-0009)
  - $12,169,500 from the Federation of Canadian Municipalities for the Better Homes Loan Program consisting of a grant up to $4,056,500 and a loan up to $8,113,000. An additional $3.887 million in loans was committed from VanCity Community Investment Bank.
  - $83,000 grant from the Federation of Canadian Municipalities to assess waste heat potential
  - $10,000 grant from Enbridge to support the development of Community Energy Plans
  - Four additional funding applications are awaiting decision to support development or implementation of Energy Evolution projects.
  - Submitted nine letters of support provided for community led funding applications.
- Advocacy initiatives:
  - Staff submitted official comments through the Environmental Registry of Ontario on Ontario's long-term energy planning framework, the hydrogen strategy white paper, and community net metering

- Staff submitted a letter to the Ontario Energy Board requesting that Ottawa be selected for an enhanced gas demand side management pilot project
- Staff submitted comments to the Independent Electricity System Operator (IESO) on the phase out of natural gas electricity generation in Ontario and participated in IESO's Regional Electricity planning municipal engagement
- Staff have repeatedly reached out to Enbridge Gas' geothermal division to encourage them to take up geothermal heating projects in Ottawa

Next steps:

- Staff will continue to develop climate change education and outreach programs to support private action and the roll out of community focused Energy Evolution and climate resiliency projects
- Staff will continue to monitor and pursue funding and advocacy opportunities support implementation of the Climate Change Master Plan including Energy Evolution and climate resiliency projects.
- Staff will develop an overarching advocacy strategy to advance Energy Evolution and climate resiliency projects.
- Staff will provide comment on Enbridge's Demand Side Management Plans

8. Develop a governance framework to build corporate and community capacity, align priorities, and share accountability in tackling climate change

Transitioning to a clean, renewable, and resilient city will require broad and deep participation in mitigation and adaptation efforts. Through Energy Evolution, the City has identified a comprehensive and ambitious strategy to reduce GHG emissions. Following the development of local climate projections, the City will undertake a vulnerability assessment and develop a climate resiliency strategy to help adapt to the current and future changes of our climate.

Major stakeholders in the National Capital Region including the federal government, the National Capital Commission, the City of Gatineau, Hydro Ottawa, the conservation authorities, and institutions such as universities also have strategies underway to address climate change. However, there is currently no forum in which large or leading organizations can come together to coordinate efforts, align priorities, and mobilize the

broader community. This priority will explore governance approaches to support and encourage collaboration over the course of what will be a profound transition.

Progress to date:

- Continued to work with key stakeholders and technical working groups to advance Energy Evolution projects and the climate vulnerability and risk assessment
- Met with the Climate Change Council Sponsors Group four times
- Established a General Manager Climate Change Tiger Team and identified key climate advisors to embed climate considerations in City business
- Established monthly regular meetings with Hydro Ottawa and Envari to support information exchange with utilities
- The Chair of the Standing Committee on Environment, Waste and Water Management joined the Board of the Ottawa Climate Action Fund
- Supported the launch of the Ottawa Climate Action Fund in May 2021
- Partnered with the Ottawa Climate Action Fund to develop a group of climate communications leaders in Ottawa to align messaging and tactics to accelerate climate action
- Continued to participate in bi-weekly information exchanges with climate change colleagues across the country through the Canadian Urban Sustainability Practitioners
- Joined the international "Race to Zero" campaign and invited other large employers and energy consumers to do the same
- Selected as a participating city in the International Urban and Regional Cooperation program and will partner with Zaragoza, Spain to facilitate and promote cooperation on sustainable urban development and exchange international best practices

Next steps:

- Continue working internally with the Council Sponsors Group, General Manager Tiger Team, and key advisors and externally with key stakeholders, municipal colleagues, and partners to:
    - Coordinate implementation of climate mitigation and adaptation actions

- Scale up of community wide projects, programs, or policies resulting in observable increase in action to reduce GHG emissions (e.g., community wide EV charging network, retrofit program, etc.) or to increase resiliency
- Influence and mobilize organizations and residents that would not otherwise be and motivate to take action
- Finalize the climate vulnerability and risk assessment to identify shared risks

- Provide a memo to Council in December 2022 with a status update on the Climate Change Master Plan to support Council transition and inform strategic priorities

Recommendations, as required, to advance the Climate Change Master Plan priorities

Staff are implementing recommendations approved in previous Council reports as described above.

New budget pressures, if required

Staff and resource pressures will be identified as each of the Climate Change Master Plan priority projects are further developed and brought to Committee and Council, where required. Opportunities to embed financial considerations will be explored in relevant long-range financial plans and future annual budget processes. Staff will also continue to identify and apply for external funding opportunities.

Recommendation #2: Approve that the 2020 Hydro Ottawa dividend surplus of $800,000 be used to fund the proposed spending plan attached as Document 3 and summarized in this report.

In March 2019 (Motion No 9/3), Council directed that any surplus in the Hydro Ottawa dividend received in the 2018-2022 Term of Council be directed toward energy efficiency, conservation or renewable energy programs within Ottawa, with specific projects to be recommended by staff and approved by the Standing Committee on Environmental Protection, Water & Waste Management and Council once the specific dollar amount, if any, is known.

In June 2021 (ACS2021-OCC-HOH-0001), Council received the Hydro Ottawa Holding Inc. 2020 Annual Report which identified a dividend of $20.8 million to the City of Ottawa in 2021. The 2020 Hydro Ottawa dividend surplus is $800,000. In accordance with the March 2019 Council-approved dividend policy to direct any surplus in the Hydro

Ottawa dividend received in the 2018-2022 Term of Council toward energy efficiency, conservation or renewable energy programs within Ottawa, staff have identified specific projects to be approved by the Standing Committee on Environmental Protection, Water & Waste Management and Council.

Document 3 proposes a total spending plan of $800,000 funded through the 2020 Hydro Ottawa dividend surplus. The spending plan proposes funding to support 6 of 20 Energy Evolution priority projects, leverage federal and provincial funds where possible, and implement energy efficiency,conservation, and renewable energy generation projects. Projects include, but are not limited to, municipal energy conservation, public and municipal electric vehicle charging infrastructure, district energy, and solar panels on municipal facilities. The spending plan also proposes to extend one existing temporary full-time position to support communication and outreach associated with implementation of Energy Evolution projects. The spending plan and associated funding is for all project related costs including feasibility and design studies, pilots, construction, and equipment acquisition or installation.

FINANCIAL IMPLICATIONS

Recommendation 1: There are no direct financial implications associated with receiving the status update.

Recommendation 2: Funds are available from the 2020 Hydro Ottawa dividend surplus. Pending Council approval of the proposed spending plan, budget authority of $800,000 will be added to 908880 Energy Evolution, 100 per cent funded from the dividend surplus.

LEGAL IMPLICATIONS

There are no legal impediments to Committee and Council's approval of the recommendations of this report.

COMMENTS BY THE WARD COUNCILLORS

This is a city-wide report – not applicable.

ADVISORY COMMITTEE COMMENTS

A presentation will be given to the Environmental Stewardship Advisory Committee on October 7, 2021.

CONSULTATION

No public consultation was required for this status update report. Public consultation was completed in each of the relevant projects.

ACCESSIBILITY IMPACTS

Accessibility impacts will be assessed as part of the development and implementation of the Climate Change Master Plan's eight priorities.

ASSET MANAGEMENT IMPLICATIONS

As per the status update for Priority #4, Climate Change considerations are being actively integrated into the City's CAM Program through direct inclusions in the updated CAM Policy and the Framework for developing the Asset Management Plans (AMPs). Work is already well underway on the AMPs for core services (water, wastewater, stormwater, roads, and bridges). There has been close collaboration between Asset Management Branch and the Climate Change and Resiliency Section to ensure that climate change considerations are being appropriately addressed and embedded in these key documents.

CLIMATE IMPLICATIONS

This report covers climate implications associated with significant policies, programs, and plans being developed to achieve the vision of the Climate Change Master Plan to take unprecedented collective action to transition Ottawa into a clean, renewable and resilient city by 2050. Climate implications associated with Climate Change Master Plan projects will be explored as the priorities continue to be further developed in 2022.

ECONOMIC IMPLICATIONS

There are no economic implications associated with the recommendations of this report.

ENVIRONMENTAL IMPLICATIONS

There are no environmental implications associated with the recommendations of this report. Environmental implications associated with the Climate Change Master Plan will be explored as the priorities continue to be further developed in 2022.

INDIGENOUS GENDER AND EQUITY IMPLICATIONS

There are no indigenous, gender or equity implications associated with the recommendations of this report. Indigenous, gender and equity implications associated

with the Climate Change Master Plan will be explored as the priorities continue to be further developed in 2022.

RISK MANAGEMENT IMPLICATIONS

There are no risk implications for this report. Risk implications associated with implementation of the Climate Change Master Plan has been and will continue to be identified and addressed in each of the relevant priority projects.

RURAL IMPLICATIONS

All regions of Ottawa, including the city's rural areas, are key to meeting the goals of the Climate Change Master Plan. The Climate Change Council Sponsors Group includes a rural Councillor.

TERM OF COUNCIL PRIORITIES

The Climate Change Master Plan aligns with the current 2019-2022 Term of Council priority, Environmental Stewardship, to grow and protect a healthy, beautiful, and vibrant city that can adapt to change. Identified outcomes in support of this priority include:

- The City has climate change mitigation and adaptation plans in place
- The City is a leader in energy management and in conserving, recycling, and reusing resources
- The City's long-term plan for solid waste includes more diversion from landfills
- The City reduces its greenhouse gas output and embeds climate change considerations across all operations.

SUPPORTING DOCUMENTATION

Document 1 Results of the 2020 Community and Corporate GHG Inventories (Issued separately and held on file)

Document 2 Status Update of Energy Evolution projects (Immediately follows this report)

Document 3 Proposed 2020 Hydro Ottawa Dividend Surplus Spending Plan

DISPOSITION

The Planning, Infrastructure and Economic Development Department will continue to coordinate the Climate Change Master Plan with input from various departments to implement the eight priority actions.

Document 2 – Status Update of Energy Evolution Projects

Document 2 provides a status update of the 20 projects identified in Energy Evolution to accelerate action and investment towards achieving Ottawa's GHG emission reduction targets. Annual updates include the current status of the project, project achievements to-date, next steps, and timelines. Most of the projects are led by the municipality and are being undertaken in collaboration with community partners. In many cases, implementation of projects is contingent on future Standing Committee and Council approval, where required, and future staff and budget (capital and operating) pressures.

The project milestones and timelines proposed in October 2020 were based on the best available data and information at that time. Since then, some project milestones and timelines have changed; revised milestones and timelines are identified in Table X. Looking ahead, there are risk to achieving these milestones and timelines. These risks may include:

- Insufficient financial support from different levels of government and the private sector to meet the budgetary and staffing needs of the 20 projects and beyond;
- Higher capital and operating costs, as well as lower than expected saving and revenues, beyond what's currently estimated for project implementation and municipal operations;
- Regulatory barriers and compliance issues that impede the municipality from action and innovation, either by impeding the municipality directly through its own operations or impeding how the municipality can enact change in the community;
- Lack of uptake or buy-in from residents, businesses, industry, or the municipality that impacts the viability of a new program or new standard;
- Diverging interpretations between stakeholders on how best to achieve the 100% scenario;
- Competing Council priorities or processes associated with other projects across the corporation;

- Competing departmental priorities including current operational mandates of impacted services, and how their mandates will need to change in order to work to achieve the emissions reductions in Energy Evolution;
- Lack of alignment between what the Energy Evolution model calls for and recommendations that come forward for plans and strategies that directly relate to Energy Evolution. Note that although it is expected that the range of options evaluated will include one or more scenarios that achieve the GHG reductions required in the 100% scenario, those scenario(s) may not ultimately be recommended;
- Aggressive implementation timelines which may not account for typical City processes including capital budget approval, Long-Range Financial Plan, planning, consultation, approvals, design, construction, and commissioning or account for provincial or federal approval processes that are out of the City's control;
- Changes in behavior, policy, and best practices related to COVID-19.

Sector: Land Use

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
Integration of energy and climate mitigation policies in the new Official Plan and supporting master plans to address multiple challenges being faced by the city over the next 25 years, climate change being one of the most critical. The Official	City	Ongoing / On-track	• Q4 2020: Draft Official Plan released • Q4 2021: Council adoption • Q1 2022: Ministry approval	☑ November 2020: Draft Official Plan released for review ☑ September 2021: Public Open House ☐ October 2021: Draft Official Plan tabled at Joint Planning and Rural Affairs Committee

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
Plan and supporting master plans will be guided by the Climate Change Master Plan with Council approved targets to reduce GHGs by 2050.				and Council for adoption ☐ Q1 2022: Official Plan approval by the Ministry of Municipal Affairs and Housing

Sector: Buildings

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
Residential Building Retrofit Accelerator Program to accelerate small residential building retrofits through marketing, information, and financial mechanisms.	City & Community	Ongoing / On-track	• 2020: Decision on Federation of Canadian Municipalities funding for the Better Homes Loan Program. • 2021: If successful, launch the Better Homes Loan Program and retrofit education campaign • 2021: Explore an efficiency utility[4]. Develop a bulk heat pump program. Advocate for authorities necessary for this project • 2022: Develop a retrofit portal and energy labeling tool. • 2023: Develop renovation	☑ March 2021: City approved for $12,169,500 from the Federation of Canadian Municipalities for the Better Homes Loan Program ☑ July 2021: Council approves launching of the Better Homes Loan Program to support residential retrofits (ACS2021-PIE-EDP-0029) ☐ October 2021: Targeted launch of the Better Homes Loan Program ☐ 2022: Develop a bulk heat pump program. Advocate for authorities necessary for this

[4] Based on discussion with utilities, key stakeholders and leaders in the field, staff are not currently pursuing the concept of an efficiency utility. Staff will continue to monitor efficiency utilities and revisit the concept in the future, if helpful.

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
			standard, as municipal authority allows	project ☐ 2022: Develop a retrofit portal and energy labeling tool. ☐ 2023: Develop renovation standard, as municipal authority allows
Commercial Building Retrofit Accelerator Program to accelerate multi-unit residential, commercial, industrial, and institutional building retrofits through marketing, information, and financial mechanisms	City & Community	Ongoing / On-track	• 2020-2021: Develop a strategy for commercial retrofits with stakeholder consultation • 2021-2023: Increase uptake of benchmarking and transparency • 2021: Launch marketing and education programs • 2022: Launch programs for accelerating retrofits • 2025: Launch energy retrofit standard	☐ October 2021: Better Buildings Ottawa Strategy and Benchmarking and Auditing program to be considered by Committee and Council ☐ 2021-2023: Increase uptake of benchmarking and transparency ☐ 2022: Publish the Commercial Retrofit Roadmap and launch marketing and education programs ☐ 2022: Launch financing

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
				program(s) for accelerating retrofits ☐ 2025: Launch regulations for benchmarking, auditing and/or energy performance
Building Retrofits through Local Improvement Charge Program to accelerate and finance deep energy retrofits of buildings through the local improvement charge mechanism.	City	Ongoing / On-track	• 2020: Program designed, capitalized, and partners confirmed; decision on Federation of Canadian Municipalities funding for the Better Homes Loan Program • 2021: Pilot handful of neighbourhoods while leaving the program open to all residents. Recoup admin costs through financing and admin fee. • 2022: Develop and launch commercial building Local Improvement Charge (LIC)	☑ March 2021: City approved for $12,169,500 from the Federation of Canadian Municipalities for the Better Homes Loan Program ☑ July 2021: Council approves launching of the Better Homes Loan Program to support residential retrofits, which includes an LIC bylaw (ACS2021-PIE-EDP-0029) ☐ 2022: Develop and launch commercial building financing program that may utilize the Local Improvement Charge

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
			Program. • 2022: Recapitalize. Scale up to retrofit 15,000 homes and 900,000m2 of commercial space retrofitted per year (not all expected to use the LIC program but will be encouraged to use the online retrofit portal for tracking).	(LIC) mechanism ☐ 2023+: Recapitalize. Scale up to retrofit 15,000 homes and 900,000m2 of commercial space retrofitted per year (not all expected to use the LIC program but will be encouraged to use the online retrofit portal for tracking).
Energy Community Improvement Plans (CIP) to incentivize superior energy performance and deep energy retrofits using tax grants.	City	Ongoing / On-track	• 2021[5]: Retrofit accelerator roadmap • 2022: Draft policy and program • 2023: Policy reviewed and approved by council • 2023: Enabling by-laws enacted by Council	☐ 2021: Official Plan includes policies to support energy retrofits through CIP mechanism under the *Planning Act* ☐ 2022: Research and identify opportunities to use CIP mechanism to advance energy

[5] The Retrofit Roadmap is being completed as part of the foundation of the Better Buildings Ottawa Strategy, so it has been moved to the Commercial Building Retrofit Accelerator Program section above.

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
				retrofits ☐ 2023: Table recommendations for energy focused CIP program at Committee and Council I
Community Building Heating Strategy to address infrastructure and utility requirements for new ways of heating buildings.	City & Community	Ongoing / Delayed	• 2021: Engage with industry and consultant to develop roadmap for Community Building Heating Strategy • 2022 and beyond: Implementation of the strategy	☑ 2021: Signed an MOU with Ottawa Community Housing to explore the concept of a greenhouse gas (GHG) Neutral district energy system at Gladstone Village ☐ 2021 Community Energy Plan Terms of References completed to support community energy planning in new communities as part of the High Performance Development Standard ☐ 2021: Completion of a waste

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
				heat study ☐ 2022: Develop a Community Building Heating Roadmap
High-Performance Development Standard to improve building design and construction across the community and support an industry-wide transition of new buildings to net zero emissions.	City	Ongoing / On-track	• 2020: Draft High-Performance Development Standard metrics; consult with industry • 2022: Program comes into effect in line with the new Official Plan • 2026: Adopt 2nd Version of the Standard	☐ November 2020-November 2021: Consulted and collaborated with internal and external stakeholders to develop new standards ☐ December 2021: New High-Performance Development Standard to be tabled at Committee and Council ☐ 2022: High Performance Development Standard comes into effect following approval ☐ 2026: 2nd version of High Performance Development Standard to be brought forward.

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
Municipal Buildings Renewal and Retrofit Program to achieve higher building energy performance improvements in City owned buildings.	City	Ongoing / Delayed	• 2020: Establish a working group, develop criteria to prioritize deep building retrofits and apply it to the asset list of buildings and establish a preliminary schedule to direct deep building retrofits • 2021: Set standards and guidelines for deep building retrofit and complete first City building deep retrofit • 2022: As funding permits, conduct deep retrofits on up to two more City buildings • 2023: Complete a performance review of the first buildings retrofitted and adjust actions as required	☑ 2021: Replaced aging fossil fuel-based heating systems at Fitzroy and Dunrobin community centers with heat pumps ☐ 2021: Submit funding applications to the Green and Inclusive Community Building Program ☐ 2021: Complete a Project Charter and establish a working group to support the program's development ☐ 2022: Identify, evaluate, and prioritize building candidates and potential funding sources ☐ 2022: Set standards and guidelines through program for deep building retrofits ☐ 2022-2023: Start deep retrofits

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
				and adjust program as required
Update Municipal Green Building Policy to align with corporate GHG reduction targets	City	Ongoing / Delayed	• 2020: Where possible influence upcoming and ongoing projects with these new criteria, complete policy impact analysis • 2021: Propose new policy and if approved, new green building policy would begin to transition into effect • 2025: Net zero emissions required for all new City facilities	☐ 2020-2022: Where possible, influence upcoming and ongoing projects ☐ 2022: Update to Municipal Green Building Policy to be tabled at Committee and Council ☐ 2025: Net zero emissions required for all new City facilities

Sector: Transportation

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
Personal Vehicles Electrification Strategy to enable and encourage personal electric vehicle adoption.	City & Community	Ongoing / On-track	• 2020 onwards: City participates in advocacy and monitors adequacy of local public charging. • 2020 to 2023: City to apply for expected EV funding programs undertaken by Natural Resources Canada and others • 2021: Update the Corporate Electric Vehicle Charging Station Policy; develop a City public charging infrastructure and building retrofit charging plan	☐ 2021: City installing 12 double-headed Level 2 charging stations in the right-of-way, a Level 2 charging station at the renovated Blackburn/Lois Kemp Arena, and one 150kW charger at Bob MacQuarrie Recreation Complex ☐ 2021-2023: Continue monitoring and applying for expected EV funding programs undertaken by Natural Resources Canada and others ☐ 2022: Proposed Personal Electric Vehicle Strategy to be tabled at Committee and Council. ☐ 2022: Update to the Corporate Electric Vehicle Charging

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
				Station Policy to be tabled at Committee and Council ☐ Ongoing: Continue advocacy and monitoring adequacy of local public charging
Zero Emissions Commercial Vehicles Strategy to enable and encourage commercial electric vehicle adoption.	City & Community	Not started	• Q1 2021: Consult with commercial fleets and support advocacy • 2022: Report on encouraging electrification of light-duty fleets • 2022: Summary report with recommendations on zero emission commercial vehicles	☐ 2022: Consult with commercial fleets and support advocacy ☐ 2022: Report on encouraging electrification of light-duty fleets ☐ 2022: Summary report with recommendations on zero emission commercial vehicles
Municipal Green Fleet Plan Update an updated plan to continue the conversion of City vehicles to lower emission vehicles where possible.	City	Ongoing / On-track	• 2022: Update of the Municipal Green Fleet Plan • To be determined	☑ September 2021: PIED applied to Natural Resources Canada for funding to support electrical and infrastructure requirements in the Green Fleet Plan; Fleet Services applied to FCM for

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
				funding to support transition to greener fleet options. ☐ Q2 2022: Update of the Municipal Green Fleet Plan tabled at Committee and Council ☐ 2022 - 2024: Implement the Municipal Green Fleet Plan in coordination with the PIED project to install supporting charging infrastructure
Alternative Energy Sources for Transit Program to build a 100% zero emissions Concept Transit Network by 2030.	City	Ongoing / On-Track	• 2020: TMP Update environmental scan completed • 2021: TSD study of alternative energy sources for transit fleet options to feed into the Fleet Strategy update; Alternative Energy Transit Project to be completed	☐ June 2021: Zero-Emission Buses for OC Transpo report carried at Council (ACS2021-TSD-TS-0009) ☐ 2021: Four electric buses are added to the bus fleet ☐ 2023: Up to 74 electric buses are added to the bus fleet

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
			• Fall 2023: Transportation Master Plan Update completed	☐ 2024: Part 2 of Transportation Master Plan Update (Capital Infrastructure Plan for Transit, Active Transportation and Roads) to be tabled at Committee and Council ☐ 2024-2027: Up to 450 electric buses in operation by 2027 (based on funding availability and operational needs)
Transportation Mode Shift to reduce the reliance on personal vehicles in favour of sustainable modes including public transit, walking, cycling, and carpooling.	City	Ongoing / Partially Delayed	• Fall 2023: Transportation Master Plan Update completed	☐ 2022: Part 1 of Transportation Master Plan Update (Policy) and Active Transportation capital project list to be tabled at Committee and Council ☐ 2024: Part 2 of Transportation Master Plan Update (Capital Infrastructure Plan for Transit, Active Transportation and Roads) to be tabled at

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
				Committee and Council

Sector: Waste

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
Organics Resource Recovery Strategy to reduce emissions associated with managing waste and enable energy from waste.	City & Community	Ongoing / Partially Delayed	• 2022: Complete a baseline assessment of the industrial, commercial, and institutional waste in Ottawa with a view to reducing amounts generated and recovering organics from this stream • 2022: Solid Waste Master Plan completed	☑ July 2021: Solid Waste Master Plan – Phase 2 report was carried by Council (ACS2021-PWE-SWS-0003) ☐ Fall 2021: Solid Waste Master Plan Engagement Series 2 ☐ 2022: Draft Solid Waste Master Plan tabled for Council consideration and further public consultation ☐ 2023: Final Solid Waste Master Plan tabled at

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
				Committee and Council ☐ 2023: Complete an assessment of the industrial, commercial, and institutional waste in Ottawa with a view to reducing amounts generated and recovering organics from this stream
Renewable Natural Gas Strategy to supply GHG neutral gas to the community.	City	Ongoing / On-track	• 2020-2022: Identify key issues and opportunities; complete Biogas Optimization Study, Solid Waste Master Plan and ROPEC Site Master Plan; assess interest in renewable natural gas (RNG) from the agricultural community and private landfills; look for opportunities to expedite RNG projects; look for way to minimize the release of fugitive or other waste related emissions	☑ November 2020: City approved for $82,450 from the Federation of Canadian Municipalities for the Robert O. Pickard Environmental Centre (ROPEC) Biogas Optimization Study ☑ September 2021: ROPEC Biogas Optimization Study completed

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
			• 2022-2025: Develop a Renewable Natural Gas Strategy and implement plans	☐ 2021-2022: RNG market study ☐ 2022-2023: Complete a feasibility study for a RNG production facility at ROPEC ☐ 2022-2025: Develop a Renewable Natural Gas Strategy and implement plans

Sector: Electricity

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
Electricity Resource Strategy to develop local or regional renewable electricity supplies.	City	Ongoing	• 2020: Provide input to and comment on the Hydro Ottawa five-year direction plan to align it with Energy Evolution targets • 2020 onwards: Remain active in	☑ 2020: Provide input to and comment on the Hydro Ottawa five-year direction plan to align it with Energy Evolution targets

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
			planning at the Independent Electricity System Operator and the Ontario Energy Board • 2021: Establish a stakeholder working group to evaluate distributed generation and storage options and encourage private and community investment • 2021 onwards: Implement additional smart grid showcases in several parts of the City • 2020-22: Install power to thermal at City facilities which have access to low cost wholesale priced power	☑ 2020 onwards: Remain active in planning at the Independent Electricity System Operator and the Ontario Energy Board ☑ 2020 onwards: Install power to thermal at City facilities which have access to low cost wholesale priced power ☐ 2021-2023: Staff participate in OEB's stakeholder working group to evaluate distributed generation and storage options and encourage private and community investment ☐ 2022: Complete first round of solar panel installations at City facilities

Sector: Enabling Projects

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
Climate Ambassadors Network to engage commercial and institutional champions to meet long term GHG reduction targets.	City & Community	Ongoing / Delayed	• 2021 Q1: Identify and determine level of interest from large energy consumers and employers • 2021 Q1: Review Ethical Purchasing Policy to support network objectives • 2021 Q2: Develop network activities and programs • 2021 Q3: Launch network and initial activities • 2022: Participants publish GHG reduction targets and carbon budgets and implement significant carbon reduction activities • 2023: If successful, expand	☐ Q3 2021: Ottawa joined the Race to Zero and encouraged other large employers and energy consumers to join their respective streams ☐ Q4 2021: Launch the Better Buildings Ottawa Network. Offer network activities, education opportunities, and perform thermal scans mainly focused on large commercial buildings. ☐ Work with the Network participants to develop an effective commercial building retrofit financing program. ☐ 2022: Continue to review Ethical Purchasing Policy to

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
			network to include small medium enterprises	support Network objectives ☐ 2022 - ongoing: Participants publish GHG reduction targets and carbon budgets and implement significant carbon reduction activities ☐ 2023: If successful, expand network to include small medium enterprises ☐
Climate Change Education and Outreach Program to engage the public in collective private action to meet long term GHG reduction targets.	City & Community	Ongoing	• 2020: Develop program materials and engage community partners, launch campaign • 2021: Expand campaigns; monitor effectiveness • 2021: Presentations to support on-going alignment of priorities,	☑ 2021: Developed and implemented communications and engagement plan in support of Energy Evolution projects. This included presentations, Engage Ottawa surveys and engagement, climate change newsletter,

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
			workplans, and budgets to internal and external stakeholders • 2022: Adjust as necessary for effectiveness	and social media ☐ 2022 - ongoing: Develop and implement annual communication and engagement plan in support of Energy Evolution projects
Fund the Evolution to further assess potential sources of municipal funding.	City	Ongoing	• 2021: Consult on potential revenue sources advocate for mechanisms not in City's control, if required and provide input into Long Range Financial Plan and bylaws as opportunities arise • 2022: Begin to implement revenue and funding mechanisms per council direction • 2023: Measure success and continue to pursue revenue and	☐ 2021 - ongoing: Continue consulting on potential revenue sources advocate for mechanisms not in City's control, if required and provide input into Long Range Financial Plan and bylaws as opportunities arise ☐ 2020 - ongoing: Work with senior levels of government to accelerate ambition and action to meet the urgency of climate change and provide additional resources for municipalities

Project Description	Lead (City / Community)	Status	Estimated Project Milestones (October 2020)	Project Achievements / Next Steps & Updated Timelines
			funding opportunities	and the public to reduce their GHG emissions and build resiliency to climate impacts.

Document 3 – Proposed 2020 Hydro Ottawa Dividend Surplus Spending Plan

Document 3 proposes a spending plan for 2020 Hydro Ottawa dividend surplus to support Energy Evolution priority projects, leverage federal and provincial funds where possible, and implement energy efficiency, conservation, and renewable energy generation projects. Energy Evolution projects include, but are not limited to, municipal energy conservation, public and municipal electric vehicle charging infrastructure, district energy, solar panels on municipal facilities, and communication, education and engagement programs that support Energy Evolution objectives. Funds could also be used to implement other energy efficiency, conservation, and renewable energy generation projects as they emerge. The funding is for all project related costs including feasibility and design studies, pilots, construction, and equipment acquisition or installation.

Energy Evolution Project	Project Name	Project Description	Estimated Cost
Municipal Buildings Renewal and Retrofit Program	High Performance Windows	High performance windows to support deep retrofit work.	$175,000
Municipal Buildings Renewal and Retrofit Program	Renewal Opportunities	Leverage federal funding opportunities and take advantage of GHG reduction as opportunities occur. Opportunities may be identified during audits, by City staff or during breakdown repair work.	$175,000
Municipal Buildings Renewal and Retrofit Program and Municipal Green Fleet Plan	Green Fleet Electrical Upgrades	Leverage federal funding opportunities and support electrical work and upgrades required to support the Municipal Green Fleet Plan including charging and associated infrastructure.	$100,000

Energy Evolution Project	Project Name	Project Description	Estimated Cost
Personal Vehicles Electrification Strategy	EV Charging Infrastructure	Leverage funding opportunities for new EV charging stations.	$100,000
Community Building Heating Strategy	Gladstone/Somerset District Energy Study	Study to assess district energy options for new Gladstone development.	$70,000
Electricity Resource Strategy	Solar on Municipal Facilities	Aim to identify 6-8 potential municipal solar sites, complete structural assessments, and assess prospective leaser's installation proposals.	$50,000
Climate Change Education and Outreach Program	Education and Outreach Staff	Extend temporary staff to support the communication, education and outreach campaigns that support implementation of the Climate Change Master Plan priority "Private Action". This position would support other Climate Change Master Plan priorities including the roll out of community focused Energy Evolution projects and the Climate Resiliency Strategy.	$130,000
		TOTAL	**$800,000**

ENERGY EVOLUTION

OTTAWA'S COMMUNITY ENERGY TRANSITION STRATEGY – FINAL REPORT

City of Ottawa
Planning, Infrastructure
and Economic Development

October 2020

ottawa.ca/climatechange

ottawa.ca 3-1-1
TTY/ATS 613-580-2401

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THANK YOU TO OUR PARTNERS

City staff benefited immensely from feedback and leadership provided by community stakeholders throughout the development of Energy Evolution: Ottawa's Community Energy Transition Strategy. The City extends its sincere thanks and appreciation to almost 200 public and private stakeholders representing more than 90 organizations who participated in high-level "Sounding Board" discussions as well as technical workshops.

- Arborus Consulting
- Association of Energy Engineers – Eastern Canada Conference
- Aspen Solar Management
- Atmospheric Energy Systems
- BGIS
- Building Owners and Managers Association
- Bullfrog Power
- Burritts Rapids Renewable Energy Association
- Canada Green Building Council
- Canadian Association for Renewable Energies
- Canadian Biogas Association
- Canadian Geoexchange Coalition
- Canada Science and Technology Museums Corporation
- Canadian Urban Transit Research and Innovation Consortium
- CanmetENERGY
- Carbon Impact Consultants
- Carleton University
- Centretown Citizens Ottawa Corporation
- Chamber of Commerce
- CH Four Biogas
- City of Ottawa (various departments and branches)
- City of Hamilton (Office of Energy Initiatives)
- City of Markham (Solid Waste)
- City of Toronto (Planning Department)
- Clean Air Partnership
- Clean Energy Canada
- Community Associations for Environmental Sustainability
- Communauto
- Domicile Development Inc.
- Eastern Ontario Landlord Organization
- EcoGen Energy Inc.
- Ecology Ottawa
- Econogics Inc.
- EDF Renewables
- Electric Vehicle Council of Ottawa
- Enbridge Gas Distribution Inc.
- Energy Ottawa
- Envari
- Envirocentre
- Enwave
- Federation of Canadian Municipalities
- FVB Energy Inc.
- GHD Limited
- Gloucester Housing Corporation
- Greater Ottawa Home Builders' Association
- Green Communities Canada
- Healthy Transportation Coalition
- Hydraulic Energy and Renewable Energy Technologies
- Hydro One
- Hydro Ottawa
- Independent Electricity System Operator
- Innovative Hydro Controls
- Invest Ottawa
- iSolara Solar Power
- JAZZ Solar Solutions
- JJ McNeil Commercial Inc.
- J. Michael Wiggin Consulting
- J.L. Richards
- Ken Church Consulting
- Leidos Canada
- Lumos Energy

- Master Group
- Minto Group
- National Capital Commission
- National Research Council
- Natural Resources Canada
- Norsun Energy
- Nova Bus
- Ontario Biogas Association
- Ontario Ministry of Agriculture, Food and Rural Affairs
- Ontario Energy Board
- Ottawa Carleton District School Board
- Ottawa Centre EcoDistrict
- Ottawa Climate Action Fund
- Ottawa Community Foundation
- Ottawa Community Housing
- Ottawa Gatineau Hotel Association
- Ottawa Macdonald–Cartier International Airport
- Ottawa Renewable Energy Co operative
- Ottawa Regional Society of Architects
- Ottawa Student Transportation Authority
- Passive House Canada
- Peak Power Energy
- Plug'n Drive
- Pollution Probe
- Public Services and Procurement Canada
- QUEST
- Regional Group
- RND Construction
- Rightwheel Inc.
- Smarter Shift
- Sustainability Solutions Group
- Transport Canada
- Treasury Board of Canada
- Tucker House
- University of Ottawa
- VRTUCAR
- Waste Watch Ottawa
- whatIf? Technologies Inc.
- Windmill Development Group Ltd.
- WSP
- ZEBx
- Zibi

Additionally, sincere thanks and appreciation to the following City stakeholders for providing their subject matter expertise and continued feedback throughout the process.

- Climate Change Council Sponsors Group
- Mayor's Office
- City Manager's Office
- City departments
  - » Financial Services
  - » Innovative Client Services
  - » Planning, Infrastructure and Economic Development
  - » Public Works and Environmental Services
  - » Recreation, Cultural and Facility Services
  - » Transportation Services
- Ottawa Public Health

MESSAGE FROM THE CHAIR OF THE STANDING COMMITTEE ON ENVIRONMENTAL PROTECTION, WATER AND WASTE MANAGEMENT

In 2020, Ottawa City Council took a bold step in unanimously approving our Climate Change Master Plan. Coupled with a declaration of a climate emergency, it was a strong commitment toward a better future for our city and beyond. Alone, though, the adoption and declaration are simply not enough.

To that end, Ottawa has committed to reducing community emissions by 100% by 2050 and reducing emissions from City operations by 100% by 2040. This puts us in lockstep with the recommendations of the Intergovernmental Panel on Climate Change.

Energy Evolution will outline what it will take to achieve the ambitious targets mentioned above. These are achievements that will not be reached in isolation. There is not a single municipality or government that can achieve this alone. We all must work together and support each other to get there.

We all play a role in this process and toward these stated goals. Residents, business, utility companies, governments large and small. We are all in this together and together is how we will find success.

Councillor Scott Moffatt

Chair, Standing Committee on Environmental Protection,
Water and Waste Management

COUNCIL DIRECTION

In July 2015, development of a Renewable Energy Strategy (later renamed Energy Evolution) was identified as a strategic priority within the 2015-2018 City Strategic Plan.

In December 2017, Council received Energy Evolution Phase 1 and directed staff to initiate the recommendations in the report and complete Phase 2 of the Energy Evolution Strategy (ACS2017-PIE-EDP-0048).

In April 2019, City Council approved a motion to declare a climate emergency (ACS2019-CCS-ENV-0005), which included the following directions for the Energy Evolution final report:

- Status update of Energy Evolution Phase 1 actions
- New concrete actions and resource implications (staff and financial) to achieve GHG emission reduction targets
- Use an equity and inclusion lens in the prioritization of actions
- Funding and savings options for the City when implementing emission reductions

In January 2020, City Council unanimously approved the Climate Change Master Plan, which included setting new short-, mid- and long-term targets to reduce community GHG emissions by 100% by 2050 and corporate GHG emissions by 100% by 2040. Energy Evolution is one of eight priority actions under the Climate Change Master Plan. Council also received an update on Energy Evolution and a draft energy and emissions model (ACS2019-PIE-EDP-0053).

Photo: City of Ottawa

EXECUTIVE SUMMARY

On January 29, 2020, Ottawa City Council approved short-, mid- and long-term community and corporate GHG emission reduction targets that aligned with the Intergovernmental Panel on Climate Change target to limit global warming increases to 1.5°C.

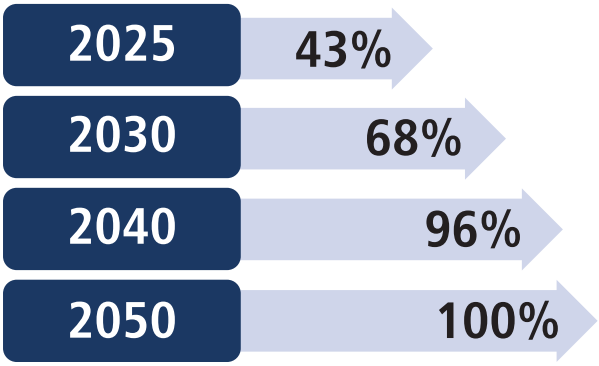


Figure 1: Short-, mid- and long-term community targets to reach 100% by 2050 target

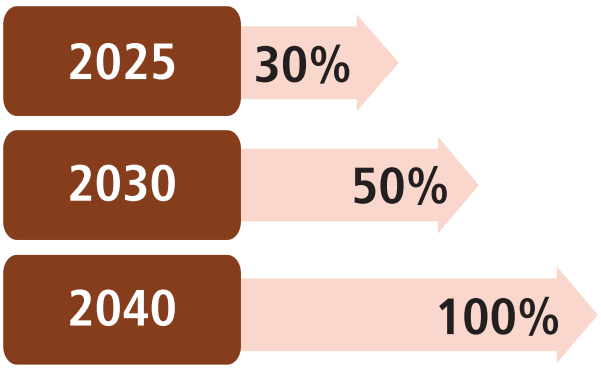


Figure 2: Short-, mid- and long-term corporate targets to reach 100% by 2040 target

Energy Evolution sets the framework for what it will take for Ottawa to achieve these GHG emission reduction targets. It is a community energy transition strategy designed to manage energy consumption, promote the use of renewable energy and advance local economic development opportunities in Ottawa. Developed in collaboration with more than 40 staff representing six departments, almost 200 public and private stakeholders representing more than 90 organizations, and the Climate Change Council Sponsors Group, Energy Evolution is a community-wide initiative with a vision to transform Ottawa into a thriving city powered by clean, renewable energy.

This strategy responds to Council's directive to identify the scale of change and investment required to achieve Council's long-term GHG reduction targets. It acknowledges that achieving these targets will require concerted efforts and collaboration across all sectors of society, and that the scope and scale required is unprecedented in both action and investment. Realizing this action and investment carries many risks including that the strategy is currently under resourced and unfunded and will rely on involvement and funding from all levels of government.

This strategy also advances the 2019-2022 Term of Council priority Environmental Stewardship by identifying projects to reduce the City's GHG emissions and embed climate change considerations across all operations. It aims to strengthen Council's commitment to naming, framing and deepening Ottawa's commitment to protecting our economy, our ecosystems, and our community from climate change and it helps implement the Climate Change Master Plan.

Energy and Emissions Model

At the core of Energy Evolution is a comprehensive, custom-built energy, emissions and finance model. The model incorporates growth, land use, buildings, transportation, and waste data with energy conservation, efficiency, and renewable energy pathway studies and presents two GHG emission scenarios:

- A Business-as-Planned scenario (BAP scenario)
- A 100% by 2050 target scenario (100% scenario)

The model projects that Ottawa's emissions will remain relatively flat for the next 30 years under the BAP scenario, far from achieving the long-term target to reduce emissions by 100% by 2050. In order to achieve the 100% scenario, the model identifies the need to greatly reduce energy demand through conservation and efficiency and projects that:

- All fossil fuels will have to be phased out.
- Heating and transportation systems will have to be nearly fully electrified or transition to zero emission.
- Waste heat utilization and renewable natural gas production will have to be added.
- Sufficient renewable electricity (mostly wind and solar) generation and electricity storage will be required to meet demand and offset emissions on the provincial grid.

Benefits of a Community Energy Transition Strategy

There are many co-benefits that can be achieved through a community energy transition to low carbon energy sources, including:

- Local economic development, including job creation, access to funding, and local energy dollar creation
- Improved public health
- Equity and inclusion
- Energy security and resiliency
- Mitigating future risk

Achieving the 100% Scenario

The model projects what outcomes are required to meet the 100% scenario in five key sectors: land use and growth management, buildings (new and existing), transportation, waste and renewable natural gas, and electricity. It will require implementation of the municipality's ongoing and planned actions, implementation of new actions that the municipality has not yet approved, and action and investment from all segments of society. Tables 1 through 7 (pages 3 through 7) and Figure 3 (page 3) provide a summary of the projected GHG emission reductions and proposed projects by sector to achieve the 100% scenario.

Table 1 (page 3) identifies the projected emission reduction by sector to achieve the 100% scenario. According to the model, the buildings and transportation sectors are projected to account for roughly 75% of cumulative emission reductions from now until 2050. The remaining 25% is projected to come from the waste and renewable natural gas and electricity sectors.

Within those sectors, 39 actions have been identified to achieve the 100% scenario. Table 2 (page 4) identifies the top five actions from the model, which combine for roughly 80% of projected cumulative GHG emission reductions required.

A total of 20 projects have been identified over the next five years to accelerate action and investment towards achieving the 100% scenario. Most of the projects are to be led by the municipality and are to be undertaken in collaboration with community partners. Proposed projects are contingent on future Standing Committee and Council approval as well as future staff and budget (capital and operating). To achieve the GHG reductions required in the 100% scenario, some projects may evaluate options beyond what's been identified prior to going to the Standing Committee and Council.

Table 1: Total projected community-wide GHG emission reductions required to achieve 100% scenario incremental to BAP scenario, 2030 and 2050 (non-cumulative)

Sector	Percentage (%) of Total Projected GHG Emission Reductions	
	2030	2050
Land use and growth management	Embedded in other actions	Embedded in other actions
Buildings (new and existing)	37.1%	38.0%
Transportation	29.9%	36.7%
Waste and renewable natural gas	26.1%	16.9%
Electricity	6.5%	8.5%

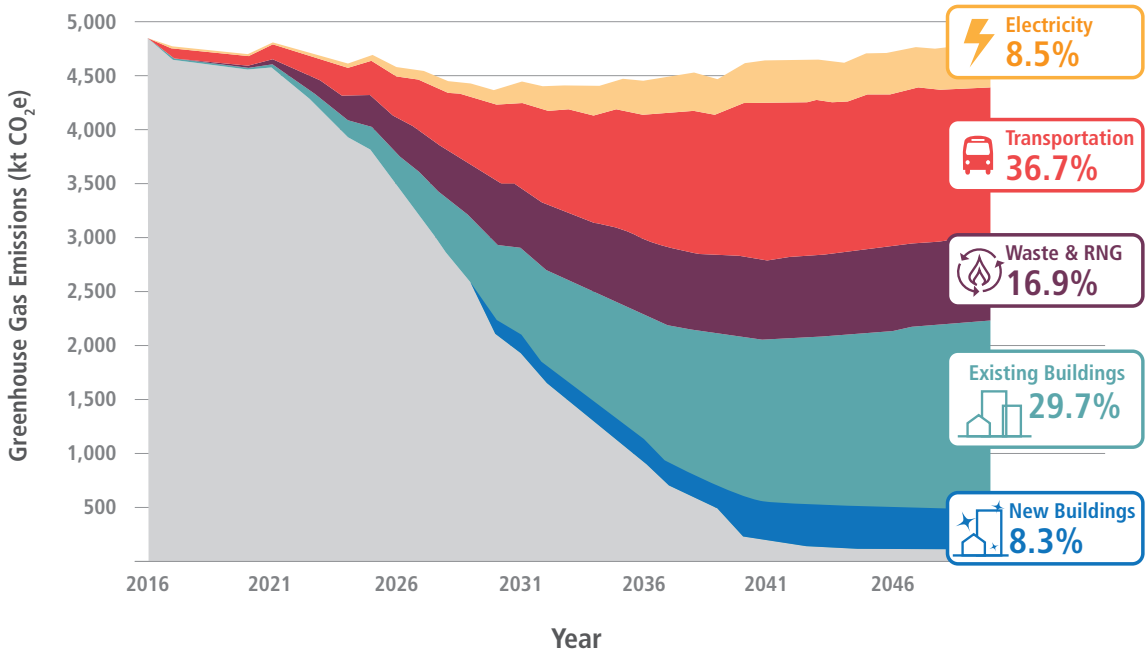


Figure 3: Total projected community-wide GHG emission reductions required to achieve 100% scenario incremental to BAP scenario by sector, 2016-2050 (percentages shown at 2050 are non-cumulative)

Table 2: Projected top five actions from the energy and emissions model to achieve the 100% scenario by 2050

Actions	Cumulative GHG Reductions by 2050 (%)
1. Electrify personal vehicles	22.7%
2. Retrofit residential buildings[1]	17.9%
3. Divert organics and create renewable natural gas[2]	17.2%
4. Retrofit commercial buildings[3]	15.1%
5. Transition to zero emission commercial fleets	8.3%

Table 3: Projects to be undertaken in the land use and growth management sector (2020 2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Integration of energy and climate mitigation policies into the new Official Plan and supporting master plans to address multiple challenges being faced by the city over the next 25 years, climate change being one of the most critical. The Official Plan and supporting master plans will be guided by the Climate Change Master Plan with Council approved targets to reduce GHGs by 2050.	Energy and climate mitigation policies embedded into the new Official Plan and supporting master plans	Enabler

Table 4: Projects to be undertaken in the buildings sector (2020-2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Residential Building Retrofit Accelerator Program to accelerate residential, multi-unit residential, and commercial and institutional building retrofits through marketing, information and financial mechanisms	• 17% of existing residential buildings renovated or replaced • 20% of existing residential buildings transition to heat pumps • 10% of domestic hot water heating transitions to non emitting sources	22% (222 kt CO_2e)

1 Includes retrofitting pre- and post-1980 homes, low rise residential and apartment building heat pumps.

2 Includes waste diversion and RNG production, rural biogas generation, waste heat, and power to gas.

3 Includes retrofitting commercial, office, and residential buildings, and commercial building heat pumps.

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Commercial Building Retrofit Accelerator Program to accelerate multi-unit residential, commercial, industrial, and institutional building retrofits through marketing, information and financial mechanisms	• 15% of existing commercial buildings renovated or replaced • 20% of existing commercial buildings transition to heat pumps • 10% of domestic hot water heating transition to non emitting sources	18% (175 kt CO_2e)
Building Retrofits through Local Improvement Charge Program to accelerate and finance deep energy retrofits of buildings through the local improvement charge mechanism	Embedded within the residential and commercial building retrofit accelerator programs	
Energy Community Improvement Plans to incentivize superior energy performance and deep energy retrofits using tax grants	Embedded within the residential and commercial building retrofit accelerator programs	
Community Building Heating Strategy to address infrastructure and utility requirements for new ways of heating buildings	30% drop in GHG intensity of federal district energy system	9% (92 kt CO_2e)
Municipal Buildings Renewal and Retrofit Program to achieve higher building energy performance improvements in municipal owned buildings	Ramping towards having 27% of municipal buildings net zero by 2030	1% (12 kt CO_2e)
Update to Municipal Green Building Policy to align with corporate GHG reduction targets	Embedded within the Municipal Buildings Renewal and Retrofit Program	
High-Performance Development Standard to improve building design and construction across the community and support an industry-wide transition of new buildings to net zero emissions ready by 2030	Ramping towards all new buildings being net zero energy by 2030	6% (59 kt CO_2e)

Table 5: Projects to be undertaken in the transportation sector (2020-2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Personal Vehicles Electrification Strategy to enable and encourage personal electric vehicle adoption	7% of personal vehicle sales are EVs in 2025	5% (49 kt CO_2e)
Zero Emissions Commercial Vehicles Strategy to enable and encourage commercial electric vehicle adoption	18% of commercial fleet is electric by 2025	6% (63 kt CO_2e)
Municipal Green Fleet Plan Update to consider corporate greenhouse gas reduction targets	Progress towards the 2030 target	<1% (<10 kt CO_2e)
Alternative Energy Sources for Transit Project to build a 100% zero emissions Concept Transit Network[4] by 2030	48% of OC Transpo's passenger fleet is zero emission by 2025	6% (63 kt CO_2e)
Transportation Mode Shift to reduce the reliance on personal vehicles in favour of sustainable modes including public transit, walking, cycling and carpooling	Steady progress towards the 2030 mode share targets	3% (33 kt CO_2e)

Table 6: Projects to be undertaken in the waste and renewable natural gas sector (2020 2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Organics Resource Recovery Strategy to reduce emissions associated with managing waste and enable energy from waste[5]	Significant increase in organics diversion starting in 2023	7% (73 kt CO_2e)
Renewable Natural Gas Strategy to supply GHG neutral gas and other heating to the community	Initial renewable natural gas production in the community starting in 2022	12% (122 kt CO_2e)

4 The Concept Transit Network refers to the 2013 Transportation Master Plan rapid transit 2031 network concept.

5 This will be considered for residential waste management through the municipal Solid Waste Master Plan (SWMP), expected to be complete by the end of Q2 2022. The SWMP will determine the direction and goals for residential solid waste management, diversion, and reduction over the next 30 years.

Table 7: Projects to be undertaken in the electricity sector (2020-2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Electricity Resource Strategy to develop local or regional renewable electricity supplies and advocate for zero emission generation at the provincial level	Install: • 150 MW solar • 20 MW wind • 20 MW hydro • 20 MW electricity storage	7% total, comprised of: • Solar: 57 kt CO_2e • Wind: 4 kt CO_2e • Hydro: 10 kt CO_2e

Table 8: Enabling projects to support meeting the 100% scenario (2020-2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Climate Ambassadors Network to engage commercial and institutional champions to meet long term GHG reduction targets	• Reduced barriers to implementation • Increased funding to support implementation	Enabler
Climate Change Education and Outreach Program to engage the public in collective private action to meet long term GHG reduction targets	Increased awareness and action	Enabler
Fund the Evolution to further assess potential sources of municipal funding, financing, and market enabling mechanisms	Increased funding to support implementation	Enabler

Financials

A community-wide financial analysis was undertaken to analyze those Energy Evolution actions that have financial impacts. The analysis represents investments required by and potential savings for everyone in Ottawa including the municipality, residents, businesses, institutions, and organizations.

All financial information presented represents high level estimates that are currently uncommitted and unfunded capital and operational needs. The analysis does not commit the municipality or any partners to any financial decision or provide direction on how to address funding gaps. The analysis is intended to:

- Identify the magnitude of funding required to implement Energy Evolution for the municipality and community partners, including senior levels of government
- Assess which potential funding sources, financial mechanisms or delivery mechanisms may be most appropriate for implementing Energy Evolution actions
- Inform strategic discussions, policy direction, annual budget cycles and the Long Range Financial Plan

It is not intended to provide sufficiently accurate financial information to make decisions. This level of detail will be brought forward to the Standing Committee and Council when approval is sought on priority projects.

The financial analysis projects that in order to meet the 100% scenario, cumulative community-wide investment from 2020 to 2050 totals $57.4 billion with a present value of $31.8 billion. All costs and net returns projected for the 100% scenario are incremental, above and beyond the BAP scenario. In the short term, annual community-wide capital costs are higher up front as investments in public infrastructure, buildings, vehicles, energy-related equipment and renewables are made that will lead to long-term savings. Starting in 2032, there is a projected net financial benefit to society when the net annual savings and potential revenues exceed the annual investments. Investments made by 2050 will accrue a community-wide net return of $87.7 billion ($12.4 billion when discounted to 2020 dollars). In the year 2050, the community will have accrued a potential net return of $28.4 billion ($2.7 billion in 2020 dollars). Table 9 (below) shows how the net return could accumulate to 2050 and beyond based on the life expectancies of the investments made.

Annual incremental community-wide investments of approximately $1.6 billion per year net present value would be required for the next decade (2020-2030) to achieve GHG reductions in line with the model and the 100% scenario. Of this, $581 million per year net present value would be required (2020-2030) for transit and active transportation infrastructure and an additional $41 million per year net present value would be required (2020-2030) for municipal building retrofits, zero emission non-transit municipal fleet, and renewable natural gas generation at wastewater, solid waste or agricultural facilities. Annual incremental community-wide investments drop to around $782 million per year from 2031-2050. During this period, net returns are expected to be much higher primarily due to saved energy costs and earned revenues from local energy generation. A breakdown of the actions bundled into each of the sectors is provided in Table 10 (below).

Table 9: Financial net value to society for achieving the 100% scenario

Capital Investments and Savings	Undiscounted ($Billion)	Present value (4.5% discount rate) ($Billion)
Capital investments	($ 57.4)	($ 31.8)
Operations and maintenance savings	$ 22.6	$ 9.0
Energy savings	$ 70.9	$ 18.1
Carbon price savings	$ 13.4	$ 4.0
Revenue from local generation	$ 38.2	$ 13.1
Community-wide net return	**$ 87.7**	**$ 12.4**

Table 10: Breakdown of net costs and returns by sector (net present value 2020$, in billions)

Sector	Estimated Net Costs ($Billions)	Estimated Net Returns by 2050 ($Billions)	Estimated Net Returns over Life of Investment ($Billions)
Land use and growth management	$ 0	$ 0	$ 0
Buildings (new and existing)	($ 17.7)	($ 6.0)	$ 0.4
Transportation	($ 7.9)	$ 3.9	$ 4.8
Waste and renewable natural gas	($ 0.2)	$ 0.01	$ 0.02
Electricity	($ 6.0)	$ 4.8	$ 7.2
Total	**($ 31.8)**	**$ 2.7**	**$ 12.4**

It is recognized that the municipality alone will not be able to accomplish the scale of investment required. Future year funding commitments by the municipality, combined with revenue streams, private capital sources, and funding from senior levels of government will ultimately influence the City's success in achieving emission reductions. Approval of future municipal annual incremental operating requests will be critical to expanding the staffing and resource capacity of departments that are leading projects to advance Energy Evolution. This funding would enable program optimization and improve the likelihood of leveraging capital from external sources, including federal grants and infrastructure monies.

Risks to Implementation

The scope and scale required to achieve the 100% scenario is unprecedented in both action and investment. Realizing this action and investment carries many risks. These risks may include:

- Insufficient financial support from different levels of government and the private sector to meet the budgetary and staffing needs of the Action and Investment Plan and beyond
- Higher capital and operating costs, as well as lower than expected saving and revenues, beyond what's currently estimated for project implementation and municipal operations
- Regulatory barriers and compliance issues that impede the municipality from action and innovation, either by impeding the municipality directly through its own operations or impeding how the municipality can enact change in the community
- Lack of uptake or buy-in from residents, businesses, industry or the municipality that impacts the viability of a new program or new standard
- Diverging interpretations between stakeholders on how best to achieve the 100% scenario
- Competing Council priorities or processes associated with other projects across the corporation
- Competing departmental priorities including current operational mandates of impacted services, and how their mandates will need to change in order to work to achieve the emission reductions in Energy Evolution
- Lack of alignment between what the Energy Evolution model calls for and recommendations that come forward for plans and strategies that directly relate to Energy Evolution. Note that although it is expected that the range of options evaluated will include one or more scenarios that achieve the GHG reductions required in the 100% scenario, those scenario(s) may not ultimately be recommended
- Aggressive implementation timelines that may not account for typical City processes including capital budget approval, the Long Range Financial Plan, planning, consultation, approvals, design, construction, and commissioning or account for provincial or federal approval processes that are out of the City's control
- Changes in behaviour, policy, and best practices related to COVID-19

To mitigate these risks, the Energy Evolution project team will continue to work with City staff at all levels across the corporation, community partners, other levels of government, and the public to build out Energy Evolution projects and act as a resource or provide technical advice on related projects. Information and recommendations to support project implementation will be shared with a Tiger Team comprised of all General Managers, the Chief Financial Officer, the City Manager's Office and Ottawa Health; the Climate Change Council Sponsors Group; the Environmental Stewardship Advisory Committee; a community-wide governance structure; and community partners to align and coordinate priorities, workplans, annual budgets, communications and advocacy efforts. The Energy Evolution project team will also continue to work with municipal colleagues across the country through organizations like the Canadian Urban Sustainability Practitioners network, Clean Air Partnership and Low Carbon Cities Canada to share information, best practices, and lessons learned.

Additionally, at the time of the writing of the strategy, multiple City plans and strategies were in the process of being developed that directly relate to Energy Evolution including the new Official Plan, the Transportation Master Plan Update, the Solid Waste Master Plan, the Alternative Energy Sources for Transit Project, and the Municipal Green Fleet Plan. It is understood that these plans will complete their own options analysis to achieve each respective plan's

goals and targets and that the outcomes may differ from what has been identified. It is expected that the range of options evaluated will include one or more scenarios that achieve the GHG reductions required in the 100% scenario, although those scenario(s) may not ultimately be recommended.

Next Steps and Reporting

- All 20 projects will be further developed with input from staff, stakeholders, and the public as required. Some projects may evaluate options beyond what's been identified prior to going to the Standing Committee and Council. Once projects are fully developed, projects will be brought to the appropriate future Standing Committee and Council for approval.
- Staff will develop a 10-year spending plan that can be considered in annual municipal budget processes and feed into the City's Long Range Financial Plan. The next Long Range Financial Plan will be updated at the beginning of the 2022-2026 term of Council. Budget and staffing requirements would be brought forward as part of the annual budget process.
- Staff will continue to engage with and provide training to staff and the public to embed climate considerations more broadly across the corporation and the community.
- Staff will prepare department specific presentations on Energy Evolution starting in 2021 to ensure that staff across the corporation are aware of, can align with, and continue to make use of relevant information. They will be delivered to departmental leadership teams and offered to appropriate service area, branch or unit teams to support ongoing alignment of priorities, workplans, and budgets.
- Staff intend to rerun the energy and emissions model every five years to assess how the City and the community are tracking towards achieving the 100% scenario and to determine what actions should be prioritized in the short term.
- As part of the annual status update on the Climate Change Master Plan, staff will include annual corporate and community GHG inventories to help gauge Ottawa's progress towards GHG emission reduction targets, provide a status update on the Energy Evolution projects, and recommendations to advance the projects as required.
- A full review and update of the Climate Change Master Plan will be completed in 2025. Simultaneously, Energy Evolution and the future Climate Resiliency Strategy will be reviewed to see whether the three standalone documents can be merged into one.

Photo: City of Ottawa

SECTION 1
INTRODUCTION

Worldwide, climate scientists agree that fast-rising global temperatures have created a climate emergency.[6] In 2018, the Intergovernmental Panel on Climate Change (IPCC) released The Special Report on Global Warming of 1.5°C providing the scientific evidence for the need to limit global warming increases to 1.5ºC. The IPCC states that limiting global warming to 1.5ºC is possible but "would require rapid, far-reaching and unprecedented changes in all aspects of society"[7].

While the current climate trends are alarming, the technological solutions, skills and knowledge exist to transition away from fossil fuels to clean, renewable energy sources. According to the IPCC and international scientific consensus, there are about 10 years to make significant change if average global temperature increase is to be limited to 1.5ºC and it will take accelerated community-wide action and investment.

On April 24, 2019, Ottawa City Council declared a climate emergency, joining a global movement calling for urgent action to avert the climate crisis. In less than a year, City Council responded to the declaration, hiring additional staff in the Climate Change and Resiliency team and unanimously approving the Climate Change Master Plan. Energy Evolution is one of eight priorities approved in the Climate Change Master Plan.

Figure 4 (below) provides an overview of Ottawa's climate change framework and describes work associated with both mitigation and adaption.

Figure 4: Climate change framework

6 William J Ripple, Christopher Wolf, Thomas M Newsome, Phoebe Barnard, William R Moomaw, World Scientists' Warning of a Climate Emergency, BioScience, Volume 70, Issue 1, January 2020, Pages 8–12, https://doi.org/10.1093/biosci/biz088

7 IPCC Press Release. Summary for Policymakers of IPCC Special Report on Global Warming of 1.5ºC approved by governments. October 8, 2018. https://www.ipcc.ch/site/assets/uploads/2018/11/pr_181008_P48_spm_en.pdf

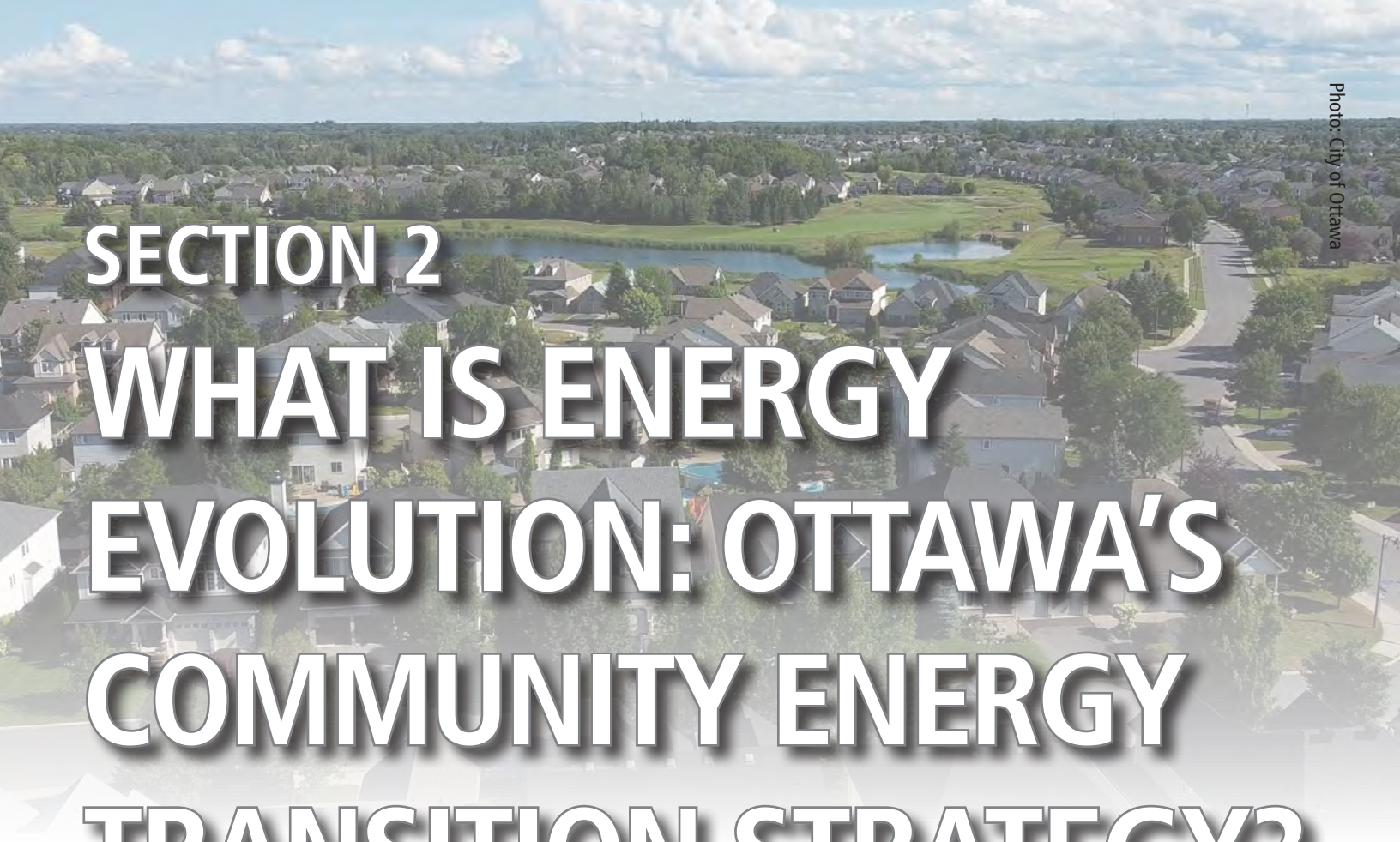


Photo: City of Ottawa

SECTION 2

WHAT IS ENERGY EVOLUTION: OTTAWA'S COMMUNITY ENERGY TRANSITION STRATEGY?

On January 29, 2020, Ottawa City Council approved short-, mid- and long-term community and corporate GHG emission reduction targets that aligned with the IPCC target to limit global warming increases to 1.5°C.

Energy Evolution sets the framework for what it will take for Ottawa to achieve these GHG emission reduction targets. It is a community energy transition strategy designed to manage energy consumption, promote the use of renewable energy and advance local economic development opportunities in Ottawa. Developed in collaboration with more than 40 staff representing six departments, almost 200 public and private stakeholders representing more than 90 organizations, and the Climate Change Council Sponsors Group, Energy Evolution is a community-wide initiative with a vision to transform Ottawa into a thriving city powered by clean, renewable energy.

To achieve Energy Evolution's vision, residents, businesses, organizations and governments would be required to make a sustained transition away from a dependence on fossil fuels by:

- Reducing energy usage through conservation and efficiency
- Increasing the supply of renewable energy through local and regional production
- Prioritizing the procurement of clean, renewable energy.

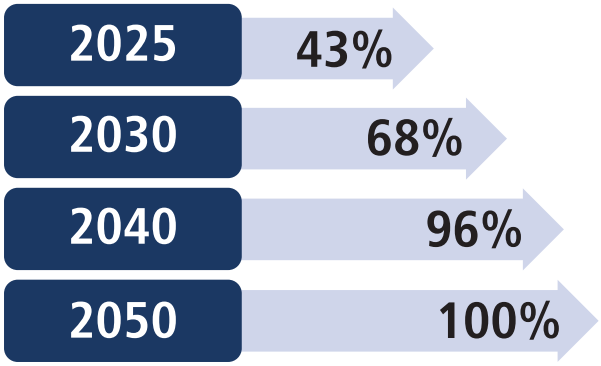


Figure 5: Short-, mid- and long-term community targets to reach 100% by 2050 target

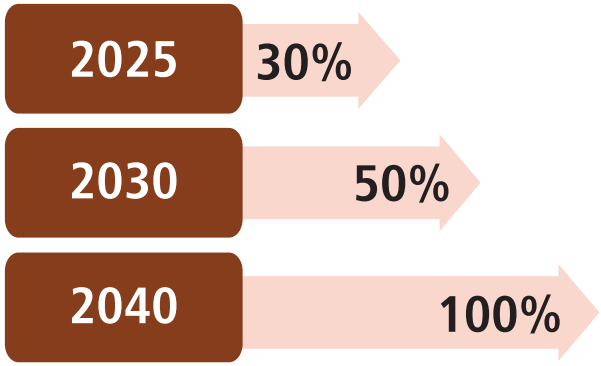


Figure 6: Short-, mid- and long-term corporate targets to reach 100% by 2040 target

At the core of Energy Evolution is a comprehensive, custom-built energy, emissions and finance model. The model incorporates growth, land use, buildings, transportation, and waste data with energy conservation, efficiency, and renewable energy pathway studies and presents two GHG emission scenarios:

- A Business-as-Planned scenario (BAP scenario)
- A 100% by 2050 target scenario (100% scenario)

The model projects what outcomes are required to meet these scenarios in five key sectors: land use and growth management, buildings (new and existing), transportation, waste and renewable natural gas, and electricity. To achieve the 100% scenario, rapid and far-reaching action and investment are required.

The model's financial analysis provides high-level cost estimates and preliminary estimates of savings and revenue. To help achieve the GHG emission reduction targets, Energy Evolution proposes 20 projects to initiate and further refine action within these five sectors over the next five years.

This strategy responds to Council's directive to identify the scale of change and investment required to achieve Council's long-term GHG reduction targets. It acknowledges that achieving these targets will require concerted efforts and collaboration across all sectors of society, and that the scope and scale required is unprecedented in both action and investment. Realizing this action and investment carries many risks including that the strategy is currently under resourced and unfunded and will rely on involvement and funding from all levels of government.

This strategy also advances the 2019-2022 Term of Council priority Environmental Stewardship by identifying projects to reduce the City's GHG emissions and embed climate change considerations across all operations. It aims to strengthen Council's commitment to naming, framing, and deepening Ottawa's commitment to protecting our economy, our ecosystems, and our community from climate change and it helps implement the Climate Change Master Plan.

2.1 Benefits of a Community Energy Transition Strategy

There are many co-benefits that can be achieved through a low carbon transition, including local economic development and job creation, improved public health, equity and inclusion, energy security and resiliency, and mitigating future risk.

2.1.1 Local Economic Development

If given the proper signals, markets can play a key role in responding to global challenges such as climate change. At the national level, one of the most powerful market signals entered into force is the federal government's commitment to require a price on carbon in all Canadian provinces and territories.[8]

Supporting Ottawa's local businesses in the transition towards a low carbon economy will help companies reduce operating costs and represents an opportunity to:

8 Prime Minister of Canada. (2016). Prime Minister Trudeau delivers a speech on pricing carbon pollution. Accessed electronically on September 6 from: http://www.pm.gc.ca/eng/news/2016/10/03/prime-minister-trudeau-delivers-speech-pricing-carbon-pollution (2017).

- Create good local jobs
- Attract investment and encourage innovation
- Keep a greater share of energy dollars (expenditures) within the local economy

2.1.1.1 Job Creation

Reducing energy consumption and promoting the use of renewable energy is already credited with the creation of new green jobs in manufacturing, construction, and trades. According to the International Renewable Energy Agency, the global renewable energy sector employed 11 million people in 2018 and the number of people employed in solar power alone is estimated at 3.6 million.[9] Canada's clean energy sector is growing faster than the rest of the country's economy (4.8% versus 3.6% annually between 2010 and 2017), while also attracting tens of billions of dollars in investment every year. It's a large and growing employer, accounting for 298,000 jobs in Canada in 2017, which is equal to direct employment in the real estate sector.[10]

The job creation potential associated with energy efficiency is equally well established. Retrofitting existing homes and buildings increases the demand for various low carbon and renewable energy technologies while also generating a demand for workers who can perform building upgrades, such as adding insulation, installing building automation systems, or replacing inefficient furnaces.

2.1.1.2 Attracting Investment and Encouraging Innovation

Ottawa has cultivated a reputation as a centre for innovation and is home to dozens of federal research agencies and laboratories as well as several post-secondary institutions. In 2010, the city was named one of the top seven intelligent communities in the world by the Intelligent Community Forum.[11] According to the Ottawa Business Growth Survey, Ottawa's reputation as an innovation hub remains strong, with local business confidence highest among technology-sector companies and growing in the construction and hospitality sectors.[12]

In addition to advancing climate change and sustainability objectives, a community energy transition strategy can directly support efforts to promote innovation, entrepreneurship and technology development in Ottawa.

One direct connection is the contribution of energy efficiency and renewable energy technologies towards the development of Ottawa's clean technology sector. Ottawa is home to an estimated 240 clean technology companies, and the sector is one of six high growth "knowledge-based industries" local economic development organization Invest Ottawa is currently working to support.[13]

Energy information and technology is also considered to be a key element of smart cities—the concept of using information and communication technology to deliver more effective municipal services and to grow the local knowledge-based economy. With potential applications ranging from smart grids and energy storage to automated electric vehicles and smart mobility systems, community energy planning will support the City as it looks for ongoing opportunities to advance the Smart City 2.0 strategy.

2.1.1.3 Local Energy Dollars

According to the Federation of Canadian Municipalities, medium to large cities spend an average of $2.7 billion per year on energy—large expenditures that typically leave the municipality.[14] Energy consumption data obtained

9 IRENA. (2018). Renewable Energy Jobs, Annual Review 2017. Accessed on November 18, 2019 from http://resourceirena.irena.org/gateway/dashboard/?topic=7&subTopic=10 https://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf

10 Clean Energy Canada. (2019). Missing the Bigger Picture: Tracking the Energy Revolution 2019. Accessed on November 18, 2019 from https://cleanenergycanada.org/report/missing-the-bigger-picture/

11 Intelligent Community Forum. (2017). The Top7 Intelligent Communities of the Year. Accessed electronically on September 14, 2017 from http://www.intelligentcommunity.org/top7

12 Welch LLP and Ottawa Chamber of Commerce. (2019). Ottawa Business Growth Survey 2019.

13 Invest Ottawa. (2017). Clean Technologies. Accessed electronically on September 14, 2017 from https://www.investottawa.ca/clean-technologies/

14 Federation of Canadian Municipalities. (2016). Partners for Climate Protection National Measures Report 2015. Page 7. Accessed electronically on September 20, 2017 from https://fcm.ca/home/programs/partners-for-climate-protection/national-measures-report.htm

from local utility providers in Ottawa yields a similar but more accurate estimate, with Ottawa residents spending $3.0 billion—or roughly $3,200 per capita—across all energy types in 2015.[15]

By examining the supply and the cost of energy consumed locally, there is an opportunity to keep millions of energy dollars circulating within the local or regional economy, with benefits ranging from business retention and attraction to housing affordability.[16] Hydro Ottawa is one example of a local energy company that aims to create long-term value for its shareholder, the City of Ottawa, and the communities it serves. In 2018, the company yielded a record $22.3 million dividend payment to the City—money that is directly invested into City programs and services.[17]

2.1.1.4 Low Carbon Cities Canada (LC3)

Through the 2019 federal budget and the Federation of Canadian Municipalities, a network of seven Low Carbon Cities Canada (LC3) was established across the country. The Ottawa LC3, called the Ottawa Climate Action Fund (OCAF), received a $20 million endowment and close to $2 million in initial operating funds to advance initiatives to significantly reduce carbon emissions by investing, providing grants, promoting understanding and influencing policies.

OCAF is hosted by the Ottawa Community Foundation. The Ottawa Community Foundation will support relationship building, program development, and the development of levers of influence and their advisory board will have a high level of independence in strategic direction, priority-setting, and decision-making.

Staff have joined the OCAF Advisory Board and signed a Memorandum of Understanding between the City of Ottawa and the Ottawa Community Foundation describing the intention and willingness to work together on reducing GHG emissions.

2.1.1.5 Access to Funding

Achieving energy and emissions targets will require significant resources and investments. Senior levels of government rely on cities to help achieve many of their energy and emissions commitments, whereas municipalities typically do not have the necessary revenues to sufficiently fund local climate action and rely on funding from senior levels of government. Provincial and federal government programs can spur change by incentivizing local action through funding programs. In some cases, these programs require municipalities to meet special requirements or apply a climate lens in order to be eligible to apply. Initiatives such as Energy Evolution are essential to enabling the City to apply and gain access to funding that would otherwise be unavailable. The most applicable funding for climate change solutions available today for both municipalities and the private sector is from the Federation of Canadian Municipalities. It requires municipal approval for eligibility.

2.1.2 Public Health

To achieve the 100% GHG emission reduction target, the combustion of fossil fuels in furnaces, industrial activities, and vehicles would need to be nearly eliminated by 2050. As fossil fuel combustion declines, cardiovascular and respiratory health effects associated with their emissions will also decline.

An increased deployment of heat pumps for heating buildings would have the added benefit of increasing access to efficient air conditioning, thus reducing the health risk of extreme heat waves. Reducing noise levels from the source and using engineering measures are important ways to manage noise. For example, transitioning away from combustion engine vehicles to electric vehicles and better insulating buildings could improve sleep quality and certain aspects of human health. Additionally, a healthy built environment encourages more active transportation and creates more opportunities for social connections, which lead to better physical and mental health.

15 Baseline Energy Study for Ottawa 2015: Including Supply Origin, Fuel Type, Use by Sector, GHG Impacts and Cost.

16 QUEST – Quality Urban Energy Systems of Tomorrow. (2016). Community Energy Planning in Ontario: A Competitive Advantage for Your Community.

17 Hydro Ottawa Holding Inc. (2019). Annual Report 2018.

2.1.3 Equity and Inclusion

Everyone has a role to play in meeting Ottawa's 100% GHG reduction target. Some, however, are better positioned to participate in the energy transition required to meet the target. Issues of poverty, affordable housing and climate change are complex, intractable and interrelated.

Experience in other municipalities suggests that when climate solutions include equity and inclusion considerations, multiple priorities can be addressed at the same time and more people can participate in the low carbon transition.

To better understand equity and inclusion challenges, the Canadian Urban Sustainability Practitioners (CUSP) network has developed an Energy Poverty and Equity Explorer tool[18] to access relevant data and develop equitable and inclusive clean energy programs to meet residents' needs.

2.1.4 Energy Security and Resiliency

Managing the uninterrupted availability of energy sources at an affordable price is fundamental to ensuring sustainable development, as well as protecting the well-being of residents and the bottom line for businesses. In addition to increasing demands from a steadily increasing population, extreme weather events such as high winds, freezing rain and ice storms can disrupt the power supply. The challenge becomes how to manage that upward pressure and build resiliency against power disruptions from extreme weather events to provide residents the same uninterrupted level of service.

The City has a key role to play in ensuring energy security through land-use planning and policy development in order to identify local priorities, reduce energy demand, and ensure energy resources are available. Identifying local energy resource opportunities can help to ensure local energy security, increase diversity of energy sources, promote economic competitiveness, and improve reliability of energy systems and resiliency to extreme weather events. Renewable energy technologies play an increasingly important role in energy security. For example, converting vehicles from fossil fuels to renewable fuel sources such as biofuels, or introducing new technology such as electric vehicles, can reduce reliance on a volatile oil market. By diversifying local renewable energy sources, Ottawa decreases its reliance on the unpredictability of energy supply from outside the city boundary while boosting local economic growth.

2.1.5 Mitigating Future Risk

The magnitude of future climate impacts depends on the action taken to reduce emissions. Climate change is already impacting communities globally and locally. Canada is warming at twice the rate of global averages, and the rising occurrence of heat waves, flooding, tornadoes and wildfire is harming our communities, infrastructure, natural environment and economy.[19] Insurance claims for climate-related hazards across Canada have exceeded $1 billion per year since 2008, compared to average annual costs of $400 million in the previous 30 years. In 2018 alone, insured damage from severe weather reached $2 billion, and it is estimated that climate change could cost Canada $21 to $43 billion per year by 2050.[20] Of course, insured losses only account for a portion of the full costs attributed to catastrophic events. For every dollar of losses borne by insurers in Canada, $3-4 are estimated to be borne by governments, households and businesses.[21]

Considerable investments are needed to make our communities less vulnerable to the impacts of climate change that are already being felt. The Federation of Canadian Municipalities and Insurance Bureau of Canada released a report in February 2020 that estimates an average annual investment in municipal infrastructure and local adaptation measures of $5.3 billion is needed to minimize the worst impacts of extreme weather events. In national terms, this represents an annual expenditure of 0.26% of the

18 The Energy Poverty and Equity Explorer tool (https://energypoverty.ca/).

19 Environment and Climate Change Canada, 2019. Canada's Changing Climate Report https://www.nrcan.gc.ca/maps-tools-publications/publications/climate-change-publications/canada-changing-climate-reports/canadas-changing-climate-report/21177

20 National Round Table on the Environment and the Economy. 2011. Climate Prosperity. Paying the Price: The Economic Impacts of Climate Change for Canada.

21 Moudrak, N., Feltmate, B., Venema, H., Osman, H. 2018. Combatting Canada's Rising Flood Costs: Natural infrastructure is an underutilized option. Prepared for Insurance Bureau of Canada. Intact Centre on Climate Adaptation, University of Waterloo.

national GDP.[22] Fortunately, studies have shown a return on investment around 6:1, meaning that for every dollar invested in disaster mitigation measures, $6 is saved in future damages.[23]

The rising occurrence of extreme weather events is also leading to higher insurance costs for both homeowners and municipalities. Climate change was cited as the reason for insurance companies across Canada increasing home insurance rates for 2019 by 5-10% on top of inflation, and premiums and deductibles for flood damage have also increased.[24] Municipalities such as Toronto and Calgary saw increased premiums, higher deductibles and changes to municipal insurance policies limiting liability following large flood events in 2013.[25] In Ontario, municipal liability premiums increased by 22.2% between 2007 and 2016 to account for increased liability coverage.

These costs reflect the investments needed to reduce our vulnerability to the impacts of climate change that are already being felt—managing the unavoidable impacts of climate change. As noted by reports by the IPCC[26] and the Government of Canada,[27] significant action is required to limit global warming to 1.5ºC to avoid the unmanageable impacts of climate change. Climate projections for the National Capital Region show the range in projected increases in temperature and precipitation in the region depending on future emission scenarios. Investments in Energy Evolution are therefore key in reducing the extent of future risks and costs from further climate change.

2.2 The Role of the Municipality

As a local authority with powers handed down by the Province, the City has direct control over a range of services that touch people's everyday lives and affect how energy is consumed, including housing, transportation systems, water and sewer infrastructure, and waste management. The City controls where and how growth will occur through the designation of land and in the development and enforcement of zoning by-laws. Building construction is also controlled through site plan control measures, urban design guidelines and building code enforcement. In carrying out its duties, the City partners with several associated agencies, including utility companies, the development industry, and housing authorities, as well as other levels of government and the private sector throughout the National Capital Region.

In addition to its regulatory powers, the City also plays a key role in bringing community stakeholders together to facilitate discussions and foster collaboration in planning and strategizing integrated approaches to achieve long-term energy sustainability goals. Through education and civic engagement, the City has a responsibility to communicate the basis for and the pathways to take towards a long-term sustainable energy future. Through municipal investment and delivery mechanisms, the City also has an opportunity to catalyze community action.

Despite the important role that the City plays in mobilizing forces toward a low carbon future, there are limitations on the extent of power that can be exerted by local government. This is due in part to the limit on financial resources available to the City to act on key initiatives and jurisdictional barriers and conflicts with regulatory requirements from other tiers of government. Ottawa's ability to meet GHG reduction targets is therefore contingent upon senior levels of government, stakeholders and partners to commit to action within their specific jurisdictions (utilities, housing, development industry, etc.).

22 Insurance Bureau of Canada and FCM. Investing in Canada's Future: The Cost of Climate Adaptation at the Local Level, 2020 https://data.fcm.ca/documents/reports/investing-in-canadas-future-the-cost-of-climate-adaptation.pdf

23 Ibid.

24 Osental, D. 2019. Broker points to climate change as reason for rising home insurance rates. Insurance Business (industry magazine). 2019.

25 Henstra, D., and Thistlethwaite, J. 2017. Climate Change, Floods, and Municipal Risk Sharing in Canada. Munk School of Global Affairs (University of Toronto). [online] Available at: https://munkschool.utoronto.ca/imfg/uploads/373/1917_imfg_no_30_online_final.pdf

26 Intergovernmental Panel on Climate Change (IPCC), 2018 Special Report on Global Warming of 1.5°C https://www.ipcc.ch/sr15/

27 Canada's Changing Climate Report (2019). Retrieved from: https://changingclimate.ca/CCCR2019

2.2.1 Long-Term Municipal Plans

Coordination is needed amongst long-term municipal plans that directly relate to Energy Evolution to ensure a harmonized approach to achieving the long-term GHG emission reduction targets. Long-term municipal plans include but are not limited to:

New Official Plan – The Official Plan provides a vision for the future growth of the city and a policy framework to guide the city's physical development. A new Official Plan for Ottawa is currently underway, to be completed by 2021. Changes to the Planning Act exempt new Official Plans from review for 10 years, which will provide the City with a stable monitoring period to evaluate the effectiveness of new land use policies. The planning horizon for the new Official Plan is to 2046, which is a 25-year horizon.

Transportation Master Plan Update – The Transportation Master Plan (TMP) Update is guided by and being developed alongside the new Official Plan and is expected to be completed in fall 2023. The TMP and accompanying Ottawa Cycling Plan and Ottawa Pedestrian Plan provide the City's blueprint for planning, developing and operating its walking, cycling, transit and road networks over the next several decades. The TMP Update model scenarios will include an analysis of greenhouse gas projections.

Solid Waste Master Plan – The municipal Solid Waste Master Plan is intended to provide the overall framework, direction, and goals for solid waste management, diversion and reduction policy over the short-, medium and longer-term horizon, primarily for residential waste. Its development is currently underway and is expected to be completed in 2022.

Energy Conservation and Demand Management – The municipality is committed to improving energy management in the operations of its municipal facilities. The Energy Conservation and Demand Management Plan focuses on projects that reduce energy demand from electricity, natural gas, heating oil, propane and water in addition to reducing GHG emissions.

Comprehensive Asset Management (CAM) – Asset Management is an integrated business approach involving the different disciplines of planning, finance, engineering, maintenance, and operations to effectively manage existing and new infrastructure through their lifecycle. The City maintains nearly $42 billion (State of Asset Report, 2017) in existing infrastructure and works to ensure safe and sustainable services are delivered to our communities in a cost-effective way while committing to consider climate change resiliency.

Long Range Financial Plan – Within each term of Council, the Long Range Financial Plan (LRFP) is updated to reflect any changes to the City's long term operating and capital requirements, ensuring consistency with recommendations of the Transportation Master Plan, the Infrastructure Master Plan, the future Solid Waste Master Plan and the City's Fiscal Framework. The Long Range Financial Plan provides a multiple-year outlook of the City's operating and capital requirements, focusing on the funding strategies that are required to provide for the renewal and maintenance of the City's assets in a state of good repair.

2.2.2 Notable Municipal and Community Initiatives

2.2.2.1 Land Use

Ottawa Next: Beyond 2036 – This study explored policy implications and areas of potential disruption that Ottawa would need to address as it grows from a city of 1 million to a city of 2 million and its role as the centre of a larger region of up to 3 million people by the end of the century. The study served as a basis for the review and development of the new Official Plan for the City. Policy implications were intended to trigger the critical evaluation of the resiliency of the City's growth management strategies.

Five Big Moves – The City is proposing to make a number of significant policy changes through the new Official Plan to make Ottawa the most liveable mid sized city in North America. Referred to as the Five Big Moves, these high-level policy directions propose shifts in how the City approaches five foundational planning issues: growth, mobility, urban design, resiliency and economy.

Gladstone Station Secondary Plan – In 2019, a Secondary Plan study was initiated for the Gladstone Station District. It is one of the first Secondary Plans undertaken by the City that has considered energy conservation and

renewable energy technology as part of the planning process. The Gladstone Secondary Plan is expected to include opportunities to target net zero carbon emissions in new development using renewable energy solutions for heating and cooling, electrical energy generation and other initiatives such as low impact development designs.

2.2.2.2 Buildings

Green Building Policy for the Construction of Corporate Buildings – Ongoing since 2005, the policy dictates that all new municipal buildings greater than 500 m2 will be designed and delivered in accordance with the Certified performance level of the Leadership in Energy and Environmental Design – Canada (LEED Canada) Green Building Rating System. Where possible, a LEED Gold performance level will be targeted.

Deep Retrofits on Municipal Buildings – Envari has provided the City with a high-level estimate and scope of work for deep retrofits on three City buildings: a recreation centre, a community centre and a family shelter. The City is developing financial and environmental justification criteria and metrics. These criteria and metrics will support determining how to best develop a deep retrofit program and how it will align with the current life cycle renewal of existing municipal buildings.

Glebe Community Centre Innovative Window Technology Pilot – The Glebe Community Association and the City are replacing 12 existing windows with an r value of roughly 2 within the Glebe Community Centre with new windows with an r value of 11. This next generation technology uses suspended films between conventional panes of glass to provide multiple thermal barriers to heat loss. This trial is vital to improving building performance as windows are a huge source of heat loss from building envelopes, and ultimately GHG emissions, across the community.

Tenant Engagement at Centretown Citizens Ottawa Corporation (CCOC) and Ottawa Community Housing (OCH) – Both the CCOC and OCH have initiated successful tenant energy engagement programs in recent years. The CCOC has created the Green Commitments program to engage tenants and empower them with small, daily activities they can do to reduce their environmental impact. And OCH has created the Tenant Energy Engagement Pilot program to increase the energy literacy of tenants and initiate, support and sustain behaviour change toward sustainability through active engagement, passive engagement, and conservation tools.

2.2.2.3 Transportation

Light Rail Transit (LRT) – The first phase of the LRT opened in September 2019, replacing a 12.5 km stretch of bus rapid transit with low carbon electric powered trains. The second phase of the LRT is scheduled to be completed in 2025 and will introduce 44 km of new rail to the LRT system.

Municipal Green Fleet Plan – The City has kept well-informed of developments in the industry with regards to the municipal fleet. This includes trialing alternate fuels, implementing devices and technologies that reduce GHG emissions, and purchasing low- and no-emission vehicles and equipment where they meet the operational needs of the client department and are available. An updated Municipal Green Fleet Plan will be brought forward in 2021.

Public Electric Vehicle Charging Network – The City is contributing to the expansion of the public electric vehicle (EV) charging network to help address charging access barriers to EV adoption. This network includes requirements for electric vehicle chargers at all new city facilities or facilities undergoing major renovations, twelve new stations in the right of way, and a new fast charger at Bob MacQuarrie Recreation Complex.

Communauto – Communauto has grown to be the largest carshare fleet in Canada and operates approximately 135 cars in Ottawa/Gatineau. Each car-sharing vehicle replaces 10 private cars, thus their contribution results in 1,215 fewer cars on the roads in Ottawa/Gatineau. Many of these cars are hybrids, which produce 33% less greenhouse gas emissions than their gas equivalent vehicle.

Municipal Parking Management Strategy – The City manages parking through a service-orientated approach. The program focuses on providing short-term parking in support of the local economy while also resolving issues in residential areas caused by sources of high parking demand. In addition, there is active support for programs and facilities that encourage sustainable mobility choices (e.g., funding for EV charging infrastructure, Park & Rides and bike parking).

2.2.2.4 Solid Waste and Wastewater

Landfill Gas Improvements at City's Trail Waste Facility – A Landfill Gas Perimeter Collection System was constructed at the Trail Waste Facility to augment the existing gas collection wells at the landfill and to reduce landfill gas migration off site. This action had the co-benefit of reducing GHG emissions and the most significant reductions within the corporation as of 2018. However, it should be noted that starting in 2021, it is expected that an increase in emissions will be observed at the landfill as a result of provincial regulatory requirements to reduce the contaminating lifespan of the landfill in the future.

Robert O. Pickard Environmental Centre (ROPEC) Electrical Reliability and Efficient Use of Digester Gas Project – In 2019, Council approved funding to replace the three existing end-of-life cogeneration engines at ROPEC and add a fourth cogeneration engine. These engines use digester gas produced through the wastewater treatment process to produce on-site electricity and heat used to offset electricity and natural gas imported from the utility grids. The project is expected to reduce GHG emissions by an additional 1,565 tonnes of CO_2e per year in comparison with the use of three existing cogeneration units and is to be completed by the end of 2024.

Biogas Optimization Study – The City is currently undertaking a Biogas Optimization Study which seeks to identify options that effectively and efficiently optimize the production and benefits of the digester gas at ROPEC. The study will evaluate methods to increase the production of biogas through the addition of other feedstocks or biogas sources, as well as evaluate emerging processes and technologies that could be used in conjunction with cogeneration.

University of Ottawa's Waste Diversion Program – Ottawa U has set out to try and create a zero waste campus. In 2019 the campus was able to divert 65% of waste from landfill. This is achieved through increased access to recycling stations; low waste food service contracts; a zero waste dining hall; and free store and reuse programs for staff and students.

Queen Street Fare – Since 2018, the food hall Queen Street Fare has been dedicated to reducing waste and cutting greenhouse gas emissions. The food hall is committed to sending no consumer waste to landfill: all packaging is compostable, stainless steel cutlery, cups and dishes are reused, and what limited material is left is recycled.

2.2.2.5 Energy Generation

Just Food, Bullfrog Power and Beau's Brewing Company Solar Energy Project – In 2017, Bullfrog Power and Beau's Brewing Company partnered with Just Food to install a 10 kW solar energy project at Just Food's community farm facility that provides power to the farm's greenhouse, cooler, and educational centre. The solar panel shed was designed to lower Just Food's operating costs and carbon footprint while also providing a demonstration of renewable energy use on a farm.

Community Solar Net Metering on the Canadian Museum of Science and Technology – Hosted on top of the Canadian Museum of Science and Technology, the solar rooftop project marks the first community-owned, net metered solar electricity installation in Ottawa. This 215 kW project will produce a projected 230,000 kWh of clean energy, directly consumed by the Museum, and is expected to keep energy bills lower and more predictable over the next 30 years.

Photo: City of Ottawa

SECTION 3
DEVELOPING ENERGY EVOLUTION: THE MODEL

To understand the scope and scale of change required to achieve the GHG emission reduction targets, Sustainability Solutions Group and whatIf? Technologies Inc. was contracted to develop a comprehensive energy, emissions and finance model. The model, called CityInSight,[28] was custom built to replicate Ottawa and includes data for population, dwellings, jobs, buildings, transportation, waste, industry, and land use. It enables bottom-up accounting for GHG and financial analysis, energy supply and demand including renewable resources, conventional fuels, energy consuming technology stocks (e.g., vehicles, appliances, dwellings, buildings) and all intermediate energy flows (e.g., electricity and heat).

The sections that follow provide an overview of how the energy and emissions model was developed and includes the following elements:

- Model assumptions and limitations
- Emissions baseline
- Pathway studies
- Business-as-Planned (BAP) scenario
- 100% scenario

3.1 Model Assumptions and Limitations

Typically, a time-based predictive model is based on a scenario, which is a plausible prediction of how the future may unfold, but by no means a guarantee. The Energy Evolution models are no exception. Although actions proposed to achieve the GHG reduction targets were mainly drawn from a set of thoroughly vetted pathway studies and recent experience of best practices from other municipalities, it is acknowledged that actions proposed over the 30-year period may differ from what actually happens. This could be due to unexpected external factors that could influence the outcome such as the state of the economy or the need for social behaviour change, or the effectiveness of the action may differ than what was predicted.

Some GHG emissions are not accounted for in the modelling because limited data was available, or emissions were deemed to be outside of the scope of the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories as outlined in Appendix A: Data, Methodologies, and Assumptions Manual. Emissions not included in the model include

28 CityInSight follows the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC Protocol) framework, an international standard for GHG emissions accounting.

aviation, inter-city rail, small equipment, and agriculture. The model also does not factor in natural gas pipe leakage, embodied carbon in materials of buildings or equipment, or carbon sequestration activities.

Additionally, many City master plans were either being updated or in their infancy at the time that the models were being developed. These include the Official Plan, the Transportation Master Plan, and the Solid Waste Master Plan. The input data from City departments for areas such as land use, transportation, and solid waste was based on the best available data at the time and may not reflect current data being used to develop the master plans.

As these plans will come forward after Energy Evolution, it should be understood that:

- These plans will evaluate a range of options to achieve each respective plan's goals and targets and outcomes may differ from what has been identified in this strategy.
- It is expected that the range of options will include one or more scenarios that achieve the GHG reductions required to achieve the GHG emission reduction targets, but those scenario(s) may not ultimately be recommended.
- Data provided by City departments to inform the model was based on the best available data at the time and may differ from the data used to inform the plans and programs.
- Different models may be used to perform a more detailed and sector specific assessment of the projected GHG implications, providing a level of granularity not available in the Energy Evolution model.

Sector specific model assumptions for land use, buildings, transportation, waste and renewable natural gas and electricity are captured in Section 5.0. Details on the scope of the protocol and information used to populate the CityInSight model can be found in Appendix A: Data, Methodologies, and Assumptions Manual.

3.2 Emissions Baseline

A baseline energy and emissions profile was developed for 2016. Although the baseline year of the GHG emission reduction targets is 2012, 2016 was chosen as the baseline of the model in order to be calibrated to align with the 2016 Canadian Census.

In 2016, the emissions baseline in Ottawa was 5.09 megatonnes of carbon dioxide equivalent (Mt CO_2e), or 5.07 tonnes of CO_2e per capita, and includes emissions from buildings (residential and non-residential), in-boundary transportation, waste and fugitive emissions from landfills. Commercial buildings, residential buildings, and transportation sectors were responsible for the majority of Ottawa's emissions, contributing 18.8%, 28.9% and 40.4% of total emissions, respectively. The highest emitter by fuel type was natural gas (used in buildings), with 38.7% of total emissions, while gasoline and diesel (used in transportation) combined for 41.3%. Together, they constitute over three quarters of total fuel emissions. Details on the baseline can be found in Appendix B: Business as Planned Scenario Report.

3.3 Pathway Studies

Pathway studies are focused technical reports describing how a specific energy technology or improvement in energy use may be developed over time in Ottawa and were used collectively as a basis to develop the 100% scenario model. They considered the overall technical potential for implementation and any constraints (economic, regulatory, etc.) that could influence uptake. To determine a given technology's potential to help achieve the long-term GHG target, each technology or improvement was estimated for a degree of uptake by the community as either conservative, moderate, or aggressive. For Ottawa to achieve its short-, mid- and long-term GHG reduction targets, the model calls for implementation of the aggressive scenario in almost all cases and in some cases, the model demands actions that exceed the aggressive scenario or are new actions that the pathway studies did not foresee.

The pathway studies were developed with technical experts from the municipality, senior levels of government, utilities, developers, consultants (Leidos, Sustainability Solutions Group, and whatIf? Technologies Inc.) and subject matter experts through a series of technical workshops. The workshops were critical to better understanding the barriers, opportunities, and options for advancing specific energy technologies in Ottawa.

A total of 14 pathway studies were developed to inform Energy Evolution. Details on the pathways can be found in Appendix C: Pathway Studies. The pathway studies completed were:

- Solar Power
- Wind Power
- Biogas Energy
- Existing Residential Buildings
- New Residential Buildings
- Electrification of Transport – Light Vehicles
- Demand Side Management and Energy Storage
- Waterpower
- Heat Pumps
- District Energy
- Existing Non-Residential Buildings
- New Non-Residential Buildings
- Transportation
- Solid Waste, Wastewater, and Other Waste Sources

Additionally, the following actions beyond the pathways are explored:

- Additional renewable electricity and electricity storage
- Use of waste heat
- Power to gas
- Zero emission vehicle zones
- Gasification of leaf and yard waste

3.4 Business-as-Planned (BAP) Scenario

The BAP scenario is a projection from today until 2050. It is designed to illustrate the anticipated energy use and emissions in Ottawa if no additional policies, actions, or strategies are implemented beyond those that are currently underway or planned. It accounts for population and demographic trends and uses energy and emissions information from all levels of government to inform assumptions about buildings, transportation, energy use, and waste. It also builds in the anticipated GHG emission reductions that would result from the municipality's current and planned commitments including projects such as Stage 1 and Stage 2 of the light rail transit network.

It is expected that between 2016 and 2046, Ottawa's population will grow to almost 1.4 million people, a growth of about 402,000 people, correlating to roughly 195,000 new private households within the city. Employment is expected to scale with population, with 280,447 jobs added between 2016 and 2046. Typically, the upward trend in population and demographics would result in greater community emissions. However, the anticipated introduction of greater fuel efficiency standards, a decline in building heating requirements (a result of increasing average temperatures due to climate change and typical improvements to the building code), and a gradual uptake of electric vehicles provide a counterbalance.

Taking everything into account, the BAP scenario projects that community wide GHG emissions will increase by only 0.1 Mt CO_2e, indicating that emissions would remain relatively flat through to 2050 despite population growth.

Figure 7 (page 24) shows the GHG emissions projections by sector in the BAP scenario while Figure 8 (page 24) depicts those same emissions by fuel source.

3.5 100% Scenario

The 100% scenario explores the scope and scale of change required if Ottawa is to align with the IPCC target to limit global warming to 1.5ºC and reduce emissions by 100% by 2050 as approved by Council. To achieve this target, it requires reducing emissions by 4.82 Mt CO_2e over the next 30 years. The results indicate that in order to achieve the 100% scenario, rapid and far-reaching action and investment is required.

This means that almost all fossil fuels will have to be phased out, heating and transportation systems would have to be nearly fully electrified or transition to zero emission, waste heat utilization and renewable natural gas production would have to be added, and sufficient renewable electricity (mostly wind and solar) generation and electricity storage will be required to meet demand and offset emissions on the provincial grid. In the case of the buildings sector, energy conservation will typically need to occur before fuel switching. Since the timing of renewable energy production does not necessarily align with demand, the scenario relies on the storage proposed in the model and grid balancing to ensure that electrical demands are always met. For further details on the 100% scenario, refer to Appendix D: Technical Report.

Table 11 (page 26) compares the difference in total emissions between the BAP scenario and 100% scenario, relative to the 2016 baseline.

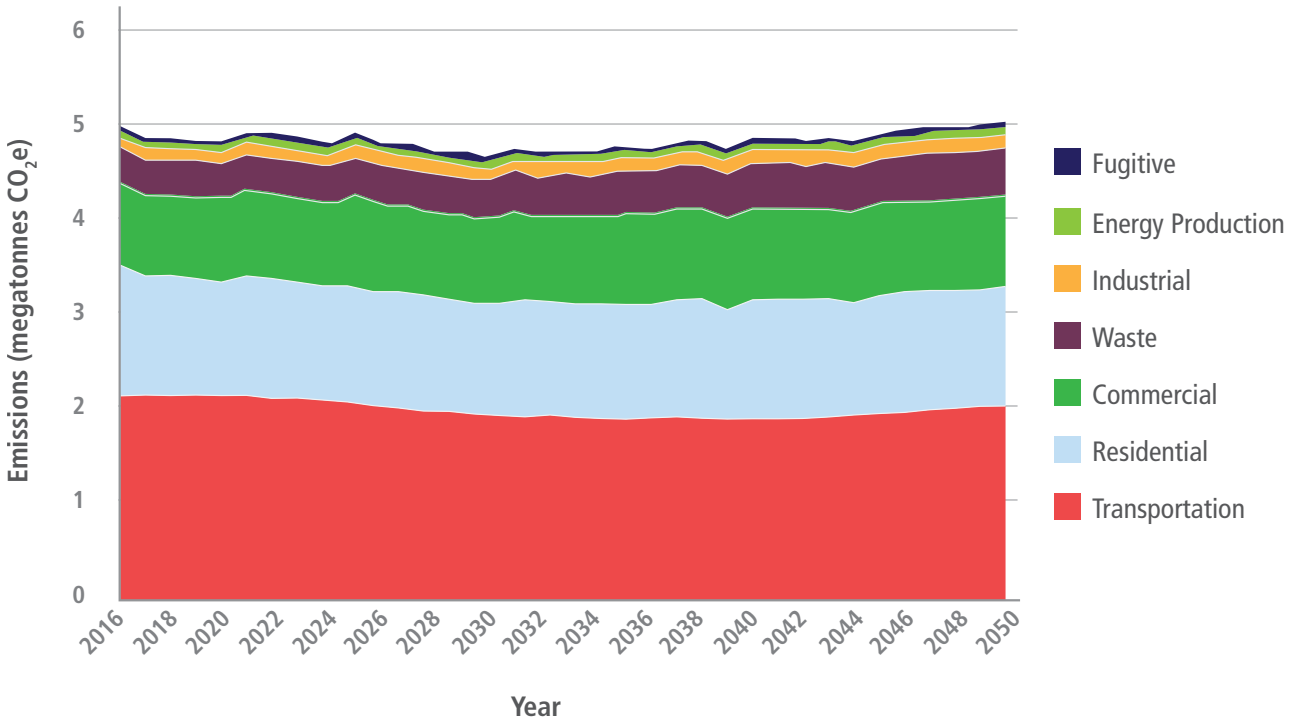


Figure 7: Projected emissions by sector for BAP scenario, 2016-2050

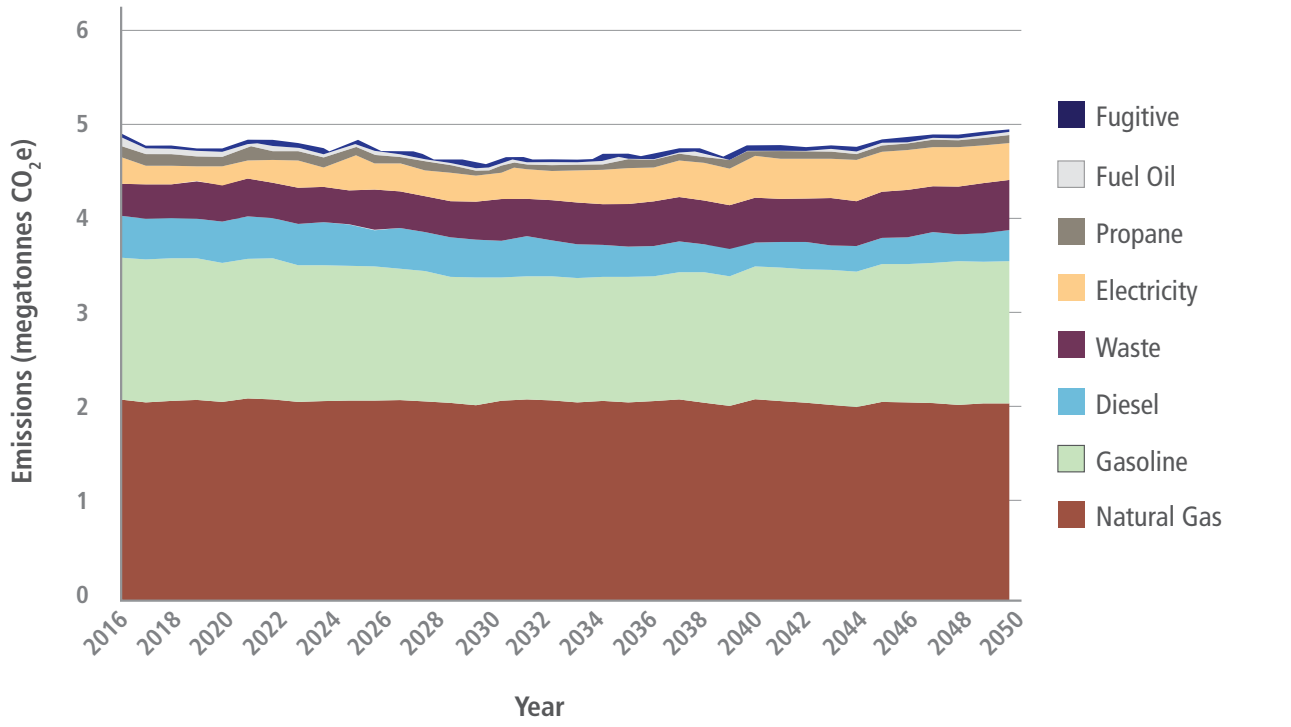


Figure 8: Projected emissions by fuel source for the BAP scenario, 2016-2050

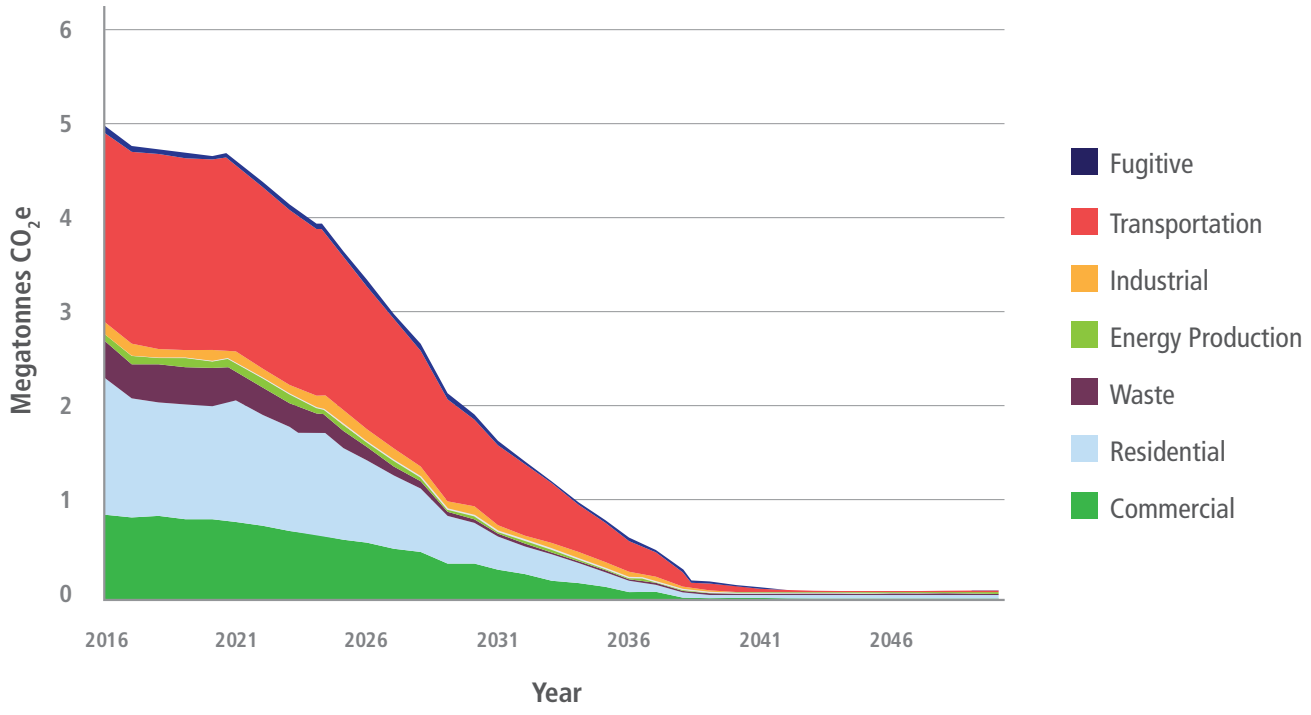


Figure 9: Projected emissions by sector for 100% scenario, 2016-2050

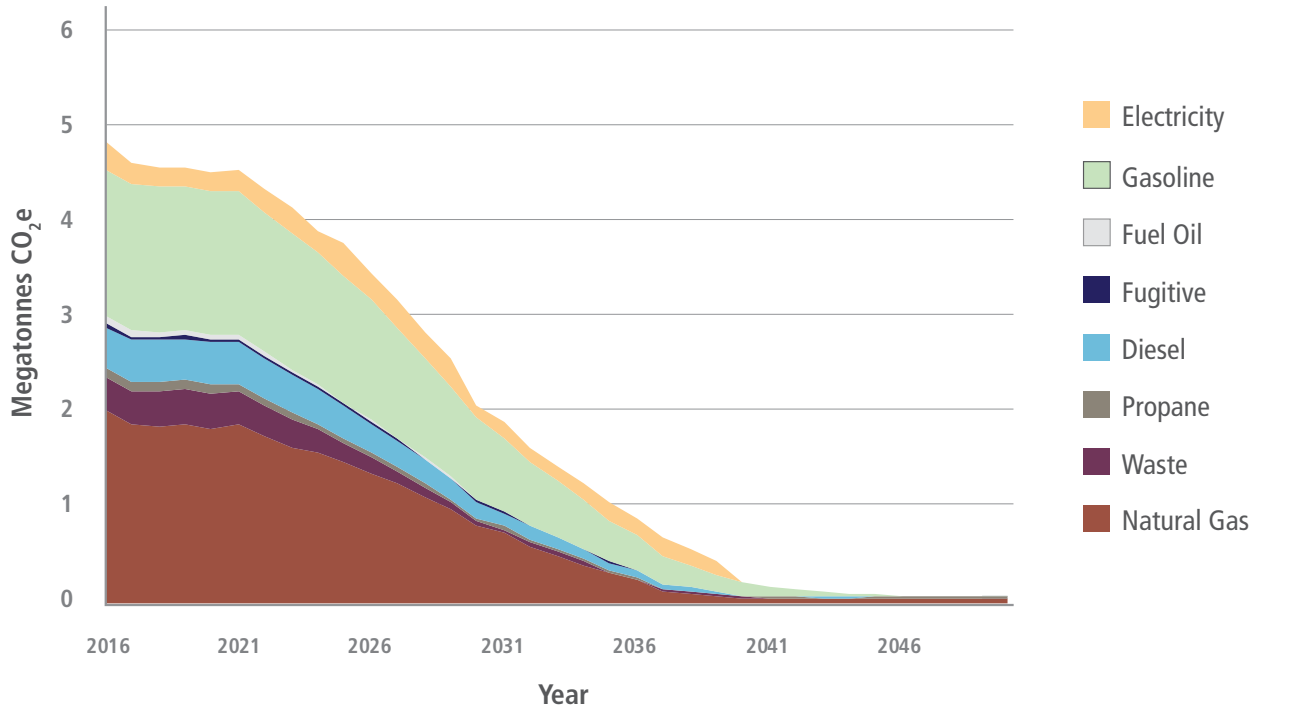


Figure 10: Projected emissions by fuel source for 100% scenario, 2016-2050

Table 11: Comparison of total emissions for BAP scenario and 100% scenario, 2016 and 2050

Scenario	Description	GHG Emissions (Mt CO_2e)		
		2016	2050	Change
BAP Scenario	Aligns with current planned initiatives	4.88	4.98	0.1
100% Scenario	Aims to achieve a GHG reduction consistent with the IPCC recommendation of limiting global temperature increase to 1.5°C	4.88	0.07	-4.82

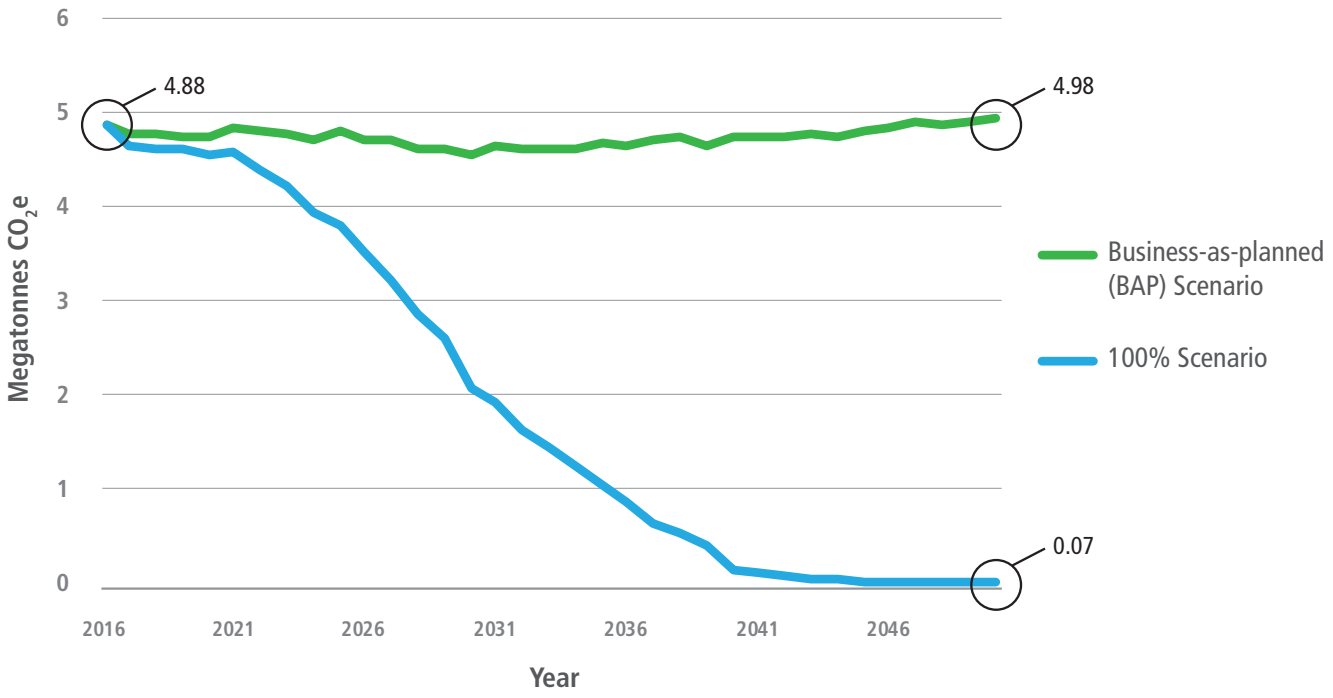


Figure 11: Comparison between BAP scenario and 100% scenario, 2016-2050

Photo: iStock

SECTION 4

ACHIEVING OTTAWA'S GHG REDUCTION TARGETS

Ottawa has made significant investments in recent years in projects that reduce the city's greenhouse gas emissions, notably light rail transit, landfill gas capture and municipal facility improvements. Yet, as indicated in the previous section, the model projects that Ottawa's emissions will remain relatively flat for the next 30 years under the BAP scenario, far from achieving the long-term GHG emission reduction targets.

Achieving Ottawa's GHG reduction targets will require implementation of the municipality's ongoing and planned actions, implementation of new actions that the municipality has not yet approved, and action and investment from all segments of society. Table 12 (page 28) provides a summary of where community-wide GHG emission reductions are modelled to come from between now and 2050 in five key sectors:

- Land use and growth management
- Buildings (new and existing)
- Transportation
- Waste and renewable natural gas
- Electricity

Table 12 (page 28) identifies the projected emission reduction by sector to achieve the 100% scenario. According to the model, the buildings and transportation sectors are projected to account for roughly 75% of cumulative emission reductions from now until 2050. The remaining 25% is projected to come from the waste and renewable natural gas and electricity sectors.

Table 12: Total projected community-wide GHG emission reductions required to achieve 100% scenario incremental to BAP scenario, 2030 and 2050 (non-cumulative)

Sector	Percentage (%) of Total Projected GHG Emission Reductions	
	2030	2050
Land use and growth management	Embedded in other actions	Embedded in other actions
Buildings (new and existing)	37.1%	38.0%
Transportation	29.9%	36.7%
Waste and renewable natural gas	26.1%	16.9%
Electricity	6.5%	8.5%

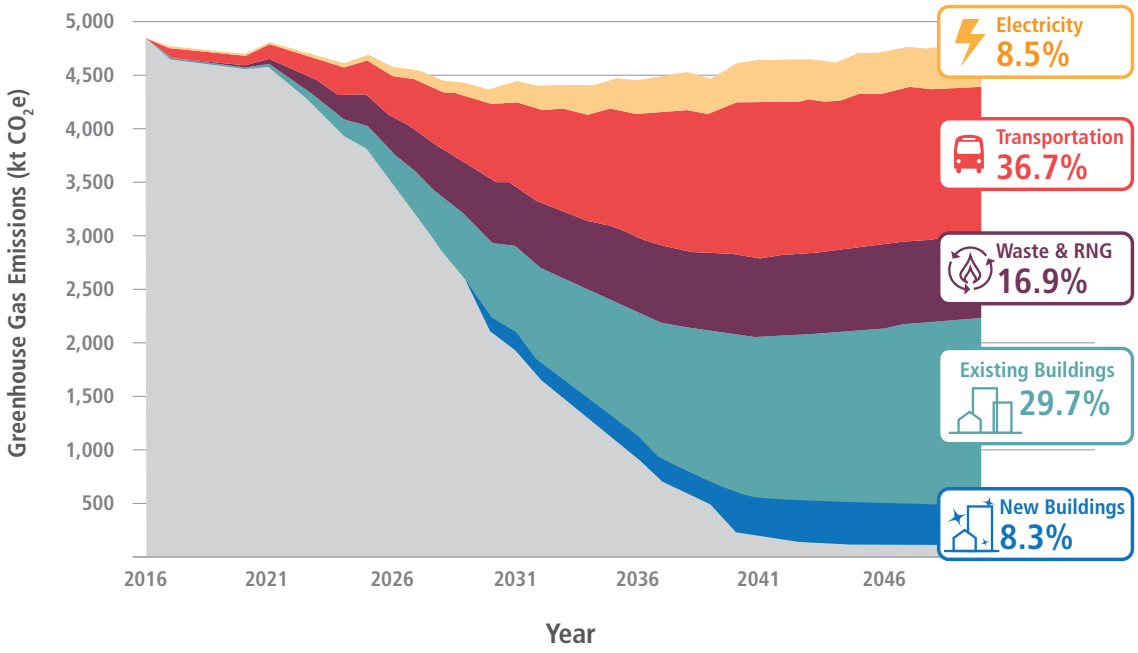


Figure 12: Total projected community-wide GHG emission reductions required to achieve 100% scenario incremental to BAP scenario by sector, 2016-2050 (percentages shown at 2050 are non-cumulative)

Within those sectors, 39 actions have been identified to achieve the 100% scenario. Table 13 (below) identifies the top five actions from the model, which combine for roughly 80% of projected cumulative GHG emission reductions required.

Sections 4.1 through 4.5 provide an overview of each sector and are broken down as follows:

- A brief description of each sector.
- An overview of jurisdictional considerations.
- The assumptions that went into the model regarding each sector.
- How each sector contributes to GHG emissions in the 2016 model baseline year and the BAP scenario.
- The minimum results required to meet the 100% scenario and based off the energy and emissions model outputs. Further options may be evaluated under this project to meet the scale of action required. For the full list of model metrics and their relative GHG emission reductions, refer to Appendix E: Modelling Ottawa's Greenhouse Gas Emissions to 2050: Summary of Results.
- Proposed projects to catalyze action in Ottawa within the next five years (2020-2025). These projects are contingent on future Standing Committee and Council approval as well as future staff and budget (capital and operating) pressures. To achieve the GHG reductions required in the 100% scenario, some projects may evaluate options beyond what's been identified in the strategy prior to going to Standing Committee and Council. Where applicable, projects will go through the standard City project management process. For an overview of each project including the project description, co-benefits, risks, project metrics, key departments, key community partners, timelines, resources, and financial profile, refer to Appendix F: Project Overviews. For a summary of the projects, refer to Appendix G: Summary of Energy Evolution Projects (2020-2025).

4.1 Land Use and Growth Management

Ottawa's population reached 1 million people in 2019 and is projected to grow to approximately 1.4 million people by 2050. Household growth between 2018 and 2046 is anticipated to reach 195,000 units. For Ottawa to evolve in an era of climate change will require greater energy conservation and efficiency measures in shaping patterns of growth.

Municipal decisions affecting land use planning matters are to be consistent with the Provincial Policy Statement (PPS) set out in the Planning Act. The PPS directs that municipalities achieve a compact form of development that makes the most

Table 13: Projected top five actions from the energy and emissions model to achieve the 100% scenario by 2050

Actions	Cumulative GHG Reductions by 2050 (%)
1. Electrify personal vehicles	22.7%
2. Retrofit residential buildings[29]	17.9%
3. Divert organics and create renewable natural gas[30]	17.2%
4. Retrofit commercial buildings[31]	15.1%
5. Transition to zero emission commercial fleets	8.3%

29 Includes retrofitting pre- and post-1980 homes, low rise residential and apartment building heat pumps.

30 Includes waste diversion and RNG production, rural biogas generation, waste heat, and power to gas.

31 Includes retrofitting commercial, office, and residential buildings, and commercial building heat pumps.

efficient use of infrastructure and land. PPS policies provide broad directions with respect to housing mix and choice, efficient use of infrastructure, and climate change. Council recently adopted the growth management strategy for the new Official Plan, which considered each of these factors and established a direction that is consistent with the PPS. The Official Plan will maximize opportunities to achieve the targeted GHG emission reductions by directing that urban growth occur in a compact form, in locations with transportation options that integrate active transportation and support the use of current and future transit, and to minimize the length and number of vehicle trips.

The Climate Change Master Plan, modelling work from Energy Evolution and climate projections from the National Capital Region Climate Projections study were also used to inform the policy directions on growth and development as part of the new Official Plan, which is expected in 2021.

Building on the key findings of Ottawa Next: Beyond 2036, embedding public health, environmental, climate and energy resiliency into the framework of our planning policies is one of the Five Big Moves identified for the new Plan. Official Plan policies will guide reductions in greenhouse gas emissions through land use, transportation and energy planning consistent with Council approved targets.

4.1.1 Jurisdictional Considerations

Municipalities have primary responsibility for land use planning in Ontario working within the parameters of the Planning Act. Bill 68, Modernizing Ontario's Municipal Legislation Act, included climate change as a matter of provincial interest for decision makers to address when carrying out their responsibilities under the Planning Act. This inclusion gave municipalities broad powers to pass by-laws respecting climate change and to participate in long-term planning for energy use. The Provincial Policy Statement (PPS) is issued under Section 3 of the Planning Act and all decisions affecting land use planning matters must be consistent with the PPS. The PPS encourages municipalities to provide opportunities for the development of energy supply including electricity generation facilities and transmission and distribution systems, district energy, and renewable energy systems and their supporting infrastructure to accommodate current and projected needs. In addition, as part of recent updates, the PPS requires municipalities to prepare for the local impacts of a changing climate and mitigate the risks to human health, safety, property and the environment.

The municipality's principal land use planning document is the Official Plan. The two greatest contributors to GHG emissions in Ottawa are buildings and transportation. The Official Plan, through its growth management strategy, intends to implement a model of urbanization that minimizes the need to travel, lessens the reliance on personal vehicles, and requires built forms that are less energy intensive.

4.1.2 Model Assumptions

The following assumptions were built into the energy and emissions model regarding land use that influenced the other sectors:

- Population of 1,500,664 people and 910,638 people employed by 2050[32]
- 224,059 new dwelling units and 385,074 existing dwelling units by 2050
- The rate of intensification within the urban area increases to 60% by 2046[33]

4.1.3 Baseline and BAP Scenario

The current Official Plan has targets for the percentage of new dwelling units to be accommodated through intensification, being redevelopment that results in a net increase in the number of residential units. The intensification targets incrementally increase by 2% every five-year period, starting at 38% between 2012-2016, and ending at 46% by 2032-2036. However, an overall intensification rate of 51% was achieved from 2012 to 2019, exceeding Official Plan targets.

32 There are slight variations in population and employment data between the projections in the Official Plan and the Energy Evolution model. These variations do not have a significant impact and can be addressed in the next model update.

33 These numbers reflect planning assumptions at the time the modelling was done and will be updated after the Draft Official Plan is tabled. As we are targeting a 100% GHG reduction, the effect of changing input assumptions related to intensification will have only a small impact on the actions the model says we need to undertake.

The current Official Plan focuses intensification within the Central Area, Mixed-Use Centres, Town Centres, Transit-Oriented Development areas and along Arterial Mainstreets, collectively referred to as "intensification target areas." The recommended intensification areas to 2046 will be identified as part of the new Official Plan.

The BAP Scenario assumes that a continuation of the current Official Plan policy framework of incremental intensification rate is maintained with suburban growth developed at a further distance from the rapid transit network, decreasing transportation mode options which lead to more automobile-centric development and consequently increased GHG emissions.

4.1.4 Achieving the 100% Scenario

a) Land Use and Growth Management

Population and employment projections for the new Official Plan, as they stood at the time of modelling in Q3 2019, were incorporated into the models to inform the anticipated level of growth and development between 2018 and 2046 with an extrapolation made to 2050. Land use considerations were factored into the model including a housing mix that supports intensification, targeting greater densities in proximity to transit as well as built in thresholds for new development to be built to higher efficiency standards.

The approved growth management strategy sets a target of 51% of all urban growth to be accommodated in the built-up area through intensification, and 49% through greenfield development over the course of the planning period to 2046. Intensification will absorb a share of the projected ground-oriented units, such as single-detached, semi-detached and rowhouses, or other built forms to support larger households. In so doing, the preliminary policy directions include recommendations for a built environment to achieve denser, 15-minute neighbourhoods to help reduce emissions from transportation by increasing viable options for walking and cycling and promote social, mental and physical health and sustainable neighbourhoods. Policy guidance on new developing neighbourhoods will also promote opportunities for renewable energy supplies through Community Energy Plans.

Land use and transportation information were foundational geo-spatial inputs into the integrated model. The model was not explicitly designed to assess land use or growth management strategies. Regardless, the rate of intensification used in the model was used to compare the difference in required emissions between the Business-as-Planned scenario and the 100% Reduction scenario. The difference in cumulative GHG reductions under the 100% Reduction scenario was found to be 0.38% of required emission reductions to 2050. The slight variation is largely attributed to increased vehicle kilometres travelled (VKT). This increases emissions from fossil fuel powered vehicles in the period before they are phased out and from electric vehicles in the period before emissions from grid electricity are removed.

Any numerical differences that exist between the growth management strategy for the new Official Plan and the Energy Evolution model will be addressed in the next model update. These differences are modest and do not influence the necessary actions to be undertaken in the period up to 2025.

b) Buildings

Mitigating emissions from the buildings sector is also addressed through the Official Plan by giving direction for high-performance development standards for certain types of new construction with metrics for building energy efficiency and thermal performance based on criteria set out in Ontario's Building Code with progression towards net zero energy ready buildings with higher performance to be encouraged through incentives. Other tools that exist under the *Planning Act* such as Community Improvement Plans can be used by the City in support of improvements to existing building stock in order to conserve energy and reduce greenhouse gas emissions. The Energy Evolution model takes into account reduced dwelling sizes which are associated with reduced household energy costs, as their energy requirements for electricity and heating and cooling decline. The Official Plan is also expected to emphasize "building form" rather than "building type," which will enable a broader range of housing options to be built.

c) Transportation

The new Official Plan's growth management strategy is in lockstep with the vision and guiding principles for the Transportation Master Plan Update, expected in 2022. The provision of higher-order transit in new and intensification growth areas is one of the key strategies that will help mitigate emissions from transportation by planning for the majority

of trips to be made by sustainable modes by 2046. Increasing compact development also reduces overall transportation infrastructure costs and encourages active transportation.

d) Waste and Renewable Natural Gas

The Official Plan will bring into effect new high-performance development standards that will contain metrics for managing waste for certain types of development. Resource recovery and waste diversion practices will be applied to materials used by developers during construction. Development strategies to promote waste diversion among residents at multi-residential properties will be considered for inclusion.

It is also possible for the City to achieve emission reductions through the Solid Waste Master Plan. Opportunities for waste transfer stations will be considered if they are required to enable zero emission waste collection and optimal renewable natural gas production. All options to be considered through the Solid Waste Master Plan will be measured against an evaluation matrix that balances social, environmental and financial considerations, which will include analysis of the net GHG impact of all potential initiatives and technologies.

e) Local Renewable Energy

Local energy generation and storage will ensure local energy security and reliability as well as promote economic competitiveness and resiliency. The PPS requires municipalities to seek opportunities for the development of energy supply including electrical generation facilities and transmission and distribution systems, and district energy systems, including renewable and alternative energy systems, to accommodate current and projected needs. Given that less than 6% of the energy consumed in Ottawa is generated in Ottawa, it is evident that renewable energy technologies will play an increasingly important role in protecting Ottawa's long-term energy security.

The Energy Evolution model actions include several renewable energy sources to capitalize for generation, including solar, water, and wind energy. Under the authority of the Planning Act, the new Official Plan intends to recognize and include renewable energy and energy storage facilities as generally permitted uses in some designations with accompanying compatibility criteria applicable to the built form context. Large facilities and buildings are also to be recognized as priority locations in support of their rooftop photovoltaic electricity potential to generate local renewable energy while reducing greenhouse gas emissions.

4.1.5 Priority Projects for the Next Five Years (2020-2025)

The new Official Plan, to be adopted in 2021 by Council, is a strategic document that describes the growth and physical development of the city over the next 25 years. It also sets the foundation upon which the reviews and updates of the Transportation Master Plan, Infrastructure Master Plan, Solid Waste Master Plan and the Greenspace Master Plan are to be built. Staff will update the Energy Evolution model as new information becomes available or when it would clarify the GHG implications of significant City plans and policies such as the Official Plan and master plans.

Table 14: Projects to be undertaken in the land use and growth management sector (2020 2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Integration of energy and climate mitigation policies into the new Official Plan and supporting master plans to address multiple challenges being faced by the city over the next 25 years, climate change being one of the most critical. The Official Plan and supporting master plans will be guided by the Climate Change Master Plan with Council approved targets to reduce GHGs by 2050.	Energy and climate mitigation policies embedded into the new Official Plan and supporting master plans	Enabler

4.2 Buildings (New and Existing)

The buildings sector is currently the largest contributing sector to emissions in Ottawa and the largest energy consumer. It accounts for emissions generated mostly through the combustion of fossil fuels (natural gas, some electricity, propane, heating oil, and diesel) for heating. Lower carbon electricity is employed for cooling, appliances, and lighting, which together form the balance of energy demands but a small contribution to emissions. Key opportunities identified for significant potential GHG reductions include deep energy retrofits, high-performance buildings, and the use of heat pumps and district energy for space for heating.

4.2.1 Jurisdictional Considerations

The provincial government is responsible for the regulation of building construction and renovations through Ontario Regulation (O. Reg.) 332/12: Building Code under the Building Code Act, but it is enforced at the municipal level. Ontario's Building Code is based on the National Building Code of Canada but remains solely within provincial jurisdiction. Additionally, owners of large buildings (i.e., buildings that are 50,000 square feet or more) must report their energy use to the Province of Ontario under O. Reg. 506/18: Reporting of Energy Consumption and Water Use.

The National Energy Code of Canada for Buildings is reviewed on a five-year cycle. The next release is expected in 2020. This version will contain major revisions to advance energy performance and are expected to include guidance on retrofits and reduced window to wall ratios. In addition, the new code is expected to include stepped pathways to support provinces with more frequent progressive steps toward net zero energy buildings.

The federal government is responsible for setting standards for home heating under Canada's Energy Efficiency Regulations. At the provincial level, the government requires municipalities to commit to consider climate change—both mitigation and adaptation—in asset management planning.

4.2.2 Model Assumptions

The following assumptions were built into the BAP scenario for the buildings sector:

- 10% improvement in new buildings every five years based on the Ontario building code and new building energy performance standards
- Building area per person will increase from 77.3 m^2/person to 88.1 m^2/person. Building floorspace projections of new buildings are based on existing persons per unit (for residential) and floorspace (m^2) per employee/job (for non-residential space)
- Projected decrease in heating degree days and increase in cooling degree days

4.2.3 Baseline and BAP Scenario

In 2016, 48.2% of GHG emissions in Ottawa came from buildings, with residential buildings contributing 27.5% and non-residential buildings contributing 20.7%. Natural gas employed for space and water heating was the highest emitting fuel type, responsible for 38.7% of community emissions. While electricity was responsible for the second highest share of energy consumed in buildings after natural gas, it equated to only 5.8% of total emissions due to the low-emission electrical grid in Ontario.

As Ottawa's population increases, the building stock is also expected to increase to accommodate people in homes, offices and commercial spaces. Under the BAP scenario, building emissions are expected to remain relatively constant despite this growth, primarily due to anticipated building upgrades, energy efficiency improvements, and the projected decrease in heating degree days (Figure 12 – page 28).

4.2.4 Achieving the 100% Scenario

The model projects that the buildings sector could contribute roughly 38% of total GHG emission reductions required to achieve the 100% scenario. In order to realize these emission reductions, deep energy retrofits are required. As identified by the model, retrofitting residential buildings is projected to account for 17.9% of cumulative GHG emission

reductions over the next 30 years, while retrofitting commercial buildings is projected to account for 15.1%. Electricity becomes the primary fuel for all building types and the switch to heat pumps for space heating and cooling is effective in reducing building emissions. Emissions from natural gas will decrease by 98% as a result of fuel switching and energy efficiency measures, while emissions from propane and fuel oil will decrease between 90% and 99%. By switching to electricity and reducing overall consumption, GHG emissions are projected to reduce by 99% in residential buildings, 97% in commercial buildings, and 97% in industrial buildings by 2050. Additionally, district energy use increases in the residential and industrial sectors due to the expansion of the existing federal district energy system and the addition of new district energy systems.

The model indicates that the minimum results required to meet the 100% scenario under the buildings sector are:[34]

- 98% of existing residential and small commercial buildings and 95% of existing large commercial and industrial buildings are retrofit for 70% heating savings and 30% electrical savings by 2040.
- 16% of existing municipal buildings are retrofit to net zero emissions by 2030 and 99% by 2040.100% of new homes are net zero emissions by 2030.
- 100% of new commercial buildings are near net zero emissions-ready after 2030.
- 560,350 residential heat pumps are installed and 73% of commercial building heat load served by heat pumps by 2050 (buildings that must retain heating during prolonged power failures have backup power generation for their heat pumps if required).
- 80% of existing commercial and apartment buildings and 15% of residential buildings are served by district energy by 2050.
- The federal district energy system to be converted to geothermal by 2040 and 100% of the district energy systems are to be geothermal by 2050.

4.2.5 Priority Projects for The Next Five Years (2020-2025)

Table 15 (page 36-37) identifies projects to be initiated within the next five years to accelerate retrofits of existing buildings, the decarbonization of heating sources, and net zero emissions building construction.

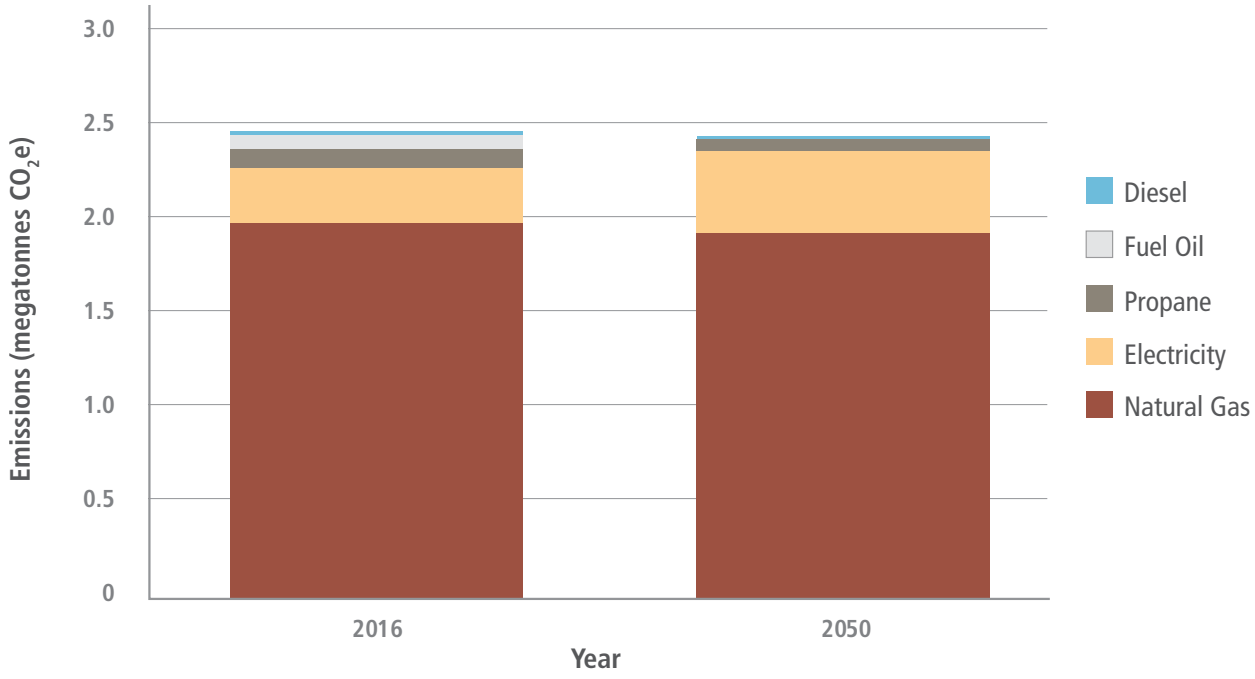


Figure 13: Buildings sector emissions by fuel type for BAP scenario, 2016 and 2050

34 The minimum results are based off the energy and emissions model outputs. Further options may be evaluated under this project to meet the scale of action required.

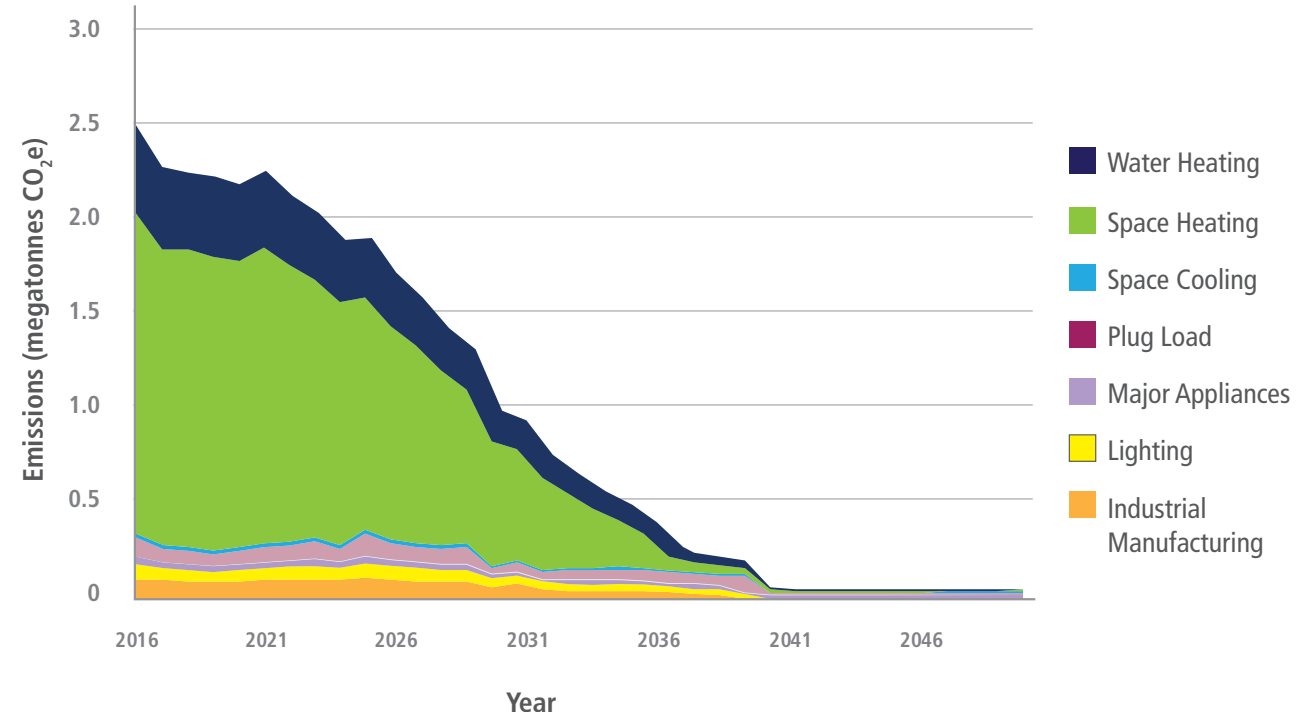


Figure 14: Buildings sector emissions by end use for 100% scenario, 2016-2050

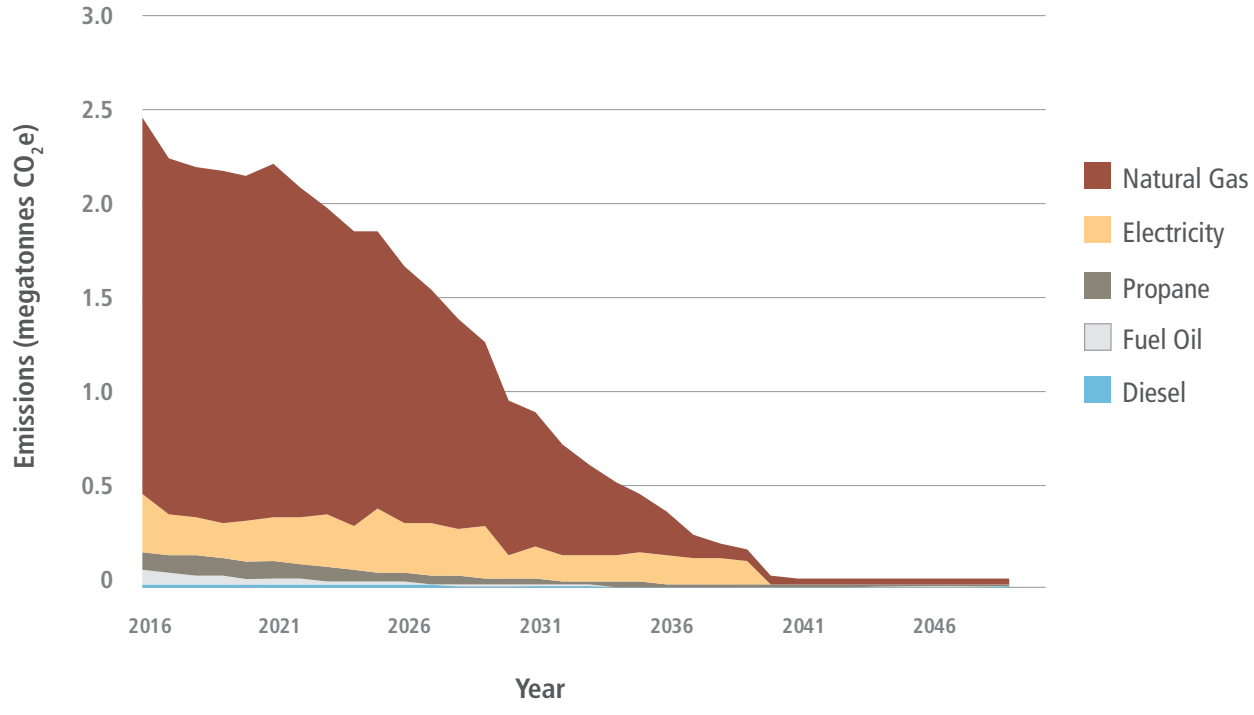


Figure 15: Buildings sector emissions by source for 100% scenario, 2016-2050

Table 15: Projects to be undertaken in the buildings sector (2020-2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Residential Building Retrofit Accelerator Program to accelerate residential, multi-unit residential, and commercial and institutional building retrofits through marketing, information and financial mechanisms	• 17% of existing residential buildings renovated or replaced • 20% of existing residential buildings transition to heat pumps • 10% of domestic hot water heating transitions to non emitting sources	22% (222 kt CO_2e)
Commercial Building Retrofit Accelerator Program to accelerate multi-unit residential, commercial, industrial, and institutional building retrofits through marketing, information and financial mechanisms	• 15% of existing commercial buildings renovated or replaced • 20% of existing commercial buildings transition to heat pumps • 10% of domestic hot water heating transition to non emitting sources	18% (175 kt CO_2e)
Building Retrofits through Local Improvement Charge Program to accelerate and finance deep energy retrofits of buildings through the local improvement charge mechanism	Embedded within the residential and commercial building retrofit accelerator programs	
Energy Community Improvement Plans to incentivize superior energy performance and deep energy retrofits using tax grants	Embedded within the residential and commercial building retrofit accelerator programs	
Community Building Heating Strategy to address infrastructure and utility requirements for new ways of heating buildings	30% drop in GHG intensity of federal district energy system	9% (92 kt CO_2e)
Municipal Buildings Renewal and Retrofit Program to achieve higher building energy performance improvements in municipal owned buildings	Ramping towards having 27% of municipal buildings net zero by 2030	1% (12 kt CO_2e)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Update to Municipal Green Building Policy to align with corporate GHG reduction targets	Embedded within the Municipal Buildings Renewal and Retrofit Program	
High-Performance Development Standard to improve building design and construction across the community and support an industry-wide transition of new buildings to net zero emissions ready by 2030	Ramping towards all new buildings being net zero energy by 2030	6% (59 kt CO_2e)

4.3 Transportation

The transportation sector is currently the second largest contributing sector to emissions in Ottawa and the second largest energy consumer. It includes five vehicle types (cars, light trucks, heavy trucks, urban buses, and light rail transit [LRT]) and accounts for emissions generated through the combustion of fossil fuels (diesel and gasoline) as well as alternative fuels (biodiesel, ethanol, and electricity).

Achieving significant GHG reductions hinges on transforming transportation in two ways: how people and goods move within the city and the National Capital Region and what fuels this movement. A flexible, integrated set of options will be required to allow seamless transition between transportation options to reduce reliance on vehicles, leading to a reduction in vehicle kilometres travelled and associated emissions. This would include a robust public transportation system with frequent service, increased active transportation options supported by safe walking and cycling facilities, shared mobility including shared commuting, auto-share and bike-share programs, and mobility hubs.[35] At the same time, transportation options need to be electrified (or other zero carbon solution) to drastically reduce GHG emissions.

4.3.1 Jurisdictional Considerations

The federal government is responsible for regulating the automotive industry and setting fuel standards, whereas the provincial government sets emission standards for all vehicles in Ontario and renewable content for fuel, and has a regulatory role in the provision of measures such as road user fees.

At the local level, the municipality's Transportation Master Plan sets out the transportation growth management and travel demand policies along with the planning and implementation of its walking, cycling, transit, and road networks. The municipality also operates the traffic management system, has control over the allocation of municipal roadway space for different users, and sets parking fees for on-street parking and municipal lots. Spending of parking revenues is governed by the Municipal Act and the Municipal Parking Management Strategy. Additionally, it has control over the procurement and operation of its own fleet.

4.3.2 Model Assumptions

The following assumptions were built into the BAP scenario for the transportation sector:

- Electric vehicles are 5.5% of personal vehicle stock in 2050.
- The total number of personal and commercial vehicles is proportional to households in the BAP scenario; personal vehicle stock share decreases and commercial stock remains the same between 2016 and 2050.
- Annual vehicle kilometres travelled increase from 5.7 billion to 9.6 billion by 2050; this is driven by autonomous vehicles, which increase transportation

35 A mobility hub is a location that has several transportation options and is a concentrated point for a mix of uses such as transit, employment, housing, recreation and shopping.

demand and contribute to vehicle movement because of deadheading.

- Vehicle fuel consumption rates reflect the U.S. Corporate Average Fuel Economy (CAFE) fuel standard for light duty vehicles and Phase 1 and Phase 2 of Environmental Protection Agency (EPA) Heavy Duty Vehicles (HDV) fuel standards for medium and heavy-duty vehicles.
- Mode share for transit, cycling, and walking is based on 2013 Transportation Master Plan model data for 2011 and 2031 and held constant post 2031.
- Transit fleet is electrified by 2050.

4.3.3 Baseline and BAP Scenario

In 2016, 41.3% of GHG emissions in Ottawa came from transportation, with cars and light trucks accounting for roughly 85% of transportation emissions. Gasoline was the highest emitting fuel by type, responsible for 80% of emissions within the transportation sector and 33% of total emissions in Ottawa. Diesel accounted for the remaining 20% of transportation emissions.

Under the BAP scenario, transportation emissions are expected to slightly increase due to population growth and an increase in freight and associated diesel emissions. While there will be an increase in the electrification of personal vehicles, gasoline and diesel remain the dominant fuel types in 2050, accounting for 95% of transportation energy use.

4.3.4 Achieving the 100% Scenario

The model projects that the transportation sector could contribute roughly 37% of total GHG emission reductions to achieve the 100% scenario. In order to realize these emission reductions, electric vehicles must replace internal combustion engines and the use of diesel and gasoline as a fuel source for both personal and commercial vehicles. The model projects that the electrification of personal vehicles (cars and light trucks) is the single most impactful action in Ottawa over the next 30 years, accounting for 22.7% of cumulative GHG emission reductions. Transitioning commercial fleets to zero emission vehicles is also in the top five actions accounting for 8.3% of cumulative GHG emission reductions. Over the course of transitioning to electric vehicles, emission reductions can be further accelerated by reducing overall vehicle kilometres travelled as a result of an increased share of transit use and active transport modes. All factors combined result in a 99% reduction in emissions in the transportation sector.

The model indicates that the minimum results required to meet the 100% scenario under the transportation sector are:[36]

- Electric vehicles (EVs) comprise 90% of new personal vehicle sales by 2030 and 100% by 2040.
- 40% of heavy trucks are zero emission by 2030 and 100% by 2040.
- 100% of transit fleet is zero emission by 2030.
- Municipal fleet is 60% zero emission by 2030 and 100% by 2040.
- Bus rapid transit and light rail transit increase in frequency by 2030.
- Active transportation mode share is at 21% by 2030.[37]
- Expanded transit to reflect the "Concept Network."[38]
- ByWard Market and part of downtown Ottawa[39] are car free by 2030.
- Congestion charges, EV only areas and increased parking fees.

4.3.5 Priority Projects for The Next Five Years (2020-2025)

Table 16 (page 39) identifies projects to be initiated within the next five years to accelerate the electrification of the transportation sector and the expansion of transit and active transportation infrastructure.

36 The minimum results are based off the energy and emissions model outputs. Further options may be evaluated under this project to meet the scale of action required.

37 The updated Transportation Master Plan (TMP) will recommend new mode share targets and establish the policies to support the vision that most trips will be made by sustainable transportation (i.e., walking, cycling, transit or other non-auto modes) by 2046.

38 The Concept Transit Network defined in the 2013 TMP refers only to the recommended infrastructure, not how it is operated. Through the updated TMP, additional transit network planning will be completed to 2046.

39 Boundary defined as Wellington Street–Rideau Street, Sparks Street, Bank Street, and University of Ottawa campus.

Table 16: Projects to be undertaken in the transportation sector (2020-2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Personal Vehicles Electrification Strategy to enable and encourage personal electric vehicle adoption	7% of personal vehicle sales are EVs in 2025	5% (49 kt CO_2e)
Zero Emissions Commercial Vehicles Strategy to enable and encourage commercial electric vehicle adoption	18% of commercial fleet is electric by 2025	6% (63 kt CO_2e)
Municipal Green Fleet Plan Update to consider corporate greenhouse gas reduction targets	Progress towards the 2030 target	<1% (<10 kt CO_2e)
Alternative Energy Sources for Transit Project to build a 100% zero emissions Concept Transit Network by 2030	48% of OC Transpo's passenger fleet is zero emission by 2025	6% (63 kt CO_2e)
Transportation Mode Shift to reduce the reliance on personal vehicles in favour of sustainable modes including public transit, walking, cycling and carpooling	Steady progress towards the 2030 mode share targets	3% (33 kt CO_2e)

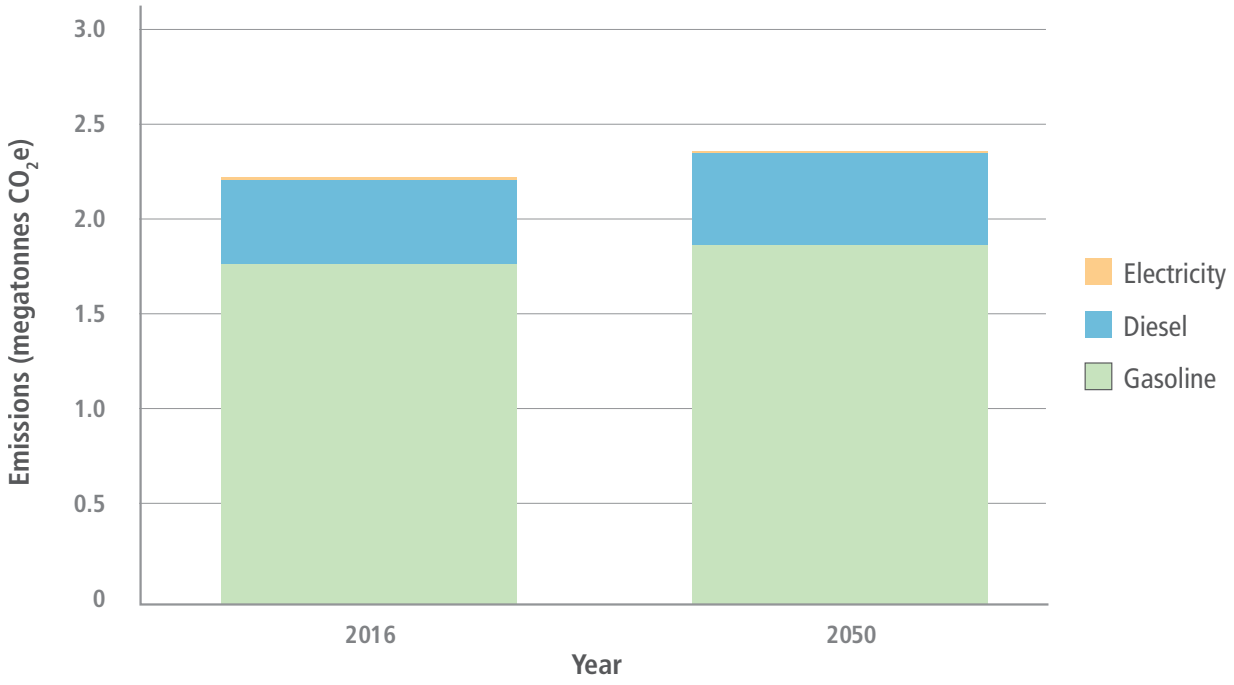


Figure 16: Transportation sector emissions by fuel type for BAP scenario, 2016 and 2050

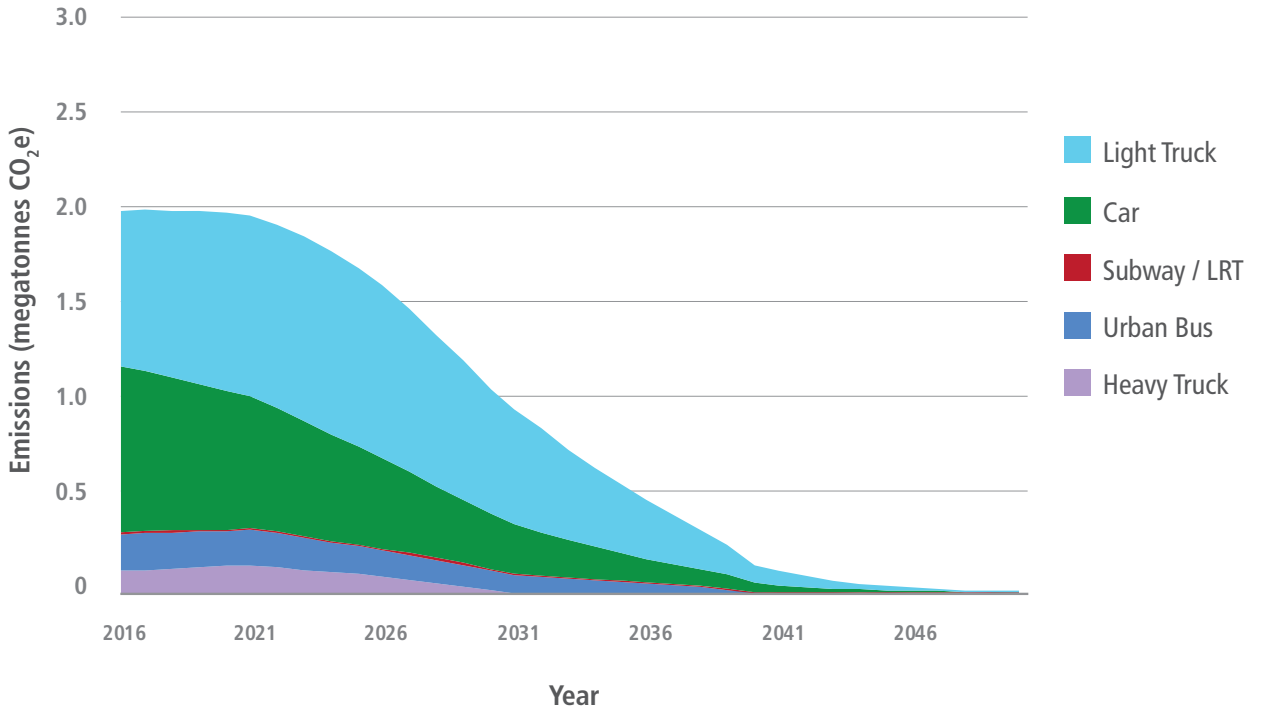


Figure 17: Transportation sector emissions by vehicle type for 100% scenario, 2016-2050

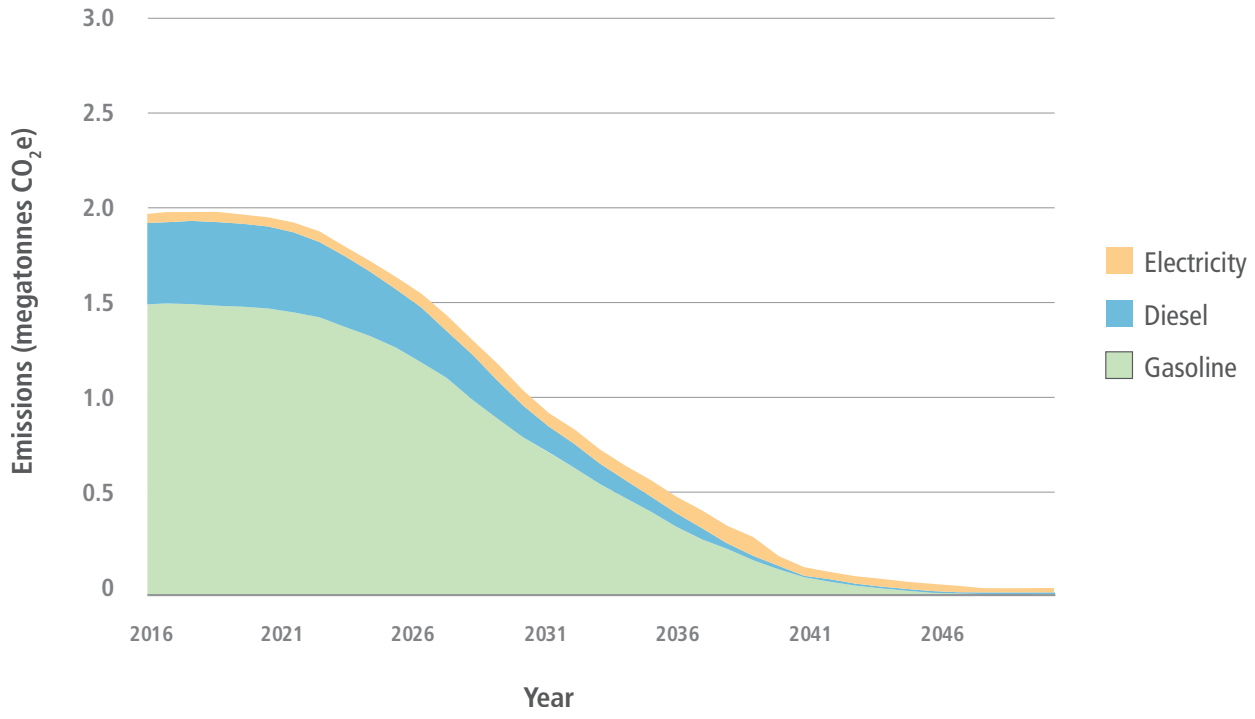


Figure 18: Transportation sector emissions by source for 100% scenario, 2016-2050

4.4 Waste and Renewable Natural Gas

The waste and renewable natural gas sector is one of the smaller contributing sectors to emissions in Ottawa but presents a large opportunity to create net zero emission fuel. It is comprised of emissions from solid waste and wastewater and opportunities to displace conventional fossil fuels such as natural gas. The Energy Evolution model assumes that achieving additional GHG reductions within the waste sector hinges on two steps: eliminating organics from the landfill and converting all available waste organic material into usable energy using anaerobic digestors or gasifiers to generate renewable natural gas (RNG).[40] Additionally, smaller contributions from waste heat,[41] power to gas and district energy are part of the overall emission reduction opportunities in this sector. Solid waste includes residential and non-residential waste, recyclables, and source separated organics. Source separated organics are comprised of organic materials such as food scraps, paper waste, and leaf and yard waste. Most organic waste that ends up in a landfill does not breakdown. The portion that does decompose releases methane, a potent GHG emission that must be captured in Ontario to ensure it does not migrate to properties neighbouring the landfill. This captured gas can be used to generate electricity or can be recovered as a fuel source. The Province of Ontario has proposed banning organic waste from landfills by as early as 2022; however, no formal strategy or plan for how this will roll out has been released by the Province. The Solid Waste Master Plan will investigate policy options and programs that could achieve this provincial direction. Emissions from solid waste collection vehicles are accounted for in the transportation sector and emissions associated with energy used at waste facilities are accounted for in the buildings sector.

4.4.1 Jurisdictional Considerations

In Canada, all three levels of government have a role to play in waste management, with the federal and provincial government establishing:

- Waste reduction and diversion policies and programs
- Regulations and standards for waste management facilities and operations
- Approval and monitoring of waste management facilities and operations

The municipality is the operator and manager of the public waste management system, which includes the municipal wastewater treatment plant, recycling and organic waste collection, as well as the disposal of solid non-hazardous waste at the Trail Road Waste Facility. The municipality also provides collection services for some parts of the industrial, commercial, and institutional (ICI) sector, although it is not required to do so by the provincial government. Within this sector, the municipality provides service to most of the city's multi-residential buildings, municipally owned facilities, and small business through the Yellow Bag Program. ICI waste is regulated by the provincial government and is generally privately managed and operated.

4.4.2 Model Assumptions

The following assumptions were built into the BAP scenario for the waste sector:

- Emissions projections for waste are derived using projected population growth and existing rates of waste produced per capita and assumes no reduction in per capita waste.[42]
- 2016 residential, multi-residential waste diversion rate of 47% was held constant to 2050; ICI sector diversion rates are unchanged from 2016 to 2050.
- No new technology for carbon emission reductions in solid waste or wastewater treatment facilities assumed beyond 2016.
- Landfill emissions include those from operating and retired landfills.

4.4.3 Baseline and BAP Scenario

In 2016, 7% of GHG emissions in Ottawa came from waste, the vast majority of which came from organic solid waste and a small amount from wastewater. Over 1 million tonnes

40 Renewable natural gas refers to gas generated through electrolysis or gas generated through anaerobic digestion or gasification of organic waste.

41 Waste heat refers to existing sources of unwanted heat, e.g., heat from existing industrial processes or sewers.

42 Waste projections are being updated through the Solid Waste Master Plan and any changes will be considered in the next update of the model.

of residential and ICI solid waste was produced in 2016, of which almost 70% was sent to landfills, 20% was recycled and 10% was biologically treated (through composting and anaerobic digestion). Additionally, over 100 million m^3 of wastewater was produced, the vast majority of which was treated at the Robert O. Pickard Environmental Centre. Emissions in solid waste and wastewater are built from actual site data comprised of direct emissions from biological material and energy (fuel, electricity) used to process materials.

Under the BAP scenario, both Ottawa's solid waste and wastewater production are expected to increase in step with population growth, by 40% and 35% respectively. As a result, emissions associated with solid waste and wastewater are expected to also increase under this scenario, rising over 37% by 2050. Notable increases in paper, wood waste, plastic and metal, and compost are also expected, driven by population growth.

4.4.4 Achieving the 100% Scenario

The model projects that the waste and RNG sector could contribute roughly 17% of total GHG emission reductions to achieve the 100% scenario. The diversion of organics from the landfill and using that organic material to make RNG is one of the most impactful actions to achieve the 100% scenario. The reduction in waste emissions could reach approximately 97% by 2050 by greatly reduced fugitive emissions (predominantly methane) and nearly perfect solid waste diversion rates. Additionally, biogas produced by capturing off-gassing from organic waste decomposition makes up the majority of emission reductions within this sector. Natural gas will need to be eliminated through conservation and switching to electrically powered heating and RNG.

The model indicates that the minimum results required to meet the 100% scenario under the waste and renewable natural gas sector are:[43]

- All leaf and yard waste gasified after 2030 to displace natural gas
- Displace 1.5% of natural gas through power to gas[44] by 2030
- Anaerobic digester gas and landfill gas are predominantly used as renewable natural gas and displace natural gas use
- 98% of organics diverted by 2024
- 100% of paper waste diverted by 2042
- 3 MW of electricity from farm biogas until 2030; after 2030, farm biogas doubles and is used to produce RNG rather than electricity
- Use of waste heat displaces close to 4% of the emissions from building heating by 2050

4.4.5 Priority Projects for The Next Five Years (2020-2025)

Table 17 (below) identifies projects to be initiated within the next five years to accelerate the emission reductions from waste.

Table 17: Projects to be undertaken in the waste and renewable natural gas sector (2020 2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Organics Resource Recovery Strategy to reduce emissions associated with managing waste and enable energy from waste[45]	Significant increase in organics diversion starting in 2023	7% (73 kt CO_2e)
Renewable Natural Gas Strategy to supply GHG neutral gas and other heating to the community	Initial renewable natural gas production in the community starting in 2022	12% (122 kt CO_2e)

43 The minimum results are based off the energy and emissions model outputs. Further options may be evaluated under this project to meet the scale of action required.

44 Power to gas involves the hydrolysis of water using electricity to make hydrogen or methane for injection into the gas grid. Biogas and power to gas are collectively referred to as renewable natural gas.

45 Options to achieve this aggressive target along with all other considerations and implications will be explored through the development of the municipal Solid Waste Master Plan (SWMP), expected to be complete by Q1 2022. The SWMP will determine the direction and goals for residential solid waste management, diversion, and reduction over the next 30 years.

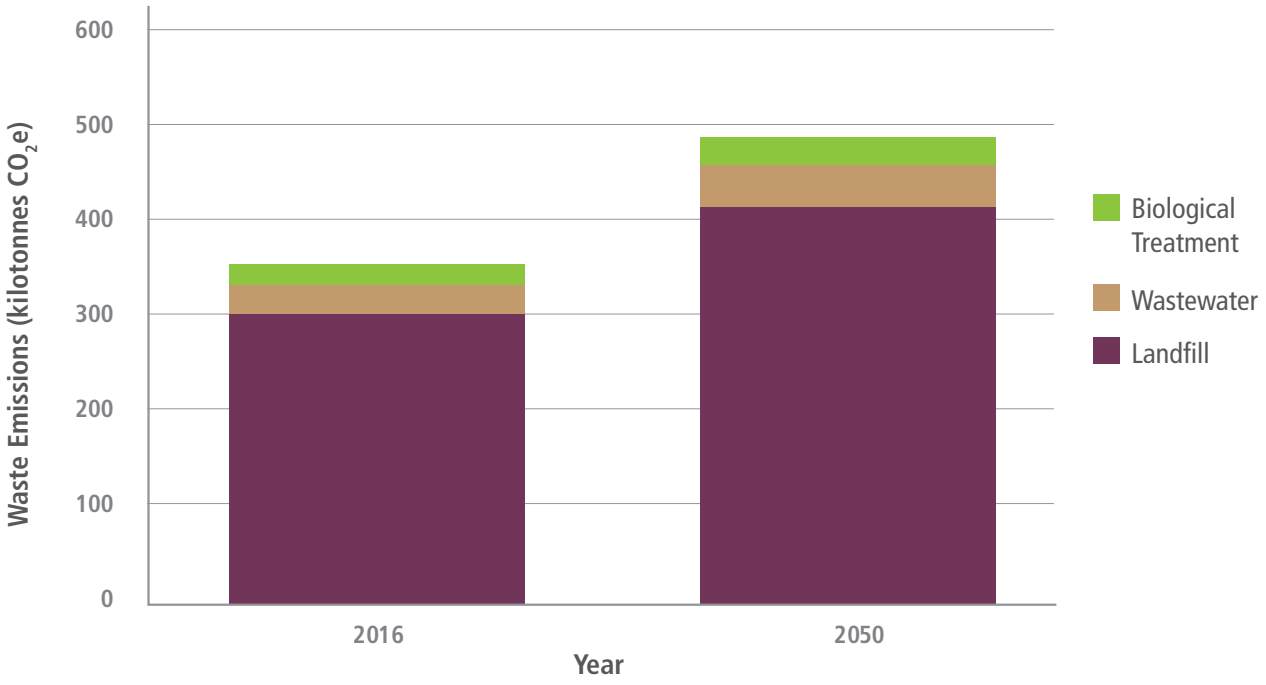


Figure 19: Solid and liquid waste emissions for BAP scenario, 2016 and 2050

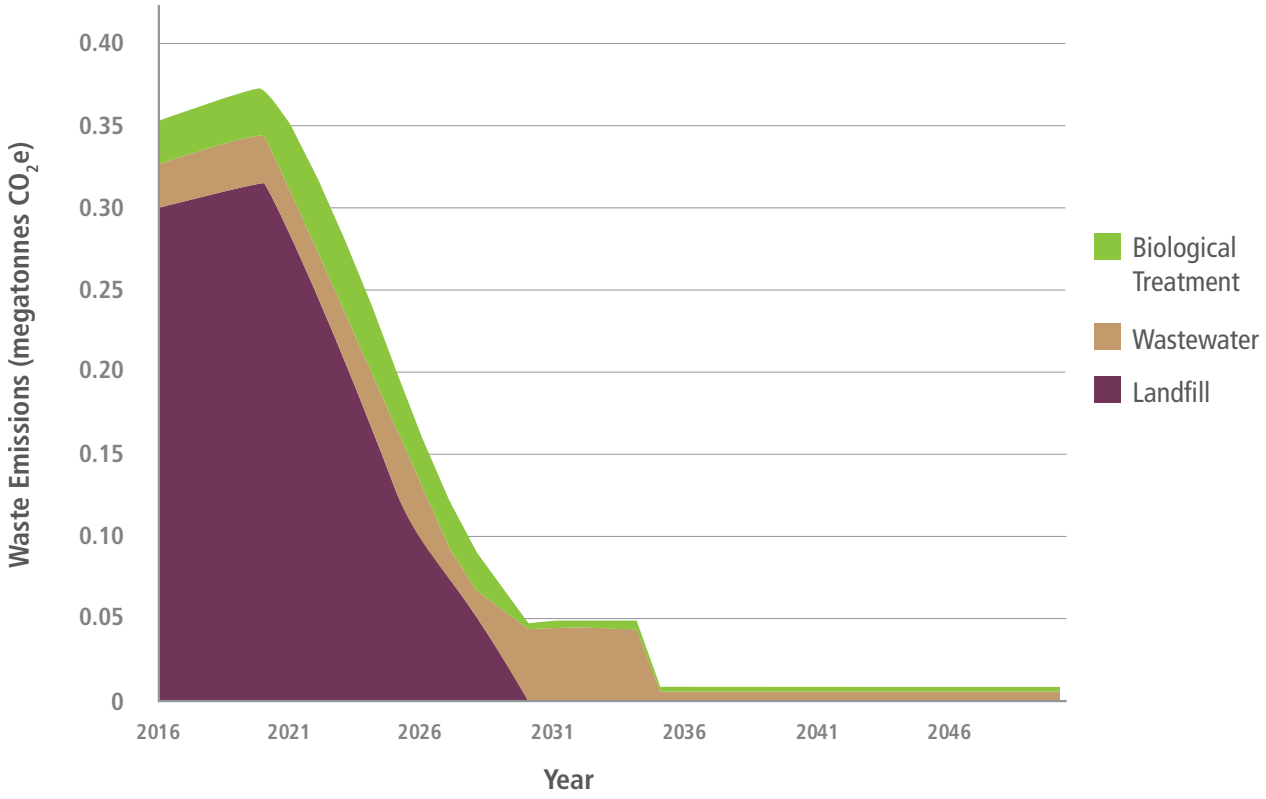


Figure 20: Solid waste and wastewater emissions for 100% scenario, 2016-2050

4.5 Electricity

Reducing emissions to 100% by 2050 will require an increase in electricity production and delivery. Ontario's current electricity supply has a low emissions profile; however, the model projects a doubling of electrical demand as electrification of transportation, heating and population growth drive demand. The additional requirements for renewable electricity generation will reflect the need to both meet new demand and offset anticipated carbon intensity of the provincial grid as forecasted by the Ontario Ministry of Energy, Northern Development and Mines. Eliminating electricity generated from fossil fuel in Ontario's electrical supply will be a long-term activity and provincial commitments in this area could partially replace the need to install capacity in the community.

4.5.1 Jurisdictional Considerations

The Province is the regulator and a large owner of the bulk of the electricity generation in Ontario. A number of municipal and private energy generation operators do contribute power to the grid, but it is a highly regulated environment.

At the local level, Hydro Ottawa is fully owned by the municipality and Portage Power, a subsidiary of Hydro Ottawa, is the largest municipally owned producer of green power in Ontario. Portage Power currently has the following green energy operations in Ottawa and surrounding areas:

- Sixteen run-of-the-river hydroelectric facilities, including six stations in Ottawa's downtown core
- Hydroelectric generation capacity of 84.6 MW at Chaudière Falls
- Landfill gas-to-energy generation capacity of 10.2 MW, powering enough electricity for 10,000 homes
- Fourteen solar installations across Ottawa
- Ten hydroelectric stations located in Eastern Ontario and nearby New York State that have a total combined output of 31 MW

4.5.2 Model Assumptions

The following assumptions were built into the BAP scenario for the electricity sector:

- Applied the Independent Electricity Systems Operator's 2016 Ontario Planning Outlook and the National Energy Board's 2016 Ontario projected electricity generation capacity
- Slight increase in carbon intensity from 2016 onwards as nuclear loses some of its share. Post 2035, natural gas generation is maintained, effectively locking in a problematic GHG contribution

4.5.3 Baseline and BAP Scenario

In 2016, 5.8% of community emissions came from electricity consumption, predominantly from the buildings sector. Approximately 92% of electricity consumed in Ottawa comes from zero emission sources (primarily from the provincial grid), with local generation contributing 17.4% of the zero emission electricity consumed via hydro and solar power.

Under the BAP scenario, electricity demand is on par with natural gas demand by 2050. Emissions associated with electricity production are expected to increase over the next 30 years due to population growth, energy demands being increasingly electrified, and a slight increase in the provincial bulk transmission grid emissions factor. Despite the growing demand for electricity, emissions associated with electricity are anticipated to account for only 8% of total emissions in Ottawa in 2050. This is in contrast to natural gas, which is projected to have the same energy demands as electricity but would be responsible for 36% of emissions in Ottawa.

4.5.4 Achieving the 100% Scenario

The model projects that making the local electricity supply zero emission could contribute roughly 8.5% of total GHG emission reductions required to achieve the 100% scenario. To realize this target, electricity would need to become the dominant energy source, supplying 88% of the total energy required in Ottawa. As a result, the electricity supply will need to increase by 127% and the local electricity supply will need to become entirely emission free, even with significant increases in electricity use for the electrification of transportation and heating. This kind of energy transition is only possible if conservation and efficiency in the building and transportation sectors greatly reduces energy demand in concert with a move to electrification. As electricity demand is expected to increase over the next 30 years, discussions with Ottawa's local distribution companies, the Independent Electricity System Operator and the Ontario Energy Board, are already underway. Proactive demand forecasting and frameworks to allow more distributed energy resources are being explored.

The model indicates that the minimum results required to meet the 100% scenario under the electricity sector are:[46]

- Solar photovoltaic (PV) reaches 1,060 MW by 2050 (approximately 36 km^2 of solar PV[47] mostly on rooftops)
- Wind generation reaches 3,218 MW by 2050 (approximately 710 large scale turbines)
- 310 MW of local energy storage by 2030 and 612 MW by 2050[48] (122 large shipping containers of lithium batteries) approximately

4.5.5 Priority Projects for the Next Five Years (2020-2025)

Table 18 (below) identifies projects to be initiated within the next five years to increase renewable energy generation and energy storage.

4.6 Enabling Projects and Ongoing Engagement

Reducing emissions to 100% by 2050 will require significant investment, policy alignment and regulatory changes amongst various levels of government, community partners including utilities, commercial and institutional champions, and the general public.

As directed by the Climate Emergency motion (ACS2019-CCS-ENV-0005), staff will work with senior levels of government to accelerate ambition and action to meet the urgency of climate change and provide additional resources for municipalities and the public to reduce their GHG emissions. This will be accomplished through an Advocacy Strategy to coordinate communications with senior levels of government, utilities, stakeholders, the broader community, and other Ontario and Canadian municipalities.

Community partners, including more than 200 key stakeholders representing approximately 90 organizations in Ottawa, have been critical in guiding and informing the development of the strategy and action and investment plan. Ongoing engagement with these community partners will be crucial to the successful implementation of Energy Evolution. Partners who have already committed to supporting projects are included in Appendix F: Project Overviews. Staff will continue to work with both these community partners and new ones as they emerge to identify opportunities, resourcing needs and financing to scale up community-wide efforts. The final modelling work done through Energy Evolution will be shared with stakeholders who have not yet been involved to facilitate an integrated approach across the community and to encourage collaboration amongst various levels of government, utilities, stakeholders, and the broader community. Staff will also seek to develop a new Climate Ambassadors Network to engage community partners to meet long term GHG reduction targets.

Table 18: Projects to be undertaken in the electricity sector (2020-2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Electricity Resource Strategy to develop local or regional renewable electricity supplies and advocate for zero emission generation at the provincial level	Install: • 150 MW solar • 20 MW wind • 20 MW hydro • 20 MW electricity storage	7% total, comprised of: • Solar: 57 kt CO_2e • Wind: 4 kt CO_2e • Hydro: 10 kt CO_2e

46 The minimum results are based off the energy and emissions model outputs. Further options may be evaluated under this project to meet the scale of action required.

47 The required area could be less if the energy density of PV panels continues to increase.

48 Assumes each MW of capacity stores 4 MWh of energy.

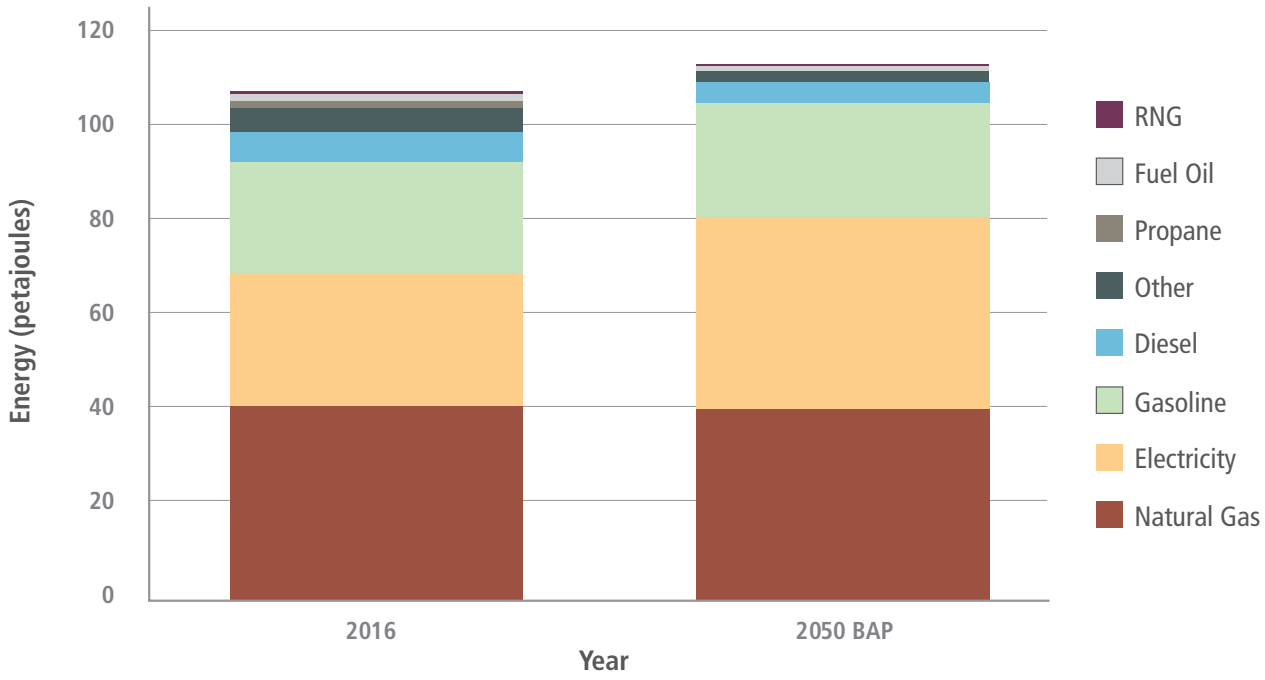


Figure 21: Energy use by fuel type for BAP, 2016 and 2050

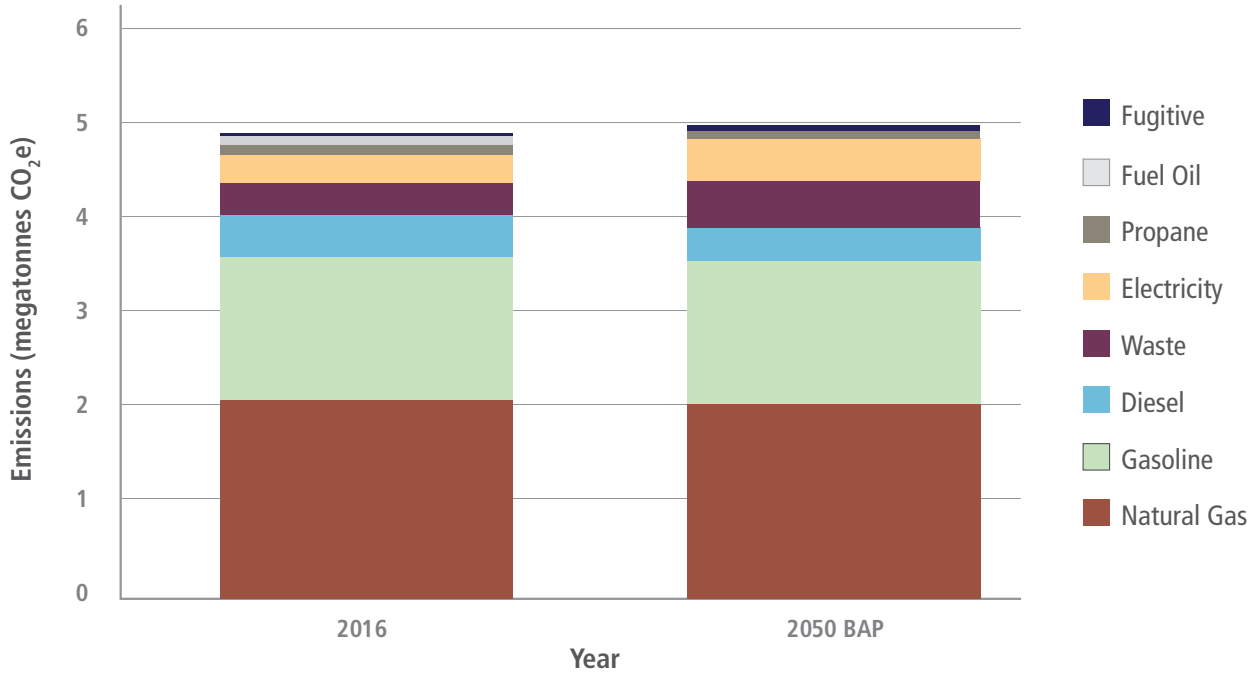


Figure 22: Emissions by fuel type for BAP scenario, 2016 and 2050

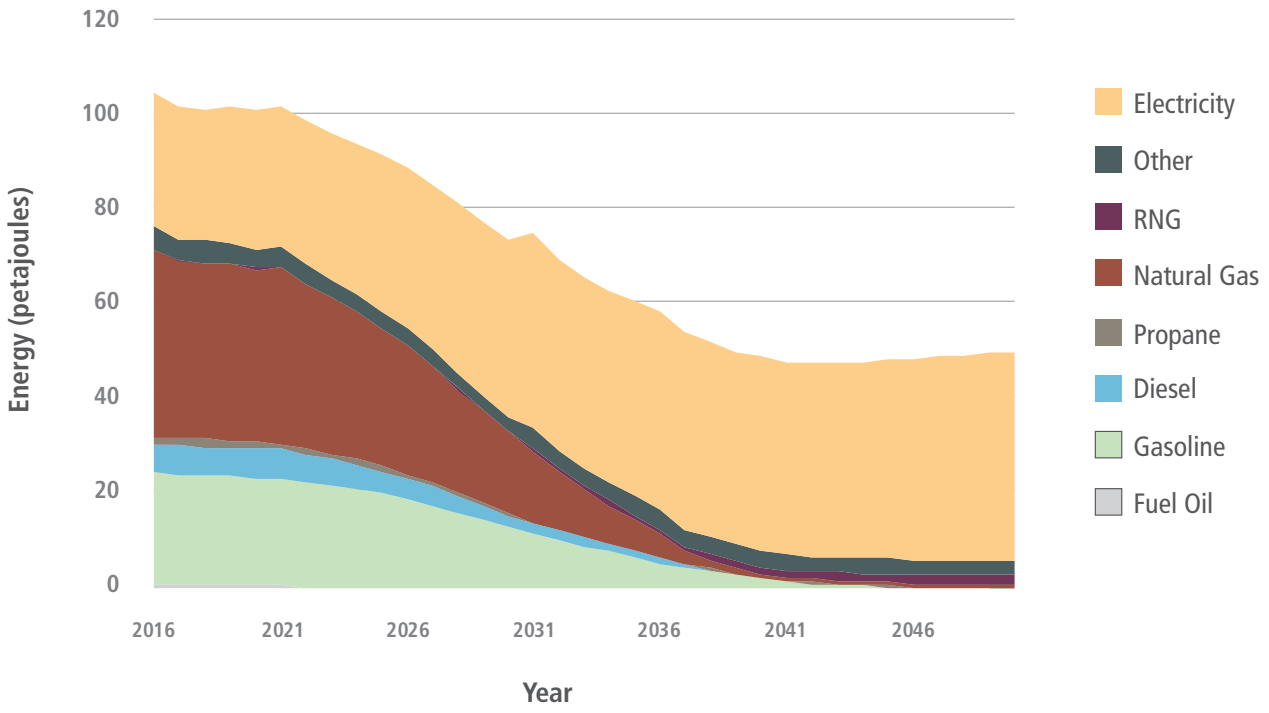


Figure 23: Energy consumption by fuel type for 100% scenario, 2016-2050

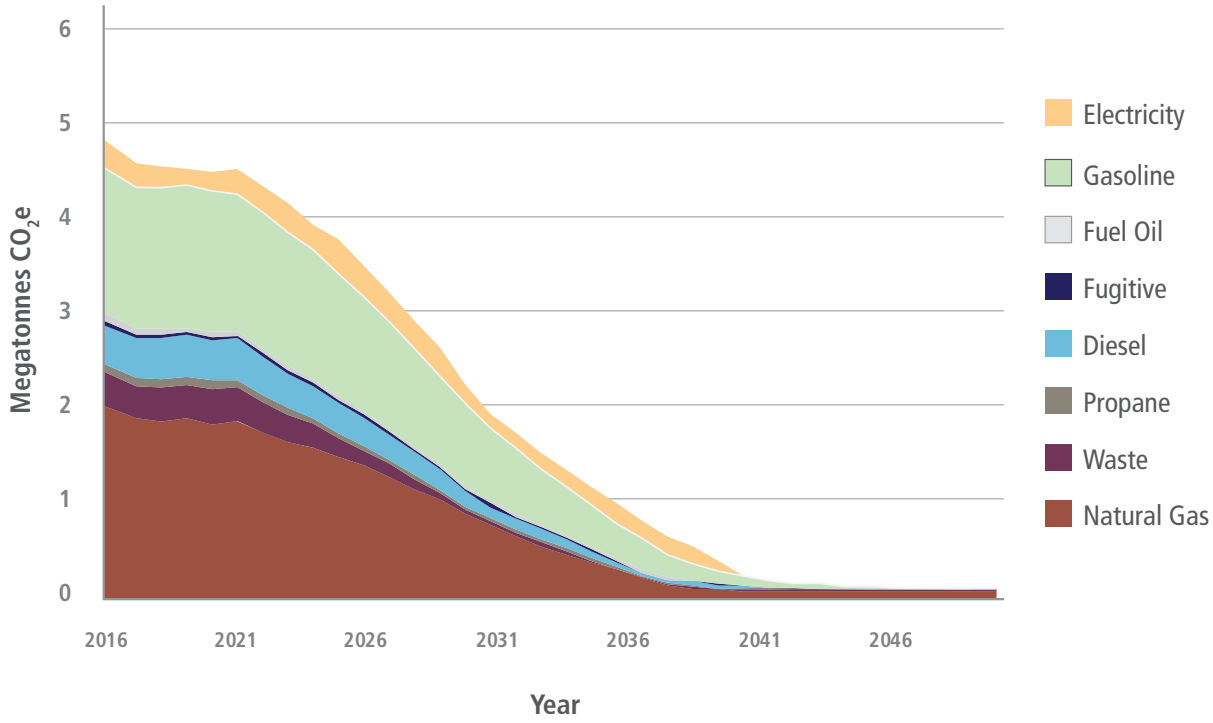


Figure 24: Emissions by fuel type for 100% scenario, 2016-2050

Expanding education and outreach with the broader public will be crucial to achieving community-wide GHG reduction targets. A Climate Change Education and Outreach Program will support broad communications and outreach to help all residents and stakeholders understand what the City is doing, and what they can do, to reduce greenhouse gas emissions and adapt to Ottawa's changing climate.

Table 19 (below) identifies enabling projects to be initiated within the next five years to support private action.

Table 19: Enabling projects to support meeting the 100% scenario (2020-2025)

Project Description	Project Metrics	Cumulative GHG Reduction Requirements
Climate Ambassadors Network to engage commercial and institutional champions to meet long term GHG reduction targets	• Reduced barriers to implementation • Increased funding to support implementation	Enabler
Climate Change Education and Outreach Program to engage the public in collective private action to meet long term GHG reduction targets	Increased awareness and action	Enabler
Fund the Evolution to further assess potential sources of municipal funding, financing, and market enabling mechanisms	Increased funding to support implementation	Enabler

SECTION 5
FINANCIALS

5.1 Analysis

Financial analysis was undertaken for Energy Evolution actions that have financial impacts. Analysis to meet Council's approved targets included:

- Capital investments
- Operating costs
- Savings
- Revenues
- Net present values
- Return on investment
- Cash flow impacts
- Annual GHG emission reductions
- Employment impacts (it is estimated that 30 job-years of employment will be created for every $1 million invested in energy efficiency)[49]
- Economic development opportunities

The analysis was undertaken at a community-wide level. As such, the analysis represents investments required by and potential savings for everyone in Ottawa including the City, residents, businesses, institutions, and organizations.

All financial information presented represents high level estimates that are currently uncommitted and unfunded capital and operational needs. The analysis does not commit the City or any partners to any financial decision or provide direction to staff how to address funding gaps. The analysis is intended to:

- Identify the magnitude of funding required to implement Energy Evolution for the City and partners, including senior levels of government
- Assess which funding sources, financial mechanisms or delivery mechanisms may be most appropriate for implementing Energy Evolution actions
- Inform strategic discussions, policy direction, annual budget cycles and the Long Range Financial Plan

It is not intended to provide sufficiently accurate financial information to make final decisions. This level of detail will be brought forward to the Standing Committee and Council when approval is sought on priority projects.

5.1.1 Methodology

To complete the financial analysis, Sustainability Solutions Group developed a "Cost Catalogue" based on research and consultation with internal and external experts. This research and consultation also informed the development of assumptions that went into determining the rate of uptake of the model metrics. The Cost Catalogue projects the capital and operating costs for all metrics in the Energy Evolution model that have financial implications and can be referenced in Appendix H: Cost Catalogue.

Data sources for capital costs included peer reviewed research, national and provincial projection documents, market trend statistics as well as City of Ottawa financial assumptions, past project costs, and future project estimates. Section 5.1 and 5.2 of Appendix D: Technical Report explain the data sources accessed.

49 Dunsky Energy Consulting. The Economic Impact of Improved Energy Efficiency in Canada. 2018.

Consultations included discussions with City staff from Finance Services, Transportation Services, Recreation, Cultural and Facilities Services, Public Works and Environmental Services and Planning, Infrastructure and Economic Development departments. External experts, including industry representatives from the sustainable building, renewable energy, and transportation sectors, were used to verify the capital cost assumptions and their relevancy in the Ottawa context.

All costs and profits projected for the 100% Scenario are incremental, above and beyond the BAP Scenario. A revolving loan tool was developed to project the capital needs and annual returns of each action in the Energy Evolution model independently or combined, to model how the returns from the early adopters can be rolled into the next actions to reduce the overall cost to society.

5.1.2 Assumptions and Limitations

Key inputs of the financial analysis are based on the Energy Evolution model assumptions, including:

- Discount rate of 4.5% as is the standard currently used by the City of Ottawa for long term financial projections
- Inflation is excluded in projections and net present value calculations
- Federal carbon price escalating to $50 per tonne by 2022, as stated by the federal government, and increasing at approximately 3% annually thereafter
- Revenue streams from renewable heat and electricity sales
- Congestion charge revenues at $20/car entering downtown on weekdays
- Parking rate increases of 50%
- Amortization periods based on the shorter of life expectancies of equipment or 25 years
- Interest rates for borrowed funds at 4%
- Energy cost increases
  (Figures 25, 26 and 27 – pages 51 and 52)

It is recognized that these are based on modelled projections and will require further study and Committee and Council approval in many cases. See Appendix D: Technical Report for discussion about overall assumptions and limitations of the Energy Evolution model. Details about the assumptions and the methodology are available in Appendix A: Data, Methodologies, and Assumptions Manual and Appendix B: Business-as-Planned Scenario Report.

Financial analysis was based on the best data available at the time. Key limitations of the data include:

- Expansion of the transit network is based on the 2013 TMP. For the purposes of modelling the financial considerations of meeting Council's GHG reduction targets, the financial analysis uses the Concept Transit Network, and associated costing from the 2013 TMP. The City of Ottawa is at the beginning of the process to update the TMP and the proposed transit network may change. Council's approval of the updated TMP (including the recommended transit network) is expected in 2023. As part of the development of the TMP, both the Energy Evolution energy and emissions model and associated financial analysis can be updated to consider and evaluate all options from a climate impact lens and ensure alignment. This is significant because expansion of the transit network is the single biggest municipal cost included in the model.
- The Solid Waste Master Plan (SWMP) was under development at the time of the writing of this strategy. As such, this strategy is based on the known contracts and practices of the City's Solid Waste Services at that time. As part of the development of the SWMP, both the Energy Evolution energy and emissions model and associated financial analysis can be updated to consider and evaluate all options from a climate impact lens and ensure alignment. It is also recognized that the SWMP only deals with the residential component of the solid waste generated in the City. Waste management strategies and a financial model for the ICI sector currently fall outside of the scope of the SWMP.

This financial analysis is considered portfolio level analysis based on high level, or Class D, estimates. More detailed financial analysis will be required for specific projects as they move towards implementation. Estimates will require consideration within the City's annual budget cycle, the Long Range Financial Plan, and the Asset Management Plan, since all financial requirements are currently unfunded.

The City recognizes that the municipality alone will not be able to accomplish the scale of investment required, but the City is in a position to play a role in visioning, planning for success, coordinating collective action amongst local entities, and collaborating with senior levels of government. A proposal for how the funds will be acquired as well as how the profits could benefit all residents is included as part of this analysis.

5.1.3 Cumulative Community-Wide Investments by 2050

Financial analysis indicates that cumulative community-wide investments from 2020 to 2050 total $57.4 billion with a present value of $31.8 billion. The financial analysis considers total investment and savings for the community, not just the municipality of Ottawa.

In the short term, annual community-wide capital costs are higher than in the BAP scenario, as upfront investments in buildings, vehicles, energy-related equipment and renewables are made that will lead to long-term savings. Figure 28 (page 53) shows that there is a net financial benefit to society starting in 2032 when the net annual savings and revenues exceed the annual investments. For all investments made to reach the 2050 target, the net return community-wide totals $87.7 billion, which is $12.4 billion when discounted to 2020 dollars. Table 20 (page 53) shows how the net return accumulates to 2050 and beyond based on the life expectancies of the investments made. More details on the financial analysis are included in Appendix D: Technical Report.[50]

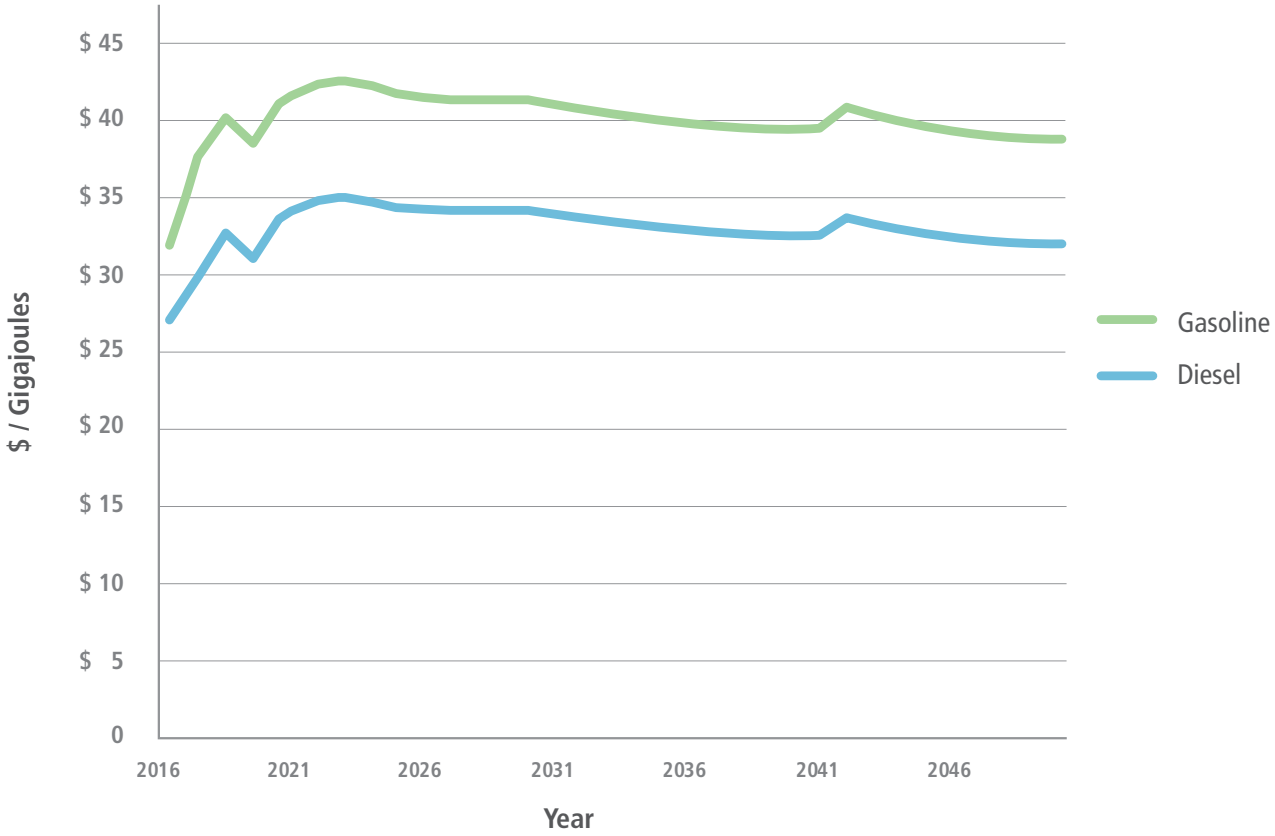


Figure 25: Transportation fuels cost projections, 2016-2050

50 The values in Table 8 differ slightly from the values in Table 5-2 of the Technical Report in Appendix D because of different assumption related to interest rates and loan terms. The consultants, Sustainable Solutions Group and whatIf? Technologies Inc. used a 3% interest rate and 20-year loan term expectancy for all assets. The City of Ottawa Finance Department uses a 4% interest rate and the Energy Evolution project team adjusted loan terms based on the useful life of the asset.

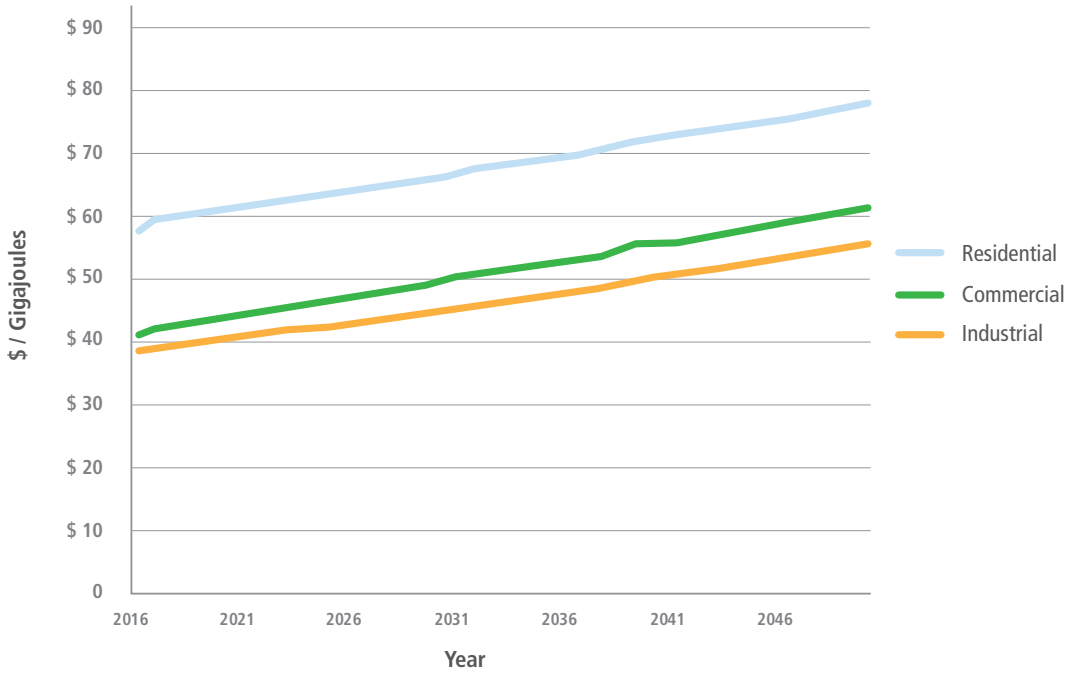


Figure 26: Electricity cost projections, 2016-2050

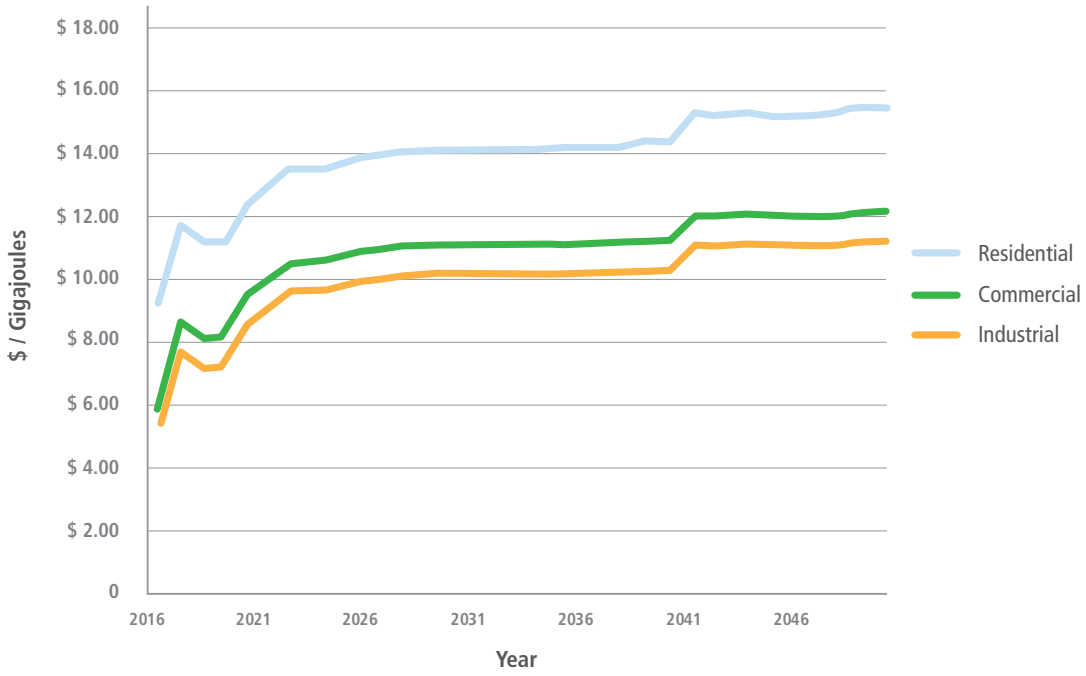


Figure 27: Natural gas cost projections, 2016-2050

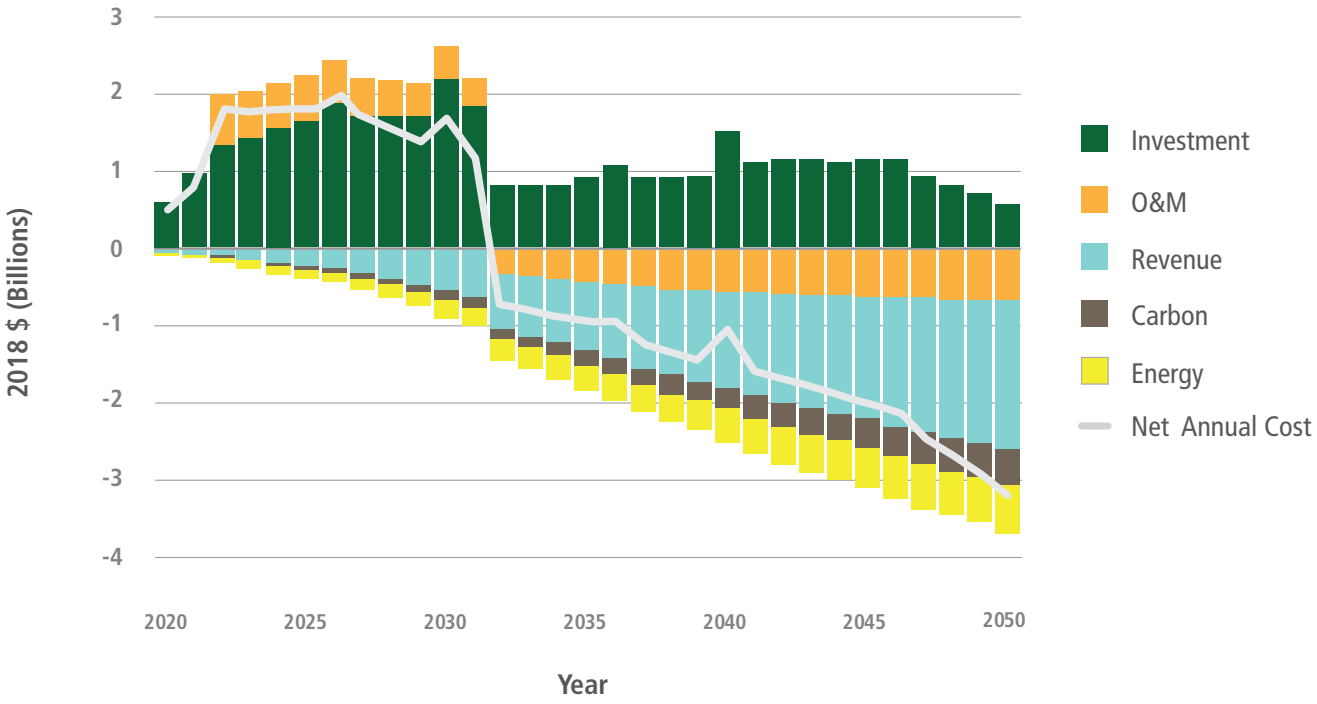


Figure 28: Annual incremental expenditures, savings, and revenues, 2020-2050

Table 20: Financial net value to society for achieving the 100% scenario

Capital Investments and Savings	Undiscounted ($Billion)	Present value (4.5% discount rate) ($Billion)
Capital investments	($ 57.4)	($ 31.8)
Operations and maintenance savings	$ 22.6	$ 9.0
Energy savings	$ 70.9	$ 18.1
Carbon price savings	$ 13.4	$ 4.0
Revenue from local generation	$ 38.2	$ 13.1
Community-wide net return	**$ 87.7**	**$ 12.4**

5.1.4 Annual Incremental Community-Wide Capital Investments by 2050

Achieving the 100% scenario will require unprecedented investments from the City, senior levels of government, and the community in the next 10 years. Compared to the BAP, annual incremental community-wide investments of approximately $1.6 billion per year net present value would be required for the next decade (2020-2030) to achieve GHG reductions in line with the model. Of this, $581 million per year net present value would be required (2020-2030) for transit and active transportation infrastructure. An additional $41 million per year net present value would be required (2020-2030) for municipal building retrofits, transitioning to a zero emission municipal (non-transit) fleet, sewer heat capture, and renewable natural gas generation at wastewater and solid waste facilities.

Annual incremental community-wide investments drop to around $782 million per year from 2031-2050. During this period, net returns are much higher than in the BAP, primarily because of the saved energy costs and earned revenues from local energy generation. Adding to the savings include saved carbon fees and lower operation and maintenance costs (for electric technologies including vehicles).

While the analysis indicates that there is a compelling economic argument for decarbonizing the city, other barriers remain including coordination, capture and reinvestment of savings, lock-in of existing energy systems, education and capacity, access to capital, delivery mechanisms, and legal and policy barriers. For example, private vehicle financing, when they are debt financed (or leased), is often provided by the dealership, which can offer more attractive terms due to their ability to lump the cost of financing into the cost of the car. Table 21 (below) summarizes the annual incremental community-wide investments by 2050. Figure 29 (below) shows where significant community wide capital investments will be required between 2020 and 2050. The full analysis is included in Appendix D: Technical Report.

Table 21: Comparison of the present value of investments to meet the 100% scenario

Short-Term Annual Incremental Community-Wide Investments (2020-2030)	Long-Term Annual Incremental Community-Wide Investments (2031-2050)
$1.6 billion	$782 million

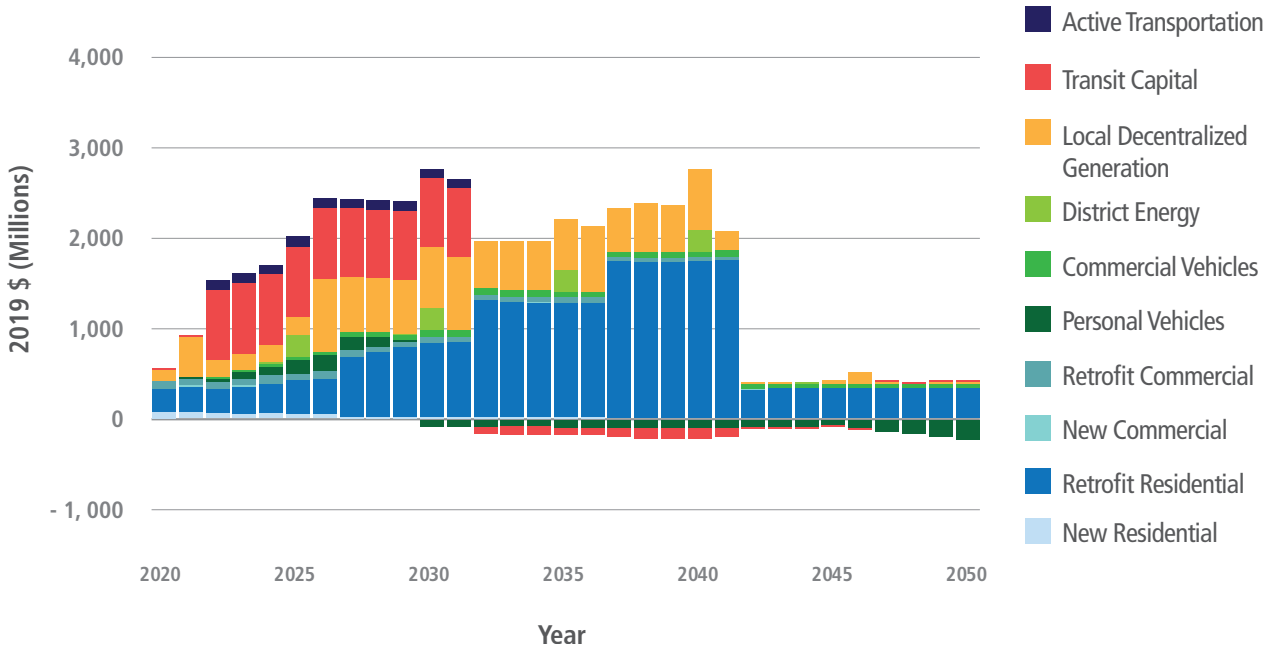


Figure 29: Community-wide capital investments by action, 2020-2050

5.1.5 Net Costs and Savings by Sector

Figure 30 (page 56) depicts the annual breakdown of the capital investments, energy and operational savings, carbon fee savings, and generation revenue associated with implementing actions in Energy Evolution. The value of the cost savings increases dramatically as the time period progresses.

A breakdown of the actions bundled into each of the sectors is provided in Table 22 (page 56).

5.1.6 Cost Estimates in Context

To comprehend the magnitude of these financial projections, it is helpful to compare the figures to other relevant Ottawa statistics as listed below:

- Annual GDP in 2016: $63 billion
- Annual City budget: $3.76 billion
- Annual spending on energy: $3 billion (for all end uses of energy)
- Annual spending on building improvements / renovations: $2.9 billion
- Annual spending on new motor vehicles: $5.8 billion
- Annual spending on cell phone plans: $480 million
- Insurance payouts in 2018 related to natural disasters exacerbated by climate change: $53 million
- City spending on road resurfacing in 2019: $51 million

5.1.7 Impacts on Vulnerable Populations in Ottawa

Although a portion of the population has access to funds and leveraging, a significant portion of Ottawa's population experiences energy poverty[51] and has fewer resources to take the recommended carbon reduction actions. 18% of all Ottawa households, or nearly 56,000 Ottawa households, experience high energy cost burdens. This is disproportionately higher in lower income households. As the proposed projects, programs and policies are developed, these segments of the population will be considered to ensure equity and inclusion of the most vulnerable.

5.2 Financing

5.2.1 Municipal Action

Compared to the BAP, annual incremental municipal investments of approximately $621 million per year present value would be required for the next decade (2020-2030) to achieve GHG reductions in line with the model and the targets. Nine municipal actions have been identified that would require financing to achieve Council's GHG reduction targets:

1. Expand transit
2. Alternative energy sources for transit
3. Transportation mode shift
4. Transitioning to a zero emission municipal (non-transit) fleet
5. Municipal building retrofits
6. Organic waste diversion
7. Renewable natural gas generation
8. Power to gas
9. Car free zones

Table 23 (page 57-59) provides an overview of projected financing for municipal GHG reduction actions associated with the nine municipal actions above.

51 Energy poverty is defined by the Canadian Urban Sustainability Practitioners network as homes that spend more than 6% of their after-tax income (two times the national average) on home energy bills, primarily electricity and natural gas (https://energypoverty.ca/).

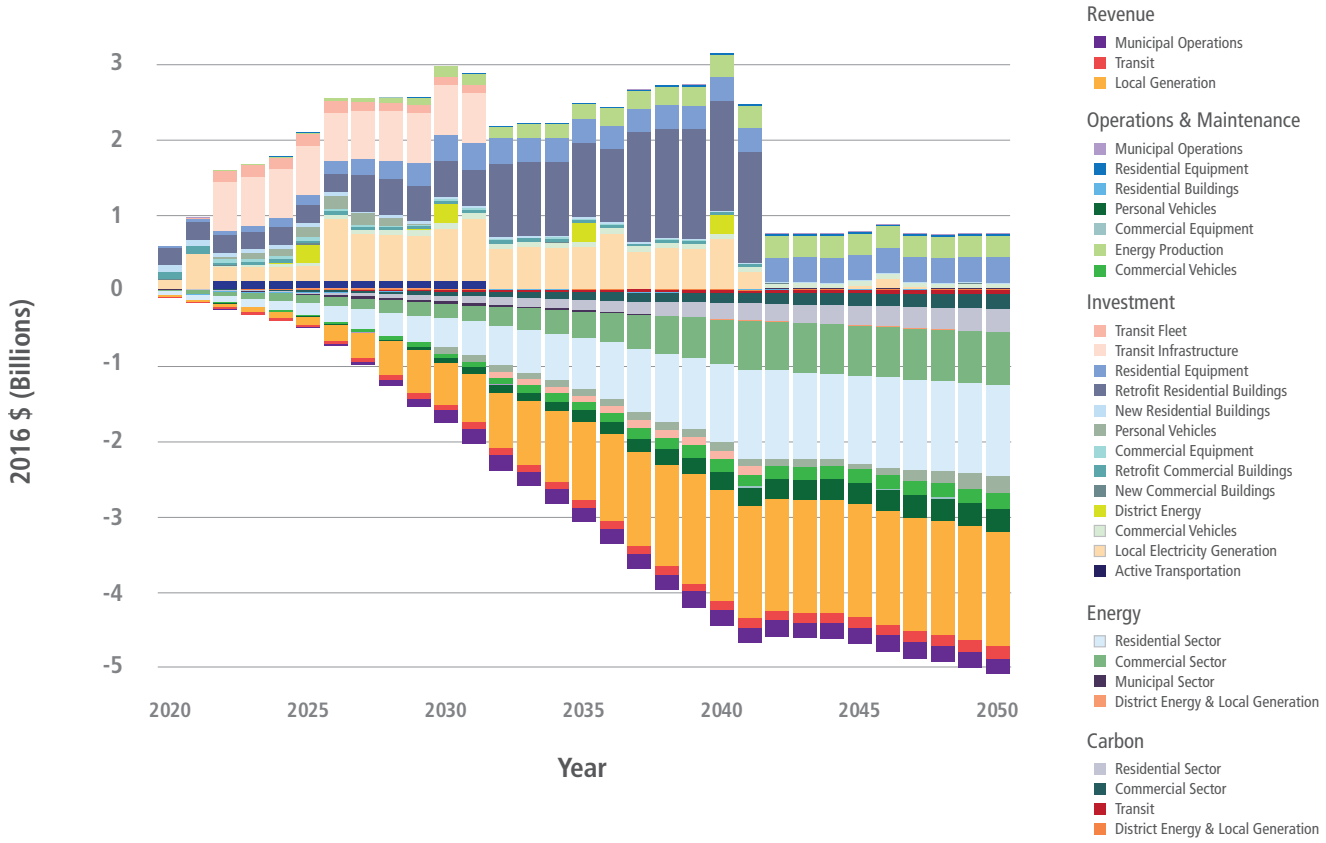


Figure 30: Breakdown of annual incremental net costs and savings, 2020-2050

Table 22: Breakdown of net costs and returns by sector (net present value 2020$, in billions)

Sector	Estimated Net Costs ($Billions)	Estimated Net Returns by 2050 ($Billions)	Estimated Net Returns over Life of Investment ($Billions)
Land use and growth management	$ 0	$ 0	$ 0
Buildings (new and existing)	($ 17.7)	($ 6.0)	$ 0.4
Transportation	($ 7.9)	$ 3.9	$ 4.8
Waste and renewable natural gas	($ 0.2)	$ 0.01	$ 0.02
Electricity	($ 6.0)	$ 4.8	$ 7.2
Total	**($ 31.8)**	**$ 2.7**	**$ 12.4**

Table 23: Overview of projected financial returns for municipal GHG reduction actions (net present value, life expectancy of assets, in billions)

Municipal Actions Requiring Financing Based on Model	Associated Project	Projected Initial Capital Investments	Projected Net Return by 2050	Projected Net Return over Life of Asset	Potential Sources of Capital Funding	Potential Financial Mechanisms	Potential Delivery Mechanisms
Expand transit	Zero Emissions Transit Project	($5.0)	($2.0)	($1.6)	• Grants from senior levels of government (e.g., FCM) • Development charges • Gas tax • Debt financing	• Congestion charge, parking lot licensing	• City to build the Concept Network
Zero emissions transit	Zero Emissions Transit Project	($0.7)	$0.3	$0.3	• Grants from senior levels of government (e.g., FCM) • Gas tax • Debt financing	• Possibly leases for the first few years until the technology risk is overcome	• OC Transpo, possibly through bus or battery leases; chargers and rail infrastructure through P3
Road infrastructure costs	Transportation Mode Shift	$0	$0.2	$0.2	• Expenditure savings	• Expenditure savings	• Reduced road expansion costs from reduced vehicle use
Congestion charge	Transportation Mode Shift	$0 (TBD)[52]	$1.7	$1.7	• User fee	• Daily charge to enter downtown	• Technology, equipment and cost to collect
Increase public parking revenues	Transportation Mode Shift	$0	$0.1	$0.1	• User fee	• Street and public lot parking fees, public lot rates	• City for on street parking and City lots

52 The Transportation Master Plan will assess the cost to implement various road user fee mechanisms.

Municipal Actions Requiring Financing Based on Model	Associated Project	Projected Initial Capital Investments	Projected Net Return by 2050	Projected Net Return over Life of Asset	Potential Sources of Capital Funding	Potential Financial Mechanisms	Potential Delivery Mechanisms
Increase / improve cycling and walking infrastructure	Transportation Mode Shift	($0.7)	($0.5)	($0.5)	• Grants from senior levels of government (e.g., FCM) • Development charges • Debt financing	• Repaid through road infrastructure savings	• City investment and cost to maintain
Car free zone	Transportation Mode Shift	$0 (TBD)	$0.001	$0.001	• Grants from senior levels of government (e.g., FCM) • Debt financing	• Some road infra-structure savings	• City investment and cost of enforcement
EV zones	Personal Vehicles Electrification Strategy	($0.0004)	$0.1	$0.1	• Grants from senior levels of government (e.g., FCM) • Debt financing	• Offset through EV charger revenue	• City investment and cost of enforcement
Zero emissions municipal fleet	Municipal Green Fleet Plan Update	($0.002)	$0.03	$0.03	• Grants from senior levels of government (e.g., FCM) • Annual contribution to capital	• Replace fleet over time as part of fleet long range plan	• Owned or leased
Municipal building retrofits	Municipal Buildings Renewal and Retrofit Program	($0.8)	$0.9	$1.7	• Private service providers, Envari, City capital funds	• City investments or leases • Energy cost savings	• Energy service contracts, fee for service, equip-ment leases

Municipal Actions Requiring Financing Based on Model	Associated Project	Projected Initial Capital Investments	Projected Net Return by 2050	Projected Net Return over Life of Asset	Potential Sources of Capital Funding	Potential Financial Mechanisms	Potential Delivery Mechanisms
Waste diversion	Organics Resource Recovery Strategy	($0.07)	$0.3	$0.3	• Recycling to be paid for through producer pays fees • Residential organics and waste may be paid by City service and/or tax fees (under review in the SWMP) • ICI waste services paid by private sector	• Service fees, tax base, private contracts for ICI	• City to deliver residential waste services; Province regulates ICI waste services, which are provided and managed by the private sector
Expand wastewater treatment plant biogas generation	Renewable Natural Gas Strategy	($0.03)	($0.05)	($0.03)	• Private capital • Grants from senior levels of government (e.g., FCM) • Debt financing	• Repaid through sale of biogas	• P3 or City owned
Power to gas	Renewable Natural Gas Strategy	($0.1)	($0.05)	($0.05)	• Private capital, Canada Infrastructure Bank, FCM, grants from senior levels of government • Debt financing	• Repaid through sale of biogas	• P3 or City owned
Total		**($7.5)**	**$1.3)**	**$2.4**			

5.2.2 Community Action

5.2.2.1 Rationale for Municipal Involvement

Municipalities are uniquely positioned to catalyze community emission reductions. Most significant emission reductions achieved around the world are expedited through municipal, provincial and federal governments creating enabling conditions that have a market transformation influence. The role for municipalities can be lumped into two categories: enabling policies and effective financing tools.

Municipalities are also uniquely positioned to operate with an equity and inclusion lens, ensuring vulnerable populations are not left behind. Private financiers do not have this mandate.

The municipality stands to benefit from playing this catalyst role, as a low carbon economy is economically stable, more attractive to businesses, more cost effective to operate, healthier for residents, and equitable for all.

5.2.2.2 Enabling Policies

The finance-related enabling policies uniquely available to municipalities that have been effectively employed in emission reductions from buildings strategies include:

- Community improvement plans
- Property tax rates and associated grants based on carbon emissions
- Licensing exemptions for achieving low carbon goals
- Green procurement standards
- Green leases
- Bylaws and fines
- Service fees

These tools present effective ways of overcoming barriers to GHG emission reduction solutions.

5.2.2.3 Effective Financing Tools

Each of the actions identified in the Energy Evolution model can be delivered in various ways. Some of these can be delivered in such a way that the savings are captured for reinvestment, while others will be harder to do so. Some of the measures will have quick paybacks while others are longer or have no payback at all. Bundling the quick payback measures with the longer payback measures will help all of them become successful.

A coordinated financing strategy can ensure the savings are used to capitalize deeper GHG reduction projects. Modelling shows that, if a low carbon revolving loan fund were set up to finance a significant portion of the actions (all those considered reasonably financed by a public bank), the net return from the carbon reduction actions could be captured and reinvested into the next action. This would decrease the total cost to the Ottawa economy to meet the climate goals by up to 60%. This was modelled for Ottawa using a revolving loan tool.

All levels of government are well positioned to play a role in the financing and revolving of capital in the community for a few reasons. They can borrow funds at low interest rates, which can make all the actions requiring upfront investment more financially attractive. P3 arrangements are also well positioned because they de-risk projects, making it easier to access low cost private capital.

Typically, the public sector provides services that have no return on investment while the private sector manages only profitable services. There is an opportunity for the public sector to participate in carbon reduction programs and services and benefit from the associated cashflows.

Financing mechanisms that the municipal public sector could be involved in are listed below and associated with specific actions in Table 24 (page 61-65):

- Local improvement charges
- On-bill financing
- Public-private partnership (P3)
- Equipment leases
- Energy service agreements
- Credit enhancements

Table 24: Key opportunities for government financing to catalyze community action (net present value, 2020-2050, in billions)

Community Actions Based on Model	Associated Project	Projected Initial Capital Investments	Projected Net Return by 2050	Projected Net Return over Life of Asset	Potential Sources of Capital Funding	Potential Financial Mechanisms	Potential Delivery Mechanisms
Net zero new homes	High-Performance Development Standard	($3.1)	$1.1	$2.5	• Private capital • LC3 • Canada Mortgage and Housing Corporation (CMHC)	• Financing of incremental efficiency measures at construction	• Low interest financing
New commercial buildings	High-Performance Development Standard	($0.07)	$0.3	$0.6	• Private capital • LC3 • CMHC	• Green mortgages	• Low interest financing
Retrofit houses	Residential Building Retrofit Accelerator Program	($8.0)	($0.2)	$1.8	• Private capital • Green bonds • FCM • Canada Infrastructure Bank • CMHC • Utility efficiency programs	• LIC • On-bill financing • Green mortgages • CMHC loans	• ESCO or Efficiency Utility; mechanisms involve bulk buys, PEER, and community-scale retrofits
Retrofit apartments	Residential Building Retrofit Accelerator Program	($0.3)	$0.2	$0.4	• Private capital • Green bonds • FCM • Canada Infrastructure Bank • CMHC • Utility efficiency programs	• LIC • On-bill financing • Green mortgages • CMHC loans	• ESCO or Efficiency Utility; mechanisms involve bulk buys, PEER, and community-scale retrofits

Community Actions Based on Model	Associated Project	Projected Initial Capital Investments	Projected Net Return by 2050	Projected Net Return over Life of Asset	Potential Sources of Capital Funding	Potential Financial Mechanisms	Potential Delivery Mechanisms
Retrofits for small commercial and office buildings	Commercial Building Retrofit Accelerator Program	($0.1)	$0.3	$0.6	• Private capital • Green bonds • FCM • Canada Infrastructure Bank • Natural Resources Canada • Utility efficiency programs	• LIC • MEETS • On-bill financing • ESAs	• ESCO, efficiency utility
Retrofits for commercial, office and industrial buildings	Commercial Building Retrofit Accelerator Program	($0.5)	$1.3	$2.4	• Private capital • Green bonds • FCM • Canada Infrastructure Bank • Natural Resources Canada • Utility efficiency programs	• LIC • MEETS • On-bill financing • ESAs	• ESCO, efficiency utility
District energy system	Commercial Building Retrofit Accelerator Program	($0.3)	$0.1	$0.1	• Canada Infrastructure Bank • FCM	• P3	• ESAP and/or thermal utility
Electrify commercial vehicles	Zero Emissions Commercial Vehicles Strategy	($0.8)	$1.9	$1.8	• Private capital, dealership financing	• Dealership financing • Private lenders	• Dealership financing • Carshare fleets

Community Actions Based on Model	Associated Project	Projected Initial Capital Investments	Projected Net Return by 2050	Projected Net Return over Life of Asset	Potential Sources of Capital Funding	Potential Financial Mechanisms	Potential Delivery Mechanisms
Electrify personal vehicles	Personal Vehicles Electrification Strategy	($0.6)	$4.1	$4.7	• Private capital • Dealership financing • Envari for public charging infrastructure	• Dealership financing • Green mortgages • On-bill financing	• Dealership financing • Carshare fleets
Low-rise residential heat pumps in existing buildings	Residential Building Retrofit Accelerator Program	($2.4)	($0.9)	($1.0)	• Green bonds • Envari and energy service providers capital	• LIC • On-bill financing • Green mortgages • CMHC loans	• Leased by Envari or other energy service providers
Apartments heat pumps in existing buildings	Residential and Commercial Building Retrofit Accelerator Program	($0.8)	($0.3)	($0.4)	• Green bonds • Envari and energy service providers capital	• LIC • On-bill financing • Green mortgages • CMHC loans	• Leased by Envari or other energy service providers
Commercial heat pumps in existing buildings	Commercial Building Retrofit Accelerator Program	($0.2)	($0.03)	($0.03)	• Green bonds • Envari and energy service providers capital	• LIC • On-bill financing • Green mortgages • CMHC loans	• Leased by Envari or other energy service providers
Residential PV	Electricity Resource Strategy	($0.4)	$0.7	$0.9	• Green bonds, private capital	• LIC • On-bill financing • Green mortgages	• Bulk installations through efficiency utility or renewable energy co op, leasing

Community Actions Based on Model	Associated Project	Projected Initial Capital Investments	Projected Net Return by 2050	Projected Net Return over Life of Asset	Potential Sources of Capital Funding	Potential Financial Mechanisms	Potential Delivery Mechanisms
Commercial PV	Electricity Resource Strategy	($1.1)	$0.9	$1.2	• Canada Infrastructure Bank • Private capital • Portage Power and generators • Community bonds	• Net metering, virtual net metering or opportunities from distributed energy resource planning	• Portage Power • Private generators • Renewable energy co op
Waste heat	Community Building Heating Strategy	($0.0006)	$0.1	$0.1	• Canada Infrastructure Bank • FCM	• Repaid through sale of thermal units	• City to enable capture of heat for public and/or private consumption
Electric water heaters in residential and commercial buildings	Residential and commercial building retrofit accelerator programs	($0.06)	($0.1)	($0.1)	• Private capital • Envari and energy service providers capital	• LIC • On-bill financing • Green mortgages • CMHC loans	• Leased by Envari or other energy service providers
Hydropower	Electricity Resource Strategy	($0.1)	$0.1	$0.1	• Canada Infrastructure Bank • Private capital • Portage Power • Community bonds	• Virtual net metering or opportunities from distributed energy resource planning	• Portage Power or other renewable energy generators

Community Actions Based on Model	Associated Project	Projected Initial Capital Investments	Projected Net Return by 2050	Projected Net Return over Life of Asset	Potential Sources of Capital Funding	Potential Financial Mechanisms	Potential Delivery Mechanisms
Wind	Electricity Resource Strategy	($4.4)	$8.0	$9.8	• Canada Infrastructure Bank • Private capital • Portage Power • Community bonds	• Virtual net metering or opportunities from distributed energy resource planning	• Portage Power • Private generators • Renewable energy co-op
Federal district energy systems	Community Building Heating Strategy	($1.0)	($0.5)	($0.5)	• Federal funds and/ or private capital through thermal utility	• Repaid through sale of thermal units	• PSPC and third-party providers

5.2.3 Potential Municipal Sources of Funding

Given the unprecedented capital investments required to fund Energy Evolution, different sources of funding should be explored. Potential municipal sources of funding will be further explored and assessed for viability as part of the Fund the Evolution project identified in Section 4.6 and through concurrent city strategies and plans.

For investments that have a positive financial return, borrowing funds may be a strategic option to take advantage of current low interest rates. Financing opportunities for municipal investments that will be explored as part of the strategy include:

- Debt limit adjustments
- Bonds/loans (such as green bonds)
- Reserve funds

For projects that do not offer a return on investment, other revenue streams will be required. Revenue opportunities generally within municipal authority fall into five main categories:

- Parking and road-based fees
- Property-related taxes
- Development-related charges
- User/service fees
- Environmental fines

All potential sources of municipal revenue require further analysis and Standing Committee and Council approval would be required prior to implementation. Analysis will consider additional factors such as the ability to leverage other public and private sources of funding, public acceptance, ease of implementation, limitations on revenue use, authority to implement, economic impacts, and equality and inclusion.

5.2.4 Future Municipal Budget Implications

Future year funding commitments by the City, combined with revenue streams, private capital sources, and funding from senior levels of government will significantly increase the City's success in achieving emission reductions. Also, the City's ability to debt finance projects that have a positive return on investment, for which debt servicing exemptions may be required.

Approval of future municipal annual incremental operating requests will be critical to expanding the staffing and resource capacity of departments who are leading projects to advance Energy Evolution. This funding would enable program optimization and improve the likelihood of leveraging capital from external sources, including federal grants and infrastructure monies.

Staff are monitoring relevant provincial and federal programs for municipalities, businesses, and/or residents to support GHG emission reductions. Although it is unknown at this time what level of financial support and timing of investment is to be expected by other levels of government, Ottawa should proactively position itself to take advantage of these new funding resources. Staff will be bringing forward budget requests in subsequent years as informed by this model.

5.2.4.1 Priority Projects for The Next Five Years (2020-2025)

Out of the estimated $7.4 billion investment required by the municipality, $3.2 billion is required over the next five years to undertake the priority projects identified in Section 4. Of that, $2.6 billion is required for the transit network alone. This investment should be considered in the affordability analysis for the next Long Range Financial Plans for Tax Supported Capital, Rate Supported Capital, Transit and Solid Waste and as part of the update of the TMP and the development of the SWMP.

It is recognized that the City alone will not accomplish the scale of investment required. Funding from senior levels of government and private capital sources is a crucial part of the financial strategy to address the expected funding gap that will be created by the investments required for Energy Evolution. As part of the Long Range Financial Plan updates, many of the financial strategies or mechanisms described throughout Section 5 should be further assessed to identify other potential sources of revenue, savings and financing to affordably fund the municipality's portion of the Energy Evolution priority projects.

Photo: iStock

SECTION 6
IMPLEMENTATION

6.1 Summary of Energy Evolution Projects

Section 4 identifies 20 projects over the next five years (2020-2025) to accelerate action and investment towards achieving the 100% scenario. The action and investment required is summarized in Appendix G: Summary of Energy Evolution Projects (2020 2025). These projects were selected based on their direct GHG reduction potential or ability to enable GHG reductions in order to meet the requirements under the energy and emissions model. Most of the projects are to be led by the municipality and to be undertaken in collaboration with community partners. Proposed projects are contingent on future Standing Committee and Council approval as well as future staff and budget (capital and operating) pressures. To achieve the GHG reductions required in the 100% scenario, some projects may evaluate options beyond what's been identified prior to going to the Standing Committee and Council. Where applicable, projects will go through the standard City project management process.

Appendix G: Summary of Energy Evolution Projects (2020-2025) should be read in conjunction with Appendix F: Project Overviews. The project overviews provide further details for each project including a project description, co-benefits, risks, project metrics, key departments, key community partners, timelines, resources, and financial profile.

6.1.2 Risks to Implementation

Section 4 and Section 5 identified the scope and scale required to achieve the 100% scenario both in action and investment. Realizing this action and investment carries many risks. These risks may include:

- Insufficient financial support from different levels of government and the private sector to meet the budgetary and staffing needs of the Action and Investment Plan and beyond
- Higher capital and operating costs, as well as lower than expected saving and revenues, beyond what's currently estimated for project implementation and municipal operations
- Regulatory barriers and compliance issues that impede the municipality from action and innovation, either by impeding the municipality directly through its own operations or impeding how the municipality can enact change in the community
- Lack of uptake or buy-in from residents, businesses, industry or the municipality that impacts the viability of a new program or new standard
- Diverging interpretations between stakeholders on how best to achieve the 100% scenario
- Competing Council priorities or processes associated with other projects across the corporation
- Competing departmental priorities including current operational mandates of impacted services, and how their mandates will need to change in order to work to achieve the emission reductions in Energy Evolution

- Lack of alignment between what the Energy Evolution model calls for and recommendations that come forward for plans and strategies that directly relate to Energy Evolution. Note that although it is expected that the range of options evaluated will include one or more scenarios that achieve the GHG reductions required in the 100% scenario, those scenario(s) may not ultimately be recommended
- Aggressive implementation timelines that may not account for typical City processes including capital budget approval, Long Range Financial Plan, planning, consultation, approvals, design, construction, and commissioning or account for provincial or federal approval processes that are out of the City's control
- Changes in behaviour, policy, and best practices related to COVID-19

To mitigate these risks, the Energy Evolution project team will continue to work with City staff at all levels across the corporation, community partners, other levels of government, and the public to build out Energy Evolution projects and act as a resource or provide technical advice on related projects. Information and recommendations to support project implementation will be shared with a Tiger Team comprised of all General Managers, the Chief Financial Officer, the City Manager's Office and Ottawa Health; the Climate Change Council Sponsors Group; the Environmental Stewardship Advisory Committee; a community-wide governance structure; and community partners to align and coordinate priorities, workplans, annual budgets, communications and advocacy efforts. The Energy Evolution project team will also continue to work with municipal colleagues across the country through organizations like the Canadian Urban Sustainability Practitioners network, Clean Air Partnership and Low Carbon Cities Canada to share information, best practices, and lessons learned.

Additionally, at the time of the writing of the strategy, multiple City plans and strategies were in the process of being developed that directly relate to Energy Evolution, including the new Official Plan, the Transportation Master Plan Update, the Solid Waste Master Plan, the Alternative Energy Sources for Transit Project, and the Municipal Green Fleet Plan. Recommendations that come out of these plans and programs will have direct impacts on Ottawa's GHG emissions and affect Ottawa's ability to meet Council's approved GHG emission reduction targets. Given their significance, each of these plans and programs have been captured within the 20 projects identified in Section 4. The results of the Energy Evolution modelling exercise have been shared with City staff and consultants working on these plans to facilitate knowledge and data sharing and align workplans and consultation activities where possible.

As these plans will come forward after Energy Evolution, it should be understood that:

- These plans will evaluate a range of options to achieve each respective plan's goals and targets, and outcomes may differ from what has been identified in this report and Document 1.
- It is expected that the range of options will include one or more scenarios that achieve the GHG reductions required in the 100% scenario, but those scenario(s) may not ultimately be recommended.
- Data provided by City departments to inform the model was based on the best available data at the time and may differ from the data used to inform the plans and programs.
- Different models may be used to perform a more detailed and sector specific assessment of the projected GHG implications, providing a level of granularity not available in the Energy Evolution model.
- The model includes aggressive implementation timelines that may not account for City processes that typically take several years prior to project implementation, including Council direction, capital budget approval, planning, consultation, approvals, design, construction, and commissioning. It also may not account for provincial or federal approval processes that are out of the City's control.
- All plans are contingent on future Standing Committee and Council approval as well as future staff and budget (capital and operating) pressures.

As the strategy is implemented, new City plans and policies may also be proposed and others will be updated including the Asset Management Plans, the Long Range

Financial Plan and other plans as appropriate. The results of the Energy Evolution modelling exercise can provide detailed information, assumptions and projections on energy, fuel, emissions, and financials that should be considered to achieve Council's GHG emission reduction targets.

6.1.3 Governance

Transforming Ottawa into a thriving city powered by clean, renewable energy will require broad and deep participation in mitigation efforts. Responsibility for energy conservation and renewable energy planning is shared amongst a variety of city departments as well as external agencies and community partners. Because of the complexity of the problem and the short timelines for action, a governance structure is required to build corporate and community capacity, align priorities, and share accountability in tackling climate change.

Energy Evolution will contribute to and leverage the governance framework established in the Climate Change Master Plan to:

- Establish common vision, goals, and priorities
- Coordinate implementation of climate mitigation and adaptation research and action
- Scale up community wide projects, programs, or policies
- Access funding and resources
- Influence organizations and residents to take action

Photo: M. Woehrle, City of Ottawa

SECTION 7
NEXT STEPS AND REPORTING

7.1 Next Steps

All 20 projects will be further developed with input from staff, stakeholders, and the public as required. In some cases, working groups comprised of staff and community partners will be established to help advance projects. Once projects are fully developed, staff will bring projects to the appropriate Standing Committee and Council for approval, where required.

To aid with the success of the projects, staff will:

- Develop a 10-year spending plan that can be considered in annual municipal budget processes and feed into the City's Long Range Financial Plan. The next Long Range Financial Plan will be updated at the beginning of the 2022-2026 term of Council. Budget and staffing requirements would be brought forward as part of the annual budget process.
- Continue to engage with and provide training to staff and the public to embed climate considerations more broadly across the corporation and the community. As the City's centre of expertise for climate change and resiliency, the Climate Change and Resiliency team will also continue to provide technical expertise on corporate projects and support community initiatives.
- Prepare department specific presentations on Energy Evolution starting in 2021 to ensure that staff across the corporation are aware of, can align with, and continue to make use of relevant information. Presentations will include an overview of Council's approved GHG emission reduction targets, relevant aspects of the energy and emissions model, priority projects, departmental implications, and next steps. They will be delivered to departmental leadership teams and offered to appropriate service area, branch or unit teams to support ongoing alignment of priorities, workplans, and budgets.

To ensure that staff across the corporation are aware of, can align with, and continue to make use of relevant information, presentations will be given to City departments starting in 2021. They will include an overview of Council's approved GHG emission reduction targets, relevant aspects of the energy and emissions model, priority projects, departmental implications, and next steps. These presentations will be delivered to departmental leadership teams and offered to appropriate service area, branch or unit teams to support ongoing alignment of priorities, workplans, and budgets.

To keep the model relevant, staff on the Energy Evolution project team are planning to be trained by the consultants on how to use the model in-house. This is expected to reduce costs and increase the value of the model over the long term.

Training will be explored for staff in other teams as well as external stakeholders who may also be interested in being trained on how to use the model so it can be used to support the development of plans, policies, projects and programs to meet the long-term GHG emission reduction targets.

Staff intend to rerun the energy and emissions model every five years to assess how the City and the community are tracking towards achieving the 100% scenario and to determine what actions should be prioritized in the short term. Subject to capacity and budget, staff may run parts of the Energy Evolution model before five years if it is helpful to evaluate the GHG implications of significant City plans such as the new Official Plan, the Transportation Master Plan Update and the Solid Waste Master Plan.

7.2 Reporting

A status update on the Climate Change Master Plan will be provided on an annual basis. As part of the annual status update, staff will:

- Include annual corporate and community GHG inventories to help gauge Ottawa's progress towards GHG emission reduction targets
- Provide a status update on the Energy Evolution projects
- Provide recommendations to advance the projects as required

A full review and update of the Climate Change Master Plan will be completed in 2025. Simultaneously, Energy Evolution and the future Climate Resiliency Strategy will be reviewed to see whether the three standalone documents can be merged into one.

Photo: City of Ottawa

SECTION 8
CONCLUSION

Ottawa has made significant investments in recent years in projects that reduce the city's greenhouse gas emissions. Yet, the energy and emissions model projects that Ottawa's emissions will remain relatively flat for the next 30 years under the BAP scenario, far from achieving the long-term GHG emission reduction targets.

Energy Evolution sets the framework for what it will take to achieve Ottawa's long-term target to reduce community GHG emissions by 100% by 2050. Achieving this target will require accelerated and significant investment, policy alignment and regulatory changes to make a sustained transition away from a dependence on fossil fuels. Collaboration amongst all levels of government, utilities, commercial and institutional champions, and the general public will be critical to its success.

Achieving Ottawa's GHG reduction targets will require implementation of the municipality's ongoing and planned actions, implementation of new actions that the municipality has not yet approved, and action and investment from all segments of society. An Action and Investment Plan outlines the priority projects over the next five years if Ottawa is to stay on track to achieve the 100% scenario. These projects are contingent on future Standing Committee and Council approval as well as future staff and budget (capital and operating) pressures.

Let's work together to transform Ottawa into a city powered by clean, renewable energy.

APPENDICES

Appendix A: Data, Methodologies, and Assumptions Manual

Appendix B: Business-as-Planned Scenario Report

Appendix C: Pathway Studies

Appendix D: Technical Report

Appendix E: Modelling Ottawa's Greenhouse Gas Emissions to 2050: Summary of Results

Appendix F: Project Overviews

Appendix G: Summary of Energy Evolution Projects (2020-2025)

Appendix H: Cost Catalogue

Energy Conservation & Demand Management Plan 2019 - 2022

Prepared By:

Recreation, Cultural and Facility Services
City of Ottawa

Contents

1.0 Overview

The City of Ottawa is committed to improving energy management and has made it a key component of its operations; becoming a leader in energy conservation and the reduction of greenhouse gas emissions (GHG). The City understands the social, environmental and financial implications of energy management and is continuously striving to deliver improvements and efficiencies in a responsible way.

This report presents a summary of the City's utility consumption, as well as a review of the measures and contributions identified within the first CDMP, highlighting the positive impacts of energy conservation efforts across the corporation between 2014 and 2018. In addition, and as required by the provincial Electricity Act, 1998, this document will outline the City's Energy Conservation and Demand Management Plan (CDMP) for 2019-2022.

Since implementation of the first CDMP, the City's total energy use has been reduced by 6.7%. as a direct result of its active pursuit of energy conservation initiatives, including:

- Investment of more than $1 million dollars per year over the last four years on energy conservation projects
- Implementation of a largescale street lighting LED conversion project
- Improving the energy efficiency of facilities while exploring demand peak saving opportunities
- Continued use of the Leadership in Energy and Environmental Design (LEED) standards which emphasize creating sustainable and environmentally conscious facilities
- Council approval of an Air Quality and Climate Change Management Plan (AQCCMP), that targets the reduction of GHG emissions in Ottawa by 80% by 2050 from 2012 values
- A City partnership with Envari, a subsidiary of Hydro Ottawa, on 99 energy conservation projects, at 92 different locations
- Over $1 million received in incentives from Hydro Ottawa, Hydro One, and Enbridge to expand and increase energy reduction initiatives

This 2019 to 2022 CDMP will serve as a guide and provide the basis for the City to responsibly implement improvements to its infrastructure and facilities to optimize energy use and reduce its environmental footprint.

2.0 Utility Consumption Data

As required by the Province, this section summarizes consumption over the course of the first CDMP (2014-2018) for electricity, natural gas, and water. This data is reported in the context that since 2014, the number and size of City managed facilities has grown by 5% to meet population growth and the demand for municipal services. Many of the new buildings include large surface areas and energy intensive operations such as swimming pools and arenas. Some of the new or expanded facilities include the Richcraft Recreation Centre, Minto Barrhaven Recreation Complex, Francois Dupuis Recreation Centre, OCTranspo Facilities Management Operation Centre, Arts Court and the Iber Road Works Yard.

2.1 Electricity

At the start of the first CDMP in 2014, the total amount of electricity consumed by the City was 307 GWh per year. By 2018, this consumption level had decreased to 285 GWh per year, a reduction of 22 GWh or 7.2%. The corresponding reduction in greenhouse gas emissions equates to 923 tonnes per year.

Project Examples:

Street Light LED Conversion

The City has initiated a large-scale street lighting LED conversion project over the last four years. As of the end of 2018, 35,700 of the City's 58,000 street lights have been converted to LED. This project accounts for a cumulative energy avoidance of approximately 21,700,000 kWh since its inception in 2014. Currently, this is producing an energy savings of 64%, with expected annual energy reduction between 50 and 65 percent by the end of the project.

Solar Photovoltaic Panels

12 Solar Photovoltaic Systems have been installed atop City facilities generating over 2,500 kW of clean energy for the province. Eight rooftops have been leased out to third parties for the installation and management of the solar panels.

Facility LED Lighting Conversions

Several LED lighting conversion projects were completed at Administration, Recreation, and Operational buildings across the City.

An example of the program's success is at the St. Laurent Recreation Complex. The site assessment identified several LED conversion opportunities beyond linear fluorescents. By converting to LED, this facility now demonstrates over 140,000 kWh of annual consumption savings, or 9% of the facility's total electrical use.

At Water and Wastewater facilities an Ontario Save on Energy incentive of $100,000 was leveraged to convert lighting to LED. The overall cost of the project totaled $2 million and is expected to result in an estimated annual energy savings of 2 million kWh.

The City is also working on lighting conversions at the Britannia and Lemieux Water Purification Plants. The project will cost approximately $500,000 and will also leverage incentive funds of $30,000 from Ontario Save on Energy. The projected outcome is an estimated combined annual savings of almost 400,000 kWh.

Centrifuge Upgrades

Between 2014 and 2016, 13 centrifuges were upgraded at the City's waste water plant to improve motor reliability and reduce maintenance costs. The project received approximately $90,000 in funding from Ontario Save on Energy. By implementing the latest technology, regenerative variable frequency drives and alternating-current motors, the new system reduces the equipment energy requirement by 110 kW.

2.2 Natural Gas

In Ontario, natural gas is a more cost-effective source of energy when compared to electricity or propane. In 2018, natural gas cost less than 20% per unit of energy compared to electricity. Given this lower cost, the City converted many facilities to use high-efficiency natural gas for heating. These conversions, along with the addition of new facilities heating with gas, contributed to a 4.5% (from 353 to 369) increase in the number of gas accounts. Although the number of accounts has increased, the total consumption of natural gas decreased over the same period due to the integration of high-efficiency technology. The amount of natural gas used in 2018 was 21.3 million m^3, compared to 22.7 million m^3 in 2014. Representing a consumption decrease of 1.4 million m^3 or 6.3%, and a reduction of 2713.4 tonnes of GHGs.

2.3 Water

The City recognizes the value and importance of fresh water as a resource and has taken measures to reduce water consumption throughout its facilities. High-efficiency toilets and urinals have been replacing traditional units, and nozzles designed to reduce water flow have been installed on at the City's busiest splash pads.

Over the last four years, 64 water accounts have been added, many of which are for splash pads. Water use consumption peaked in 2015 with 2.2 million m^3. Since then, the City has reduced water consumption by 2% to 2 million m^3 in 2018 through various conservation initiatives.

Project Example:

Playground Splash Pad Optimization

The Splash Pad Optimization Project took place between May 2016 and May 2017. To conserve water, $50,000 was invested into 25 splash pads with the highest water consumption levels. Nozzles designed to reduce water flow were installed, re-commissioning work such as repairing leaks was completed, and re-programming was done to ensure water did not run for an excessive amount of time. As a result, water consumption levels decreased by 37,000 m^3 or 22% with some splash pads reducing water use by over 50%. This project yielded an annual savings of $147,000 without compromising play value.

3.0 Results of the first CDMP 2014-2018

The various initiatives implemented through the 2014-2018 CDMP have made a significant impact on energy conservation and demand management. The Energy Management Program outlined reduction targets for electricity, natural gas and water.

The table below outlines the annual targets and provides the estimated savings achieved by the end of 2018.[1]

[1] The Playground Splash Pad Optimization Project accounts for an additional savings of 36,985 m^3 of water in 2017

	Annual Savings Targets	Estimated Savings 2015	Estimated Savings 2016	Estimated Savings 2017	Estimated Savings 2018	Total Estimated Savings
Electricity	250,000 kWh	1.5M kWh	1.6M kWh	1.2M kWh	1.6M kWh	5.9M kWh
Natural Gas	125,000 m^3	32,837 m^3	75,833 m^3	83,333 m^3	105,906 m^3	297,909 m^3
Water	15,000 m^3	7,504 m^3	2,593 m^3	1,511 m^3	37,054 m^3	48,662 m^3

Utility price fluctuations, combined with the evolving affordability of technologies such as LED, had a significant influence on the selection the of electricity conservation projects undertaken. Significant improvements were also made through the reduction of greenhouse gas emission (GHG) projects, as well as water conservation.

3.1 Building Energy Performance Index 2014-2018

Each year, staff evaluates the performance of its energy reduction measures for electricity and natural gas. City facilities with a minimum area of 100 square meters are included in the calculation of the overall building energy use coefficient. In 2018, there were 336 facilities in this category.

The building energy use coefficient describes how effectively a facility, or group of facilities, is using its electrical and natural gas energy. Dividing the total energy used by the total area produces the average energy intensity coefficient, otherwise known as the Building Energy Performance Index, or the BEPI. The various energy conservation programs implemented have contributed to the steady decline in the BEPI for City facilities.

The following illustration demonstrates the decline in the BEPI over the 2014-2018 period:

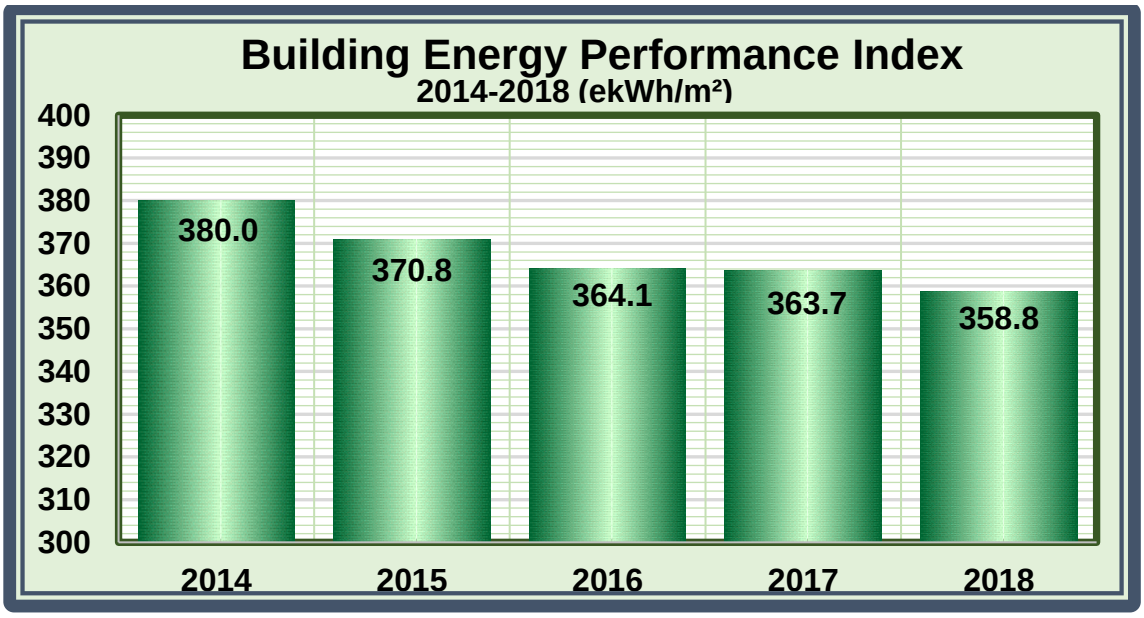


Figure 1. Building Energy Performance Index for the years 2014 – 2018

The steady decline in the BEPI over this time-period indicates a significant reduction in the energy intensity of the 336 largest facilities, resulting in an annual savings of $844,000, and a total reduction of 545 tonnes of GHG emissions.

3.2 Building Automation System Integration

Building Automation System (BAS) Integration was a key component of the first CDMP. It is the automatic centralized control of a building's heating, ventilation, air conditioning, lighting, and other systems through a building automation system. BAS integration allows for much more effective optimization of both energy use and comfort in facilities, as well as enabling central support for site staff.

The City developed a platform that allowed technology from 35 different vendors, including 15 different control companies, to be accessed by staff at 122 sites through one universal portal. This portal may be accessed remotely by any computer on the City network or approved mobile device; allowing staff to monitor and adjust building equipment set-points and schedules as needed from any location.

This unique platform has been studied internationally and emulated by other municipalities throughout the province.

Heating and ventilation improvements have also been completed at Britannia and Lemieux Water Purification Plants. The cost of the work was approximately $1.9 million. The integration of the building's automation system with unit heaters and exhaust fans,

along with improved air handling, will result in a combined estimated annual electricity savings of almost 35,000 kWh.

3.3 Energy Evolution - Phase One

Energy Evolution is a renewable energy strategy, developed by City in collaboration with the community, designed to manage energy consumption, promote the use of renewable energy and advance local economic development opportunities in Ottawa.

In 2015, Council directed staff to develop a municipal renewable energy strategy. Work on the strategy began in 2016 with the creation of a community Sounding Board comprised of over 100 individuals representing 50 local organizations. Over the course of 2016 and 2017, staff worked with members of the Sounding Board as well as targeted stakeholders in the energy sector to establish an overarching vision for the strategy, assess renewable energy generation and energy reduction opportunities, and identify a series of actions to implement between 2018 and 2020.

Phase One of the strategy, approved by Council on December 13, 2017, delivered a baseline inventory and analysis of Ottawa's current energy consumption and assessed opportunities primarily related to renewable energy generation (e.g., solar power, heat pumps, biogas, etc.). It also included a short-term action plan comprised of over 30 initiatives to be implemented by the City and its community partners by 2020.

3.4 Leadership in Energy and Environmental Design (LEED)

Ottawa continues to demonstrate a strong commitment to sustainable environmental practices. Green building practices show responsible management and good business sense. These practices reduce the impact of construction and building operation on the environment as well as resources, while reducing the cost of maintaining and operating a building over its life cycle.

Since the adoption of the Green Building Policy in 2005, the City has made a concentrated effort to increase the number of LEED certified buildings. Over this period, 27 buildings have earned LEED certification. Five have achieved Gold certification, 12 have achieved Silver and 10 have achieved LEED Certified rating. There are currently six buildings undergoing the LEED certification process. The Lansdowne Redevelopment project, completed in 2014, has been recognized as an innovative example of the City's sustainable building practices, as the first project in Canada to receive full LEED for Neighbourhood Development Stage 3 built Project Silver certification from the US Green Building council.

3.5 Backup Generator Investigation

The 2014-2018 CDMP suggested that the large backup generator at the Britannia Water Purification Plant be used to assist in managing the demand of energy during peak times. An investigation into this possible opportunity was undertake but it was determined that this generator cannot be made available for any other purpose other than in an emergency, as indicated in Schedule B, Section 5.3 of the City of Ottawa's Drinking Water Works Permit 008-202, Issue 5.

3.6 Clean Water and Wastewater Fund Projects

The City received over $69 million in funding as part of the Clean Water and Wastewater fund (CWWF). This funding was part of a short-term Canada-wide program for investment of $2 billion to support rehabilitation of both water treatment and distribution infrastructure and existing wastewater and storm water treatment systems; collection and conveyance infrastructure; and initiatives that improve asset management, system optimization, and planning for future upgrades to water and wastewater systems.

In October 2016, Council approved the proposed projects for submission (ACS2016-PIE-GEN-0001) and in 2018, Council received an update on the projects.

3.6 Raw Sewage Pumping Station (RSPS)

The Raw Sewage Pumping Station (RSPS) heating, ventilation and air conditioning upgrade project replaced the existing RSPS chillers and installed a new dry-cooler system. The project received approximately $8,000 in funding from Ontario Save on Energy and will reduce the equipment energy requirements by 10 kW.

4.0 Changes to CDMP for Future Initiatives

Historically, energy reduction programs have concentrated on reducing energy use and supplying a relatively aggressive return on investment. Moving into the future, the City will place additional emphasis on also initiating projects with a greater impact on GHG reductions.

In the first CDMP, investments concentrated primarily on projects with a 5.5-year payback. For the 2019-2022 plan it is proposed to include projects with a payback of up to 8 years. Notably, the utility costs avoided for these projects will equal the investment made within eight years. The extended payback period, coupled with the increased

investments, will allow for additional capital to be contributed towards more comprehensive upgrade opportunities that have a more direct impact on reducing GHG emissions.

4.1 Greenhouse Gas Emission Reduction

In 2019, Council allocated $3 million annually for energy, water and greenhouse gas reduction measures for City buildings, subject to annual budget consideration. The increased funding allows the City to expand the CDMP and better target the reduction of greenhouse gas emissions, while allowing for more comprehensive building upgrades.

4.2 District Energy

Over the last two years, the City and Public Services and Procurement Canada have pursued discussions on the merits and challenges of connecting the federal district heating and cooling system to Ottawa City Hall as the primary source of heating and cooling for the building. More recently, discussions have also extended to considering the inclusion of the City's new Main Library building. Through detailed discussions, both parties have explored the implications on the City's GHG emissions, upfront capital costs of connecting to district energy, and the ongoing cost implications to the City. These discussions are ongoing.

5.0 CDMP 2019-2022 - Current and Proposed Energy Conservation

The sections below outline the initiatives, measures, and projects planned under the 2019-2022 CDMP.

5.1 LED Conversion Program

The City has initiated lighting surveys of its facilities. Based on results, old lighting technology is being upgraded to high efficiency LED's. As many bulbs as possible will be replaced, as well as ballasts. The program targets 18,000 four-foot linear fluorescent bulbs and ballasts throughout all facilities. Identified lighting fixture replacement opportunities, such as in pools, arenas, and parking lots will also be considered.

Lighting conversions are also underway at more than 50 of the City's drinking water and wastewater pumping stations. The cost of this work is approximately $350,000 and the City is anticipating receiving $10,000 in Ontario Save on Energy incentives. The estimated total annual energy savings are over 70,000 kWh.

In 2019, it is anticipated that the City will spend up to $1.7 million on lighting upgrades, excluding any third-party incentives that may be received. Over the next three years, the City will be targeting City Hall, fire stations, Central Archives, its indoor ice pads, indoor pools, parking lots, as well as linear and pot light fluorescents for LED retrofits.

5.2 Building Automation System Integration Program

The BAS Integration Program has been in place since 2010. The project will continue to onboard facilities with network access to the BAS Integrator. With improved monitoring in mind, the BAS Integration Program expansion will continue to be a high priority. In 2019, approximately $1 million is planned to be spent on optimizing controls and expanding the program.

5.3 Mechanical Retrofits

In 2019 the City intends to make investments of approximately $300,000 on mechanical retrofits. Many of the mechanical efficiency upgrades will be done in conjunction with the replacement of mechanics that have reached end of life cycle. These may include boiler replacement with condensing, or the replacement of rooftop ventilation units, among others.

There are plans to retrofit portions of the HVAC system at the City's waste water plant. These initiatives include heat recovery and have the potential to reduce energy demands by up to 40%.

5.4 Pilot Projects

With increased funding comes the opportunity to explore new and emerging technologies, along with innovative uses of existing technologies. The following are projects currently being examined:

Electric Boiler Usage

This pilot program involves the innovative use of electric boilers at Walter Baker Sports Centre. With an incentive from the Federation of Canadian Municipalities, this program proposes using an electric boiler, as the facility's heating source when the cost of electricity is less than that of natural gas. Walter Baker is one of a limited number of large electrical users that are listed as a Class A hydro account. The rate per kWh for these accounts reflects the actual cost for electricity from the Province which varies dramatically over the day, month, and year. It is anticipated that the cost of electricity will be less than that of natural gas 50% of the time at this Class A facility.

Envelope Upgrade Demonstration

Building envelope demonstration projects are currently underway using next generation envelope components at the Glebe Community Centre. The building envelope consists of anything on the outside of a building, protecting it from the elements; this includes windows, siding, doors, etc. The goal of this project is to demonstrate to the surrounding community how improving components of a heritage building envelope can enhance both the occupant comfort and the energy effectiveness of the overall envelope, while still maintaining the style or character of the building.

There are eleven windows in the community centre that have been identified, within this project, as candidates for replacement. The proposed innovative windows are estimated to have an R-Value of R11 with a predicted lifespan of 60 years, as opposed to traditionally energy efficient windows with a R3 or R4 value which typically only lasts 15-20 years. The new windows will reduce heat loss by 90% and improve energy intensity.

The existing uninsulated steel door is also proposed to be replaced. In its current state, this component of the building envelope is highly energy intensive and is causing a condensation problem. A fiberglass reinforced polyester (FRP) door will be the recommended replacement. The FRP door is almost 65% less energy intensive than traditional steel doors and it will not dent, scratch, or rust.

5.5 Retro-Commissioning

Retro-commissioning is a process to improve the efficiency of an existing building's equipment or systems. As equipment ages, or building usage changes, building mechanical controls and envelope systems may be repaired over time with different generations of parts that can make the technology or equipment, less energy efficient. This leads to opportunities of retro-commissioning which Natural Resources Canada has indicated can yield energy savings of up to 16% with attractive payback periods. The City will review select facilities and identify retro-commissioning opportunities.

5.6 Incentives

The City has an aggressive plan to investigate and pursue all energy conservation incentive funding from external sources and to apply all secured funding back into additional projects to further the reduction of energy usage and greenhouse gas emissions.

5.7 Electrical Master Plan Study

An Electrical Master Plan study for the City's waste water plant is expected to be completed by the end of 2019. This study will address life-cycle replacements, risk assessments associated with aged equipment, capacity, growth, and service level expectations. The key objective of this work is to increase the facility's electrical reliability, including the ability to operate independent of the electrical grid using the power produced on-site by the Co-generation Facility. The study will provide a framework of projects needed to meet the plan's objectives.

5.8 Street Lighting

The City continues to execute the street lighting conversion project laid out in the previous CDMP. As of the end of 2018, an estimated 22,300 street lights remain to be converted to LED. The anticipated project completion date is July 2020, with a target annual energy reduction of 18,626,000 kWh.

5.9 Leadership in Energy and Environmental Design

The updated 2018 Green Building Policy report maintains the requirement that all newly constructed municipal buildings with a footprint greater than 500 square meters (5,400 square feet) be designed, delivered and certified by the Canada Green Building Council (CaGBC) as being Leadership in Energy and Environmental Design (LEED®) Certified at minimum. The current practice for retrofit and renovation projects is to apply sustainable design principles.

Noted in the 2018 Green Building Policy report, the CaGBC has made significant changes to its rating system, updating from LEED 2009 to LEED v4. Many of the changes in LEED v 4 are focused on a project's continued performance, rather than just its initial design. This is important to ensure reduced energy requirements and lower lifecycle costs for buildings. The City is reviewing and familiarizing itself with the new LEED v4 requirements and implications and is committed to working with the CaGBC to evaluate and assess the new certification system.

5.10 Climate Change and Resiliency Group

The City's Climate Change and Resiliency Group, established in 2018, focuses on climate change adaptation, resiliency and mitigation. Their mandate is to undertake actions to adapt to impacts of climate change on the City, as well as initiate actions that will facilitate the overall reduction of greenhouse gases in the community. This includes

legislation, policy, incentives, studies, etc. They also monitor emissions for the municipality. The City is currently on target to reduce community-wide emissions by 12% below 2012 levels by 2024.

5.11 Energy Evolution – Phase 2

The Energy Evolution Plan – Phase 1, outlined the City's target of a community wide GHG emission reduction of 80% by 2050. Phase 2 of the Energy Evolution Plan is expected to be completed in Q4 2019. It is anticipated that the report will suggest building energy conservation to be a key component of the plan to achieve the targeted emissions reduction. This could include deep building retrofits of municipal buildings which are typically beyond the scope of a CDMP, however, critical to achieve large GHG reductions.

5.12 City of Ottawa Official Plan

The official plan is currently under review and is expected to be completed and presented to Council by 2021. The plan is expected to include a section on energy. To date, an energy discussion paper has been produced and it has gone through an initial public consultation process.

6.0 Demand Management

Demand management is an approach to control peak electrical use in a facility. Projects addressing demand management are listed below.

6.1 Co-Generation Facility at ROPEC

Since 1997, the co-generation facility has used methane, a by-product of the wastewater treatment process, to produce heat and electricity. This reduces the amount of electricity and natural gas required from utility suppliers, which also reduces the City's greenhouse gas emissions.

In 2018, the facility reduced its need to purchase energy from the grid by generating almost 17 million kW-hours of electrical energy Staff are preparing a report for Committee and Council's consideration to increase the climate resiliency of ROPEC, including the use of co-generation and other plant upgrades to increase the plant's electrical reliability, provide financial savings, and GHG reductions.

6.2 Energy Demand Peak Management at Waste Water Plant

During forecasted provincial peak demand events, the City's Waste Water Plant Operations reduces its demand on the Ontario power grid. This is done by reducing raw sewage pumping through the storage collection system, as well as reducing air conditioning loads in the site buildings, and reducing equipment loads that do not affect short term process quality. Additionally, co-generation engine maintenance is scheduled to ensure the units are operational during forecasted peak demand events. These activities do not reduce the amount of energy consumed but rather shift it outside of peak demand events. This demand management initiative reduced the plant's hydro costs by approximately $498,000 annually.

6.3 Electric Boiler at Walter Baker Sports Centre

The City has developed a pilot program to install electric boilers at select Class A facilities. This is planned for the Walter Baker Sports Centre. During periods when electricity is less expensive than natural gas, the electric boiler will be used for space and process heating while consuming some of the surplus electricity from the Ontario grid.

7.0 Conclusion

The City of Ottawa is committed to taking a leadership role in environmental sustainability. With a proven record of accomplishment and a focus on the future, the City continues to improve on energy conservation and demand management, while tackling climate change through GHG emission reduction initiatives. The goal of reducing greenhouse gas emissions by 80% from 2012 levels by 2050, will require the City to continue to focus on reducing energy use and emissions in the coming years.

City of Ottawa Sites in St. Lurent Area

Compiled by Mike Fletcher December 22, 2021.

Site	January 2019 gas usage (m3)	All months 2019 Gas Usage	Comments
Ottawa City Hall	88,647	453,422	
Beacon Hill Community Ctr	467	3,049	
Bernard GrandMaitre Arena	4,810	25,778	
Bingham Park Comfort Station	280	1,665	
Brantwood Park Field House and Pavillion	825	4,261	
Brewer Park Pool Complex	17,074	92,934	
Centre Richelieu	6,450	28,413	
Champagne Bath Pool	8,466	41,776	
Don Gamble - St. Laurent Complex	25,133	157,848	
Earl Armsrong Arena	5,553	34,670	
Elections Office and Warehouse	5,078	33,983	
Fire Station 51	3,787	19,311	
Fire Station 56	3,837	19,583	
Fire Station 57	3,618	15,331	
Garry J Armstrong LTC	69,461	339,827	
Gil O Gilian FH	994	4,252	
Hurdman Yard Office and Garage	6,662	44,143	
Jack Purcell Recreation Centre	11,951	68,272	
Jardiniere Tournesol Care Ctr	796	4,316	
Jules Morin Field House	575	2,756	
LindenLea Community Centre	556	3,050	
Lowertown Pool Complex	15,597	109,342	
Montreal Road EMS	1,231	5,935	
Montreal Road Pumping Station	1,617	5,292	January 2020 data - no gas until end of 2019
OC Transpo 899 Belfast	22,716	107,414	
OC Transpo North + southGarage	426,805	1,796,247	
OC Transpo South Garage	22,716	107,414	
OPL North Gloucester Branch	3,811	24,330	2019 NA - Broken Meter-2020 Data shown
OPL Sunnyside Branch	1,638	8,440	
Ottawa East Community Centre	1,070	4,607	
Ottawa South Community Ctr	3,111	15,734	
Ottawa Workers' Heritage Ctr	373	1,803	
Overbrooke Pool	7,850	36,406	
Pat Clarke Community Centre	3,122	16,504	
Raymond Charbot Grant Thorton Park	16,370	88,684	
Rideau Library	2,208	9,326	
Rideau Rockcliffe Community Centre	1,347	6,525	
Rockcliffe Park Community Centre	1,191	5,178	
Routhier School Community Ctr	7,155	32,052	
Sandy Hill Arena	5,959	46,430	
Sandy Hill Community Ctr	2,739	13,137	
Splash Wave Pool (East)	36,294	265,953	
Vanier Garage	6,475	31,471	
Vanier Library	1,390	6,280	
Village Green Park Chalet		556	No January data; May to December only
Westboro Academy	3,944	17,778	
TOTALS	***861,748***	***4,161,477***	

Serving GOVERNMENT, serving CANADIANS.

Connecting to Ottawa's Emerging Downtown Districts

Presented by:

Tomasz Smetny-Sowa and Don Grant
Energy Services Acquisition Program
Public Services and Procurement Canada

June 25, 2019

ESAP PASE

Program Overview

The **Energy Services Acquisition Program (ESAP)** is modernizing the District Energy System (DES) which provides heating services to over 80 buildings and cooling services to 67 buildings in the National Capital Region (>1.6M m^2 of floor space), accommodating 55,000+ occupants

There are **two stages** to ESAP:

- Stage 1: DES Modernization
- Stage 2: Deeper Greening

Where are the Plants?

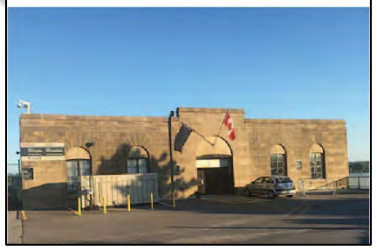
National Printing Bureau

Cliff

Tunney's Pasture

New connections

NRC



Confederation Heights

Sneak Peak at the Design for Stage 1: Modernization

Cliff Plant – Historically

Architectural Design – Cliff Plant

View of the Cliff plant from Gatineau showing the exterior and the stainless steel stacks.

Aesthetic Design Overview - Cliff Plant

View of the Cliff CHCP from the NCC's multiuse pathway (MUP).

Architectural Design - Cliff Plant

View from the public meeting area. Notice the access from top to bottom by staircase and by elevator.

Architectural Design – Cliff Plant

View of the upper plateau blending walkways, seating areas, trees and plants and offering spectacular views.

Architectural Design – Tunney's Pasture Plant

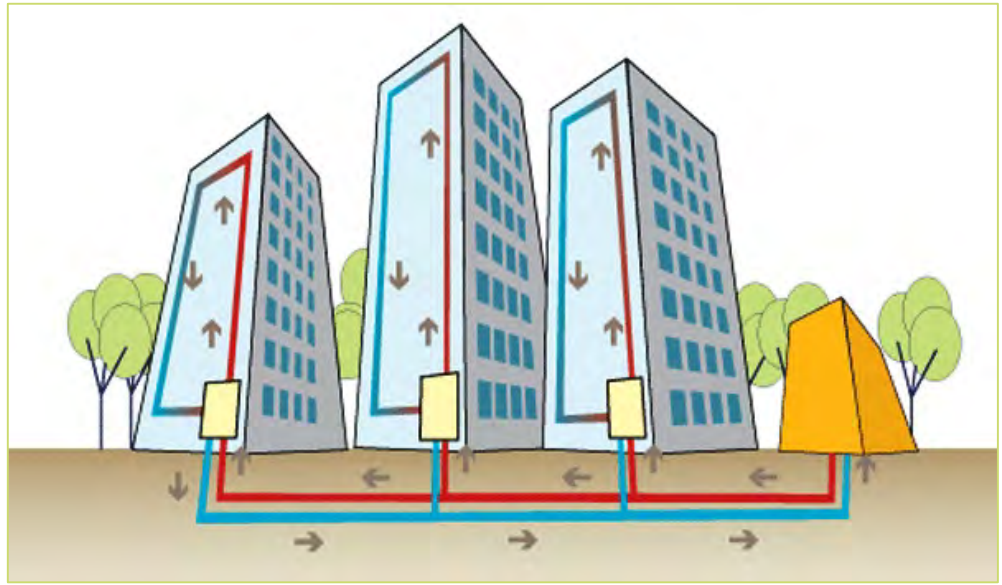
View of the Tunney's Pasture CHCP looking towards the Ottawa River.

Architectural Design – Tunney's Pasture Plant

View of the Tunney's Pasture CHCP from the street in front.

Stage 1: Creating a Thermal Grid

- In Stage 1: Modernization, one of the most important benefits will be the creation of a thermal grid
- It will be able to distribute hot and cold water as energy sources
- This will include not only delivering energy but also receiving energy from other plants, buildings and waste heat sources



Stage 2: Plan for Low Carbon Heating and Cooling

- By 2025 the DES in the National Capital Region will be modern and highly efficient
- Cooling will use 100% clean electricity and will be **carbon neutral**
- Studies and pilot projects are underway to examine carbon neutral energy sources and how they can be used for heating

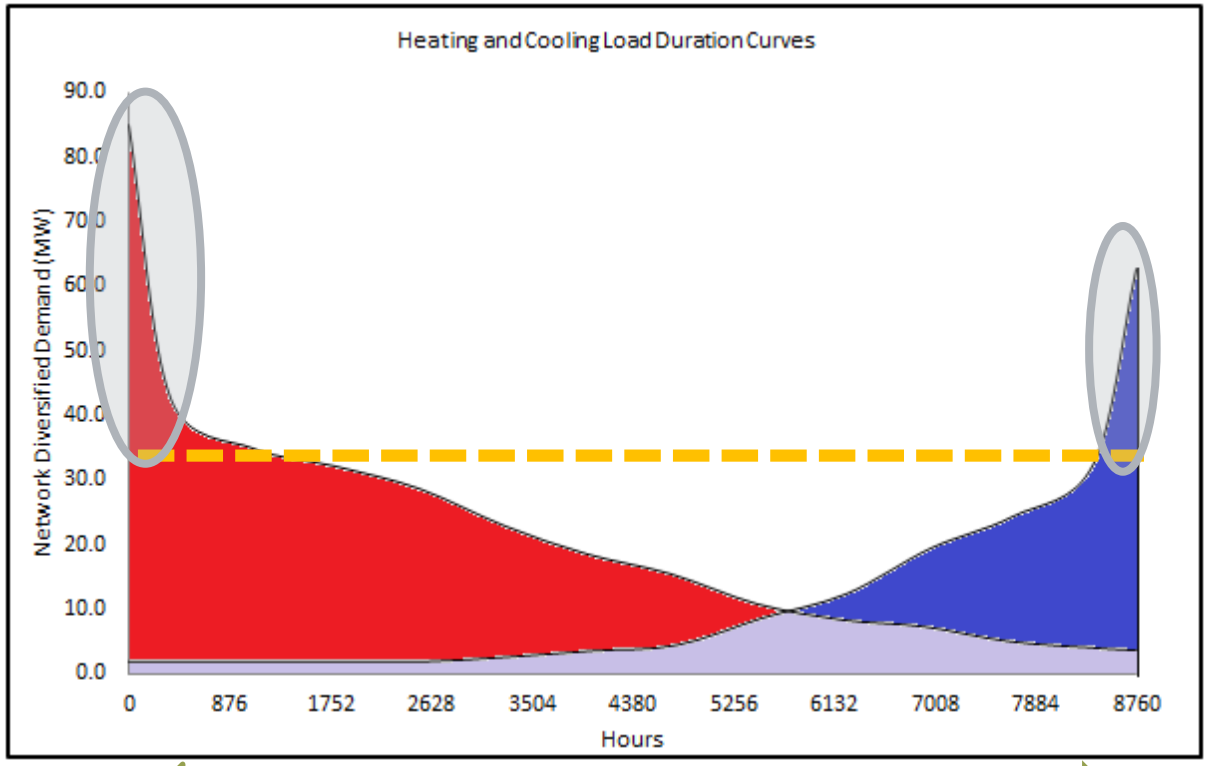
Stage 2: Enabling Low Carbon Government

- Modernizing the DES is a GOC priority that will provide long term financial savings and greenhouse gas (GHG) emissions reductions
- It is part of a portfolio of solutions for GHG reduction:
  - Smart buildings and plants
  - Reducing building energy demand with efficient retrofits
  - New building construction to highest standards
  - Adding renewable energy generation capacity on site

Stage 2: Aligning with Net Zero Design

- Government of Canada direction is that "*all new buildings should be constructed to be net-zero carbon ready at the latest in 2022*"
- ESAP can help clients in the transition to Net Zero buildings
- We can act as thermal storage, accepting excess energy on sunny days for example, and being a source of heating on very cold days

Understanding Energy Demand



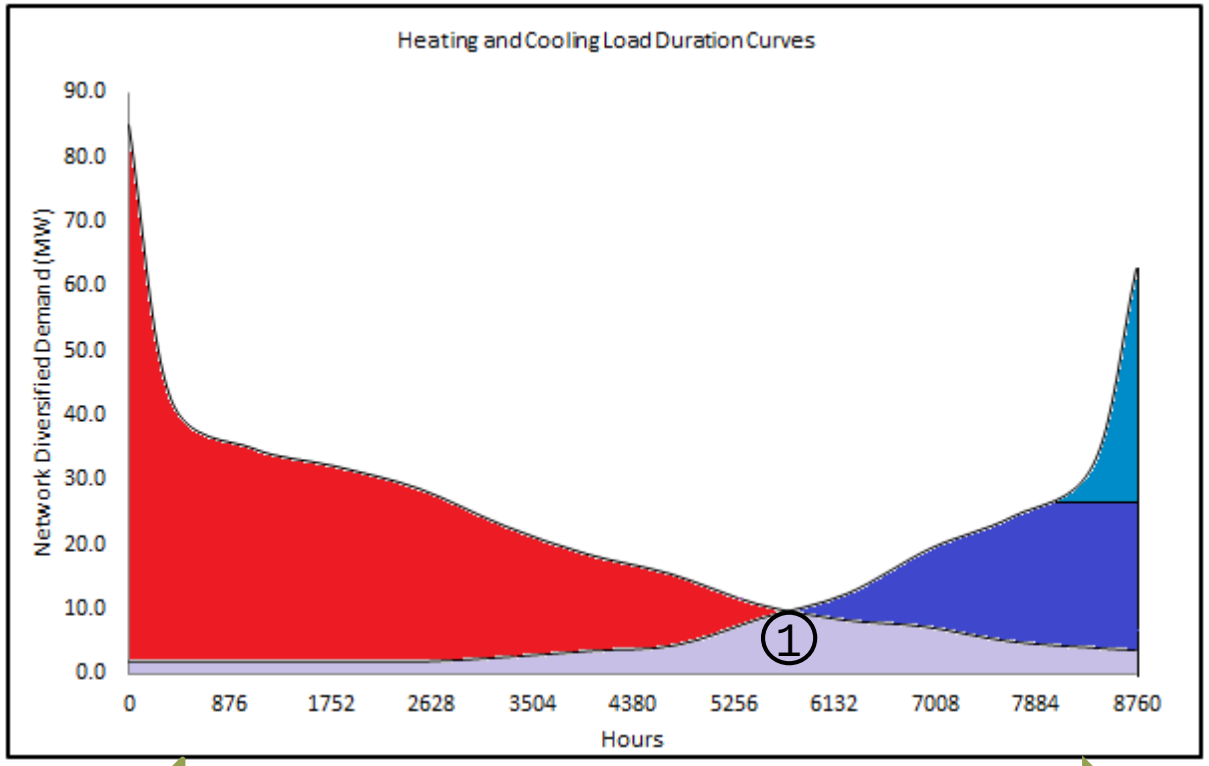
- Base Load produces the bulk of the annual energy use
  - ➢ Focus for low carbon sources
- Peak Demand is critical for customer comfort but is small % of total energy use
  - ➢ Focus for RNG, Offsets (ON elec.)

Heating

Cooling

Heating and Cooling

Energy From Renewables

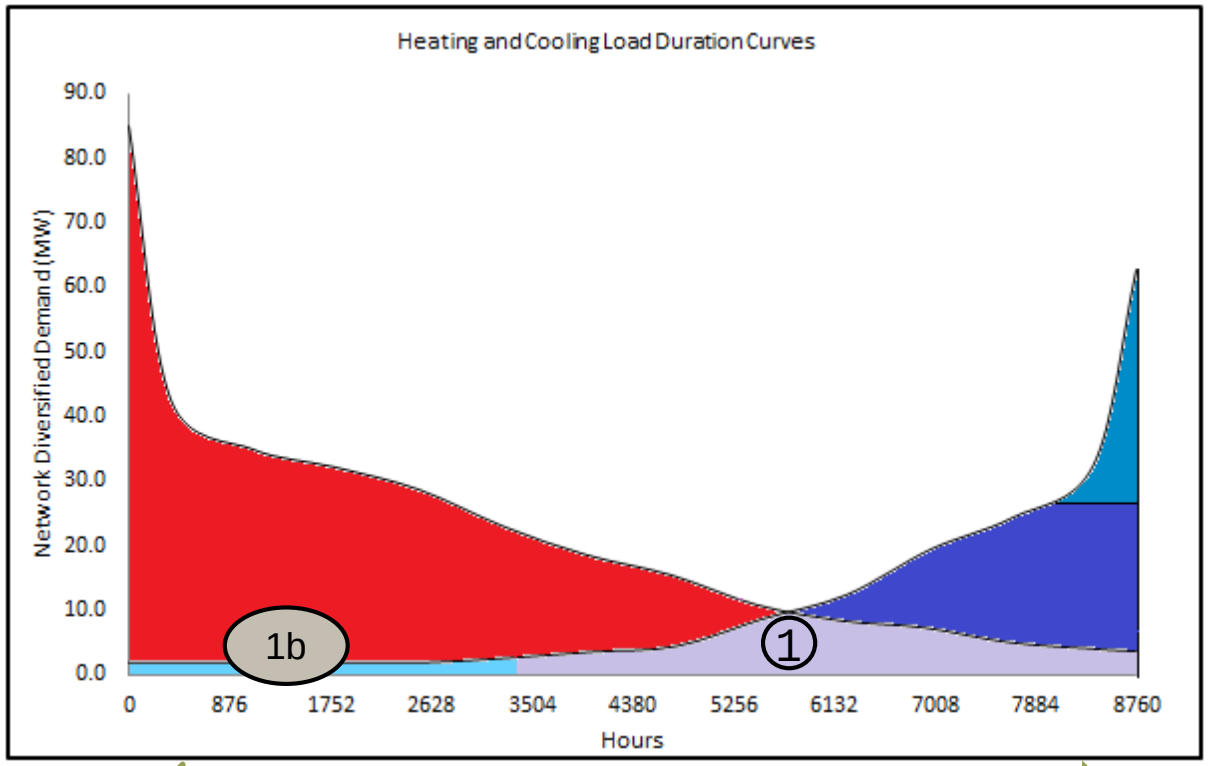


Towards -30°C

Towards 30°C

- Natural Gas
- QC Electricity
- ON Electricity
- HR Heat Pumps

Energy From Renewables

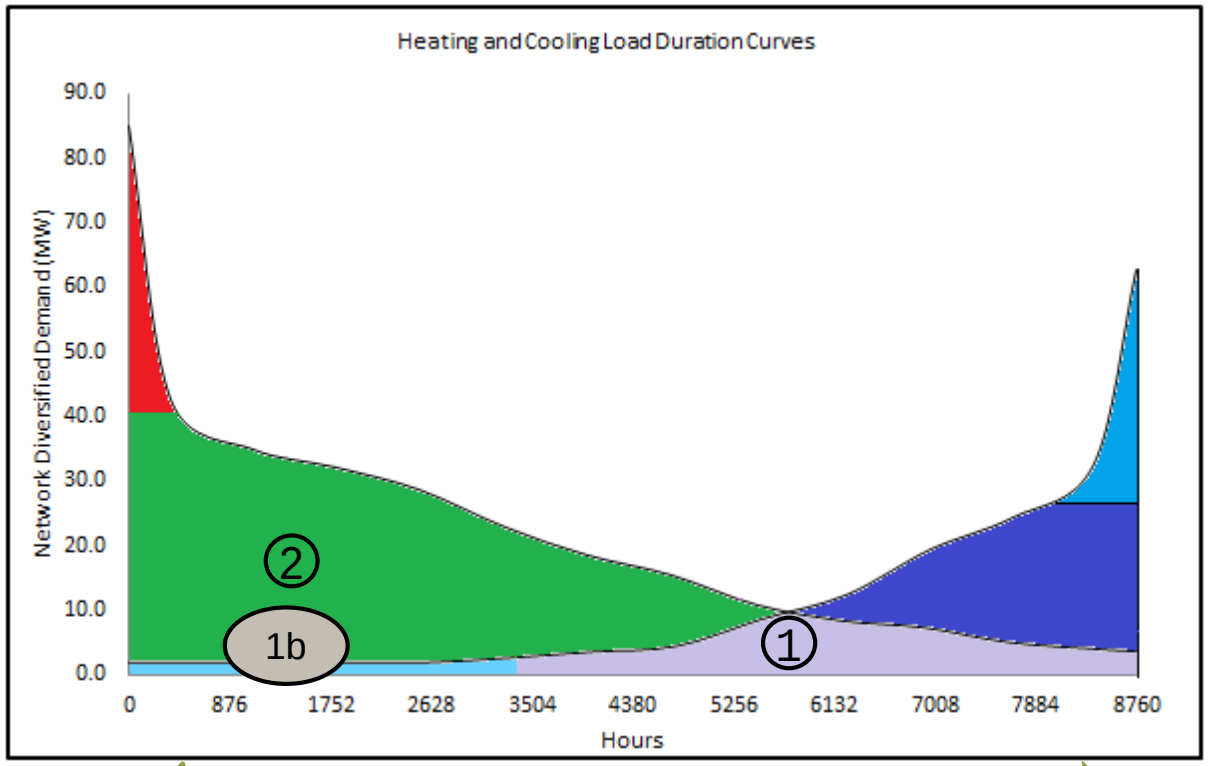


Towards -30°C

Towards 30°C

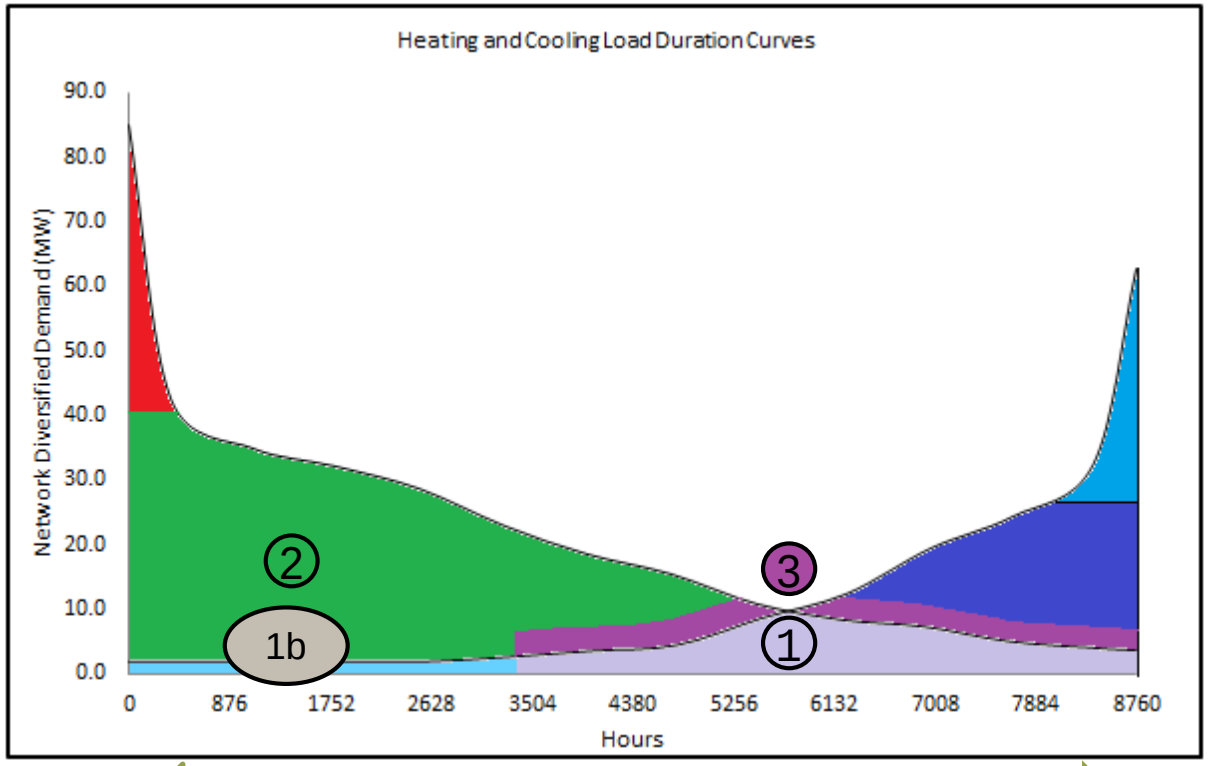
- Natural Gas
- QC Electricity
- ON Electricity
- HR Heat Pumps
- River Water Cooling

Energy From Renewables



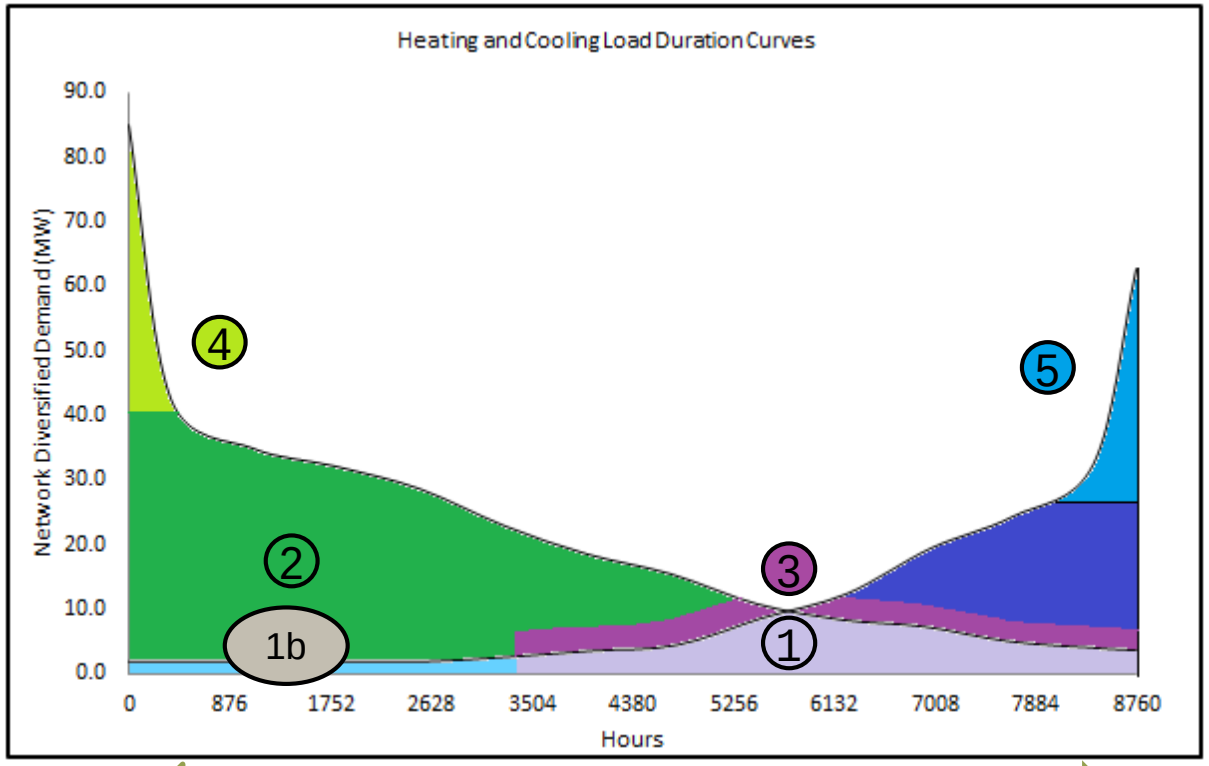
Natural Gas
QC Electricity
ON Electricity
HR Heat Pumps
River Water Cooling
LC Source (large)

Energy From Renewables



- Natural Gas
- QU Electricity
- ON Electricity
- HR Heat Pumps
- River Water Cooling
- LC Source (large)
- Geoexchange

Energy from Renewables



QU Electricity

ON Electricity

HR Heat Pumps

River Water Cooling

LC Source (large)

Geoexchange

RNG

How ESAP Can Expand The Network

Supply new development at LeBreton Flats

Supply new development at Tunney's Pasture

Supply new Ottawa Hospital and Carleton University

We can expand to supply new customers with low carbon heating and cooling

- New connections
- Possible future connections

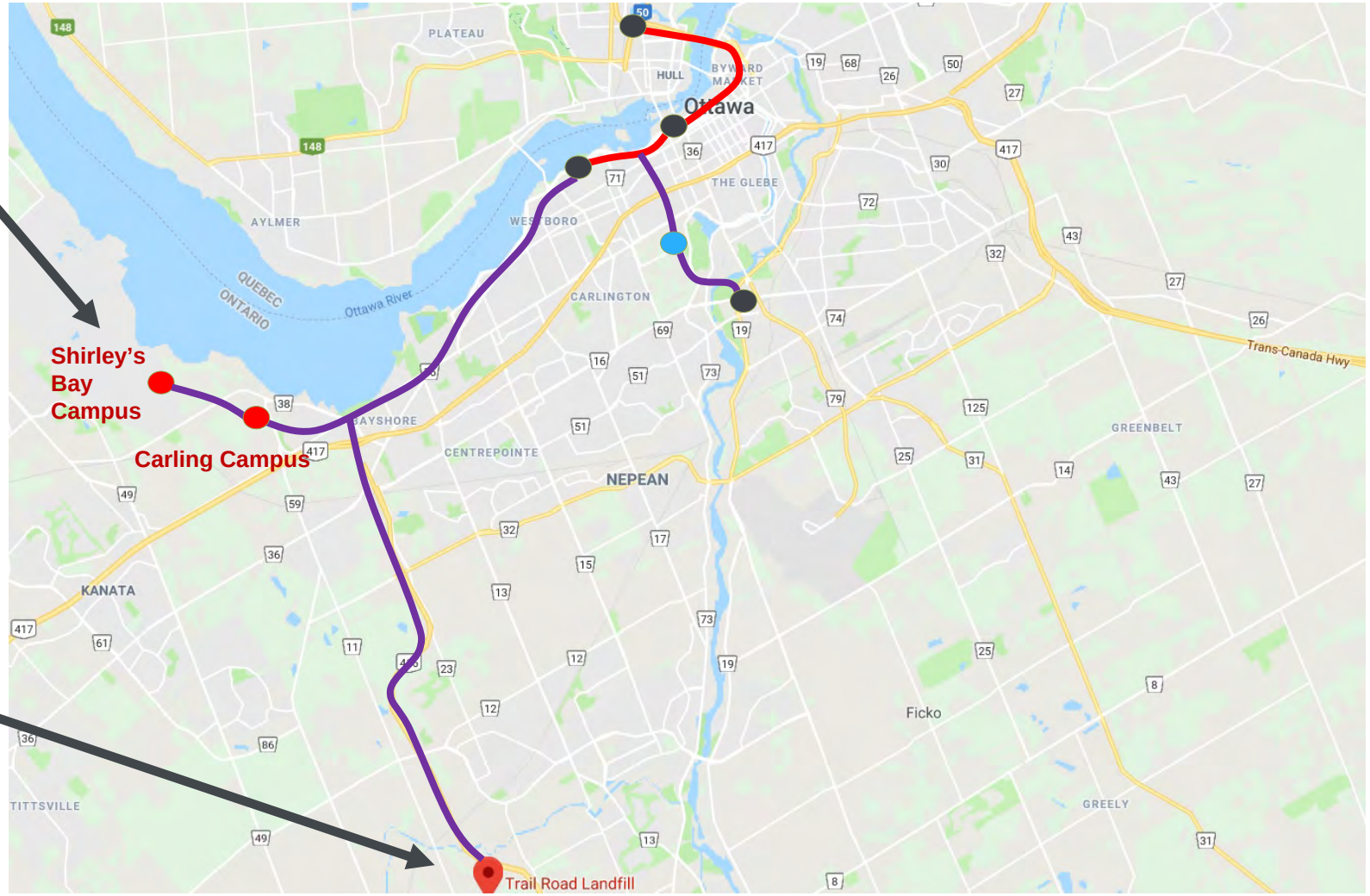
Connect to more buildings in the downtown core

Supply new development at Confederation Heights

- Existing PSPC DES locations
- Existing Plants
- Potential DES Growth and Expansion
- New Hospital

Ultimate Future DES Network

Connect to federal campuses in West End



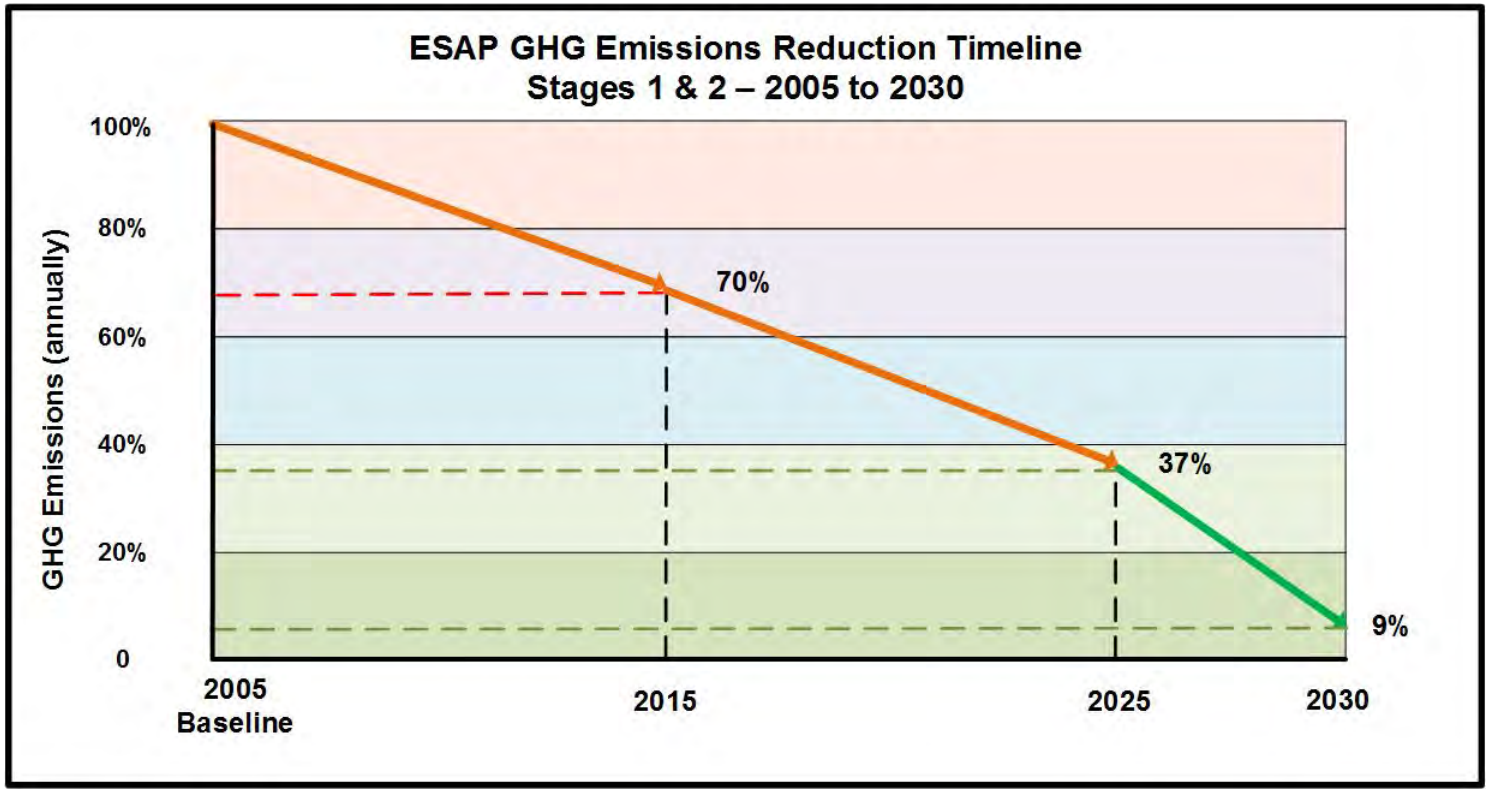
Connect to landfill if City moves to Energy from Waste

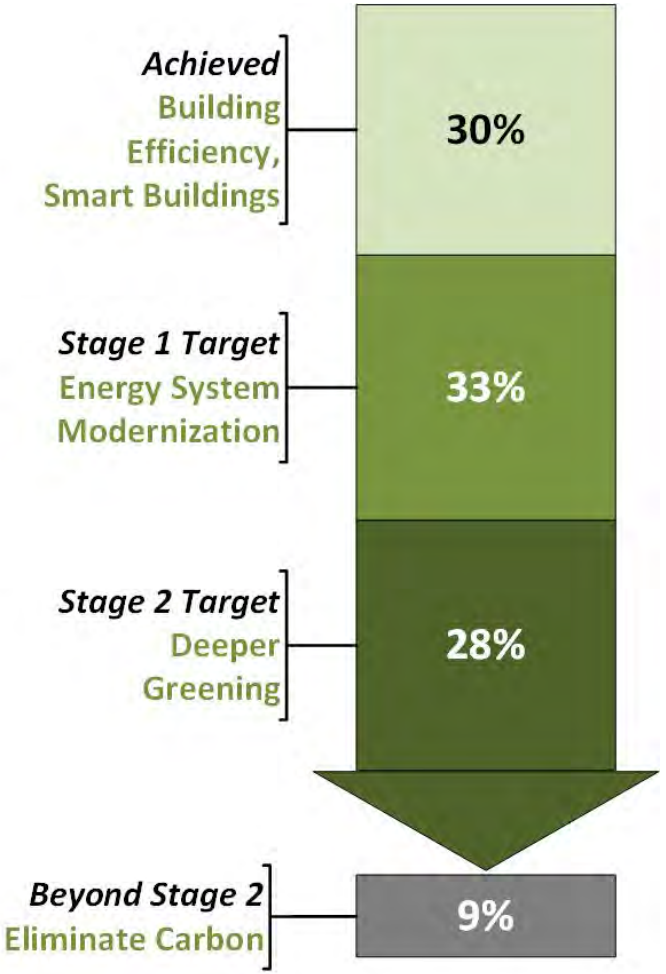
Ultimately we can connect to large federal campuses and our municipal landfill

- New connections
- Possible future connections

- Existing PSPC DES locations
- Existing Plants
- Potential DES Growth and Expansion
- New Hospital

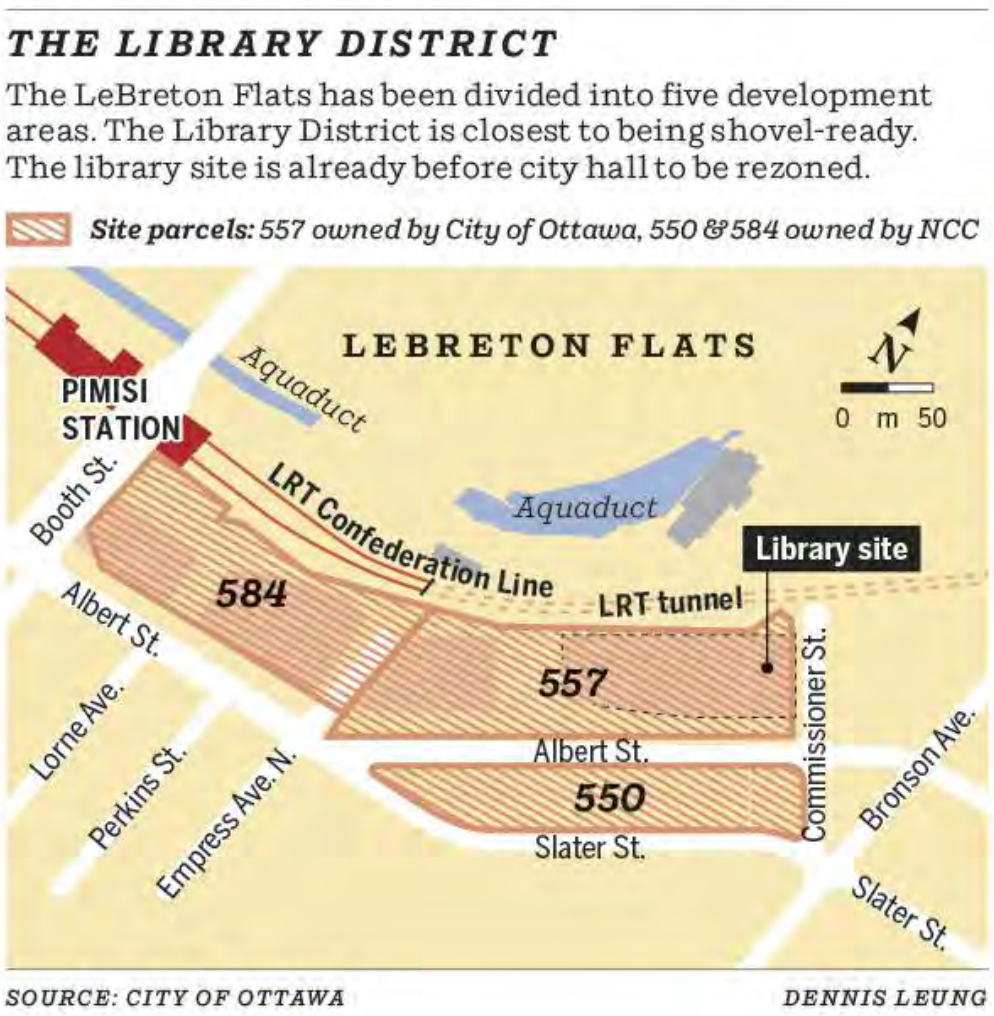
Expansion Makes Sense Because of GHG Reductions

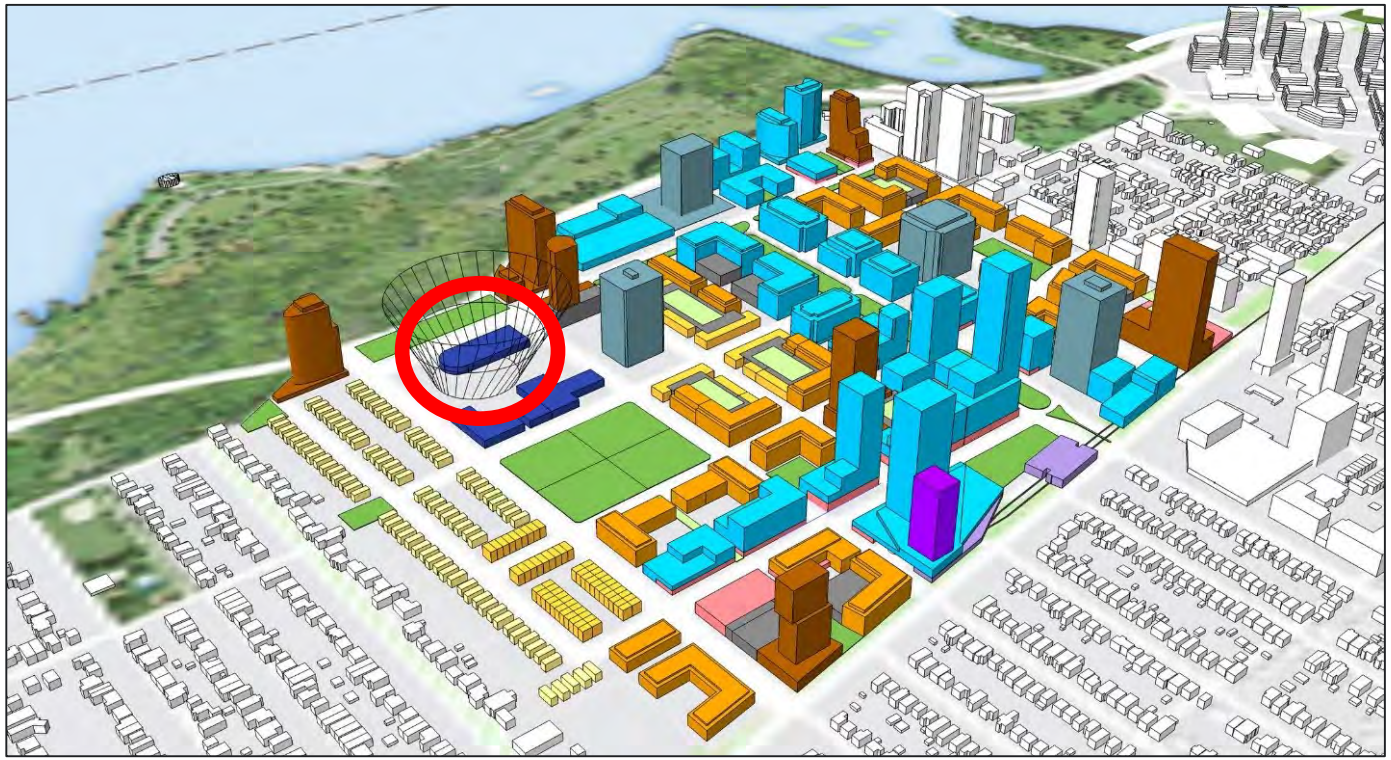




By 2030, GHG emissions will be reduced to less than 10% of 2005 baseline emissions if we complete Stage 2

Linking to LeBreton Flats and Tunney's Pasture





Tunney's Pasture Master Plan Visualization

Expansion Value Proposition

- Carbon free cooling and low carbon heating
- Cost of energy competes with ‘business as usual’ solutions
- Uses river water for ‘free’ cooling
- No heating/cooling generation equipment on-site
- Flexible, fuel agnostic, low carbon approach to heating
- Energy input flexibility – easier to change sources in centralized DES
- Resiliency, redundancy and back up in case of emergencies
- Ability to accept energy from individual buildings or campuses
- State of the art refrigerant equipment provides LEED credit

Thank You -> Any Questions ?

Tomasz Smetny-Sowa

Energy Services Acquisition Program

Public Services and Procurement Canada

Don Grant

Energy Services Acquisition Program

Public Services and Procurement Canada

Bruyère

January 12, 2022

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City Of Ottawa Letter

Bruyère is providing the following update to the City of Ottawa in relation to its energy and greenhouse gas (GHG) reduction plans. These plans are in alignment with the City of Ottawa Energy Evolution plan. Bruyère has been pursuing a 2% per year energy reduction goal and the information below outline how we intend to reduce energy and emissions by a more significant amount into the future.

Bruyère Continuing Care (Bruyère) is a healthcare organization providing complex continuing care, rehabilitation, palliative care, long-term care, and affordable housing for seniors. Serving the Ottawa area and operating from three sites, Bruyère incorporates 875,508 ft2 of floor space, 946 beds; and employs 2,169 staff, including 68 physicians and 600 volunteers.

Bruyere's Conservation and Demand Management Plan continues to be a work in progress with several projects and system renewals underway that contribute to our goal in reducing GHG emissions. We are midterm on our current plan, but it will be updated to reflect recent changes in our organizational objectives and supporting the City's plan to be carbon neutral by 2050.

Operationally we continue to introduce new measures like updating Building Automation Systems to improve environmental performance, replacing aging Air Handling Units, replacing aging cooling towers, improving distribution systems, implementing new heat exchangers, replacing ageing VFD's, steam trap maintenance measures and updating lighting with the introduction of LED technology.

These measures support our objective in continuously improving our energy performance measures and reducing our consumption of fuels including natural gas.

Bruyère

Bruyere Continuing Care has also initiated a redevelopment plan to replacing the aging Elizabeth Bruyere Campus located at 43 and 75 Bruyere St with a new state of the art facility designed to LEED Building Design and Construction Standards with an objective of achieving the highest possible LEED Rating. The long-term plan is to consolidate the Elizabeth Bruyere Campus and the St. Vincent Hospital Campus to a new single site. Within the next 10 years the plan envisions the replacement of the Elizabeth Bruyere Hospital followed by replacing Saint-Vincent Hospital over the following 10 years. These plans are in the preliminary stages of development and the approval process with the Ministry of Health.

In 2018, with the aim of reducing our hydro expenses and improving our environmental heating and controls systems, Bruyere added a natural gas cogenator at the St. Vincent Hospital Campus.

At the present time, there are no plans to introduce any additional measures that would result in increased use of natural gas at any of our facilities and our consumption is forecasted to decrease in alignment with the City's net zero 2050 goals.

Regards,

Rejean Proulx

Gestionnaire centrale thermique et électrique, Soins continus Bruyère

Manager Heat and Power Plant, Bruyère Continuing Care

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OTTAWA COMMUNITY HOUSING CORPORATION
BOARD OF DIRECTORS MEETING
PUBLIC MINUTES

Thursday, December 2, 2021 **Virtual Meeting**
Meeting Start Time: 4:30 PM

Directors:	Councillor Mathieu Fleury, Chair	Ferenaz Raheem, Corporate Secretary
	Brendan Lawlor, Treasurer	Councillor Theresa Kavanagh
	Councillor Rawlson King	Rebecca Hickey, Vice Chair
	Councillor Catherine McKenney	Councillor Scott Moffatt
	Girum Simmie	Michele Brenning
	Jennifer Mondoux	
OCHC Staff:	Stéphane Giguère, Chief Executive Officer	Cliff Youdale, Chief Development Officer
	Nathalie Fauvel, VP, Finance, and Chief Financial Officer	Shaun Simms, VP, People and Culture
	Guy Arseneau, Chief Operating Officer	Alain Cadieux, Director, Property Management and Support Services
	Brian Gilligan, VP, Community and Tenant Support	Wendy McColgan, Manager, Executive Operations
	Cindy Newell, Director, Human Resources	Kelly Hastings, Manager, Policy and Governance
	Erin Duncan, Administrative Assistant	Kristen Bailey, Director, Legal Services
	Barron Meyerhoffer, Director, Development	Jean-Marc Carrière, Senior Manager, Tenancy Administration
	Gordon Downes, Director, Construction	Dan Dicaire, Manager, Conservation and Sustainability
	Jeff Wilkie, Senior Manager, Property Management	Michelle Parisien, Senior Manager, Property Management
	Hussein Jaffal, Senior Manager, Tenant Service Operations	Tetyana Nozina, Manager, Financial Planning, Analysis and Reporting
	Debbie Mills, Senior Manager, Tenancy Administration	David Ricottone, Director, Digital Solutions
	Robert MacNeil, Director, Realty Initiatives	Erin Forzley, Project Manager, Land Development

1. Motion "Race To Zero" Pledge

Moved by: Councillor Moffatt
Seconded by: Councillor King

Whereas OCHC is committed to reducing its environmental impact by improving energy efficiency and reducing its green house gas (GHG) emissions which currently average 29,000 ton of CO2 equivalent per year.

Whereas the City of Ottawa has approved the Climate Change Master Plan which sets the following targets for Community and City Operations GHG emissions:

Reduce emissions from the community by:
- *43 per cent by 2025*
- *68 per cent by 2030*
- *96 per cent by 2040*
- *100 per cent by 2050*

Reduce emissions from City Operations by:
- *30 per cent by 2025*
- *50 per cent by 2030*
- *100 per cent by 2040*

Whereas the City of Ottawa is joining the Race to Zero, a global campaign to rally leadership and support from businesses, cities, regions, and investors for a healthy, resilient, zero carbon recovery that prevents future threats, creates decent jobs, and unlocks inclusive, sustainable growth. The City of Ottawa is joining Montreal, Toronto, Vancouver, and Halifax who are already signatories to the Race to Zero.

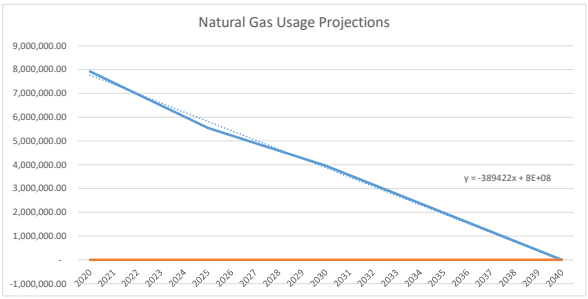
Therefore, be it resolved that OCHC sign the Race to Zero Pledge and commits to the following:

- *A 50 per cent GHG emissions reduction by 2030*
- *Achieve Net-Zero emissions by 2040*
- *Creating a corporation wide strategy to achieve the targets mentioned above*
- *Putting GHG emissions targets at the heart of corporate decision making*
- *Seek additional funding to sustain GHG efforts*
- *Report OCHC progress on achieving its targets*

Carried

	Number of Unit Without Gas bills	
Address or Site	**# of Unit**	**Estimated or Actual Gas Consumption**
Thorncliffe	61	148,733
Overbrook	711	1,733,597
725 Bernard	107	115,816
1030 Du Pere Charlebois	53	129,227
500 St Laurent	112	61,929
800 St Laurent	207	68,685
140 Den Haag	74	75,624
Bathgate	70	170,678
Carsons	28	68,271
Carson/Paul	89	217,004
Bathgate	70	170,678
726 Borthwick	1	2,438
GardenVale Rd	2	4,877
Marquerite	6	14,630
954 Beaudry	1	2,438
251 Donald	240	134,405
255 Donald	143	73,641
158-160 Acadie Crt	2	4,490
White Fathers	10	21,654
280 Monfort	51	16,000
300 Lacasse	183	145,617
374 Richelieu	3	7,315
378-386 Richelieu	30	18,244
751 - 817 Belisle	31	45,305
Crichton	6	7,091
261 Garneau	15	40,437
540 Thomson	249	131,574
124 Robinson Ave	14	22,011
430 Wiggins	76	54,561
320 Wiggins	40	16,660
310 Wiggins	40	10,692
300 Wiggins	41	99,968
333-355 Wiggins	12	29,259
301-331 Wiggins	16	39,012
721 Chapel	81	42,094
54 Wiggins	6	14,630
300 Goulburn, 124 Mann, 114 M	92	169,378
731 Chapel	1	2,438
Strathcona	138	336,479
214-216 Somerset	14	34,136
218-224 Somerset	31	75,586
48 Bruyere	15	9,676
Bruyere & Belanger	29	70,709
181 Bruyere	39	30,633
312 Cumberland	84	40,817
380 Cumberland		47,165
25 Nelson	3	5,525
Beausejour 1&2	128	312,096
Beausejour 4	13	31,697
Beausoleil	112	273,084
160 Charlotte	216	108,534
Friel	154	121,549
303 King Edward	46	69,849
595 Rideau	62	89,706
380 Murray	230	345,356
215 Wurtemburg	114	154,800
Macdonald Manor	232	291,266
495-497 Cumberland	29	5,531
212 Bronson	30	40,623
494 & 504 Albert	17	41,450
340 Gloucester	70	63,779
343 Nepean	4	9,753
450 Laurier	126	225,055
Lyon St	4	9,753
215 Nepean	80	36,879
170 Gloucester	28	12,032
453 Cooper	104	163,744
395 Somerset	250	81,873
380 Somerset	60	69,090
415 Maclaren	251	145,822
375-379 Gilmour		30,664
205 Gladstone	54	21,053
125 Mcloed	107	134,484
Frank	18	43,889
Mcgillvery	2	4,877
507 Riverdale	76	131,019
663 Chadburn	1	2,438
Carsons Rd	29	70,709
		-
TOTALS	5974	7924281.856

		30%	50%	100%
Consumption (m³)	**7,924,281.86**	**5,546,997.30**	**3,962,140.93**	-
Year	2020	2025	2030	2040
Reduction m³		**2,377,285**	**3,962,141**	**7,924,282**



OCH Eco² Plan - Ottawa Community Housing (OCH)

och-lco.ca/och-eco2-plan/

Leading the social housing sector towards sustainability

In a challenging economy, Ottawa Community Housing (OCH) has successfully matched a desire to make the world a better place with the need for more financially sustainable operations. The outcome is a more comfortable living environment for tenants, significant savings to the bottom line and a remarkable reduction in our carbon footprint. Pioneering environmental initiatives has placed OCH on the national stage to share our successes to benefit the social housing sector as a whole.

Taking a holistic approach to greening OCH has meant focusing sustainability efforts on three pillars:

- Our buildings
- Our people
- Our culture

To date, integrating green practices has generated many benefits such as cutting utility costs, reducing and diverting waste, enhancing the aesthetics and performance of the portfolio, improving health, conserving energy and of course, reducing greenhouse gas emissions.

Watch Video At: https://youtu.be/ZroKJnHkMN8

ECO² Plan

Click here to download

Green Corner: Ashgrove Pulls Together to Keep Community Clean

Exciting things are happening in Ashgrove! A group of tenants have volunteered to help keep the community clean. Their focus? The… Continue Reading Green Corner: Ashgrove Pulls Together to Keep Community Clean

Green Corner: Reducing Waste

This post is also available in: Français (French)

Green Corner : PEER Project

This post is also available in: Français (French)

Green Corner: OCH is expanding the green bin program

This post is also available in: Français (French)

Green Corner: Great Demand Response

This post is also available in: Français (French)

OCH applauds government commitment to housing strategy

Feb. 28, 2018 – Ottawa Community Housing Corporation applauds the federal government for the continued commitment to the National Housing… Continue Reading OCH applauds government commitment to housing strategy

Solar panel project powered up in Regina Lane, an OCH community

An array of solar panels covering an area equal to five tennis courts on our Regina Lane townhomes is now… Continue Reading Solar panel project powered up in Regina Lane, an OCH community

OCH Receives $70,000 from the City of Ottawa's Energy Evolution Catalyst Projects Program

(OTTAWA) February 21, 2017 – Ottawa Community Housing (OCH) acknowledges the financial support from the City of Ottawa's Energy Evolution… Continue Reading OCH Receives $70,000 from the City of Ottawa's Energy Evolution Catalyst Projects Program

LED Retrofits

This post is also available in: Français (French)

Tree Planting Program

This post is also available in: Français (French)

OCH's Journey Towards Sustainability

Greening OCH began in earnest in 2010 with the hiring of a dedicated resource. The development of the first OCH Green Plan a year later helped channel the organization's efforts to achieve many successes to date. OCH's newly updated plan, the OCH ECO² Plan aims at enhancing and building on an already strong foundation of sustainable practices.

Corporate Initiatives

OCH introduced paperless practices in 2014, including:

- Double-sided printing to reduce paper consumption
- Deployment of tablets and hand-held devices to replace paper and support operational requirements
- Procurement of environmentally-friendly cleaning products for common areas and offices
- Waste diversion and recycling in staff lunchrooms and washrooms

Tenant Awareness

OCH has developed tailored communications plans developed for each green initiative to inform and educate tenants on the benefits and behaviours that support more sustainable communities.

E.g. **Green Corner** in 'The Quarterly' OCH Tenant Newsletter.

Ongoing ECO² Initiatives

- PEER Presland
- Maintenance Vehicle Fleet
- New Developments
- Waste Diversion Program

PEER PRESLAND

Date
Construction on the retrofit began in the spring of 2020.

Highlights/Savings
PEER uses 24, nine-foot by 20-foot panels to create new outer walls for the four townhomes. The homes will also receive a new roof, new windows and a bank of 34-kilowatt solar panels that will produce more energy than the homes use each year. The project will reduce the Presland Avenue townhomes' energy consumption for heating by 90%. The project is a partnership with Natural Resources Canada, read more here.

Maintenance Vehicle Fleet

Date
2012

Highlights/Savings
Introduction of smart cars in the fleet is helping to reduce fuel consumption and emissions.

OCH Build Environment

Date
Ongoing since 2014

Highlights/Savings
Green building technologies and approaches in all new construction are building higher performance homes.

Examples of new builds include:

- Carlington Community (2019)
- Ashgrove expansion (2019)
- Rochester Heights (811 Gladstone) (2020)

Use of heated floor systems, regionally sourced building materials selection, LED lighting, EnergyStar appliances, waste diversion systems, all promoting sustainable and resilient buildings, equal lower costs on maintenance and utilities in the long term.

Waste Diversion Program

Date
Launched in the fall of 2016 in partnership with the City of Ottawa

Highlights/Savings
OCH is encouraging tenants to participate in the green bin program throughout the communities in order to reduce waste to landfill sites. We are setting up infrastructure in communities to provide ease of access to facilitate waste diversion.

If you are interested in bringing the Waste Diversion Program in your community, contact us at info@och.ca

Between the solar panels, home weatherization program, water, windows and door retrofits, OCH has saved

$36M

Results of Completed ECO² Initatives: Case Studies

- Heating Energy Management System Pilot
- Plumbing Retrofit
- Solar Wall
- Weatherization and Air Sealing
- Windows and Balcony Door Replacement

Date

2013

Highlights/Savings

Designed to reduce energy waste, the system was installed in two high-rise buildings. After one year, there was a 31% reduction in the energy consumption while maintaining tenant comfort. This system was deployed in an additional eight buildings and will likely be rolled out to all electricity-heated buildings.

This system is capable of regulating the heating energy allocated to each apartment unit based on several criteria including local outdoor temperature, floor level and orientation.

Click here to read the full case study.



Date
2011-2013

Highlights/Savings
Award-winning retrofit of 15,000 homes with new high efficiency toilets, showerheads, and basin aerators has reduced water consumption by 1.6M cubic meters of water annually. Old fixtures were crushed and distributed for road aggregate; metal and plastic parts were completely recycled.

Ottawa Community Housing (OCH) saw an opportunity to save water and money by retrofitting plumbing fixtures throughout its portfolio. Early analysis suggested that new water-efficient fixtures would use less water, reduce undiagnosed leaks and offer significant cost savings. OCH was also motivated to lower its water consumption to reduce its impact on the environment.

Read the full Plumbing Retrofit Case Study.

Date
2011-2012

Highlights/Savings
Over 1,500 solar photovoltaic panels have been installed in 32 OCH communities. These installations represent over $250,000 of clean electricity or energy conservation annually.

The replacement of 8,500 sq. ft. of brick cladding on the exterior wall at one 17-storey apartment, with a solar wall that preheats air supplied to the building's corridor ventilation, has netted a 21% reduction in natural consumption annually at that property.

The brick cladding at Clementine Towers (1455 Clementine Ave) required replacement to address deficiencies and deterioration. This offered an opportunity for Ottawa Community Housing (OCH) to install an innovative "solar wall" to preheat air supplied to the building's corridor ventilation system. The project reduced energy consumption and operating costs while showcasing green building practices.

Read the full Solar Wall Case Study.

Date
Ongoing since 2012

Highlights/Savings
Participating in Enbridge's 'Home Winterproofing Program', OCH has worked with the EnviroCentre to retrofit uninsulated basements of hundreds of townhomes. In the four largest communities where insulation and sealing was completed in 611 homes, collectively tenants are seeing an estimated annual natural gas savings of $91,000.

Ottawa Community Housing (OCH) had an opportunity to save energy, improve the building conditions and enhance tenant comfort in its townhouse communities by retrofitting uninsulated and poorly sealed basement walls.

Read the full Weatherization and Air Sealing Case Study.

Date
2008-2013

Highlights/Savings
A federal grant enabled OCH to replace windows and doors in nearly 1,300 aging apartments that were in poor condition and experiencing air leakage and water penetration into tenant's homes. This capital repair resulted not only in annual energy savings of up to 14%, it also improved the durability of other building components and, most importantly, it vastly improved resident's comfort by eliminating drafts and water leaks.

Building components are generally expected to perform over a certain service life. As windows and doors age, they become vulnerable to air and water leakage and can pose a deterioration risk for building envelopes and interior finishes. In 2008, a Federal Government grant for social housing energy retrofits provided Ottawa Community Housing (OCH) with the necessary capital to proceed with window and door replacement projects at select buildings.

Read the full Windows and Balcony Door Replacement Case Study.

Partners

OCH's success has been largely due to its partnerships with many important contributors and sustainability-focused organizations such as:

- EnviroCentre
- Enbridge
- EnergyOttawa
- Hydro Ottawa
- City of Ottawa, through its Climate Action Plan
- Federal and provincial programs

The original Green Plan enabled OCH to begin its sustainable transformation through various pilot projects, but also to achieve a state of readiness in order to access generous incentives to make pilot projects even more feasible for social housing providers like us.

In April 2016, OCH was awarded $12.2M in SHARP funding from Ontario's Green Investment Fund to refurbish aging buildings in the portfolio with retrofits such as energy-efficient boilers, insulation and windows. This will enable OCH, as an operator of large social housing buildings constructed in the 1960's and 1970's, to better meet the challenges of climate change.

Awards

2020

- Association of Energy Engineers **Young Energy Professional of the Year for Dan Dicaire**
- Greater Ottawa Home Builders Association **Innovation Award – Green Building of the Year for 1290 Coldrey**

2016

- CLEAN50 Emerging Green Leader Award
- Canadian Housing Renewal Association (CHRA) National Sustainability Award

Table of Contents

1. GENERAL

1.1. Background

Established in 2002, Ottawa Community Housing Corporation ("OCHC") owns, operates and maintains about 15,000 affordable and subsidized residential units in communities across Ottawa. With governance provided by a Board of Directors composed of municipal elected officials as well as community and tenant representatives, OCHC is an independent non-profit corporation that is owned by the City of Ottawa. The housing portfolio consists of townhouses, low rise and high rise apartments, and some single family homes. For more information, visit our website at http://www.OCH-lco.ca.

The head office of OCHC is located at 39 Auriga Drive, Ottawa, Ontario housing the office of the Chief Executive Officer as well as a number of functions, including Community Development, Asset Management, Organizational Effectiveness, Corporate Services, and a Call Centre. There are five (5) tenant experience centres based in two (2) operational zones.

1.2. Introduction

In 2019, OCHC established a 10-Year Development Plan to provide continued support to the affordable housing requirements of the City of Ottawa. Through disposition, renewal and new construction, OCHC will capitally repair, replace and build upon our current rental stock. With a plan of delivering 300 new affordable units annually, OCHC will be bring a range of housing options to the rental market though a mix of townhouses, mid-rise, and high-rise buildings. To sustain this output, year after year, upfront design work will be key to meeting targets.

OCHC's development framework supports the engagement of a prime consultant for each development opportunity. The prime consultant will be responsible to drive the design process, for design coordination and will OCHC's single point of contact. The development framework also supports the retention of a Construction Manager (CM) under a CCDC 5b contract or a General Contractor (GC) under a CCDC 2 contract, to deliver each new project. Depending on the construction procurement methodology and the timing of the projects, CM firms may or may not be engaged during the design preconstruction activities.

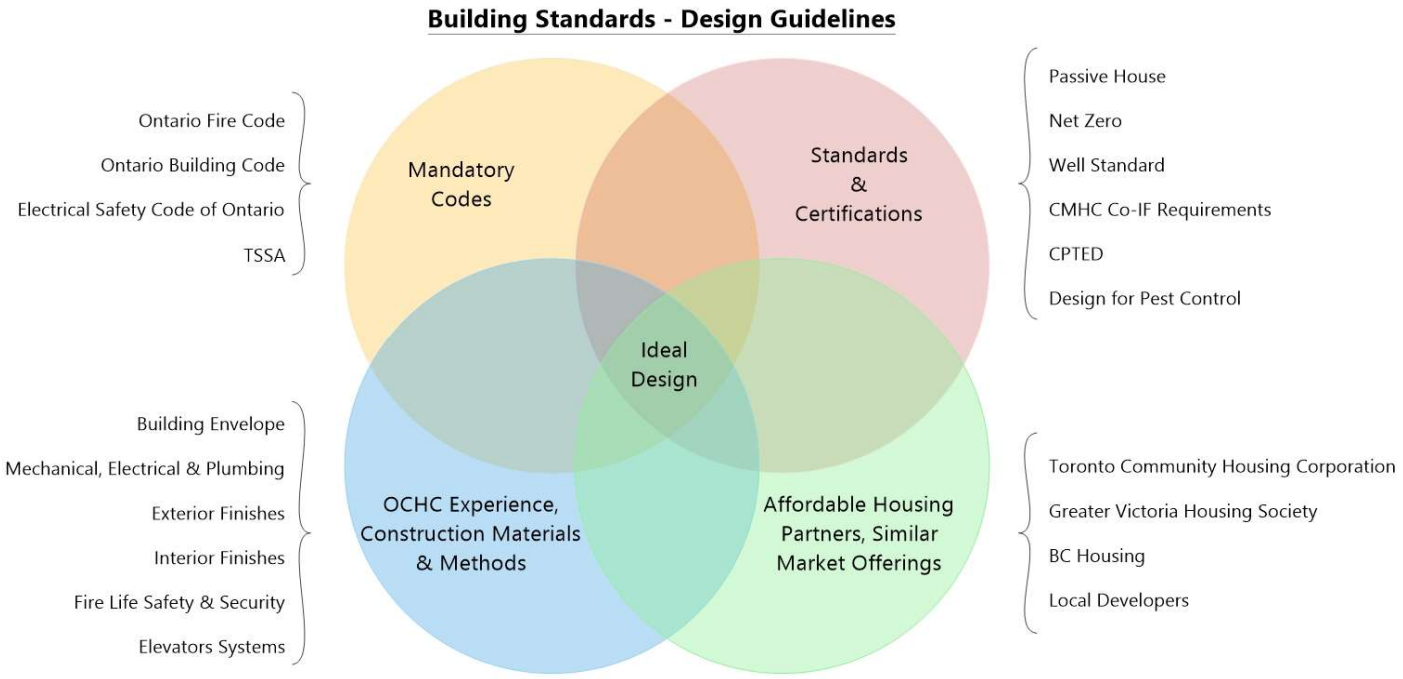
To ensure consistency across design projects and to reduce the levels of effort for all involved, OCHC has developed this Design Guideline to facilitate and expedite the design process. This guideline is an organic document, which OCHC expects will evolve over time with gained experience and as technologies change.

1.3. Guideline Development

OCHC is on track to develop a midmarket rental product that will be functional and maintainable throughout its entire life-cycle. As OCHC employs a long-term hold asset management strategy, the building design, chosen materials, and construction methods are intended to support a targeted building lifespan of 75 years.

These design standards have been developed with consideration to long-term operational efficiency, durability and life-cycle costing, sustainability and energy savings; all with the goal of providing safe and healthy housing that responds to the needs of its tenant community. The resulting longevity of project will allow OCHC to offer a deeper affordability to our residents over time.

The Guidelines are not intended to supersede any applicable codes or regulations of any authority having jurisdiction. All design documents must fully comply with the latest applicable laws, including, but not limited to building, electrical, plumbing, TSSA, and fire codes. These codes notwithstanding, OCHC has adopted a number of standards that will drive certain design decisions, together with specific requirements and restrictions imposed by contribution agreements. These requirements must be reviewed, combined and balanced with OCHC's proven experience with methods of construction and materials, to provide an optimal design.



1.4. Application of the Guideline

OCHC expects the design team to take all applicable aspects of this guideline into account during the design process, however incorporating every component may not be possible. Where the design is required to deviate from this guideline, it is important to record decisions and document the details leading to the change, as a number of the requirements are tied to funding agreements.

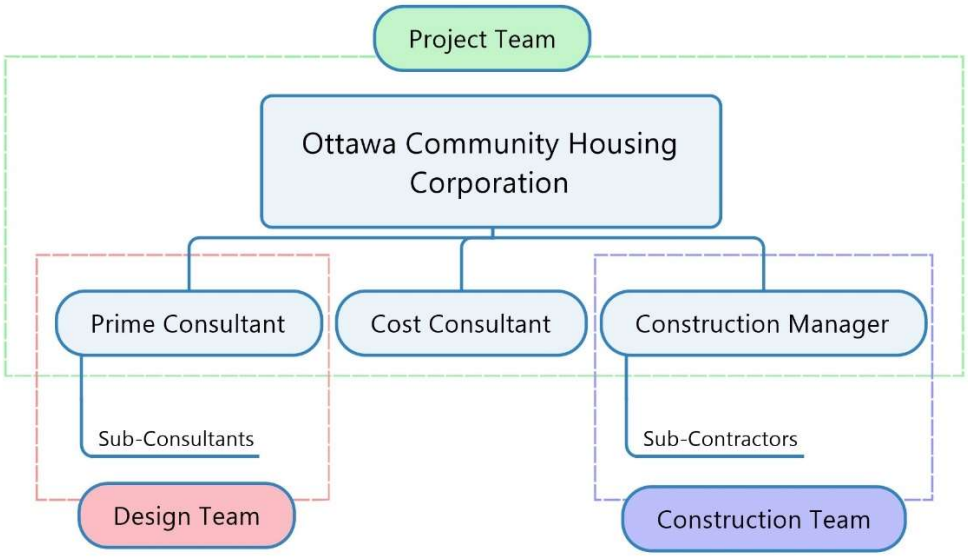
Any specific products named in this document are not to be taken as OCHC's endorsement of that product, but rather as an example of a standard of quality that has proven successful in the past. OCHC will consider other products that meet the same level of quality, but their use is not to proceed without prior discussion and acceptance.

2. DESIGN PROCESS

To facilitate successful project development, it is important that the project team be engaged at the start of a project to work collaboratively to meet OCHC's requirements and budget. An integrated approach to building design seeks to attain high performance on a wide variety of specific environmental and social goals while staying within budgetary and scheduling limitations. The specific phases associated with the process are directly related to the project's design intent.

In addition to extensive collaboration, integrated design involves a "whole building design" approach as opposed to an accumulation of separate components (site, structure, systems, and use). The goal of

looking at all systems together is to make sure that they all work in harmony with each other. An effective integrated design approach can ensure that the project team incorporates the needs of OCHC, based on our concerns, function, and operational requirements. Also, this kind of process can ensure information is shared on daily operations such as who will be performing regular maintenance and what their level of expertise is and what training will be required. This process also minimizes costs, as changes that are needed can be addressed earlier in the development process. An integrated design approach is an OCHC requirement for all projects.



2.1. Pre-Design

The earliest stages of design represent an opportunity to set goals, objectives and the overall direction for a project. OCHC will outline requirements and concerns to ensure the design team understands the project needs and necessities. Design Team will develop Concept Design options. A Class D, Opinion of Probable Cost will be developed at this stage and issued with the finalized concept.

2.2. Schematic Design

In the Schematic Design phase the Design Team will develop the chosen Concept Design. The project team will investigate options and innovative solutions that will help the project to optimize the design for the site and meet operational needs within the project budget. Evaluation of options and solutions should be as holistic and life-cycle based as possible, taking into account the particulars of the opportunities especially the passive design strategies and constraints unique to the project. A Class C, Opinion of Probable Cost will be developed at this stage and will be delivered concurrently with the schematic design submission.

2.3. Design Development

The optimized schematic design will be finalized in the Design Development phase of design. Design review will confirm alignment with project objectives and OCHC Design Standards. In addition, a final analysis of options should be conducted with input from the whole project team and presented to OCHC for approval. The design development documents, drawings and other documents will describe the size and character of the Project including, as appropriate, the architectural, structural, mechanical, electrical and sustainability systems, materials and such other elements. A Class B, Opinion of Probable

Cost will be developed at this stage and will be delivered concurrently with the design development documents.

2.4. Construction Documentation

The project team shall ensure that the concerns raised during earlier phases are addressed in detail in the construction documents. At 50% CD a formal review of the design against the OCHC Design Standards shall be performed in addition to a general review to confirm that the integration achieved earlier is maintained, within budget and schedule constraints. Design reviews will occur at 33%, 50% and 95% (permit) and 100% (tender) completion. A Class A, Opinion of Probable Cost will be developed at this stage and will be delivered concurrently with the 100% review documents.

2.5. Bidding, Construction and Commissioning

The design team shall make sure that knowledge and information about both the goals of the project team and the operating requirements of the building must be passed from design team to the construction team to the operating team.

Full scale mock ups shall be constructed as early as is feasible for OCHC review and approval of interior finishes for accessible suites and amenity spaces, as well as any other assemblies considered appropriate by the project team.

Effective communication through regular site meetings, drawing reviews, site inspections/reports, proper scheduling, qualified workmanship, commissioning and training shall be integral part in this phase. Where construction is being conducted in larger OCHC communities, a thorough and regular communication strategy will be implemented throughout the project lifecycle and will require input from the project team. Ensuring that project scheduling and execution minimizes disruption and annoyance for the community, as well as a means of soliciting and following through on feedback is required.

2.6. Post Construction

The design and construction team ensures that deficiency items follow up, closeout documentations, commissioning activities and building handover tasks are taken into account. All project team members bear some responsibility for these activities.

2.7. Post Occupancy

Once the building is occupied and complete, integration and the process are still continued through the maintenance and operation activities. Operational and maintenance data for all equipment and systems will be retained and compared to the commissioning data to confirm operating performance is as intended. Those that do not meet performance will be identified to the Project Team for review and correction during the warranty period.

At OCHC's discretion, the Project Team may be required to partake in a Lessons Learned exercise to identify opportunities for improvement of processes and standards of design.

3. SUSTAINABILITY GUIDELINES

In 2020, the City of Ottawa adopted its Climate Change Master plan setting a goal of eliminating GHG emissions from its operation by 2040 and from the city as a whole by 2050.

In general, OCHC applies a long-term hold strategy to the assets within their portfolio and therefore our newly constructed buildings will intersect with this initiative. As a subsidiary of the City of Ottawa, all new developments shall be designed with those targets in mind.

3.1. Incentive Programs

It is OCHC's intention to maximize the funding for all new development. An important portion of this is to investigate potential grant or incentive programs being offered by government (municipal, provincial or federal), utilities (Enbridge or HydroOttawa) as well as programs offered by/through various partner organizations (Federation of Canadian Municipalities, Canada Mortgage and Housing Corporation, etc). Design teams participating in OCHC new development should familiarize themselves with the grant and incentive programs offered when a new project begins and include the necessary time and resources to apply to these programs with their schedule and fees.

3.2. Energy Performance Target for Buildings

Projects will be constructed to achieve a minimum 55% decrease in energy consumption and a minimum decrease of 55% in greenhouse gas emissions relative to an equivalent building designed to the requirements of the National Energy Code of Canada for Buildings 2015 (NECCB 2015).

An energy budget shall be developed at the beginning of schematic design for the project based on NECCB 2015 and, revised and resubmitted at the end of each design phase (schematic, design development and construction) to ensure compliance.

3.3. Passive House

All new OCHC development will be built to meet the performance of the Passive House Standard. Either Passive House International (PHI) or Passive House Institute US (PHIUS) are acceptable; OCHC has found the PHIUS approach to be more flexible and better suited to our Ottawa climate. Although the development may not seek formal certification from PHI or PHIUS, all documentations required for certification, all energy modeling (high level energy budget, PHPP, dynamic modeling) and thermal bridging calculations required to support design and for certification and all testing pre/post construction testing required to meet certification will be included in the project.

The design team will include a Passive House Designer/Advisor/Champion role responsible for ensuring that the design of the building will achieve the required metrics. This role will be a liaison between the Design Team and the Construction Manager/General Contractor and the trades so that the intricacies of the PH design are well understood and implemented. The role will assist the QAQC team in ensuring that they know what level of quality is needed to maintain the PH design during their QAQC activities on the project. The role will create the PH commissioning process for the project, outlining the testing and commissioning required under the PH standard, and interface with the Mechanical/electrical commissioning team to identify overlap and synergies between the two commissioning/testing procedures so there is no double work. The testing unique to Passive House will be scoped. This role will interface with the 3rd party PH Verifier to ensure the design meets the standard. If seeking certification, this role will ensure the required documentation is submitted and completed.

OCHC is actively designing extreme climate resiliency into our buildings and therefore mandates designers to include the capacity in the mechanical system to provide the cooling to eliminate the allowable 10% of hours above 25°C under the passive house requirement.

3.4. Solar Arrays

All new OCHC developments will have solar arrays as part of their design. This includes townhomes, mid-rise and high-rise designs. The building design will maximize roof space and building orientation to accommodate the optimal solar generation for the site. Consider the roofing layout together with the mechanical and elevator penthouse locations to minimize un-necessary shadows on the roof. The solar array will be connected to the common load of the building in a net-metering configuration.

The design team will:

- optimize the design for the best solar generation on site,
- model the generation of the selected option to provide the energy model with the anticipated on site generation,
- produce a solar system design to incorporate the array into the building's electrical system,
- produce specs to be tendered by the Construction Manager/General Contractor,
- review submission and inspect the construction of the array.

3.5. Net Zero

As part of the Design Development phase, the feasibility of achieving net-zero GHG emission on the development should be evaluated. If OCHC and the design team decide not to pursue net-zero GHG emissions for the development, strategies for future conversion should be factors in the end design.

3.6. District Energy Systems

OCHC believes the best way to achieve both the mandatory requirements and the aspirational goals noted above is through a district energy system. This may look like a geothermal solution serving multiple buildings in a development or through connection to an existing (or future) district energy system.

OCHC expects the design team to use the energy budget to explore these options during schematic design and support OCHC in engaging with district energy or geothermal providers.

4. HEALTH and WELLNESS CONSIDERATION

OCH is committed to promoting health and wellness within its developments. The WELL Building Standard is rapidly setting the bar for creating healthy building and the design team should familiarize itself with its concepts. During the design development phase, the design team should evaluate the feasibility of incorporating WELL building standard elements into the development. Particular attention should be paid to incorporating the following elements of the WELL Building Standard:

- All pre-requisites,
- 19 Operable windows,
- 20 Outdoor Air System,
- 24 Combustion Minimization,
- 27 Antimicrobial Activity for Surfaces,
- 28 Cleanable Environment,
- 50 Food Storage,
- 51 Food Production,
- 58 Colour Quality,
- 59 Surface Design,

- 61 Right to Light,
- 64 Interior Fitness Circulation,
- 67 Exterior Active design

5. GENERAL BUILDING REQUIREMENTS

5.1. Space Considerations

A Functional Program shall be prepared by the project team to confirm the space requirements of OCHC and other user groups when partnerships are formed, to confirm the efficiency of the building design. The Functional Program is to be submitted to OCHC and partners, where applicable, for approval at the Schematic Design Stage.

5.2. Accessible Design and Adaptability

5.2.1. Accessible Design Requirements - External

Confirm with OCHC representative if the funding stream for the project includes requirements for a specific ratio or number of accessible or barrier free units. Site specific accessibility design criteria will be provided for each project.

5.2.2. Accessible Design Requirements - Internal

Beyond the requirements of the applicable funding program, OCHC requires all units be visitable, where feasible. Additional “Elements of Accessibility” have been identified throughout this guide for consideration.

5.2.3. Visitability

Visitability refers to a design strategy that aims to provide basic access to a home through three key design elements:

- Level entry and clear space at entrance area;
- Wider doors and accessible routes throughout the entrance level; and
- A washroom on the same level as the accessible entrance.

Visitability does not refer to the creation of barrier-free / fully accessible units, but rather, it provides considerations for basic access and adaptability. Through the use of minimal adjustments, visitable housing makes communities more livable for people with physical disabilities, those who use mobility aids, and seniors by providing options to age in place.

5.2.4. Adaptability

All units which are not fully accessible should consider the following measures for future adaptability.

- Wherever possible, cabinets under kitchen and bathroom sinks should be easily removed to allow future adaptability for wheelchair users.
- Waste pipes in bathroom and kitchen sinks shall be roughed into the wall to facilitate future lowering of the countertops when converting to a wheelchair accessible unit.

5.3. Common Spaces

5.3.1. General

Common areas for buildings consist of:

- Administration and Program Support Services,
- Indoor amenity spaces for tenants' use,
- Common Area Service Areas,
- Operational Service Areas,
- Circulation and Access,
- Outdoor Spaces for recreation and services
    - Provision for these spaces will depend on program objectives, the level of support services to be provided for the tenants, project size, location and budget parameters.
- Common areas to include Elements of Accessibility

5.3.2. Administration and Program Support Services

Where OCHC partners with a 3rd party service provider, their operational and functional programs will be provided such that the administration and program support services spaces can be programmed and designed.

5.3.3. Indoor Amenity Space

Amenity spaces are an important part of developments, providing space for meetings and social gatherings and should be designed to offer tenants the option for social interaction and to encourage a sense of community within the project. They are to be designed for use as a refuge area in emergency.

Site specific area requirements will be determined by Authorities Having Jurisdiction, however OCHC will assess the individual building's needs with the Design Team.

The space should be centrally located and adjacent to outdoor common space. It should ideally be at grade but in multi-storey urban buildings this may not be possible. Below grade amenity spaces are not acceptable. It is desirable to cluster the amenity space with other common facilities such as the laundry and project office.

For projects with multiple bedroom units, the amenity space should be located adjacent to the children's play area (where applicable) with clear view and access.

Amenity areas to have particular heavy duty finishes (flooring, abuse resistant drywall, corner protection, laminates, etc.) throughout.

Where feasible, provide amenity spaces with independent heating, cooling, and emergency backup power.

A typical amenity space shall consist of the following adjacent functions:

- multi-purpose room
- kitchenette
- universal toilet room(s)
- general storage room
- Elements of Accessibility

5.3.3.1. Multipurpose Room

The size of the multipurpose room shall, at a minimum be in accordance with the requirements of the Authorities Having Jurisdiction. The universal toilet room and amenity kitchenette should be adjacent to the multi-purpose room. In addition, the multipurpose room should feature:

- Considerations for A/V – Confirm with OCHC
- Considerations for Elements of Accessibility
- Coat closet

5.3.3.2. Kitchenette

The typical amenity kitchenette is not intended to be used for commercial cooking purposes and is to be fully accessible, where possible. Typical minimum inclusions:

- A preference for 4875mm (16'-0") of linear countertop where possible, in configurations which allow for multiple simultaneous users
- a double bowl stainless steel sink
- a 15.0 ft^3 refrigerator (bottom freezer), ENERGY STAR® rated
- microwave outlet and shelf
- Countertops to be ¾" thick Quartz with suede finish. All exposed edges to be straight beveled
- Cabinetry to be custom made with ¾" Baltic Birch Plywood with 25% clear lacquer finish.
- Cupboard doors to have 180-degree Euro-style hinges where possible and drawers to have soft-close full extension slides.
- Cabinet pulls to be steel with brushed satin nickel finish
- Design shall avoid the necessity for a commercial kitchen exhaust and fire suppression system. However, if the intent is to provide a small scale commercial kitchen as a local social enterprise amenity, consider its provision in a separate, lockable space so as to allow for casual use of a separate kitchenette. It is recommended that a commercial kitchen designer be engaged early in the design process to advise on space and other system requirements for a commercial kitchen suited to the scale of the project. When considered, a commercial kitchen must have operational funding and be fully accessible. In all cases, avoid the provision of a deep fryer, walk-in-cooler and walk-in-freezer.

5.3.3.3. Universal Toilet Room

Preference for two but a minimum of one universal toilet room shall be provided adjacent to the main lobby, and on each floor where a common amenity space is provided. This shall be designed to the requirements of the OBC and consider Elements of Accessibility.

Common area fixtures shall align with unit fixture requirements.

5.3.3.4. Storage Room in Amenity Space

- Storage for stacking tables and chairs
- Utility shelving for program related storage
- Double door, unencumbered access

5.3.3.5. Elements of Accessibility

Review the various Elements of Accessibility identified throughout this guide and incorporate those applicable, if feasible.

5.3.4. Common Area Service Spaces

5.3.4.1. Laundry Facilities

Current OCHC sites typically provide common laundry amenities for its tenant through a 3rd party service provider contract. It is OCHC's preference that the building be designed to allow the use of typical laundry fixtures provided by the service provider. Attention shall be given to the service clearances required at the back of the laundry equipment.

Note that the laundry room will require additional considerations on the Passive House design, which have been incorporated in previous Passive House buildings.

- Common laundry facilities shall be located above grade level.
- Common Laundry Rooms should be planned to serve as informal meeting space, with sightlines providing passive security over entrance lobbies, child play areas, courtyards, etc.
- Access card c/w integrated automatic door opener,
- Security camera,
- Cashless systems (typically provided by through the 3rd party service provider),
- Provide laundry sink,
- Provide countertops/folding surfaces,
- Provide space for seating, c/w appropriate fixturing.

Elements of Accessibility

- Accommodate larger mobility devices.
- Accessible height sinks, and folding tables.
- Accessible routes providing access to all amenities.

5.3.4.2. Garbage & Recycling

New builds will not have garbage chutes. All buildings will have accessible waste sorting rooms that are open and inviting to encourage waste diversion. Consider material movement during design by situating the sorting room adjacent to, but separate from the garbage front end loading ("FEL") bins room by a door in order to keep the sorting room for tenant comfortable and inviting and free of smells. In the sorting room, small organics collection bins and recycling bins can feed into larger bins on the other side of the wall. Developments must accommodate ample space for Garbage, Glass/Metal/Plastic ("GMP"), Fibre Recycling and Organics diversion.

- Items for Consideration
  - Odour control by means of mechanical ventilation and cooling for bulk waste storage area.
  - Walls of bulk storage area to be of durable construction, reinforced as required to resist impact, wear and tear from heavy equipment.
  - Floors to be poured concrete with slip resistant, epoxy finish, sloped to drain(s).

    - Hose bib with hot and cold water in bulk waste storage areas.
- Elements of Accessibility for Consideration
    - Garbage rooms are configured to accommodate larger wheelchairs and other types of mobility devices.
    - Garbage room doors are equipped with a automatic door operator.
    - Provide kickplates on all doors, both sides.

In-suite waste diversion shall include, at a minimum, three streams; GMP/Fibre, Garbage and Organics. To facilitate, each unit will be equipped with:

- under-sink mounted organic collection container (specific container to be provided by the City of Ottawa);
- free-standing (or built-in) collection cabinet to house removable containers for recycling (GMP/fibre) and garbage.

5.3.4.3. Canada Post Mailroom

- https://www.canadapost.ca/cpo/mr/assets/pdf/business/standardsmanual_en.pdf
- Mailroom access from building interior to support passive house design.
- Refer to Building Technology for parcel delivery systems.
- Elements of Accessibility
    - A cupped, 200 mm (8 in.) wide shelf will be installed directly below and the full length of the mailbox system to stop mail from dropping to floor. The shelf to be capable of bearing a 136 kg. (300 lb.) weight.
    - Where a separate mailroom is provided, doors shall be equipped with a power door operator.

5.3.4.4. Tenant Storage

Provide options for either in-suite storage or common locker storage area.

- Elements of Accessibility:
    - Lockers are configured to accommodate larger wheelchairs and other types of mobility devices.
    - 10% of total number of lockers, but never less than 1, are accessible.
    - The number of accessible lockers provided must never be less than the number of accessible dwelling units within the building.
    - Locking mechanism is easily operable and mounted at an accessible height.
    - Lockers are accessible, visible and usable

5.3.4.5. Scooter Storage Room

- Consider providing space for scooter storage. Could be combined with bicycle storage. Size requirement will changed depending on expected occupancy type.
- Card access & camera
- Electrical for charging

5.3.5. Operational Service Areas

5.3.5.1. Operations Space - Front of House

Consider including an on-site office

5.3.5.2. Janitor's Rooms and Operations Storage

Identify a location that allows for janitor space and operations storage to alternate on each floor. Janitor's room should commence on the ground floor.

Each janitor shall include a floor sink, wall mounted faucet, extraction fan, space for storing bucket, mops, brooms, vacuum, etc. Consider a larger janitor's room on ground floor to allow for ladder, supplies for cleaning, shelves for paper/supply products, etc.

In addition to the above-noted Operations Storage, where space and budget allows, consider providing ground floor storage, that is an insulated, heated, finished space for maintenance and general building storage, appropriate to the requirements of the project, ideally with direct access to the exterior for garden and lawn maintenance equipment. Allow space for storage of emergency supplies.

5.3.5.3. Provisions to Facilitate Move-in/Bulk Deliveries

- Consider provisions that can facilitate move-in and delivery of large materials.
- Ideally, loading area to accommodate a moving/delivery truck without blocking vehicular circulation.

5.3.5.4. Mechanical & Electrical Rooms

Ensure that the mechanical and electrical rooms are located as close as possible to the entry point for utilities. Locate for efficient distribution, including space and access for servicing.

Mechanical and electrical rooms shall have a sufficient access path to allow for the removal of the largest piece of equipment without disassembly of the equipment.

Where air handing equipment is located outside on roofs or decks, engage an acoustic consultant to recommend mitigation measures to prevent noise transmission both internally within the building and to the neighbouring area. Wherever possible mechanical equipment should be located in climate controlled mechanical rooms with sufficient space for maintenance, including replacement of filters, and heating and cooling coils.

Weather-tightness is required for all construction surrounding mechanical, electrical, or water vulnerable equipment if the room is located below grade. Mechanical and electrical room, switchgear or panel must be located above a Flood Construction Level (FCL).

All mechanical rooms shall be equipped with adequately primed floor drains located in proximity to those pieces of equipment most likely to leak or require draining for servicing or replacement. Slope floors to drains.

Mechanical room floors are to be finished with a waterproof flooring (unless slab-on-grade) such as an epoxy coating, or as otherwise noted in Section 7.4.3. All mechanical rooms on suspended slabs shall be watertight.

All floor mounted equipment is to be placed on 100mm reinforced concrete housekeeping pads and all floor penetrations to be sleeved with cast-in-place schedule 40 steel pipe sleeves, extending 25mm above the sealed floor and all duct and pipe penetrations enveloped in 100mm high concrete curbs. Sleeves to be insulated and caulked as part of or in addition to fire stopping

Mechanical room door width must be 915mm (36") at a minimum, 1015mm to 1067mm (40"to 42") is preferred. Notwithstanding the foregoing, door widths must consider equipment maintenance and replacement.

5.3.6. Circulation and Building Access

5.3.6.1. Building entrances/Waiting/Lobby Areas

- Where possible, include a covered area above the front entrance.
- Provide comfortable, well-lit areas for tenants to sit, socialize and wait for vehicular pick-up.
- Seating/waiting area to accommodate persons with mobility devices.
- Clear sightlines to the vehicular entrance and arrival area.
- Areas around elevators should have additional space to accommodate mobility devices.
- Provide abuse-resistant drywall to minimum 2440 mm (4’-0”) above finished floor;
- Provide full-height stainless steel corner guards throughout (ensure no sharp edges or corners);
- Provide automatic door opening devices on all amenity space, washroom, entrance vestibules.

5.3.6.2. Elevator Lobbies

- Location of ground floor elevator should be visible from main entrance.
- The size of the main elevator lobby area must allow for the loading, unloading and queuing of passengers and other goods or materials (such as furniture) that will be transported.
- stainless steel corner guards on all outside corners of the elevator lobby
- Provide glazed, lockable, notice boards, mounted at a height to promote access to information.
- Provisions for Engagement Screens at the ground floor elevator lobby.

5.3.6.3. Corridors

- Stainless corner guards in high traffic or high risk areas.
- Kick plates installed on both sides of door, extending the full width of door, to a height of 30” (762mm) AFF.
- Minimize corners in Seniors’ buildings (scooter maneuverability & impact).
- Consider shorter corridor length in Seniors’ buildings.

5.3.6.4. Stairwells

- Natural light, where possible.
- Primary stair location to promote stair usage.
- Size difference for primary stairwell.
- Refer to Well Standards.
- Convex mirrors at each stair landing to increase security.

6. DWELLING UNIT DESIGN

6.1. Unit Sizes

OCHC aims to strike a balance in unit size between rent-ability (larger) and financial feasibility (smaller), with the understanding the unit size decision on may be determined by the terms and conditions of our funding partners. At a minimum, unit sizes to be 15% above the OBC size requirements.

Design team to provide drawings of proposed units which show possible furniture arrangements in all living areas at schematic design stage. Bedrooms should show possible bed sizes, accessible space on either side. Living and dining areas should provide enough seating for the number of tenants living in the household.

6.2. Living – Dining Areas

6.2.1. Suite Entrance

- Provide a defined, primary entrance area to the suite.
- Provide a clothes closet close to the entrance. See Entry Clothes Closet below.

6.2.2. Living Area

Living areas should be designed to provide for seating capacities in accordance with the requirements noted below. Seating capacity may be provided by any reasonable combination of sofas, love seats and armchairs. Confirm with furniture plan.

Unit Type	Living Area Seating Capacity
Studio Units	3
One Bedroom Units	4
Two Bedroom Units	5
Three Bedroom Units	6
Four Bedroom Units	8
Five Bedroom Units	10

For accessible and adaptable units, target a minimum corridor width of 1067mm (3'-6").

Suggested furniture layouts should be coordinated with baseboard heater and forced air vent locations as appropriate.

6.2.3. Dining Area

Dining areas should be designed to provide for seating capacities in accordance with the requirements noted below.

Unit Type	Living Area Seating Capacity
Studio Units	3
One Bedroom Units	4
Two Bedroom Units	4
Three Bedroom Units	6
Four Bedroom Units	8
Five Bedroom Units	10

6.3. Bedrooms

6.3.1. General

- Locate bedrooms and sleeping areas so that they are visually separated from the unit entrance.
- Avoid furniture layout conflicts with baseboard heaters and supply vents.
- Locate doors so that they are able to open a full 110 degrees.
- Allow access to both sides and the foot of all beds.
- Avoid possible conflict between the placement of beds and access to the clothes closet.
- Consider minimizing corridors by accessing bedrooms off of living space.

6.4. Bedroom Closets

- Minimum required clothes closet depth is 610 mm (2’-0”); minimum width is 1220 mm (4’-0”)
- Rods – use 1.25” EMT conduit
- Provide shelving above rod.
- Use hollow core flat door slabs on robust, commercial grade slider hardware.

6.4.1. Elements of Accessibility

- Closest are located on an accessible route.
- Closet doors are accessible.
- Two rods are provided within closets, positioned at different heights.

6.5. Linen Closet

Provide linen storage with four adjustable shelves in a location readily accessible to the main bathroom and bedrooms and according to the following:

- studio apartments: none required;
- 1 & 2-bedroom units: may be built into the master bedroom clothes closet provided that the closet width is min. 1830 mm (6’-0”) wide; and
- 3, 4, and 5-bedroom units: provide a separate linen closet with a hinged door.

6.6. Entry Clothes Closet

- Minimum required clothes closet depth is 610 mm (2’-0”); minimum width is 1220 mm (4’-0”)
- Rods – use 1.25” EMT conduit
- Provide 300 mm (1'-0") deep shelf above rod.
- Consider the available space at the entry when specifying the door type/swing/etc.

6.7. In-Suite Laundry Facilities

- Provide in-suite laundry to all units, two bedroom in size and above.
- If the building design includes in-suite laundry fixtures for the tenants, residential grade heat pump dryers may be considered.

6.8. In-Suite Storage

6.8.1. General Storage

OCHC prefers common area storage lockers. Where this isn't possible due to building configuration, provide additional in-suite storage rooms for general household items as outlined in the table below.

	Min. Required Area	
Suite Type	m^2	ft^2
Studio	N/A	N/A
1 Bdrm	1.9	20
2Bdrm	1.9	20
3Bdrm	2.3	25
4Bdrm	2.3	25
5Bdrm	2.8	30

Provide three 300 mm (1'-0") deep adjustable shelves along the entire length of the longest wall of all in-suite storage areas.

6.9. Bathrooms

6.9.1. General

Provide full (3-piece) bathrooms as follows:

Studio	1 bathroom	1st bathroom – provide bathtub c/w shower fixture
1- Bedroom	1 bathroom	1st bathroom – provide bathtub c/w shower fixture
2-Bedrooms	1.5 bathrooms	1st bathroom – provide bathtub c/w shower fixture ½ bathroom – pedestal sink + toilet. no bath/shower
3-Bedrooms	2 bathrooms	1st bathroom – provide bathtub c/w shower fixture 2nd bathroom – provide shower
4-Bedrooms	2 bathrooms	1st bathroom – provide bathtub c/w shower fixture 2nd bathroom – provide shower
5-Bedrooms	2.5 or 3 bathrooms	1st bathroom – provide bathtub c/w shower fixture 2nd bathroom – provide bathtub c/w shower fixture 3rd bathroom – provide shower

- The location of bathrooms and powder rooms should address the need for visual and acoustical privacy.
- Bathrooms and powder rooms should be accessible from a common hallway. No ensuites.
- Ensure adequate wood blocking behind all bathroom accessories
- Moisture / mould resistant drywall to be installed on all walls and ceiling.
- In Passive House projects, incorporate bathroom exhaust into overall mechanical design.
- Do not locate pipe spaces at exterior walls or in party walls.
- Waste pipes in bathroom and kitchen sinks roughed into the wall no higher than 355mm (14") from floor level to the centre of the pipe in order to facilitate future lowering of the countertops when converting to a wheelchair-accessible unit.

6.9.2. Cabinetry

- Pre-fabricated vanity assembly complete with counters or similarly construction to kitchen cabinetry.
- Vanity to accept top-mount sink.
- No vanity required in ½ bathrooms/powder rooms – use pedestal sink.

6.9.3. Accessible Showers

Where required, provide Accessible Showers that include the following:

- a level transition to allow ease of access using mobility devices.
- a handheld showerhead having a flowrate of no grater than 1.5gpm c/w a hose at least 1800 mm (71 in.) long;
- showerhead mounding heights to be vertically adjustable between 1200 and 2030 mm (47 1/4 – 80 in.) from the floor;
- the showerhead and the mounting hardware shall not obstruct the grab bars;
- Shower controls middle of back wall of shower stall, reachable from a seated position.
- Doors or curtains for shower stalls shall not obstruct the controls or the transfer space.
- Walls at accessible shower stalls shall be structurally reinforced to allow the installation of a fold-up shower seat on either end of the shower stall.
- ensure adequate wood blocking behind all bathroom accessories and grab bar locations

6.10. Kitchens

6.10.1. General

The kitchen should be located adjacent to or connect directly with the dining area. Linear kitchens are preferable, however provide options for alternate layouts.

Standardize the kitchen designs as much as possible so as to provide as few different types as practical throughout the building.

Provide a drain clean-out with lockable access panel in kitchens at every floor.

6.10.2. Kitchen Design

- Cabinetry to be custom made with 25% clear lacquer finish ½” Baltic Birch Plywood with “eased” edges.
- Cupboard doors to have 180-degree Euro-style hinges where possible and drawers to have soft-close full extension slides.
- In units sized 2-bedrooms and above, ensure cabinetry will be able to accept the proper installation of a standard dishwasher (24” wide). Location to be adjacent to the sink to allow proper supply and drain connections. The decision to include a dishwasher will be made project to project.
- In all cases, regardless if a dishwasher is included, ensure sufficient counter space adjacent to the sink to allow for a full-size drying rack.
- Each base cabinet shall have one intermediate, fully adjustable shelf.
- All base corner cabinets shall have full height doors with a minimum clear opening width of 305mm (12").
- Inaccessible corners are not acceptable.
- Provide D- pull handles which are easily graspable.

- Provide for a microwave shelf and outlet or allow for counter space for a microwave oven.
- Wherever possible, cabinets under kitchen and bathroom sinks should be easily removed to allow future adaptability for wheelchair users.
- Upper cabinets to be mounted on wood blocking as required for adequate support;
- Full-depth (610mm, 2'-0") cabinet above the fridge;
- Broom closet cabinet min 12" width; height of fridge
- Formica square edge counters c/w 4" high plastic laminate upturn.
- Previously, OCHC has not provided backsplashes. Consider the current mid-market offering and determine if porcelain or ceramic tile backsplash above counters and behind stove for full height of wall are appropriate.
- Moisture resistant substrate for countertops – avoid butt and mitre joints and seal with clear silicone where unavoidable
- Provide 4-bin pull out compartment for Garbage, Glass/Metal/Plastic ("GMP"), Fibre Recycling and Organics diversion under the kitchen sink.
- Drain clean out with key lockable access panel within kitchen cabinetry.
- All material and assembly joints on wet surfaces to be sealed with clear mildew resistant sealant with 6mm (1/4") bead

6.10.3. Special Needs Accessible

- Cabinetry in Special Needs Accessible apartment units to comply with CSA standard B651-12 "Accessible Design for the Built Environment"

7. INTERIORS

7.1. Elements of Accessibility

- Hardware is operable by everyone.
- Hardware is reachable from a standing and seated position.
- Location of hardware is emphasized through use of distinct colour contrast.
- Baseboards to be painted with distinct colour providing contrast to cabinetry, flooring and walls.
- Accommodate larger mobility devices.
- Accessible height sinks, and folding tables.
- Accessible routes providing access to all amenities.

7.2. Pest and Odour Migration

Follow best current practice in the design and construction to prevent the spread of bedbugs, other pests and odours. Use the following approach including:

- Provide additional caulking around all perimeter walls of every unit to reduce the ability of bugs to travel between units.
- Consider installing diatomaceous (silica-based) earth between units. Engage in a conversation with OCHC on alternatives and associated pros and cons.
- Caulk, foam, seal, paint and otherwise fill any cracks and holes in the walls (between units and corridors), ceilings and floors. The same protection should be provided between rooms within a unit.
- During construction, keep the site and particularly open wall cavities clean. Be alert for any evidence of animal/pests and take immediate action to eliminate.

- Install hard wood floors (wood, tile, linoleum, etc) instead of carpets or rugs.
- Seal all through-slab penetrations, including those in piping and duct shafts.

7.3. Flooring – In-Units

7.3.1. In-Units - Living Spaces, Bedrooms, Hallways, Kitchens

Acceptable products include:

- Luxury vinyl tile
- Engineered hardwood
- Polished concrete
- Provide appropriate sound attenuating underlay

7.3.2. Bathrooms

Acceptable products include:

- Sheet vinyl resilient non-slip; or
- Non- slip porcelain floor tile

7.3.3. Unit Baseboards and Casings

Acceptable finishes include:

- 1”x6” finger jointed pine baseboards
- 1”x3” finger jointed pine casings
- Caulked at floor and wall
- Baseboard to be continuous at closet doors without a gap so that sliding doors can stop at the baseboard and protect drywall finish. This also allows for a continuous seal of the base to the floor.

7.4. Flooring – Common and Service Areas

7.4.1. Entry & Ground Floor Corridors/Elevator Lobby

- Solid Porcelain Tile including base trim. May transition to typical corridor flooring where practical.
- Review Elements of Accessibility

7.4.1. Corridors

- Solid Vinyl Tile,

7.4.2. Laundry Facilities

- Solid Vinyl Composition Tile,

7.4.3. Mechanical and Service Spaces

Acceptable finishes include:

- 2-part textured epoxy finish
- Enamel painted finish

7.4.4. Baseboards

Acceptable finishes include:

- vinyl floors: 25mm x 150mm (1” x 6”) finger jointed pine
- porcelain tile floors: 100mm (4”) porcelain tile
- other floors: 100mm (4”) vinyl

7.5. Stairs in Dwellings

- Stair stringers to be solid wood (closed both sides) – paint/stain grade to be determined.
- Treads to be plywood to receive LVT flooring, completed with nosing.
- Paint/stain grade plywood risers acceptable.
- Wood species to be determined for stain finishes.
- Natural or stained oak or maple handrails.
- Pickets to be paint/stain grade or metal, mounted on top of closed stringer to facilitate flooring replacement without cutting around obstructions.

7.6. Wall Finishes In-Units

- Kitchens, bathrooms, and laundry walls to be G5 (Semi-Gloss).
- All other walls to be G3 (Eggshell)
- Painted doors, frames and trim to be G5 (Semi-Gloss)
- G1 (Flat) and G2 (Matte) finishes are not acceptable for any areas other than ceilings.
- All other surfaces to be either G5 (Semi-Gloss), G4 (Satin), or G3 (Eggshell) (Confirm with OCHC)
- Engage in conversation with OCHC if there is a desire to leverage our Dulux supply relationship.

7.7. Wall Finishes In Common Areas

- Common kitchens, washrooms, laundry, mechanical/electrical, garbage and janitor’s room walls to be G5 (Semi-Gloss).
- Painted doors, frames and trim to be G5 (Semi-Gloss)
- Walls to be G3 (Eggshell)
- G1 (Flat) and G2 (Matte) finishes are not acceptable for any areas other than ceilings.
- All other surfaces to be either G5 (Semi-Gloss), G4 (Satin), or G3 (Eggshell) (Confirm with OCHC)
- Engage in conversation with OCHC if there is a desire to leverage our Dulux supply relationship.

7.8. Ceilings

Where access above ceilings is required for regular inspection and maintenance, consider suspended ceilings systems. Where this is considered in high-traffic, public areas, assess more secure alternatives.

7.9. Doors, Frames and Keying

7.9.1. Automatic Door Operators

All doors along accessible paths of travel leading to all common areas to be fully accessible and operable by an automatic door operator. Operators at all exterior doors to be heavy-duty models.

- Installed in following locations (expand as required/discussed):
  - Front and rear building entrances
  - Public Washrooms

- Laundry Facilities
- Community Areas
- Bike/Scooter Storage
- Parking Garage
- Garbage & Recycling Rooms
- Accessible Unit Entry Doors

- Connected to emergency power.
- Power Door Operator timing to be set at 5 seconds to open, 5 seconds to stay open, 5 seconds to close (timing may change as requested by community).
- Doorways in the accessible path of travel to be 1070 mm (42") wide throughout the building.

7.9.2. Unit Entry Doors – Mid/High Rise

- Solid core wood, paint or stain-grade in welded pressed frames - fire-rated as required;
- Minimum dimensions are 2135 mm x 915 mm (7’-0” x 3’-0”) or as per OBC;
- Stained solid wood or metal threshold;
- Door viewer

7.9.3. Interior Unit Doors Residential

- Doors within suite to be painted hollow-core wood. Consider budget when specifying either steel or wood frames with casing.

7.9.4. Common Areas and Service Locations

- All common area doors to be hollow metal door and frame, minimum 1065 mm (42”) wide, designed with appropriate fire rating.
- Common area doors (including doors at fire separations and exit stairs) to have as much glazing as permitted by the OBC. This does not apply to Service Rooms.
- Consider side-lites to maximize daylight harvesting.
- Equip with 760 mm (30”) high heavy-duty kick plates on all high traffic common area doors including stairwell doors, laundry rooms, bike rooms and locker rooms.

7.9.5. Exterior Doors

- To be insulated steel, in thermally-broken insulated metal frames
- Building design to determine if ingress is required.

7.9.6. Main Entrances and Vestibules

- Commercial-grade thermally-broken aluminum,
- Institutional-grade hinges
- Heavy-duty Automatic Door Opener (ADO) with
- Feature to prevent door from over-extending.
- Maximum vision glazing
- Design should consider the impact of wind on door operation and screen, as necessary
- Provide all entry doors with weather protection consisting of a roof overhang or canopy extending past both door jambs.
- Vestibules to include drainage mats. Consider if location permits a floor drain below or evaporation.

7.9.7. Hardware Schedule

Under development by OCHC.

- Common Area, Exterior, and Service Areas, Elevator Service Cabinets and key switches within to receive BEST Small Format Inter-changeable Cores.
- Hardware to include construction cores and keys.
- Final cores (each with 2 blank keys) to be provided to OCHC for pinning and keying by OCHC.

7.10. Windows and Blinds.

- Window systems to support Passive House Design requirements.
- Operable window to be provided in each room.
- Provide insect screens for all operable windows.
- Ground floor windows should not sit at grade.
- Where the mechanical design does not include air conditioning, the operable windows must accommodate an adaptor plate designed for an exhaust duct from a portable air conditioning unit. Alternate solutions to vent portable air conditioning units will be considered.
- Window blinds are required due to Passive house shading requirements.
  - OCHC will provide a roller blind specification.
  - Provide commercial grade solar blinds with aluminum cassette and 1% openness fabric for all exterior windows within units.
  - Blinds in amenity spaces to be 3% openness fabric.
  - Include appropriate blocking to facilitate installation.
- Elements of Accessibility
  - Window hardware is operable by everyone.
  - Window hardware is reachable from a standing and seating position.
  - Location of window hardware is emphasized through us of distinct colour contrast.

8. SITE DESIGN

A careful analysis of the site should be undertaken to determine the best location for the building on the site. Factors such as topography, existing vegetation, site drainage, vehicular access, pedestrian access, fire truck access, location of services, required setbacks, relationship to neighbouring buildings, and solar orientation must all be taken into consideration. Obviously, for urban sites the flexibility in site planning is limited.

All exterior areas intended for tenant use including landscaped open space and outdoor recreation areas use should be universally accessible to persons of all ages and abilities.

8.1. Walkability and Low ratios of personal vehicles

OCHC communities will be designed for a high level of walkability and low ratios of personal vehicles. This requires the developments to have accommodations for various delivery services (such as small packages, daily food delivery and furniture delivery), waiting areas and lay-bys for ride share services as well as parking areas for Car-share programs. Although the developments will have low ratios of personal vehicles, they must remain highly accessible for automobile based services.

8.2. Exterior Spaces

Design, configuration and detailing of exterior open space should be carefully considered with respect to drainage, use and tenant population.

8.2.1. Site Drainage

- A comprehensive site water management strategy should be developed by the project team at an early stage. Erosion control, and storm water management should be addressed. Investigate measures such as pervious paving, rain gardens, bio swales, storm water retention and storm water treatment.
- Ensure that site grading is designed to slope away from the building areas.
- Ensure that appropriate drainage systems are put in place to deal with run-off from adjacent sites.
- Ensure that area drainage is provided to avoid water and ice accumulation particularly in areas used by the tenants.
- Where feasible, retain the maximum amount of existing planting materials and top soil. If trees and vegetation are removed investigate the impact on the site drainage.

8.2.2. Outdoor Recreation Areas

- Projects should incorporate a conveniently located outdoor open area near amenity space that is universally accessible from the main building and facilitates social interaction.
- The exterior recreation area should permit tenants to relax and sit in the sun or shade, out of the wind, in quiet spots or with a large group. To facilitate these activities consider the following:
    - A hard surface patio.
    - Weather protected areas at the common patio through the use of an awning, canopy, building overhang or gazebo.
    - Consider private outdoor spaces for ground-related units that are clearly identifiable as private.
    - Exterior landscaped space shall be adequately lit, usable and visible from adjacent spaces.

8.2.3. Tenant Garden

- Where appropriate, provide an outdoor area for tenant gardening. Consider the location and size of the area, access to sunlight and water, proximity to other structures, lighting and security, types of plants and tools, as well as accessibility.
- Provide a secure shed for storing gardening tools, with counter space and a sink.
- Provide minimum 50% raised beds to facilitate access for tenants with wheelchair or restricted movement.

8.2.4. Outdoor Play Spaces for Families

- Provide adequate and secure play space for children where possible. Locate play spaces so they are overlooked by common facilities such as the common amenity areas, laundry rooms and individual dwelling units. Rules for play areas should be provided and posted.
- Criteria for providing CSA compliant playgrounds which incorporate City of Ottawa guidelines.

8.2.5. Outdoor Spaces for Seniors

- Provide an exterior recreation area that is conveniently accessible from the common amenity area. The exterior recreation area should permit tenants to participate in both active and passive activities such as:
  - watching outside street life.
  - sitting in the sun or shade, out of the wind, in both quiet spots and with a large group walking conveniently without encountering stairs
  - tai chi or other low impact group movement activities

8.2.6. Bicycle Parking

- Bicycle parking at a minimum of 80% ratio, spot to unit, or as required by City of Ottawa Planning Department.
- Bicycle parking may use stacked parking systems, pursuant to variance from City.
- Bicycle parking is preferred to be at grade level, accessible by card access and fitted with an automatic door operator and security cameras.
- Consider providing covered, exterior, convenience bicycle parking for both public and tenant use near the main entrance as appropriate or required.

8.2.7. Outdoor Storage Areas

- If not otherwise within the building, provide secure storage for seasonal landscape tools, lawnmowers, chairs, etc.

8.3. Crime Prevention Through Environmental Design

Consider the principles of Crime Prevention through Environmental Design (CPTED) in the site planning and landscape design to promote the security of the residents and staff, e.g., territoriality, natural surveillance, activity support and access control as well as other recognized Crime Prevention Through Environmental Design (CPTED) principles.

8.4. Landscaping

8.4.1. General

- Incorporate the landscape design into the overall sustainability strategy for the project. Use passive landscape design strategies to contribute to the environmental quality of the project.
- Exterior landscape designs should be simple in nature with low maintenance, drought resistant planting and durable hard surfaces as the highest priorities. For sloped areas, review appropriate planting material suitable for that area.
- Provide a reasonable balance of hard and soft landscaped areas. Incorporate interest in landscaped areas by providing a variety of colours, textures, heights and massing.
- The landscaping of interior courtyards and suspended concrete slabs over parkades requires particular consideration in order to avoid ongoing maintenance problems. Built-in planters and large trees with aggressive root systems in these locations are not acceptable.
- To facilitate the maintenance of waterproofed suspended slabs, provide removable landscape finishes such as concrete pavers or movable planters in lieu of large landscape overburden or poured concrete finishes.

- Avoid large heavy planters that could damage concrete pavers and the waterproofing membrane.
- Grass areas should be eliminated or minimized. Avoid grass areas in sloping areas or small areas of sod in locations not readily accessible to a lawn mower, e.g. narrow fingers of sod between parking spaces and small areas on elevated concrete slabs or interior courtyards.
- Locate trees and select species in regard to foliage so as not to obscure natural surveillance into an area or block or screen lights.
- Outdoor furniture and seating are to be durable, low maintenance, fire resistant and allow universal access.
- All landscaping, including movable planters, should be separated from the building by a minimum 6" wide gravel strip and have a minimum clearance of 8" from the underside of the cladding. Window boxes are not acceptable.
- Consider climate adaptation strategies in design. For storm, avoid planting large trees too close to buildings, pathways or roads for vulnerability. Trees are to be placed a minimum 4.5 m (15') away from the building.

8.4.2. Landscape Irrigation

To promote water conservation, provide native or drought resistant landscaping as irrigation systems are not permitted.

Lockable, tamper resistant hose bibs to be provided on the exterior of the building. These will help establish initial planting. Consider using captured or harvested storm water for site or landscape irrigation wherever possible.

8.5. Hardscaping

8.5.1. General

- Concrete or unit paver walkways. Avoid asphalt walkways.
- Consider snowmelt systems in high traffic walkway areas and facilitate compliance with AODA.
- Provide concrete curbs to all interior roadways. Provide broom finished concrete sidewalks to all interior roadways, building entrances and common areas with exterior access such as the amenity rooms. Break up large impermeable hardscaped areas with permeable hardscape to support watershed. Consider using permeable paving surfaces to assist with storm water management, installing sustainable drainage systems, and, where paving is necessary, installing permeable (and light coloured) pavements.
- Sidewalks should meet accessible requirements defined by Code including maximum grades, slopes and cross slopes, location and sizes of obstacles, guard and handrail requirements and curb cuts.
- Provide a maximum slope of 5% for exterior walkways. If steeper slope is unavoidable provide handrails to meet Code requirements. Provide minimum slope for surface drainage to prevent slips from ice or water accumulation. Cross slopes for drainage may be provided but must be kept to a maximum of 2%.
- Curb cuts for wheelchair or stroller access should be as gradual as possible and should not project into the roadway. Where a curb cut is in the path of travel, the sides should be sloped to avoid the problem of pedestrians, especially the visually impaired, from unexpectedly stepping down into the cut.

- On the downhill side of sloped sidewalks, provide guards and tapping rails for the safety of persons with mobility or visual impairments.
- Walkways shall be constructed using concrete, unit pavers or other materials which have an even slip-resistant surface. Where precast or unit pavers are used, ensure that joints are flush as possible to a maximum tolerance of 6 mm (1/4"). Avoid herringbone paving patterns and high contrast paver variation.
- In order to improve visibility of walkways without additional lighting, use products that create contrast in colour and/or texture. For example, use a different boundary colour and/or texture on the perimeter of walkways.

8.5.2. Snow Removal

- The site plan must incorporate designated snow storage areas, with adequate drainage to accommodate snow melt and icy conditions during freeze thaw cycles. These areas should be finished with “grass crete”, asphalt, or a similar material. Soft landscaping, including sod, should not be used in these areas.
- Avoid curbs, planters or other snow plow obstructions in parking areas. Provide low profile curb and gutter section.
- Location and type of fencing should be coordinated with the snow removal plan and CPTED guidelines.
- Ensure that areas intended for tenant access to the building are protected from ice and snow accumulation or shedding from roof.

8.6. Fencing

- Townhouses fencing standard incudes painted steel frame with wood panel inserts.
- Provide fencing or screening to protect tenants and children from access to potentially dangerous areas such as gas meters, electrical transformers, roads and steep slopes.
- Fencing design shall avoid horizontal slats and spacing that could facilitate climbing
- Fencing design should not allow for debris to be placed or trapped, in a cavity between slats, for instance. Slats should be finished either close to ground 25 mm (1”) or with a significant 150 mm (6”) gap from grade to bottom of fence, depending on security requirements or proximity to a children’s play area.

8.7. Retaining Walls

- All abrupt vertical changes in grade greater than 610 mm (2'-0") shall be retained by a modular or poured in place concrete retaining wall engineered to resist the lateral pressure of the retained material.
- Retaining wall designs shall avoid using wood.
- Vertical grade changes greater than 610 mm (2'-0") are required to have guardrail that meets the appropriate requirements of the OBC. Where guardrails are located along walkways, provide graspable handrails that meets the requirements of the OBC.
- Provide appropriate drainage behind all retaining walls.

8.8. Wayfinding and Signage

For each new development, OCHC will engage a 3rd party firm to complete a branding exercise based on initial design concepts. The resulting brand manual will be forwarded to the Design Team to guide on colour palette, logotype and typeface.

The brand manual is to be used in the development of building signage and wayfinding, ensuring signage is easy to read and positioned to avoid shadow areas and glare. Use pictogram signage where possible, otherwise bilingual signage is required. Signage package to be provided to OCHC for review and approval.

Provide directional signage for sites with more than one building.

8.8.1. Elements of Accessibility

- The street address is clearly visible and readable from the street.
- Exterior signs locate accessible parking facilities and accessible entrances.
- Signs incorporate distinct colour contrast between the sign messaging and the sign background material.
- Where signage, including electronic displays, is provided, it shall be consistently located and positioned to avoid shadow areas and glare.
- The "International Symbol of Accessibility" should be used to identify special amenities, such as accessible parking, accessible entrances, or accessible activity spaces for tenants and kids playground.

9. PARKING

9.1. Requirements

While Zoning By-law will dictate parking requirements, consider differing parking requirements associated with the various types of occupancy. Request input from OCHC's market research to confirm if alternate requirements are supported.

Include for the following:

- Provide sufficient electrical capacity for 10% of building parking to accommodate electrical vehicles.
- Provide electrical infrastructure to provide for charging stations that align with the above (from electrical room and terminate outside of the exterior wall.
- Designate one (1) surface parking spot for car sharing program (i.e., CommunAuto). Spot can be converted to tenant part if program is not available.
- Designate one (1) to two (2) parking spots for OCHC Operations, depending on size of development.

10. BUILDING SYSTEMS and COMPONENTS

10.1. Structural

Consideration shall be given to the passive house outcomes when determining the structural systems and materials employed in the design. Consider column locations as they can greatly impact efficient suite layout and circulation.

A mixture of structure types within a building should be avoided unless required for an economical approach to passive house design. Clear direction beyond general drawing notes shall be provided when delegating structural design responsibility.

10.2. Through Slab Penetrations

All duct and pipe risers to be sleeved with schedule 40 steel pipe extending 25mm above finished floor. Sleeves to be insulated and caulked as part of or in addition to fire stopping.

10.3. Foundations

Avoid concrete block. Waterproof and install drainage mat on exterior surfaces. Install weeping tile. Foundations to extend minimum 15” above grade.

10.4. Parking Garages

Depending on site orientation and size, target underground parking structures to be no more than 1-storey.

Maintain 2100mm clearance in drive aisles and the majority of parking stalls.

Paint garage white to assist with lighting levels.

10.4.1. Interior Suspended Slabs

Protect all interior suspended slabs with an Elastomeric traffic topping that incorporates a waterproofing membrane and different levels of wear course:

- standard thickness at parking areas
- extra layer at drive lanes
- heavy duty layer at turning radii and ramps
- No mastic asphalt traffic topping or asphaltic systems
- membrane to have 6" upturn at all vertical surfaces

10.4.2. Columns at Slab on Grade Level

- sealer applied to all vertical surfaces to a height of 600mm above slab, and below slab to bottom of footings
- base of all columns and walls to have a non-sag sealant applied 1" x1", to protect concrete bases

10.4.3. Exterior Ramps

Ideally slabs on grade and not suspended structural slabs. Ensure waterproof membrane extends min. 4 inches above the finished surface, protected with a metal flashing. Sidewalls should be coated with an elastomeric coating such as Allguard for protection of concrete.

Snow and ice melting systems:
Must

- be electric heating cables embedded in asphaltic topping
- be installed in multiple zones,
- dividing each half of the ramp lengthwise
- dividing the length of the ramp in maximum 25ft lengths;

Avoid

- glycol-based systems in concrete toppings;
- mastic asphalt toppings
- electrified rebar for ease of replacement,

10.4.4. Garage roof slab

Avoid enclosing services and piping within gypsum board ceilings. If ceilings are required, consider suspended T-Bar type ceilings, for ease of maintenance & repair.

10.4.5. Garage HVAC

Where heating has been included in the design, note that the underground parking garage will be considered outside of the passive house envelope.

Ensure separation of fresh air intakes and all plumbing lines (supply and discharge) to avoid freezing.

10.4.1. Washing Bay (Dogs, Bikes, Scooters, Cars)

Consider designing a specific area to provide washing facilities.

10.5. Balconies

OCHC prefers designs that exclude balconies, except where required by code. Where balconies are included in the building design, specific attention must be given to minimize thermal bridging.

10.6. Building Envelope

10.6.1. Insulation & Air Tightness

Refer to the passive house standard for guidance.

10.6.2. Eliminating thermal bridging:

Thermal bridging through the building envelope can greatly reduce the effectiveness of the envelope performance and should be addressed in the design of the envelope. The consultant will identify and mitigate thermal bridges in designs and details on drawings so the contractor can implement those effectively in construction. Thermal bridging should be accounted for in the energy model.

10.6.3. Cladding

Ensure that cladding system starts min. 15" above grade. Use only cladding systems known to be durable, impact resistant and provide a minimum 30-year lifespan. Use stainless steel ties for masonry installations.

Avoid the following materials:

- Vinyl Siding
- Fiber-cement Siding
- Wood Siding
- Precast Panel System for high-rise buildings.

10.7. Sloped Roofing Systems

Minimum standard: 35 year architectural shingles. Consider standing seam metal roofing or metal roofing with the appearance of asphalt shingles.

- Use underlayment and ice & water shield full height (not just lower 6ft)
- Use ridge vent system for venting attic spaces.
- Design roof structure with capacity to support solar panel arrays.
- Minimize roof penetrations.
- Avoid chimneys.

- Install vents that are through-wall rather than through-roof.
- No skylights.
- Install aluminum eaves-troughs and downspouts, with gutter guards; downspouts to drain onto grade and to be directed away from driveways and walking paths.
- Install snow guards.

10.8. Flat Roof Systems

- Design roof structure to support Passive House Design objectives.
- Design with capacity to support solar panel arrays.
- Consider protected membrane system with bi-level drains;
- Membrane to be fully bonded to slab, with additional support to upturns and penetrations;
- Minimize penetrations through roof.
- Ensure that there is a separation sheet between membrane and insulation.
- Ballast the insulation with concrete pavers that have drainage grooves.
- Any decking or guards are to be self-ballasted;
- Install through-bolt type roof anchors.
- Consider providing guard-height parapets at full roof perimeter unless snow loading will be problematic.
- Where guard height parapets aren't possible, provide self ballasted guardrail and walkway systems.

11. M.E.P. and FIRE PROTECTION

11.1. Mechanical Systems

Mechanical systems are to be designed to support Passive House design intent. See 14.0 for information on Commissioning requirements.

11.2. Space Conditioning

OCHC considers the following two options as viable solutions to provide the required space conditioning to our projects.

11.2.1. Decentralized Solution

In this model, each unit will house its own, stand-alone unit that provides heating, cooling, dehumidification and heat recovery ventilation. Design layout shall ensure an accessible installation, allowing maintenance to occur without suite access.

11.2.2. Centralized Solution

Space conditioning for the building will be provided through a 4 pipe fan coil system which has the ability to provide heating and cooling to all parts of the building through a central network. At no time shall a confined space be designed to house piping network.

Ventilation shall be provided by a centralized heat recovery ventilator.

Including the capacity in the mechanical system to provide the cooling to eliminate the allowable 10% of hours above 25°C under the passive house requirement.

11.2.3. Boiler Systems and Make –up Air Units

- High efficiency

- Boiler systems to have N+1 redundancy.
- Connected to BAS
- Condensate neutralizer c/w pH sensors

11.2.4. Ventilation

- Ventilation shall be provided by a heat recovery ventilator.

11.2.5. Temperature Settings – Amenities and Common Areas

Mode	Setpoint (adjustable)	Occupancy (by occ. sensor or override button)	Time of Day (by local/central schedule, adjustable)
unoccupied cooling	28°C/82°F	no	12am - 6am
standby cooling	26°C/78°F	no	6am-12am
occupied cooling	23°C/74°F	yes	anytime
occupied heating	21°C/70°F	yes	anytime
standby heating	19°C/66°F	no	6am-12am
unoccupied heating	17°C/62°F	no	12am - 6am

11.2.6. Temperature Settings – Units

Mode	Setpoint (Adjustable)	Occupancy (by sensor or override button)
standby cooling	26°C/78°F	no
occupied cooling	23°C/74°F	yes
occupied heating	21°C/70°F	yes
standby heating	19°C/66°F	no
vacant suite	10°C/50°F	no

11.2.7. Metering

Heating and Cooling usage: Heating and Cooling is included in the tenant's rent for both townhomes and Mid/High rise developments.

Where leased premises are considered as part of the building design, propose opportunities to sub-meter thermal energy usage and gas. The agreements between OCHC and a 3rd party group will dictate if sub-metering is permitted or required.

11.3. Plumbing Systems

11.3.1. Water Distribution - Isolation

Include ball valves to allow isolation at the following levels:

- Isolation of Domestic Hot Water ("DHW") plant
- Isolation of each riser (H&C)
- Isolation of each unit from riser (H&C)
    - Individual fixture shutoffs are not required if unit can be isolated.
- Avoid plumbing in party walls. If unavoidable, consider how sound transmission will be minimized.

11.3.2. Metering

Water is included in the tenant's rent for both townhomes and Mid/High Rise developments.

Discuss with OCHC Sustainability Representative if there is a certain level of water metering required, based on building systems or special agreements.

Where there is leased space with an OCHC building, provide separate metering for both DHW and DCW, should lease agreements permit.

11.3.3. Domestic Hot Water

- High-rise & Mid-rise
  - High efficiency boiler c/w storage tanks
  - provide N+1 redundancy
  - Where condensate neutralizers are used, include for pH sensors on discharge and connect to the BAS system.
- Towns
  - Consider centralized systems
  - Engage in discussions regarding Gas-fired or Electric systems.

Where district energy or geothermal systems are being considered, ensure domestic hot water loads are included in the calculations.

11.3.4. Energy Efficient Technologies

During the Design Development phase, the mechanical design will evaluate the use various energy efficiency technologies, including but not limited to:

- Drain-pipe/waste water heat recovery
- Heat recovery ventilation
- Heat pumps

11.3.5. Additional Items

- Provide the necessary plumbing requirements (DCW supply and sanitary drain piping) within the kitchen cabinetry prepared to accept a standard dishwasher. Note that only 2-bedroom units and above will receive dishwashers.
- Exterior hose bibs to be lockable and tamperproof.

11.4. Tagging and Identification

OCHC is developing a tagging and identification program for Fire, Domestic Water and Heating systems. Discuss with the OCHC representative to obtain further information.

11.5. Building Automation System

OCHC has integrated various Energy Management Control Systems ("EMCS") into a front-end enterprise solution using Schneider Electric Ecostruxure which is also the graphical user interface. All mechanical systems with active controls and programming will need to be integrated to this enterprise system.

OCHC will provide the graphical user interface for the EMCS and provide instance numbering ranges for the EMCS connected devices. Refer to drawings for location of OCHC provided BACnet/IP gateways for termination of EMCS field level networks. EMCS Contractor to utilize OCHC point naming convention and field controller system identifiers for all EMCS field controllers.

Connect mechanical systems to the Schneider graphical interface. Local Operator interface device is not required.

All controllers shall interface to building controller through either MS/TP LAN using BACnet protocol, or Ethernet LAN using BACnet over Ethernet or BACnet TCP/IP.

The Mechanical contractor is responsible for performing all commissioning activities of the systems they are contractor for. If the mechanical contractor is unable to perform the integration to the Enterprise BAS system, they will include for time and resources to support the integration

11.6. Faucets and Fixtures

Where alterations to the proposed basis of design products are required to meet accessibility requirements, address proposed changes directly with OCHC.

11.6.1. Bathrooms – Units & Common Area

11.6.1.1. Faucets and Showerheads

- Low flow, single lever bathroom faucet with a consumption of less than 1.0gpm. Basis of design – Moen Chateau Single-Handle Lavatory Faucet.
- Low flow showerhead with a consumption of less than 1.5gpm. Basis of design: Moen Chateau Posi-Temp Single-Handle Tub/Shower Trim Kit. Model with "EP suffix" delivers 1.75gpm.

11.6.1.2. Fixtures

- Vanity installed bathroom sinks to be top mount, white porcelain.
- Where wall mounted sinks are installed, ensure appropriate carriers are used.
- Steel enamel tub with shower head and tub spout.
- Confirm OCHC standard toilet and flush valve.
- Tub surround to be discussed with OCHC for confirmation.

11.6.1.3. Accessories

- Shower curtain rod to be screwed in place with heavy duty screws (no tension rods). Provide wood or sufficient backing, as required.
- In common area washroom, consider automatic paper towel and soap dispensers.

11.6.2. Kitchens – Units & Common Areas

11.6.2.1. Faucets

- Low flow, single lever kitchen faucet with a consumption of less than 1.5gpm. Rotation of faucet shall be restricted so as not to exceed the bounds of the sink. Basis of design – Moen Chateau Low-Arc Single-Handle Standard Kitchen Faucet. Rotation shall not exceed 150°.

11.6.2.2. Fixtures

- Kitchen sinks to be top mount, double bowl stainless steel.

11.6.3. Janitor Rooms

11.6.3.1. Faucets

Model: 8230 - M-DURA Rough Chrome Two-Handle Service Sink Faucet, or similar.

11.6.3.2. Fixtures

Floor mounted mop sink.

11.6.3.3. Accessories

Hose connection, stainless tub surround, mop holders.

11.7. Electrical Systems

11.7.1. Solar Photovoltaic

All new OCHC developments will have solar arrays as part of their design. The building design will maximize roof space and building orientation to accommodate the optimal solar generation for the site. The solar array will be connected the common load of the building in a net-metering configuration.

The design team will:

- Optimize the design for the best solar generation on site.
- Model the generation of the selected option to provide the energy model with the anticipated on site generation.
- Produce a solar system design to incorporate the array into the building's electrical system.
- Produce specifications for tendering by the Construction Manager/General Contractor.
- Review submission and inspect the construction of the array.
- Ensure an internet connection is available for portal connection.

11.7.2. Metering

Tenants are responsible for their in-unit plug load usage. Provide options for metering solutions. Each unit shall be separately metered and the tenants must create an account with HydroOttawa for which they pay.

OCHC will have a separate meter for all remaining electrical consumption, including all space conditioning requirements.

Where OCHC lease to 3rd party groups, the metering requirements will depend on individual agreements in place.

11.7.3. Lighting

All lighting in OCHC developments is to be LED. The following list of lighting products represent preferred selections. To facilitate future maintenance, the design team is directed to draw 100% of the design's in-suite fixtures, 90% of the design's exterior fixtures and 60% of the design's common area fixtures from this list.

While OCHC has provided the following products, it is understood that most manufacturers have similar products that may be considered.

11.7.3.1. Exterior

RAB Design Lighting - AWL-LED26W – Wall, Ceiling or Ground Mounted
RAB Design Lighting - AWL2-LED80 – Adjustable Wall Pack
RAB Design Lighting - RFL1-LED20 – LED Flood Light

11.7.3.2. Interior

Lotus LED Lights - LED-S9W – 4" Ultra Slim Round Recessed LED 9W
Cooper Lighting MetaLux AP Series – FMLED12 – 12” Ceiling Light
Cooper Lighting MetaLux AP Series – FMLED16 – 16” Ceiling Light
CFI Fluorescent – TX228-120SO – Surface Mounted Fluorescent Light
CFI Fluorescent – SLB2GFSVA2U6120SO – Surface Mounted Fluorescent Light

11.7.4. Emergency / Backup Generators

Generators are to provide for both Emergency and Backup power. Consider fuel types when designing, understanding the non-life safety requirements that are considered essential for occupant well-being (e.g. water supply, heating, elevators), should be accommodated for at least 72 hours. Emergency generators to be sized for building resiliency in emergencies.

- Provide emergency or back-up generators for the following type of projects, even where not required by Code or the Authority Having Jurisdiction.
  - Housing for seniors or persons with disabilities where prolonged power outages could present a safety or major mobility issue
  - Projects where local conditions or remoteness of location could affect the operation of the project or needs of the residents during prolonged power outages
- Discuss location of the generator at the early design stage and consider end-of-life replacement activities when finalizing location.
- Systems or items commonly supported by the emergency/back-up generator include:
  - Fire alarm equipment
  - Emergency and exit lighting
  - Emergency voice communication systems
  - One elevator
  - Digital access control systems and door operators
  - HVAC systems and components thereof.
  - Fire & Water booster pumps.
- Additional capacity should be considered for:
  - Area of Refuge
  - CCTV system
  - Intercom system
  - 70-100% of common area lighting within the building
  - Exterior lighting promoting safety
  - Multiple duplex receptacles for equipment
  - Network equipment (per IT requirements)
  - Garage Doors

11.7.5. General Items

- Light and exhaust fans switched together in washrooms.
- Humidistat also initiates exhaust fan

- Provide swing stage electrical outlets in appropriate locations at the roof level.
- Provide the necessary electrical requirements within the kitchen cabinetry to accommodate the proper installation of a dishwasher in units sized 2-bedrooms and above.

11.7.6. Telephone/Internet/Television

OCHC will enter into wiring agreements with service providers for television, telephone and internet. Each service supplier, at their sole cost, will supply and install their own fiber optic network throughout the building to serve each apartment unit. OCHC will provide the required conduit, through-slab sleeves, and mounting plywood, to accommodate their system.

11.7.6.1. Demarcation Locations

- Logically located to support easy distribution throughout the building.
- Sufficient space to house required OCHC IT infrastructure.
- Sufficient space to accommodate two (s) internet/telephone/television service providers.
- For each service provider, provide a 4'x8' sheet of plywood, mounted on the wall. If required, ensure the plywood is fire-rated, as appropriate. Provide a quad receptacle at location to be confirmed.

11.7.6.2. Telecom Closets

To support the vertical distribution, provide stacked telecom closets on each floor. Within each closet, supply and install two (2) - 4" through-slab sleeves, fire rated as appropriate. Include ¾" plywood on the nearest wall, to allow support of the wiring within. If required, ensure the plywood is fire-rated, as appropriate.

Horizontal distribution from telecom closet to each suite shall include two (2) – 1" conduits, terminating in a P3000 media panel. Fire rate conduit run, as appropriate. Media panels are supplied by Bell Canada (at no cost to the project) and installed by project electrician. Each media panel will require 15A duplex receptacle.

11.7.6.3. Apartments Units

Service provider will wire one (1) outlet in the living room of each apartment. Provide conduit from the media panel to a single gang box in the living room.

Additional elements, provided by the project shall include the following:

- One outlet located in each bedroom.
- One outlet located in the kitchen.
- All wiring from the media panel to the above outlets shall be Cat6A
- For the above outlets, include the OLU.

11.7.6.4. Structured Cabling Backbone

Plan under development

11.7.6.5. Building WIFI

OCHC is developing policies related to providing WIFI to entire building.

11.8. Fire Protection

- Non-proprietary systems
- Strobe/Horn combo signalling devices
- Consider specific FA vertical chase, sized to support future code mandated upgrades/end of lifecycle replacement.
- Provide relay to allow separate monitoring of trouble alarms, (using card access or BAS system inputs).
- Use concealed sprinkler heads wherever possible. If concealed are not possible, consider semi-recessed.
- Where neither concealed nor semi-recessed heads are possible, install protective cages and install a lamacoid sign with a similar pictograph as below.

- The fire safety contractor shall prepare a fire safety plan and documentations in accordance with the current Ontario Fire Code and the City of Ottawa Fire Department. Provide both hard and soft copies of fire safety plan and install all associated documentation within the building to be compliant. Consult with OCHC to ensure proper branding is performed for all prepared and posted documentation.

11.9. Appliances

OCHC In-Unit Appliance Strategy, which includes a procurement strategy, is under development. The Design Team shall include all mechanical and electrical requirements for the following appliances:

- Fridge (sizes to be confirmed in the Appliance Strategy)
- Stove
- Cooktop + Wall Ovens to be considered in barrier-free designs.
- Dishwasher (provided in units sized 2-bedroom and above)
- Hood fan (Consider Passive House requirements)
- Washer & Dryer (provided in units sized 2-bedroom and above)

12. ELEVATOR SYSTEMS

The location, type, number, size and speed of elevators shall be determined using elevator analysis calculations and simulation techniques performed by an experienced Elevator Engineer or Consultant. The locations of high traffic areas such as lounges, laundry facilities, gardens, mail rooms and other amenity rooms must be taken into consideration when calculating elevator requirements. If these areas are located at levels different from the main lobby, their impact on the elevator traffic patterns should be taken into consideration when calculating elevator requirements.

Avoid Machine Room-Less (MRL) type installations.

Use gearless machines for traction installations. Hydraulic installations should only be considered where budget restrictions exist, or for separate underground parking access. All underground parking levels must be served by at least one elevator.

Where multiple cars are designed, they should be arranged side by side with no separation between their hoistways.

1-year maintenance provided based on current OCHC maintenance agreement. The maintenance agreement shall commence at Substantial Completion.

Elevator design to include Lift-Net elevator monitoring system.

If the hoistway or machinery areas are located adjacent to residential rooms the walls and suite ceilings shall be appropriately sound and vibration isolated. Where required, engage an Acoustic Consultant.

Specific OCHC requirements are outlined herein:

- Provide an elevator control and drive system that is totally Non-Proprietary.
- Provide a written guarantee from the manufacturer of the equipment, including the controller, that the equipment is non-propriety. This includes:
    - Parts including circuit boards shall be available for direct purchase from the factory in quantities and not on a one-for-one "exchange only" basis. Parts to be stocked to allow overnight shipment.
    - All circuit boards shall be available for purchase for under $2,500 (CPI escalation permitted), as to be demonstrated by a parts list supplied by the shop drawings.
    - Manufacturer offers engineering support and technician training directly to any service contract at reasonable prices.
    - All diagnostics are on board.
    - All programming and diagrams required for long-term maintenance are provided with the controller.
    - The controller will not shut down or alter its functionality in any way after a pre-determined increment of time or use.
    - All specialized tools required for maintenance of the equipment, including door operators, are supplied with the elevator and shall be come the property of the Owner and remain on-site. A list of specialized tools shall be provided by the Contractor.
- Acceptable Control Manufacturers
    - GAL Manufacturing - Galaxy IV controller, complete with a monitor in the machine room, installed on the controller door.
    - Motion Control Engineering – I-Control type controller, complete with mView monitoring application in the machine room.
- Acceptable Fixture Manufacturer
    - Dupar Controls Inc.
    - All complete car operating panels, hall fixture cover plates, and position indicator fixture plates shall be by Dupar.
    - Where an equivalent alternative is offered, present to the elevator consultant for review during tendering.

13. SECURITY

13.1. Card Access Systems

Integrate system into OCHC's existing S2 System. Security consultant to review existing system capacities to ensure expansion requirements are incorporated in to scope of work. Use Mercury input boards to support possible future head end replacement. Note that pricing associated for S2's Software Upgrade and Support Plan (SUSP), shall align with rates negotiated between OCHC and S2.

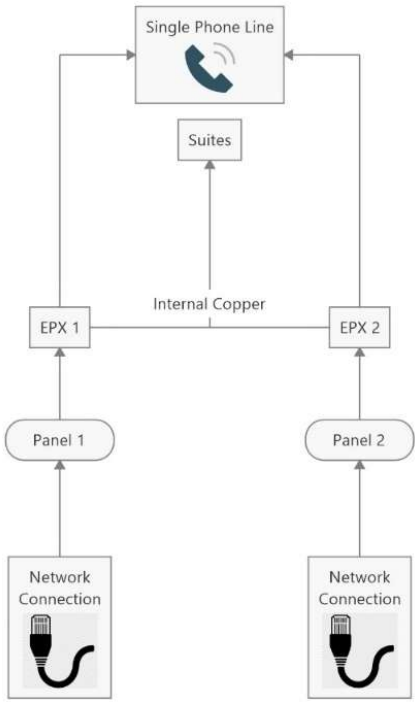
OCHC will supply FOBs, and therefore shall not be included in the specifications.

13.1. Security Cameras

Integrate a new NetVR video recording system into OCHC existing system. Basis of design for cameras – AXIS Model M3046-V complete with memory card (at least 64 GB of local storage capacity)

13.2. Entry Phone Intercom

Basis of design – Enterphone IQ



13.3. Parcel Delivery System

Basis of design - Lockourier. Each system will require the following:

- One - 110V-15A duplex electrical outlet installed behind the main module, with the base of the outlet at a height of 77-inches from the finished floor and centered above the main module.
- One data outlet for Internet access located adjacent to the 110V-15A duplex outlet for the main module (the base of the outlet at a height of 77-inches from the finished floor). Homerun a single Cat6e to the OCH's network demarcation point.

- One data outlet installed, centered across the width of the modules, at 90” AFF, with a Cat6e homerun to the demarcation point.
- The locker system can be enclosed on the top and sides, provided there is at least a 1/2” clearance.

14. QUALITY CONTROL and QUALITY ASSURANCE and COMMISSIONING

14.1. Quality Control and Quality Assurance

OCHC requires the Construction Manager/General Contractor to create a Project Quality Management Plan, developed from of their corporate quality plan, and is to include individual quality plans for the subcontractors performing all major activities.

The Construction Manager/General Contractor’s QA/QC team will work with the design team, OCHC’s 3rd party testing agents and the Passive House Verifier to create the above-noted plan to ensure that the Passive House design requirements are being met on site and throughout construction.

14.2. Commissioning

OCHC will retain a Commissioning Agent (CA) who will provide third party commissioning services for the building's mechanical, electrical and security systems. The role of the CA is to supervise the commissioning process of Mechanical and Electrical Systems, as carried out by the Constructor. Mechanical and Electrical System’s commissioning efforts will be made in order to record and validate that the project requirements, details, plans and specifications are in lines with on-site installed equipment. This is a different role to

The commissioning services provided for the occupancy and operations phase, will include:

- HVAC systems (Heating, Ventilation, Air Conditioning Systems) and associated controls;
- ERV units;
- Domestic Water Distribution;
- Electrical systems (including Lighting and Daylighting controls);
- Security (alarm and access) Systems (Review during testing);
- Controls (Building Automation Control - BAS system implementation)
- Backup Generator & transfer switch (Review during testing);
- PV Solar System (Review during testing):
- Elevator Energetic Performance testing;
- Sump pumps, floats and associated controls
- Snow melt system
- Staff training and video recording.

14.3. Information Repository

OCHC maintains their own Information Repository of all mechanical and electrical components installed throughout our portfolio. As part of the commissioning phase, OCHC requires the design and construction teams to provide design/as-built information, as requested in a provided format.

15. CLOSE-OUT and WARRANTY

15.1. Close-out Documentation

OCHC requires two hard copies and a soft copy (PDF) of the close out documentation. In addition, OCH requires copies of the finalized as-built drawings in both AutoCAD and PDF format.

OCHC requires the prime consultant and CM to meet regularly throughout construction to ensure the on-going assembly of this documentation.

15.2. Warranty on Construction

OCHC is currently developing this section as it relates to warranty year maintenance, warranty call procedures, etc.

DOCUMENT HISTORY

Revision Number	Date of Issue	Author(s)	Brief Description of Change
0	2020-12-03	Rob Badger	Document created.
1	2021-03-31	Rob Badger	Added portable a/c connection requirements, confined spaces.
2	2021-04-12	Rob Badger	Dishwasher wording, addition of drying rack space. Minimize corridors/bedroom access from living space.
3	2021-04-14	Rob Badger	Revise unit sizing to leverage design team experience. Set minimum to 15% above OBC
4	2021-04-15	Rob Badger	Changed size of amenity space fridge. Added visitability definition.
5	2021-04-16	Rob Badger/Dan Dicaire	Update sustainability, mechanical, electrical and waste sections. Added wording to Commissioning.
6	2021-04-19	Rob Badger	Signage & Wayfinding + Branding

ProEng CONSULTING INC.
Building and Energy Engineers

CLIENT CALCULATIONS REVIEW LETTER

Project:	31 Building Energy Audit - Various Locations		
Client:	Ottawa Community Housing Corporation	**Project No:**	2021-007
Attention:	Ernesto Marin B.Sc.	**Date:**	January 10, 2021

ProEng Consulting Inc. was retained by Ottawa Community Housing Corporation (OCH) to conduct a review of their preliminary energy and green house gas (GHG) consumption savings calculations. The purpose of this report is to review OCH's calculations and advise if they are likely to reach their energy and GHG consumptions savings goals.

The available resources and information for the purposes of the review were restricted to the following:

- Client Provided Excel Spreadsheet Identifying Mechanical Equipment Lists – "201127 OCH-Equipment List-Mech-FLS" – Received on December 15th, 2020.
- Client Provided Excel Spreadsheet of Energy & GHG Consumption Calculations – "201214 CMHC CoInvestment Savings and GHG Calcs" - Received on December 15th, 2020.
- Client Provided Excel Spreadsheet of List of Buildings – "Appendix A - List of Properties" - Received on December 15th, 2020.
- PDF of Mechanical, Electrical & Architectural Record Drawings for 215 Wurtemburg Street – Dated June 1970
- PDF of Mechanical, Electrical & Architectural Record Drawings for 2651 Regina Street – Dated September 1995

The following procedures were provided in order to review the client's preliminary calculations:

1. Reviewed existing record drawings for two (2) sample buildings (215 Wurtemburg & 2651 Regina).
2. Reviewed options for architectural, mechanical and electrical modifications to reduce energy and GHG consumption.
3. Obtained preliminary selections for proposed modifications c/w equipment energy efficiencies at various weather conditions and part load capacities.
4. Completed load models and energy simulations of the two (2) sample buildings using Carrier HAP Software. Load models and energy simulations were completed for the existing systems (base case) and the proposed modifications.
5. Completed hand calculations using weather data for Ottawa from the ASHRAE Fundamentals Handbook to verify software results.
6. Compared OCH preliminary calculations with ProEng sample building results.
7. Reviewed client calculations for remaining 29 buildings based on results from sample buildings.

ProEng Consulting Inc. has completed a preliminary review of OCH's calculations for energy and GHG emissions savings as a result of their proposed architectural, mechanical & electrical modifications. Pending further verification, the plan as currently proposed is likely to achieve the 25% energy savings and 25% GHG emissions savings for the works portfolio as a whole, not on an individual building basis. Refer to attached Client Calculations Review Table for summary of results.

Thank you,

Richard Cameron, P.Eng.

ProEng Consulting Inc.
Unit 101-399 Bayrose Drive, Ottawa, ON, Canada, K2J 5W3
Tel: (613) 702-0244 email: info@proengconsulting.com

ProEng CONSULTING INC.

Project #: 2021-007
Date: January 10th, 2021

Client Calculations Review

Building Information					Proposed Modifications							High Level Calculation Review	
Property Name	Address	# of Units	Building Type	Heating Type	DHW Boiler to HP	HTG Boiler to HP	AMU to HRV	AMU to HP	Windows/ Doors	Enveloppe	PEER/Tower Retrofit	Client Calculated Energy Savings Post Modifications vs. Base Case (kWh/year)	Client Calculated GHG Savings Post Modifications vs. Base Case (m3/year)
2178 St Laurent	2178 St Laurent	20	TownHomes	Natural Gas					X			26,871	2,585
280 Montfort	280 Montfort St GAS	51	High Rise Apt	Electric	X							53,118	10,220
303 King Edward	303 King Edward Ave GAS	46	Low Rise Apt	Natural Gas	X	X	X	X			X	680,519	65,466
312 Cumberland	312 Cumberland St GAS	84	High Rise Apt	Electric	X							37,942	7,300
380 Somerset	380 Somerset St W GAS	60	High Rise Apt	Natural Gas	X	X						371,150	71,409
395 Somerset	395 SOMERSET GAS	205	High Rise Apt	Electric	X				X			422,742	54,750
Albion Gardens & Heatherington	1450 B Heatherington Rd GAS	274	TownHomes	Natural Gas		X					X	7,082,197	681,308
Bank	1365 BANK GAS	230	High Rise Apt	Electric			X	X				1,226,515	259,321
Bellevue	1465 CALDWELL GAS	324	High Rise Apt	Natural Gas						X		850,000	78,000
Blair	1546 Station Blvd GAS	72	TownHomes	Natural Gas	X	X						212,453	40,876
Brittannia	Britannia Woods (121 Ritchie)	179	TownHomes	Natural Gas							X	5,162,098	496,594
Brook tower	125 MCLEOD GAS	107	High Rise Apt	Natural Gas	X	X	X	X			X	1,341,900	161,364
Charlotte	160 CHARLOTTE GAS	216	High Rise Apt	Electric					X			100,166	0
Debra	960 Debra Ave Unit 48 GAS	136	TownHomes	Natural Gas							X	3,440,340	330,961
Donald	251 DONALD GAS	240	High Rise Apt	Electric	X		X	X			X	2,589,974	129,455
Donald Low	255 Donald St GAS	140	High Rise Apt	Natural Gas	X	X	X	X			X	915,692	88,090
Hamption	616 KIRKWOOD GAS	250	High Rise Apt	Electric						X		152,645	0
Heather Manor	1455 Heatherington Rd GAS	243	High Rise Apt	Electric	X							607,068	58,400
Iris	2487 Iris St GAS	21	Low Rise Apt	Natural Gas	X	X	X	X			X	555,117	53,402
Lepage	1390/1400 Lepage Ave GAS	310	High Rise Apt	Electric	X		X	X			X	3,312,627	130,809
Michelle Heights	2924 Michele Dr GAS	132	TownHomes	Natural Gas							X	3,465,398	333,372
North Gower	2363 Roger Stevens Dr GAS	15	Low Rise Apt	Natural Gas	X			X	X			54,756	9,573
Penfield	231 Penfield Dr GAS	40	Low Rise Apt	Electric	X			X	X			244,415	39,275
Ramsey	1065 RAMSEY GAS	208	High Rise Apt	Natural Gas						X		296,938	28,565
Regina	2651 Regina St GAS	244	High Rise Apt	Electric	X		X	X			X	2,524,957	123,413
Russell Gardens	2080/2100 RUSSELL RD GAS	336	High Rise Apt	Electric					X			216,296	0
Russell Heights	Russel Heights (1761-1803 Russell	160	TownHomes	Natural Gas							X	2,430,840	233,847
Shillington	1180 Shillington Ave GAS	30	Low Rise Apt	Natural Gas	X	X	X	X			X	538,246	51,779
Viewmount	263/265/267 Viewmount Dr GAS	99	Low Rise Apt	Electric	X			X				404,823	77,888
Walkley	1650/1660/1670/1690 Walkley Rd GAS	248	Low/High Rise Apt	Electric	X		X	X			X	3,029,957	114,035
Wurtemburg	215 Wurtemburg St GAS	114	High Rise Apt	Natural Gas	X	X	X	X			X	1,522,073	197,870
												43,869,834	3,929,926
												175,228,889	10,967,161
												25%	**36%**

Total Proposed Calculated Savings Post Modifications vs. Base Case (kWh/year & m3/year respectively)

Total Measured Avearage Consumption Over Previous three (3) years (Whole Portfolio) (kWh/year & m3/year respectively)

Total Proposed Calculated Savings Post Modifications vs. Base Case (%)