



City of Hamilton
GENERAL ISSUES COMMITTEE
AGENDA

Meeting #: 22-016
Date: August 8, 2022
Time: 9:30 a.m.
Location: Council Chambers (GIC)
Hamilton City Hall
71 Main Street West

Stephanie Paparella, Legislative Coordinator (905) 546-2424 ext. 3993

1. CEREMONIAL ACTIVITIES

2. APPROVAL OF AGENDA

(Added Items, if applicable, will be noted with *)

3. DECLARATIONS OF INTEREST

4. APPROVAL OF MINUTES OF PREVIOUS MEETING

4.1. July 4, 2022

5. COMMUNICATIONS

6. DELEGATION REQUESTS

6.1. Respecting Item 8.1 - Report CM22016/PED22058(a)/HSC22030(a) - Hamilton's Climate Action Strategy Implementation Resources and Governance (for today's meeting)

a. Peter Appleton - Video Presentation

b. Thomas Cooper, Hamilton Roundtable for Poverty Reduction

7. CONSENT ITEMS

8. STAFF PRESENTATIONS

- 8.1. Hamilton's Climate Action Strategy Implementation Resources and Governance (CM22016/PED22058(a)/HSC22030(a)) (City Wide)
- 8.2. Hamilton Regional Decarbonization Hub (CM22013 / HSC22046 / PED22176) (City Wide)
- 8.3. 2023 - 2025 Multi-Year Outlook and Capital Financing Plan Update (FCS22064) (City Wide)

9. PUBLIC HEARINGS / DELEGATIONS**10. DISCUSSION ITEMS**

- 10.1. Green Fleet Strategy and Action Plan (PW03147(f)) (City Wide)
- 10.2. Response to the Bay Area Climate Change Council's Options for Travel Report (PED22181) (Ward 1)
- 10.3. 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide)
- 10.4. Increase in Capital Project Expenses (FCS22067) (City Wide)
- 10.5. Chedoke Creek Order - Procurement Update PW19008(p) (City Wide)
- 10.6. Red Hill Valley Parkway Inquiry Update (LS19036 (m)) (City Wide)
- 10.7. Downtown Entertainment Precinct Master Agreement Update (PED18168(h)) (Ward 2)
- 10.8. City Hall Safety Plan (HUR22012) (City Wide)
- 10.9. Definition of Affordable Housing (HSC22051/PED22183) (City Wide)
- 10.10. Advisory Committee for Persons with Disabilities Report 22-009, July 12, 2022

11. MOTIONS**12. NOTICES OF MOTION****13. GENERAL INFORMATION / OTHER BUSINESS**

- 13.1. Amendments to the Outstanding Business List
 - a. Items to be Removed:

- a. Pilot Program, Partnership Between Hamilton Civic Museums and Hamilton Public Library for Free Museum Admission

(Addressed as item 10.1 on the June 15, 2022 GIC agenda - Report PED20069(a))
 - b. Occupancy Agreement(s), with The Cardus Institute for the adaptive reuse of the Balfour House/Chedoke Estate

(Addressed at the May 18, 2022 GIC as Item 10.2 - Report PED19168(c))
 - c. City of Hamilton Public Engagement Policy

(Addressed at the July 4, 2022 GIC as Item 10.5 - Report CM21011(a))
 - d. Response to the Bay Area Climate Change Council's Options for Travel Report

(Addressed on this agenda as Item 10.2 - Report PED22181)
 - e. Response to the Bay Area Climate Change Council's Options for Travel Report

(Addressed as Item 10.2 on today's agenda - Report PED22181)
 - f. Hamilton's Climate Change Strategy

(Addressed on this agenda as Item 8.1 - Report PED22058(a)/HSC22030(a))
- b. Items to be Referred to another Standing Committee:
- a. Security Report on Theft and Vandalism Prevention in City-Owned Spaces - Results of 2-Year Pilot Program

To be REFERRED to the Public Works Committee with a due date of February 15, 2023.
- c. Proposed New Due Dates:
- a. Annual Update - Implementation of the Public Art Master Plan

Current Due Date: September 21, 2022

Proposed New Due Date: November 30, 2022

b. Updated Hamilton Tourism Strategy

Current Due Date: August 8, 2022

Proposed New Due Date: November 30, 2022

c. Health -Related Incidents Associated with Exposure to Contaminated Waterways in the Chedoke Creek and Cootes Paradise

Current Due Date: November 30, 2022

Proposed New Due Date: March 22, 2023

14. PRIVATE AND CONFIDENTIAL

14.1. Closed Session Minutes - July 4, 2022

Pursuant to Section 9.1, Sub-sections (b), (c), (e), (f), and (k) of the City's Procedural By-law 21-021, as amended, and Section 239(2), Sub-sections (b), (c), (e), (f), and (k) of the *Ontario Municipal Act*, 2001, as amended, as the subject matters pertain to personal matters about an identifiable individual, including municipal or local board employees; a proposed or pending acquisition or disposition of land by the municipality or local board; litigation or potential litigation, including matters before administrative tribunals, affecting the municipality or local board; advice that is subject to solicitor-client privilege, including communications necessary for that purpose; and, a position, plan, procedure, criteria or instruction to be applied to any negotiations carried on or to be carried on by or on behalf of the municipality or local board.

14.2. Directions on a Potential Litigation Matter (LS22028) (City Wide)

Pursuant to Section 9.1, Sub-sections (e), (f) and (k) of the City's Procedural By-law 21-021, as amended, and Section 239(2), Sub-sections (e), (f) and (k) of the *Ontario Municipal Act*, 2001, as amended, as the subject matter pertains to litigation or potential litigation, including matters before administrative tribunals, affecting the municipality or local board; advice that is subject to solicitor-client privilege, including communications necessary for that purpose; and, a position, plan, procedure, criteria or instruction to be applied to any negotiations carried on or to be carried on by or on behalf of the municipality or local board.

14.3. Red Hill Valley Parkway Inquiry Update (LS19036(n)) (City Wide)

Pursuant to Section 9.1, Sub-sections (e), (f), (i) and (k) of the City's Procedural By-law 21-021, as amended, and Section 239(2), Sub-sections (e), (f), (i) and (k) of the *Ontario Municipal Act*, 2001, as amended, as the subject matter pertains to litigation or potential litigation, including matters before administrative tribunals, affecting the municipality or local board; advice that is subject to solicitor-client privilege, including communications necessary for that purpose; a trade secret or scientific, technical, commercial, financial or labour relations information, supplied in confidence to the municipality or local board, which, if disclosed, could reasonably be expected to prejudice significantly the competitive position or interfere significantly with the contractual or other negotiations of a person, group of persons, or organization; and, a position, plan, procedure, criteria or instruction to be applied to any negotiations carried on or to be carried on by or on behalf of the municipality or local board.

14.4. Appendix A to Report HUR22012, respecting City Hall Safety Plan

Pursuant to Section 9.1, Sub-sections (a) and (b) of the City's Procedural By-law 21-021, as amended, and Section 239(2), Sub-sections (a) and (b) of the *Ontario Municipal Act*, 2001, as amended, as the subject matter pertains to the security of the property of the municipality or local board; and, personal matters about an identifiable individual, including municipal or local board employees.

15. **ADJOURNMENT**



GENERAL ISSUES COMMITTEE MINUTES 22-014

9:30 a.m.

July 4, 2022

Council Chambers, City Hall, 2nd Floor
71 Main Street West, Hamilton, Ontario

Present: Mayor F. Eisenberger, Deputy Mayor E. Pauls (Chair)
Councillors J. Farr, N. Nann, S. Merulla, R. Powers, T. Jackson,
J.P. Danko, B Clark, M. Pearson, B. Johnson, L. Ferguson,
A. VanderBeek, J. Partridge

Absent: Councillors M. Wilson and T. Whitehead – Personal

THE FOLLOWING ITEMS WERE REFERRED TO COUNCIL FOR CONSIDERATION:

1. Waterdown Business Improvement Area (BIA) Revised Board of Management (PED22152) (Ward 15) (Item 7.1)

(Partridge/VanderBeek)

- (a) That the following individuals be appointed to the Waterdown Business Improvement Area (BIA) Board of Management, effective July 8, 2022;
- (i) Shari Reaume; and,
 - (ii) Buket Necip; and,
- (b) That the following individual be appointed to the Waterdown Business Improvement Area (BIA) Board of Management, effective July 19, 2022.
- (i) Christina Birmingham.

Result: MOTION, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Ninder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers

**General Issues Committee
Minutes 22-014**

**July 4, 2022
Page 2 of 39**

Yes	-	Ward 6	Councillor Tom Jackson
Yes	-	Ward 7	Councillor Esther Pauls, Deputy Mayor
Absent	-	Ward 8	Councillor J. P. Danko
Yes	-	Ward 9	Councillor Brad Clark
Yes	-	Ward 10	Councillor Maria Pearson
Yes	-	Ward 11	Councillor Brenda Johnson
Yes	-	Ward 12	Councillor Lloyd Ferguson
Yes	-	Ward 13	Councillor Arlene VanderBeek
Absent	-	Ward 14	Councillor Terry Whitehead
Yes	-	Ward 15	Councillor Judi Partridge

2. Emergency Operations Centre COVID-19 Recovery Phase and After-Action Reporting (CM22010) (City Wide) (Item 7.2)

(Eisenberger/Ferguson)

That Report CM22010, respecting the Emergency Operations Centre COVID-19 Recovery Phase and After-Action Reporting, be received.

Result: MOTION, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Absent	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

3. Annual Update on Economic Development Action Plan (PED22104) (City Wide) (Item 8.1)

(Ferguson/Danko)

That Report PED22104, respecting the Annual Update on Economic Development Action Plan, be received.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

4. City Manager 2021 – 2022 Review (CM22011) (City Wide) (Item 8.2)

(Pearson/VanderBeek)

That Report CM22011, respecting the City Manager 2021-2022 Review, be received.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

5. Term of Council Priorities 2018 to 2022 Summary Report (CM16003(e)) (City Wide) (Item 8.3)

(Jackson/Pearson)

That Report CM16003(e), respecting the Term of Council Priorities 2018 to 2022 Summary Report, be received.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

6. Commonwealth Games 2030 - Revised Memorandum of Understanding (PED19108(i)) (City Wide) (Item 10.1)

(Eisenberger/Partridge)

That the General Manager of Finance and Corporate Services, or their designate, be authorized and directed to execute, on behalf of the City of Hamilton, a Memorandum of Understanding (MOU) with Hamilton100 Commonwealth Games Bid Corporation (Hamilton100), attached as Appendix "A" to Report PED19108(i), and any other required ancillary documents or agreements, all in a form satisfactory to the City Solicitor.

Result: MOTION, CARRIED by a vote of 12 to 2, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
No	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers

Yes	-	Ward 6	Councillor Tom Jackson
Yes	-	Ward 7	Councillor Esther Pauls, Deputy Mayor
No	-	Ward 8	Councillor J. P. Danko
Yes	-	Ward 9	Councillor Brad Clark
Yes	-	Ward 10	Councillor Maria Pearson
Yes	-	Ward 11	Councillor Brenda Johnson
Yes	-	Ward 12	Councillor Lloyd Ferguson
Yes	-	Ward 13	Councillor Arlene VanderBeek
Absent	-	Ward 14	Councillor Terry Whitehead
Yes	-	Ward 15	Councillor Judi Partridge

**7. Environmental Remediation and Site Enhancement (ERASE)
Redevelopment Grant Application, 415 Main Street West, Hamilton ERG-21-05 (PED22136) (Ward 1) (Item 10.2)**

(Eisenberger/Johnson)

- (a) That Environmental Remediation and Site Enhancement (ERASE) Redevelopment Grant Application ERG-21-05, submitted by Main 415 Inc. (Morteza Vossough and Shahram Heidari), owner of the property at 415 Main Street West, Hamilton for an ERASE Redevelopment Grant not to exceed \$239,325, for estimated eligible remediation costs provided over a maximum of ten years, be authorized and approved in accordance with the terms and conditions of the ERASE Redevelopment Agreement;
- (b) That the General Manager of the Planning and Economic Development Department be authorized and directed to execute the Environmental Remediation and Site Enhancement (ERASE) Redevelopment Agreement together with any ancillary documentation required, to give effect to the ERASE Redevelopment Grant for Main 415 Inc. (Morteza Vossough and Shahram Heidari), owner of the property at 415 Main Street West, Hamilton in a form satisfactory to the City Solicitor; and,
- (c) That the General Manager of the Planning and Economic Development Department be authorized and directed to administer the Grant and Grant Agreement including but not limited to: deciding on actions to take in respect of events of default and executing any Grant Amending Agreements, together with any ancillary amending documentation, if required, provided that the terms and conditions of the Environmental Remediation and Site Enhancement (ERASE) Redevelopment Grant, as approved by City Council, are maintained and that any applicable Grant Amending Agreements are undertaken in a form satisfactory to the City Solicitor.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

8. Environmental Remediation and Site Enhancement (ERASE) Redevelopment Grant Application, 4 Vickers Road, Hamilton ERG-20-03 (PED22148) (Ward 7) (Item 10.3)

(Merulla/Ferguson)

- (a) That Environmental Remediation and Site Enhancement (ERASE) Redevelopment Grant Application ERG-20-03, submitted by DiCenzo (Linden Park) Holdings Inc., owner of the property at 4 Vickers Road, Hamilton for an ERASE Redevelopment Grant not to exceed \$68,527 in actual eligible costs for the abatement and removal of designated substances and hazardous materials to be provided over a maximum of ten years, be authorized and approved in accordance with the terms and conditions of the ERASE Redevelopment Agreement;
- (b) That the General Manager of the Planning and Economic Development Department be authorized and directed to execute the Environmental Remediation and Site Enhancement (ERASE) Redevelopment Agreement together with any ancillary documentation required, to give effect to the ERASE Redevelopment Grant for DiCenzo (Linden Park) Holdings Inc., owner of the property at 4 Vickers Road, Hamilton in a form satisfactory to the City Solicitor; and,
- (c) That the General Manager of the Planning and Economic Development Department be authorized and directed to administer the Grant and Grant Agreement including but not limited to: deciding on actions to take in respect of events of default and executing any Grant Amending Agreements, together with any ancillary amending documentation, if required, provided that the terms and conditions of the Environmental

Remediation and Site Enhancement (ERASE) Redevelopment Grant, as approved by City Council, are maintained and that any applicable Grant Amending Agreements are undertaken in a form satisfactory to the City Solicitor.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

**9. Revitalizing Hamilton Tax Increment Grant - 9 Robert Street (PED22147)
(Ward 2) (Item 10.4)**

(Jackson/Powers)

- (a) That a Revitalizing Hamilton Tax Increment Grant Program (RHTIG) Application submitted by 2691597Ontario Inc. (Golden Spruce Homes Inc., 1943255 Ontario Inc., Damian Guiducci, Joshua Abraham, Terrence Chung), for the property at 9 Robert Street, Hamilton, estimated at \$155,738.85 over a maximum of a four year period, and based upon the incremental tax increase attributable to the redevelopment of 9 Robert Street, Hamilton, be authorized and approved in accordance with the terms and conditions of the RHTIG;
- (b) That the General Manager of the Planning and Economic Development Department be authorized and directed to execute a Grant Agreement together with any ancillary documentation required, to give effect to the RHTIG for 2691597Ontario Inc. (Golden Spruce Homes Inc., 1943255 Ontario Inc., Damian Guiducci, Joshua Abraham, Terrence Chung) for the property known as 9 Robert Street, Hamilton, in a form satisfactory to the City Solicitor; and,

- (c) That the General Manager of the Planning and Economic Development Department be authorized and directed to administer the Grant, and Grant Agreement including, but not limited to, deciding on actions to take in respect of events of default and executing any Grant Amending Agreements, together with any ancillary amending documentation, if required, provided that the terms and conditions of the RHTIG Program, as approved by City Council, are maintained and that any applicable Grant Amending Agreements are undertaken in a form satisfactory to the City Solicitor.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

**10. Public Engagement Policy and Administrative Framework (CM21011(a))
(City Wide) (Item 10.5)**

(Farr/Nann)

- (a) That staff be directed to develop a corporate-wide Public Engagement Policy and Administrative Framework that is informed by public feedback and consultation efforts with relevant stakeholder groups including residents, community partners, the City's Public Engagement Community of Practice cross-departmental staff members, City's Senior Leadership Team, special workshop with City Council, and priority City-led equity, diversity and inclusion initiatives;
- (b) That temporary resources for 9 months for an amount up to, but not exceeding \$225,000, to be funded from the Tax Stabilization Reserve #110046, be approved for the estimated operating costs to support the development of a corporate-wide public engagement policy and

framework; corporate-wide public engagement programming and training; and, Our Future Hamilton Public Engagement Summit, in order to continue the momentum of existing work;

- (c) That the equivalent of 2 FTEs and the associated program budget of \$300,000, be referred to the 2023 operating budget for the Government and Community Relations team, to facilitate corporate-wide public engagement programming, training, and annual costs associated with the Our Future Annual Public Engagement Summit, in order to provide the necessary resources and structure to the support the Government and Community Relations team;
- (d) That staff be directed to identify and source options to support corporate-wide public engagement efforts that are accessible and meet the City's Equity, Diversity and Inclusion goals;
- (e) That staff be directed to update the City's Public Engagement Charter, in consultation with key stakeholders, to ensure alignment with the City's Public Engagement Policy, Administrative Framework and Implementation Plan; and,
- (f) That staff be directed to report back to the General Issues Committee by December 31, 2023 with a status update respecting the Public Engagement Policy and Administrative Framework.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

11. Business Improvement Area Advisory Committee Report 22-006, June 14, 2022 (Item 10.6)

(Ferguson/Pauls)

(a) International Village Business Improvement Area Expenditure Request (Item 11.1)

- (i) That the expenditure request from the International Village Business Improvement Area, in the amount of \$7,316.97 for the purchase of banners, programming and promotions, to be funded from the Community Improvement Plan (CIP) Contribution Program (BIA Payments Account 815010-56905), be approved; and,
- (ii) That the expenditure request from the International Village Business Improvement Area, in the amount of \$12,362.71 for the cost of graffiti removal and banners, to be funded from the Shared Parking Revenue Program (Parking Revenue Account 815010-45559), be approved.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

12. Hamilton-Wentworth District School Board Liaison Committee Report 22-001, May 9, 2022 (Item 10.7)

(Partridge/Jackson)

(a) Public Access to Modernized Hamilton Wentworth District School Board Facilities (Artificial Turf Fields) (Item 10.1)

- (i) That the Public Access to Modernized Hamilton-Wentworth District School Board (HWDSB) Facilities (Artificial Turf Fields) report, be referred to HWDSB staff for a formal detailed response to be brought forward at the next Committee meeting; and
- (ii) That Hamilton-Wentworth District School Board (HWDSB) staff report back to the Hamilton-Wentworth District School Board Liaison Committee with a formal response respecting Public Access to Modernized HWDSB Facilities (Artificial Turf Fields), with all details including costs.

(b) Bernie Custis Secondary Access to Tim Horton's Field (Item 10.2)

That staff from the City and Hamilton-Wentworth District School Board report back to the Hamilton-Wentworth District School Board Liaison Committee, with respect to the details, including costs, regarding the removal of the berms at Bernie Custis Secondary School.

(c) Status of City of Hamilton and Hamilton-Wentworth District School Board Property/Facility Agreements (Item 10.3)

That the report respecting the Status of City of Hamilton and Hamilton-Wentworth District School Board Property/Facility Agreements, be received.

(d) Active and Sustainable School Transportation Charter Agreement - Opportunities coming out of the pandemic (Added Item 10.5)

That staff be directed to report back to the Hamilton-Wentworth District School Board Liaison Committee on the status of and availability of Metrolinx funding for the Active and Sustainable School Transportation Charter Agreement.

(e) Hamilton-Wentworth District School Board Liaison Committee Terms of Reference Review (Added Item 10.6)

That the Membership and Mandate sections of the Hamilton-Wentworth District School Board Liaison Committee Terms of Reference, be amended to read as follows:

(a) MEMBERSHIP

Total of three Trustees (Chair of the Board and two Trustees)

Total of two Members of Council (Mayor and one member of Council)

Total of three HWDSB Secondary Students (non-voting)

City and Board Staff will be invited to attend meetings, as required.

The term of membership on each committee shall be consistent with the practices of each of the respective bodies.

(b) MANDATE

- (1) To strengthen the relationship between the City and HWDSB;
- (2) To assist in addressing issues affecting the governing bodies;
- (3) To promote increased co-operation, synergies and efficiencies between City Council and HWDSB;
- (4) To explore common interests;
- (5) To better understand and co-ordinate services;
- (6) To increase and maintain regular communication;
- (7) To work in a spirit of co-operation to further the mission of the City and HWDSB;
- (8) Joint initiatives and outcomes will align;
- (9) To develop ongoing collaborative and timely public communication strategies reflective of common purpose, work in progress and outcomes;
- (10) To monitor the work developed by staff on the Joint Property Asset Committee (JPAC) as outlined in the

Terms of Reference of JPAC and attached as Appendix "A"; and,

- (11) To promote the health and wellbeing of children and their families.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

**13. Non-Union Compensation Sub-Committee Report 22-001, June 21, 2022
(Item 10.8)**

(Ferguson/Pearson)

**(a) Senior Leadership Team Preventative Health Assessment
(HUR22009) (City Wide) (Item 9.2)**

- (i) That the direction provided to staff in Closed Session, respecting Report HUR22009, Senior Leadership Team Preventative Health Assessment, be approved; and,
- (ii) That Report HUR22009, Senior Leadership Team Preventative Health Assessment, remain confidential until approved by Council.

(b) Non-Union Benefit Policy (HUR22008) (City Wide) (Item 9.3)

- (i) That the Non-Union Benefit Policy, attached as Private & Confidential Appendix “A” to Report HUR22008, be approved; and,
- (ii) That Report HUR22008, respecting the Non-Union Benefit Policy and its Private & Confidential Appendix “A” remain confidential until approved by Council, at which time both the report and the appendix may be publicly released.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

14. Advisory Committee for Persons with Disabilities Report 22-007, June 14, 2022 (Item 10.9)

(VanderBeek/Powers)

(a) Accessible Open Spaces and Parklands Working Group Draft Terms of Reference (Item 7.6 (a))

That the Accessible Open Spaces and Parklands Working Group Draft Work Plan, attached as Appendix “A” to Advisory Committee for Persons with Disabilities 22-007, as amended, be approved.

(b) Appointment of Paula Kilburn to the Accessible Open Spaces and Parklands Working Group (Added Item 7.6 (c))

That Paula Kilburn be appointed to the Accessible Open Spaces and Parklands Working Group of the Advisory Committee for Persons with Disabilities.

(c) Invitation to Staff Respecting the Differences Between By-laws, Regulations and Guidelines (Added Item 7.6 (d))

That the appropriate staff be invited to a future meeting of the Advisory Committee for Persons with Disabilities (ACPD) respecting the differences between by-laws, regulations and guidelines, what the City can and cannot enact and what ACPD could recommend be enacted with respect to by-laws, regulations and guidelines.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

15. Airport Sub-Committee Report 22-002, June 28, 2022 (Item 10.10)

(Pearson/Johnson)

(a) Airport Sub-Committee – Terms of Reference (Item 7.1)

That the updated Terms of Reference for the Airport Sub-Committee, that were approved by City Council on June 8, 2022, be received.

(b) John C. Munro Hamilton International Airport - Conventional Transit Service Levels and Ridership (PW22057) (City Wide) (Item 7.2)

That Report PW2205,7 respecting the John C. Munro Hamilton International Airport - Conventional Transit Service Levels and Ridership, be received.

(c) Potential Development and Expansion Proposal at John C. Munro Hamilton International Airport (CYHM, YHM) (PED22159) (Ward 11) (Item 14.2)

- (i) That the Closed Session Recommendations respecting Report PED22159, Potential Development and Expansion Proposal at John C. Munro Hamilton International Airport (CYHM, YHM), be approved and remain confidential; and,
- (ii) That the complete Report PED22159 respecting the Potential Development and Expansion Proposal at John C. Munro Hamilton International Airport (CYHM, YHM), remain confidential.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

16. **Memorandum of Understanding with City and Aeon Studios on Barton-Tiffany Lands (PED19063(d)) (Ward 2) (Item 10.11)**

(Farr/Pearson)

- (a) That the materials presented by Aeon Studio Group (Aeon) in Appendix "C" to Report PED19063(d) entitled "Aeon Studio Group Submission Package" and Confidential Appendix "D" entitled "Aeon Studio Group Confidential Submission Package – Preliminary Project Construction Costing", be received;
- (b) That staff be authorized and directed to negotiate the necessary contractual agreements with Aeon, including a Master Development Agreement and/or proposed Agreement(s) of Purchase and Sale, based on the materials submitted by Aeon Studio Group, and the key City parameters, outlined in Appendix "E" to Report PED19063(d), and report to back to the General Issues Committee for approval, and on such terms and conditions deemed appropriate by the General Manager of Planning and Economic Development or designate, and in a form acceptable to the City Solicitor;
- (c) That staff be authorized and directed to undertake an appraisal, and to retain a development consultant to confirm the developability of the concept for the Barton-Tiffany lands, with a cost not to exceed \$150 K, to be funded from West Harbour Capital Project Account 4411706201, and report back to the General Issues Committee at the same time as the recommended agreements identified in Recommendation (b) of Report PED19063(d);
- (d) That Appendix "D" to Report PED19063(d), respecting the Memorandum of Understanding with City and Aeon Studios on Barton-Tiffany Lands, remain confidential;
- (e) ***That staff be directed to review opportunities for affordable housing through proceeds of the sale of the Barton-Tiffany lands and report back to the General Issues Committee; and,***
- (f) ***That staff be directed to determine a definition of "affordable housing", from the City's perspective, in the forthcoming report, respecting review opportunities for affordable housing through proceeds of the sale of the Barton-Tiffany lands.***

Result: MAIN MOTION, As Amended, CARRIED by a vote of 13 to 0, as follows:

Yes - Mayor Fred Eisenberger
Absent - Ward 1 Councillor Maureen Wilson

**General Issues Committee
Minutes 22-014**

**July 4, 2022
Page 18 of 39**

Yes	-	Ward 2	Councillor Jason Farr
Yes	-	Ward 3	Councillor Nrinder Nann
Yes	-	Ward 4	Councillor Sam Merulla
Yes	-	Ward 5	Councillor Russ Powers
Yes	-	Ward 6	Councillor Tom Jackson
Yes	-	Ward 7	Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8	Councillor J. P. Danko
Yes	-	Ward 9	Councillor Brad Clark
Yes	-	Ward 10	Councillor Maria Pearson
Yes	-	Ward 11	Councillor Brenda Johnson
Yes	-	Ward 12	Councillor Lloyd Ferguson
Absent	-	Ward 13	Councillor Arlene VanderBeek
Absent	-	Ward 14	Councillor Terry Whitehead
Yes	-	Ward 15	Councillor Judi Partridge

17. Advisory Committee for Persons with Disabilities Report 22-008, June 28, 2022 (Item 10.12)

(Eisenberger/Jackson)

(a) Advisory Committee for Persons with Disabilities - Accessibility Fair Budget (Item 7.3 (a))

That the proposed budget for the “Ability First” Advisory Committee for Persons with Disabilities Accessibility Fair, to be held October 5, 2022, attached as Appendix “A” to the Advisory Committee for Persons with Disabilities Report 22-008, be approved, with the purchase, cost and the reservation fee for the banner being approved subject to the following condition:

- (i) the City’s ability to store the banner being purchased for this event and for future events by the Advisory Committee for Persons with Disabilities.

Result: MOTION, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark

Yes	-	Ward 10	Councillor Maria Pearson
Yes	-	Ward 11	Councillor Brenda Johnson
Yes	-	Ward 12	Councillor Lloyd Ferguson
Absent	-	Ward 13	Councillor Arlene VanderBeek
Absent	-	Ward 14	Councillor Terry Whitehead
Yes	-	Ward 15	Councillor Judi Partridge

18. Property Acquisition and Exchange to Facilitate Parkland and New School (PED22045) (Ward 6 and Ward 12) (Item 14.1)

(Jackson/Ferguson)

- (a) That the direction provided to staff in Closed Session respecting Report PED22045, Property Acquisition and Exchange to Facilitate Parkland and New School, be approved;
- (b) That the budget for the Property Acquisition and Exchange to Facilitate Parkland and New School, as outlined in Appendix “E” to Report PED22045, be approved;
- (c) That all costs for the Property Acquisition and Exchange to Facilitate Parkland and New School be charged to Project ID Account No. 4401356300, and real estate and legal costs of \$382 K be debited from 59806-4401356300 and credited to Dept. ID Account No. 59806-812036 (Real Estate – Admin Recovery);
- (d) That the City Solicitor be authorized and directed to complete the transactions respecting the Property Acquisition and Exchange to Facilitate Parkland and New School on behalf of the City, including paying any necessary expenses, amending the closings, due diligence and other dates, and amending and waiving such other terms and conditions as deemed reasonable;
- (e) That the Mayor and Clerk be authorized and directed to execute the requisite agreements and all associated and necessary documents respecting the Property Acquisition and Exchange to Facilitate Parkland and New School, with all such documents to be in a form satisfactory to the City Solicitor; and,
- (f) That the complete Report PED22045, respecting the Property Acquisition and Exchange to Facilitate Parkland and New School, remain confidential until completion of the real estate transactions, except for Appendix “E” to Report PED22045, which is to remain confidential.

Result: MOTION, CARRIED by a vote of 9 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Absent	-	Ward 3 Councillor Nrinder Nann
Absent	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Absent	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Absent	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Absent	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

19. Partial Acquisition of Land in Ward 15 (PED22142) (Ward 15) (Item 14.2)

(Partridge/Johnson)

- (a) That an Option to Purchase, scheduled to close on July 28, 2022, for the Partial Acquisition of Land in Ward 15, as shown in Appendix "A" to Report PED22142, based substantially on the Terms and Conditions, attached as Appendix "B" to Report PED22142, and such other terms and conditions deemed appropriate by the General Manager of the Planning and Economic Development Department, be approved;
- (b) That all costs related to the Partial Acquisition of Land in Ward 15, be charged to Project ID Account No. 59806-4031280288;
- (c) That the sum of \$20,202 be funded from Project ID Account No. 59806-4031280288 and be credited to Dept ID Account No. 59806-812036 (Real Estate – Admin Recovery) for recovery of expenses including real estate and legal fees and costs, with respect to the Partial Acquisition of Land in Ward 15;
- (d) That the City Solicitor be authorized and directed to complete the Partial Acquisition of Land in Ward 15 on behalf of the City, including paying any necessary expenses, amending the closing, due diligence and other dates, and amending and waiving terms and conditions on such terms, as considered reasonable;
- (e) That the Mayor and Clerk be authorized and directed to execute the necessary documents for the Partial Acquisition of Land in Ward 15, in a form satisfactory to the City Solicitor; and,

- (f) That the complete Report PED22142, respecting the Partial Acquisition of Land in Ward 15, remain confidential until completion of the real estate transaction.

Result: MOTION, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Absent	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

20. Red Hill Valley Parkway Class Action Update (LS20014(b)) (City Wide) Red Hill Valley Parkway Class Action Update (LS20014(b)) (City Wide) (Item 14.4)

(Eisenberger/Powers)

- (a) That the direction provided to staff in Closed Session, respecting Report LS20014(b) - Red Hill Valley Parkway Class Action Update, be approved; and,
- (b) That Report LS20014(b) respecting the Red Hill Valley Parkway Class Action Update and its appendix remain confidential.

Result: MOTION, CARRIED by a vote of 9 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Absent	-	Ward 3 Councillor Nrinder Nann
Absent	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor

Absent	-	Ward 8	Councillor J. P. Danko
Yes	-	Ward 9	Councillor Brad Clark
Yes	-	Ward 10	Councillor Maria Pearson
Absent	-	Ward 11	Councillor Brenda Johnson
Yes	-	Ward 12	Councillor Lloyd Ferguson
Absent	-	Ward 13	Councillor Arlene VanderBeek
Absent	-	Ward 14	Councillor Terry Whitehead
Yes	-	Ward 15	Councillor Judi Partridge

FOR INFORMATION:

(a) APPROVAL OF AGENDA (Item 2)

The Committee Clerk advised of the following changes the agenda:

6. DELEGATION REQUESTS

6.1. Dr. Bob Maton, respecting the City's Vaccine Mandate

This delegation has withdrawn their request.

6.8 Val Sarjeant, Stoney Creek Athletics, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding

This delegation has withdrawn their request.

6.16. Kevin Duffy, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (For the July 4, 2022 GIC)

6.17 Dean Hustwick, President and Board Chair, Athletics Ontario, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (For the July 4, 2022 GIC)

10. DISCUSSION ITEMS

10.12. Advisory Committee for Persons with Disabilities Report 22-008, June 28, 2022

(Nann/Partridge)

That the agenda for the July 4, 2022 General Issues Committee meeting, be approved, as presented.

Result: MOTION, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Absent	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

(b) DECLARATIONS OF INTEREST (Item 3)

- (i) Councillor J. P. Danko, declared a non-disqualifying interest to Item 10.7, respecting the Hamilton-Wentworth District School Board Liaison Committee Report 22-001, May 9, 2022, as his wife is the Chair of the Hamilton-Wentworth District School Board.
- (ii) Councillor S. Merulla declared a non-disqualifying interest to Item 14.1, respecting Report PED22045 - Property Acquisition and Exchange to Facilitate Parkland and New School, as his daughter works for the Conseil Scolaire Catholique Monavenir.
- (iii) Mayor F. Eisenberger declared a non-disqualifying interest to Item 14.1, respecting Report PED22045 - Property Acquisition and Exchange to Facilitate Parkland and New School, as his son works for the Conseil Scolaire Catholique Monavenir.

(c) APPROVAL OF MINUTES OF PREVIOUS MEETINGS (Item 4)

(i) June 15, 2022 and June 23, 2022 (Items 4.1 and 14.2)

(Ferguson/Pearson)

That the Minutes of the June 15, 2022 and June 23, 2022 General Issues Committee meetings be approved, as presented.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

(d) DELEGATION REQUESTS (Item 6)

(Johnson/VanderBeek)

That the following delegation requests be approved for the July 4, 2022 General Issues Committee:

- 6.2 Cesare Di Donato, Industry Education Council, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.3 Richard Gelder, Hamilton Olympic Club, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.4 Carmella Trombetta respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding

- 6.5 Jeff Anders, Aeon Studio Group, respecting Item 10.11 - Report PED19063(d)), Memorandum of Understanding with City and Aeon Studios on Barton-Tiffany Lands
- 6.6 Mike Strange, Two-time Commonwealth Games Gold Medalist, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.7 Mike Moore, Hamilton Challenger Baseball Association, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.9 Louis Frapporti and P.J. Mercanti, Hamilton100, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.10 Paul Paletta, Alinea Group Holdings Inc., respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.11 Shendal Yalchin, The Hamilton Club, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.12 Ed Dunn, International Children's Games, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.13 Helen Downey, SportHamilton, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.14 Michael Norris, ACFO, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.15 Anthony Frisina, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (video)
- 6.16. Kevin Duffy, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding
- 6.17 Dean Hustwick, President and Board Chair, Athletics Ontario, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

(Ferguson/Pearson)

That the delegation request submitted by Louis Frapporti and P.J. Mercanti, Hamilton100, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding, be moved up on the agenda to be heard as the first delegate.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

(e) STAFF PRESENTATIONS (Item 8)

**(i) Annual Update on Economic Development Action Plan (PED22104)
(City Wide) (Item 8.1)**

Norm Schleeahn, Director of Economic Development; and, Carrie Brooks-Joiner, Director, Tourism & Culture, provided the presentation respecting Report PED22104 - Annual Update on Economic Development Action Plan.

(Powers/Jackson)

That the presentation, respecting Report PED22104, Annual Update on Economic Development Action Plan, be received.

Result: MOTION, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Absent	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

For disposition of this matter, please refer to Item 3.

(ii) City Manager 2021 – 2022 Review (CM22011) (City Wide) (Item 8.2)

Janette Smith, City Manager, provided a presentation respecting Report CM22011, City Manager 2021 – 2022 Review.

(Nann/Johnson)

That the presentation respecting Report CM22011, City Manager 2021 – 2022 Review, be received.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

**General Issues Committee
Minutes 22-014**

**July 4, 2022
Page 28 of 39**

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

For disposition of this matter, please refer to Item 4.

(Partridge/Powers)

That the presentation and consideration of Item 8.3 - Report CM16003(e), respecting the Term of Council Priorities 2018 to 2022 Summary Report, be DEFERRED until after the consideration of Item 10.1.

Result: MOTION, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Absent	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

**(iii) Term of Council Priorities 2018 to 2022 Summary Report
(CM16003(e)) (City Wide) (Item 8.3)**

Janette Smith, City Manager, provided a presentation respecting Report CM16003(e), Term of Council Priorities 2018 to 2022 Summary Report.

(Johnson/Powers)

That the presentation respecting Report CM16003(e), Term of Council Priorities 2018 to 2022 Summary Report, be received.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

For disposition of this matter, please refer to Item 6.

(f) PUBLIC HEARINGS / DELEGATIONS (Item 9)

(i) Louis Frapporti and P.J. Mercanti, Hamilton100, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.8)

(Farr/Pearson)

That the 5-minute speaking limit, outlined in sub-section (6), Section 5.12 – Delegations, of the Procedural by law 21-021, as amended, be waived and the delegation of Louis Frapporti and P. J. Mercanti, Hamilton100, be permitted to take the appropriate time required to provide their presentation to Committee

Result: MOTION, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Absent	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

Louis Frapporti and P. J. Mercanti, Hamilton100, addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

(ii) Cesare Di Donato, Industry Education Council, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.1)

Cesare Di Donato, Industry Education Council, addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

(iii) Richard Gelder, Hamilton Olympic Club, respecting Item 10.1 – Report PED19108(i), respecting the Commonwealth Games 2030 – Revised Memorandum of Understanding (Item 9.2)

Richard Gelder, Hamilton Olympic Club, addressed the Committee respecting Item 10.1 – Report PED19108(i), respecting the Commonwealth Games 2030 – Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

- (iv) **Carmella Trombetta respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.3)**

Carmella Trombetta addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

- (v) **Jeff Anders and Mazyar Mortazavi, Aeon Studio Group, respecting Item 10.11 - Report PED19063(d)), Memorandum of Understanding with City and Aeon Studios on Barton-Tiffany Lands (Item 9.4)**

(Farr/Clark)

That the 5-minute speaking limit, outlined in sub-section (6), Section 5.12 – Delegations, of the Procedural by law 21-021, as amended, be waived and the delegation of Jeff Anders and Mazyar Mortazavi, Aeon Studio Group, respecting Item 10.11 - Report PED19063(d)), Memorandum of Understanding with City and Aeon Studios on Barton-Tiffany Lands, be permitted to take an additional 5 minutes to provide their presentation to Committee.

Result: MOTION, CARRIED by a vote of 12 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Absent	-	Ward 3 Councillor Nrinder Nann
Absent	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

Jeff Anders and Mazyar Mortazavi, Aeon Studio Group, addressed the Committee respecting Item 10.11 - Report PED19063(d)), Memorandum of Understanding with City and Aeon Studios on Barton-Tiffany Lands.

For disposition of this matter, please refer to Item 16.

- (vi) Mike Strange, Two-time Commonwealth Games Gold Medalist, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.5)**

Mike Strange, two-time Commonwealth Games gold medalist, addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

- (vii) Mike Moore, Hamilton Challenger Baseball Association, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.6)**

Mike Moore, Hamilton Challenger Baseball Association, addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

- (viii) Paul Paletta, President, Alinea Group Holdings Inc., respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.9)**

Paul Paletta, President, Alinea Group Holdings Inc., addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

- (ix) **Shendal Yalchin, General Manager and Chief Operating Officer, The Hamilton Club, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.10)**

Shendal Yalchin, General Manager and Chief Operating Officer, The Hamilton Club, addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

- (x) **Ed Dunn, President, International Children's Games Hamilton Inc., respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.11)**

Ed Dunn, President, International Children's Games Hamilton Inc., addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

- (xi) **Helen Downey, SportHamilton, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.12)**

Helen Downey, SportHamilton, addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

- (xii) **Michael Norris, ACFO Hamilton, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.13)**

Michael Norris, ACFO Hamilton, addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

- (xiii) **Anthony Frisina, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (video) (Item 9.14)**

The video from Anthony Frisina, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding, was shown to the Committee.

For disposition of this matter, please refer to Item 6.

- (xiv) **Kevin Duffy, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.15)**

Kevin Duffy addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

- (xv) **Dean Hustwick, President and Board Chair, Athletics Ontario, respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding (Item 9.16)**

Dean Hustwick, President and Board Chair, Athletics Ontario, addressed the Committee respecting Item 10.1 - Report PED19108(i), respecting the Commonwealth Games 2030 - Revised Memorandum of Understanding.

For disposition of this matter, please refer to Item 6.

(Eisenberger/Powers)

That all of the delegations respecting Item 10.1 - Report PED19108(i), Commonwealth Games 2030 - Revised Memorandum of Understanding; and, Item 10.11 - Report PED19063(d)), Memorandum of Understanding with City and Aeon Studios on Barton-Tiffany Lands, be received.

Result: MOTION, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Absent	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann

**General Issues Committee
Minutes 22-014**

**July 4, 2022
Page 35 of 39**

Yes	-	Ward 4	Councillor Sam Merulla
Yes	-	Ward 5	Councillor Russ Powers
Yes	-	Ward 6	Councillor Tom Jackson
Yes	-	Ward 7	Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8	Councillor J. P. Danko
Yes	-	Ward 9	Councillor Brad Clark
Yes	-	Ward 10	Councillor Maria Pearson
Yes	-	Ward 11	Councillor Brenda Johnson
Yes	-	Ward 12	Councillor Lloyd Ferguson
Yes	-	Ward 13	Councillor Arlene VanderBeek
Absent	-	Ward 14	Councillor Terry Whitehead
Yes	-	Ward 15	Councillor Judi Partridge

For disposition of these matters, please refer to Items 6 and 16.

(Ferguson/Pearson)

That the General Issues Committee recess for one half hour until 3:05 p.m.

Result: MOTION, CARRIED by a vote of 14 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Yes	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

(g) DISCUSSION ITEMS (Item 10)**(i) Memorandum of Understanding with City and Aeon Studios on Barton-Tiffany Lands (PED19063(d)) (Ward 2) (Item 10.11)****(Nann/Clark)**

That sub-section (k)(3) to Appendix “E” to Report PED19063(d), respecting the Memorandum of Understanding with the City and Aeon Studios on Barton-Tiffany Lands, ***be amended*** by adding the words “***options including geared to income housing***”, to read as follows:

- (k) Any agreements shall have specific requirements with respect to:
- (1) the provision of affordable space for local artists;
 - (2) residential unit mix, inclusive of family-friendly residential units;
 - (3) affordable housing ***options including geared to income housing***; and,
 - (4) sustainability, climate resilience, and environmental performance.

Result: Amendment, DEFEATED by a vote of 4 to 10, as follows:

No	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
No	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
No	-	Ward 4 Councillor Sam Merulla
No	-	Ward 5 Councillor Russ Powers
No	-	Ward 6 Councillor Tom Jackson
No	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
No	-	Ward 10 Councillor Maria Pearson
No	-	Ward 11 Councillor Brenda Johnson
No	-	Ward 12 Councillor Lloyd Ferguson
No	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

For disposition of this matter, please refer to Item 16.

(Eisenberger/Farr)

That Report PED19063(d), respecting the Memorandum of Understanding with the City and Aeon Studios on Barton-Tiffany Lands, **be amended** by adding new sub-sections (e) and (f), to read as follows:

- (e) ***That staff be directed to review opportunities for affordable housing through proceeds of the sale of the Barton-Tiffany lands and report back to the General Issues Committee; and,***
- (f) ***That staff be directed to determine a definition of "affordable housing", from the City's perspective, in the forthcoming report, respecting review opportunities for affordable housing through proceeds of the sale of the Barton-Tiffany lands.***

Result: Amendment, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Absent	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

For disposition of this matter, please refer to Item 16.

(h) PRIVATE & CONFIDENTIAL (Item 14)**(Farr/Jackson)**

That Committee to move into Closed Session to discuss Items 14.1, 14.4 and 14.5, pursuant to Section 9.1, Sub-sections (b), (c), (e), (f), and (k) of the City's Procedural By-law 21-021, as amended, and Section 239(2), Sub-sections (b), (c), (e), (f), and (k) of the *Ontario Municipal Act*, 2001, as amended, as the subject matters pertain to personal matters about an identifiable individual, including municipal or local board employees; a proposed or pending acquisition or disposition of land by the municipality or local board; litigation or potential

litigation, including matters before administrative tribunals, affecting the municipality or local board; advice that is subject to solicitor-client privilege, including communications necessary for that purpose; and, a position, plan, procedure, criteria or instruction to be applied to any negotiations carried on or to be carried on by or on behalf of the municipality or local board.

Result: MOTION, CARRIED by a vote of 13 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Yes	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Yes	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Yes	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Yes	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Absent	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

(i) Appendix "D" to Report PED19063(d), respecting the Memorandum of Understanding with City and Aeon Studios on Barton-Tiffany Lands (Item 14.3)

For disposition of this matter, please refer to Item 16.

(ii) City Manager 2021-2022 Review (Item 14.5)

There was no information to report in Open Session respecting the City Manager's 2021-2022 review.

(h) ADJOURNMENT (Item 15)

(Ferguson/Powers)

That there being no further business, the General Issues Committee be adjourned at 7:14 p.m.

Result: MOTION, CARRIED by a vote of 9 to 0, as follows:

Yes	-	Mayor Fred Eisenberger
Absent	-	Ward 1 Councillor Maureen Wilson
Absent	-	Ward 2 Councillor Jason Farr
Yes	-	Ward 3 Councillor Nrinder Nann
Absent	-	Ward 4 Councillor Sam Merulla
Yes	-	Ward 5 Councillor Russ Powers
Yes	-	Ward 6 Councillor Tom Jackson
Yes	-	Ward 7 Councillor Esther Pauls, Deputy Mayor
Absent	-	Ward 8 Councillor J. P. Danko
Yes	-	Ward 9 Councillor Brad Clark
Yes	-	Ward 10 Councillor Maria Pearson
Absent	-	Ward 11 Councillor Brenda Johnson
Yes	-	Ward 12 Councillor Lloyd Ferguson
Absent	-	Ward 13 Councillor Arlene VanderBeek
Absent	-	Ward 14 Councillor Terry Whitehead
Yes	-	Ward 15 Councillor Judi Partridge

Respectfully submitted,

Esther Pauls, Deputy Mayor
Chair, General Issues Committee

Stephanie Paparella
Legislative Coordinator,
Office of the City Clerk

-----Original Message-----

From: City of Hamilton, Ontario, Canada via City of Hamilton, Ontario, Canada <[no-reply@hamilton.ca](mailto:reply@hamilton.ca)>

Sent: Tuesday, August 2, 2022 8:26 PM

To: clerk@hamilton.ca

Subject: Form submission from: Request to Speak to Committee of Council Form

Submitted on Tuesday, August 2, 2022 - 8:25pm Submitted by anonymous user:
108.162.241.135 Submitted values are:

==Committee Requested==

Committee: General Issues Committee

Will you be delegating in person or virtually? Virtually

Will you be delegating via a pre-recorded video? Yes

==Requestor Information==

Name of Organization (if applicable):

Name of Individual: Peter Appleton

Preferred Pronoun:

Contact Number: [REDACTED]

Email Address: [REDACTED]

Mailing Address:

[REDACTED]

[REDACTED]

[REDACTED]

Reason(s) for delegation request: To improve Hamilton's climate plan and discuss the Save our Streams Restore Hamilton Plan.

Will you be requesting funds from the City? No

Will you be submitting a formal presentation? No

The results of this submission may be viewed at:

<https://www.hamilton.ca/node/286/submission/644881>

-----Original Message-----

From: City of Hamilton, Ontario, Canada via City of Hamilton, Ontario, Canada <[no-reply@hamilton.ca](mailto:reply@hamilton.ca)>

Sent: Wednesday, August 3, 2022 10:24 AM

To: clerk@hamilton.ca

Subject: Form submission from: Request to Speak to Committee of Council Form

Submitted on Wednesday, August 3, 2022 - 10:24am Submitted by anonymous user:
172.70.126.131 Submitted values are:

==Committee Requested==

Committee: General Issues Committee

Will you be delegating in person or virtually? In person (as of
May 30, 2022)

Will you be delegating via a pre-recorded video? No

==Requestor Information==

Name of Organization (if applicable): Hamilton Roundtable for
Poverty Reduction

Name of Individual: Thomas Cooper

Preferred Pronoun: he/him

Contact Number: [REDACTED]

Email Address: tom@hamiltonpoverty.ca

Mailing Address:

100 Main Street East, Suite 203

Hamilton, ON

Reason(s) for delegation request: Discuss collaboration with
community partners and the City of Hamilton regarding
contributions to the Climate Change Impact Adaptation Plan to
date, and particularly some of the work to address the impact of
extreme heat events for vulnerable populations in Hamilton.

Will you be requesting funds from the City? No


Will you be submitting a formal presentation? No

The results of this submission may be viewed at:

<https://www.hamilton.ca/node/286/submission/645026>



CITY OF HAMILTON
CITY MANAGER'S OFFICE
 and
PLANNING AND ECONOMIC DEVELOPMENT DEPARTMENT
 Planning Division
 and
HEALTHY AND SAFE COMMUNITIES DEPARTMENT
 Healthy Environments Division

TO:	Mayor and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	Hamilton's Climate Action Strategy Implementation Resources and Governance (CM22016/PED22058(a)/HSC22030(a)) (City Wide) (Outstanding Business List Item)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Trevor Imhoff (905) 546-2424 Ext. 1308 Christine Newbold (905) 546-2424 Ext. 1279 Andrea McDowell (905) 546-2424 Ext. 5288
SUBMITTED BY:	Janette Smith City Manager
SIGNATURE:	
SUBMITTED BY:	Jason Thorne General Manager Planning and Economic Development Department
SIGNATURE:	
SUBMITTED BY:	Angela Burden General Manager Healthy and Safe Communities Department
SIGNATURE:	

OUR Vision: To be the best place to raise a child and age successfully.

OUR Mission: To provide high quality cost conscious public services that contribute to a healthy, safe and prosperous community, in a sustainable manner.

OUR Culture: Collective Ownership, Steadfast Integrity, Courageous Change, Sensational Service, Engaged Empowered Employees.

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 2 of 18**

RECOMMENDATION

- (a) That the final “ReCharge Hamilton – Our Community Energy + Emissions Plan” (CEEP) attached as Appendix “C” to Report CM22016/PED22058(a)/HSC22030(a) be approved and that it comprise the climate change mitigation component of the City’s Climate Action Strategy;
- (b) That the final “Climate Change Impact Adaptation Plan” (CCIAP) attached as Appendix “D” to Report CM22016/PED22058(a)/HSC22030(a) be approved and that it comprise the climate change adaptation component of the City’s Climate Action Strategy;
- (c) That the following supporting studies and reports be received:
 - (i) “Hamilton’s Climate Action Strategy - Final Consultation Report” attached as Appendix “A” to Report CM22016/PED22058(a)/HSC22030(a);
 - (ii) “How Much Is Climate Change Costing Canadian Communities” Report attached as Appendix “B” to Report CM22016/PED22058(a)/HSC22030(a);
 - (iii) “Hamilton’s Climate Action Strategy Departmental Resource Considerations” Table attached as Appendix “E” to Report CM22116/PED22058(a)/HSC22030(a)
- (d) That staff be directed to prepare a Draft Terms of Reference for a Climate Change Advisory Committee of Council for the 2022-2026 Council Term, that will help guide the implementation of the City’s Climate Action Strategy, and which includes a composition that ensures a diverse representation of Hamilton’s community;
- (e) That the City Manager be authorized and directed to establish a Climate Change Office within the Planning and Economic Development Department to lead the implementation of the City’s Climate Action Strategy, and to implement the following changes within the Planning and Economic Development Department:
 - (i) create a Director of Climate Change Initiatives position within the Climate Change Office representing an estimated annual cost of \$215,000 inclusive of salary and non-salary costs (1 permanent FTE); and
 - (ii) transfer the Senior Project Manager, Air Quality and Climate Change (1 FTE) from Public Health Services, Healthy and Safe Communities

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 3 of 18**

Department, to the Climate Change Office within the Planning and Economic Development Department, with no impact on the levy.

- (f) That the creation of two additional permanent positions within the Climate Change Office to support the implementation of Hamilton's Climate Action Strategy and to support the community and stakeholder engagement component of the Climate Action Strategy, be brought forward for Council's consideration as part of the 2023 Operating Budget;
- (g) That the General Manager of Planning and Economic Development and the General Manager of Public Works, in consultation with the Executive Director of Human Resources, be directed to review the function and role of the Energy Office within the Energy, Fleet and Facilities Management Division of Public Works, and any other potential service areas, and report back to Council with any recommended organizational changes that would align and integrate the work of the Energy Office or other service areas with that of the Climate Change Office.
- (h) That the City of Hamilton's annual contribution of \$160,000 towards the Bay Area Climate Change Office (BACCO) be referred to the 2023 Operating Budget, and that, subject to Council's approval of funding through the 2023 Operating Budget, the City Manager be authorized to negotiate, enter into and execute a Funding Agreement / Memorandum of Understanding with Mohawk College for the continuation of the City's participation in the BACCO, in a form satisfactory to the City Solicitor, and that this funding be administered through the Climate Change Office, Planning and Economic Development Department; and
- (i) That the following items on the Outstanding Business Lists (OBL) be removed:
 - (i) Item LL (General Issues Committee OBL) - General Issues Committee June 1, 2022, Item 2, respecting final public consultation, advisory committee structure and governance and organization structure and resourcing for Hamilton's Climate Action Strategy;
 - (ii) Item 19-L (Emergency & Community Services Committee OBL) - General Issues Committee December 19, 2021, Item 4, respecting Implementation and Resources Required re: Corporate Goals and Areas of Focus for Climate Mitigation & Adaptation;
 - (iii) Item 19-I (Audit Finance & Administration Committee OBL) - General Issues Committee December 19, 2021, Item 4, respecting Implementation

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 4 of 18**

and Resources Required re: Corporate Goals and Areas of Focus for Climate Mitigation & Adaptation.

EXECUTIVE SUMMARY

Climate change is one of the greatest threats facing the world today. Without immediate, rapid and large-scale reductions of greenhouse gas (GHG) emissions, the Intergovernmental Panel on Climate Change (IPCC) in its Sixth Assessment Report states global warming of 2°C will be exceeded during this century. It further states that many changes due to past and future GHG emissions are irreversible for centuries to millennia. It is therefore necessary for the City of Hamilton to rapidly reduce GHG emissions while at the same time preparing for the unavoidable impacts of climate change.

The City of Hamilton elected to meet that challenge through its own planning and action process. In October 2015, Council endorsed “Taking Action on Climate Change in Hamilton – A Community Plan”. In 2019, Council further expanded its commitment to climate action by adopting a Climate Emergency Declaration and directing staff to identify actions to achieve net-zero carbon emissions before 2050.

Since that time, a number of climate change mitigation and adaptation initiatives have been undertaken including the Green Fleet Strategy, updating of the Corporate Energy and Sustainability Policy to align corporate targets to those in the Emergency Declaration, undertaking an Asset Management Strategy with a climate lens, continued investment in the ten-year transit strategy, various plans and investments related to cycling and active transportation, and many others. Also among those actions, has been the development of the Community Energy and Emissions Plan (CEEP) and the Climate Change Impact Adaptation Plan (CCIAP). This Report CM22016/PED22058(a)/HSC22030(a) presents the final CEEP and CCIAP for Council approval, which together comprise Hamilton’s Climate Action Strategy (the Strategy) for achieving the goal of net-zero carbon emissions by 2050. An overview of these plans appears below.

Climate Change Mitigation – The CEEP

The CEEP establishes a low-carbon scenario model based on 28 targets that will get the entire community to net-zero GHG emissions. Additional financial and economic analysis was completed using standard economic tools including a Marginal Abatement Cost Curve that showed the net benefit of reaching those targets resulted in a \$64 M savings to the entire community. This is broken down in detail in Appendix “C” to Report CM22016/PED22058(a)/HSC22030(a) which provides the incremental investment costs

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 5 of 18**

and the savings which is a combination of energy cost savings, avoided carbon costs, avoided maintenance costs and revenues generated.

Climate Change Adaptation – The CCIAP

The CCIAP establishes an action-oriented plan that is based on global and regional climate models downscaled to the local level to establish and prioritize climate risk and vulnerabilities. These actions deal with the most urgent climate risks expected for the City of Hamilton. Previous reports to Council (PED2205(a)/HSC22030(a)) have highlighted research and trends from sources and organizations across Canada on the costs of climate change to communities and provide strong evidence that the City of Hamilton faces significant costs as a result of climate change, many of which can be mitigated or reduced through action.

Governance and Resourcing

Hamilton's Climate Action Strategy works to reduce GHG emissions and prepare for the worsening impacts of climate change. It will require a multi-faceted approach to implementation. This report is recommending an overall governance structure that is based on research from the Federation of Canadian Municipalities Factsheet on Governance for Deep Decarbonization, a multi-jurisdiction scan across the Greater Toronto and Hamilton Area (GTHA), and from community-wide public consultation and engagement with social, environmental, institutional, Indigenous and equity-seeking organizations.

The recommended governance structure is comprised of a newly created Climate Change Office within the Planning and Economic Development Department, led by a new director level position reporting to the General Manager of PED and routinely reporting progress to the City Manager and Senior Leadership. The structure also includes a multi-department director level Steering Committee to coordinate many of the cross-cutting actions needed across the corporation and with community and industry stakeholders, and a community climate advisory committee.

Alternatives for Consideration – See Page 17

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: Hamilton's Climate Action Strategy includes actions that will be led by the City, but also actions that will be led through other levels of government, local industry, and community stakeholders. With respect to City-led actions, these will be subject to annual budget approval. Appendix "E" to Report CM22016/PED22058(a)/HSC22030(a) includes preliminary

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 6 of 18**

resource considerations to implement the City-lead actions identified in the Climate Action Strategy. Where additional resources are identified these estimates would be further refined and a financing strategy would be brought forward for Council consideration through the annual budget process or through separate Committee reports.

Report CM22016/PED22058(a)/HSC22030(a) includes the following recommendation which will have an immediate financial implication:

- the establishment of a new Climate Change Office within the Planning and Economic Development Department, including the creation of one permanent FTE representing an estimated annual cost of \$215,000 to be funded through the levy.

Report CM22016/PED22058(a)/HSC22030(a) also includes a referral to the 2023 Operating Budget for the following:

- two additional permanent positions within the Climate Change Office to support the implementation of Hamilton's Climate Action Strategy and to support the community and stakeholder engagement component of the Climate Action Strategy
- renewal of the City of Hamilton's annual contribution of \$160,000 towards the Bay Area Climate Change Office (BACCO)

Staffing: The Climate Action Strategy includes actions that will be undertaken by staff across the Corporation.

Report CM22016/PED22058(a)/HSC22030(a) is recommending the establishment of a new Climate Change Office within the Planning and Economic Development Department, including the creation of one FTE, being the role of Director of Climate Change Initiatives. This report is also recommending that the potential creation of two additional FTE to support the implementation and overall internal and external coordination required for Hamilton's Climate Action Strategy and to support the community and stakeholder education and engagement components of the Climate Action Strategy be referred to the 2023 Operating Budget for Council's consideration.

In addition, Report CM22016/PED22058(a)/HSC22030(a) is recommending the transfer of the existing Senior Project Manager, Air Quality and Climate Change (1 FTE) from Public Health Services, Healthy

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 7 of 18**

and Safe Communities Department, to the Climate Change Office within the Planning and Economic Development Department, with no impact on the levy.

Legal: Not applicable.

HISTORICAL BACKGROUND

In October 2015, Council endorsed “Taking Action on Climate Change in Hamilton – A Community Plan”. In 2019, Council further expanded its commitment to climate action by adopting a Climate Emergency Declaration and directing staff to identify actions to achieve net-zero carbon emissions before 2050.

Since that time, a number of climate change mitigation and adaptation initiatives have been undertaken including the Green Fleet Strategy, updating of the Corporate Energy and Sustainability Policy to align corporate targets to those in the Emergency Declaration, undertaking an Asset Management Strategy with a climate lens, continued investment in the ten-year transit strategy, various plans and investments related to cycling and active transportation, and many others. Also among those actions, has been the development of the Community Energy and Emissions Plan (CEEP) and the Climate Change Impact Adaptation Plan (CCIAP) which are the subject of this report.

On June 8, 2022, Council approved the following recommendations of Item 8.1 of General Issues Committee - Report PED22058/HSC22030 – Hamilton’s Climate Change Action Strategy:

- (a) *That the draft “ReCharge Hamilton – Our Community Energy + Emissions Plan” (CEEP) attached as Appendix “A” to Report PED22058/HSC22030 be received;*
- (b) *That “Hamilton’s Climate Vulnerability and Risk Assessment Report” as completion of Milestone 2 of ICLEI Canada’s Building Adaptive and Resilient Communities Framework attached as Appendix “B” to PED22058/HSC22030 be received;*
- (c) *That staff be directed to undertake final public and stakeholder consultation on the draft “ReCharge Hamilton – Our Community Energy + Emissions Plan” (CEEP) and the “Hamilton’s Climate Change Impact Adaptation Plan” (CCIAP) and report back to the General Issues Committee with the results of the public consultation and the recommended final CEEP and final CCIAP, which together will form Hamilton’s Climate Change Action Strategy for Council’s consideration;*

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 8 of 18**

- (d) *That staff be directed to report back to the General Issues Committee on the recommended approach for establishing an advisory committee structure for Hamilton's Climate Change Action Strategy with a deadline of August 8, 2022;*
- (e) *That staff be directed to report back to General Issues Committee on a recommended scope, governance and organizational structure, and resourcing for the centralized implementation, monitoring and reporting of Hamilton's Climate Change Action Strategy with a deadline of August 8, 2022."*

Report CM22016/PED22058(a)/HSC22030(a) responds to this Council direction and presents the results of the consultation that Council directed to be undertaken, the final CEEP and CCIAP for Council's approval, and the recommended governance and resourcing strategy.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

Policy and legislated requirements are identified on pages 5-11 of the previous Report PED22058/HSC22030.

RELEVANT CONSULTATION

A complete description of the engagement and consultation activities on both the CEEP and the CCIAP that had been undertaken up until mid-May 2022 is presented in the previous Report PED22058/HSC22030. The further public engagement that occurred in June and July 2022 is briefly described below and is further detailed in Appendix "A" to Report CM22016/PED22058(a)/HSC22030(a).

The CEEP Stakeholder Advisory Committee (Advisory Committee) met on June 10th, 2022 to review and discuss the draft CEEP. In addition, the Advisory Committee was presented with the work on the CCIAP and they were invited to comment on the actions in both plans as well as the common elements of governance and oversight. Follow-up meetings with individual stakeholders were offered and a follow-up survey focused on implementation was sent to the Advisory Committee.

Internal consultation with City staff for both the draft CEEP and the CCIAP was undertaken from late May to mid-July 2022 through Department, Division, and Section leadership meetings and one-on-one consultation with key project staff in various departments. Consultation meetings covered both the CEEP and CCIAP action implementation planning where necessary and practical.

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 9 of 18**

Staff engaged in extensive external consultations to develop the Implementation Plan for the CCIAP, consisting largely of individual or small-group consultation meetings based on Implementation Worksheets to gather information about the participation level and role of community organizations.

Online public engagement was held through June and early July on the EngageHamilton Platform and a Virtual Public Information Session was also held on June 29, 2022.

A full description of these engagements is provided in Appendix “A” to Report CM22016/PED22058(a)/HSC22030(a).

ANALYSIS AND RATIONALE FOR RECOMMENDATION

Hamilton’s Climate Action Strategy (the Strategy) is comprised of two key plans focusing on climate mitigation (the reduction of greenhouse gas emissions) and climate adaptation (avoiding, preparing and recovering from climate impacts):

- Climate Change Mitigation: ReCharge Hamilton – Our Community Energy + Emissions Plan (CEEP)
- Climate Change Adaptation: Hamilton’s Climate Change Impact Adaptation Plan (CCIAP)

Climate Change Mitigation

The Community Energy & Emissions Plan (CEEP) is attached as Appendix “C” to Report CM22016/PED22058(a)/ HSC22030(a).

The CEEP is based on a goal of achieving a community-wide GHG emission reduction target of net-zero by 2050. It establishes a low-carbon pathway, modelling 28 targets for industrial, building, transportation, renewable energy and the natural environment. The CEEP includes an implementation strategy and financial and economic analysis for fully meeting the 28 targets. It also provides an implementation strategy of actions for both the City of Hamilton and the community to take in order to transition to a prosperous net-zero emission community.

The Community Energy & Emissions Plan includes five Low-Carbon Transformations based on current city-wide data. The Transformations and a high-level description of corresponding actions are provided below:

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 10 of 18**

- Transformation #1: Innovating Our Industry – setting ambitious energy efficiency targets, creating an industrial working group, and growing the skilled professionals required;
- Transformation #2: Transforming Our Buildings – creating a city-wide building retrofit program that is scalable, establishing Green Development Standards for new buildings, and building our skilled trade labour force;
- Transformation #3: Changing How We Move – getting people out of their cars and taking active/sustainable forms of transportation, electrifying the cars we do drive;
- Transformation #4: Revolutionizing Renewables – generating renewable energy and advocating for a clean energy grid, learning how to expand different forms of clean energy and complete technical analysis for hydrogen potential; and
- Transformation #5: Growing Green – setting a 50,000 per year tree planting target and ensuring climate change is integrated into all planning policies including updating Hamilton’s Rural and Urban Official Plans and Secondary Plans.

Climate Change Adaptation

The Climate Change Impact Adaptation Plan (CCIAP) is attached as Appendix “D” to Report CM22016/PED22058(a)/ HSC22030(a). The CCIAP is Hamilton’s evidence-informed pathway to a more resilient Hamilton that includes 13 priority climate risk impacts developed through downscaled global and regional climate modelling and a community-wide risk and vulnerability assessment.

In addition to the Climate Change Impact Adaptation Plan, ICLEI Canada also assisted the City of Hamilton in developing a national research report titled “How Much Is Climate Change Costing Canadian Communities” which is attached as Appendix “B” to Report CM22016/PED22058(a)/HSC22030(a). It details climate risks identified through Hamilton’s Vulnerability and Risk Assessment (VRA) Report and references estimated costs. There are four main risks analysed that can be reasonably expected to be experienced in Hamilton:

- Risk 1 – Overland flooding damaging buildings and homes: The Financial Accountability Officer (FAO) reported that under a high emissions scenario (RCP 8.5) climate change is projected to add an additional \$47 B in operating and maintenance costs to Ontario’s building and facilities budgets by the end of the

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**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 11 of 18**

century (Page 16, Appendix “B” to Report CM22016/PED22058(a)/HSC22030(a)).

- Risk 2 – Increase temperatures and precipitation: Temperature related damage projections at the municipal level indicate that climate change-induced damage to road maintenance and repairs could cost an additional \$3.1 B annually by 2050 (Page 27 Appendix “B” to Report CM22016/PED22058(a)/HSC22030(a)).
- Risk 3 – Overland Flooding leading to loss of business and public service: It is estimated there are over 5,000 healthcare centres across Canada (1,440 in Ontario) at risk of flooding that can disrupt medical supply chains and critical public health services. An example is provided from the 2013 Alberta floods which estimates the workforce was unable to work over two-weeks which is equivalent of 5.1 M hours of lost work and \$601 M of lost economic output (Page 32, Appendix “B” to Report CM22016/PED22058(a)/HSC22030(a)).
- Risk 4 – Extreme heat resulting in negative health outcomes: In Quebec, health expenditures attributed to climate change (e.g. increase vector-borne disease, extreme heat events and aeroallergens) are estimated at just under \$1 B over 50 years through 2065 (Page 39, Appendix “B” to Report CM22016/PED22058(a)/HSC22030(a)).

Equity Considerations

Research on climate change shows clearly that marginalized groups are disproportionately affected by its impacts, and that these disproportionate impacts vary by demographics and community. It is therefore imperative that mitigation and adaptation plans seek to address these impacts and eliminate barriers to adaptation resources.

For example, there have been important cross-links identified with the Climate Change Impact Adaptation Plan (CCIAP) and the Community Energy and Emissions Plan (CEEP) and Hamilton’s Urban Indigenous Strategy and Implementation Report. The CCIAP also recognizes that low-income and/or Racialized Canadians are likely to live in areas exposed to environmental hazards (i.e. air pollution, flooding risks, etc.). The CCIAP actions include flood risk/vulnerability assessments with additional vulnerable socio-demographic mapping to propose solutions to reduce those inequalities.

In all cases, it will be important for disproportionately affected communities to have regular opportunities to provide input into how these programs are structured and delivered.

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 12 of 18**

Climate Action Strategy Governance

As part of approving Report PED22058/HSC22030 on June 1, 2022, Council directed the following:

That staff be directed to report back to General Issues Committee on a recommended scope, governance and organizational structure, and resourcing for the centralized implementation, monitoring and reporting of Hamilton's Climate Change Action Strategy.

To respond to this Council direction, staff reviewed the Federation of Canadian Municipalities guidance on "Governance Components for Deep Decarbonization", undertook a best practice scan of other municipalities, and sought input and feedback from stakeholders and the public.

The Federation of Canadian Municipalities guidance on "Governance Components for Deep Decarbonization" recommends that successful governance structures require five main components:

1. Coordination and oversight – The establishment of a dedicated team for the coordination and oversight of climate change actions is critical to the success of any climate change initiative. For smaller municipalities, it is typical to have climate change staff within the City Manager's Office, however larger municipalities tend to have their climate team situated in one of the municipality's operating departments.
2. Communication – Communication, both internal and external, is a key component of the success of any climate change strategy. Establishing formal and regular communication channels between various departments and community-wide communication channels builds trust and transparency and optimizes knowledge exchange.
3. Monitoring and reporting – Regular and consistent monitoring and reporting is vital to track progress, ensure accountability and enable adjustments. For larger municipalities, with multiple departments working on decarbonization, monitoring generally occurs in the individual departments, and tracking and reporting is undertaken through the dedicated climate change team.
4. An integrated approach – While centralized coordination and oversight of climate change initiatives is critical, so too is embedding a 'climate lens' throughout the organization and beyond. It is equally important to embed equity, diversity and inclusivity into the governance structures and climate action plans. Aligning social

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**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 13 of 18**

and environmental goals with corporate/community-wide decarbonization efforts can help address potential equity deficits.

5. Budget and financing – Decarbonization initiatives require both internal and external funding. Decarbonization initiatives should be planned ahead of the budgeting cycle, and resources and funding should be aligned with current and future climate change goals.

To develop the recommended approach to governance and resourcing, staff also partnered with the Clean Air Partnership to conduct a survey of resourcing in other GTHA municipalities. A summary of the survey results is provided in Table 1 below. In most GTHA municipalities, the dedicated climate change team is located within one of the operating departments, typically the department responsible for planning, environment and/or engineering. Staffing levels generally range from 1.0 to 5.0 FTE.

Table 1: Dedicated Climate Change Staffing in GTHA Municipalities

Municipality	# FTE	Department
City of Brampton	5 FTEs	Environment and Development Engineering
City of Mississauga	3.5 FTEs	Parks, Forestry and Environment
City of Burlington	2 FTEs	Environment, Infrastructure & Community Services
City of Guelph	0 FTEs – in house 1 FTEs – third party org	Third party non-profit 'Our Energy Guelph'
City of Kingston	2 FTEs	Business, Real Estate and Environment
Durham Region	2 FTEs	Chief Administrative Officer (CAO office)
Municipality of Clarington	1 FTEs	Planning and Development Services
Town of Whitby	2 FTEs	Office of the CAO
Town of Oakville	1 FTEs	Strategic Policy and Communications
Town of Halton Hills	5 FTEs	Office of the CAO, Strategic Initiatives
Region of Waterloo	1 FTEs	Community Planning
Town of Newmarket	2 (part-time) FTE	Planning and Building Services

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**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 14 of 18**

Town of Caledon	1 FTE (plus part of Managers portfolio)	Energy & Environment
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Finally, staff also sought input from the public and local stakeholders on their desired resourcing and governance structure. There was strong interest from many respondents to have a “high-ranking” position lead the climate change office, and someone who would have a senior enough role, to be in a position of influence within the corporation. There was also strong consensus from the community that any future climate change office needs to be “well resourced”, and it was equally expressed that resources would also be required and needed for each Department to fully implement and accelerate climate change action.

Based on the research described above, staff are recommending that the centralized implementation, monitoring and reporting of Hamilton’s Climate Action Strategy be undertaken by a new Climate Change Office, to be housed within the Planning and Economic Development (PED) Department, and to be led by a Director of Climate Change Initiatives, who would report to the General Manager of PED.

A centralized staff team within the City would act as a hub for coordination and implementation across the municipal corporation and reporting on corporate and community progress. It will coordinate the implementation of City actions, work with and support the proposed advisory committees on the implementation of community-led actions, report on climate progress throughout the City, lead public engagement on the City’s climate change work, and update the City’s strategic climate change documents such as the CEEP and CCIAP, as needed.

This governance and resourcing model is similar to that being used in the City currently for other major corporate initiatives that require centralized coordination, but have impacts across multiple divisions, for example asset management, the Urban Indigenous Strategy, and LRT.

Governance for the Climate Action Strategy would be led through a Climate Change Initiatives Steering Committee, comprising Director-level staff from key divisions across the corporation, and chaired by the Director of Climate Change Initiatives. Given the significant cross-divisional and cross-disciplinary nature of Hamilton’s Climate Action Strategy, a City-wide Climate Change Initiatives Extended Leadership Group would also be established, comprising supervisor and manager-level representatives of service areas across the corporation. The role of the Extended Leadership Group would be for both information sharing, as well as tracking progress on climate change initiatives.

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 15 of 18**

To ensure senior-level accountability for the Climate Action Strategy, the Director of Climate Change Initiatives will report regularly to the City Manager and Senior Leadership Team which includes all General Managers.

An overview of the proposed governance structure is provided in Figure 1 below.

Figure 1: Internal Climate Action Strategy Governance Structure



Climate Change Office Staffing

Staff are recommending that the Climate Change Office be led by a senior-level Director of Climate Change Initiatives, who would report to the General Manager of PED. This report is recommending that a permanent FTE be created for the role of the Director Climate Change Initiatives representing an estimated annual cost of \$215,000 (including salary and non-salary costs).

Staff are also recommending that the current position of Senior Project Manager, Air Quality and Climate Change be transferred from Public Health Services, Healthy and Safe Communities Department, to the Climate Change Office within the Planning and Economic Development Department, with no impact on the levy.

The above recommendations would immediately establish two full-time, permanent staff dedicated to the implementation of the Climate Action Strategy.

Staff anticipate that additional dedicated resources will also be required and are recommending that two additional FTE enhancements be referred to the 2023 Operating Budget. These roles would focus on implementation of cross-sectoral and

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 16 of 18**

cross-divisional climate change initiatives, and on community and stakeholder engagement, public education, support for community-led climate change initiatives, and support for the recommended Advisory Committee.

The proposed new Climate Change Office would have close interaction with the Energy Office within the Energy, Fleet and Facilities Management Division of Public Works. The Energy Office currently is guided by the Corporate Energy and Sustainability Policy (CESP). This policy, in short, outlines the energy and emission reduction targets for all Corporate assets and operations, including our Net Zero target by 2050. The Energy Office plays a key role in developing the pathway to net zero activities for the large emission portfolios (Fleet/Transit, Corporate Buildings and Water/Wastewater) which currently produce > 95% of the City's corporate GHG's. The Energy Office manages all utility data and commodity purchasing contracts, implements energy and emission reduction projects (often partially funded by the Energy Reserve) and manages the daily operations of the City's renewable energy portfolio. While these activities are distinct from the role of the Climate Change Office, staff are recommending that the General Manager of Planning and Economic Development and the General Manager of Public Works, in consultation with the Executive Director of Human Resources, be directed to review the function and role of the Energy Office and the Climate Change Office, and any other relevant service areas, and report back to Council with any recommended organizational changes that would best align and integrate their work.

Climate Change Advisory Committee of Council

To provide advice to staff and Council on the implementation of the City's Climate Action Strategy, staff are recommending that a Climate Change Advisory Committee of Council, which includes a composition that ensures a diverse representation of Hamilton's community, be established for the 2022-2026 Council Term. Staff are recommending that a Draft Terms of Reference for the scope and membership of the Advisory Committee be brought forward for Council's consideration in the new term of Council.

Bay Area Climate Change Council

The Bay Area Climate Change Council (BACCC) is a 15-member organization across the cities of Hamilton and Burlington that was originally created in 2017-2018 when the two cities came together with Mohawk College to create BACCC and open the Bay Area Climate Change Office (BACCO). The City of Hamilton previously committed to funding the BACCO in the amount of \$160,000 per year from 2020 to 2022. This funding, with the additional funding from City of Burlington, and in-kind administrative support from Mohawk College, has been used to hire two full-time support staff.

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**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 17 of 18**

Since 2020, the BACCO has undertaken the following:

- supporting over \$1 M in local investment requests;
- led over 15 policy initiatives to help local government tackle climate change, including municipal retrofit program design, green economic development strategy and optimized transportation network framework;
- hosts annual free events for residents which saw a sell-out crowd in 2021 with over 600 registrants; and,
- leveraged City funds to employ 9 additional youth, on top of the 2-full time staff through additional grants.

The Memorandum of Understanding (MOU) signed between the City of Hamilton and Mohawk College expires at the end of 2022. Staff are recommending that a renewed funding commitment from the City of Hamilton for this partnership be brought forward for Council's consideration as part of the 2023 budget process and that, is approved, it be administered through the new Climate Change Office within the Planning and Economic Development Department.

ALTERNATIVES FOR CONSIDERATION

Council may revise or choose not to adopt Hamilton's Climate Action Strategy and the proposed actions within the Community Energy and Emissions Plan (CCEP) and Climate Change Impact Adaptation Plan (CCIAP).

Council may choose to revise the governance structure for Hamilton's Climate Action Strategy including the proposed Climate Change Office.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Community Engagement and Participation

Hamilton has an open, transparent and accessible approach to City government that engages with and empowers all citizens to be involved in their community

Economic Prosperity and Growth

Hamilton has a prosperous and diverse local economy where people have opportunities to grow and develop.

Healthy and Safe Communities

Hamilton is a safe and supportive City where people are active, healthy, and have a high quality of life.

**SUBJECT: Hamilton's Climate Change Action Strategy Implementation
Resources and Governance (CM22016/PED22058(a)/HSC22030(a))
(City Wide) - Page 18 of 18**

Clean and Green

Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

Built Environment and Infrastructure

Hamilton is supported by state-of-the-art infrastructure, transportation options, buildings and public spaces that create a dynamic City.

Culture and Diversity

Hamilton is a thriving, vibrant place for arts, culture, and heritage where diversity and inclusivity are embraced and celebrated.

Our People and Performance

Hamiltonians have a high level of trust and confidence in their City government.

APPENDICES AND SCHEDULES ATTACHED

Appendix "A" to Report CM22016/PED22058(a)/HSC22030(a) – Final Consultation Report: Hamilton's Climate Action Strategy

Appendix "B" to Report CM22016/PED22058(a)/HSC22030(a) – How Much Is Climate Change Costing Canadian Communities? City of Hamilton Report

Appendix "C" to Report CM22016/PED22058(a)/HSC22030(a) – ReCharge Hamilton – Our Community Energy and Emissions Plan

Appendix "D" to Report CM22016/PED22058(a)/HSC22030(a) – Hamilton's Climate Change Impact Adaptation Plan

Appendix E to Report CM22016/PED22058(a)/HSC22030(a) – Hamilton's Climate Action Strategy Departmental Resource Considerations

FINAL CONSULTATION REPORT

Hamilton's Climate Action Strategy

Community Energy & Emissions Plan
Climate Change Impact Adaptation Plan

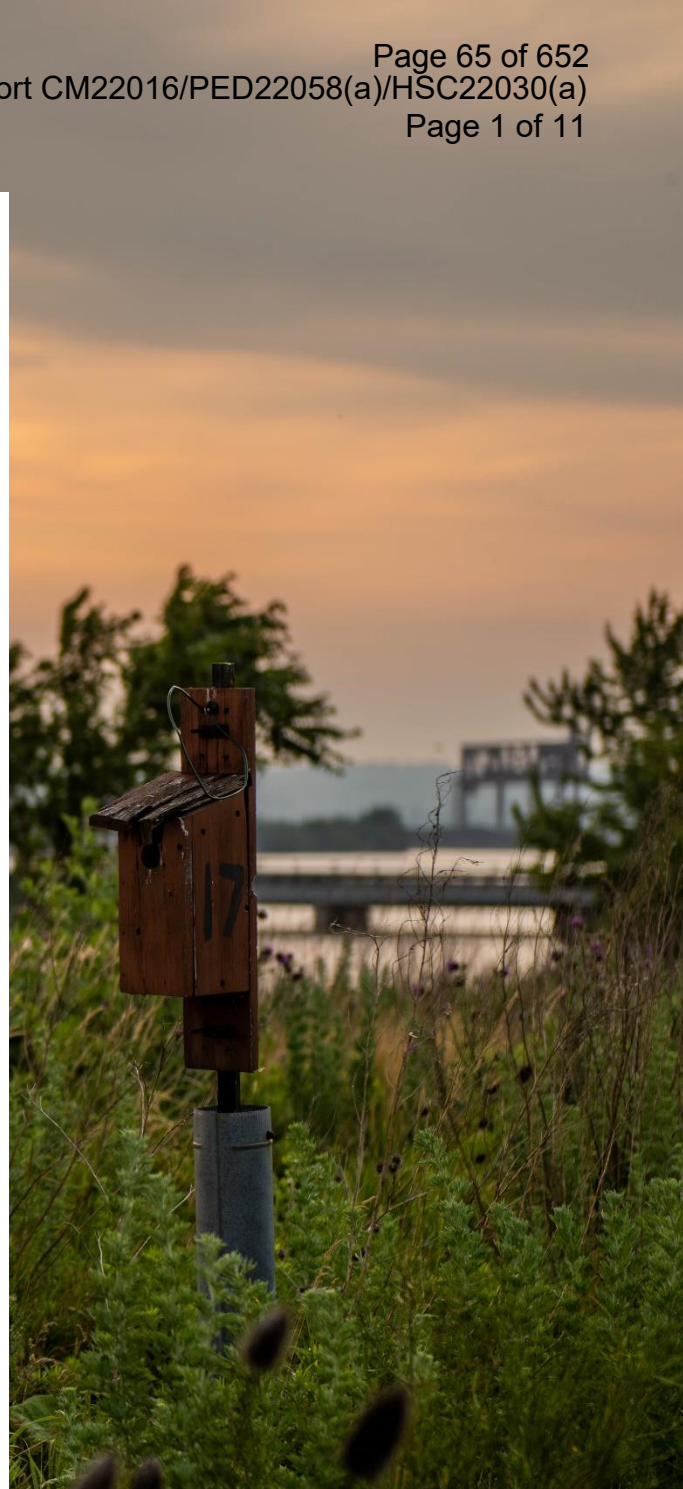
August 2022

City of Hamilton

Planning & Economic Development Department
Healthy & Safe Communities Department



Hamilton



1.0 Overview

On June 8th, Hamilton City Council approved Report PED22058/HSC22030 – Hamilton’s Climate Change Action Strategy. The report presented the draft *ReCharge Hamilton – Our Community Energy and Emissions Plan* (CEEP) and provided an update on *Hamilton’s Climate Change Impact Adaptation Plan* (CCIAP). The development of the CEEP and CCIAP have been undertaken as distinct, yet related projects. Together, these Plans form the foundational components of “Hamilton’s Climate Action Strategy”. Through the approval of the Report, Hamilton City Council directed staff to undertake final public and stakeholder consultation on these two initiatives and report back on the results of the public consultation.

This Consultation Summary presents the results of the final consultation phase on the CEEP and the CCIAP, adding to public and stakeholder engagement and input on both initiatives over their development. For a full review of consultation activities undertaken prior to this final consultation phase, please refer to project webpages www.engage.hamilton.ca/climate-change-adaptation and www.hamilton.ca/ceep .

2.0 Consultation Approaches

In this final phase, consultation on both the CEEP and the CCIAP proceeded in tandem, focusing on reviewing draft actions and potential administrative and governance frameworks for implementation. A variety of engagement and consultation approaches were used in this phase including general public engagement, targeted meetings with stakeholder groups, agencies, and City of Hamilton staff, including follow-up phone calls where needed.

General public engagement occurred on-line through the City of Hamilton’s EngageHamilton platforms www.engagehamilton.ca/ceep and www.engagehamilton.ca/climate-change-adaptation which had been used for previous engagement on both CEEP and CCIAP projects. The CEEP project website www.hamilton.ca/ceep was also updated and directed viewers to the EngageHamilton page. Materials were posted online for public review and comment and the June 1, 2022 Staff Report package was made available. This general engagement was open between June 6 and July 10, 2022. The city’s general climate change website www.hamilton.ca/climatechange was also updated to direct viewers to both the CEEP website and EngageHamilton pages for the final consultation phase. Registration for a virtual public information meeting occurred through the EngageHamilton pages. The virtual public information meeting was held on June 29, 2022.

General outreach on the final engagement occurred through broadcast of the EngageHamilton pages through various project mailing lists including the general

EngageHamilton mailing list. The on-line engagement and the virtual public information webinar were also advertised in the Hamilton Spectator on June 24 and June 27. An interview on CMHL 900 was given on June 27 where staff discussed the project and provided information on the upcoming virtual meeting and on-line engagement.

3.0 City of Hamilton Staff Consultation

Final Staff consultation for both the draft CEEP and CCIAP took place from late May to mid-July 2022 through Department, Division, and Section leadership meetings and one-on-one consultation with key project staff. These meetings covered both Plans where possible. Extensive staff consultation on draft CEEP actions had occurred during the development of the draft CEEP (Fall 2021 – Spring 2022). CCIAP actions were developed later than CEEP actions, so the meetings focused primarily on adaptive action implementation.

In late May 2022, four focus groups were held with staff to begin Implementation Planning for the CCIAP. Several follow-up meetings with individual staff and teams filled remaining gaps. In addition to implementation planning for the CCIAP, the draft actions of the CEEP were reviewed and implementation discussions took place, where relevant in June and July. Discussions on resourcing of actions also occurred

Tables 1 and 2 below identify the departments, divisions, sections and groups involved in developing the Implementation Plan for the CCIAP and reviewing actions of the CEEP.

Table 1: CCIAP Implementation Planning, Staff Focus Groups

Dates (2022)	Attendees
May 26	Public Works & Planning and Economic Development
May 26	Healthy and Safe Communities
May 26	Finance, Communications, City Housing
May 27	2 nd Public Works & Planning and Economic Development

Table 2: Internal Staff Implementation Planning Meetings (CCIAP and CEEP)

Dates (2022)	Attendees
June 2	Healthy and Safe Communities, Department Leadership Team– (CCIAP, CEEP)
June 7	Healthy and Safe Communities, Community Services Neighbourhood Development (CSND) (CCIAP, CEEP)
June 8	Healthy and Safe Communities, CSND follow-up (CCIAP)
June 9	Healthy and Safe Communities, Epidemiologist, Wellness and Communicable Disease Control (EWCDC) (CCIAP)
June 10	Healthy and Safe Communities, Food Security (CCIAP)

June 10	Planning and Economic Development, Transportation Planning & Parking (CEEP)
June 15	Healthy and Safe Communities, EWCDC follow-up (CCIAP)
June 17	Planning and Economic Development, Department Leadership Team (CCIAP, CEEP)
June 17	Healthy and Safe Communities, Food Strategy (CCIAP, CEEP)
June 23	Planning and Economic Development, Licencing & By-law (CEEP, CCIAP)
June 24	Healthy and Safe Communities, Housing Delivery (CCIAP)
June 27	Healthy and Safe Communities, Urban Indigenous Strategy (CCIAP, CEEP)
June 30	Planning and Economic Development, Heritage & Urban Design, Urban Forest Strategy (CCIAP, CEEP)
July 5	Corporate Services Department – Finance & Administration (CEEP, CCIAP)
July 11	Public Works, Energy, Fleet & Facilities Management (CEEP)
July 11	Planning and Economic Development, Building Division (CEEP)
July 13	Public Works, Transportations, Operations & Maintenance (CEEP)

3.1 What We Heard

Draft CEEP and Draft CCIAP Actions

- Many actions have crossover between departments so substantial coordination will be required.
- Where there is substantial multi-departmental crossover the proposed central Climate Change Office can play a pivotal role in coordination, education, and awareness.
- Some actions will need additional resources either in capital dollars to get initial work and studies started and/or additional staff resources to undertake the work.
- Additional studies and ‘enabling actions’ (e.g. feasibility, risk, modelling etc.) need to be completed to better inform scope and range of expected costs.
- Studies and ‘enabling actions’ should include targets and dates to better inform resource requirements to meet these targets and dates.
- City staff are excited about the opportunities the actions present

Proposed Climate Office

- City staff can do a better job profiling all the climate change work already being done in the City – a Central Climate Office can assist.
- The proposed Climate Change Office needs to play a large role in providing education, information on actions where City is the lead in addition to department project outreach activities.
- Relationship between departments and the proposed climate change office still needs to be clarified.

- Proposed Climate Change Office should coordinate the linking of community actions with City actions where the City plays a supporting role.

Indigenous Engagement

- Climate Change Office should work together with Indigenous Relations Office to provide on-going and meaningful engagement with Indigenous Knowledge Keepers and other Indigenous groups on the Climate Change Action Strategy.
 - Further advocacy should be explored on the potential to hire Indigenous peoples to work on climate change within the City and/or support Indigenous peoples to be involved in the strategic direction of climate action. As actions are advanced, there are opportunities to provide an Indigenous lens to implementation and some elements that respond to the interest and perspectives of the Indigenous groups.

4.0 Stakeholder Consultation

Staff engaged in extensive external consultations to develop the Implementation Plan for the CCIAP, consisting largely of individual or small-group consultation meetings based on Implementation Worksheets to gather information about the participation level and role of community organizations. The draft CEEP was also reviewed at some of these meetings with a focus on potential involvement in action implementation. Table 3, below, shows these meetings.

Table 3: CCIAP and CEEP Implementation Planning Meetings

Dates 2022	Organization
May 30	Environment Hamilton (CCIAP, CEEP)
June 13	Faith and the Common Good (CCIAP)
June 14	Hamilton Conservation Authority (CCIAP)
June 17	Association of Dundas Churches, Climate Team (CCIAP)
June 20	YWCA (CCIAP)
June 20	Seniors Advisory Committee (CCIAP, CEEP)
June 21	Community Response to Extreme Weather (CCIAP)
June 21	Advisory Committee for Persons with Disabilities (CCIAP, CEEP)
June 21	LimeRidge Mall (CCIAP, CEEP)
June 22	Sustainability Leadership (CCIAP)
June 22	Welcome Inn (CCIAP)
June 22	Mohawk College (CCIAP)
June 23	Hamilton Oshawa Port Authority (CCIAP, CEEP)
June 23	Hamilton 350 (CCIAP)
June 24	Social Planning Research Council (CCIAP)
June 24	Hamilton Community Foundation (CCIAP)

June 27	Alectra (CCIP, CEEP)
June 27	McMaster University (CCIAP)
June 29	Hamilton Poverty Roundtable (CCIAP)
July 4	United Way Halton Hamilton (CCIAP)

4.1 What We Heard

Overall Climate Change Strategy

- Stakeholders were impressed with the depth of research, analysis and overall work completed.
- It is necessary and important to include actions for both climate mitigation (through CEEP) and adaptation (through CCIAP), while also identifying synergies between actions.
- Local academic institutions can play key roles in CEEP and CCIAP actions that require Research and Development (R&D).
- The Climate Action Strategy requires bold targets and bold actions that are properly communicated across the City.
- Several Stakeholders asked the question ‘*how can we help*’ and expressed interest in receiving future proposals for review.

CCIAP Draft Actions

- Many stakeholders saw themselves and/or their organizations supporting many of the CCIAP actions.
- Some stakeholders saw the potential to take leading roles, based on expertise of the action, however additional resource requirements would need to be confirmed first.
- Stakeholders were impressed on how well the project lead consulted with so many organizations that directly worked with or represented equity seeking groups.
- There is a lot of existing work and ongoing actions across the community that can inform future program(s) development.
- Many stakeholders are concerned with climate change impacts expressed urgency in implementing all these actions.

Draft CEEP

- Some organizations stated their commitment to reaching net-zero emissions by 2050.
- Some stakeholders highlighted need for the City to publicly highlight and/or reaffirm its commitment to an interim target for GHG reduction.

- Several stakeholders highlighted the need to engage the public through an extensive education/engagement campaign.
- Expertise in high-performance building standards (e.g. Passive House) from social housing providers can be transferred to private developers.

Governance and Administration

- Limited feedback was provided on the proposed governance pieces of Hamilton's Climate Action Strategy during one-on-one external stakeholder consultations.
- Some comments received highlighted the need for the lead of the proposed Climate Change Office be someone of authority and influence within the City's corporate structure.

4.2 Indigenous Consultation

Staff reached out to representatives of Indigenous nations and local urban Indigenous organizations at key stages to provide information on the CEEP project and offer further engagement opportunities. Two Indigenous nations expressed interest in discussing the climate action strategy and requested the draft documents once available. In early June, Staff provided draft CEEP and CCIAP documents, inviting further engagement. As of the date of this Report, no comments or requests have been received. Staff continue to follow-up.

In June, Staff met with the City's Indigenous Relations Office to review the draft CCIAP actions, and to a lesser extent CEEP actions, and seek feedback and collaboration to ensure an Indigenous voice and perspective remains part of the implementation of actions. Comments from the Indigenous Relations Office are summarized in Section 3.1 above.

4.3 CEEP Community Stakeholder Advisory Committee (CSAC)

A meeting of the Community Stakeholder Advisory Committee for the CEEP was held on June 10, 2022. The role of the CSAC is to provide feedback, guidance and advice to the CEEP project team at key intervals in the development of the Plan. The CSAC met four times prior to this meeting. At this meeting the CSAC reviewed the draft actions of the CEEP and provided comments on actions, implementation and governance elements. During the meeting, a presentation on the CCIAP was also given. A follow-up feedback survey was distributed after the meeting to seek any additional comments from members on the implementation and proposed governance framework for Hamilton's overall Climate Action Strategy.

4.3.1 What We Heard

- Climate Change Office needs to be properly funded and staffed.
- Equity seeking groups, industry, member(s) of council, community groups should be represented on the Community Advisory Committee
- The City should to be the innovator and early adopter which is not a typical role for municipalities.
- There is a lot of innovation in the private sector as well which should be leveraged.
- Life cycle assessments should be part of every building and infrastructure project, whether a city project or a project in the community.
- Potential for district energy expansion and use of residual waste heat is strong and could be more prominently expressed in the actions.
- Every decision the City takes needs to help address the city's carbon footprint.
- The City needs to make bold statements and lead on every City facility project.
- The City needs to be bold with the development community on addressing energy in buildings.
- Utilities are willing to assist with the implementation of the plan through their existing programs.

The full meeting summary can be found on the CEEP project webpage at www.hamilton.ca/CEEP.

5.0 General Public Consultation

5.1 On-line Consultation

On-line Consultation was held through the EngageHamilton pages www.engage.hamilton.ca/ceep and www.engage.hamilton.ca/climate-impact-adaptation. These pages included links to draft document and project materials and a link to register for a Virtual Public Information Meeting. An open-ended comment form was available on the EngageHamilton pages. The EngageHamilton websites had 2,704 visitors during the final consultation period. Ten questions were submitted in advance of the virtual public meeting for staff response. Two emails were received following the public meeting. A Feedback Report on the June 29th meeting was prepared to document the questions and comments and submissions.

5.2 Virtual Public Information Meeting

On June 29th, a virtual public meeting information session was held. 78 participants registered for the meeting. 52 connections participated in the meeting. Registrants

were encouraged to submit questions to staff in advance of the meeting. Ten questions were submitted in advance of the virtual public meeting. The live meeting was facilitated by an independent facilitator. Staff presentations on the Climate Action Strategy, which included the draft CEEP and the actions for the CCIAP were given, and a facilitated questions and answer session occurred. Questions submitted in advance of the meeting were answered by staff during the virtual meeting. Two follow-up emails were received after the meeting. A video recording of the meeting was posted on the EngageHamilton pages and project websites along with a Feedback Report, including verbatim comments and staff responses from the meeting.

Following the virtual meeting, meeting registrants were sent a follow-up survey and invited to submit further feedback on:

- whether participants wanted to be kept informed on implementation and how they may want to participate;
- whether participants talk about climate change with friends and family;
- the type of sources participants use to get their news and information; and,
- if representing an organization, it participants think that the organization should be kept up-to-date on implementation.

To date, no follow-up surveys from meeting attendees have been received by Staff.

5.2.1 What We Heard

Overall Climate Action Strategy

- Addressing food security is important with a changing climate.
- Net Zero needs to be achieved quicker than by 2050.
- Prioritization of adaptation and mitigation is a difficult decision and not discussed.
- Important to continue to protect natural areas for adaptation and mitigation
- Actions in CEEP don't go far enough.
- Improved communications and charismatic leadership are needed on the Strategy.

Draft CEEP

Low-Carbon Transformation #1: Innovating Our Industry

- A climate change/green lens could be considered in recruitment of industry and businesses by Economic Development Division.
- Emphasis needs to be on industry for the greatest impact to overall well being.

Low-Carbon Transformation #2: Transforming Our Buildings

- Green development standards need to get in place.
- Stricter building codes needed for residential and commercial/industrial buildings.
- Heat pumps are the way to go.
- Climate change considerations need to be part of Planning recommendations.
- Group purchasing power for retrofit items can assist homeowners directly.

Low-Carbon Transformation #3: Changing How We Move

- Greening of fleets is important and city should continue to pursue improvement.
- Airport emissions need to be addressed.
- Active transportation networks and transit must improve
- Remote work can assist in reducing auto trips

Low-Carbon Transformation #4: Revolutionizing Renewables

- Support for co-op neighbourhood energy generation
- Phasing out natural gas needs to happen as soon as possible
- Need a plan for hydrogen use
- Electricity grid is not reliable

Low-Carbon Transformation #5: Growing Green

- Urban Forest Strategy approval is important and implementation of it needs to move in tandem with climate change work.
- Private tree protection is needed.
- The City needs to stop developers from cutting down large trees.

CCIAP Draft Actions

Theme #1: Built Environment

- Increased road salt for road safety in storm events has negative impact on natural areas

Theme #2: People and Health

- Cooling stations and capping temperatures in high rise buildings are needed to keep people safe in extreme heat.

Theme #3: Natural Environment, Agriculture and Water

- Urban Forest Strategy approval is important and implementation of it needs to move in tandem with climate change work.

- Tree planting and habitat restoration are two different actions and have different impacts and should go deeper into these actions.
- Local sustainable agriculture addresses food insecurity.

Theme #4: Energy and Economy

- *The City can play a role in helping owners through purchasing power to install heat pumps and other types of retrofits.*

Governance and Administration

Climate Change Office

- Should have a strong passionate Director and qualified staff
- Need sufficient budget to maintain the functions of the office
- Should establish a public education and outreach programs
- Should meet regularly with department heads, keep the public informed
- Should engage/liaise/work closely with community organizations, school boards grass roots groups, Indigenous groups, persons with disabilities, youth.
- Should play a role in ensuring climate lens is applied to corporate decisions
- Communication and reporting on actions as well as data collection and measurement is a critical role for the Office

Climate Advisory Committee

- *Membership should include representation from community members including, BIPOC, marginalized communities and have racial and economic diversity.*

The full Feedback Report on June 29th meeting can be found on the following project websites:

www.hamilton.ca/climatechange

www.hamilton.ca/ceep

www.engagehamilton.ca/ceep

www.engagehamilton.ca/climate-change-adaptation

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES?

CITY OF HAMILTON
REPORT

JULY, 2022



Hamilton



**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



TABLE OF CONTENTS

INTRODUCTION	3
Climate change impacts in a municipal context	3
About this report	10
RISK 1: Increasing frequency of extreme precipitation events leading to overland flooding and damage to buildings and homes.	13
What to know about this risk	13
The impacts of this risk	14
Costs related to this risk	16
RISK 2: Increasing temperature and precipitation leading to increased replacement and maintenance cost of roads and transportation infrastructure.	19
What to know about this risk	19
The impacts of this risk	22
Costs related to this risk	26
RISK 3: Increasing frequency of extreme precipitation events leading to overland flooding and loss of local business and public services.	29
What to know about this risk	29
The impacts of this risk	30
Costs related to this risk	31

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



RISK 4: Increasing frequency of extreme heat resulting in negative health outcomes, particularly to vulnerable populations, from reduced air-quality and increased heat-stress. 33

What to know about this risk 33

The impacts of this risk 36

Costs related to this risk 38

RECOMMENDATIONS 41

APPENDIX A 42

REFERENCES 52

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



INTRODUCTION

Climate change impacts in a municipal context

Summary of key climate hazards and impacts facing communities across Canada

The effects of climate change in Canada are already evident, and are projected to worsen in the future, including more frequent extreme heat events, more frequent wildfires, reduced air quality, increased coastal erosion, more frequent extreme precipitation resulting in flooding, and more frequent extreme weather events (e.g., windstorms, ice storms, tornados) (Bush et al., 2022; IPCC, 2021). Consequently, Canadian communities are facing a wide range of direct and indirect costs, with numerous implications for the built, socio-economic and natural systems. Municipalities are facing increased financial costs that include both direct and indirect economic costs (e.g., costs of repairs, increased operations, and maintenance (O & M) expenses, loss of service delivery and business interruption) (Boyd & Markandya, 2021).

National estimates show climate change is now costing Canada billions of dollars every year. Furthermore, as the trend in extreme weather events have increased, so too have the trends in insured and uninsured losses. A growing body of evidence indicates that uninsured losses are often underestimated and may dwarf insured losses (Boyd & Markandya, 2021; IBC & FCM, 2020; Ness et al., 2021; Sawyer et al., 2020).

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



National Resource Highlight

The Insurance Bureau of Canada (IBC) tracks private insurance payouts for extreme weather events and has seen a jump in the average annual insured losses from \$0.4 billion per year, between 1983-2007, to \$1.9 billion per year between 2008-2018 (Boyd & Markandya, 2021).

Climate change driven natural disasters have continued to cause significant damage to Canadian communities, with evidence supporting projections that their intensity and frequency are increasing. In fact, eight of the top ten costliest disasters have occurred over the past decade (Figure 1).

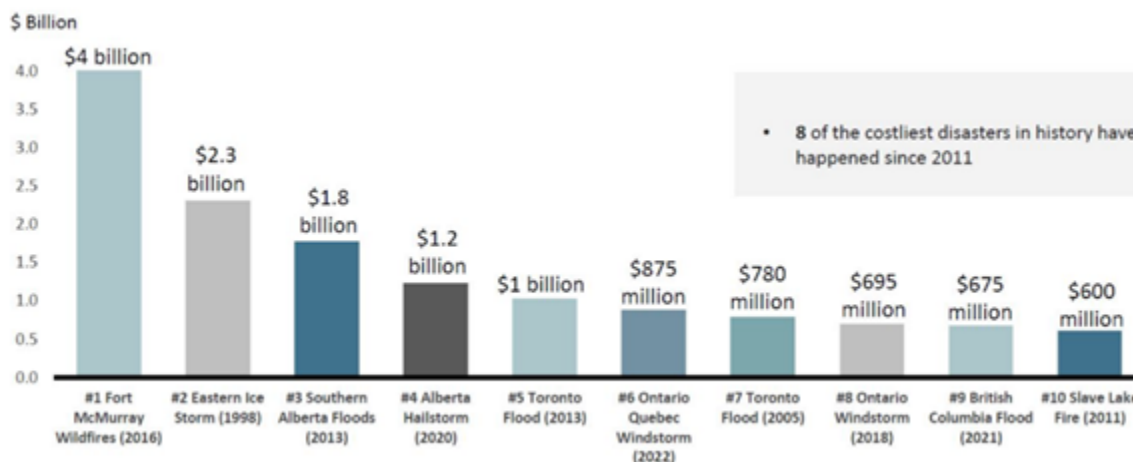


Figure 1: Canada’s costliest natural disasters in terms of insurance payouts (in 2021 CAD). Losses exclude loss adjustment expenses (Source: IBC Fact Book 2021, CatQ, Swiss Re, Munich Re & Deloitte).

Table 1 highlights extreme weather events over just the last five years (2016-2021), which have resulted in billions in damages as well unprecedented human and ecological impacts (discussed below).

Table 1: The costliest weather events over the period of 2016-2021.

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



Date Location Weather Event and Cost Estimates

2021	South coast, BC	Multiple atmospheric rivers converged producing record precipitation that led to severe flooding across the region. Early estimates of insured losses are \$450 million (IBC, 2021), however, broader estimates suggest billions in damages.
2020	Calgary, AB	Severe hail-storm causing nearly \$1.2 billion in damages (IBC, 2020)
2020	Fort MacMurray, AB	Extreme precipitation event that resulted in flooding and \$500 million in damages.
2018	Eastern ON and southern QC	Severe thunderstorm which spawned multiple tornados that caused \$300 million in damages.
2018	Southern ON and QC	Severe thunderstorms produced hurricane-force gusts that caused over a \$1 billion in damages (Government of Canada, 2019)
2017	Southern BC	Widespread and long-lasting wildfires caused an estimated \$650 million in damages.
2016	Fort MacMurray, AB	Wildfires caused over \$4 billion in insured losses and had a broader economic cost of nearly \$11 billion (Alam & Islam, 2017).

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



Re-Defining costs

Beyond the clear financial costs associated with the damage caused by climate change driven extreme weather events, multiple cascading or indirect costs are not accounted for in these estimates, including municipal service disruption, supply chain disruptions, transportation network interruptions, business interruptions, power outages, food and water shortages, as well as non-market costs.

Linking financial costs to non-market costs

While the financial costs are of paramount importance, non-market costs (the costs to human health and well-being and the natural environment) must also be considered to fully understand the breadth of climate impacts; to allocate public resources for climate adaptation, and to ensure that these resources are directed towards the most efficient actions. It will be important for decision-makers to consider these broader systemic human and environmental costs of climate change as they often have wider spatial and temporal scales than the financial costs (Boyd & Markandya, 2021). Similarly to the financial costs, these non-market costs may be incurred directly and indirectly. It is therefore critical to consider the combined direct and indirect financial and non-market costs of climate change:

Direct costs result from the direct physical impacts of climate change

- Damage to hard infrastructure and buildings (e.g. repair and replacement costs after a flood event)
- Increased wear and tear resulting in increased operations and maintenance costs

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



- Physical and mental health impacts (e.g. costs for medical treatment after extreme heat event)
- Damage to ecosystems (e.g. damage to tree canopy after a wind storm resulting in loss of ecosystem services)

Indirect costs stem from the direct impacts of climate change

- Flood damage to municipal infrastructure causes disruption/interruption of service delivery. (e.g. water and waste) which in turn results in workers not being able to get to work
- Workers not able to get to work due to damaged transportation networks
- Rising insurance premiums from flooded buildings
- Long-term physical and mental health impacts
- Loss of revenue in businesses who work with directly impacted businesses

impacts to human health and well-being cannot be understated. Extreme heat events are projected to become more common in Canada and are proving to be increasingly dangerous and costly. These climate hazards will have a profound impact on human health and well-being, on our health care systems and specifically on vulnerable populations. Specific groups, such as those who work outside, low-income and racialized populations, infants and young children, older adults (over the age of 65), those with limited mobility and chronic medical conditions, and people experiencing homelessness are particularly at risk (Berry & Schnitter, 2022).

The compounding hazards of extreme heat and higher concentrations of ground level ozone are of particular concern. Ground level ozone, a major component of urban smog, is made more dangerous by interacting with sunlight and warm temperatures. High levels are

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



linked to increased mortality and respiratory illnesses (Berry & Schnitter, 2022; Clarke et al., 2021). Without intervention, as Canadian summers get hotter, including more severe and frequent heat waves, poor air quality is expected to increase.

National Resource Highlight

The Canadian Disaster Database (CDD) provides public data on a wide number of impact metrics from weather related disasters (between 1900-present) including estimated and normalized costs (CAD 2016) deaths, injuries, evacuations and power outages.

The Canadian Institute for Climate Risks projects that by 2080, healthcare costs associated with ground-level ozone could reach \$1 Billion per year, while the costs of premature deaths from ground-level ozone could exceed \$300 Billion per year under a high-emissions scenario (Clark et al., 2021). The recent 2021 heat dome event in British Columbia is one such example, where a stagnant air mass and solar radiation contributed to very high ground-level ozone concentrations resulting in 619 deaths and many more heat-related physical and mental morbidities (Henderson et al., 2022). Data compiled from the Canadian Disaster Database (CDD, 2022) shows that heat events are responsible for the greatest loss of life in terms of weather-related natural disasters. Figure 2 below shows the top 8 deadliest weather-related natural disasters across Canada between 1900 and 201. Importantly, 3 of the top 5 deadliest heat events have occurred over the past 15 years.

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



Disaster-related mortalities 1900-2021

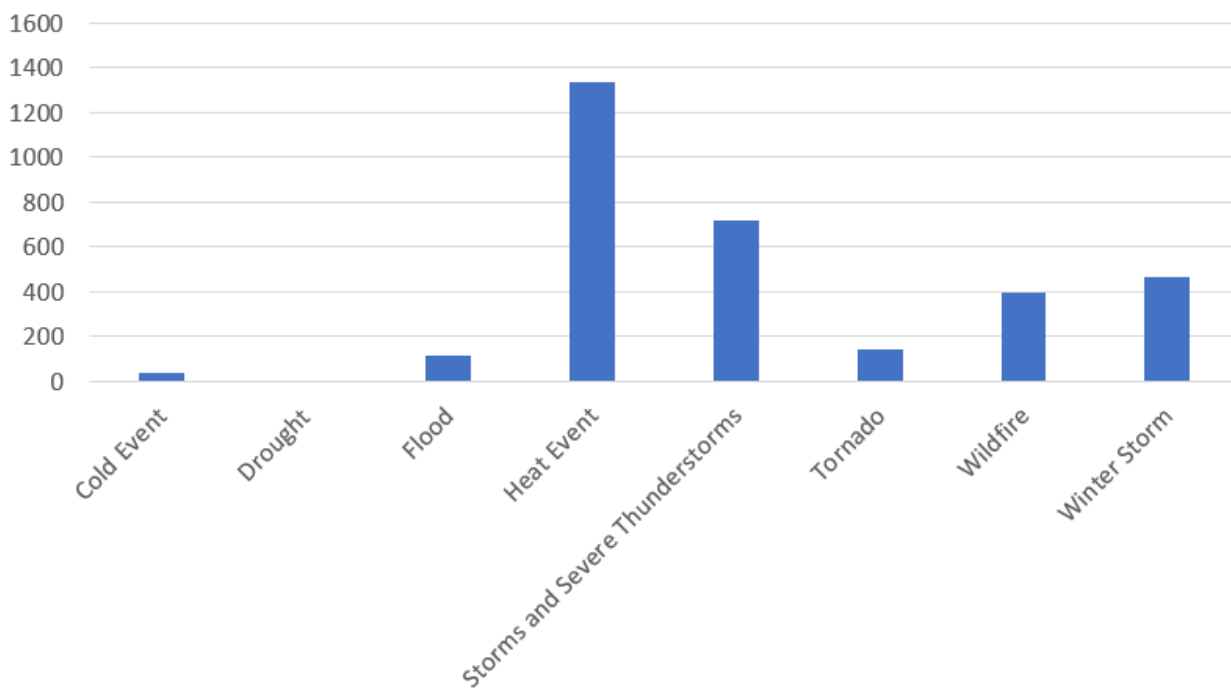


Figure 2: Sum of disaster related mortalities in Canada by category: cold event, drought, flood, heat event, storms and severe thunderstorms, tornados, wildfire, winter storm (Source: CDD, 2022).

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



About this report

Rationale

The mounting costs of climate change present a serious fiscal and logistical challenge for municipalities whose budgets and capacities are already stretched. Without immediate action, these costs will only increase and threaten to consume funds and resources needed for maintaining and operating critical services and addressing existing and emerging priorities.

While these climate change-driven consequences are happening throughout Canada, municipal governments still lack a complete understanding of the costs (both market and non-market) of climate change. With these costs expected to increase as the climate continues to warm, municipalities need to move rapidly to better understand and prioritize adaptive measures to limit these costs. There is also strong evidence that these will be even greater without rapid decarbonization and adaptive measures that build resilience against mounting risks from climate change.

Further, municipal governments are now responsible for a significantly larger share of infrastructure funding than in the past. To ensure that municipal dollars are efficiently and responsibly allocated, investments in municipal assets and infrastructure must keep the effects of climate change in mind. In making these decisions, the trade-offs and costs of doing nothing must be properly assessed.

National and subnational costing estimates are time sensitive and will change as new information becomes available. They also vary by source and depend on the focus (e.g. economic, insured losses, damages). While this costing data is key to understanding larger trends and scale, local data is key as it can support national figures with on-the-ground real-time reporting.

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



The goal of this resource is to provide municipal decision makers with guidance on collecting locally-relevant data , and weighing the costs of action vs. inaction. This report will explore the national and provincial/territorial context and examine the costs and impacts of climate change across a number of climate change hazards and sectors.

How to use this report

As municipalities develop their responses to climate change through the Building Adaptive and Resilient Communities (BARC) framework, information on the net costs of inaction (i.e., the net cost reflecting the difference between the costs and any beneficial opportunities arising from climate change) plays a critical role in two areas:

1. The costs of inaction can be used to help document the need and urgency to allocate resources to adaptation planning, including:
 - a. the scale and timeframe of climate-related costs;
 - b. the distribution of those costs across locations, sectors, population groups, etc.;
2. It can also be used by municipalities and stakeholders as a baseline to inform the prioritization of current and future climate risks and vulnerabilities during the assessment stage.

This report was developed based on the critical risks identified by City of Hamilton staff and key stakeholders through a collaborative risk and vulnerability assessment (VRA) process. The VRA is a key step with the BARC framework and informed the development of the climate change impact adaptation plan. Hamilton's key risks were mapped to national impact statements developed by ICLEI Canada. These impact statements were chosen based on their relevance (high costs, risks and impacts) to Canadian municipalities, the frequency with which they are identified as local impacts by municipalities, and the availability of data from a wide range of sources (local, provincial/territorial, national and academic).

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



National Impact Statements

1. Increasing frequency of extreme precipitation events leading to overland flooding and damage to buildings and homes.
2. Increasing temperature and precipitation leading to increased replacement and maintenance cost of roads and transportation infrastructure.
3. Increasing frequency of extreme precipitation events leading to overland flooding and loss of local business and public services.
4. Increasing frequency of extreme heat resulting in negative health outcomes, particularly to vulnerable populations, from reduced air-quality and increased heat-stress.

For each of the selected national impact statements, corresponding risks and climate hazards and projections from the City of Hamilton's Climate Science Report and VRA are described. National and subnational costing data is then examined, as well as recent examples of climate change costs incurred by Canadian municipalities. Combined, this information can provide the basis for further exploration by the City of Hamilton to identify local sources of data that can inform decision-making on appropriate allocation of resources to adapt municipal assets, infrastructure and services to reduce risk and build resilience.

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?
CITY OF HAMILTON REPORT**



RISK 1

Increasing frequency of extreme precipitation events leading to overland flooding and damage to buildings and homes.

What to know about this risk

The annual mean precipitation in Canada has increased since the mid-20th century and is projected to increase further under both low and high emission scenarios (Bush & Lemmen, 2019). Climate change is also expected to increase the intensity, duration and frequency of extreme precipitation events. For example, in Toronto, Edmonton, and Calgary, 100-year flood events are expected to become 6-year events (Ness et al., 2021).

Increasing frequency of extreme precipitation events in Hamilton

Both total annual average precipitation and heavy precipitation events are projected to increase for the City of Hamilton (ICLEI Canada, 2021).

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



Total precipitation

The total annual average precipitation is projected to increase from a baseline of 844 mm to approximately 898 mm in the 2021-2050 period, and to 923 mm by the 2051-2080 period. Across the City, heavy precipitation days are also expected to increase across the City.

Heavy precipitation

Across the City, heavy precipitation days are expected to increase by approximately 3 days for 10 mm day events, and 2 days for 20 mm day events. Maximum 1-day and 5-day events are also expected to increase across the City, with the greatest increase in 5-day events. For example, Max 5-day events are projected to increase from a baseline of 65 mm to 74 mm by 2051-2080.

The impacts of this risk

The impacts related to this risk are influenced by various local factors and vary from one community to the next.

Local Impacts related to this risk identified in the City of Hamilton's 2021 Risk and Vulnerability Assessment

Several of the impact statements identified in the City's Risk and Vulnerability Assessment are related to the increased risk of either direct or indirect damage to buildings and homes from increasing frequency of extreme precipitation events as listed below.

- Reduced capacity of flood protection measures and water storage caused by an increase in rainfall intensity leading to flooding. (Medium to High Risk)

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



- Changes in the frequency of extreme rainfall events will result in increased instances of flooding on private and public properties. (Medium to Low Risk)
- Increase rainfall intensity while ground is frozen resulting in sewer system surcharge and flash floods. (Medium to Low Risk)
- Changes in precipitation resulting in decreased functionality of sewers, combined sewers and storm water ponds causing surcharge. (Low Risk)

Past extreme precipitation and flooding events in Hamilton

2009 Red Hill Valley Flood Event

The City of Hamilton experienced unprecedented extent and magnitudes of flooding with only one rain gauge which remained operational after the storm, recorded an astonishing 91 millimeters alone (Sheckenberger, 2010).

April 2017 Dundas Flooding Event

Heavy rain clogged storm drains and swollen the Red Hill Creek in East Hamilton, and Spencer Creek in Dundas, triggering a mudslide and flooding at least eight streets in the community. A nearby plaza owner was quoted saying "This is the worst it's been in 40 years" (Fraser, 2017).

2021 Water/Wastewater Bypasses

Based on its Woodward Wastewater Treatment Plant Bypass and Combined Sewer Overflow Log, the City of Hamilton estimated that 4059.84 million liters of water/wastewater were bypassed in 2021.

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



Costs related to this risk

Flooding due to extreme precipitation is among the most prevalent and costly climate change hazards affecting Canadian municipalities. Intense precipitation combined with lack of permeable surfaces can quickly overwhelm the capacity of drainage systems and lead to flooding, water infiltration and damage to buildings and homes. In addition, infrastructure damage has cascading impacts through socio-economic and natural systems including reducing economic output, threatening health, well-being, and livelihoods of municipal residents.

Canada has a major deficit in public asset and infrastructure spending, with recent estimates to maintain existing infrastructure at between \$110 and \$270 billion (Ness et al., 2021). This deficit is compounded by the fact that public assets and infrastructure were not built for a warmer, wetter, and more volatile climate. Maintaining these in a state of good repair will require more money to address accelerated deterioration due to climate change (FAO, 2021).

A recent report by the Financial Accountability Office of Ontario (FAO) found that climate change under the high emissions scenario (RCP 8.5) is projected to add an additional \$47 billion in O & M costs to Ontario's municipal building and facilities budgets by the end of the century (FAO, 2021).

Since 2010, flooding has accounted for the costliest extreme weather disaster affecting Canadians in the form of insurable and uninsurable losses and disaster-assistance payouts by federal, provincial, and territorial governments (Moudrak & Feltmate, 2020). Homes and buildings are highly exposed to flood damages. Flood and water related losses have been trending upwards from 1983-2000 baselines with Disaster Financial Assistance Agreements expected to reach \$1 billion per year by 2020 (Moudrak & Feltmate., 2020) and costs in annual damages reaching between \$1.3 and \$12.4 billion by the end of the century (Ness et al., 2021).

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



As shown in Figure 3, the costs of flooding damage to households located in flood zones will significantly increase under both low and high emission scenarios as can be seen in the data from six major Canadian cities.

Canada’s private infrastructure was valued at \$6.1 trillion in 2019 with privately-owned homes and buildings making up 85% (or \$5.18 trillion) of this number (Moudrak & Feltmate, 2020). As extreme events become more commonplace, homeowners and governments will bear the brunt of these costs. The burden of paying for flood- related damages has already shifted to homeowners as the industry average premium for homeowner insurance has risen by 20-25% over the past five years in Canada (Moudrak & Feltmate, 2020).

Homes at risk of inland flooding will face more damage more often

Flood damages, millions of dollars (2019 CAD)

CMA Name	Province	Households in flood zone	Baseline	Mid-century, low-emissions	Mid-century, high-emissions	End of century, low-emissions	End of century, high-emissions
Toronto	Ontario	146,798	\$99	\$557	\$592	\$548	\$566
Winnipeg	Manitoba	250,918	\$54	\$285	\$239	\$259	\$325
Calgary	Alberta	105,441	\$37	\$193	\$195	\$193	\$234
Mississauga	Ontario	38,341	\$24	\$162	\$166	\$157	\$165
Edmonton	Alberta	108,171	\$35	\$131	\$108	\$129	\$144
Ottawa	Ontario	75,514	\$44	\$114	\$92	\$109	\$114

Figure 3: Canadian Institute for Climate Choices. (2020). Under Water: The Costs of Climate Change for Canada’s Infrastructure.

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



Cost examples from across Canada

2013 Calgary flooding

2013 Calgary flooding is estimated to have cost a combined \$5 billion in financial loss and property damage with \$409 million in damages to key municipal infrastructure in Calgary alone (City of Calgary, 2021).

The cost of increasing frequency of extreme precipitation events in Hamilton

Damage caused by intense and frequent precipitation in the spring of 2017 cost between \$1.8 and \$2.5 million (Hamilton Spectator, 2017).

RISK 2

Increased temperature and precipitation leading to increased replacement and maintenance cost of roads and transportation infrastructure.

What to know about this risk

The greatest threats to Canada's transportation structure come in the form of increased annual and extreme temperature, increased precipitation, and freeze-thaw events. Projected changes in temperature, especially +30°C and extended heat wave events, will have a serious effect on roadways and paved surfaces.

As asphalt and pavement are susceptible to increased wear and tear due to high temperatures, freeze thaw events, and erosion from precipitation, understanding how the climate will change is an important first step in assessing the potential future costs of maintenance and replacement.

Extreme temperatures and heat waves

Extreme heat events are extended spells of high temperatures, often described as days over 30°C. As heat events increase in intensity, duration, and frequency they will cause increasing stress on infrastructure and building assets causing damage and increase the

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



rate of degradation. This will result in increased costs of repair, placement, operation and maintenance.

The Climate Atlas of Canada projects a major increase in the number of +30°C days in Ontario, from a baseline average of 3.9 days per year, to 11.8 day by mid-century, and up to 25.5 days by the end of the century. The number of heatwaves and length of heatwaves is also expected to increase substantially. These effects will be acutely experienced in southern Ontario.

Increasing temperatures in Hamilton

As described in the 2021 Climate Science Report Prepared for the City of Hamilton by ICLEI Canada, all temperature indices for the City of Hamilton are projected to experience significant warming under all climate change modeling scenarios. The minimum, average and maximum monthly temperatures will increase, as will the number of extreme heat days, while the number of extreme cold days will decrease.

The City of Hamilton has recently broken late summer temperature records in 2016 and 2018. 2016 also saw 26 heat alert days (where daytime temperatures reached at least 31°C or at least 40°C with humidex with nightly temperatures lingering above 20°C) compared to 17 in 2015.

Maximum temperatures

In terms of maximum temperatures, Hamilton will experience an increase in all seasonal maximum temperatures, with average summer maximum temperatures expected to reach over 30°C in the years 2051-2080 compared to the current baseline of 25.9°C.

In addition to the average maximum temperatures, the warmest maximum temperature is also expected to increase (i.e. the single, hottest day of the year to 36.4°C in the immediate future (2021-2050), and 38.9°C in the near future (2051-2080) compared to the current baseline average of 34.1°C. . These temperatures do not

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



factor in additional warming due to the humidex which could make it feel 5 to 10°C warmer.

The number of days where the daily maximum temperature exceeds 30°C, 32°C and 34°C will also increase. The baseline average number of days when the maximum temperature was greater than or equal to 30°C was 16.1 days for the City of Hamilton. This is expected to increase to an average of 63.3 days in the 2051-2080 period and means there will be close to four times more days above 30°C by 2080.

Length of the hot season

The length of the hot season, or the days from the first day of the year with $t_{max} \geq 30^{\circ}\text{C}$ to the last day with $t_{max} \geq 30^{\circ}\text{C}$, is also expected to increase. The baseline average length of the Hot Season is currently 71.6 days. By 2051-2080, Hamilton can expect an increase to 126.2 days, which is almost double the length of the current hot season.

Heat waves

Heat wave events will become more frequent and prolonged in the City of Hamilton. The annual number of heatwave event baseline numbers for the City of Hamilton is currently 2.1 and is expected to increase to almost 7.0 in the 2051-2080 period, more than triple the current number of occurrences.

With regards to the average length of heat waves (in days), the City of Hamilton's baseline is 3.8 days of heatwave conditions. In the 2051-2080 period, Hamilton can expect to see an average heatwave event occurring for 8.4 days, more than double the current length of heat wave events.

Overall, heatwave events are projected to occur more frequently and for longer periods of time and these changes become more pronounced as time goes on in higher emissions scenarios. The baseline average of consecutive length of 30°C Days for the City of Hamilton is 4.0. By 2051-2080, Hamilton could experience 19.2 consecutive days where temperatures exceed 30°C. This potentially would signify an Extended Heat Warning for the City for more than two and a half weeks.

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?
CITY OF HAMILTON REPORT**



Increasing frequency of extreme precipitation events in Hamilton

As mentioned in the previous section (RISK 1), total annual average precipitation and heavy precipitation events is projected to increase for the City of Hamilton (ICLEI Canada, 2021).

Total precipitation

The total annual average precipitation is projected to increase from a baseline of 844 mm to approximately 898 mm in the 2021-2050 period, and to 923 mm by the 2051-2080 period. Across the City, heavy precipitation days are also expected to increase across the City.

Heavy precipitation

Across the City, heavy precipitation days are expected to increase by approximately 3 days for 10 mm day events, and 2 days for 20 mm day events. Maximum 1-day and 5-day events are also expected to increase across the City, with the greatest increase in 5-day events. For example, Max 5-day events are projected to increase from a baseline of 65 mm to 74 mm by 2051-2080.

The impacts of this risk

Roads and rail lines are an integral part of Canada's transportation network that facilitates movement of people, goods and services across the country and within municipalities. As the climate continues to warm, increasing intensity and frequency of climate hazards will expedite the degradation of this critical infrastructure.

The sensitivity of paved surfaces and transportation infrastructure is mainly affected by three factors: age, composition, and design (City of Windsor, 2019). The average lifespan of

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



roadways varies by province but generally local, collector, and arterial roads have a lifespan of anywhere from 20 to 35 years (Statistics Canada, 2020); however, high temperatures can significantly reduce this lifespan. Table 2 shows some of the impacts that extreme heat has on road infrastructure (City of Windsor, 2019).

In addition to the impacts of high temperatures and heat waves, increased precipitation and other extreme weather events such as ice storms and wind storms can also lead to damage and reduced transportation infrastructure lifespan. This can include blockages from snow, the damage or destruction of roads and railways from washouts, and dangerous travel conditions. Extreme weather like hail, freezing rain and high winds can also damage traffic and rail signals.

Changing winter precipitation patterns and freeze-thaw cycles will further deteriorate roads, pavement (including sidewalks), and increase the risk of injury or death from accidents and slips on icy surfaces.

The result of these climate-driven hazards will be ever increasing disruption of supply chains, disruption and delay of services, reduced economic output, increased risk of toxic spills, and increased risk of injury and death from transportation accidents.

Table 2: Impacts on various types of infrastructure due to high temperatures (City of Windsor, 2019).

Highways, Roads	Bridges	Buildings
<ul style="list-style-type: none"> • Pavement softening causing rutting • Increased flushing and bleeding of older pavement • Reduction in maximum loads that can be safely transported • Buckling of roads and sidewalks • Shortened life expectancy of highways, roads and rail 	<ul style="list-style-type: none"> • Cracking of bridge decks due to limits of expansion joints being exceeded • Drier conditions can affect the life cycle of bridges and culverts 	<ul style="list-style-type: none"> • Building damage has been observed when clay soils dry out • Premature weathering • Increased indoor air temperature and reliance on cooling systems

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



Impacts related to this risk identified in the City of Hamilton's 2021 Risk and Vulnerability Assessment

The following impact statements identified in the City's Risk and Vulnerability Assessment are related to the need for increased maintenance and replacement of roads and transportation infrastructure due to increased temperature and precipitation:

- Changes in precipitation resulting in erosion of natural systems such as waterbanks leading to washout of bridges and roadways. (Medium Risk)
- Increased depth of frost penetration due to extreme cold temperature leading to greater frost heaving and damages to built infrastructure (e.g. gas pipes, building foundation, roadways, sidewalks). (Medium to Low Risk)
- Increased damage to and breakdowns of power lines and transportation systems as a result of more severe heat waves. (Medium to Low Risk)
- Increased demand on roadways and transit due to fewer people walking, running or cycling in extreme heat. (Very Low Risk)

Overarching risks associated with increased heat and precipitation events in Hamilton are also acknowledged in the following impact statements:

- Increased instances of heat-related issues due to extreme heat. (Medium Risk)
- Increased instances of safety-related issues due to hazardous outdoor conditions caused by increasing rainfall intensity. (Low Risk)

It is worth noting that the City of Hamilton identified several additional risks that are indirectly related but can impact the need for increased maintenance and replacement of roads and transportation infrastructure:

- Increased freeze-thaw cycles during the winter months leading to hazardous roads, pathways and sidewalks conditions. (Medium to Low Risk)

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



- Changes in precipitation leading to more hazardous roads, pathways and sidewalks conditions, especially on frozen ground (e.g. black ice). (Medium to Low Risk)
- Increase in snow storm intensity leading to more hazardous roads, pathways and sidewalks conditions. (Medium to Low Risk)
- Increased freeze-thaw cycles during the winter months damaging public infrastructure (e.g. roads, sidewalks, buildings, bridges, sewer system). (Low Risk)

Past extreme heat and precipitation events that have affected transportation infrastructure in Hamilton

May 2017 High Water Levels

Extremely high water levels in Lake Ontario combined with recent rainfall events continued to cause damage along Hamilton's shoreline, requiring the City to start emergency repairs along the Breezeway Trail and on the Waterfront Trail (City of Hamilton, 2017).

2017 Slope Instability Work

Hamilton's escarpment is slowly eroding to the southwest towards the City of London. According to the General Manager of Public Works, slope instability on the Claremont access cost the City of Hamilton about \$1.3 M with further work planned for the Sherman access and Fifty Road access are estimated at \$2.5 M each (Cain, S, 2017).

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?
CITY OF HAMILTON REPORT**



2018 July Extreme Heat Event

Metrolinx issued warnings to riders across the Greater Toronto and Hamilton Area to expect delays as temperatures reached a sweltering 35°C and 36°C over the weekend. Spokesperson for Metrolinx was quoted saying “[...] Slower orders having to be issued amid the risk of rails buckling or warping amid the extreme heat.”

2019 Flood Event

Flooding caused the City of Hamilton and Hamilton Conservation Authority to close sections of the Hamilton Harbour Waterfront Trail and Lake Ontario Waterfront Trail (City of Hamilton, 2019).

2019 Rain and Wind Storm

The City of Hamilton closed Highway 8 in Dundas due to significant erosion in October of 2018. The City had to deploy numerous crews to clean up damage from a rain and wind storm that hit Hamilton and the area on Tuesday afternoon (Mitchell, 2019).

2022 Slope Instability Work

The City of Hamilton closed Sydenham Road in February 2022 due to erosion and slope stability concerns along the escarpment access. To safely address an urgent erosion and slope stability concern along the Sydenham Road escarpment access, the City of Hamilton will close the Sydenham escarpment access this week to immediately conduct required repairs (City of Hamilton, 2022).

Costs related to this risk

Increased temperatures and precipitation are expected to reduce the reliability of transportation services and increase the time of both freight services and the cost of lost time and economic opportunity. Temperature increase will lead to greater surface degradation, increased roughness, and thermal cracking and rutting resulting in increased

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



maintenance and repair costs, as well as decreased levels of service delivery and economic losses.

Maintenance and replacement

Statistics Canada (2021) estimates Canada's 2.8 million kilometers of roads already cost federal, provincial, territorial, Indigenous, and municipal governments approximately \$20.2 billion per year to maintain. This cost is expected to reach \$300 billion over the coming decade (Ness et al., 2021) and is likely to further increase as summers become longer and hotter, and as precipitation events become more frequent and extreme.

Temperature-related damage is projected to be the costliest of climate impacts on transportation infrastructure, accounting for 87% of expected costs (Ness et al., 2021). At the municipal level, projections indicate that climate change-induced damage to road maintenance and repairs could cost an additional \$3.1 billion annually by 2050 (CICC, 2021).

Economic losses

Economic losses associated with congested and roadways, transportation system interruptions, and supply chain issues are also expected to increase. In 2017 alone, \$2.2 trillion worth of goods were moved on Canadian roads (Ness et al., 2021). Estimated annual costs of road delay across Canada are expected to reach nearly \$2 billion by the end of the century if no adaptation measures are implemented, compared to \$250 million where proactive adaptation measures are taken (Ness et al., 2021). Poor road conditions also cost Canadian drivers an average of \$3 billion per year in higher vehicle operating costs, while traffic congestion in Toronto and Hamilton is estimated to cost \$11 billion in lost time and economic opportunity (Ness et al., 2021).

Other costs

Increased maintenance and replacement costs may also result in increased taxes and shipping costs, transport delays and disruptions, increased road and travel related accidents, risk of injury and death.

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



Cost examples from across Canada

2013 Toronto flood

In 2013, a summer storm produced 126 mm in precipitation and caused flash-flooding throughout the Greater Toronto area. The flooding closed multiple transportation corridors, caused wide-spread property damage, and disrupted power causing over \$940 million in insured property damage (CDD, n.d.).

2021 extreme heat event in British Columbia

British Columbia experienced an unprecedented heat dome event in 2021 with record-breaking temperatures throughout much of the province. Peak temperatures in the town of Lytton reached 49.6°C and set a national record for Canada. The extreme heat caused power grids to fail, roads and pavement to buckle, and rail lines to deform.

RISK 3

Increasing frequency of extreme precipitation events leading to overland flooding and loss of local business and public services.

What to know about this risk

As mentioned for RISK 1, the annual mean precipitation in Canada has increased since the mid-20th century and is projected to increase further under both low and high emission scenarios (Bush & Lemmen, 2019). Climate change is also expected to increase the intensity, duration and frequency of extreme precipitation events. For example, in Toronto, Edmonton, and Calgary, 100-year flood events are expected to become 6-year events (Ness et al., 2021).

Increasing frequency of extreme precipitation events in Hamilton

As mentioned in the previous section (RISK 1), total annual average precipitation and heavy precipitation events is projected to increase for the City of Hamilton (ICLEI Canada, 2021).

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



Total precipitation

The total annual average precipitation is projected to increase from a baseline of 844 mm to approximately 898 mm in the 2021-2050 period, and to 923 mm by the 2051-2080 period. Across the City, heavy precipitation days are also expected to increase.

Heavy precipitation

Heavy precipitation days are expected to increase by approximately 3 days for 10 mm day events, and 2 days for 20 mm day events. Maximum 1-day and 5-day events are also expected to increase, with the greatest increase in 5-day events. For example, Max 5-day events are projected to increase from a baseline of 65 mm to 74 mm by 2051-2080.

The impacts of this risk

As mentioned in RISK 1, the impacts related to this risk are influenced by various local factors and vary from one community to the next.

Local Impacts related to this risk identified in the City of Hamilton's 2021 Risk and Vulnerability Assessment

Several of the impact statements identified in the City's Risk and Vulnerability Assessment are related to the loss of local business and public services from increasing frequency of extreme precipitation events as listed below.

- Changes in the frequency of extreme rainfall events will result in increased instances of flooding on private and public properties. (Medium to Low Risk)

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



It is worth noting that the City of Hamilton identified several additional risks related to increased extreme precipitation events that although indirectly related, can lead to the loss of local business and public services:

- Reduced capacity of flood protection measures and water storage caused by an increase in rainfall intensity leading to flooding. (Medium to High Risk)
- Increase rainfall intensity while ground is frozen resulting in sewer system surcharge and flash floods. (Medium to Low Risk)
- Changes in precipitation resulting in increased flooding and increased need for evacuation of impacted citizens. (Medium to Low Risk)
- Changes in precipitation resulting in decreased functionality of sewers, combined sewers and storm water ponds causing surcharge. (Low Risk)

Costs related to this risk

The impacts of climate change such as overland flooding routinely disrupt businesses and public services including health care services. While the exact costs related to service loss and disruptions are not yet fully understood, recent reports suggest that the related direct and indirect costs will continue to grow (Sawyer et al., 2020). These include costs related to transportation delays, loss of business income, loss of business value, business disruptions, labour productivity losses, and reduced economic growth due to flooding (Sawyer et al., 2020).

Service disruptions

The cost of public service disruption related to flooding will also increase. Direct flood damage to healthcare facilities as well as related electrical and water service outages can disrupt medical supply chains and critical public health services while demands for such services are at their highest (Clark et al., 2021). Over 5,000 healthcare centers are at risk of flooding across Canada including 1,072 in Alberta and 1,440 in Ontario alone (Clark et al.,

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



2021). A similar proportion of other critical public services such as police and fire stations are also at risk of flooding (Clark et al., 2021).

Other indirect costs

The impacts of business loss of public service disruption on physical and mental health, quality of life, loss of spiritually and culturally important lands, and destruction of ecosystems are more difficult to measure but represent important costs (Sawyer et al., 2020). For example, current productivity loss estimates associated with depression and anxiety combined could increase from the current \$51 billion per year cost (Clark et al., 2021).

Cost examples from across Canada

2013 Alberta Floods

14% of Alberta's workforce was unable to work for over two-weeks during the 2013 floods which is the equivalent of 5.1 million hours of lost work and \$601 million of lost economic output (Sawyer et al., 2020).

2019 Floods in New Brunswick, Quebec, and Ontario

Spring flooding in 2019 affected 3,800 businesses across New Brunswick, Quebec, and Ontario, most of which were small businesses that are more vulnerable to business disruption (Sawyer et al., 2020).

RISK 4

Increasing frequency of extreme heat resulting in negative health outcomes, particularly to vulnerable populations, from reduced air-quality and increased heat-stress.

What to know about this risk

Climate projections show increased extreme heat events in communities across Canada throughout the rest of this century. The number of days when the maximum temperature climbs over 30°C has already increased by about one to three days annually from 1948 to 2016.

As mentioned for RISK 2, the Climate Atlas of Canada projects a major increase in the number of +30°C days in Ontario, from a baseline average of 3.9 days per year, to 11.8 days by mid-century, and up to 25.5 days by the end of the century. The number and length of heatwaves is also expected to increase substantially. These effects will be acutely experienced in southern Ontario.

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



Increasing temperatures in Hamilton

As mentioned for RISK 2, all temperature indices for the City of Hamilton are projected to experience significant warming under all climate change modeling scenarios (ICLEI Canada, 2021). The minimum, average and maximum monthly temperatures will increase, as will the number of extreme heat days, while the number of extreme cold days will decrease.

The City of Hamilton has recently broken late summer temperature records in 2016 and 2018. 2016 also saw 26 heat alert days (where daytime temperatures reached at least 31°C or at least 40°C with humidex with nightly temperatures lingering above 20°C) compared to 17 in 2015.

Maximum temperatures

In terms of maximum temperatures, Hamilton will experience an increase in all seasonal maximum temperatures, with average summer maximum temperatures expected to reach over 30°C in the years 2051-2080 compared to the current baseline of 25.9°C.

In addition to an increase in the average maximum temperatures, the warmest maximum temperature is also expected to increase (i.e. the single, hottest day of the year) to 36.4°C in the immediate future (2021-2050), and 38.9°C in the near future (2051-2080) compared to the current baseline average of 34.1°C. These temperatures do not factor in additional warming due to the humidex which could make it feel 5 to 10°C warmer. This can cause heat-related illnesses in not only vulnerable populations but also healthy, young adults.

Days where the daily maximum temperatures exceed 30°C, 32°C and 34°C present the greatest threats to community health due to heat-related illnesses. Examples of these include heat cramps, heat edema, heat exhaustion, or heat stroke. Specific groups, such as those who work outside, infants and young children, older adults (over the age of 65), those with chronic medical conditions, people experiencing

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



homelessness, people planning outdoor sports or activities, and those with limited mobility may be more adversely affected.

The number of days where the daily maximum temperature exceeds 30°C, 32°C and 34°C will also increase. The baseline average number of days when the maximum temperature was greater than or equal to 30°C was 16.1 days; this is expected to increase to an average of 63.3 days in the 2051-2080 period and means there will be close to four times more days above 30°C by 2080.

Length of the hot season

The length of the hot season, or the days from the first day of the year with $t_{max} \geq 30^{\circ}\text{C}$ to the last day with $t_{max} \geq 30^{\circ}\text{C}$, is also expected to increase. The baseline average length of the Hot Season is currently 71.6 days. By 2051-2080, Hamilton can expect an increase to 126.2 days, which is almost double the length of the current hot season.

Heat waves

Heat waves are defined as prolonged periods of excessively hot weather, which may be accompanied by high humidity. Extreme temperatures sustained over several days will have significant impacts on the health of individuals in the City of Hamilton. Heat illnesses can manifest quickly, and lead to long-term health problems and even death. Overexposure to extreme heat is especially dangerous for children and elderly adults, and those who work outside or are physically active outdoors.

Heat wave events will become more frequent and prolonged. The baseline annual number of heatwaves is 2.1; this is expected to increase to almost 7.0 in the 2051-2080 period, more than triple the current number of occurrences.

The baseline length of heat alerts is 3.8 days. In the 2051-2080 period, Hamilton can expect to see this increase to 8.4 days, more than double the current length.

Overall, heat alerts are projected to occur more frequently and for longer periods of time and these changes will become more pronounced in higher emissions scenarios.

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



The baseline average of consecutive 30°C Days is 4.0. By 2051-2080, Hamilton could experience 19.2 consecutive days where temperatures exceed 30°C.

Tropical nights

Traditional patterns of hot days and cooler nights can often be enough to mitigate heat exposure impacts. However, during heat alerts, local populations may experience prolonged exposure to heat due to tropical nights (where temperatures do not drop below 20C). This increases the risk of heat exhaustion or heat stroke For the City of Hamilton, the baseline average number of tropical nights is 6.4 per year. Hamilton could experience 33.4 more tropical nights on average by 2080, more than a fivefold increase.

The impacts of this risk

While climate change can affect all Canadians, the distribution and degree of the health-related impacts are uneven. Recent studies have highlighted the interplay between these complex interconnected socio-economic and health factors that increase vulnerability and exposure to climate hazards (Heaviside et al., 2017; Vargo et al., 2016).

Many of the climate hazards occur in the areas where the most vulnerable populations (including seniors, children, racialized populations, low-income individuals, individuals with chronic health conditions, and First Nations, Inuit, and Métis peoples) live (Heaviside et al., 2017; Vargo et al., 2016). Moreover, many of the current strategies to reduce these health impacts are not feasible in areas that need it most, and favour areas that already benefit from the greatest adaptive capacity.

Also, when climate-related emergencies and disasters strike, health facilities and services are affected. In some cases, climate-related events force health care centres and hospitals in Canada to close temporarily, evacuate patients, and/or cancel operations and other

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



services. But it is precisely during these disasters that Canadians need emergency services, and health care disruptions can have major effects on health and well-being.

Even if health facilities and services remain operational during a climate-related disaster, they can be pushed beyond their capacity to respond because of injuries, illnesses, and patient transfers due to the disaster. Combined effects of climate change that overlap and interact could lead to cascading effects on several health outcomes simultaneously.

Local Impacts related to this risk identified in the City of Hamilton's 2021 Risk and Vulnerability Assessment

Several of the impact statements identified in the City's Risk and Vulnerability Assessment are related to negative health outcomes from reduced air-quality and increased heat-stress caused by extreme heat as listed below:

- Drier, hotter and longer summers may affect the health and safety of local vulnerable populations. (Medium Risk)
- More frequent and intense heatwaves will increase instances of heat-related health and safety issues, particularly for households without access to reliable air-conditioning and the homeless. (Medium Risk)

Overarching risks associated with increased heat events in Hamilton is also acknowledged in the following impact statement:

- Increased instances of heat-related issues due to extreme heat. (Medium Risk)

It is worth noting that the City of Hamilton identified several additional risks related to reduced extreme heat that, although indirectly related, can lead to negative health outcomes:

- Rising summer temperatures and extreme heat will increase energy demand for air conditioning, causing a financial burden for low-income households. (Medium Risk)

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



- Rising summer temperature and extreme heat leading to greater demand for air conditioning and electricity generating more NOx emissions that contribute to smog. (Medium to Low Risk)

Higher than average lung cancer and chronic obstructive pulmonary disease in Hamilton means extreme heat events could impact more of Hamilton's population.

In 2018 the City of Hamilton Public Health Services released the Health Check: Assessing the local burden of disease in the City of Hamilton report. The report concluded that Lung Cancer and Chronic Obstructive Pulmonary Disease (COPD) are within the top three most burdening health outcomes in Hamilton and are higher than provincial averages (City of Hamilton, 2018).

Increased temperature and extreme heat events worsen air pollution and exacerbate symptoms and risks with people who experience respiratory or cardiovascular illnesses such as lung cancer and COPD which means that Hamilton's population is at greater risk for this climate change impact compared to other populations across Ontario.

Costs related to this risk

The recent Health Canada (Berry & Schnitter, 2022) report on the Health of Canadians in a Changing Climate, highlights the growing body of research that attributes increasing physical and mental health costs of climate change hazards including heat waves. The connection between climate change and negative health outcomes can be both direct through loss of life, injury and increased cases of mental health disorders (e.g. PTSD,

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



climate-anxiety) or indirect through a range of social, environmental, cultural, and economic pathways that have effects on health (Berry & Schnitter, 2022).

Cost to healthcare services

Under future climate conditions, climate-related negative health outcomes are expected to increase, increasing health costs and putting further strain on healthcare systems. In Quebec, estimates of health expenditures attributed to climate change (e.g., increased vector-borne diseases, extreme heat events and aeroallergens) is estimated at just under \$1 billion over 50 years through 2065 (in 2012 dollars) (Boyd & Markandya, 2021).

Costs of mental health borne by Canadian health systems are expected to increase in the absence of adaptation measures (Berry & Schnitter, 2022). Climate change increases the risks of mental health impacts, can worsen existing mental illness such as psychosis, and trigger new-onset mental illness such as post-traumatic stress disorder. Climate change can also increase mental health stressors such as grief, worry, anxiety, and vicarious trauma. Some medications, including those for schizophrenia, increase heat sensitivity and the likelihood of negative health outcomes during extreme heat events (Government of Canada, 2011).

Extreme heat can also increase hospitalization for cardiovascular problems and pregnancy complications, including premature birth, early delivery, miscarriage, and congenital abnormalities such as neural tube defects.

Costs from losses in labour and productivity

Productivity costs are related to the lost productivity caused when people are unable to work and participate in other work-related activities because of environmental conditions, illness, or premature death. Reduced output, interruption of services, and loss of employment can all result from heat stress and other climate-related factors. Temperature stress can affect workers (Henderson et al., 2022) either through direct physical or psychological discomfort and/or through reduced task productivity by altering the amount of effort exerted overtime compared to the return on that effort resulting in a loss of

HOW MUCH IS CLIMATE CHANGE COSTING CANADIAN COMMUNITIES? CITY OF HAMILTON REPORT



economic output (Henderson et al., 2022). Overall, impacts to labor productivity could affect economic growth and incomes at a national scale (Clark et al., 2021).

Under a high emissions scenario, the Canadian Institute for Climate Risk (Clark et al., 2021), projects that drop in annual labour productivity could cost up to \$5.4 billion dollars by mid-century, and \$14.8 billion by end of century, with much of those losses experienced in Ontario and Quebec. This amounts to 128 million hours, or 62 000 full time workers, in lost productivity annually across the country.

Cost examples from across Canada

2021 extreme heat event in British Columbia

British Columbia experienced an unprecedented heat dome event in 2021 with record-breaking temperatures throughout much of the province. This included peak temperatures of 49.6°C in Lytton, setting a national record for Canada. The deaths of 619 British Columbians were attributed to this event (Report to the Chief Coroner of British Columbia, 2022).

Research suggests that the risk of death was associated with socio-economic characteristics including deprivation, less access and proximity to green infrastructure, older age, and sex (Henderson et al., 2022). Municipal decision-makers must account for the uneven distribution of impacts as they consider the allocation of funds to address these impacts. For example, focusing efforts on highly deprived neighborhoods with low access to air conditioning and greenspace. (Henderson et al., 2022).

2010 and 2018 extreme heat events in Quebec

It is estimated that recent extreme heat events in Quebec have led to a significant number of deaths. 291 people died in the 2010 extreme heat event, and 86 died in the 2018 extreme heat event.

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



RECOMMENDATIONS

Next steps for the City of Hamilton

In order for the City of Hamilton to better understand its own specific costs related to climate change, it is important for the City to investigate potential data sources listed in Appendix A to better understand the costs associated with the risks presented in this report.

City Staff currently in Public Health Services - Healthy Environment's Division are currently investigating data sources across City Departments to begin gathering local costs associated with the Climate Risk Statements outlined within this report. This data collection process can be complicated, especially where data may not be tracked properly. In this case it will require the collective buy-in from top decision-makers at the City of Hamilton to prioritize this type of data collection and storage in order to properly assess the climate change impacts and costs specifically for Hamilton.



APPENDIX A

Sample data sources for local climate change impacts and costs

Risk 1: Increasing frequency of extreme precipitation events leading to overland flooding and damage to buildings and homes.

Type	Data	Notes
Climate data	Local IDF Curves, local precipitation data (total/mean precip, intensity rate, max/min precip)	IDF data selected according to project and relevant return periods (should also apply scaling to adjust for climate change)
Climate Data	Flood plain mapping by regional bodies	Can be obtained from local conservation authorities
Event based data	Historical records of extreme precipitation events	Going back a minimum of 10 years
Event based data	Historical records of 311 calls to report flooding of buildings and homes	Going back a minimum of 10 years
Event based data	Flood mapping (i.e. reported flooding locations)	Going back a minimum of 10 years
Departmental data	Major expense records incurred by multiple departments in their response and cleanup to flooding	Going back a minimum of 10 years

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



Type	Data	Notes
	events. (e.g. operational costs for response and clean-ups of flooding events such as contract services, salaries, landfill fees, etc.)	
Event based data	Municipal subsidy program applications (e.g. number of applications from homeowners applying after flooding events)	Going back a minimum of 10 years
Event based data	Historical records of costs incurred by municipal-run social housing and shelters as a result of flooding	Going back a minimum of 10 years
Climate and Event based	Models of municipal sewer system maps combined with IDF for different return periods and different climate projections to estimate the number of flooded properties for both current and future flood events	Can also apply Insurance Bureau of Canada estimates to determine costs (e.g. Insurance Bureau of Canada estimates the average home basement repair costs approx. \$43K)
National / provincial and territorial data	Counts of disaster-assistance payouts	Local data
Event based insurance data	Records of claims following flooding events	Can be obtained from Insurance Bureau of Canada data
Community outreach / engagement data	Survey data from homeowners costs, type of flood damage, timing of flood impacts, sources of finances to repair damage	Can work with community partners to carry out outreach/engagement

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



Risk 2: Increasing temperature and precipitation leading to increased replacement and maintenance cost of roads and transportation infrastructure.

Type	Data	Notes
Climate Data	IDF Curves adjusted to return period and accounting for climate change (can be used as proxies for 20yr, 50yr, 100yr flooding events)	IDF data selected according to project and relevant return periods (should also apply scaling to adjust for climate change)
Climate Data	Both current and future temperature and precipitation data (Temperature extremes, precipitation averages and totals, etc.)	Visit ClimateData.ca for more information
Climate / Event Data	Records of local heat warnings (e.g. from heat alert system)	Local data
Event based data / Departmental Data	Historic records of extreme heat and precipitation events and associated costs for road and transport system repair and maintenance (this should include costs of repair and maintenance of transportation fleet)	Going back a minimum of 10 years
Departmental Data	Analysis of road and transportation infrastructure life cycle	
National Data	Costs to transportation infrastructure as a result of precipitation and heat damage (e.g. thermal cracking, rutting,	More information from the Canadian Institute for Climate Choices

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



Type	Data	Notes
	increased roughness, degradation, increased maintenance and repair costs, damage to bridges, decreased service delivery)	
National Data	Transportation of goods	More information from Statistics Canada
Provincial Data	Data collected for the asset management planning for municipal infrastructure regulation (O. Reg. 588/17)	

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



Risk 3: Increasing frequency of extreme precipitation events leading to overland flooding and loss of local business and public services.

Type	Data	Notes
Climate data	Local IDF Curves, Local precipitation data (total/mean precip, intensity rate, max/min precip)	Selected according project and relevant return periods. Should also apply scaling to adjust for climate change
Climate Data	Flood plain mapping by regional bodies	Can be obtained from local conservation authorities
Climate data / event based data	River and lake level records	More information from ClimateData.ca and Climate Atlas, National Oceanic and Atmospheric Administration Great Lake climate change projections
Climate data / event based data	Records of flood warnings issued by local or regional bodies	Going back a minimum of 10 years
Event based data	Records of high river and lake level records and associated costs to businesses and public services (beaches, recreation, parks)	
Event based data	Historical records of extreme precipitation events	Going back a minimum of 10 years
Event based data	Historical records of reports of flooding of local businesses and public buildings	Going back a minimum of 10 years

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



Type	Data	Notes
Event based data	Flood mapping (i.e. reported flooding locations)	Going back a minimum of 10 years
Event based data	Flood mapping of current and future at-risk / vulnerable businesses and public services under climate change	Can be obtained from the Climate Atlas
Event based data	Estimates of costs of flooding to businesses and public services under current and future climate change projections.	Can combine flood mapping with Insurance Bureau of Canada cost estimates
Departmental data	Major expense records incurred by multiple departments in their response and cleanup to flooding events. (e.g. operational costs for response and clean-ups of flooding events including contract services, salaries, landfill fees, etc.)	Going back a minimum of 10 years
Departmental data	Records of service disruptions and closures associated with flooding events (e.g. libraries, transit, recreation centres/facilities/parks etc.) and records of lost revenue from service disruptions/closures	Going back a minimum of 10 years
Event based data	Historical records of costs incurred by municipal-run public services (e.g. libraries, recreation centres, parks, transit, social housing) as a result of flooding events	Going back a minimum of 10 years

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



Type	Data	Notes
Climate and Event based	Models of municipal sewer system maps combined with IDF for different return periods and different climate projections to estimate the number of flooded businesses and public services (e.g. libraries, recreation centres, parks, transit, social housing) for both current and future flood events	
National / provincial and territorial data	Counts of disaster-assistance payouts	Local data
Event based insurance data	Records of claims following flooding events	Can be obtained from the Insurance Bureau of Canada

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



Risk 4: Increasing frequency of extreme heat resulting in negative health outcomes, particularly to vulnerable populations, from reduced air-quality and increased heat-stress.

Type	Data	Notes
Climate Data	Current and future projections of extreme heat (# of extreme heat days, mean maximum temp, # of heat waves, avg length of heat waves, evening/night time temperatures)	Visit ClimateData.ca for more information
Event based data	Local counts of extreme heat warning (heat alerts) including number of heat warnings, extended heat warnings (duration)	Going back a minimum of 10 years
Event based data	Local count of air quality statements, smog advisories, number of days with Air Quality Health Index Moderate-High	
Departmental Data	Increased demand on cooling infrastructure (e.g. shade spaces, cooling centres and social housing)	
Departmental Data	Decreased enrollment and revenue from municipal outdoor programs	
Departmental Data	Records of heat stress and air quality related health leave and absenteeism for municipal staff, in particular those vulnerable/exposed to heat (e.g.	

**HOW MUCH IS CLIMATE CHANGE COSTING
 CANADIAN COMMUNITIES?**
 CITY OF HAMILTON REPORT



Type	Data	Notes
	outdoor workers, age, pre-existing health conditions)	
Departmental Data	Increased operational, maintenance and repair costs from increased use of air conditioning in municipal buildings, cooling centres and transport fleets	
Departmental Data	Records of cooling centre and municipal pool use including costs for maintenance, energy use and chemical use	
Health Risk and Vulnerability Assessment Data (National, Provincial and Local)	National Health Vulnerability assessment for increasing heat events; Ontario Climate Change and Health Vulnerability Assessment toolkit and data; Local Risk and Vulnerability assessment that includes health outcomes (particularly to vulnerable populations)	More information from Health Canada and the Province of Ontario
National Data / Provincial Data	Climate change driven negative health outcomes (e.g. increased mortality, increased hospital visits as a result of increasing extreme heat)	More information from Health Canada
National Data	Health Costs of Climate Change related to poor air quality and extreme heat stress	

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



Type	Data	Notes
National Data	Economic costs of pre-mature deaths, illness and absenteeism related to extreme heat and poor air quality	More information from the National Round Table on the Environment and Economy

**HOW MUCH IS CLIMATE CHANGE COSTING
CANADIAN COMMUNITIES?**
CITY OF HAMILTON REPORT



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CITY OF HAMILTON REPORT



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CITY OF HAMILTON REPORT



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ReCharge Hamilton

A Prosperous, Equitable, Post-Carbon City
Our Community Energy + Emissions Plan

August 2022

Contributors

City of Hamilton:

Christine Newbold, Spencer Skidmore, Tom Chessman, Trevor Imhoff, Andrea McDowell

SSG/whatIf? Technologies:

Yuill Herbert, Kyra Bell-Pasht, John Kohng, Ralph Torrie, Stephen Salter, Naomi Devine,
Penny Beames

CONTENTS

Contributors 2

1.0 Land Acknowledgement 4

2.0 Message from the Mayor 5

3.0 Acknowledgements 6

4.0 Executive Summary 9

5.0 Part I: Setting the Scene 18

6.0 Part II: The 5 Low-carbon Transformations 27

7.0 Part III: Towards Implementation 47

8.0 Acronyms 50

9.0 Glossary 51

Figures

Figure ES1. Projected business-as-planned GHG emissions (Mt CO₂e) by sector, 2016-2050. 11

Figure ES2. GHG emissions reductions (Mt CO₂e) in the net-zero scenario. 12

Figure 1. Projected business-as-planned GHG emissions (Mt CO₂e) for the City of Hamilton, by sector, 2016-2050. 21

Figure 2. GHG emissions reductions (Mt CO₂e) in the net-zero scenario. 22

Figure 3. Capital expenditures vs. savings and revenues from the net-zero scenario, 2021-2050. 23

Figure 4. Average annual household energy costs (including transportation fuels) in the business-as-planned (BAP) and net-zero scenarios, 2016-2050. 32

1.0 Land Acknowledgement

The City of Hamilton is situated upon the traditional territories of the Erie, Neutral, Huron-Wendat, Haudenosaunee, and Mississaugas. This land is covered by the Dish With One Spoon Wampum Belt Covenant, which was an agreement between the Haudenosaunee and Anishinaabek to share and care for the resources around the Great Lakes. We further acknowledge that this land is covered by the Between the Lakes Purchase, 1792, between the Crown and the Mississaugas of the Credit First Nation.

Today, the City of Hamilton is home to many Indigenous people from across Turtle Island (North America) and we recognize that we must do more to learn about the rich history of this land so that we can better understand our roles as residents, neighbours, partners, and caretakers.



2.0 Message from the Mayor

3.0 Acknowledgements

Sincere thank you to the dozens of members of the community that participated on the Stakeholder Advisory Committee (SAC), giving their time and energy over nearly two years. SAC members spent hours learning about Hamilton’s energy and emissions profile, as well as climate action best practices. Members shared their expertise to create a Plan for all Hamiltonians.

Hamilton Community Stakeholder Advisory Committee organizations:

- Alectra Utilities
- ArcelorMittal Dofasco
- Bay Area Climate Change Council
- CityHousing Hamilton
- Centre for Climate Change Management at Mohawk College
- Clean Air Hamilton
- Enbridge
- Environment Hamilton
- Faith and the Common Good
- Hamilton Burlington Society of Architects
- Hamilton Chamber of Commerce
- Hamilton Health Sciences
- Hamilton Industrial Environmental Association
- Hamilton Community Enterprises Inc.
- Hamilton Oshawa Port Authority
- Hamilton-Wentworth Catholic District School Board
- Hydro One
- McCallumSather Architects
- McMaster University
- Mohawk College
- Neighbour 2 Neighbour Centre
- Smarter Alloys
- Sustainable Hamilton Burlington
- Stelco
- West End Home Builders Association

As a major stakeholder in this Community-wide initiative, the City of Hamilton has provided staff resources from the following departments and sections to assist in the development of this Plan:

- Planning and Economic Development Department (Transportation Planning, Transit, Planning, Growth Management, Building, and Economic Development Divisions)
- Corporate Services Department (Financial Planning, Administration and Policy Division)
- Public Works Department (Environmental Services, Office of Energy Initiatives)
- Healthy and Safe Communities Department (Health Hazards and Vector Borne Diseases, and Neighbourhood Development Divisions).

In addition, the City would like to thank other organizations that provided their expertise and advice during one-on-one interviews, including:

- NRCan Canmet MATERIALS Lab at McMaster Innovation Park;
- Independent Electricity System Operator (IESO);
- Green Venture;
- the Canadian Steel Producers Association;
- Hamilton Community Enterprises;
- Federation of Canadian Municipalities; and
- The Atmospheric Fund

Acknowledgement also goes to the Province of Ontario, which provided funding support through the Ministry of Energy, Northern Development and Mines Municipal Energy Plan program.



A nighttime photograph of a city skyline, likely Pittsburgh, with several tall buildings illuminated. The image is overlaid with several vertical, semi-transparent rectangular bars in shades of blue and white. The text 'Executive Summary' is centered in a large, white, sans-serif font.

Executive Summary

4.0 Executive Summary

ReCharge Hamilton is a Community Energy and Emissions Plan (CEEP) that lays out a major component of the City of Hamilton's strategy for responding to the climate emergency. With the input of local industry, academia, utilities, local non-profits, and the public this plan aims for Hamilton to achieve net-zero carbon emissions, citywide, by 2050 and become a prosperous, equitable, post-carbon city.

Hamilton will be well on its way to becoming net-zero by focusing on the plan's **5 Low-carbon Transformations**:

- 1. INNOVATING OUR INDUSTRY:** Actions focused on supporting the City's industry in decarbonizing and increasing the energy efficiency of their industrial processes.
- 2. TRANSFORMING OUR BUILDINGS:** Actions that support the retrofitting of existing buildings to be more energy efficient and to encourage fuel switching. It also includes actions that support improving the energy efficiency and GHG profile of new buildings within the City.
- 3. CHANGING HOW WE MOVE:** Actions that focus on increasing the modal split of transit and active transportation and decreasing the number of trips taken in personal vehicles. These actions also focus on decarbonizing the remaining personal and commercial vehicles and the City's vehicle fleet.
- 4. REVOLUTIONIZING RENEWABLES:** Actions that promote renewable energy generation. This includes reviewing the City's development policy and regulatory framework to remove any barriers for the development of renewable energy projects. The City and other organizations and community groups can also explore local, alternative ownership structures for renewable energy projects, such as cooperatives. Actions also include leveraging existing renewable energy initiatives in the City such as expanding and decarbonizing existing district energy systems (with the potential to include industrial residual heat), and investigating increasing our household organic waste diversion from landfills to anaerobic digesters to increase biogas and RNG production.
- 5. GROWING GREEN:** Actions that promote carbon sequestration through the growth of the City's tree canopy and preserving the City's existing natural heritage features through land use planning processes.

The detailed actions, including timelines and targets, that enable these **5 Low-carbon Transformations** are spelled out in greater detail throughout this report and in the Implementation Strategy attached as Appendix C.

This plan builds on growing climate action momentum across the community, from youth activists to the carbon-intensive steel sector. It is also bolstered by national and international calls to action, including the federal government's decision to cut emissions by 40-45% by 2030 and achieve net-zero by 2050, as well as the International Energy Agency's landmark 2021 report that advises against all new investments in fossil fuels.¹ Policies, programs, funding, and private investment are increasingly focused on net zero. This Plan will help leverage these investments to protect the environment, support the local economy, and promote community wellbeing.

ReCharge Hamilton provides a foundation for a community-wide effort to help prevent the most catastrophic impacts of climate change.

4.1 The Vision

The community was integral in designing the following vision for this Plan:

ReCharge Hamilton identifies a pathway to net zero GHG emissions by 2050 that increases the resilience of the energy system and improves economic prosperity for all. Drawing on a history of work, policies, and initiatives in this area, ReCharge Hamilton builds on Hamilton's historic and current strengths as an industrial leader in the midst of a rich natural environment, and as a caring community.

4.2 An Evidence-Based, Community-Informed Pathway

ReCharge Hamilton is informed by a detailed energy use and greenhouse gas (GHG) emissions model of the City. The sources and amounts of Hamilton's GHG emissions were collected for the year 2016 to build a thorough inventory of the City emissions. Emissions data was then combined with other important data from 2016, like population, number and types of houses, number of cars, and working hours, to create a picture of what Hamilton's activities and emissions looked like in 2016. Using this picture as a base year, the City's GHG emission future was then modelled using current trends out to 2050 in a business-as-planned (BAP) scenario. This business-as-planned scenario illustrates the scope of the problem, i.e. how much carbon Hamilton could emit between now and 2050 if no actions are taken to lower emissions. It's against this possible future that the net-zero scenario—the basis of ReCharge Hamilton—was built.

The industrial sector, primarily steel, is by far the city's largest source of emissions. It represents 64% of emissions in 2016 (the base year), and in 2050 if Hamilton follows the BAP scenario. Transportation represents 19% of emissions in the base year, then reduces to 17% by 2050 in the BAP. Buildings (residential and commercial) together represent about 15% of Hamilton's emissions in the base year, but those increase to 17% by 2050 in the BAP. Figure ES1 shows the City's projected BAP GHG emissions by sector from 2016 to 2050.

¹ International Energy Agency, Net Zero by 2050: A Roadmap for the Global Energy Sector (May 2021).

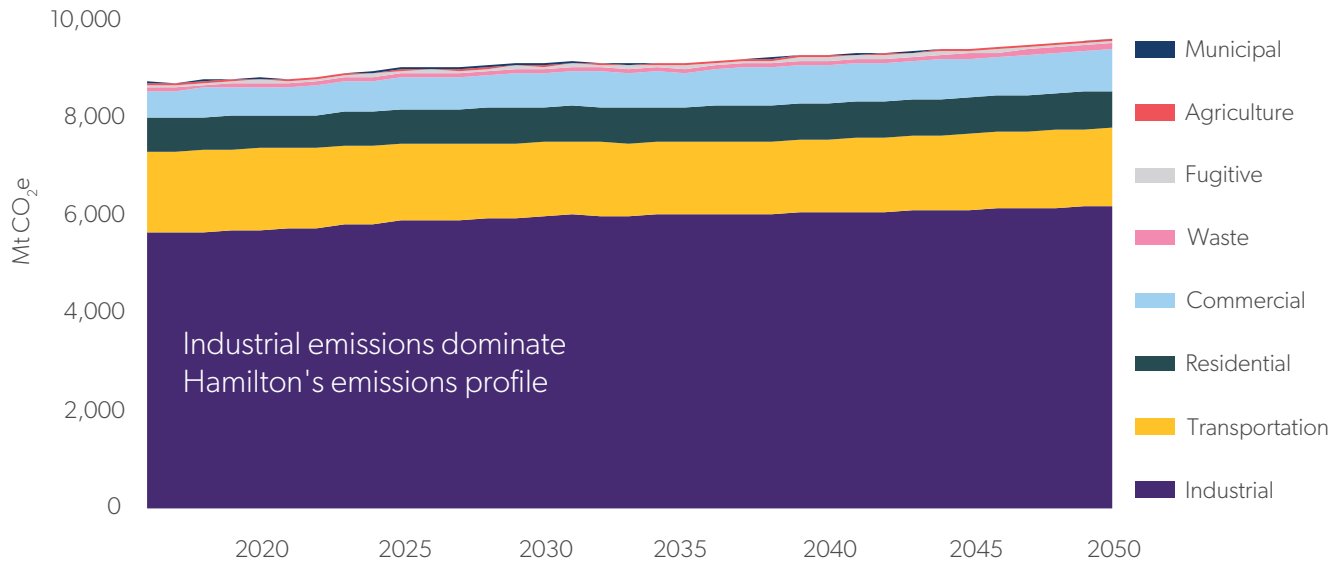


Figure ES1. Projected business-as-planned GHG emissions (Mt CO₂e) by sector, 2016-2050.

Based on best practices and community input, 30 low-carbon targets were modelled to assess how Hamilton could reach its goal of net-zero emissions by 2050. The net-zero scenario prioritizes energy efficiency in order to minimize the societal and environmental costs of the low-carbon transition. As a general rule, a unit of energy saved is less expensive than building another unit of energy production capacity, regardless of fuel source. Only after energy efficiency measures are incorporated is fuel switching to low-carbon/renewable energy sources considered. Figure ES2 shows the GHG reductions (by sector) resulting from the net-zero scenario.

The modelled low-carbon actions still result in positive GHG emissions by 2050. These are primarily from the few remaining combustion engine vehicles on the road and a small amount of industrial emissions. These remaining emissions are called 'the carbon gap.' The carbon gap will need to be addressed in future iterations of the plan using technological or policy innovations, or through carbon offsets.

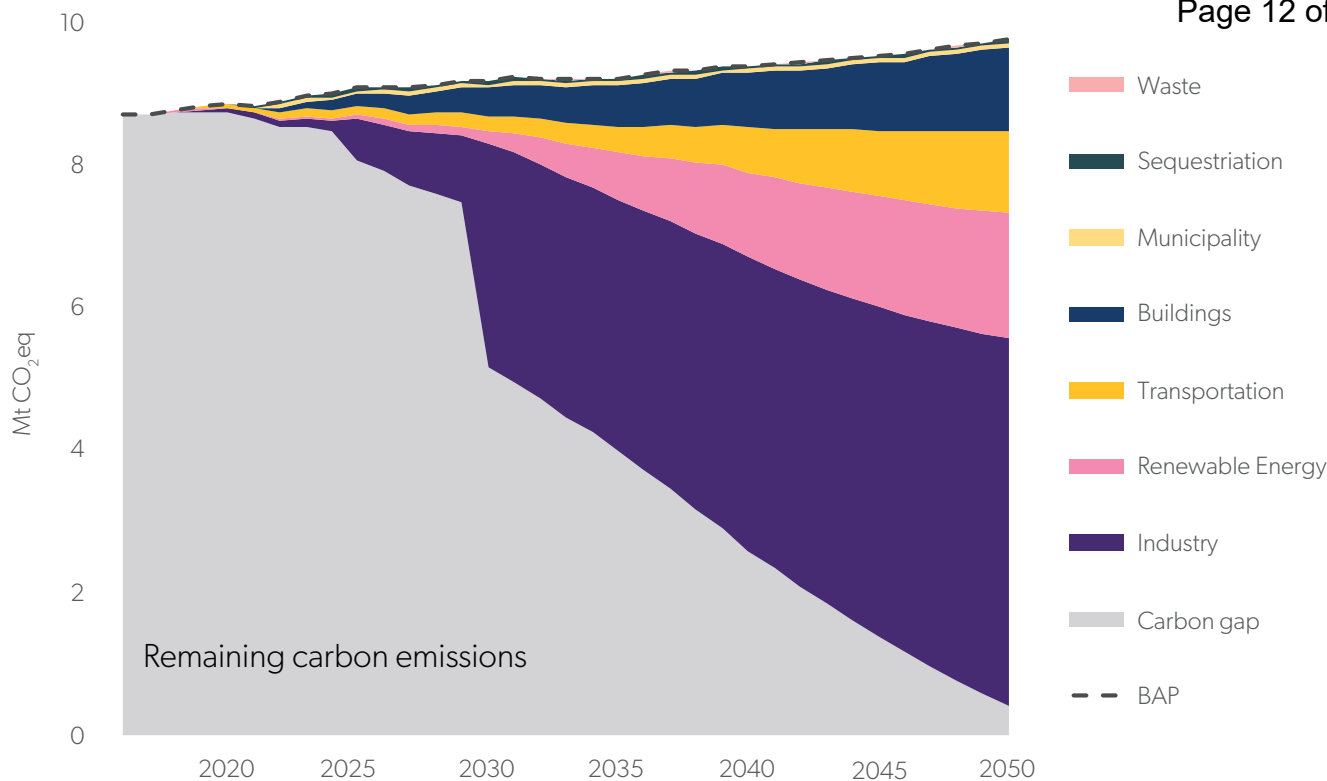


Figure ES2. GHG emissions reductions (Mt CO₂e) in the net-zero scenario. Note: For visual clarity, modelled targets are grouped by sector. A complete list of modelled targets is provided in Appendix A.

4.3 Getting to Net-Zero: Co-Benefits

In addition to reducing GHG emissions, ReCharge Hamilton has the potential to act as an economic catalyst and create about 5,500 full-time jobs within the City, primarily due to the mass industrial process efficiency and building retrofit program at its core.² The plan will also create a variety of other co-benefits, or benefits that go beyond greenhouse gas reductions.

Households will see energy bills drop by an average of 50% by 2050 as household comfort increases. Air quality will improve, and there will be less noise from combustion engine vehicles. Biodiversity and protection of wildlife are an additional outcome of protecting and expanding the city’s natural areas. Several of the actions proposed within ReCharge Hamilton also have the co-benefit of increasing physical activity through the promotion of active transportation, transit, and e-mobility, which can contribute to an increase in positive health outcomes.

Getting to net-zero emissions provides benefits beyond the borders of Hamilton. The City of Hamilton and neighboring City of Burlington (The Bay Area) are projected to grow significantly by 2050 and a regional low-carbon future requires changes across all aspects of the community, including new and existing buildings, transportation, industry, and waste management. Implementing the actions of ReCharge Hamilton supports and strengthens the ongoing regional collaboration on climate change with the Bay Area Climate Change Council (BACCC) and contributes to reducing regional emissions and creating cross-border co-benefits of economic growth, biodiversity, improved air quality and community health.

² The equivalent of about 161 thousand person years of employment from 2022 to 2050.

4.4 The Challenges

The pathway described in ReCharge Hamilton describes a City that by 2050 uses significantly less energy, switches nearly all of its energy to emission-free sources, and produces more renewable energy by applying practical, feasible, known solutions. Two of the major challenges for Hamilton are decarbonizing the steel industry and retrofitting the City's extensive older building stock.

The technological pathway for decarbonizing the steel industry is still emerging and there are fewer local and international examples of successfully decarbonizing the steel manufacturing process. Recent announcements by the Federal and Provincial governments to assist the Steel industry with funding to decarbonize is a promising move towards overcoming this challenge. Going forward, the City will need to work closely with the steel industry, research partners, utilities, all levels of government, and other stakeholders in order to help facilitate and implement a pathway to decarbonizing Hamilton's steel industry.

Completing mass deep energy building retrofits at scale represents a more common challenge that many municipalities across Canada and globally are trying to understand and resolve. Whereas the technologies to undertake retrofits are clear and established, a successful framework to deliver retrofits at the scale required is still being developed. The City will need to work with all levels of government, the skilled trades, educational establishments, Hamilton homeowners, other municipalities, and industry experts in order to develop a framework that works for Hamilton.

4.5 The Low-carbon Transformations

The actions proposed in this plan have been organized to focus on 5 key low-carbon transformations that will be pivotal in achieving Hamilton's low-carbon future.

TRANSFORMATION 1: Innovating Our Industry



Hamilton has long been an industrial hub for one of Canada's most carbon-intensive primary industries: steel. This industry represents over half of the City's emissions today.

Supporting and encouraging industrial efforts to decarbonize is key to achieving the City's targets. This means encouraging businesses and industry groups to adopt organizational net-zero targets, tracking progress towards those targets, connecting industry with resources, and engaging other levels of government for support. This includes establishing a net-zero working group for local industry stakeholders, and the creation of a cleantech accelerator to expedite low-carbon technology development and increase industry access to upcoming technology.

For the steel industry, it will mean switching from coal to emission-free alternatives, like sustainably sourced biochar or green hydrogen. For other industries, the focus will be on improving energy efficiency using new and emerging technologies and fuel-switching to clean energy sources.

TRANSFORMATION 2: Transforming Our Buildings



By 2050 in the BAP scenario, residential and commercial buildings are projected to represent the second largest source of emissions in Hamilton, primarily from the use of natural gas for space and water heating, particularly in older, more inefficient homes.

This plan features a comprehensive energy efficiency and fuel switching building retrofit program. This fuel switching will primarily serve to replace natural gas furnaces with electric heat pumps. The program will aim to cover most of the City of Hamilton by 2050. This plan also recommends partnering with local institutions, labour associations, and not-for-profits to ensure that appropriate education and training programs are in place to prepare the labour force for the proposed mass building retrofits.

This plan will also recommend the creation of comprehensive sustainable building and development guidelines, which will help increase the energy efficiency and decrease the GHG impact of new development. There are various examples of such guidelines throughout Ontario. This will also limit the need for new buildings to be retrofitted in the future.

TRANSFORMATION 3: Changing How We Move



Closely following buildings, fossil-fuel combustion in cars, trucks, and buses are estimated to account for about 19% of the City's GHG emissions in 2016, and decline slightly to 17% of Hamilton's emissions in a BAP scenario by 2050.

To achieve net-zero in this sector, the City will play a key role: expanding active transportation, e-mobility and transit networks, decarbonizing their fleet and transit, and by ensuring the City is designed to support electric vehicle adoption by creating a City-wide EV Strategy that will provide a comprehensive overview of how the City can support the uptake of EVs and encourage the private sector to do so as well. The City and its partners will also work with commercial fleet owners to form a community of best practice to share information, support the setting of fleet net-zero targets, track progress towards them, and help connect businesses with resources.

TRANSFORMATION 4: Revolutionizing Renewables



ReCharge Hamilton prioritizes maximizing energy efficiency. Then, the plan relies on fuel switching away from gasoline, diesel, coal, and natural gas to renewable electricity, renewable natural gas, and green hydrogen to achieve net-zero emissions.

Where possible, the production of local renewable electricity is best, as it helps support local economic development and energy independence. Hamilton has access to a wealth of untapped energy and renewable energy resources. For example, the low-carbon model includes:

- Industrial residual heat;
- Rooftop and ground mount solar energy;
- Wind; and
- Biogas from the decomposition of household organic waste.

These combine to meet about 7% of the City’s energy needs. Additional renewable energy capacity is available, for example from large-scale wind (inside or outside the City boundaries) along with agricultural and institutional organic waste.

This plan recommends a review of planning and regulatory documents to remove regulatory and policy barriers to the establishment of renewable energy projects, while also encouraging innovative, local ownership structures for these projects. ReCharge Hamilton will also recommend that the City, with its partners, further investigate renewable sources of energy, such as those originating from industrial residual heat, household organics and green hydrogen. This includes exploring the creation of a “hydrogen hub” in Hamilton.

TRANSFORMATION 5: Growing Green



Green space defines Hamilton; it is a lifeline for local wildlife, water quality, and resident well-being and health. Continuing to protect and expand these natural areas is an important part of achieving net zero, as trees and healthy soil are an important source of carbon sequestration. ReCharge Hamilton will focus on preserving and expanding the City’s tree canopy cover, which helps sequester carbon, while providing significant co-benefits such as moderating micro-climates, providing stormwater storage, improving air quality, and enhancing energy efficiency.

This plan proposes to plant 50,000 trees per year across the entire community, including efforts from the City, local Conservation Authorities, the general public and the private and not-for-profit sectors. The City will also ensure it’s land use planning policies and regulations preserve the City’s existing tree canopy cover wherever possible.

4.6 Plugging the Emissions Gap

The net-zero scenario modelled for ReCharge Hamilton doesn't quite achieve zero emissions. Remaining emissions come from:

- aviation, rail, and marine sources;
- some remaining natural gas use in homes and industry; and
- gasoline and diesel in the few gas-powered cars.

Much of these emissions are difficult to address and lack current policy and technological solutions. These emissions will be addressed through carbon offsets, technology developments (for aviation, rail and marine sectors), or other emerging strategies.

4.7 Equity in Action

ReCharge Hamilton sets the course for a green, equitable recovery. During the development of the City's Community Energy and Emissions Plan, the COVID-19 pandemic spread across the globe, severely impacting communities throughout Canada and the world. Hamilton was no exception. This pandemic has demonstrated the ability of individuals, communities, and leaders to quickly change and adapt their habits and behavior in a time of crisis to achieve a common goal for the greater good of society. This highlighted people's ability to adapt, change, innovate and problem solve. As we recover from COVID-19, we have the opportunity to "build back better," using this same innovative and creative spirit to address the climate crisis. At the forefront of this approach should be ensuring a just and equitable recovery for all Hamiltonians.

Decarbonization programs will be designed, first and foremost, with low-income and traditionally marginalized communities in mind. For example, home retrofit programs will prioritize residents experiencing energy poverty.³ Job training for low-carbon industries will prioritize historically under-employed communities. Business owners from historically marginalized communities contributing to the net-zero economy will be supported by the City. Investments in tree planting, as well as cycling and walking infrastructure, will be targeted at historically underserved communities. Consultation with these communities will be a core component of implementation as this plan moves forward.

A core guiding principle in the development of ReCharge Hamilton has been to ensure that equity is a foremost consideration in its implementation, in order to maximize benefits to the City's marginalized communities.

³ Households that spend more than 6% of their income on their energy needs. ("Energy Poverty in Canada: a CUSP Backgrounder" (CUSP, October 2019) at 2, online: www.energypoverty.ca/backgrounder.pdf; Alternatively, Homelesshub.ca defines energy poverty as those spending more than 10% of their income on energy (see: Homelesshub.ca, "Energy Poverty" (accessed May 2021) online: <https://www.homelesshub.ca/povertyhub/basic-needs/energy-poverty>.)

Part 1



5.0 Part I: Setting the Scene

5.1 Net Zero by 2050

On March 27th, 2019, Hamilton City Council passed a motion stating that,

“*[T]he City of Hamilton declares a climate emergency that threatens our city, region, province, nation, civilization, humanity and the natural world.*”

As part of this motion, City Council directed Staff to investigate and identify a path for the entire city to achieve net-zero carbon emissions by 2050, including a process for measuring and reporting on progress towards that goal. With support and guidance from a multi-stakeholder advisory committee and input from the broader public, ReCharge Hamilton seeks to do just that.

5.2 What is a Community Energy and Emissions Plan?

ReCharge Hamilton is a community energy and emissions plan (CEEP). A CEEP is a tool that helps municipalities understand their influence on greenhouse gas emissions (GHG), and how to plan their communities so that the goal of reducing GHGs is aligned with other community social and economic goals.⁴

Developing a CEEP enables communities to consider energy and emissions early in the land-use and infrastructure planning process, and identify opportunities to integrate local renewable energy solutions at a building or neighbourhood-scale. The impetus for developing a CEEP is summarized well in a 2015 report on local finance best practices:

Setting GHG Reduction Targets: The Science

Net zero by 2050 aligns with the goals of the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement and the Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5°C.¹ This target increases the likelihood of avoiding catastrophic global climate change.

The IPCC identifies global targets of net zero by 2045 to 2055. UN treaties recognize that rich countries, such as Canada, need to reduce their emissions more quickly. This requires a steep decline in emissions starting as soon as possible.

Moving from targets decades in the future to interim targets (e.g., for 2025, 2030, etc.) and annual emissions targets that can be meaningfully operationalized is an important next step in this City's response to the climate emergency.

¹ C40 Cities, Science-Based Climate Targets, a Guide for Cities (November 2020), online at sciencebasedtargetsnetwork.org/wp-content/uploads/2020/11/SBTs-for-cities-guide-nov-2020.pdf.

⁴ Community Emissions Reduction Planning: A Guide for Municipalities (Government of Ontario, December 2017) at 20.

“The infrastructure planning and financing decisions made today will determine the world’s climate and development outcomes for the next century. Taken together, these decisions will lead to the building of either low-emission, climate-resilient infrastructure that increases economic opportunity or more of what we have already, effectively locking the world into a carbon-intensive pathway with sprawling human settlements, hazardous pollution, and heightened vulnerability to climate change.”⁵

5.3 Building on Community Climate Action

This plan covers GHG emissions from across the community. The effort builds on momentum for energy efficiency, renewable energy production, and emission reductions action already underway across the City energy sector, industry, business, and institutions and within the City of Hamilton itself. The Plan also builds on regional action to address emissions and contribute to a sustainable future for the Bay Area. Some notable examples of action are highlighted throughout Part II of this document.

5.4 Developing the Plan

The Plan was developed using technical models that help quantify the GHG impact of certain actions that can be implemented by the City and broader community. These technical models helped inform what actions, and to what extent, would be included within the Plan to help Hamilton reach net-zero by 2050. Equally as important, however, was the significant public and stakeholder consultation that was completed throughout the development of the Plan. This consultation helped identify what actions should be prioritized, highlight what actions represented community priorities, and inform how these actions should be implemented.

Significant public engagement, with a variety of groups and in a variety of formats, has fed into this Plan. Four multi-disciplinary groups provided their input. These included:

- The City Steering Committee (CSC), a group of representatives from relevant departments across the municipal corporation;
- The Stakeholder Advisory Committee (SAC), a group of representatives invited by the City from relevant Hamilton organizations (see the Acknowledgments section for a list of participating organizations);
- Individual experts; and
- The general public.

⁵ The State of City Climate Finance (Cities Climate Finance Leadership Alliance, 2015) online: http://wedocs.unep.org/bitstream/handle/20.500.11822/7523/-The_State_of_City_Climate_Finance-2015CCFLA_State-of-City-Climate-Finance_2015.pdf?sequence=3&isAllowed=y.

The CSC and SAC participated in several workshops designed to elicit informed input into the plan. These workshops covered:

- An introduction to the project and the process;
- An overview of the base year and business-as-planned energy use and emissions;
- An overview of the net-zero scenario pathway and the associated costs and benefits; and
- An overview of the Implementation Strategy.

Through these workshops, the CSC and SAC helped shape the project's Visions and Goals and define the sectoral energy efficiency and GHG-reduction targets, as well as key short-term implementation actions. These groups also had an opportunity to provide feedback on a draft version of this Plan.

Individual experts, like those at the Natural Resources Canada's CanmetMATERIALS Lab at McMaster University and the Canadian Steel Producers Association, provided critical context on the state of knowledge and best practice relating to the low-carbon transition pathways for Hamilton's steel producers and manufacturers.

The public provided their input through a series of online surveys and a public information session. Some of the responses from these surveys are highlighted throughout this Plan.

5.5 The Pathway: A Collection of Targets

Hamilton is home to a large and growing population, a major industrial sector (most notably steel), impressive academic institutions and healthcare services, a major port, and diverse neighbourhoods—all of this, and much more, contribute to its current energy use and GHG emissions. These features are also sources of potential energy savings, renewable energy, climate innovation, and other climate solutions.

Based on a series of assumptions regarding existing plans and policies that are likely to be in place through to 2050 ('business-as-planned' or BAP scenario), overall GHG emissions for the city are projected to increase by 10% (see Figure 1). However, on a per person basis, energy use and GHG emissions will decline by 28%, as Hamilton's population is projected to increase by 53% over the period. In a BAP scenario Hamilton's 2050 GHG emissions will be far from its net-zero GHG emission target. In 2050, each Hamiltonian will represent the equivalent of 11.2 tonnes of GHGs. As a whole, the City will emit 9.6 Mt CO₂e, up from 8.7 Mt CO₂e in 2016.



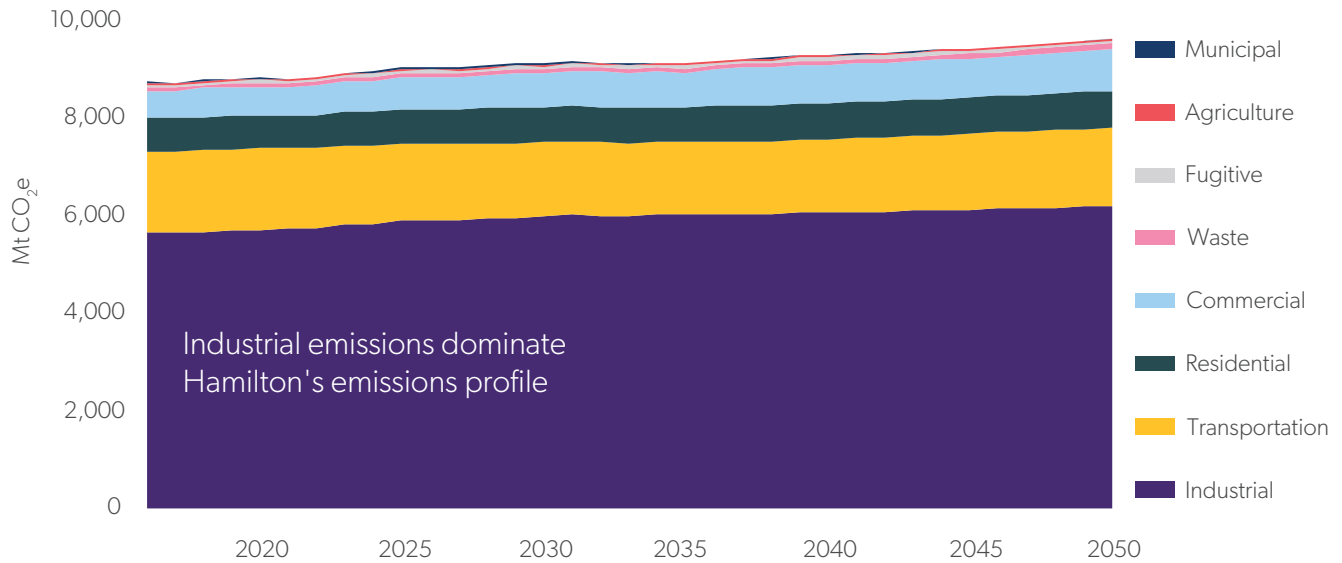


Figure 1. Projected business-as-planned GHG emissions (Mt CO₂e) for the city of Hamilton, by sector, 2016-2050.

What is unique about Hamilton’s current emissions profile is the proportion of emissions that are attributed to industry (primarily steel): 64%. Transportation is a distant second at 17% of the City’s emissions, followed by commercial buildings (9%) and then by residential buildings (8%). For a more detailed analysis on the City’s base year (2016) and business-as-planned (2050) emissions, please refer to the Base Year and Business-As-Planned 2016-2050 Energy and Emissions Report attached hereto as Appendix D.

Based on a detailed study of the community’s current and projected energy uses and emissions in a BAP scenario out to 2050, the City and stakeholders were able to develop a pathway for Hamilton to achieve net zero by 2050.

The wedges diagram in Figure 2 show the 30 low-carbon targets that were modelled to reduce the 2050 BAP emissions by 96%, bundled by sector. (A comprehensive table of modelled targets is provided in Appendix A.)

While accommodating a projected increase in the city’s population of 53% by 2050, the net-zero pathway models a reduction of per capita GHG emissions from over 11 tonnes in a BAP scenario to less than 1 tonne.



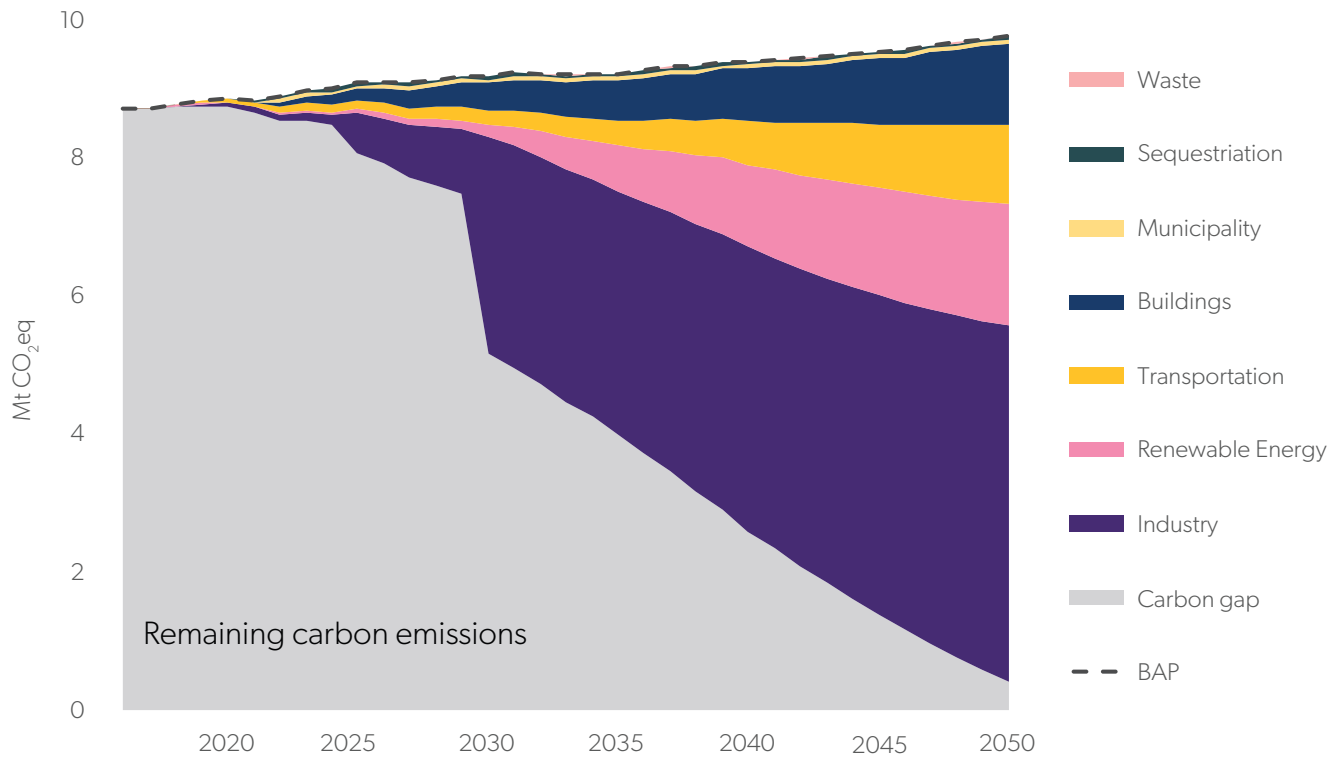


Figure 2. GHG emissions reductions (Mt CO₂e) in the net-zero scenario. Note: For visual clarity, modelled actions are grouped by sector. A complete list of modelled actions is provided in Appendix A.

In order to achieve net-zero emissions by 2050, the remaining carbon gap will need to be addressed via the purchase of offsets or in future CEEP iterations via new technological developments, regulations, or policies.

It is very important to note that the modelled pathway represents only one of many possible community-informed, evidence-based GHG-reduction pathways for the City of Hamilton. This pathway was selected based on community and stakeholder input, City advice, and consultant research on best practices. The pathway assembled and presented in this Plan is ambitious and will not be without challenges. Moreover, the pathway is dynamic and will change as new technologies, opportunities, and challenges arise over the coming decades.

- » This Plan includes 30 targets, outlined in tables at the beginning of the section on each sector. Together, they are designed to achieve maximum energy efficiency, avoid waste-related GHG emissions, switch to local renewable energy sources, and maximize natural carbon sequestration.

5.6 The Cost of Action and Inaction

The net-zero scenario offers many direct financial and economic benefits to the city, including new jobs, a positive return on investment, and reduced household and business energy costs. All low-carbon actions included in the net-zero scenario with publicly-available financial data were evaluated in a financial analysis (see Appendix B).

The net-zero scenario requires an estimated \$367 million/year of investment, excluding the cost of changes to the steel and marine sectors, and the expansion of active transportation infrastructure. This investment will have a marginally net-positive return for the community of \$1 per tonne of GHG reduced, or \$63 million dollars, over the life of the investments.⁶ These annual investments, which amount to just over a third of the City’s annual tax operating budget, will not be the sole responsibility of the City, but rather will be shared across the community and various levels of government in a manner that has yet to be determined. For example, a mass home energy retrofit program is contingent on the investment of homeowners to improve the efficiency of their homes; however, it is assumed that there will be low-interest financing and grants available from various levels of government to improve the business case and return on investment, while also reducing the burden of the large up-front capital cost on the homeowner.

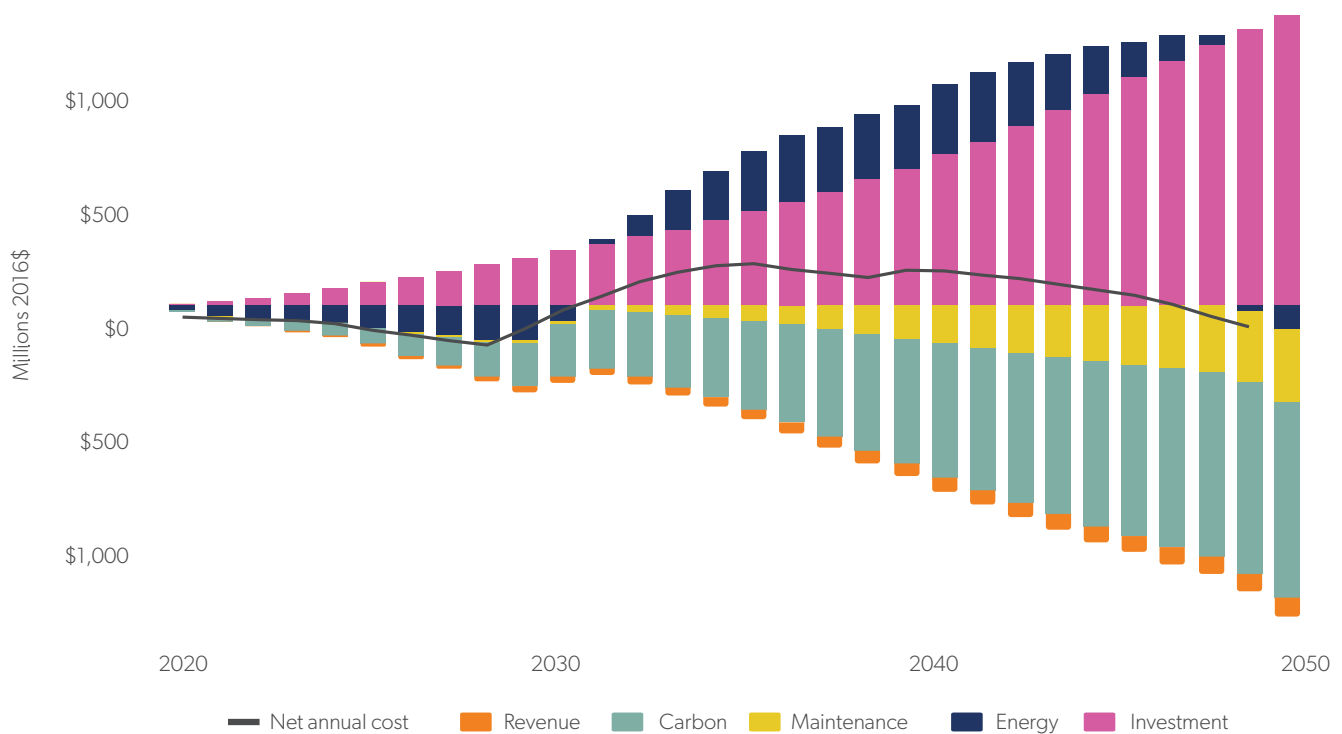


Figure 3. Capital expenditures vs. savings and revenues from the net-zero scenario, 2021-2050.

In addition, most elements of the net-zero pathway also offer co-benefits—which are benefits additional to the reduction of GHG emissions—including positive health outcomes and improvements in social wellbeing and equity.

⁶ This number does not account for a few low-carbon actions where defensible cost and savings data was not available: namely steel sector decarbonization, active transportation infrastructure expansion, marine fuel efficiency improvements, and water use reduction.

A financial and economic risk facing Hamilton is failing to engage in the global transition to a low-carbon economy. Though impossible to quantify this risk, some have made valiant attempts. For example, the global re-insurer Swiss Re estimates the global GDP will drop by 18% if no climate action is taken.⁷ A second risk is if the transition further entrenches social inequalities. Residents that are already marginalized face the brunt of extreme weather and other climate-related social impacts (e.g., food price shocks). If they are not financially supported in the transition to a net-zero economy, they face being left further behind, and becoming even more vulnerable to the impacts of climate change.

- » The tables at the beginning of each low-carbon transformation provide the cost or savings associated with reducing each tonne of GHG emissions per action (this is referred to as the marginal abatement cost), where defensible data was available.

5.7 Co-benefits: Vision and Purpose

At the outset of the project, the community Stakeholder Advisory Committee (SAC) established the following visions and principles for Hamilton’s net-zero pathway, that it:

- Supports an equitable energy transition;
- Helps improve the City’s resilience to climate change;
- Is community-led;
- Involves a public education campaign;
- Promotes the development and use of clean energy;
- Protects and supports biodiversity;
- Encourages local economic development; and
- Promotes practical climate mitigation and adaptation actions.

The following is a statement that summarizes these principles:

ReCharge Hamilton identifies a pathway to net zero GHG emissions by 2050 that increases the resilience of the energy system and improves economic prosperity for all. Drawing on a history of work, policies and initiatives in this area, ReCharge Hamilton builds on Hamilton’s historic and current strengths as an industrial leader in the midst of a rich natural environment, and as a caring community.

⁷ “World economy set to lose up to 18% GDP from climate change if no action taken, reveals Swiss Re Institute’s stress-test analysis” (Zurich, 22 Apr 2021) Swiss Re, online: www.swissre.com/media/news-releases/nr-20210422-economics-of-climate-change-risks.html.

These principles and vision helped guide the identification of actions and the design of the implementation framework to maximize co-benefits, such as enhancing equity. Opportunities for improved social equity will be realized during implementation. For example, in designing a residential retrofit program, low-income communities experiencing energy poverty would be targeted. In designing improved transit, those communities that do not have the luxury of owning a personal vehicle would be prioritized. Similarly, in designing urban tree planting projects, neighbourhoods with less access to green space and lower existing canopy cover would be targeted. Throughout the implementation of every action the equity lens will be applied in order to maximize the co-benefits of the Plan.

- » Throughout this Plan, the co-benefits section for each low-carbon transformation outlines how the sectoral targets support this vision and purpose.

5.8 Turning to Action

Time is of the essence. For this reason, key short-term actions and their potential delivery partners, funding, and financing solutions have been identified throughout this plan. These were determined based on consultations across the City Corporation, the SAC and the public.

The City will play a leadership role by committing to net-zero emissions ahead of 2050 and supporting community-wide implementation with its partners.

- » Throughout this Plan, the implementation section for each sector outlines key actions that will need to be taken in the next five years in order for the GHG reduction targets to be achieved. Each action is numbered to correspond with the appropriate action in the Implementation Strategy attached as Appendix C.





Hamilton

Part 2

6.0 Part II: The 5 Low-carbon Transformations

It's 2050, our major industrial emitters have adopted new, low-carbon technologies to power their processes, reducing the City emissions by over 50% from business-as-planned (BAP). Most homes and businesses have been retrofitted to use less energy, many have rooftop solar, and all heating is produced by clean electricity, renewable natural gas or green hydrogen. As a result, energy bills are lower and comfort is higher. More people are taking transit and active modes of transportation and almost all cars on the road are electric, which reduces noise and air pollution and cuts our City's emissions by over 10% from BAP. The City has more trees, producing cleaner air, providing shelter and food for animals, recreational space for residents, and stormwater management capabilities. Finally, the City is producing much more of its own energy, from the sun, industrial residual heat, and from food and other organic waste. This renewable energy supports the local economy and the City's energy independence and resilience.

This future is the result of implementing the 5 Low-carbon Transformations of ReCharge Hamilton:

1. Innovating our industry;
2. Transforming our buildings;
3. Changing how we move;
4. Revolutionizing renewables; and,
5. Growing Green.

Each transformation is described below, which includes the targets modelled including their impact on BAP emissions, cost per tonne of GHG reduced (a.k.a. marginal abatement cost or MAC), their major co-benefits, and the proposed implementation actions associated with each transformation. The modelled targets represent the low-carbon scenario model that, if achieved, can reduce City-wide GHG emissions by 96% by 2050. The Taking Action section within each low-carbon transformation will discuss immediate and near-term actions that can be taken to work towards our low-carbon future. A more detailed implementation framework can be found in Appendix C, including examples of key performance indicators proposed for monitoring each proposed action.

6.1 Innovating Our Industry

The industrial sector is the main energy consumer and GHG emitter in Hamilton, representing 64% of the City's emissions in the base year and out to 2050 in the BAP scenario. The majority of these emissions are from the coal used at the steel mills. Hydrogen, biochar, and electric arc technologies, all of which are low-carbon alternatives, are likely to be able to replace coal well before 2050. Recent announcements from the Federal and Provincial governments to support decarbonization of the steel sector locally with funding is a promising development for reducing and eliminating emissions from steel production.

For the remaining industry emissions, 50% energy efficiency targets were modelled based on measures identified in the Ontario 2019 Conservation Achievable Potential Study, undertaken on behalf of the province's energy regulator.

MODELLED TARGET	GHG REDUCTION NET ZERO VS. BAP 2050	MARGINAL ABATEMENT COST \$/TCO ₂ E (BRACKETS) REPRESENT SAVINGS
Increase industrial energy efficiency (other than steel mills) by 50% from 2016 levels by 2050.	8%	\$268
At the steel mills, reduce GHG emissions by 50% from 2016 levels by 2035 and achieve net-zero emissions by 2050.	45%	Not modelled ⁸

6.1.1 CO-BENEFITS

Reducing industrial GHG emissions vastly will improve local air quality and, as a result, local public health. Emissions reductions will support industry in participating in the growing global low-carbon economy, which will create the potential for Hamilton to become an industry leader and attract global clean-tech investment and avoid carbon leakage into other jurisdictions. Hamilton's industry must change to be competitive in a future economic climate where innovative climate pricing frameworks (such as the European Union's proposed Carbon Border Adjustment Mechanism) will become more prevalent and will place additional economic pressures on the low-carbon production of goods.

6.1.2 TAKING ACTION

In order to achieve the modelled reduction in industrial GHG emissions, the below short-term (0-5 year) implementation actions are recommended. For a more detailed breakdown of the industrial implementation pathway, please see Table 5 of Implementation Strategy, attached as Appendix C.

⁸ This action was not financially modelled as at the time of modelling, there was no reliable financial data nor certainty on the specific net-zero pathway that will be adopted by the steel industry.

1 & 1a → Industrial Energy Efficiency and Decarbonization Working Group

The City and its partners will convene an industrial energy efficiency and decarbonization working (or “net-zero”) group. This group will share information, support business or industry groups in setting organizational net-zero targets, track progress towards them, help connect industry with resources, and lobby higher levels of government for support.

In parallel and in conjunction with existing industrial sustainability-themed groups (e.g., Hamilton Industrial Environmental Association and City-led Bayfront Industrial Strategy efforts). This working group will focus explicitly on coordinating and fast-tracking GHG reductions in alignment with the City’s GHG targets.

2 → Establish a Clean-tech Accelerator

Building on the skills and expertise available at the City’s multiple post-secondary institutions, the City and its partners, with support from the Provincial and Federal governments, can support the development of a clean-tech accelerator to prioritize and accelerate the development of technologies necessary for the decarbonization of the steel and other local industries.

3 → Expand Local Industrial Energy Management Training Programs

The City and its local partners, including the Canadian Colleges to Resilient Recovery and other institutions and not-for-profits can work to expand local industrial energy management training programs. This will help build capacity and expertise in the labour force for the decarbonization of the City’s industrial sector.

What excites you about this plan?

“Hamilton can be a leader and an example of a rust belt city [embracing] climate action to enhance the local economy, environment and quality of life.”

“The potential to collaborate on a plan to move to a low-carbon steel industry based in Hamilton. This is crucial to Canada’s long-term competitiveness in steel production [...]”

» From responses to an online community survey for ReCharge Hamilton.

Community Momentum

- » In 2020, Canadian Steel Producers Association set a net-zero-by-2050 target.
- » In 2021, ArcelorMittal Dofasco (AMD) in Hamilton and the Federal and Provincial government announced funding for an initiative to transition AMD's Hamilton operation to electric arc furnace and direct reduced iron technologies. This could cut City-wide emissions by up to 30%.
- » Stelco is planning a 65 megawatt cogeneration plant and has developed a technology to reduce coke consumption using waste railway ties. Another Stelco project plans to capture 6,300 tonnes of CO₂ to produce algae for fish feed and bioplastics.
- » Hamilton Oshawa Port Authority has a goal of being carbon neutral for its own operations by 2025.



6.2 Transforming Our Buildings

In the base year (2016), commercial and residential buildings in Hamilton now account for almost a quarter of the city’s energy consumption and 14% of its GHG emissions, primarily due to natural gas use for space and water heating. Hamilton's older and more inefficient homes are a particular issue. The majority of Hamilton’s current building stock was built before any energy efficiency requirements existed (i.e., before 1990). Newer dwellings are built in accordance with the current Ontario Building Code which is more energy efficient. Older and typically more inefficient homes are an important target in order to reduce Hamilton’s GHG emissions from residential buildings.

Energy efficiency is the main priority in tackling GHG emissions in the building sector. Significant improvements in energy efficiency can be achieved via implementing energy performance standards and guidelines for new buildings and deep energy retrofits of existing buildings. It is anticipated that through future updates to the Ontario Building code, greater energy efficiencies will be achieved in new buildings. Building retrofit programs will be necessary to accelerate emissions reductions in this sector.

MODELLED TARGET	GHG REDUCTION NET ZERO VS. BAP 2050	MARGINAL ABATEMENT COST \$/TCO₂E (BRACKETS) REPRESENT SAVINGS
Retrofit 100% of commercial buildings, increasing energy efficiency by 50% by 2050 relative to 2016 levels.	2.7%	(\$257)
New commercial buildings are 60% lower in energy use intensity than 2016 levels by 2050.	1.4%	(\$320)
Retrofit 100% of existing homes to achieve 50% energy efficiency savings relative to 2016 by 2050.	2.8%	\$139
Post-retrofits, switch buildings to heat pumps for space and water heating by 2050.	4.3%	\$451
By 2031, new dwellings are 60% more energy efficient relative to 2016. Only 20% of new dwellings are single detached by 2050.	0.4%	(\$460)
By 2050, all new municipal buildings achieve net-zero emissions.	0.5%	(\$290)
By 2050, all municipal buildings are retrofitted to achieve 50% energy efficiency relative to 2016.	0.04%	\$53

6.2.1 CO-BENEFITS

Hamilton’s deep energy retrofit program will create an estimated 1,600 full time jobs and leverage local expertise in energy-efficient buildings. The benefit of these jobs can help redress

inequities if they are targeted at historically marginalized and under-employed communities, for example by providing subsidized training and retraining programs.

Energy efficiency can also help alleviate energy poverty, which is a persistent issue in Hamilton.⁹ According to the 2016 Census, about 15% of Hamilton residents (more than 1 in 6) live below the after-tax low-income cut off, and struggle to pay their energy bills.

Social equity can be improved by targeting low-income residents with the proposed home energy retrofit program, such as by prioritizing the delivery of retrofits to social housing and subsidizing retrofits for low-income residents in other types of housing. Energy efficiency retrofits have the potential to reduce household energy bills by over 80% by 2050 (see Figure 4), thereby resulting in more discretionary income for lower income households for basic needs (e.g. food) or other household purchases.

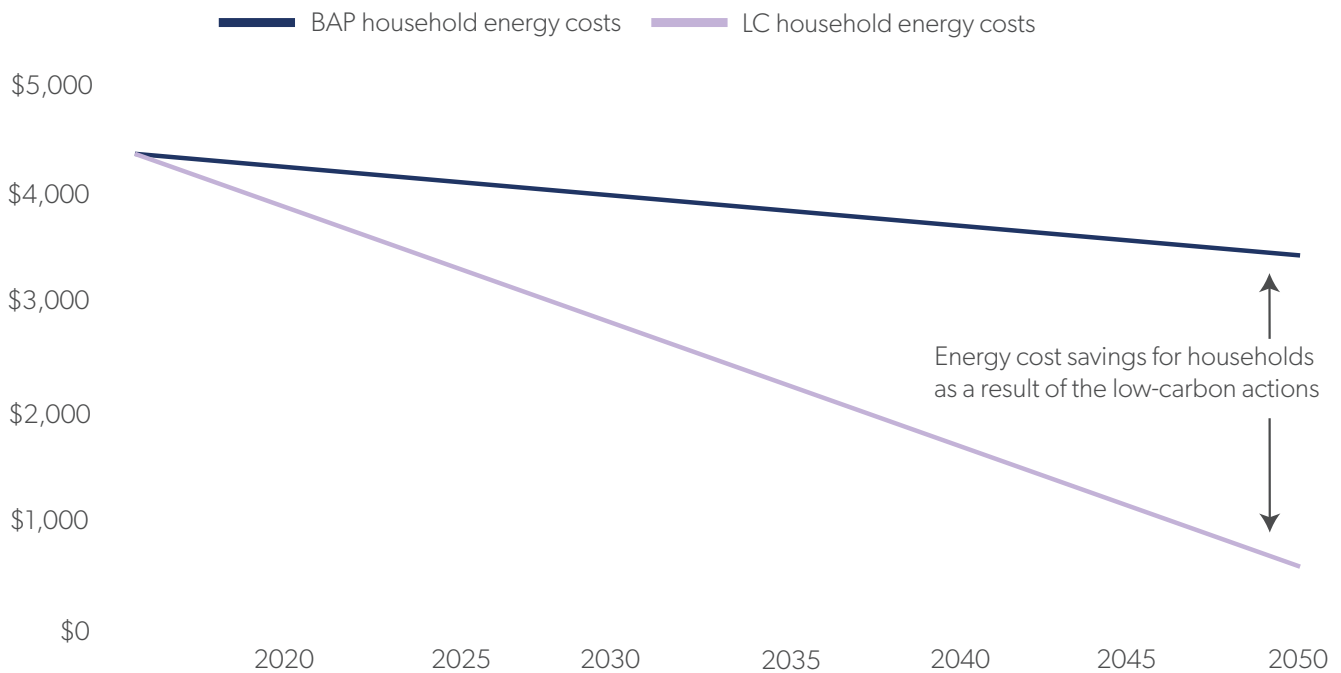


Figure 4. Average annual household energy costs (including transportation fuels) in the business-as-planned (BAP) and net-zero scenarios, 2016-2050.

6.2.2 TAKING ACTION

In order to achieve the modelled buildings GHG emissions reductions, the below short-term (0-5 year) implementation actions are recommended. For a more detailed breakdown of the buildings implementation pathway, please see Table 6 of the Implementation Strategy in Appendix C.

This plan recommends the development of a comprehensive energy retrofit program that will aim to improve energy efficiency and enable fuel switching to low-carbon sources in most of Hamilton’s homes and businesses by 2050.

⁹ Households that spend more than 6% of their income on their energy needs. (“Energy Poverty in Canada: a CUSP Backgrounder” (CUSP, October 2019) at 2, online: www.energypoverty.ca/backgrounder.pdf; Alternatively, Homelesshub.ca defines energy poverty as those spending more than 10% of their income on energy (see: Homelesshub.ca, “Energy Poverty” (accessed May 2021) online: <https://www.homelesshub.ca/povertyhub/basic-needs/energy-poverty>.)

4 → Green Standards for New Buildings/ Moving toward Net Zero Buildings

Hamilton is projected to grow by approximately 100,000 households in the 2021- 2051 time period, generally from 200,000 to 300,000 households. Although new buildings are projected to represent a relatively low share of GHG emissions in the City, new development represents long-term infrastructure that will establish patterns of energy use and GHG emissions for decades. The municipality will enact net-zero-aligned building and development standards, guidelines, or policies as soon as possible in order to avoid the need to retrofit new buildings in the future. This will involve working closely with the development community to develop and implement the guidelines. The City can also take on an advocacy role in asking the Provincial government to update the Ontario Building Code to reflect incremental changes towards net-zero construction for new buildings.

5 → Encourage Solar PV on New Buildings

In addition to the proposed Sustainable Development Guidelines, the City can review its zoning and policy framework to remove barriers for the uptake of roof-mounted solar pv systems. This includes reviewing building height and side-yard requirements for solar PV related mechanical equipment. This also includes reviewing policies and regulations related to shadowing and solar access.

6 6a, 6b, & 6c → Retrofitting Existing Buildings

Many cities are exploring how to bring down the cost of mass deep energy retrofits, such as by revisiting the current utility-led delivery model, as well as ordering equipment (e.g., heat pumps) and undertaking retrofits in bulk. Building and business owners also have a central part to play in building retrofits.

City Council approved staff to apply for available funding through the Federation of Canadian Municipalities. If successful, the City will retain the Centre for Climate Change Management (CCCM) at Mohawk College to complete a detailed design of a Home Energy Retrofit Program to accelerate home energy retrofits across the City. This will be paired with a Home Energy Retrofit Delivery Centre to drive the uptake of retrofits.

The below four key short-term steps are recommended to prepare for a mass deep Home Energy Retrofit Program:

2022: Undertake a detailed design study for a Home Energy Retrofit Program to enable accelerated retrofitting across the City.

2022-onwards: Ensure local skilled labour is being trained or retrained to prepare the local workforce for when the program design is complete and implementation begins. Hamilton's post-secondary institutions (i.e., Mohawk College, McMaster University, and Redeemer University) will be key partners in

How will you contribute to building-related GHG reductions?

“Installing solar panels on my property.”

“Undertaking an energy audit at my home or work.”

“Switching to electric appliances.”

“Reducing my water use.”

“Installing additional attic insulation.”

“Establishing a work-from-home policy at my office.”

» From responses to an online community survey for ReCharge Hamilton.

this initiative. This will enable the program to be deployed and implemented seamlessly.

2022-2023: Undertake a small scale retrofit implementation to test the business case model and address potential kinks in the concept. Target low-income households or social housing.

2024-onwards: Expand the program, with particular attention to portions of the population that would stand to benefit the most from reduced energy costs and improved comfort and air quality (among other benefits).

What excites you about this plan?

“The possibility of creating a regulatory and financial support system to transition to renewable, net-zero homes and buildings as soon as possible.”

“Buildings and houses built with self-sustaining renewable energy as the default.”

“Greater efficiency, reduced heating (and potentially reduced cooling costs)[...]”

» *From responses to an online community survey for ReCharge Hamilton.*

Community Momentum

The Bay Area Climate Change Council is advising on the design and development of a building retrofit program and “delivery centre” to help the Bay Area achieve a low-carbon future.

In 2018, local architectural firm McCallumSather was recognized by the Hamilton Burlington Society of Architects for its work on the Joyce Centre for Partnership & Innovation at Mohawk College—the first institutional building in Canada to be certified as a Zero Carbon Building.

In 2020, McMaster University published a plan to reach net-zero carbon emissions by 2050 on its main campus.



6.3 Changing How We Move

In the base year (2016), gas- and diesel-powered cars, trucks, and buses account for 19% of Hamilton’s emissions, which is second only to industrial emissions. A challenge to scaling up to electric vehicles is lifespan of existing internal combustion engine (ICE) vehicles (greater than 20 years). It will take a generation to retire these existing vehicles. This plan addresses these emissions by supporting alternatives to personal-use vehicles (PUV) through increased active transportation infrastructure (i.e., bike lanes and trails), expanded emissions-free transit, and decarbonizing personal and commercial vehicles.

MODELLED TARGET	GHG REDUCTION NET ZERO VS. BAP 2050	MARGINAL ABATEMENT COST \$/TCO₂E (BRACKETS) REPRESENT SAVINGS
100% of new PUV sales are electric by 2040.	6.6%	(\$621)
By 2050, 100% of heavy-duty vehicles are green-hydrogen based and light-duty commercial vehicles are electric.	4.0%	(\$464)
Private vehicle trips decline by 9% relative to 2016 per person by 2050. Vehicular trip length declines by 6% from 2016 levels by 2050.	0.9%	(\$424)
Increase marine energy efficiency by 50% by 2050 relative to 2016. ¹⁰	0.2%	Not modelled
100% of new municipal small and light-duty vehicles are electric by 2040.	0.04%	(\$1,521)
100% of new municipal heavy-duty vehicles switch to clean hydrogen by 2040.		
Decarbonize the transit fleet by 2035.	0.1%	\$268
By 2050, 10% of short trips are completed by e-mobility or EV car-share.	0.1%	\$1,697
Increase transit use to 15% of trips by 2050 in the urban area.	0.02%	(\$3,908)
By 2050, 50% of short trips in the urban area take place through walking or cycling.	0.00% ¹¹	Not modelled

¹⁰ This is an existing International Maritime Organization target.

¹¹ This action follows electrification of vehicles in the model, which explains why it shows no reductions of GHGs.

6.3.1 CO-BENEFITS

Research indicates that air pollution was responsible for about 90 deaths in Hamilton in 2012.¹² The exhaust emissions from cars, trucks, and buses are a leading source of poor air quality in the city.¹³ Switching from internal-combustion vehicles to zero-emissions vehicles will improve health outcomes for Hamilton residents, particularly those living, going to school, or working within 100 metres of an arterial major road or 500 metres of a controlled access highway.¹⁴ From 2013 to 2018, Hamilton recorded the highest particulate matter rating of the 10 largest cities in Ontario.¹⁵ Zero-emission vehicles will reduce tail pipe emissions components of particulate matter, leaving non-emissions components such as dust to be addressed through other means.

By increasing the number of trips that are taken using an active mode of transportation, Hamilton residents will benefit from improved cardiovascular health and equitable.

Equitable outcomes are achieved when mobility (transit, active transportation, and e-mobility) is prioritized for historically marginalized communities. Mechanic training and retraining programs to service the next generation of vehicles can also target low-income and underemployed individuals, further improving social equity outcomes.

By increasing the amount of trips that are taken using an active mode of transportation, Hamilton residents will benefit from improved cardiovascular health, as well as quieter, less stressful streets.

Equitable outcomes are achieved when mobility (transit, active transportation, and e-mobility) is prioritized for historically marginalized communities. Mechanic training and retraining programs to service the next generation of vehicles can also target low-income and underemployed individuals, further improving social equity outcomes.

6.3.2 TAKING ACTION

In order to achieve the modelled GHG emissions reductions, the below short-term (0-5 year) implementation actions related to transportation are recommended. For a more detailed breakdown of the transportation implementation pathway, please see Table 7 of the Implementation Strategy in Appendix C.

¹² 2018 Hamilton's Air Quality Trends Appendix "B" to Report BOH19039, at 14 of 15, online: pub-hamilton.escribemeetings.com/filestream.ashx?DocumentId=210129.

¹³ Anthony Ciccone and Janya Kelly, "Hamilton Airshed Modelling System: Sub-Regional Analysis" (Golder Associates, March 30, 2021) at slide 23.

¹⁴ Public Health Ontario, Traffic-Related Air Pollution: Avoiding the TRAP zone (n.d.) online: www.publichealthontario.ca/-/media/documents/O/2016/ohp-trap.pdf?la=en.

¹⁵ City of Hamilton, Epidemiology and Evaluation Healthy and Safe Communities, Health Check: Assessing the local burden of disease in the City of Hamilton, 2nd edition (July 2018) at 27, online: www.hamilton.ca/sites/default/files/media/browser/2018-08-02/health-check-report-2018-edition2-v2.pdf.

How do you see yourself contributing to transportation GHG reductions?

“Taking transit/walking/cycling to work.”

“Switching to an electric vehicle.”

“Setting up an EV charging station at work.”

“Carpooling for my commute.”

“Limiting my driving.”

“Not idling.”

» From responses to an online community survey for ReCharge Hamilton.

The following are near-term transportation actions that are designed to first reduce vehicle kilometres traveled and then switch remaining vehicle kilometres travelled (VKTs) to low and/or zero emission vehicles.

7 → Expand Active Transportation Networks

Increasing active transportation is a priority for reducing transportation emissions; it offers many co-benefits, including improved physical health and increased social well-being. The City can expedite the roll out of its Cycling Master Plan and update future iterations of the Cycling Master Plan to align with the net-zero scenario active mode share targets.

8 → Decarbonize Transit

The City has recently committed to transitioning its buses to CNG, while also piloting an RNG powered bus; however, as the following section on renewable energy highlights, there is a limited supply of sustainable RNG.

Electrification is a preferred option, as the technology is available and emission-free buses don't emit pollutants that contribute to poor air quality.

9 → Expand Transit and E-mobility Services

Expanding transit helps reduce the need for personal-use vehicles and also offers an important means of transportation for those who are not able to drive or access personal vehicles. The City should also focus on developing higher-order transit in order to attract new transit riders.

To address those trips that are not suited to transit or active transport, the City can support the establishment of local e-mobility services, such as e-car, e-bike, and e-scooter share businesses.

10 → Establish a City-wide EV Strategy

To encourage the adoption and increase uptake of EVs, an extensive EV charging network needs to be in place. The City can continue to situate charging stations on City-owned lands through the implementation of the Parking Master Plan, as well as partner with businesses and multi-unit residential buildings to install charging stations in appropriate locations. The City can also require EV infrastructure through the development process for new development within the City. These efforts, among others, can be consolidated and integrated through the development and implementation of a City-wide Electric Vehicle Strategy.

11 → Commercial Fleet Decarbonization Working Group

The City can accelerate the transition of private fleets by convening a working group to coordinate activities and share insights from implementing the City's net-zero-aligned Green Fleet Strategy, support

What excites you about this plan?

“That we might begin to eliminate cars as a primary mode of transportation and actually become a progressive, green city.”

“Less cars on roads.”

“Cleaner air and more/safer bike lanes.”

“The thought of breathing clean air, not polluted with carcinogenic matter.”

» From responses to an online community survey for ReCharge Hamilton.

fleet net-zero targets, track progress towards them, and help connect businesses with resources.

12 → Support the Transition of Automotive Mechanics

The projected increase in EVs will require a new and/or retooled labour force. The City, local colleges (e.g., Mohawk College), and professional trade associations will work together to develop a plan to train and retrain the mechanic workforce using an equity lens to shift from ICE vehicles to EVs although both share common mechanical elements..

13 → Limit Parking and Incentivize EVs

The City can continue its efforts to reduce and manage parking requirements for developments in strategic locations, such as along transit corridors and throughout the Downtown. Where parking spots are required, the City can incentivize EV access through differentiated fee structures and exploring options through legislation for enforcement. The City can also incorporate EV parking requirements into the Zoning by-law for certain types of development.

Regional Collaboration

In 2017, the Mayors of Burlington and Hamilton vowed to work together on a regional approach to climate action. Both Cities came together with Mohawk College to open the Bay Area Climate Change Office and established the Bay Area Climate Change Council (BACCC). In 2019, the BACCC commissioned the first regional greenhouse gas (GHG) inventory. The Hamilton and Burlington Low-Carbon Scenario and Technical Report 2016 – 2050 provides information on the leading sources of emissions in the Bay Area to identify actions with the highest potential for reducing these regional emissions. The report identifies five potential program areas where regional collaborations on emissions reductions and energy planning could occur: building retrofits, renewable energy generation, electric vehicle strategies, low carbon new buildings, and education and outreach.

Community Momentum

In 2021, McMaster University, with support from its industry partners, announced the establishment of a green automotive, aerospace, and advanced manufacturing hub, called iHub.

The Canada Excellence Research Chair in Hybrid Powertrain Program at McMaster is pioneering sustainable energy-efficient solutions from advanced power electronic converters and electric motor drives to electric, hybrid electric, and plug-in hybrid electric vehicles, and working to alleviate the loss of performance of lithium ion batteries over time.

In May 2021, the City Council approved its Green Fleet Strategy which includes converting 89 fossil fueled cars to electric vehicles reducing GHG emissions by 18% in 3 years (not including police, fire and transit vehicles). The Strategy also includes a long-range target of achieving net zero across the municipal fleet by 2050.

In March 2021, the City partnered with Enbridge to fuel Ontario's first carbon-negative transit bus as part of the HSR's fleet.

6.4 Revolutionizing Renewables

As a final step to achieving net zero by 2050, remaining fossil fuel energy use needs to be replaced with renewable energy. Due to the expected increased reliance on fossil fuels by the provincial electricity grid, the switch to renewable energy will require directly generating renewable energy or purchasing renewable energy from outside of City boundaries to offset remaining emissions.

The City has strategic opportunities to increase production of renewable energy via wind turbines, rooftop and ground mount solar energy, renewable natural gas (RNG) from local organic waste, and capturing residual heat from the industrial sector. The low-carbon scenario modelled for the city of Hamilton included a combination of these sources that amounted to 7% of the City’s energy needs by 2050.¹⁶ There is potential to produce much more, for example via large-scale wind and solar installations inside or outside of the city limits, as well as RNG produced from the city’s commercial and agricultural organic waste. Ample renewable energy will be crucial in order to produce the green hydrogen that is vital in the pathway to decarbonizing Hamilton’s industrial sector, including steel production.

The City is home to extensive district energy systems, local energy generation that powers multiple buildings at a time. This is an important local resource that can be leveraged to expand local renewable energy generation.

If the Provincial grid decarbonizes by 2050, then the purchase of renewable energy certificates outlined in the table below will not be required.

MODELLED TARGET	GHG REDUCTION NET ZERO VS. BAP 2050	MARGINAL ABATEMENT COST \$/TCO ₂ E (BRACKETS) REPRESENT SAVINGS
In 2050, for each MWh of central electricity demand remaining after local renewable energy production, purchase a Renewable Energy Certificate (REC). ¹⁷ (This action includes the modelled wind capacity)	6.1%	\$51
In order to replace the remaining natural gas in the City, green hydrogen (produced via renewable energy) is pumped into the natural gas distribution system.	5.0%	\$816

¹⁶ As a result of approximately 830 GWh of wind, 560 GWh of rooftop solar, 400 GWh ground mount solar, 5 GWh of RNG, and 130 GWh of industrial residual heat.

¹⁷ Renewable Energy Certificates (RECs) are a market-based instrument that certifies the bearer owns one megawatt-hour (MWh) of electricity generated from a renewable energy resource. Once the power provider has fed the energy into the grid, the REC received can then be sold on the open market as an energy commodity. RECs earned may be sold, for example, to other entities that are polluting as a carbon credit to offset their emissions.

MODELLED TARGET	GHG REDUCTION NET ZERO VS. BAP 2050	MARGINAL ABATEMENT COST \$/TCO ₂ E (BRACKETS) REPRESENT SAVINGS
By 2050, Installation of 280 MW of ground mount solar PV, inside or outside the City boundary.	0.3%	(\$1,254)
Expansion of the downtown district energy network powered by industrial residual heat.	0.1% ¹⁸	\$192 ¹⁹
By 2050, Installation of rooftop solar PV capacity to power, on average, 50% of building electric load, before the introduction of heat pumps.	0.2%	(\$959)
Starting in 2031, all new homes have 30% annual load coverage by solar PV, before the introduction of heat pumps.	0.2%	(\$1,343)
Starting in 2026, all new commercial buildings include rooftop solar PV panels.	0.2%	(\$654)
By 2050, 50% of municipal buildings will add rooftop solar PV, covering 30% of the building's electrical load.	0.01%	(\$494)
By 2050, 95% of organic waste is sent to anaerobic digestion for local energy use.	5.8%	\$74
Purchase remaining RNG needed to replace all remaining natural gas demand by 2050, starting in 2025.		

6.4.1 CO-BENEFITS

Local energy generation helps ensure local energy resilience and keeps energy dollars and jobs within the community. For Hamilton, increasing local renewable energy generation will also decrease energy waste. For example, the residual heat from industrial smoke stacks could be captured to heat buildings, instead of using natural gas, and organic waste decomposing in the landfill could be captured, processed, and then used instead of natural gas to power waste disposal trucks or the City's transit vehicles.

Switching away from fossil fuel-based sources of energy and towards renewable sources of energy will also contribute to a reduction in airborne particulate, and ultimately better air quality.

6.4.2 TAKING ACTION

Renewable electricity and renewable natural gas are essential to the City achieving its target of net zero by 2050. In terms of electricity, either the provincial electricity grid will have to

¹⁸ Further work by Hamilton Community Enterprises and its partners on their industrial residual heat harvesting project has identified a potential to reduce GHG emissions by 200,000 tCO₂e which translates to ±2.3% in the above table

¹⁹ This expanded opportunity would further reduce the marginal abatement costs to \$12/tCO₂e

decarbonize by 2050 or the City will need to increase local sources of renewable electricity. The remaining natural gas supply will need to be replaced with renewable natural gas or green hydrogen (produced by renewable electricity). For a more detailed breakdown of the revolutionize renewables implementation pathway, please see Table 8 of the Implementation Strategy in Appendix C.

14 → Advocate for and Build an Electricity Grid for the Future

To achieve greater resilience and flexibility in the electricity grid, the City will coordinate with Alectra, Hydro One, the IESO, and the Province to streamline connections for solar PV, electric vehicles, and energy storage. Strategies can include targeted investments in the grid, streamlined application/permitting, and low-interest financing.

Furthermore, building on its November 2020 resolution calling on the Province to phase-out the use of natural gas in its electricity grid by 2030, the City can partner with other municipalities to highlight the imperative for a zero-emissions Provincial grid.

15 → Encourage Local, Alternative Renewable Energy Ownership Structures

To maximize local economic benefits, the City can support alternative renewable electricity ownership structures, such as co-operatives that maximize community benefits. A regional approach to energy planning can also be taken through municipal collaborations on energy generation in the Bay Area.

16 → Ensure Land Planning Policies Support Solar Array Installations

The City can establish land planning by-laws and policies that support the development of solar arrays in a manner that maximizes the beneficial uses of lands while protecting lands that have other values, for example, on appropriate rural lands or above parking lots, commercial and industrial buildings. These regulatory and policy changes should have the effect of making it easier to establish local solar energy generation. The City, in coordination with Alectra, Hydro One, and the IESO can identify strategic lands for the development of solar energy installations.

17 & 20 → Organic Diversion and AD Systems

In order to reach net zero, as much organic waste as possible should be diverted from the landfill and used as feedstock for anaerobic digester (AD) systems. Ideally, the City needs a centralized system for multiple local organic waste streams to achieve economies of scale.

What excites you about this plan?

“The idea of decentralized energy networks.”

“[[Improving organics recovery is very exciting to both reduce emissions and move towards the circular economy.”

» From responses to an online community survey for ReCharge Hamilton.

AD systems produce biogas that can be used onsite or refined into renewable natural gas and used locally (e.g., in buses, dump trucks, district energy systems) or injected into the natural gas system as a source of City revenue. The City should complete a technical review and analysis of increasing organics diversion to anaerobic digesters for energy production.

18 → Technical Analysis of Green Hydrogen

Green hydrogen is key in the pathway to decarbonizing the City's industrial sector, including primary steel production. Green hydrogen also has enormous potential when it comes to other applications such as transportation, energy generation and storage, and building heating.

Building on the Hydrogen Strategy for Canada released in December of 2020, Hamilton needs to explore the creation of a hydrogen hub. This may include a technical analysis of the potential opportunities and challenges for green hydrogen in Hamilton, along with potential costs of green hydrogen and actions to increase green hydrogen deployment throughout the City.

19 → Decarbonize and Expand District Energy

With its partners, the City can work towards decarbonizing and expanding the downtown district energy system, drawing on RNG and industrial residual heat. Over time, this project would represent at least a thirty-two fold increase of building space served by net-zero carbon district energy, as well as many co-benefits including local revenue, jobs and energy cost-savings. This project would represent a powerful way to leverage the planned urban intensification of the downtown.

The Hamilton Chamber of Commerce along with several local partner organizations, recently released its report on the industrial waste heat recovery project in Hamilton. This report began the assessment of the feasibility of industrial waste heat in Hamilton and identified 11 project recommendations for advancing waste heat and smart energy systems in Hamilton¹⁹. Based on this work, HCE has initiated an Energy Harvesting Project to use industrial residual heat as a low-carbon energy source for district energy. The City of Hamilton should work closely with the Hamilton Chamber of Commerce and HCE & its partners to implement the recommendations of this report.

Please refer to the Large-Scale Renewable Energy Planning Practices Memo for more details on renewable energy technologies, policies, and best practices attached as Appendix F.

Community Momentum

- » Hamilton Community Enterprises (HCE) is working with the Hamilton Chamber of Commerce and other partners to harness industrial residual heat – an ample local source of low cost, emissions-free energy to modernize and expand its downtown district energy systems.
- » Since 2010, HCE and McMaster Innovation Park have been developing and implementing an innovative low-carbon district energy system at their research and innovation campus.
- » McMaster's Mechanical Engineering Department has been undertaking research on Integrated Community Energy and Harvesting (ICE-Harvest) systems, that embed integrated thermal and electrical generation, as well as storage, within communities, so they can be powered, heated and cooled in a way that's cost effective and carbon-reduced.

6.5 Growing Green

Growing ‘green’ requires the protection and expansion of the City’s green infrastructure (natural areas and urban forest) to maintain and increase carbon sequestration. Growing green also requires a focus on land use planning patterns and policies to ensure that future growth patterns support and enable related low carbon actions and behaviours such as promoting transit and active transportation, and achieving low carbon development.

In December 2021, Hamilton City Council adopted a ‘no urban boundary expansion’ pattern for future growth to 2051. While the final approval of Council’s decision has yet to be received from the Provincial government, the City is already on its way to strengthening its land use planning policy framework to support the significant increase in intensification development required to accommodate projected growth. Continuous review and revision of the City’s Urban Hamilton Official Plan and Rural Hamilton Official Plan to ensure the city is ‘growing green’ will need to occur to support the pathway to a net zero City.

6.5.1 TREE PLANTING

The Niagara Escarpment and its associated features that run through the City defines Hamilton; it is a lifeline for local wildlife, water quality, and resident well-being and health. Continuing to protect and expand these green spaces is an important part of achieving net-zero emissions, as trees and healthy soil are an important source of carbon sequestration.

MODELLED TARGET	GHG REDUCTION NET ZERO VS. BAP 2050	MARGINAL ABATEMENT COST \$/TCO ₂ E (BRACKETS) REPRESENT SAVINGS
Planting 50,000 trees a year through to 2050	0.75%	(\$2)

6.5.2 CO-BENEFITS

Land-use patterns can enable people to adopt low-carbon behaviours such as walking or cycling. Many of the factors that facilitate active transportation and reduce GHG emissions also contribute to positive equity outcomes. These changes tend to reduce household transportation costs and utility bills, which can increase affordability.

Increased sequestration from tree planting results in a relatively small reduction in GHG emissions; however, trees offer co-benefits including reduced air pollution, improved well-being, regulated temperature, shade, reduced stormwater runoff, and more.

6.5.3 TAKING ACTION

In order to achieve the modelled GHG emissions reductions, the below short-term (0-5 year) implementation actions related to land use are recommended. For a more detailed breakdown of the growing green implementation pathway, please see Table 9 of the Implementation Strategy in Appendix C.

21 → Review and Update Official Plan(s)

The City has committed to applying a climate change lens to population and employment intensification targets, which will align GHG targets with future land-use policies. The City is already reviewing its Official Plans to ensure supportive climate change and energy policies, which includes policies that support the acceleration of the development of low carbon buildings and communities, the reusing and retrofitting of existing buildings and the circular economy, enhancing the City's natural environment as a carbon sink, building community resilience, and accelerating the adoption of low-carbon transportation options.

22 → Community Energy/Climate Action Policy Into Secondary Plans

The City can require the integration of community energy/climate action policy directions into secondary plans. New greenfield areas that might be added to the City's boundary in future or redeveloped areas, should require their own community energy system planning process. Relevant considerations, such as design for passive heating and cooling, shadow studies for solar PV, embodied carbon in materials, dwelling size, connectivity of roads, proximity to and mix of destinations, consideration of district or community energy systems, and others, can be addressed at the level of the secondary plan.

23 → Carbon Sequestration and Tree Planting

The City can create an ambitious tree planting program that builds on existing City efforts, including the draft Urban Forest Strategy, as well the efforts of the local Conservation Authorities' and other institutional and not-for-profit organizations. The goal of the program will be to plant a total of 50,000 trees annually throughout the City.

Improved agricultural soil management practices is another opportunity for carbon sequestration that can be examined in future CEEP updates.

Best Climate Practices For Greenfield Development

In order to minimize environmental impacts, it is best to avoid greenfield development where possible and maximize urban intensification. At the same time, intensification can increase well-being and social equity if it is undertaken in a way that maximizes resident access to green space, improves air quality, lowers noise levels, and ensures widespread access to municipal and community services.

Intensification will help improve the City's energy-use profile by reducing reliance on personal-use vehicles and lowering building square footage per person. Improved energy efficiency is critical to enabling the net-zero target, as it reduces overall costs to the energy system. Furthermore, increased intensification can help reduce embodied carbon emissions, as well as the loss of ecosystem services associated with greenfield development.



How do you see yourself contributing to natural carbon sequestration?

“ Supporting the planting of native trees.”

“ Carbon sequestration by rebuilding a deep, rich humus layer on degraded suburban soil.”

“ Moving away from wood heating to cleaner methods.”

“ Supporting the establishment of treed pedestrian malls.”

“ Selecting trees and vegetation that are appropriate for our area and goals and gardening to provide some of our own food to reduce the need to transport.”

» From responses to an online community survey for ReCharge Hamilton.

What excites you about this plan?

“ I really like the idea about greening the urban core with tree planting/rewilding.”

» From responses to an online community survey for ReCharge Hamilton.

Community Momentum

» The Just Recovery Hamilton Coalition was created, which is a coalition of Hamilton community member organizations with a focus on policy development to address a more equitable COVID-19 recovery.

» The Centre for Climate Change Management at Mohawk College is a regional hub for collaboration on climate action. As an applied research arm of the College, the Centre is a model for how colleges can support their region’s transition to a low-carbon economy by partnering with municipal, industry, and community partners to catalyze climate change interventions.

» As a result of the City’s Corporate Energy Policy, the City has reduced its GHG emissions at City-owned facilities by 42% (as of 2018) when compared to the base year (2005).

Part 3



7.0 Part III: Towards Implementation

7.1 Monitoring, Oversight, and Adaptive Management

In order for Hamilton to get on track to meet its net-zero carbon emissions target by 2050 and respond to its climate emergency declaration, the City must implement this plan as soon as possible.

Effective implementation will require oversight and coordination. This effort will be led by the City and a properly resourced and skilled non-governmental organization working hand-in-hand with the City. Key components of the coordinating framework would be:

ANNUALLY REPORTING GHGs: the primary data to track progress towards the net-zero target. It should include community-wide and sector-specific energy and emissions reporting on established key performance indicators.

COORDINATING ADAPTIVE MANAGEMENT: regular reviews (for example, every 5 years) of ReCharge Hamilton programs based on predetermined metrics, as well as trends in overall energy use and GHG emissions, updates in policy best practice, and technological innovation.

MAINTAINING TRANSPARENCY: by ensuring that all reporting and reviews are made easily accessible to the public.

COMMUNITY ENGAGEMENT AND OVERSIGHT: via a formal body representing a cross-section of the community.

This plan recommends a three-pronged implementation framework that consists of:

1. CITY OF HAMILTON CENTRALIZED CLIMATE OFFICE

A centralized entity within the City Corporation should act as a hub for coordinating the implementation of the City-led CEEP actions across the municipal corporation, as well as reporting on corporate and community-wide progress on the implementation of CEEP actions of GHG reductions. The proposed Climate Office would also be the stewards of the proposed Climate Impact Adaptation Plan, currently under development, and would be responsible for leading updates to the City's climate change related documents such as the Community Energy and Emissions Plan and the Community Impact Adaptation Plan. The Climate Office will also partner with the Community Climate Advisory Committee to design and undertake community engagement throughout the implementation of the plan.

2. COMMUNITY CLIMATE ADVISORY COMMITTEE

The Community Climate Advisory Committee is an independent external committee of community stakeholders that operates as an independent body to review the City's corporate and community wide targets, actions, and progress on same. The Community Climate Advisory Committee will also serve as a liaison between the broader community and the proposed City Climate Office and coordinate the implementation of community-led actions, data collection, education and awareness, and reporting.

3. MULTI-DEPARTMENTAL CLIMATE CHANGE WORKING GROUP

This plan also proposes the creation of a City Multi-departmental Climate Change Working Group, with Staff resources available from each City department. The Multi-departmental Climate Change Working Group will play an important role in monitoring and reporting on targets for City-led actions. These departmental representatives will serve as a liaison to the centralized Climate Office and will be part of a Multi-Departmental Climate Change Working Group to report on actions, progress and monitor implementation and targets associated with their respective departments.

7.2 Municipal Role

Although the Municipal Corporation's GHG emissions account for less than 1% of the total City emissions, it plays a leadership role in the community. From its fleet to its buildings, the municipality can and should be a leader in reaching net zero.

In the short-term, to ensure public tax dollars are not working at cross-purposes to this Plan, the City will implement a climate lens on all budget decisions and investigate the establishment of an annual carbon budget—an emerging best practice—to ensure Council decisions align with GHG targets. The City will also develop a procurement strategy that accounts for embodied carbon emissions

In addition, the municipality will also support broader community implementation in partnership with the proposed Community Climate Advisory Committee, as outlined in the implementation sections within each key low-carbon transformation, above.

When it comes to its fleet and buildings, the City is already on a net-zero trajectory based on its most recent Green Fleet Strategy. The City has also recently updated its Corporate Energy and Sustainability Policy (formerly Corporate Energy Policy) to ensure its buildings are on the same path. Implementation and compliance with these corporate policies will be important.

Finally, the City can mobilize financial resources using tools, such as the issuance of green bonds, an expanded revolving fund that is administered by the City's Office of Energy Initiatives, and allocating a sustainable source of funding to the City's existing Climate Change Reserve fund in support of this plan.

Setting a Carbon Budget

Point-in-time carbon emissions reduction targets, like this CEEP's target of net-zero emissions by 2050, are only aligned with the Paris Agreement target of limiting global warming to well below 2.0°C and preferably 1.5°C, if they also limit cumulative emissions. Remaining within the threshold for global cumulative emissions, or rather the global carbon budget, is what will significantly reduce the risk of catastrophic climate change.¹

City-level carbon budgets are an emerging best practice that involve setting annual caps on how much communities can emit leading up to their target year(s).² Staying within the world's carbon budget generally requires a steep decline in emissions starting as soon as possible.

In setting its carbon budget, the City needs to determine its fair share of the global carbon budget. This question requires the City to consider its current per capita wealth and emissions as compared to those of other local and global jurisdictions. For example, C40 recommends that cities set their interim targets based on an average per capita emissions target.³ Per this method, Hamilton would have to limit emissions to 3.2 tCO₂e per capita by 2030, assuming a goal of keeping global warming below 2°C; to remain below 1.5°C, the budget would be even lower.

¹ Ibid.

² IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

³ C40, Deadline 2020, How Cities Will get the Job Done (n.d.) at 102, online at: resourcecentre.c40.org/resources/deadline-2020#:~:text=Deadline%202020%20identifies%20C40%20cities,tCO2e%20per%20capita%20by%202030.

7.3 Community Role

7.3.1 ENGAGING THE COMMUNITY

Going forward, there will be many ways for individuals and businesses to participate in Hamilton's path to net zero, from participating in policy and program development, to partnering in program implementation, to participating in community programs. This is why developing and delivering a public education and engagement campaign is one of the main features of the CEEP's near-term Implementation Strategy (Appendix C). As specific community based programs are developed and implemented, opportunities for further public involvement will be highlighted. This may include home energy retrofit opportunities, tree planting initiatives and participating in renewable energy project cooperatives, among many others.

How do you see yourself contributing to GHG reductions?

"I would like to join a committee or board to support this plan."

"Calling for collaboration on low-carbon steel production."

"Calling for closing compact business districts to vehicle traffic."

» From responses to an online community survey for ReCharge Hamilton.

What excites you about this plan?

"It is a bold vision for reductions, and has concrete ideas to achieve them."

"That it exists!"

"That we are finally beginning to see small steps after years of lip service to the global climate emergency. I will only really be excited when I see real progress and measurable [progress]."

"I think climate change is the most important issue we face and it's very good to see the City taking action on it."

"It will have very tangible effects on life in the city, not just reducing emissions but also making the city healthier, safer, and more human-friendly."

"It seems to be very comprehensive and full of great ideas that hopefully will be implemented."

"The opportunity to tackle our problems together for a better future, and for me to have a channel to provide input."

» From responses to an online community survey for ReCharge Hamilton.

8.0 Acronyms

AD	Anaerobic digester
BAP	Business-as-planned scenario
CEEP	Community Energy and Emissions Plan
GHG	Greenhouse Gas
EV	Electric vehicle
IPCC	Intergovernmental Panel on Climate Change
PUV	Personal-use vehicle
PV	Solar photovoltaic
RE	Renewable energy
RNG	Renewable natural gas
UNFCCC	United Nations Framework Convention on Climate Change
VKT	Vehicle kilometres travelled

9.0 Glossary

Base year: The starting year for energy or emissions projections.

Biogas: Methane captured from bacterial decomposition of sewage, manure, waste, plant crops, or other organic waste products. If refined, it can be used as a natural gas replacement.

Business-as-planned (BAP): A scenario illustrating expected energy use and greenhouse gas emissions if no additional plans, policies, programs, and projects are implemented between the present and 2050.

Carbon dioxide equivalent (CO₂e): A measure for describing the global warming potential of a greenhouse gas using the equivalent amount or concentration of carbon dioxide (CO₂) as a reference. CO₂e is commonly expressed as million metric tonnes of carbon dioxide equivalent (MtCO₂e).

Co-benefits: Benefits that are additional to the primary objective of the CEEP (i.e., to energy efficiency and emissions reductions).

Deep energy retrofit: A whole-building analysis and construction process minimizing building energy use by 50% or more compared to base year energy use.

District energy system: A centralized system that heats and/or cools multiple buildings.

Emissions: In this report, the term "emissions" refers exclusively to greenhouse gas emissions, measured in metric tonnes (CO₂e), unless otherwise indicated.

Emissions intensity: The ratio of emissions released per unit of electricity generated, measured in gCO₂e/kWh.

Energy efficiency improvement: An improvement in the ratio of energy consumed to the output produced or service performed. This improvement results in the delivery of more services for the same energy inputs or the same level of services from less energy input.

Electric vehicles (EVs): An umbrella term describing a variety of vehicle types that use electricity as their primary fuel source for propulsion or as a means to improve the efficiency of a conventional internal combustion engine.

Green bonds: Bonds whose proceeds are issued to climate-related projects, such as public transit expansions or low carbon infrastructure

Green revolving funds: Pools of money used to finance emissions reductions projects, whereby resulting savings are paid back and re-loaned for other emissions reductions projects

Greenhouse gases (GHG): Gases that trap heat in the atmosphere by absorbing and emitting solar radiation, causing a greenhouse effect that unnaturally warms the atmosphere. The main GHGs are water vapour, carbon dioxide, methane, nitrous oxide, and ozone.

Heat pump: A device that transfers heat energy from a source of heat to a target area using mechanical energy.

Low-carbon action: An action or policy to reduce emissions.

Marginal abatement cost (MAC): The cost of an action or policy compared to its potential GHG reduction, measured in tonnes CO₂e per dollar spent/saved. A negative MAC indicates an

action results in a positive net return (i.e., savings or revenue).

Renewable energy: Energy that comes from resources that are naturally replenished on a human timescale, such as sunlight, wind, moving water, and geothermal heat.

Solar photovoltaic (PV): Also known as solar electric systems or solar panels, these are systems that convert sunlight into electricity. Any excess electricity produced that a building does not use can be sold to the utility through a process called net-metering.

Vehicle kilometres travelled (VKT): Distance travelled by vehicles within a defined region over a specified time period.

GHG emissions

- 1 ktCO₂e = 1,000 tCO₂e
- 1 tCO₂e = 1,000 kgCO₂e
- 1 kgCO₂e = 1,000 gCO₂e

Energy

- 1 MWh = 1,000 kWh
- 1 MWh = 3.6 GJ
- 1 GJ = 278 kWh
- 1 GJ = 1,000,000 J
- 1 MJ = 0.001 GJ
- 1 TJ = 1,000 GJ
- 1 PJ = 1,000,000 GJ

ReCharge Hamilton

A Prosperous, Equitable, Post-Carbon City

CEEP Appendices



Hamilton

SSC

Contents

APPENDIX A: Table of Business-as-Planned and Low-Carbon Actions.....	3
APPENDIX B: Economic and Financial Analysis	18
APPENDIX C: Implementation Strategy	34
APPENDIX D: Base Year and Business-As-Planned 2016-2050 Energy and Emissions Report	63
APPENDIX E: Net-Zero Modelling Results	127
APPENDIX F: Large-Scale Renewable Energy Planning Practices	155
APPENDIX G: Memo - Impact of GRIDS 2 Scenarios on GHG Emissions and Addendum.....	169

Disclaimer

Greenhouse gas emissions modelling for the Baseline, Business-as-planned and Low-carbon Scenarios was completed between the fall of 2020 and the summer of 2021 and does not reflect low-carbon initiatives within the community that have been announced since the modelling was completed.

APPENDIX A: Table of Business-as-Planned and Low-Carbon Actions

June 2021

Purpose

This document provides a table of low-carbon actions designed to address all sources of greenhouse gas emissions identified in the base year and business-as-planned (BAP) report prepared by the Consultant. The table also provides a summary of some of the key criteria that informed each action.

These low-carbon actions form the basis of the energy and emissions modelling undertaken for Hamilton's Community Energy and Emissions Plan (CEEP) to achieve net-zero carbon emissions by 2050.

The process for designing low-carbon actions

The primary criteria for designing the following table of low-carbon actions is that they enable Hamilton to achieve its target of net-zero carbon emissions by 2050 and reflect an adequate response to the City’s climate emergency declaration. These actions are based on the consultants’ research of best practices and experience modelling net-zero energy and emissions pathways for dozens of other communities, and less ambitious pathways for dozens more. These actions were further refined by the Stakeholder Advisory Committee’s (SAC) feedback and community input.

SAC feedback was gathered during a June 2020 BAP webinar and workshop as well as through dozens of individual stakeholder meetings undertaken from June through to October 2020.

Community input was received via two online surveys, one discussing what actions residents thought should be prioritized (124 unique respondents as of October 20, 2020) and the other highlighting the criteria they felt should be prioritized in designing the net-zero pathway (67 unique respondents as of October 20, 2020).

Please note:

- Wherever the term ‘efficiency’ is used, it is always occurring pre-electrification.
- The energy and emissions base year is 2016 for all actions, unless noted otherwise.
- BAP actions were developed throughout 2020, and the low-carbon actions were developed throughout 2020-2021, and therefore do not include policy or other developments that took place subsequently.

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
LAND-USE			
1. Spatial distribution	<ul style="list-style-type: none"> • Population and employment per zone, as per City projections through to 2041. • 2041-2050: population and employment trends per zone are projected linearly (based on 2031-2041 data from City). 	<ul style="list-style-type: none"> • Population and employment distribution by zone to be consistent with the most recent projections provided by the City through to 2041. • Projections from 2031-2041 are draft not yet Council approved. • Trends provided by the City for 2031-2041 are linearly extrapolated through to 2051. 	Stakeholder input: Based on data and feedback from the City planning department

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
BUILDINGS			
New buildings - buildings codes & standards			
2. Building use energy intensity	<ul style="list-style-type: none"> Starting in 2017: 15% energy improvement from the 2016 base year for residential, and 13% for MURBs, C&I. As of 2019: new construction is 10% more efficient every 5 years. 	<ul style="list-style-type: none"> Only 20% of new dwellings to be single-detached by 2050 (a steady decline from rates in 2016). Average floor space stays constant from the base year. 	<p>Note: 50% of dwellings were single-detached in 2016, compared to 71% in 1951. Historical analysis indicates that average floorspace per Hamilton dwelling has increased slightly from 1990 to 2016.</p> <p>Research: According to US research, average home sizes have almost doubled since 1950, and family sizes have decreased (see 2012 <i>Oregon Department of Environmental Quality's presentation on the environmental benefits of smaller housing and related policies to achieve smaller housing</i>; See also <i>best practice advice on Encouraging Development of Smaller Homes from USDN</i>, municipal experts from across the US & Canada)</p>
3. New residential housing targets	<ul style="list-style-type: none"> Starting in 2017: 15% energy improvement from the 2016 base year for residential, and 13% for MURBs, C&I. As of 2019: new construction is 10% more efficient every 5 years. 	<ul style="list-style-type: none"> In 2026, new buildings are 30% more efficient, with similar efficiency improvements in 2031, resulting in new buildings being a total of 60% more efficient. As of 2031, all new homes have 30% annual load coverage by solar PV (not including additional electricity demand due to fuel switching in space and water heating). 	<p>Energy efficiency standards: Applying Toronto Green Standard-equivalent (i.e. Passive House/ Net Zero) energy efficiency improvements -- though starting 5 years later. This is despite the fact that the City of Hamilton does not have the legislative authority to supersede the Ontario Building Code with building requirements. As such, innovation in policy design and/or lobbying higher levels of government would be required to achieve this.</p> <ul style="list-style-type: none"> Stakeholder feedback: this level of ambition was just right Survey response: 74% felt this should be a priority action <p>Solar PV: Internal analysis, as well as Google Environmental Insights Explorer, indicates that about 15% of current Hamilton building load could be provided by rooftop solar PV; the 30% in this action reflects the reduced electricity demand of more efficient new buildings (this share does not include additional electricity demand due to fuel switching in space and water heating).</p>

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
4. Commercial - New commercial development targets	<ul style="list-style-type: none"> Starting in 2017: 15% energy improvement from the 2016 base year for residential, and 13% for MURBs, C&I. As of 2019: new construction is 10% more efficient every 5 years. 	<ul style="list-style-type: none"> In 2026, new buildings are 30% more efficient, with similar efficiency improvements in 2031, resulting in new buildings being a total of 60% more efficient. including roof-top PV 	<p>Best Practice: Applying Toronto Green Standard-equivalent (i.e. Passive House/ Net Zero) energy efficiency improvements-- though starting 5 years later. This is despite the fact that the City of Hamilton does not have the legislative authority to supersede the Ontario Building Code with building requirements. As such, innovation in policy design and/or lobbying higher levels of government would be required to achieve this.</p> <p>Stakeholder feedback: this level of ambition is just right.</p> <p>Solar PV: see Action 3</p>

Existing buildings - retrofitting

5. Retrofit homes built prior to 1980	<ul style="list-style-type: none"> Starting in 2020, retrofit existing building stock exponentially until in 2050 a total of 6% achieve 10% electricity and 10% heating savings 	<ul style="list-style-type: none"> Starting in 2022, by 2050, on average, all existing dwellings built before 1980 achieve thermal savings of 50%; electrical savings of 50% (not including electrification of space and water heating) Applied exponentially to homes. 90% of all pre-1980 dwellings switch to heat pumps 	<p>Research: Windsor, Ontario had a business case presented to Council in February 2020 for a City-sponsored retrofit program to cover 80% of Windsor’s 60,000 homes by 2041.</p> <p>Stakeholder feedback: Retrofit 90% of homes, built before 1980, by 2050 is just the right level of ambition, but will be tough.</p> <p>Survey: 70% of respondents felt retrofitting existing homes should be a priority action</p> <p>Note: The intensity of this action was increased from initial stakeholder consultation due to the limitations on green hydrogen and RNG supply available to replace remaining natural gas demand in the City. In the model, we have defaulted to ASHPs over ground source heat pumps (GSHPs) (due to lower capital costs and ease of installation, however, GSHPs are more efficient). In implementation efforts, the selection of ASHPs vs GSHPs should be assessed on a case-by-case basis, and future model revisions should be reconsidered as technology and experience evolve.</p>
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ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
5a. Retrofit homes post 1980	<ul style="list-style-type: none"> Starting in 2020, retrofit existing building stock exponentially until in 2050 a total of 6% achieve 10% electricity and 10% heating savings 	<ul style="list-style-type: none"> Starting in 2035, retrofit 100% of all dwellings built between 1980 and 2016, exponentially, by 2050 (following pre-1980 dwellings) Achieve on average thermal savings of 50%; electrical savings of 50% (not including electrification of space and water heating) 100% for all post-1980 dwellings switch to heat pumps 	See notes for Action 5 above.
6. Retrofits of commercial	<ul style="list-style-type: none"> Starting in 2020, retrofit existing building stock exponentially until in 2050 a total of 6% achieve 10% electricity and 10% heating savings 	<ul style="list-style-type: none"> Starting in 2022, increase efficiency for 100% of commercial buildings by 50% by 2050 (linearly) 	<p>Stakeholder feedback (Re: Retrofit 90% of institutional, commercial, and industrial (ICI) buildings, greater than 50,000 ft² by 2050): is just the right level of ambition.</p> <p>Surveys: almost 70% of survey respondents felt that retrofitting commercial buildings should be a priority action for the community.</p> <p>Note: The intensity of this action was increased from initial stakeholder consultation due to the limitations on green hydrogen and RNG supply available to replace remaining natural gas demand in the City.</p>

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
7. Industry - (processes, motive, lighting, space cooling, plug load) other than coal use in primary steel	<ul style="list-style-type: none"> Assume energy use intensity and emissions profile stays constant from 2016-2050. 	<ul style="list-style-type: none"> Starting in 2022, increase efficiency by 50% by 2050 (linear) 	<p>Surveys: Industry is a major source of community GHG emissions and air quality issues, which are a top community criteria for action design.</p> <p>Research: According to the 2019 Achievable Potential Study (for natural gas and electricity conservation) undertaken by the IESO and Ontario Energy Board, the difference between the reference case and technically achievable efficiency potential for the industrial sector is nearly 30 GWh to just over 100 GWh (over 230% increase in efficiency).</p>
7b. Industry - Primary steel	<ul style="list-style-type: none"> Assume energy use intensity and emissions profile stays constant. 	<ul style="list-style-type: none"> 50% reduction in emissions by 2035, net zero emissions by 2050 Steel industry commitment to using newly developing technologies of biochar, carbon capture and/or alternative renewable energy sources to reduce and replace coal 	<p>Stakeholder feedback: May be challenging</p> <p>Research: Based on July 2020 Hamilton AMD community environmental liaison ppt; Arcelor Europe's May 2020 climate action plan (p.4); Sept. 30, 2020 Globe and Mail article confirms the company's net-zero by 2050 target and the technological pathway and timeline selected.</p> <p>Stakeholder: emphasized the importance of mitigating primary steel industry emissions. Meetings with the Canadian Steel Producers Association and NRCan also helped inform this action.</p>

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
ENERGY GENERATION			
Renewable energy generation (on-site, building scale)			
8. Solar PV - rooftop	<ul style="list-style-type: none"> 0 MW 	<ul style="list-style-type: none"> Starting in 2022, install solar PV on pre-2016 buildings, achieving on average 30% of building electric load (not including any potential increased electricity load from fuel switching to electric space and water heating) Solar PV scales up to 50% of these buildings by 2050. 	<p>Research: According to our internal analysis, solar PV has the potential to supply just over 15% of existing building electricity load. Google Environmental Insight Explorer indicates 14%. In both cases, this is before undertaking our building retrofit action outlined above, which calls for reducing electrical load by 50%.</p>
Low- or zero-carbon energy generation (community scale)			
9. Solar PV - ground mount	<ul style="list-style-type: none"> 0 MW 	<ul style="list-style-type: none"> Install a total of 280 MW, 10 MW/yr from 2022 to 2050, inside or outside city boundary (prioritizing inside) 	<p>Stakeholder feedback (re: 5MW/yr 2022-2050): behind-the-meter/net meter has less red tape than grid supply/export permitting, but technology is there.</p> <p>Note: The community will need to use 100% clean electricity in order to achieve net zero.</p> <p>Research: 4 ha / 1 MW = 1,120 ha (11.2 km²) (Kirby Calvert, Mapping opportunities for land-based renewable energy generation in Ontario, 2019)</p>
10. Expand downtown district energy system- decarbonize	<ul style="list-style-type: none"> 15 MW of natural gas hot water and reciprocating natural gas engine for heating capacity -3.1 MW of absorption and electric chillers for cooling capacity Serves ~ 232,000 m² of residential and ICI space 	<p>Downtown DE system:</p> <ul style="list-style-type: none"> Additional 25.4 MW of industrial waste heat for heating Additional of 7.1 MW of industrial waste heat for cooling Corresponding expansion of the downtown DE network to service an additional 232,000 m² of commercial floor space 	<p>Stakeholder feedback (re: by 2050 all district energy systems are fuelled by renewable energy sources): could be more impactful if there were an expansion plan</p> <p>Stakeholder meetings: with HCE Inc. and Chamber of Commerce</p> <p>Research: Based on data provided by HCE Inc. and Chamber of Commerce, as well as internal analysis.</p>

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
11. Wind	<ul style="list-style-type: none"> 0 MW 	<ul style="list-style-type: none"> Install 250 MW by 2050 inside or outside the city, starting in 2022 (50 MW installed every 4 years, starting in 2030) 	<p>Stakeholder Feedback (re: 300 MW of wind by 2050): level of ambition is too low, but there is a real issue with NIMBYism and cost of land in the GTHA is high</p> <p>Note: The community will need to use 100% clean electricity in order to achieve net zero.</p> <p>Research: 1ha/ 3MW = 83 ha (Kirby Calvert, Mapping opportunities for land-based renewable energy generation in Ontario, 2019).</p>
12. Renewable Natural Gas	<ul style="list-style-type: none"> 50,000 GJ 	<ul style="list-style-type: none"> Replace remaining NG in the system post-retrofits and heat pumps with available supply of RNG (maximizing local RNG feedstock) (see Action 23) 	<p>Research: The Ontario Energy Board and Enbridge are actively exploring increased RNG integration; A <i>2019 Ontario Biogas and RNG Market Potential study</i> conservatively projects the potential for 5x growth in RNG energy production in the province by 2029, the most important source of supply being organic waste diverted from landfill; communities in Ontario are increasingly diverting their organic waste to anaerobic digestion facilities (e.g. Toronto and Peel, and Stratford is finalizing its AD plans).</p> <p>City input: Income generating opportunity is of interest.</p>
13. Hydrogen	<ul style="list-style-type: none"> 0 MW 	<ul style="list-style-type: none"> In order to replace remaining natural gas in the city (post action 12), starting in 2030, hydrogen (produced via renewable energy) is pumped into the natural gas distribution system 	<p>Research: A major UK project ("<i>H21</i>") is working on transitioning Northern UK's natural gas system to 100% hydrogen; Enbridge is running a <i>pilot project in Markham</i>, Ontario involving hydrogen storage</p> <p>Note: 2030 start date for this action is in order to allow time for the technology to evolve. All green hydrogen is produced from local renewable energy in excess of what is needed to replace electricity grid demand.</p>

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
TRANSPORTATION			
Transit			
14. Increase transit mode share	<ul style="list-style-type: none"> Incremental increase in bus service from 2016 transit service to keep up with population growth through to 2050. Mode share assumed to stay constant to 2016-2050. 	<ul style="list-style-type: none"> Increase transit mode share from 7% in 2019 linearly to 12% by 2031, then linearly increase to 15% by 2050 (reflects installing BRT or LRT for the urban area). 	<p>City input: The City's Transportation Master Plan sets a transit mode share target of 12% for 2031 based on the adoption of a BRT or LRT system along the major East-West transit corridor (from McMaster to EastGate), though transit expansion will only occur in urban areas, that is also where the majority of population growth will be. A small increase in modeshare through to 2050 is possible.</p> <p>Stakeholder feedback: improving modeshare in rural areas will be challenging</p> <p>Note: The impacts of Covid-19 during the modelling process cannot be understated. Transit ridership saw a steep decline, and as a result, stakeholders felt plans for future expansion were more difficult to justify.</p>
15. Electrify transit system	<ul style="list-style-type: none"> Fleet turnover reflects increasing transition to CNG and electric. 50% electric and 50% CNG by 2050 (diesel stock completely phased out by 2050) 	<ul style="list-style-type: none"> Existing CNG fleet transitioned to RNG by 2025 All other buses to be electric by 2035 	<p>Notes: Because an average bus life span is about 12 years, if starting in 2022 all new buses that are purchased can be emissions free. Emission free buses have major public health benefits, and cities globally are showing that this transition is possible.</p> <p>Research: Many places in Canada are targeting 100% electrification of their transit fleets (Montreal: by 2040; Toronto: by 2040; BC: by 2040), internationally we are seeing even more ambitious targets (Oslo: by 2020; Amsterdam: by 2025; Antelope Valley, Cal: by 2025; Los Angeles: by 2030)</p> <p>Stakeholder feedback: Even by 2050, this action is too ambitious, the City is currently on track to transition fleet to CNG, infrastructure would need to be put in place now</p> <p>City input: 100% electrification by 2050 is reasonable per City Transit Department. Bus fleet expansion numbers provided by the City for 2014-2024.</p>

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
Active Transportation and Car Sharing			
16. Home Based Work/ Transportation marketing & individual planning	<ul style="list-style-type: none"> Held constant 	<ul style="list-style-type: none"> Private vehicle trips decline by 9% per person and vehicular trip lengths declined 6%. All areas of Hamilton are affected. Implement smart commute / home-based work 	<p>Research: A 2010 UK study of 3 towns over a 5-year period, found that travel planning, increasing active transportation, and transportation marketing reduced individual car trips by 9%, and trip length by 6% (Sloman L, <i>et.al.</i> The Effects of Smarter Choice Programmes in the Sustainable Travel Towns: Summary Report, UK Department of Transport, 2010). COVID-19 has also led to the acceleration of home based work. Many large employers are now switching to hybrid or full-time remote work for employees.</p>
17. Increase/improve cycling & walking infrastructure	<ul style="list-style-type: none"> Active transportation mode share is held constant to 2050. 	<ul style="list-style-type: none"> By 2050, mode shift 50% of up to 2km trips to walking and up to 5km to cycling in the urban and whitebelt zones 	<p>Research: <i>City of Vancouver cycling trips increased by 32% between 2014 and 2015 following investments in cycling infrastructure</i> (May 2016, presentation to Vancouver City Council). This shows the potential for the scale of short-term changes possible when the right infrastructure is put in place.</p>
18. E-bikes & EV car-share	<ul style="list-style-type: none"> Active transportation mode share is held constant to 2050. 	<ul style="list-style-type: none"> By 2050, 10% of trips up to 10km are complete by E-Bike or EV Car-Share in the urban zones 	<p>Research: (Re: e-bikes) A 2015 Norwegian study indicates more is feasible (Fyhri, et al. Effects of e-bikes on bicycle use and mode share, Transportation Research Part D: Transport and Environment, 36: 2015) where participants have access, 28% of all trips up to 10.5 KM are taken by E-Bike, 18% reduction in transit and 10% in vehicle use (low estimate from the study).</p>
Private/personal use			
19. Zero-emissions municipal fleet	<ul style="list-style-type: none"> 25% of new vehicle sales are electric by 2030. 	<ul style="list-style-type: none"> 100% of new small and light-duty vehicles are electric by 2040 100% of new heavy-duty vehicles switch to clean hydrogen (or similar emissions-free technology) in 2040 	<p>Research: this is 10 years more ambitious than the City's current plan (per March 13, 2020, Information Update to Council); <i>Seattle has a target of a 100% electric fleet by 2030.</i></p> <p>Stakeholder feedback: electrifying the municipal fleet by 2030 was too ambitious/ just right; suggest acting immediately on light duty and support/ monitor heavy-duty (or pilot) for options in coming years.</p>

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
20. Electrify personal vehicles	<ul style="list-style-type: none"> Starting in 2020, 14% new sales by 2030; share holds constant to 2050 	<ul style="list-style-type: none"> Zero-emission vehicles targets of 10% of light-duty vehicles sales per year by 2025, 30% by 2030 and 100% by 2040 	<p>Stakeholder feedback (re: 90% of sales are EV by 2040): "Need to be more specific on the technology to identify feasibility; High impact and tough; battery range and infrastructure need to be improved; need for advocacy to higher level of government to provide clear direction (e.g. Sweden and Norway identifying no imports and/or manufacturing of combustible vehicles)"</p> <p>Research: The federal government set a target of 100% new passenger vehicles sales being electric by 2040 (per. IEA, Global EV Outlook 2019, p. 67.)</p> <p>Note: average lifespan of an EV is about 13 years (per CanESS model).</p>

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
21. Low-Carbon Commercial Transport Activities	<ul style="list-style-type: none"> 25% of new commercial vehicle sales are electric by 2050. 	By 2050, <ul style="list-style-type: none"> all heavy-duty vehicles are green-hydrogen based Light-duty commercial vehicles are 100% electric 	<p>Stakeholder feedback (re: 50% of commercial vehicles are EV by 2050): In between just right & too low; Vehicles will likely electrify more quickly/ or introduce hydrogen; The challenge could be the distribution system; the Hamilton Port Authority has a net zero by 2050 target; the International Maritime Organization has a 50% GHG reduction by 2050, by exploring fuels such as bio LNG.</p> <p>Research: Global EV Outlook 2019 pg 67.; Hydrogen is seen as being the most viable fuel source for heavy haul trucks (see: CBC How Ottawa hopes to supercharge Canada's hydrogen fuel sector, Sep.9, 2020); for a review of the state of the international, Canadian, and Ontario fuel cell markets, see this Electric Autonomy May 28, 2020 article; BNEF (2020) Hydrogen Economy Outlook predicts that green hydrogen could meet 24% of energy world demand by 2050; EC, A hydrogen strategy for a climate-neutral Europe (8 July 2020) "this Communication sets out a vision of how the EU can turn clean hydrogen into a viable solution to decarbonise different sectors over time, installing at least 6 GW of renewable hydrogen electrolyzers in the EU by 2024 and 40 GW of renewable hydrogen electrolyzers by 2030." (This would focus first on industrial processes, then heavy duty transport.) 1)</p>
22. Marine	<ul style="list-style-type: none"> Held constant 	<ul style="list-style-type: none"> Reduce GHGs by 50% by 2050 	The International Maritime Organization has set a goal of 50% GHG reductions by 2050.

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
WATER AND WASTE			
23. Water and Waste	<ul style="list-style-type: none"> Held constant, growing proportionate to population 	<ul style="list-style-type: none"> (1) By 2050, 95% organic waste sent to anaerobic digestion - Reroute from compost to AD (1a) Maintain existing waste diversion target (55% by 2021), then increase to 70% in 2025, 85% by 2030, 95% by 2040 (2) By 2050, 25% reduction in water / wastewater consumption (behaviour change, leak detection system, greywater reuse) (modelled as the following step changes: 15% improvement in 2030, another 10% improvement in 2035) 	<p>Stakeholder feedback (re: 95% organic waste diversion): The level of ambition is too low; scale it up by including human/sewage as well as organic waste; (re: 25% reduction of water consumption) the level of ambition is just right</p> <p>Research: Ontario is considering a ban on organic waste from landfills as well as associated resource recovery (see: Food and Organic Waste Framework); An expanded wastewater anaerobic digestion facility (to accept food waste, is being considered in Stratford Ont.); see generally ECO's <i>Every Drop Counts</i> 2016/2017 (chap. 5: water conservation; chap. 8: energy from sewage); see also A Handbook for Co-digestion Projects at Municipal Wastewater Treatment Facilities (revised March 2020)</p> <p>Note: 95% (vs. 100%) is based on assumed contamination rates</p>
24. Wastewater Process Efficiency	<ul style="list-style-type: none"> Held constant 	<ul style="list-style-type: none"> Increase efficiency by 30% by 2050 (modelled as the following step changes: 10% in 2025, 10% in 2035, 10% in 2045) 	<p>Research: see generally chap 2 of ECO's <i>Every Drop Counts</i> 2016/2017 for a description of the significant process efficiency opportunities that exist in most wastewater processes.</p>
25. Decarbonize pelletizer	<ul style="list-style-type: none"> In 2030 introduce natural gas powered pelletizer 	<ul style="list-style-type: none"> In 2030, switch fuel source to RNG 	<p>Research: City has advised of this new contract for a natural gas pelletizer, in order to avoid sunk costs, recommend switching fuel source to locally produced RNG</p>

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
Municipal Buildings			
25. Municipal buildings	<ul style="list-style-type: none"> Starting in 2020, reduce energy intensity in all corporate facilities by 60% by 2050, with an interim goal of 45% by 2030 (against a 2005 base year, retrofits assumed to be implemented linearly) 	<ul style="list-style-type: none"> In addition to the EUI improvements modeled for the residential and commercial buildings, 50% of municipal building square footage achieves (on average) net-zero emissions by 2030 -- of this, solar PV is added to 50% of rooftop area, covering 30% the related building area's electrical load Applied linearly, starting in 2024, though to 2030 From 2030, linearly to 2050, this action is applied to the remaining 50% of municipal building square footage 	<p>Stakeholder feedback: The level of ambition of this action is just right. City input: Reflects current City plans to assess and install solar PV on municipal building rooftops.</p> <p>Note: Corporate Energy measures its energy and emissions against a 2005 base year (see Appendix to the Nov. 2020 BAP report for the conversion process).</p>
Sequestration and Land Accounting			
26. Tree Planting	<ul style="list-style-type: none"> Held constant 	<ul style="list-style-type: none"> Add 50,000 trees in Hamilton by year, by 2050 (total 30 years x 50, 1.5 million) 	<p>Research: Wellington, NZ Has been planting a tree every five minutes, on average, for the past 15 years—more than 1.5m in total. Wellington is New Zealand's greenest city, and one of the few cities in the world where biodiversity is increasing. About 40% of the city's emissions are now mitigated by so-called land use, land use change and forestry (LULUCF) activities.</p> <p>Context: the City of Hamilton planted 10,000 trees per year between 2013 and 2018.</p>

ACTION	BAP	LOW-CARBON	NOTES ON LOW-CARBON ACTION
Renewable Energy Procurement			
27. Purchases of Renewable Energy Certificates	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • In 2050, for each MWh of central electricity demand remaining after local renewable energy production, purchase a Renewable Energy Certificate (REC). 	<p>Note: Each REC represents the environmental benefits of 1MWh of renewable energy generation. When you purchase RECs, renewable energy is generated on your behalf. When you purchase RECs it is guaranteed that renewable energy has been generated on your behalf and sent to the electrical grid, which is the network that delivers electricity from suppliers to consumers. However, once it enters the grid, it is impossible to distinguish where or how that electricity is being delivered. (per RenewableEnergyWorld.com (8.24.15), and US EPA)</p>
28. Purchases of Renewable Natural Gas	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • First, switch to local RNG (from wastewater and organic waste, see Action 22), undertake analysis of other sustainable local sources, then purchase remaining → starting in 2025, ramp up exponentially to 2050 in order to replace all natural gas demand 	<p>Stakeholder meeting: Enbridge explained that it is currently enabling transactions between its clients where one buys RNG that is produced and consumed outside of its borders, but is able to account for the reductions in their emissions.</p>

APPENDIX B: Economic and Financial Analysis

July 2021

Purpose of this Document

This document provides a summary of the projected costs, revenues, and savings represented by the net-zero pathway modelled for Hamilton's Community Energy and Emissions Plan. The pathway's financial impacts are assessed as a whole and on an action-by-action basis.

A detailed analysis of the net-zero scenario modelled as the basis of the CEEP is provided in Appendix E.

Contents

Overview	20
Part 1. Key Financial Analysis Concepts	21
Part 2. Hamilton's CEEP Financial Analysis Results	23
Present and Net Present Values	27
Cash Flow Analysis	27
Cost Savings for Households	29
New Job Opportunities	30
Conclusion	31

Disclaimer

Reasonable skill, care and diligence have been exercised to assess the information acquired during the preparation of this analysis, but no guarantees or warranties are made regarding the accuracy or completeness of this information. This document, the information it contains, the information and basis on which it relies, and the associated factors are subject to changes that are beyond the control of the author. The information provided by others is believed to be accurate but has not been verified.

This analysis includes strategic-level estimates of capital investments and related revenues, energy savings, and avoided costs of carbon represented by the proposed Community Energy and Emissions Plan (CEEP). The intent of this analysis is to help inform project stakeholders about the potential costs and savings represented by the CEEP in relation to the modelled business-as-planned scenario. It should not be relied upon for other purposes without verification. The authors do not accept responsibility for the use of this analysis for any purpose other than that stated above and do not accept responsibility to any third party for the use, in whole or in part, of the contents of this document.

This analysis applies to the City of Hamilton and cannot be applied to other jurisdictions without further analysis. Any use by the City of Hamilton, its sub-consultants or any third party, or any reliance on or decisions based on this document, is the responsibility of the user or third party.

Acronyms

AD	anaerobic digester
BAP	business-as-planned
CEEP	community energy and emissions plan
EUI	energy use intensity
GHG	greenhouse gas
NPV	net present value
MAC	marginal abatement cost
MACC	marginal abatement cost curve
PUV	personal use vehicles
PV	photovoltaic
RNG	renewable natural gas

Overview

The following table highlights the key findings from the financial analysis of the net-zero scenario modelled for Hamilton’s Community Energy and Emissions Plan (CEEP). When reviewing the results, it is useful to put them in context of the City’s current annual:

- GDP (\$34.7 billion);¹
- expenditures on fuel and electricity (\$2.1-2.4 billion, \$1.7 billion if the heavy industry is excluded);² and
- investment in buildings alone in Hamilton (\$3.6 billion).³

Details about what is captured in each financial estimate are provided in the report’s body, as indicated in the right-hand column.

The following modelled actions were not included in this financial analysis due to limited financial data:

- Primary industry (i.e. steel sector transition),
- Marine sector greenhouse gas reductions,
- Active transportation, and
- Water efficiency.

Table 1. Summary of high-level financial analysis of Hamilton’s CEEP.

FINANCIAL ESTIMATE	KEY RESULTS (PRESENTED IN TODAY’S DOLLARS, ASSUMING A 3% DISCOUNT RATE, A.K.A. ‘NET PRESENT VALUE’)	WHERE TO FIND FURTHER DETAILS
Net benefit of the CEEP investments, 2021-2089	≈ \$63 million (≈ \$7 million without avoided carbon costs)	Part 2, Table 3
Total incremental capital investment, 2021-2050	≈ \$11.4 billion ≈ \$370 million/year	Part 2, NPV and MAC Values
Total savings, 2021-2089 (incl. avoided maintenance, carbon, and energy costs,)	≈ \$10.6 billion (≈ \$3.7 billion without avoided carbon costs)	Part 2, Cash Flow Analysis
Total revenue, 2021-2089	≈ \$840 million	Part 2, Cash Flow Analysis
Average cost to reduce each tonne of GHG	≈ \$1 in savings	Part 2, Table 3

¹ Statistics Canada, Table 36-10-0468-01, Gross domestic product (GDP) at basic prices, by census metropolitan area (CMA) (x 1,000,000), online: www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610046801.

² Consultant calculation, multiplying base year numbers for energy by NRCan’s posted energy prices by fuel and sector.

³ Statistics Canada, Table 34-10-0175-01, Investment in Building Construction, 2019 data, including new buildings and renovations for residential and commercial buildings, online: www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3410017501.

FINANCIAL ESTIMATE	KEY RESULTS (PRESENTED IN TODAY'S DOLLARS, ASSUMING A 3% DISCOUNT RATE, A.K.A. 'NET PRESENT VALUE')	WHERE TO FIND FURTHER DETAILS
Most cost-effective GHG-reduction action (\$/ tonne CO ₂ e)	1. Transit Expansion: ≈ \$4,000 in savings 2. Electrify municipal fleet: ≈ \$1,500 in savings 3. Ground mount solar and new residential roof solar PV: ≈\$1,300 in savings 4. Personal use vehicle electrification: ≈ \$600 in savings 5. Commercial fleet electrification: ≈\$500 in savings	Part 2, Table 3
Household savings on energy	\$2,900 avg/year in 2050	Part 2, Cost Savings for Households

Part 1. Key Financial Analysis Concepts

The direct financial impacts of Hamilton’s Community Energy and Emissions Plan (CEEP) provide important context for local decision-makers. However, it is important to note that the direct financial impacts are a secondary motivation for undertaking actions that reduce greenhouse gas (GHG) emissions. First and foremost, GHG reductions are a critical response to the global climate emergency. In addition, most measures included in the CEEP also provide social goods to the community, such as net job creation and positive health outcomes, which are only marginally captured in this financial analysis via the cost of carbon. Similarly, the cost of inaction is not captured. Quantifying the financial costs of each tonne of GHG emissions produced is extremely complicated, they include the impacts of tailpipe emissions in individual health and economic productivity, as well as the infrastructure costs associated with extreme weather events, to name just two.

The following are key concepts that are used to analyze the financial impacts of the CEEP.

COSTS ARE RELATIVE TO THE BUSINESS AS PLANNED SCENARIO (BAP)

This financial analysis tracks projected costs and savings associated with net-zero measures that are above and beyond the assumed ‘business-as-planned’ costs.

DISCOUNT RATE

The discount rate is the investor’s baseline growth value on their investment dollar. A project is considered financially beneficial by an investor if it generates a real rate of return equal to or greater than their discount rate.

An investor's discount rate varies with the type of project, duration of the investment, risk and the scarcity of capital. The social discount rate is the discount rate applied for comparing the value to society of investments made for the common good and as such it is inherently uncertain and difficult to determine. Some argue that in the evaluation of climate change mitigation investments a very low or even zero discount rate should be applied. In this analysis, investments are valued based on a 3% future discount rate. This is the social discount rate used by the Federal Treasury Board. Governments typically use more conservative discount rates than the private sector, especially when the value of a public good is being assessed.

NET PRESENT VALUE (NPV)

The NPV of an investment is the difference between the present value of the capital investment and the present value of the future stream of savings and revenue generated by the capital investment. This means that if an investment is made in 2049, the benefits associated with that investment's expected life would be included in the NPV of the measure and the overall plan.

Five aggregate categories are used to track the financial performance of the net-zero actions in this analysis: capital expenditures, energy savings (or additional costs), carbon cost savings (assuming the carbon price reaches \$170/tonne CO₂e in 2030 and is held constant thereafter), operation and maintenance savings, and revenue generation (associated with renewable energy production facilities and some transit actions). Administrative costs associated with implementing programs, as well as any energy system infrastructure upgrades that may be required (e.g., transmission line upgrades) are not included.

ABATEMENT COST

The abatement cost of an action is the estimated cost for that action to reduce one tonne of greenhouse gas emissions ('GHG') and is calculated by dividing the action's NPV by the total GHG emissions it reduces (tCO₂e) over its lifetime. For example, if a project has a net present value of \$1,000 and generates 10 tCO₂e of savings, its abatement cost is \$100 per tCO₂e reduced.

AMORTIZATION

The costs of major capital investments are typically spread over time (e.g. a mortgage on a house commonly has a 25-year mortgage period). Amortization refers to the process of paying off capital expenditures (debt) through regular principal and interest payments over time. In this analysis, we have applied a 25-year amortization rate to all investments (no interest cost was associated with future payments).

INDUSTRIAL EMISSIONS

Financial analysis of the industrial sector includes only the low carbon investments for secondary manufacturing. Primary industry (e.g., steel manufacturing) comprises about 80% of industrial gas and electricity sales in Hamilton and emission reduction costs for that sector have not been estimated in this analysis. As the technological pathway for reaching net-zero is uncertain and specific to the individual steel manufacturing plants in Hamilton, the associated costs cannot be determined.

ENERGY AND CARBON COST PROJECTIONS

The energy cost projections displayed in Figure 1 underlie the financial analysis. These projections were derived from:

- the Independent Electricity System Operator's Long-Term Energy Plan (electricity),
- the US Energy Information Administration (propane), and
- the National Energy Board (all other fuels).

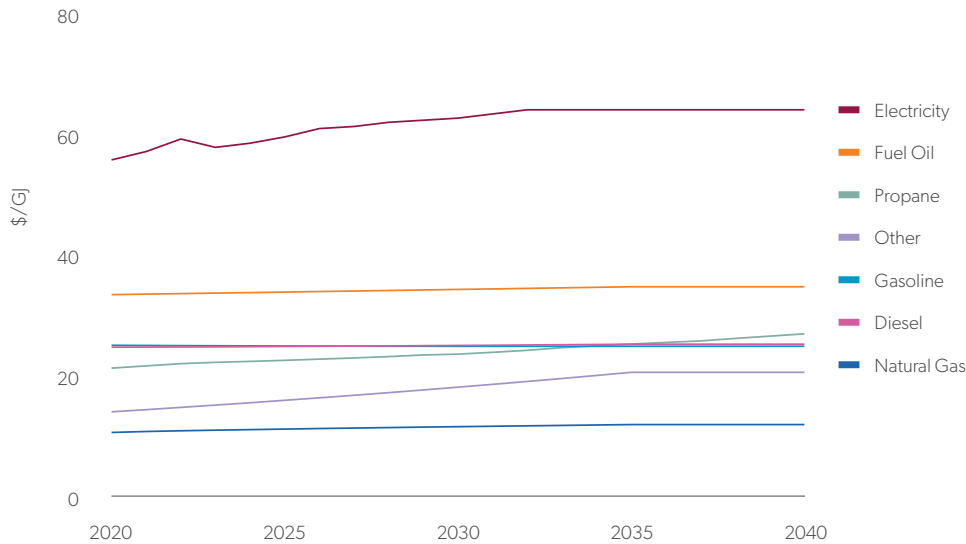


Figure 1. Projected energy costs.

The financial analysis is sensitive to electricity and natural gas costs. Electricity costs are projected to increase more rapidly than natural gas; if natural gas costs increase more rapidly, then the financial benefit of many of the actions increases.

An escalating cost of carbon, based on federal regulation, was applied out to 2030, then held constant.

Part 2. Hamilton’s CEEP Financial Analysis Results

ABATEMENT COSTS

As outlined in Table 2, the investments included in the net-zero pathway yield a positive return for each tonne of carbon reduced; that is, the net savings and revenues the reductions generate yield a positive financial return that translates to a weighted average benefit of \$1/tonne of CO₂e reduced.⁴ The values for the individual measures are also included in Table 2.

Measures with a positive net present value are highlighted in green (i.e. where the investment has a positive return of at least 3%) will therefore have a negative abatement cost, which is also highlighted in green (i.e. they would be worth doing even without consideration of the carbon benefits). Whereas measures with a negative net present value are highlighted in red and have a positive abatement cost (i.e., these are measures with returns less than the discount rate of 3%).

Reviewing the following table action-by-action requires understanding the action’s sequencing in the model (i.e., what is it offsetting), and what is bundled in each action. For example, “Waste diversion and Renewable Natural Gas with Anaerobic Digester (RNG with AD)” includes not only organic waste diversions and RNG production at an anaerobic digestion facility, but it also includes all RNG procurement in the CEEP. If RNG procurement was not included in this action, the waste diversion and AD action would have likely had negative abatement costs (meaning each tonne reduced would save money). On the other hand, heat pumps are assessed

⁴ The net present value of the measures includes credit for the avoided costs of carbon (\$170/tonne CO₂e); if that credit were excluded, the net savings per tonne of GHG mitigated would be correspondingly lower.

individually and have a positive marginal abatement cost (meaning each tonne reduced costs money), but if they were bundled with the new building and retrofit actions, as would be the case in implementation, the outcome may be more favourable

These interdependencies mean that the most important lens is the abatement cost for the entire plan.

Table 2. Net present value and abatement costs by action.

	CUMULATIVE EMISSIONS REDUCTION (KT CO ₂ EQ)	NET PRESENT VALUE	MARGINAL ABATEMENT COST (\$ / T CO ₂ EQ)
New dwelling EUI	578	\$266,175,503	-\$460
New res solar PV	257	\$345,652,988	-\$1,343
New non-res EUI	3,196	\$1,022,701,898	-\$320
New municipal EUI	1,430	\$414,230,877	-\$290
New non-res solar PV	218	\$142,798,467	-\$654
Retrofit dwellings	1,829	-\$253,658,148	\$139
Retrofit non-res	4,578	\$1,176,624,425	-\$257
Retrofit municipal	70	-\$3,740,479	\$53
Existing buildings solar PV	292	\$280,551,392	-\$959
Existing municipal buildings solar PV	22	\$10,920,507	-\$494
Heat pump	6,619	-\$2,985,962,167	\$451
Industrial efficiency	12,438	-\$3,332,733,052	\$268
Ground mount solar PV	473	\$592,878,707	-\$1,254
District energy expansion	372	-\$71,505,124	\$192
Transit expansion	19	\$73,627,043	-\$3,908
Electrify transit	263	-\$70,569,449	\$268
Trip reduction	1,361	\$577,082,595	-\$424
Electric shared mobility	80	-\$136,119,997	\$1,697
Electrify municipal fleet	43	\$65,878,667	-\$1,521
PUV electrification	6,494	\$4,030,231,161	-\$621
Commercial fleet electrification	6,224	\$2,887,986,366	-\$464
Waste diversion and RNG with AD	9,629	-\$715,191,054	\$74
Wastewater efficiency	50	\$16,317,070	-\$326
Green electricity procurement (i.e., renewable energy certificates) ⁵	8,655	-\$438,330,924	\$51
Tree planting	1,126	-\$2,500,054	\$2
Hydrogen	4,692	-\$3,829,930,585	\$816
TOTAL	70,631	\$63,416,635	AVERAGE: -\$1

⁵ The wind action modelled in the net-zero scenario was included in this category.

MARGINAL ABATEMENT COST CURVE

Figure 2 shows the marginal abatement cost curve (MACC) for measures included in Hamilton's CEEP.

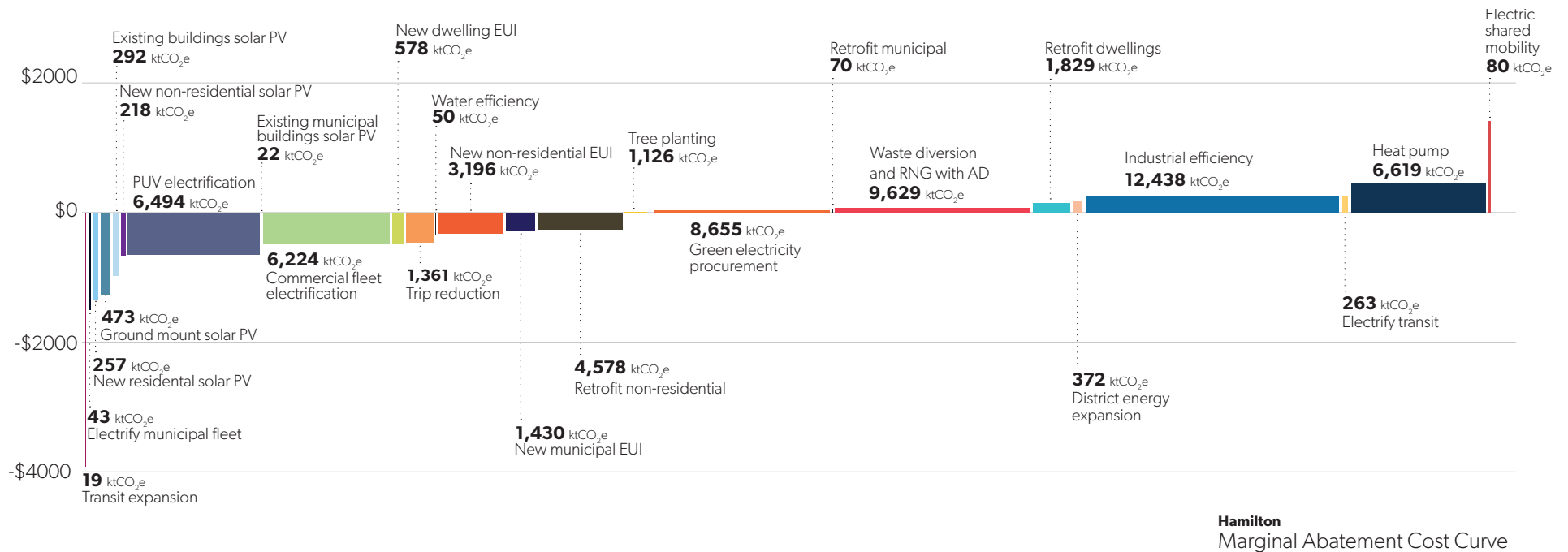


Figure 2. The marginal abatement cost curves for key actions in Hamilton's CEEP.

While a MACC illustrates the financial profile of the suite of actions, it is an imperfect indicator. The presentation of the MACC implies that the actions are a menu from which individual actions can be selected. Many of the actions are dependent on each other, for example, the district energy cost increases without retrofits. Another important message is that to achieve the City's target all the actions need to be undertaken, as soon as possible. While there can be a tendency to wait for technological improvements, this has the effect of reducing the value of the savings that can be achieved for households and businesses, and the new employment opportunities that can be created.

In Figure 2, the wider the action is, the greater the GHG emissions reduction. The higher above the middle horizontal axis the more costly the action, while the lower below the line, the more cost effective it is.

The MACC provides useful insights that guide implementation planning, for example:

- Can high cost and high savings actions be bundled to achieve greater GHG emissions reductions?
- How can the City help reduce the costs of the high-cost actions by supporting innovation or by providing subsidies?
- Which actions both save money and reduce the most GHG emissions? These can be considered the big moves.
- Which actions are likely to be of interest to the private sector, assuming barriers can be removed or supporting policies introduced?

These are exemplified in a sample Figure 3 MACC.

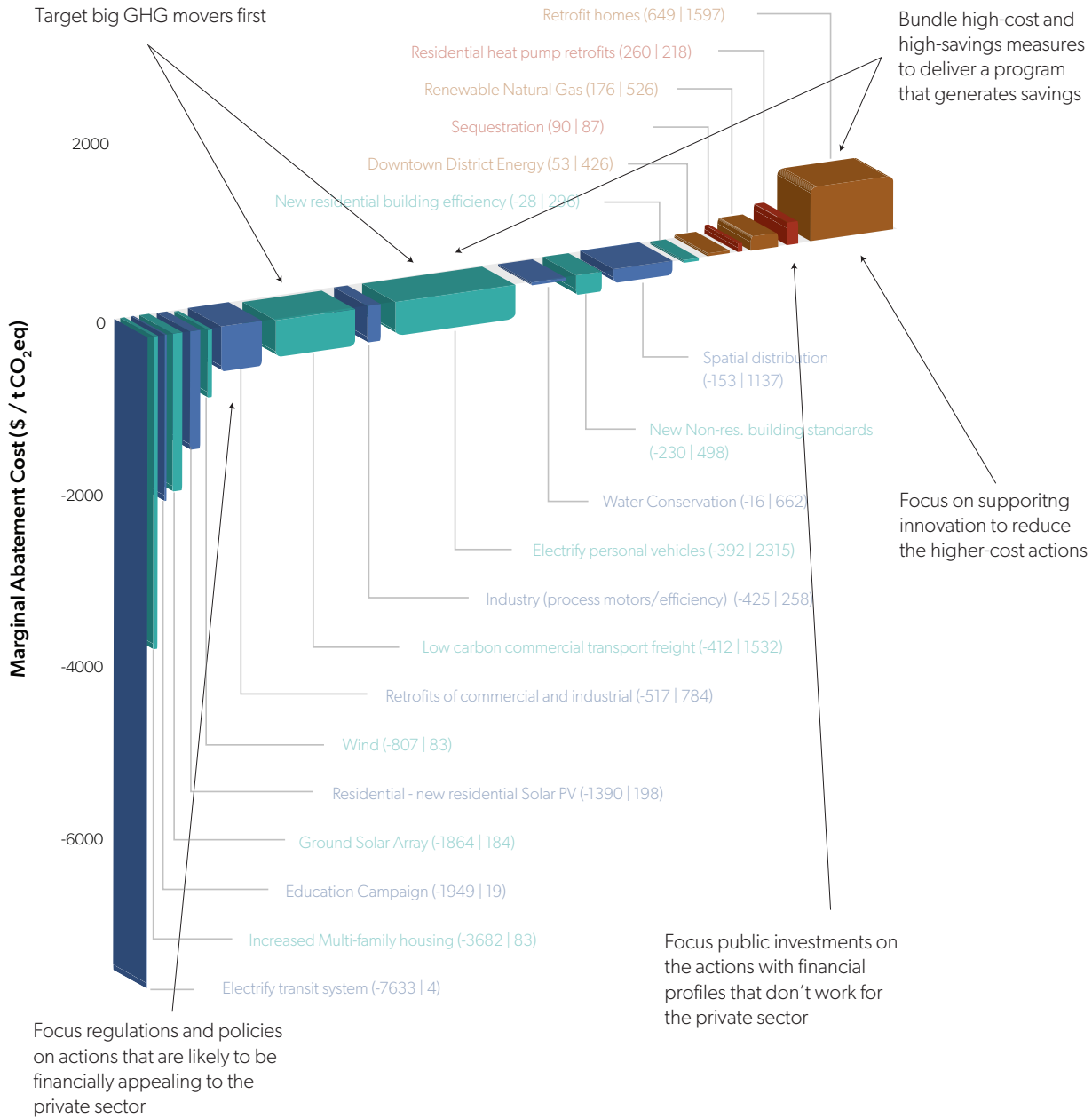


Figure 3. Examples of the strategic uses of a marginal abatement cost curve analysis.

Present and Net Present Values

As noted in the previous section, most of the actions in the net-zero scenario have positive net present values, as does the program of investments taken as a whole. Figure 4 shows the present value of the major components of CEEP: investments, operations and maintenance savings, fuel and electricity savings, avoided costs of carbon, and revenue from transit and local energy generation. After discounting at 3%, the investments in the program have a present value of \$11.4 billion and the savings and revenue have a present value of \$10.6 billion, for an NPV of the whole scenario of \$63 million.

It is important to highlight the fact that capital investment for the plan ends in 2050, however, the NPV includes the energy, maintenance, and carbon costs savings as well as revenue projected over the full life of the measure, which in some cases extend as far as 2089 (for example a building built in 2050).

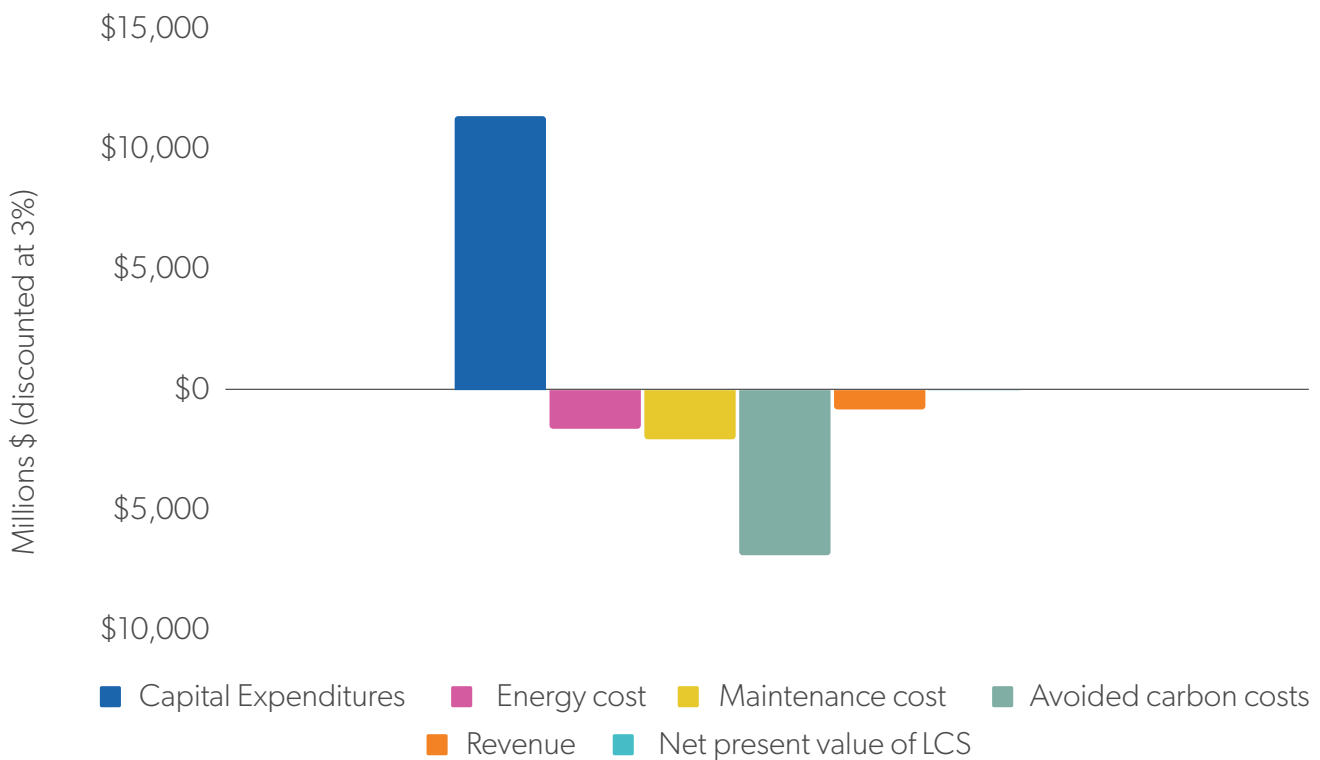


Figure 4. Present values of net-zero scenario costs, savings, and the net present value of the scenario (costs are positive, revenue and savings are negative).

Cash Flow Analysis

The annual costs, savings and revenue associated with fully implementing the actions in the CEEP are shown in detail in Figures 5, with capital expenditures shown in full in the years in which they are incurred. As is characteristic of net-zero transitions, the capital expenditures in the early years of the transition are significantly greater than the savings and revenues generated, but by the mid-2030s the annual benefits increase steadily until they nearly match the annual investments by 2050.

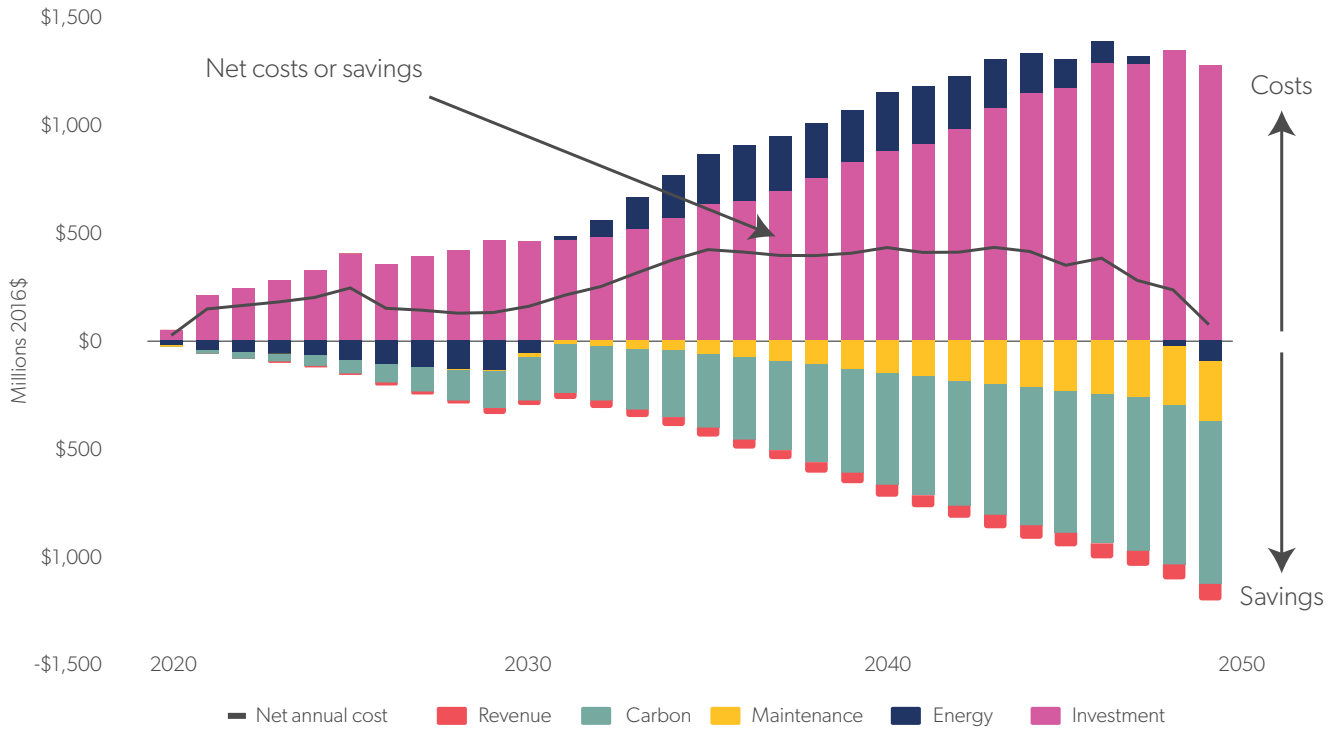


Figure 5. Capital expenditures vs. savings and revenues from the net-zero scenario, 2021-2050.

Figure 6 presents the same costs and benefits, but with the capital expenditures amortized over 25 years at 3% (no additional interest rate was applied). With this approach, which presumably would reflect actual approaches for financing the transition, the annualized capital payments are about equal to the savings and revenue generation, right from the beginning of the program. On an annual basis, the program never has a significant annual deficit. By 2050, the annual net benefit is over \$63 million. After 2050, the amortized investment payments continue to taper off, reaching zero by 2075, while the benefits and revenues continue, resulting in continuous growth in the net annual benefit in the post-2050 period.

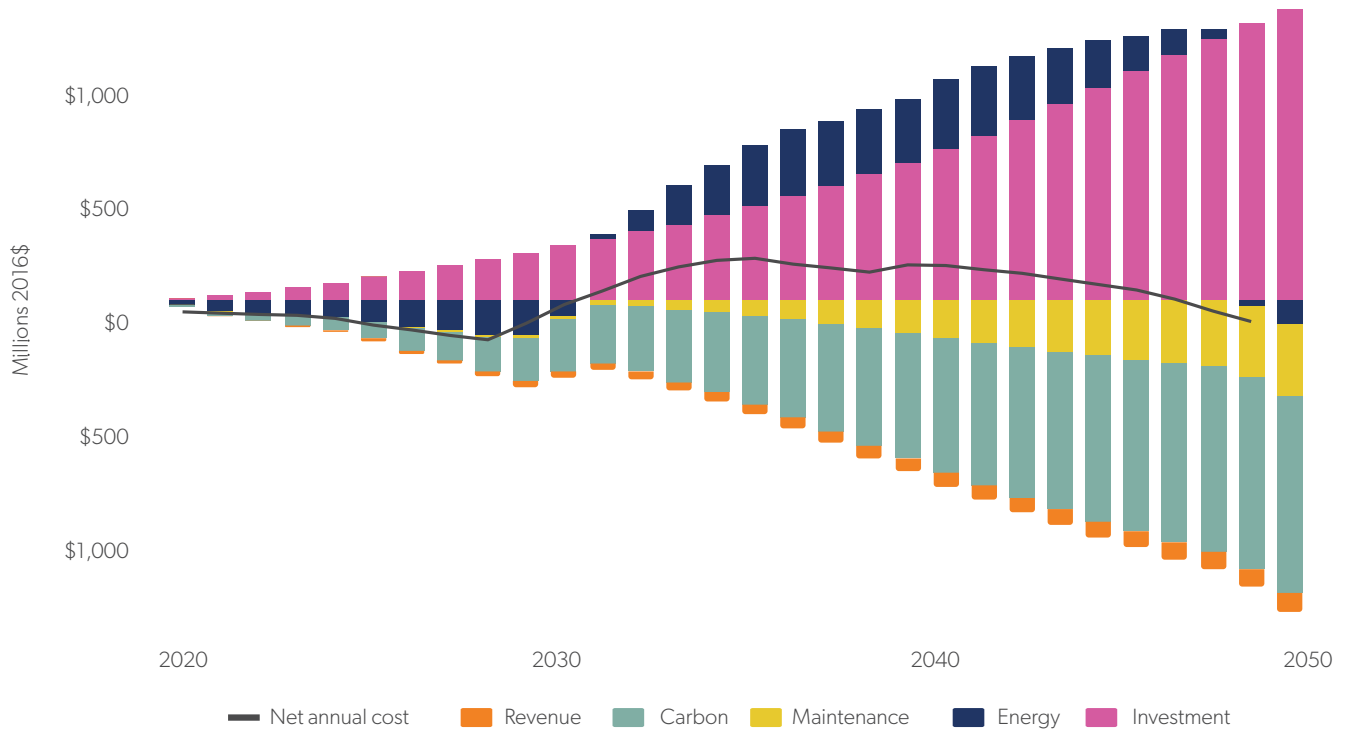


Figure 6. Annualized capital expenditures vs. savings and revenue from the net-zero scenario, 2021-2050.

Cost Savings for Households

Household expenditures on energy—natural gas, electricity, gasoline and diesel—are projected to increase in the BAP and decline in the net-zero scenario. In the BAP, household energy expenditures are relatively flat because vehicles become more efficient due to national fuel efficiency standards and because of decreased heating requirements as the climate becomes milder due to climate change. The net-zero scenario involves shifting away from natural gas and gasoline to electricity, a more costly energy source. The increased cost of electricity is partially offset by the increased efficiency of homes and electric vehicle motors. The carbon price also adds to the cost of using fossil fuels for heating and transport.

In the net-zero scenario, an average Hamilton household in 2050 spends \$2,873 less on fuel and electricity (household energy and transportation expenditures) than they would have in a BAP scenario, over 84% less than what people will spend in the 2050 BAP scenario (see Figure 7). Between 2021 and 2050, the net-zero scenario saves the average Hamilton household about \$37 thousand on fuel and electricity expenditures (this does not include any capital costs of energy efficiency improvements). Depending on the business, policy and financing strategies used in the implementation of the actions, these savings will be partly offset by the incremental capital expenditures required.

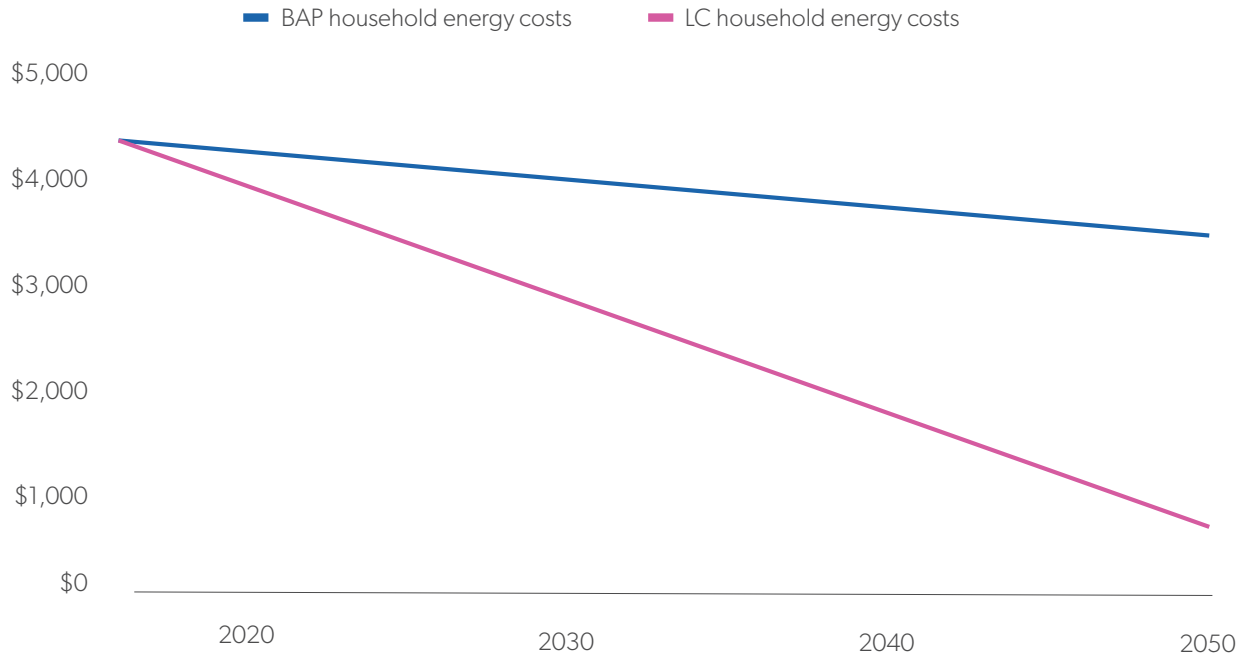


Figure 7. Average annual household energy costs in the net-zero and business-as-planned scenarios, 2021-2050.

New Job Opportunities

Transitioning to a low- or zero-carbon economy is expected to have four categories of impacts on labour markets: additional jobs will be created in emerging sectors, some employees will be shifted (e.g., from fossil fuels to renewables), certain jobs will be reduced and transitioned (e.g., combustion engine vehicle mechanics), and many existing jobs will be transformed and redefined.

From 2022 to 2050, the investments associated with the NZS are estimated to produce a total of about 160 thousand person years of employment. If these job hours were equated to full time jobs, they would total an average of 5,500 full time jobs a year (not cumulative). Implementation planning will help ensure these are local jobs.

What is evident in Figure 8 is the significant number of jobs that are expected from the industrial process efficiency action, as well as the residential and commercial retrofit actions modelled in the CEEP. Some job losses are also expected from vehicle electrification (personal and commercial) due to the reduced maintenance associated with these vehicles.

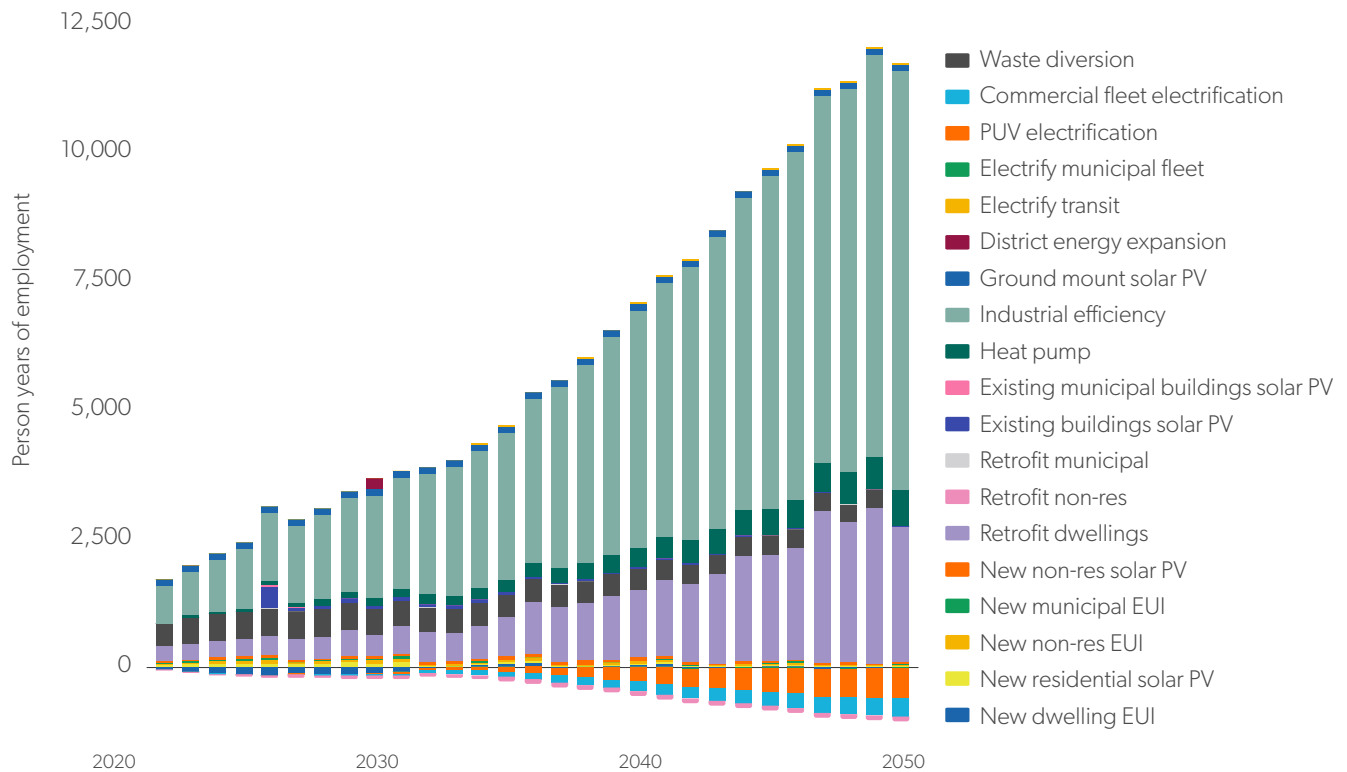


Figure 8. Additional person-years of employment associated with the net-zero scenario actions.

Conclusion

This financial analysis summarizes the overall financial and economic impacts of the CEEP in contrast to the business-as-planned scenario. Despite the fact that some actions on their own may not be cost-effective, overall the plan has a positive net present value and impact on jobs.

This analysis is based on the best available assumptions of projected costs and economic indicators out to 2050; many of these are highlighted in the table at the end of this document. It is important to note that this financial analysis is comprehensive, but incomplete. It misses many indirect benefits (e.g., on public health, resilience to extreme weather, and resilience to fuel cost fluctuations) as well as costs (e.g., the costs of inaction) that are difficult to quantify. Nonetheless, this financial and economic analysis remains an important tool to support decision-makers in their analysis of the CEEP.

Key Financial Assumptions

CAPITAL INVESTMENT ASSUMPTION	
LAND USE	
Land-use intensification	<ul style="list-style-type: none"> • Capital costs associated with land use intensification encompass standard investment in the community such as new housing developments; therefore they are considered to be \$0. • Generally speaking with more infill development new infrastructure spending decreases.
Reduce avg. dwelling size	
Decrease share of single-detached housing	
NEW BUILDINGS	
New res. buildings w/ heat pumps	<ul style="list-style-type: none"> • The cost for new construction of buildings on a \$/m² is estimated to be: <ul style="list-style-type: none"> • Single-detached: \$1,776 / m² • Double: \$1,426 / m² • Apt 1-4 storey: \$2,341 / m² • Apt 5-14 storey: \$2,556 / m² • Apt > 15 storey: \$2,610 / m² • The premium associated with meeting high-efficiency building standards is assumed to average 10%. • Energy savings associated with high-efficiency buildings is calculated to be 80-90% over existing building stock. • A residential heat pump has a capital cost of approximately \$6,000 (non-res is ~\$10,000 and scaled to the heating requirement), with approximately \$160 annually to maintain (~\$400 annually for non-res)
New res. buildings w/ solar PV	
New commercial building efficiency	
Commercial buildings w/ solar PV	
EXISTING BUILDINGS	
Retrofit homes/energy efficiency	<ul style="list-style-type: none"> • 100% of residential buildings built before 2017 are retrofitted; all non-residential buildings are retrofitted. • The average cost of retrofits was assumed to be (per GJ of energy saved): <ul style="list-style-type: none"> » Residential: \$600-\$2,500 (depending on the age of the building and baseline energy use intensity) » Non-Res: \$500-\$1,500 (depending on the age of the building and baseline energy use intensity)
Residential electric water heaters	
Heat pump as part of residential retrofits	<ul style="list-style-type: none"> • A residential heat pump has a capital cost of approximately \$6,000 (non-residential is ~\$10,000), with approximately \$160 annually to operate (~\$400 annually for non-residential)
Retrofits industrial buildings	
Retrofits of commercial and industrial	

CAPITAL INVESTMENT ASSUMPTION

RENEWABLE ENERGY

Solar PV- net metering old and new buildings	<ul style="list-style-type: none"> Solar PV has a capital cost of approximately \$2,000 per kW. The capital cost is expected to decrease towards 2050.
280 MW Ground Solar Farm	<ul style="list-style-type: none"> RECs are assumed to cost \$10/MW.
Renewable Energy Certificates (RECs)	<ul style="list-style-type: none"> The lithium-ion battery for energy storage is anticipated to decrease by as much as %50 by 2050.
Organic Waste to RNG	<ul style="list-style-type: none"> RNG upgrading costs via Canadian Biogas Association RNG Financial Tool.
Hydrogen introduced to natural gas networks	<ul style="list-style-type: none"> Hydrogen is assumed to start at \$75/GJ, decreasing to \$52.50/GJ by 2050.

INDUSTRY

Industrial upgrades	\$/GJ	
	2025	2038
Lighting upgrades (avg.)	\$115	\$59
Space heating upgrades (avg.)	\$27	\$34
Water heating upgrades (avg.)	\$33	\$49
Motive upgrades (avg.)	\$107	\$176
Process heat upgrades (avg.)	\$28	\$43

PROGRAM 5: TRANSPORT

Expand bus service	<ul style="list-style-type: none"> The cost of an electric vehicle is approximately \$55,000 in 2016 and below \$34,000 by 2050. 100% of personal car sales are electric by 2040.
Electrify transit system	
Increase/improve cycling & walking infrastructure	
E-Bikes	<ul style="list-style-type: none"> Fuel cost of gasoline per litre goes up to 26% with the carbon tax and market factors added by 2040.
Electrify municipal fleets	<ul style="list-style-type: none"> Transit electric bus capital costs assumed to decrease to traditional engine costs by 2050.
Electrify personal vehicles	
Low carbon commercial transport activity	

WASTE & WASTEWATER

25% less water use (technology & behaviour change)	<ul style="list-style-type: none"> Behaviour change programs are a cost of staff and communications from the city
Wastewater process efficiency	<ul style="list-style-type: none"> Wastewater process efficiency included under industrial efficiency

MUNICIPAL BUILDINGS

Retrofit municipal buildings	<ul style="list-style-type: none"> See retrofit and solar PV figures in Programs 1 & 3
Solar PV on municipal buildings	

NATURAL ENVIRONMENT & SEQUESTRATION

Tree planting	<ul style="list-style-type: none"> Cost of tree planting is valued over \$2.5 million (\$2.5/tree)
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APPENDIX C: Implementation Strategy

November 2021

Purpose of this document

Once Council approves the CEEP ('ReCharge Hamilton'), the City will need to turn to implementation immediately. To support the CEEP's implementation, this Strategy proposes a short-term, high-level implementation plan (0-5 years) to help the City pivot efficiently from planning to doing.

This plan also includes guidance for setting up a long-term monitoring framework to ensure progress, continuous improvement, accountability, and transparency.

Contents

Context	36
Key to the Co-benefits Indicators	36
CEEP Coordination and Oversight	38
The City of Hamilton (Corporate)	42
Innovating Our Industry	44
Transforming Our Buildings	47
Changing How We Move	51
Revolutionizing Renewables	55
Growing Green	60

Acronyms

AD	anaerobic digester
CEEP	Community Energy and Emissions Plan
CIPEC	Canadian Industry Program for Energy Conservation
CHP	combined heat and power
DE	district energy
EV	electric vehicle
FCM	Federation of Canadian Municipalities
FTE	full-time equivalent
GHG	greenhouse gas
IESO	Independent Electricity System Operator
HIEA	Hamilton Industrial Environmental Association
HRAI	Heating, Refrigeration, and Air Conditioning Institute of Canada
MOU	memorandum of understanding

NGO	non-governmental organization
NRCan	Natural Resources Canada
PACE	property assessed clean energy
PV	photovoltaic
RE	renewable energy
RNG	renewable natural gas
TBD	to be determined
VKT	vehicle kilometres travelled

UNITS

CO ₂ e	carbon dioxide equivalent
GJ	gigajoule
Km	kilometre
Kt	kilotonne
MW	megawatt
t	tonne

Context

The following near-term (0-5 year) Implementation Strategy aims to guide progress on the pathway laid out in the CEEP. The direction of the pathway is driven by the target of net-zero carbon emissions by 2050, however the shape of the pathway is influenced by:

- input from the CEEP Stakeholder Advisory Committee;
- survey responses from the general public;
- input from City Staff;
- research on best practices; and,
- consultant experience from other projects.

As a result of this input, this Strategy is designed to enable the GHG reduction measures identified in the CEEP and to maximize co-benefits including economic

Key to the Co-benefits Indicators

This Implementation Strategy focuses on the first steps in enabling and implementing key actions that are projected to have significant societal benefits. In addition to varying levels of greenhouse gas (GHG) reductions, actions included in this strategy result in various associated co-benefits. These include: equity improvements, employment increases, and return on investment. For

development, improved equity and public health outcomes.

This Strategy includes some key City-led initiatives, but the majority of CEEP implementation will require resources and leadership from various actors in the community, including utilities, industry, businesses, and institutions (e.g., colleges and universities). Partnerships are critical to achieving the target of net-zero emissions by 2050.

Partnerships mobilize diverse skills, expertise, and capacity to support the implementation of the CEEP, and they have an opportunity to improve inclusion and social equity.

Funding, resources, and enabling policies from higher levels of government will also be critical to achieving the CEEP targets. Coordinated and early outreach and liaison will need to be prioritized.

simplicity we have created a code for each potential co-benefit—enabler, low, medium, and high— based on their relative impact in the net-zero scenario model undertaken for the City (see Appendix E: Net-Zero Pathway, Technical Analysis and Appendix B: Detailed Economic and Financial Analysis). These categories, and their definitions are described in the table below.

Table 1. Co-benefits indicators and their capacity to reduce emissions and improve lives.

INDICATOR	ENABLER	LOW	MEDIUM	HIGH
Greenhouse gas emissions	Enables GHG emission reductions	<20 ktCO ₂ e reduction by 2050	21 to 1,000 ktCO ₂ e reduction by 2050	>1,000 ktCO ₂ e reduction by 2050
Equity	No discernible effect	Without intervention, this action may favor certain groups or create a greater disparity between higher and lower income groups	This action is more likely to be implemented in the community fairly, but existing powerful groups may still be at an advantage	This action contributes to enhanced equity
Employment ('Emp.')	Enables employment	0-2 person years of employment per \$million invested	3-5 person years of employment per \$million invested	>6 person years of employment per \$million invested
Cost-effectiveness ('CE')	No cost associated with supporting action	This program will need incentives, loans, or grants in order to be completed	This action has the ability to break even, in particular, if paired with a more attractive investment vehicle	This action will be a driver of total cost-effectiveness of the entire program

CEEP Coordination and Oversight

The CEEP requires an entity that helps oversee and coordinate its implementation. Its role would include:

- coordinating, collecting, and reviewing targets;
- monitoring GHG emissions;
- evaluating the effectiveness of programs and progress towards sectoral targets; and, reporting transparently.

The following table describes the functions required to support implementation.

Table 2. Functions to support CEEP implementation.

FUNCTION	ENTITY	ROLE	EXAMPLE
Accountability	<ul style="list-style-type: none"> • Community Climate Advisory Committee 	The Community Climate Advisory Committee is an independent external committee of community stakeholders that operates as an independent body to review the City's corporate and community wide targets, actions, and progress on the same. The Community Climate Advisory Committee will also serve as a liaison between the broader community and the City Climate Office and coordinate the implementation of community-led actions, data collection, education and awareness, and reporting.	City of Edmonton Environmental Advisory Committee; Region of Durham Roundtable on Climate Change.

FUNCTION	ENTITY	ROLE	EXAMPLE
Coordination	<ul style="list-style-type: none"> City of Hamilton Centralized Climate Office 	<p>The City needs a centralized entity within the City Corporation that will act as a hub for coordinating the implementation of the City-led CEEP actions across the municipal corporation, as well as reporting on corporate and community-wide progress on the implementation of CEEP actions of GHG reductions. The proposed Climate Office would also be the stewards of the proposed climate Climate Impact Adaptation Plan, currently under development, and would be responsible for leading updates to the City’s climate change related documents such as the Community Energy and Emissions Plan and the Community Impact Adaptation Plan. The Climate Office will also partner with the Community Climate Advisory Committee to design and undertake community engagement throughout the implementation of the plan.</p> <p>The Community Climate Advisory Committee will also play a role, in coordination with the City’s Climate Office, in coordinating and supporting community-led actions.</p> <p>To ensure this office is effectively coordinating climate actions across the municipal organization, there needs to be commitment about exactly what actions, targets, and metrics each City department should be responsible for reporting on.</p>	<p>Region of Peel Office of Climate Change; Town of Halton Hills, Climate and Asset Management, CAO Office; Durham Region, Strategic Initiatives Division, CAO Office; Town of Whitby, Strategic Initiatives Division, CAO Office</p> <p>See also: David Miller’s book “Solved: How the World’s Great Cities are Fixing the Climate Crisis” (2020)</p>
Implementation	<ul style="list-style-type: none"> City Climate Office Multi-Departmental Climate Change Working Group External Stakeholders across the City Community Climate Advisory Committee 	<p>The City’s centralized Climate Office will coordinate municipal actions with the various City departments. Each City department will also need to have resources dedicated to the implementation and monitoring/ reporting of the CEEP actions. These departmental representatives will serve as a liaison to the centralized Climate Office and will be part of a Multi-Departmental Climate Change Working Group to report on actions, progress and monitor implementation and targets associated with their respective departments.</p> <p>External stakeholders across the City will also be required to take action for community-based actions. This will be implemented with assistance and support from the City’s Climate Office, as well as the established Community Climate Advisory Committee.</p>	<p>Region of Durham’s Carbon Accounting Framework; Example of a third party: Our Energy Guelph; Example of contracting out for various climate change programs (see Bristol, UK); Example of procurement practices that maximize community wealth building (see Preston, UK).</p>

The process will ensure accountability, coordination of implementation, monitoring, and reporting of implementation activities.

ANNUALLY REPORTING GHGs and METRICS: This provides the primary data to track progress towards the net-zero target. It should include community-wide and sector-specific energy and emissions reporting.

ADAPTIVE MANAGEMENT: regular reviews (for example, every 5 years) of CEEP programs based on established metrics, as well as trends in overall energy use and GHG emissions, updates in policy best practice, and technological

TRANSPARENCY: by ensuring that all reporting and reviews are made easily accessible to the public.

COMMUNITY ENGAGEMENT AND OVERSIGHT: via a formal body representing a cross-sector of the community.

Such a program is proposed to be led by a newly created City Climate Office and Community Climate Advisory Committee.

FUNCTION	ENTITY	ROLE	EXAMPLE
Monitoring and reporting	<ul style="list-style-type: none"> • Energy and Climate Office • Multi-Departmental Climate Change Working Group • Community Climate Advisory Committee 	<p>The Multi-departmental Climate Change Working Group will monitor and report on targets for actions assigned to their respective departments. The Working Group will report these targets to the City’s Climate Office, who will compile a comprehensive report on the City’s corporate and community GHG emissions and progress towards reductions and action implementation.</p> <p>The Community Climate Advisory Committee will also monitor and report on community-based progress on actions, including emission reductions and other indicators and report the data to the City’s Climate Office for input into the comprehensive report.</p> <p>The City’s Climate Office will compile this data from both the City’s corporate and community GHG emissions and progress on actions and provide a comprehensive report to the Senior Leadership Team and Council annually or as often as directed.</p>	<p>Toronto’s Energy and Environment Division is responsible for tracking emissions annually.</p> <p>The Bay Area Restoration Council is an example of a local organization in Hamilton that the Bay Area Climate Change Council was modelled after that provides education and awareness and annual reporting of community-wide initiatives.</p>

Table 3. Actions, partners, and resources required for CEEP implementation.

ACTION + TIMELINE	RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
CEEP Administration					
Creation of and dedication of staff to lead and coordinate corporate and community-wide energy and climate change work through the creation of the City Climate Office.	FTE and budget TBD	<ul style="list-style-type: none"> City 	Enabler	City	Annual reporting to Community Advisory Committee and Council on: Community energy and emissions; and the state of all Corporate and Community CEEP actions and their KPIs
Climate action coordinators across all major City departments and a Multi-Departmental Climate Change Working Group	FTE and budget TBD	<ul style="list-style-type: none"> City 	Enabler	City	Departmental reporting on progress of associated CEEP actions Departmental annual and long-term budgeting to implement CEEP actions
Ensure longevity and dedicated long-term funding for Community Climate Advisory Committee 2022-onwards	Ensure ongoing funding to support the Community Climate Change Advisory Committee.	<ul style="list-style-type: none"> City and members of proposed Community Climate Advisory Committee 	Enabler	City	Annual reporting to the Centralized Climate Office: State of all Community-led CEEP actions and their KPIs in coordination with City Climate Office
Establish and deliver a public engagement program to support CEEP implementation 2022-onwards	To be completed through the resources in the City's Climate Office in partnership with the Community Climate Advisory Committee and other community partners.	<ul style="list-style-type: none"> City, Community Climate Advisory Committee, and other community partners 	Enabler	City	Design and delivery of an educational and awareness campaign

The City of Hamilton (Corporate)

When it comes to its fleet and buildings, the City is already on a net-zero trajectory based on its most recent Corporate Energy and Sustainability Policy, and Green Fleet Strategy. The next generation approach is to ensure that all Council decisions align with community GHG targets by establishing an annual carbon budget and developing a sustainable procurement strategy that also takes into account embodied carbon emissions.

In addition, the City will need to mobilize financial resources using tools such as green bonds, investigating revenue tools, and the expansion of the existing revolving energy fund.

Municipal and Community Carbon Budget

Establishing an annual emissions cap, allocating targets to departments or sectors similar to annual financial budgets (with surpluses and deficits allotted to the following year), is currently best practice in municipal climate emergency responses. Edmonton and Ottawa are implementing this approach in Canada, drawing on an example from the City of Oslo. Carbon budgets can be established at the corporate and community-wide scale, the latter was applied in Oslo.

Climate Lens

A carbon budget requires that a climate lens be applied to all strategic and budget decisions to highlight their GHG impacts. Adaptation considerations can also be integrated into the climate lens.

Procurement

When procuring goods and services, the City has an opportunity to be a

leader in supporting sustainable goods and service providers. It can do so by updating its procurement guidance to prioritize goods and service providers that are aligned with the city's net-zero target, and goods with lower embodied emissions in their products.

New and Expanding Climate Change/Corporate Energy Revolving Fund

The City has a successful revolving fund program for corporate energy efficiency programs. This successful program has the potential to be expanded to fund a broad range of low-carbon actions across the corporation. The City also has established a Climate Change Reserve and policy that guides corporate and community spending of climate actions; a clear long-term sustainable funding source for this reserve still needs to be developed.

Green Bonds

The City of Hamilton can issue green bonds to raise the capital to finance corporate and community GHG-reduction initiatives, such as deep home or business retrofits, which result in energy savings that can be used to repay the loan. The scope of eligible projects will need to be determined through the development of the bond framework (e.g., see the Climate Bonds Standard).

Community Bonds

In addition to green bonds, which are issued to large corporate investors, community bonds can be issued to community members as a source of finance for low-carbon actions. Community bonds can be issued in denominations as low as \$1,000 and can be a mechanism to enable the community to invest in its own projects.

Table 4. Actions, partners, and resources required for the Corporate plan.

ACTION + TIMELINE	RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
Municipal decision-making					
Investigate and design a carbon accounting framework (including a climate lens, carbon budget, and sustainable procurement policy) to align municipal decision-making 2022-onwards	<ul style="list-style-type: none"> Dedicated staff time Staff training 	<ul style="list-style-type: none"> City Council Municipal departments Potential expert consultant 	Enabler	<ul style="list-style-type: none"> City (staff time + operating expenses TBD) 	<ul style="list-style-type: none"> Corporate emissions Feedback from Council and staff Annual corporate and community CO₂e surplus/deficit
Municipal funding mechanism					
Corporate Energy Reserve (revolving fund) expansion assessment (including the addition of climate-aligned funding criteria) and implementation 2022-onwards	<ul style="list-style-type: none"> Dedicated staff time to develop a business case for the expanded fund, and a funding source. 	<ul style="list-style-type: none"> City (Corporate Energy Office) 	Enabler	<ul style="list-style-type: none"> City (initially) and future revenue streams Potentially Provincial and Federal government climate action funding 	<ul style="list-style-type: none"> \$ loans/ annually \$ loans/ tCO₂e & /GJ of energy reduced from the baseline \$ loans/ \$ energy costs & /social cost of carbon saved
Municipal and community green bond assessment 2022-2023	<ul style="list-style-type: none"> Dedicated staff and potentially consultant time to develop a green bond program. This analysis can also evaluate the role of community bonds. 	<ul style="list-style-type: none"> Corporate Services Department 	Enabler	<ul style="list-style-type: none"> City 	<ul style="list-style-type: none"> \$ value of green bonds issued \$ value of community bonds issued

ACTION + TIMELINE	RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
Climate Change Reserve and long-term sustainable funding sources 2022-onwards	<ul style="list-style-type: none"> City Corporate Services Division. City Climate Office 	<ul style="list-style-type: none"> Multi-departmental climate change working group may need external expertise 	Enabler	<ul style="list-style-type: none"> City 	<ul style="list-style-type: none"> \$ loans/ annually \$ loans/tCO₂e/GJ (if applicable) Estimated climate impacts (if focusing on climate adaptation)

Innovating Our Industry

Industry, particularly the steel sector, is both a major part of the City’s economy and a main source of emissions. Some segments of the sector are already hard at work reducing their energy use in order to increase their competitiveness.

Increasing industrial efficiency and Industrial decarbonization

→ Industrial energy efficiency and decarbonization working group

The City and it’s partners will convene an industrial energy efficiency and decarbonization working (or ‘net-zero’) group.

In parallel to existing industrial sustainability-themed groups (e.g., HIEA and City-led Bayfront Industrial Strategy efforts), this working group will focus explicitly on coordination of and fast tracking short and long-term GHG reductions in alignment with the City’s targets, including advocacy, funding opportunities and project development.

→ Industrial energy efficiency and fuel switching pathways

In addition to encouraging the industrial sector to adopt net-zero targets, as the steel sector has done, most industries require support in developing a pathway for deep energy process efficiency improvements and fuel switching. These pathways could be developed with support from Provincial and Federal government agencies, the working group, post-secondary institutions, and utilities.

→ Establish a clean-tech accelerator

Building on the skills and expertise available at McMaster University, Mohawk College, and Redeemer University; the City and it’s partners, with support from the Provincial and Federal governments, can support the development of a clean-tech accelerator (potentially associated with or as an expansion of the existing McMaster Innovation Park). Not only would this help develop the technologies necessary for the sector’s decarbonization, it also increases the local skilled workforce.

→ Financing for industrial decarbonization

In order to support the sector’s transition, the City may explore the potential for creative financing tools.

→ Training Local Industrial Energy Managers

In order to support the sector’s transition, the City and it’s partners will need to work with local post- secondary institutions and trade unions to support their delivery of training and retraining industrial energy managers.

Table 5. Actions, partners, and resources required for changes to industry.

ACTION + TIMELINE	RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING + FINANCING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
Industry: Energy Efficiency and Decarbonization Working Group					
<p>1. Establish net-zero industrial working group</p> <p>2022- onwards</p>	<ul style="list-style-type: none"> Staff time from the Community Climate Advisory Committee City staff time as an observer, City liaison (20 hours/month) Industry staff time (as needed) Local utility staff time (ongoing) Post-secondary institution staff time (ongoing) 	<ul style="list-style-type: none"> Led by the Community Climate Advisory Committee City (build on the eco-industrial park recommended as part of the City's Bayfront Strategy) Industry (potentially via HIEA + Chamber of Commerce) Local utilities Post-secondary institutions 	<p>Enabler</p>	<ul style="list-style-type: none"> In-kind funding (City, industry, HIEA, utilities, post-secondary institutions) 	<ul style="list-style-type: none"> Annual reporting on industry GHGs and energy use Number of industrial partners with corporate sustainability plans that are harmonized with the community-wide net-zero target
Industry: Process Efficiency Improvements					
<p>1a) Development and deployment of a zero emissions industry program (a joint public and private sector initiative)</p> <p>2022-2024</p>	<ul style="list-style-type: none"> Net-Zero Industry Working Group (see above) Industrial energy management expertise (from a consultant or utility) 	<ul style="list-style-type: none"> Led by the Community Climate Advisory Committee Local utilities Industry (potentially via HIEA + Chamber of Commerce) City Provincial/federal governments Post-secondary institutions 	<p>GHG: High Equity: Low Emp: High Cost-effectiveness: TBD</p>	<ul style="list-style-type: none"> Provincial/ federal governments (e.g., NRCan CIPEC funding) Utility ratepayers (via existing energy conservation programs) Property Assessed Clean Energy (PACE) financing 	<ul style="list-style-type: none"> Program design GJ of energy saved and tCO₂e reduced against a baseline

ACTION + TIMELINE	RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING + FINANCING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
Industry: Establish a cleantech accelerator					
<p>2. Establish a cleantech accelerator</p> <p>2022-2026</p>	<ul style="list-style-type: none"> • City/ Community Climate Advisory Committee coordinate with post-secondary institutions to design an accelerator, and identify funding sources 	<ul style="list-style-type: none"> • Led by the Community Climate Advisory Committee • City • Post-secondary institutions • Federal government (likely via NRCan) • Provincial government • HIEA 	Enabler	<p>Provincial and Federal government (e.g., NRCan CIPEC funding)</p>	<ul style="list-style-type: none"> • Establishment of a cleantech accelerator
Industrial Energy Management Training					
<p>3. Expand local industrial energy management training programs (incl. subsidized opportunities for marginalized populations)</p> <p>2022-onwards</p>	<ul style="list-style-type: none"> • Canadian Colleges for Resilient Recovery • City to help coordinate with post-secondary institutions and HIEA 	<ul style="list-style-type: none"> • Led by the Community Climate Advisory Committee • Canadian Colleges for Resilient Recovery • City • Post-secondary institutions • Federal government (likely via NRCan) • Provincial government • HIEA • -BACCO 	Enabler	<p>Provincial and Federal government (e.g., NRCan CIPEC funding)</p>	<ul style="list-style-type: none"> • Number of trained/retrained industrial energy management professionals

Transforming Our Buildings

New Buildings

Although new buildings are projected to represent a relatively low share of GHG emissions in the City, new development represents long-term infrastructure that will establish patterns of energy use and GHG emissions for decades. Despite the limitations of municipal power to set building requirements that are more stringent than the Ontario Building Code, the municipality needs to create net-zero-aligned building standards or policy solutions as soon as possible, in order to avoid the need to retrofit new buildings in the near future. Action on this front should include lobbying the provincial government to strengthen the Ontario Building Code to align with net-zero construction standards by 2050.

Existing Buildings

In order to achieve net zero by 2050, the existing building stock in Hamilton will need to be decarbonized. This is a major undertaking because most buildings in the city are heated with natural gas and are energy inefficient (as compared to current best practices). Please note that the modelling contained within this plan only includes operational carbon; however, it is recognized that embodied carbon will also need to be considered when evaluating the carbon costs of individual building retrofits.

In order to decarbonize buildings in the most cost-effective manner with the smallest environmental impact, it is necessary to first maximize energy efficiency.

Many cities are exploring how to bring down the cost of mass deep energy retrofits, for example by revisiting the current utility-led delivery model as well as ordering equipment and undertaking retrofits in bulk. The City's proposed updates to the Commercial District Revitalization Grant Program offers 50% of the cost for commercial building owners in certain commercial districts to install EV chargers, some forms of renewable energy, or green walls or roofs.

The Bay Area Climate Change Council (BACCC) is currently working on advocacy and implementation recommendations to accelerate retrofits of privately-owned buildings via a Home Energy Retrofit Program. This also includes working with the Centre for Climate Change Management at Mohawk College towards the development of a sustainable business plan for a Home Energy Retrofit Delivery Centre to act as a 'one stop shop' and drive the uptake of renovations.

Improving equity in this sector involves targeting retrofits to social housing and delivering programs for low-income residents. In addition, equitable outcomes in employment can be increased by providing subsidized training and retraining programs for underemployed and historically marginalized community members.

The timeline of the retrofit strategy is as follows:

- 2022:** Undertake a detailed design study for a residential energy efficiency program to enable deep mass retrofits.
- 2022-onwards:** Ensure local skilled labour is being trained or retrained so that when the program is designed there is a local workforce ready to hit the ground running.
- 2023-2024:** Undertake a small-scale version of the project to test the business case model and address potential flaws in the concept. Target low-income or social housing.
- 2025:** Expand the program, with particular attention to portions of the population that would stand to benefit the most from reduced energy costs and improved comfort and air quality (among other benefits).

Table 6. Actions, partners, and resources required for changes to buildings.

ACTION + TIMELINE	RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING +FINANCING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
New Building Standards					
<p>4. Develop and integrate new green development standards</p> <p>(i.e., a stepped approach to net-zero, and DE-ready in appropriate zones) 2022-2023</p>	<ul style="list-style-type: none"> Dedicated staff time City advocacy to higher levels of government related to standards of construction (OBC) Funding for annual recognition/awards event for industry leaders 	<ul style="list-style-type: none"> Led by the City of Hamilton Consultant Canada Green Building Council Urban Development Institute Higher levels of government Technical support from cities with experience Clean Air Partnership Development community 	<p>GHG: Medium</p> <p>Equity: Enabler</p> <p>Emp.: High</p> <p>Cost-effectiveness: High</p>	<ul style="list-style-type: none"> City Potential for the future development of financial incentives for implementation. Expand tax-incremental financing program provided to the downtown core 	<ul style="list-style-type: none"> Energy and emissions intensity of new buildings (per sq/ft or m²) # of buildings achieving higher tiered standards or energy efficiency certification.
<p>5. Install solar PV on new buildings</p> <p>2022- onwards</p>	<ul style="list-style-type: none"> Zoning regulation updates to minimize barriers to solar PV Funding for incentive programs (potentially through the building retrofit program) 	<ul style="list-style-type: none"> Led by the City of Hamilton Canada Renewable Energy Association Local electricity utility Development community 	<p>GHG: Medium</p> <p>Equity: Enabler</p> <p>Emp.: High</p> <p>Cost-effectiveness: High</p>	<ul style="list-style-type: none"> Potential incentive programs for implementation Property Assessed Clean Energy (PACE) financing program for new construction 	<ul style="list-style-type: none"> MW installed of solar PV on new buildings

ACTION + TIMELINE	RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING +FINANCING SOURCE(S)	MEASURES (FOR MONITORING PROGRAM)
Existing Building Retrofits					
<p>6. Design and plan for a mass deep energy retrofit program (may include retrofit delivery centre)</p> <p>2022-2023</p>	<ul style="list-style-type: none"> • City staff oversight • Technical analysis: Consultant (up to \$200,000) • Municipalities and organizations working on this same challenge 	<ul style="list-style-type: none"> • Led by the Community Climate Advisory Committee • FCM • Clean Air Partnership • City • Local energy efficiency organizations (e.g., Green Venture) • Local utilities 	Enabler	<ul style="list-style-type: none"> • FCM • City 	<ul style="list-style-type: none"> • A completed detailed plan and business case analysis
<p>6a) Training and retraining programs</p> <p>2022- onwards</p>	<ul style="list-style-type: none"> • Canadian Colleges for Resilient Recovery • Community Climate Advisory Committee • Meeting with local training centres to ensure they are preparing for the coming jobs market 	<ul style="list-style-type: none"> • Led by the Community Climate Advisory Committee • Local colleges, universities, and training centres • Building industry • City • Labour and trade unions (e.g., HRAI) • City • Canadian Colleges for Resilient Recovery 	Enabler	<ul style="list-style-type: none"> • Colleges, universities • Provincial, federal government • Trade associations, construction industry 	<ul style="list-style-type: none"> • Skilled graduates and workforce trends.

ACTION + TIMELINE	RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING +FINANCING SOURCE(S)	MEASURES (FOR MONITORING PROGRAM)
<p>6b) Launch small-scale neighbourhood deep energy and emissions retrofit projects in the residential sector</p> <p>2022-2023</p>	<ul style="list-style-type: none"> • Program delivery organization • Dwelling owners willing to participate in pilot • Example funding for program: \$4 million (\$50k * 80 homes) • Rezoning approval (potentially) • Architects / designers • Supply chain analysis of heat pumps and solar PV 	<ul style="list-style-type: none"> • City • Construction / renovation/ energy efficiency industry • Canada Green Building Council / Passive House Institute Canada • Local utilities • Potentially a 3rd party, non-profit organization 	<p>GHG: Low Equity: Medium - High Emp.: High Cost-effectiveness: TBD</p>	<ul style="list-style-type: none"> • FCM funding for program start-up • Grant program from City budget • IESO + utility incentive programs • Funding from other levels of government • Suppliers of low-carbon technology (heat pumps, solar PV, electric hot water heater) 	<ul style="list-style-type: none"> • Small-scale program completion and public reporting • Energy use and emissions intensity over subsequent years, by sector
<p>6c) Finance and deliver mass deep energy retrofit program for the residential sector, scaling up to a city-wide program Consider the development of a commercial retrofit program</p> <p>2023 - onwards</p>	<ul style="list-style-type: none"> • Program delivery organization • City 	<ul style="list-style-type: none"> • City • Construction / renovation industry • Businesses / banks • Utility companies 	<p>GHG: High Equity: Medium - High Emp.: High Cost-effectiveness: TBD</p>	<ul style="list-style-type: none"> • Incentive programs from City • FCM funding • Property Assessed Clean Energy (PACE) financing • IESO + utility support via incentives • Provincial + Federal governments 	<ul style="list-style-type: none"> • Program completion and public reporting • Energy use and emissions intensity over subsequent years by sector • # of building retrofits completed through program.

Changing How We Move

The following are near-term transportation actions that are designed to first reduce vehicle kilometres traveled and then switch remaining VKTs to low and/or zero emissions energy sources.

Equitable outcomes are amplified when mobility (transit, active transportation, and e-mobility) is prioritized for historically marginalized communities. Mechanic training and retraining programs can also target low-income and under-employed individuals, further improving social equity.

Reducing vehicle kilometres traveled

→ Expand active transportation networks

Increasing active transportation is a priority for reducing transportation emissions; it offers many co-benefits, including improved physical health and increased social well-being. The City can expedite the roll out of its Cycling Master Plan and update future iterations of the Cycling Master Plan and other City-wide transportation planning documents to align with the CEEP active mode share targets.

→ Expand transit

Expanding transit helps reduce the need for personal use vehicles and also offers an important means of transportation for those who are not able to drive or access personal vehicles. This includes the development and expansion of higher-order transit modes within the City. The City has also been examining options to offer innovative transit solutions to its low-density rural areas via an on-demand pilot.

→ Develop e-mobility services

To address those trips that are not suited to transit or active transport, the City can support establishment and expansion of local e-mobility services such as e-car, e-bike, and e-scooter share businesses.

→ Limit parking and incentivize EVs.

The City can continue its efforts to reduce parking requirements for developments. Where parking spots are required, establish guidelines, requirements, and incentivize EV access. This includes through parking

regulations for new development.

Switching to zero-emissions vehicles

→ Decarbonize transit

The City has recently committed to transitioning its buses to RNG; however, as the following section on renewable energy highlights, there is a limited supply of sustainable RNG, and many potential end uses in the City that have limited low-carbon alternatives. Electric or green hydrogen-powered busses may be a more sustainable solution to decarbonizing transit.

→ Expand EV charging network

To encourage the adoption of EVs, an extensive EV charging network needs to be in place. The City can continue to situate charging stations on City-owned land, and partner with businesses and owners of multi-unit residential buildings to install charging stations in appropriate locations. A city-wide EV strategy will help to consolidate and coordinate all of these efforts.

→ Commercial fleet decarbonization working group

The City can accelerate the transition of private fleets by convening a working group to coordinate activities and share insights from implementing the City's net-zero-aligned Green Fleet Strategy. This also includes working with and supporting private fleet owners across the City to establish net-zero targets and identify obstacles and pathways to achieving those targets.

In doing so, the City can apply best practices from other jurisdictions, such as Michigan's Green Air Alliance Green Fleet Strategy, as well as the 2020 Multi-State MOU about low- and zero-emissions medium and heavy-duty vehicles, which has 15 state signatories.

→ Support the transition of automotive mechanics

The projected increase in EVs will require a new and/or retooled labour force. The City, local colleges, and professional trade associations should work together to develop a plan to train and retrain the mechanic workforce using an equity lens.

Table 7. Actions, partners, and resources required for transportation changes.

ACTION + TIMELINE	ACTION DETAILS + RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
Transportation: Active Transportation					
<p>7. Expand and connect active transportation networks</p> <p>2022-onwards</p>	<ul style="list-style-type: none"> • Complete long-range transportation modelling requirements to align with CEEP targets • Update active transportation planning documents based on updated modelling requirements and CEEP targets. 	<ul style="list-style-type: none"> • Led by the City of Hamilton • Third party active transportation providers 	<p>GHG: Low- Medium Equity: High Emp: High Cost-effectiveness: TBD</p>	<ul style="list-style-type: none"> • Development Fees • City Infrastructure Budget • Third party active transportation providers 	<ul style="list-style-type: none"> • Km’s of active transport links connected • Km’s of total cycling infrastructure and breakdown of type (e.g., new, upgrades, separated, etc.)
Transportation: transit					
<p>8. Decarbonize the bus fleet</p> <p>2022-onwards</p>	<ul style="list-style-type: none"> • Technical analysis of bus charging or fuelling infrastructure required for fleet decarbonizationLed by the City of Hamilton 	<ul style="list-style-type: none"> • Led by the City of Hamilton • EV or green hydrogen bus manufacturers • Neighbouring cities interested in bulk purchasing • Provincial/ federal government 	<p>GHG: Medium Equity: Potentially High Empl.: High Cost-effectiveness: High</p>	<ul style="list-style-type: none"> • City • Provincial/ Federal government 	<ul style="list-style-type: none"> • Number of decarbonized buses in use • Percentage of decarbonized vs. fossil-fueled buses • Completion of infrastructure requirement technical study
<p>9. Plan for and develop expanded urban and rural transit service and e-mobility services</p> <p>2022 - onwards</p>	<ul style="list-style-type: none"> • Update Transportation Master Plan and other City-wide transportation documents with CEEP modal split targets. • Support the establishment and expansion of higher-order transit 	<ul style="list-style-type: none"> • Led by the City of Hamilton • HSR • Metrolinx • Third party e-mobility service provider 	<p>Enabler</p>	<ul style="list-style-type: none"> • City • Provincial/ federal government • Third party e-mobility service provider 	<ul style="list-style-type: none"> • Transit ridership and modal split • Establishment of e-mobility service and user statistics

ACTION + TIMELINE	ACTION DETAILS + RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
Transportation: Personal and Commercial Vehicles					
<p>10. Establish then implement a city-wide EV Strategy (residential, commercial, and municipal)</p> <p>2022-2025</p>	<ul style="list-style-type: none"> • Consultant or City staff to develop the EV Strategy • Technical analysis and program design (incl. budget) 	<ul style="list-style-type: none"> • Led by the City of Hamilton • Local electricity utility • Local institutions • Consultant 	<p>GHG: Enabler Equity: Depends on charging fees Empl.: Medium Cost-effectiveness: TBD</p>	<ul style="list-style-type: none"> • City (initial EV Strategy development) • Local utilities • Businesses and building owners • Incentive program from City • Provincial / Federal governments • Developers 	<ul style="list-style-type: none"> • Charging station per km² • Kwh/day/month/yr at each station • # of networked station
<p>11. Commercial fleet decarbonization working group</p> <p>2022-onwards</p>	<ul style="list-style-type: none"> • Commercial and industry networking group to establish fleet decarbonization pathways and targets (for both large freight and smaller and medium-sized fleets) • Development of a barrier analysis and action plan. 	<ul style="list-style-type: none"> • Led by the Community Climate Advisory Committee • A network of businesses with significant large vehicle fleets • Auto sector • Chamber of Commerce • City 	<p>Enabler</p>	<ul style="list-style-type: none"> • In-kind from participating businesses 	<ul style="list-style-type: none"> • # of fleet decarbonization targets established • GHG reductions from decarbonization of member private fleets

ACTION + TIMELINE	ACTION DETAILS + RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
<p>12. EV mechanic training and retraining program</p> <p>2022-onwards</p>	<ul style="list-style-type: none"> Ensure college programs provide the necessary mechanic/electrician training/ retraining or upgrading Canadian Colleges for Resilient Recovery 	<ul style="list-style-type: none"> Led by the Community Climate Advisory Committee Local colleges and association groups Auto sector Canadian Colleges for Resilient Recovery 	<p>GHG: Enabler</p> <p>Equity: Depends on subsidies</p> <p>Empl.: Enabler</p> <p>Cost-effectiveness: Enabler</p>	<ul style="list-style-type: none"> College / Universities Canada Homebuilders Association Trade associations 	<ul style="list-style-type: none"> Number of trained/ retrained low-carbon transportation mechanics
<p>13. Limit parking in the downtown core and promote EV parking</p> <p>2022-2025</p>	<ul style="list-style-type: none"> Continue to decrease parking maximums to encourage less parking near downtowns/ eliminate the requirement for parking, and encourage the redevelopment of large parking lots Set requirements in the Zoning By-Law for EV priority parking with charging stations / differentiated parking fees 	<ul style="list-style-type: none"> Led by the City of Hamilton 	<p>Enabler</p>	<ul style="list-style-type: none"> City Budget 	<p>Number of EV parking space created</p>

Revolutionizing Renewables

Renewable electricity and renewable natural gas are essential to the City achieving its target of net-zero by 2050. In terms of electricity, either the Provincial electricity grid will have to decarbonize by 2050 or the City will need to increase local sources of renewable electricity. The remaining natural gas supply will need to be replaced with renewable natural gas (one recent study shared by Enbridge suggests this represents 6% of today's natural gas consumption¹) or green hydrogen (produced by renewable electricity).

Renewable Electricity

→ Build an electricity grid for the future

To achieve greater resilience and flexibility in the electricity grid the City will coordinate with Alectra, Hydro One, the IESO and the Province to streamline connections for solar PV, electric vehicles, and storage. Strategies can include targeted investments in the grid, streamlined application/permitting, and low-interest financing.

→ Land planning that supports solar array installations

The City can establish land planning by-laws that support the development of solar arrays in a manner that maximizes the beneficial uses of lands, for example appropriate rural lands, above parking lots, commercial and industrial buildings, while protecting lands that have other values such as agriculture and natural or cultural heritage value. This would also include completing an analysis of the electrical grid's transmission capacity to support these types of large scale projects.

→ Encourage local, alternative RE ownership structures

To maximize local economic benefits the City can support alternative renewable electricity ownership structures, such as cooperatives that maximize community benefits.

→ Advocate for a net-zero grid

The City can partner with other municipalities and community organizations to highlight the imperative for a zero-emissions provincial grid. For example,

after 26 municipalities advocated for the Province to phase out natural gas by 2030 the IESO is proposing to complete a feasibility study, showing that many municipal voices can lead to action.

Decarbonize + Expand District Energy

The CEEP includes a proposal to decarbonize and expand the downtown district energy system, via renewable natural gas (RNG) as well as industrial waste heat. This project represents a doubling of building space served by district energy as well as many co-benefits, including: local revenue, jobs, and energy cost-savings.

The Hamilton Chamber of Commerce has assessed the feasibility of using industrial waste heat and has identified 11 enabling policies that the City can implement.

Important research on integrated community energy is also being undertaken at McMaster university (e.g., see research by Dr. Cotton), and should be leveraged. The Hamilton Chamber of Commerce (HCC) and Hamilton Community Enterprises (HCE) have signed a Memorandum of Understanding to collaborate on a multi-year initiative to modernize and expand Hamilton's downtown district energy system.

A carbon-cutting priority is to unlock known opportunities to utilize industrial residual heat readily available across Hamilton's Bayfront Industrial Area as an energy source for heating and cooling buildings linked to new and existing thermal networks.

An initial stage in the gated process is to engage specialized third-party consultants to conduct a study. The study would help determine the technical feasibility and commercial viability of one or more community-facing district energy concepts selected in consultation with stakeholders.

Results would help inform whether to proceed with detailed engineering work that could begin as early as 2023.

The vision of decarbonizing space heating by expanding the footprint of Hamilton's district energy system, utilizing industrial waste heat as a low carbon fuel source is seen as a transformational project on the path to net zero.

¹ Torchlight Bioresources, Renewable Natural Gas (Biomethane) Feedstock Potential in Canada (2020), online: [www.enbridge.com/~/_/media/Enb/Documents/Media%20Center/RNG-Canadian-Feedstock-Potential-2020%20\(1\).pdf?la=en](http://www.enbridge.com/~/_/media/Enb/Documents/Media%20Center/RNG-Canadian-Feedstock-Potential-2020%20(1).pdf?la=en).

Local Biogas + RNG

Organic matter decomposition produces methane, a potent greenhouse gas. If captured, this gas can become a local source of energy and a sustainable alternative to natural gas. The City already has experience in biogas upgrading and renewable natural gas through projects at the Woodward Avenue Water Treatment Plant and the Glanbrook Landfill. The City can build on this success and experience to expand its biogas and RNG capacity.

→ Organic diversion + AD

In order to reach net-zero, as much organic waste as possible should be diverted from the landfill and used as feedstock for anaerobic digester (AD) systems, ideally a centralized system for multiple organic waste streams (to achieve economies of scale).

AD systems produce biogas that can be used onsite or refined into renewable natural gas and used locally (e.g. in buses, dump trucks, district energy systems), or injected into the natural gas system as a source of City revenue.

Table 8. Actions, partners, and resources required for renewable energy implementation.

ACTION + TIMELINE	ACTION DETAILS + RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
Renewable Energy: Solar and Wind					
<p>14. Develop a next generation electrical grid</p> <p>2022- onwards</p>	<ul style="list-style-type: none"> Coordinate a working group with Alectra, Hydro One, IESO, the Province, post-secondary institutions. City Staff Participation in working group. 	<ul style="list-style-type: none"> Led by the City of Hamilton City Council Alectra + Hydro One IESO Provincial government Post-secondary institutions 	Enabler	Utilities FCM	<ul style="list-style-type: none"> Long-term electricity plan aligned with a net-zero future and significant local electrification (e.g., the LRT, commercial and personal EVs, increased solar PV, fuel switching from natural gas furnaces to electric heat pumps, etc.) A simple and easy program for new connections to the electricity grid for solar PV and EV charging stations. Investment by Alectra, Hydro One, IESO, and/or the Province

ACTION + TIMELINE	ACTION DETAILS + RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
<p>15. Encourage development of local renewable energy cooperatives</p> <p>2022-onwards</p>	<ul style="list-style-type: none"> Including additional points in local renewable energy development RFPs for local renewable energy cooperatives Setting up workshops featuring renewable energy cooperatives from other Ontario cities (e.g., Toronto and Ottawa) Supporting the establishment of renewable energy cooperatives throughout the City 	<ul style="list-style-type: none"> Led by the City of Hamilton Local nonprofits committed to renewable energy Renewable energy cooperatives from other municipalities 	<p>Enabler</p>	<p>n/a</p>	<ul style="list-style-type: none"> Establishment of cooperatives MW installed by cooperatives Annual return on investment for cooperatives
<p>16. Implement strategic renewable solar energy installations</p> <p>2022-2025</p>	<ul style="list-style-type: none"> Develop criteria for strategic solar development sites (in partnership with local utilities and renewable energy developers) and identify lands that meet these criteria Focus on strategic sites (e.g., sites where land can be used for more than one purpose) RFPs for these strategic sites 	<ul style="list-style-type: none"> Led by the City of Hamilton Alectra + Hydro One IESO Developers Canada Renewable Energy Association Hamilton Chamber of Commerce 	<p>GHG: Medium Equity: Low Emp.: High Cost-effectiveness: High</p>	<ul style="list-style-type: none"> Community bond program Utility companies Infrastructure Canada Renewable Energy Developers 	<ul style="list-style-type: none"> MW of RE capacity installed kWh of RE supplied

ACTION + TIMELINE	ACTION DETAILS + RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
Renewable Energy: Biomass and Green Hydrogen					
<p>17. Technical feasibility study of expanded anaerobic digestion facilities</p> <p>2023-2025</p>	<ul style="list-style-type: none"> • Technical analysis: amount of wet organic waste supply in the City (building on work undertaken through the Renewable Energy From Organics Study) • Centralized site for digester 	<ul style="list-style-type: none"> • Led by the City of Hamilton • Ontario Clean Water Association • City (incl. Glanbrook Landfill) • Enbridge • Private waste collection and disposal companies 	<p>GHG: Low - Medium Equity: Enabler Emp.: TBD Cost-effectiveness: TBD</p>	<ul style="list-style-type: none"> • FCM • City • Enbridge 	<ul style="list-style-type: none"> • Completion of feasibility study
<p>18. Technical analysis of green hydrogen potential, costs, as well as actions to increase green hydrogen deployment in the City through the creation of a "hydrogen hub"</p> <p>2024-2025</p>	<ul style="list-style-type: none"> • Potential technical consultant • Community Climate Advisory Committee • City and or utility staff time 	<ul style="list-style-type: none"> • Led by the Community Climate Advisory Committee • Local utilities • City • Clean Tech Accelerator 	<p>GHG: High Equity: TBD Emp.: TBD Cost-effectiveness: TBD</p>	<ul style="list-style-type: none"> • Local utilities • City • Industrial partners • NRCan • FCM 	<ul style="list-style-type: none"> • Evaluation of a pilot project and strategy (e.g., cost-effectiveness, efficiency)

ACTION + TIMELINE	ACTION DETAILS + RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
Decarbonize and Expand Downtown District Energy System					
<p>19. Decarbonize and expand HCE downtown district energy system</p> <p>2023-2025</p>	<ul style="list-style-type: none"> Existing CHP facility Support ongoing work being undertaken by the Chamber of Commerce and Hamilton Community Enterprises related to modernizing and expanding the downtown district energy system 	<ul style="list-style-type: none"> Led by the City of Hamilton Hamilton Community Enterprises Hamilton Chamber of Commerce Local utilities Industry (potentially via HIEA) City 	<p>GHG: Medium</p> <p>Equity: Enabler</p> <p>Emp.: High</p> <p>Cost-effectiveness: Low</p>	<ul style="list-style-type: none"> City Hamilton Community Enterprises Hamilton Chamber of Commerce Industrial partners Utilities FCM Provincial &/ or federal government 	<ul style="list-style-type: none"> GJ of residual heat GJ of RNG tCO₂e avoided
Organics Diversion + Anaerobic Digestion					
<p>20. Technical + financial analysis for expanded organics collection and diversion</p> <p>2022-onwards</p>	<ul style="list-style-type: none"> City staff time (potential for consultant support) 	<ul style="list-style-type: none"> Led by the City of Hamilton Waste management companies 	<p>GHG: Medium</p> <p>Equity: Enabler</p> <p>Emp.: High</p> <p>Cost-effectiveness: TBD</p>	<ul style="list-style-type: none"> City 	<ul style="list-style-type: none"> Tonnes of organics diverted from landfill

Growing Green

Aligning Planning Policy

Land-use patterns can either enable people to adopt low carbon behaviours such as walking or cycling, or limit their ability to adopt such behaviours. In December 2021, Hamilton City Council adopted a ‘no urban boundary expansion’ pattern for future growth to 2051. While the final approval of Council’s decision has yet to be received from the Provincial government, the City is already on its way to strengthening its land use planning policy framework to support the significant increase in intensification development required to accommodate projected growth.

In addition to evaluating the GHG impact of intensification targets, the City can also require the integration of community energy/climate action policy directions into secondary plans. For new greenfield areas added to the City’s boundary in the future, community energy systems could also be considered as part of a separate component of planning. Considerations such as design for passive heating and cooling, shadow studies for solar PV, embodied carbon in materials,

dwelling size, connectivity of roads, proximity to and mix of destinations and others can be addressed at the level of the secondary plan.

Many of the factors which facilitate active transportation and reduced GHG emissions also contribute to equity outcomes, by reducing household “operational” costs such as transportation costs and utility bills, and therefore increasing affordability.

Carbon Sequestration

Increased sequestration from tree planting results in a relatively small reduction in GHG emissions but trees offer many co-benefits including reduced air pollution, improved wellbeing and enhanced ecological services such as water runoff management, amongst others. An ambitious tree planting program would build on existing City efforts, including the draft Urban Forest Strategy, as well as the efforts of the various conservation authorities and community organizations.

Improved agricultural soil management practices is another opportunity for carbon sequestration which can be examined in future CEEP updates.

Table 9. Actions, partners, and resources required for land use and carbon sequestration implementation.

ACTION + TIMELINE	RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
Equitable, smart, and compact communities					
<p>21. Review + update Official Plan to address climate change and energy policies (incl. enabling renewable energy policies, and other enabling policies for retrofits, new construction, etc)</p> <p>2022 - onwards</p>	<ul style="list-style-type: none"> Dedicated staff time 	<ul style="list-style-type: none"> Led by the City of Hamilton City Land developers Renewable energy companies 	<p>Enabler</p>	<ul style="list-style-type: none"> City 	<ul style="list-style-type: none"> Completion of an Official Plan review and update to apply a robust climate lens. % of new dwelling units within walking access (to be defined based on local transportation planning expertise) to transit, active transportation routes, green space.

ACTION + TIMELINE	RESOURCES REQUIRED	KEY PARTNERS	GHG REDUCTIONS BY 2050 & CO-BENEFITS	PRIMARY FUNDING SOURCE(S)	METRICS (FOR MONITORING PROGRAM)
<p>22. Integrate community energy/climate action policy directions into secondary plans</p> <p>2022 - onwards</p>	<ul style="list-style-type: none"> Dedicated staff time 	<ul style="list-style-type: none"> Led by the City of Hamilton 	<p>Enabler</p>	<ul style="list-style-type: none"> City 	<ul style="list-style-type: none"> Completion of Official Plan review related to secondary plan requirements Number of secondary plans integrating energy/climate action policy direction
Tree Planting					
<p>23. Set community-wide tree planting target of 50,000 trees per year and expand existing tree planting programs</p> <p>2022 - onwards</p>	<ul style="list-style-type: none"> Implement the recommendations of the Urban Forest Strategy A 5-year tree planting work plan Establish robust database and tracking mechanisms for both corporately- owned and privately-owned trees Partner with various external governmental and community organizations on tree planting initiatives 	<ul style="list-style-type: none"> Led by the City of Hamilton Conservation Authorities Temporary workforce Community Organizations 	<p>GHG: High Equity: High potential Emp.: High Cost-effectiveness: Low</p>	<ul style="list-style-type: none"> City, province, or federal governments Community Organizations Land Developers Conservation Authorities 	<ul style="list-style-type: none"> Number of trees planted

APPENDIX D: Base Year and Business-As-Planned 2016-2050 Energy and Emissions Report

December 2020

Contents

Introduction	64
Part I: BAP Energy and Emissions, 2016-2050	66
Demographics	66
Community Energy	69
Community Emissions	74
Buildings	77
Industry	82
Transportation Sector Energy	83
Transportation Sector Emissions	87
Waste Sector Emissions	88
Agriculture and Carbon Sequestration	90
Carbon Sequestration	90
Looking to the Low-Carbon Scenario	91
Part 2: Data, Methods, and Assumptions Manual	92
1. Summary	92
2. Accounting and Reporting Principles	92
3. Assessment Characteristics	93
4. Modelling	97
5. Scenario Development	102
Appendix D.1: Data Tables	105
Appendix D.2: Key BAP Assumptions	111
Appendix D.3: GPC Emissions Scope	121
Appendix D.4: Methodology for adjusting 2005 baseline energy use intensity targets relative to 2016 energy use intensities	125

Glossary

Baseline Year: the starting year for energy or emissions projections.

Business-as-planned (BAP): a scenario illustrating energy use and greenhouse gas emissions which aims to reflect current and planned policies and actions that are likely to be implemented.

Carbon dioxide equivalent (CO₂e): a measure for describing the global warming potential of a greenhouse gas using the equivalent amount or concentration of carbon dioxide (CO₂) as a reference. CO₂e is commonly expressed as million metric tonnes of carbon dioxide equivalent (MtCO₂e).

Cooling degree days (CDD): the number of degrees that a day’s average temperature is above 18°C, requiring cooling.

District energy: Energy generation within the municipal boundary that serves more than one building.

Emissions: In this report, the term ‘emissions’ refers exclusively to greenhouse gas emissions, measured in metric tonnes (tCO₂e), unless otherwise indicated.

Electric vehicles (EVs): an umbrella term describing a variety of vehicle types that use electricity as their primary fuel source for propulsion or as a means to improve the efficiency of a conventional internal combustion engine.

Greenhouse gases (GHG): gases that trap heat in the atmosphere by absorbing and emitting solar radiation, causing a greenhouse effect that unnaturally warms the atmosphere. The main GHGs are water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

Heating Degrees Days (HDD): number of degrees that a day’s average temperature is below 18°C, requiring heating.

Local electricity: Electricity produced within the municipal boundary and sold to the electricity system operator or used behind the meter.

Renewable Natural Gas (RNG): Biogas resulting from the decomposition of organic matter under anaerobic conditions that has been upgraded for use in place of fossil natural gas.

Sankey: a diagram illustrating the flow of energy through a system, from its initial sources to points of consumption.

Vehicle kilometres travelled (VKT): distance traveled by vehicles within a defined region over a specified time period.

GHG emissions

1 mtCO₂ = 1,000,000 tCO₂e

1 ktCO₂e = 1,000 tCO₂e

1 tCO₂e = 1,000 kgCO₂e

1 kgCO₂e = 1,000 gCO₂e

Energy

1 PJ = 1,000,000,000 J

1 GJ = 1,000,000 J

1 MJ = 0.001 GJ

1 TJ = 1,000 GJ

1 PJ = 1,000,000 GJ

Units of Measurement:

To compare fuels on an equivalent basis, all energy is reported primarily as petajoules (PJ) or sometimes as gigajoules (GJ) (a PJ is a million GJ). Greenhouse gas emissions are primarily characterized as Kilotonnes or megatonnes of carbon dioxide equivalents (ktCO₂e or MtCO₂e) (a Mt is a thousand kt).

- An average house uses about 100GJ of energy in a year
- 100 liters of gasoline produces about 3.5 GJ
- A kilowatt-hour is .0036 GJ
- A terawatt-hour is 3.6 PJ
- Burning 50,000 tonnes of wood produces 1 PJ
- A typical passenger vehicle emits about 4.7 metric tons of carbon dioxide per year.*

*Data provided by United States Environmental Protection Agency

Introduction

In 2019, Hamilton City Council declared a Climate Change Emergency with a target to have net-zero carbon emissions by 2050. The Community Energy and Emissions Plan is a critical part of the City's emergency response—it sets the path for getting to net-zero by 2050.

To support and inform the development of the plan, SSG and whatIf? Technologies have been contracted by the City of Hamilton to undertake energy and emissions modelling. This modelling has 2 stages:

1. The baseline and business-as-planned (BAP) scenario

A spatial energy use and greenhouse gas (GHG) emissions baseline (2016) profile for the City of Hamilton and the reference (or business-as-planned) projection for the community out to 2050.

2. The low-carbon scenario

A spatial energy and emissions reduction model that examines the impact of implementing low-carbon actions to reduce energy consumption and emissions in the city, including through improved efficiencies, local energy generation and fuel switching.

This report summarizes the technical modelling results for the first stage: Baseline and BAP. The BAP scenario aims to reflect current and planned policies and actions that are likely to be implemented.

The energy and emissions baseline and BAP scenario were developed using CityInSight; this tool will also be used in the second stage of modelling.

The GHG accounting framework in CityInSight applies the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC Protocol). The geographic boundary of Hamilton is the inventory boundary. The model’s scope is outlined in Appendix 2.

The remainder of this report is divided into three parts:

1. **BAP Energy and Emissions, 2016-2050**, includes the results and analysis of the baseline energy use and GHG emissions inventory for the year 2016 and the business-as-planned (BAP) scenario to the year 2050. (All energy use and emissions are described on a per year basis unless specified otherwise.)
2. **The Data, Methods and Assumptions Manual** outlines the CityInSight modelling methodology and the key assumptions driving the energy use and GHG emissions in the BAP scenario.
3. **Appendices** include all the relevant energy use and emissions data tables referred to throughout the report, a list of detailed assumptions applied in the BAP, and a table outlining the scope emissions captured in the model.

MAIN FINDINGS

Based on a series of assumptions regarding existing plans and policies that are likely to be in place through to 2050 (‘business-as-planned’ or BAP scenario), overall GHG emissions for the city are projected to increase by 10%.¹ However, on a per person basis, energy use and GHG emissions will decline by 28%, as Hamilton’s population is projected to increase by 53% over the period.

In a BAP scenario Hamilton’s 2050 GHG emissions will be far from its net-zero GHG emission target. If the total GHG emissions are divided by the projected population in 2050, each Hamiltonian will represent the equivalent of 11.2 tonnes of GHGs. As a whole, the City will emit 9.6 Mt CO₂e, up from 8.7 Mt CO₂e in 2016.

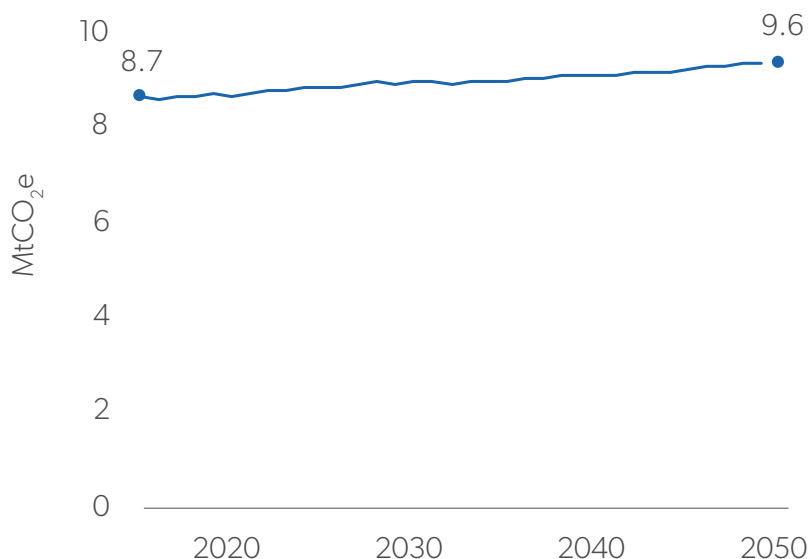


Figure 1. GHG emissions in Hamilton, 2016-2050.

¹A comprehensive Table of BAP Assumptions is provided in Appendix 2.

By examining the city’s energy use and GHG emissions in 2016 and then analyzing trends through to 2050 in the BAP scenario, it is possible to gain some insights about what is driving the city’s energy use and GHG emissions. This modelling and analysis provides a basis upon which the community can develop the policies and programs needed to work towards net zero.

As with most jurisdictions, energy use is the main driver of the city’s emissions, representing 98% of total GHG emissions. The remaining fraction is generated by organic waste, animal husbandry and fugitive emissions (i.e. methane leaks from the natural gas distribution system).

What is unique about Hamilton’s energy profile is the percentage of that energy which is used to power the industry (primarily steel): 60%. In terms of energy use, transportation is a distant second at 17%, followed by homes (13%) and then by the commercial sector (10%).

Analysis of the city’s carbon sequestration was also undertaken and it was found that a projected 314 ktCO₂e will be sequestered in 2050, mostly through urban and rural trees.

The major factors driving changes in energy use and GHG emissions in Hamilton through to 2050 in the BAP include:

- the city’s projected population and employment growth;
- growth in Hamilton’s fossil fuel-intensive industrial sector;
- An expected increase in electric vehicle ownership paired with increased vehicle fuel efficiency standards;
- A decrease in heating degree days due to a generally warming climate; and
- A marginal increase in fossil fuel use in the provincial electricity grid towards 2050.

Part I: BAP Energy and Emissions, 2016-2050

Demographics

POPULATION, HOUSEHOLDS, VEHICLES, AND EMPLOYMENT

Population and employment underlie many aspects of the modelling, including building and transportation needs, as well as waste production.

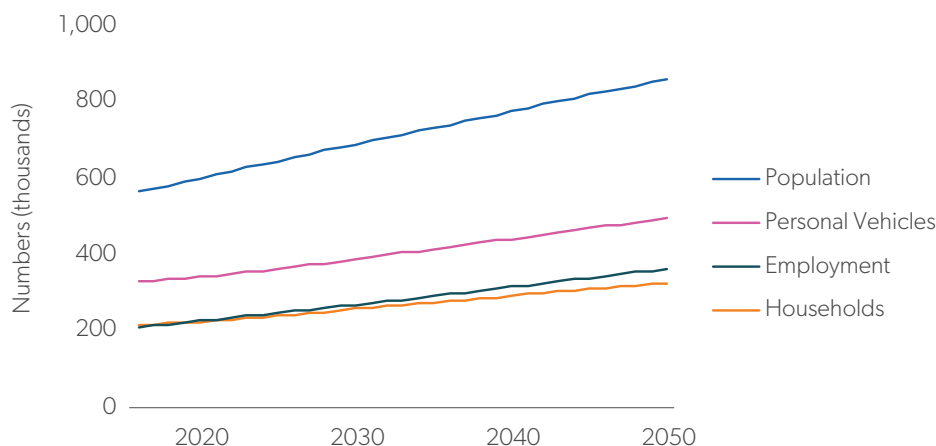


Figure 2. Projected population, personal vehicles, households, and employment 2016-2050.

A 53% population increase through to 2050 is projected in the BAP scenario, increasing from 561,918 in 2016 to 857,932 in 2050. This population growth is based on the City's projections (see Appendix 2) and a linear extrapolation of the City's projected population from 2041 to 2050 as population projection data out to 2050 was not available at the time of modeling.

This population growth is expected to result in a similar increase in households and personal vehicles (see Figure 2).

The City foresees a higher rate of employment growth, a 74% increase from 207,273 in 2016 to 361,502 in 2050. This drives increased commercial and industrial energy and emissions in the city.

Understanding how people and jobs are distributed within the city helps evaluate potential actions to decrease related emissions from transportation and buildings. For example, through land planning policies, transit, or local renewable energy generation.

The City has projected where these homes and jobs will be in space (by traffic zone) out to 2031, with draft estimates for 2041. This BAP model extends those trends out to 2050.

Figure 3 shows population density (people/hectare) by zone in 2016. Population density is clearly concentrated in the downtown and its surroundings.

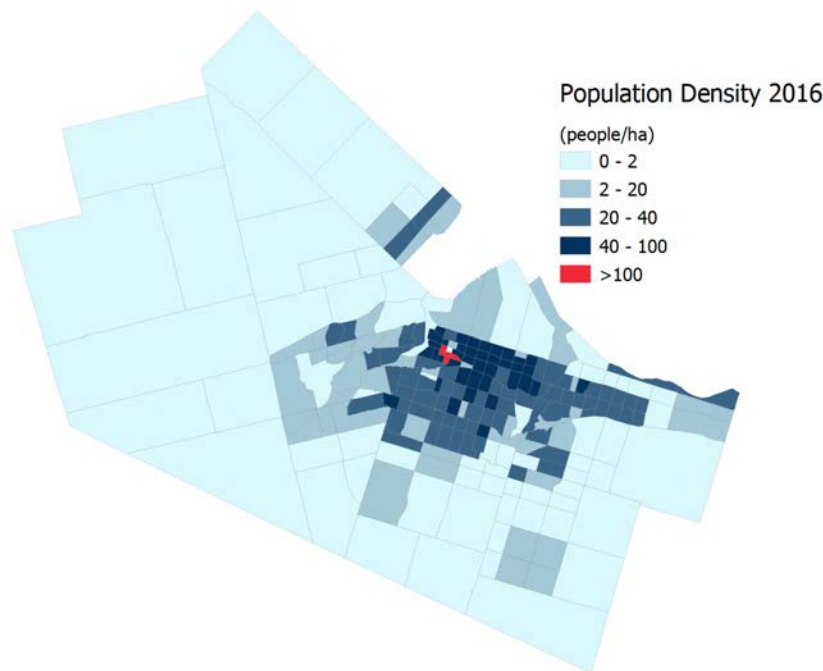


Figure 3. Population density in Hamilton in 2016, by traffic zone.

The increase in population density by 2050 is mapped in Figure 4. New population is projected to concentrate downtown, in strategic growth areas such as nodes and corridors, and as general intensification throughout the urban area. Additional growth at the periphery of the existing urban boundary may also occur, coinciding with potential future expansions of the urban boundary, and designated growth areas.

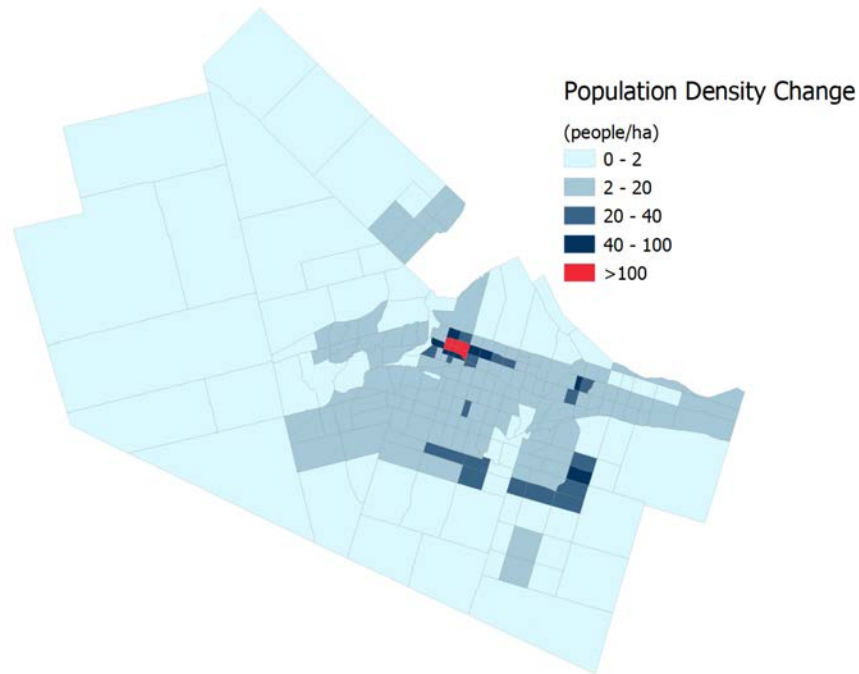


Figure 4. Population density change between 2016 and 2050 in Hamilton, by traffic zone.

In general, employment density (jobs/hectare) is located near the zones where the population is settled and this structure is mostly maintained as employment grows out until 2050 (see Figures 5 and 6). The downtown core is expected to see the largest job increases.

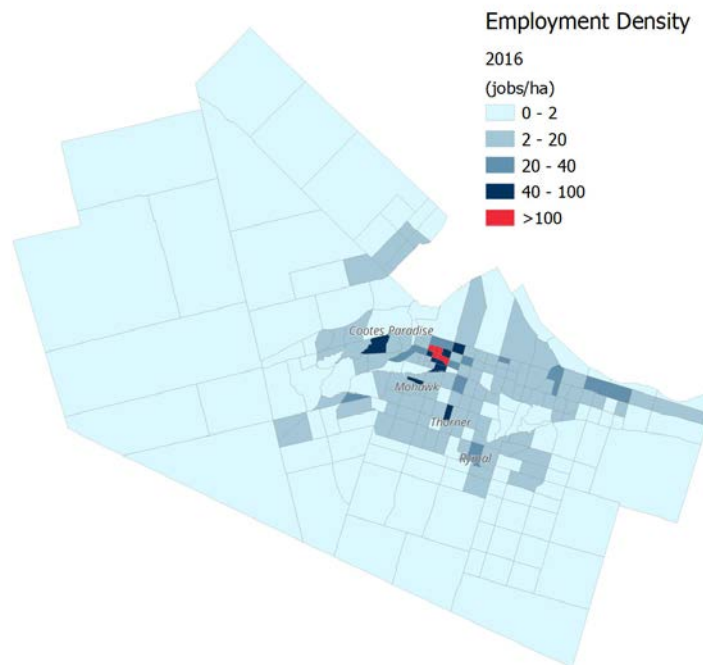


Figure 5. Employment density in Hamilton in 2016, by traffic zone. Cootes Paradise, Mohawk, Thorner, and Rymal neighborhoods are highlighted as employment hubs outside the downtown core.

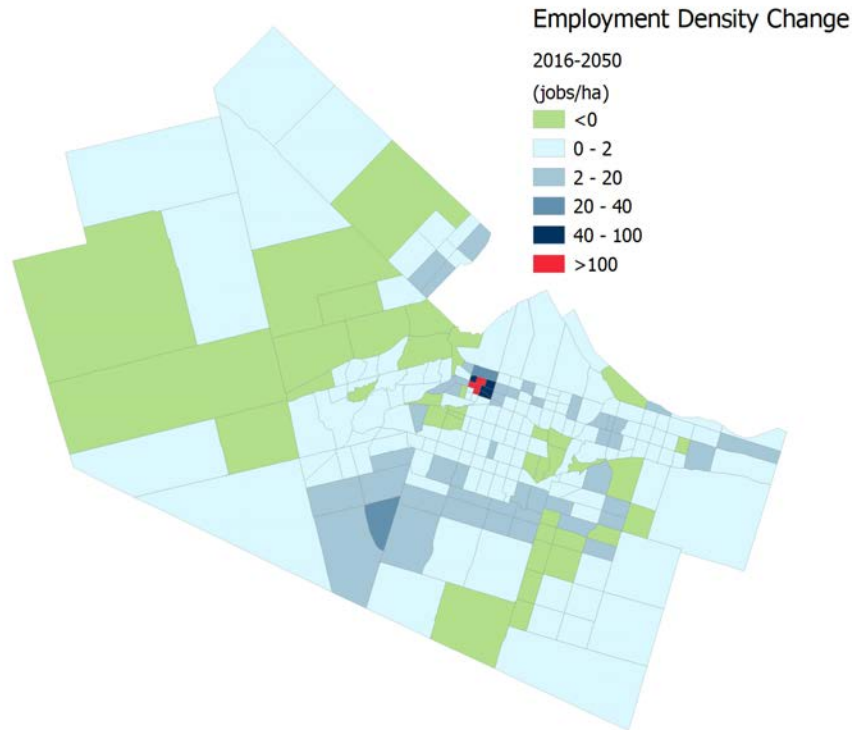


Figure 6. Employment density change in Hamilton, 2016-2050, by traffic zone. (Note: The maximum employment decrease projected for a zone does not exceed -0.32 jobs/ha).

Community Energy

ENERGY BY SECTOR

Community energy consumption for Hamilton is projected to increase by 9% in 2050, from 137 PJ in 2016 to 149 PJ.

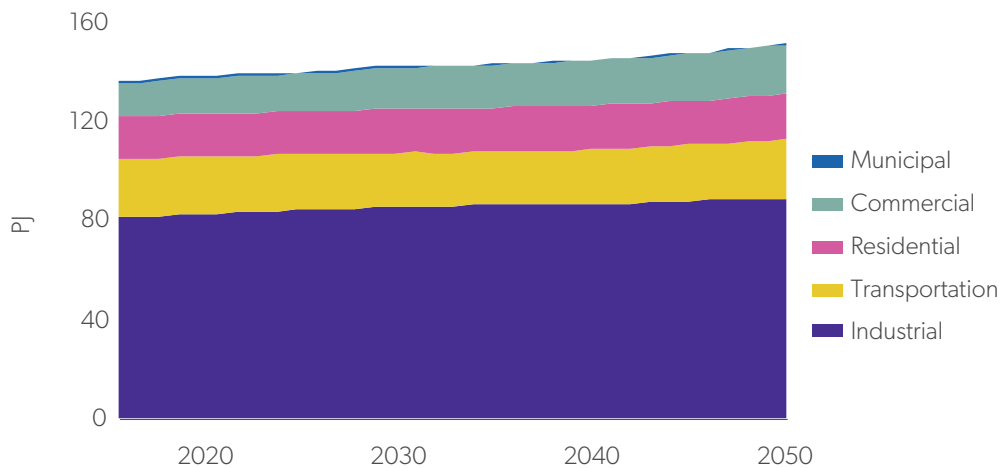


Figure 7. Projected BAP energy consumption (PJ) by sector, 2016-2050.

The majority of the increase in energy consumption is associated with the industrial sector, which is projected to increase from 82 PJ to 89 PJ. The next largest increase is in the commercial sector, which grows from 13 PJ to 19 PJ. Finally, the transportation sector is projected to increase from 23 PJ to 24 PJ (2%).

On the other hand, the residential sector energy consumption is expected to decrease from 17.7 PJ to 17.2 PJ in 2050 (-3%).

Buildings, industry and transportation sector energy use will each be examined in more detail below.

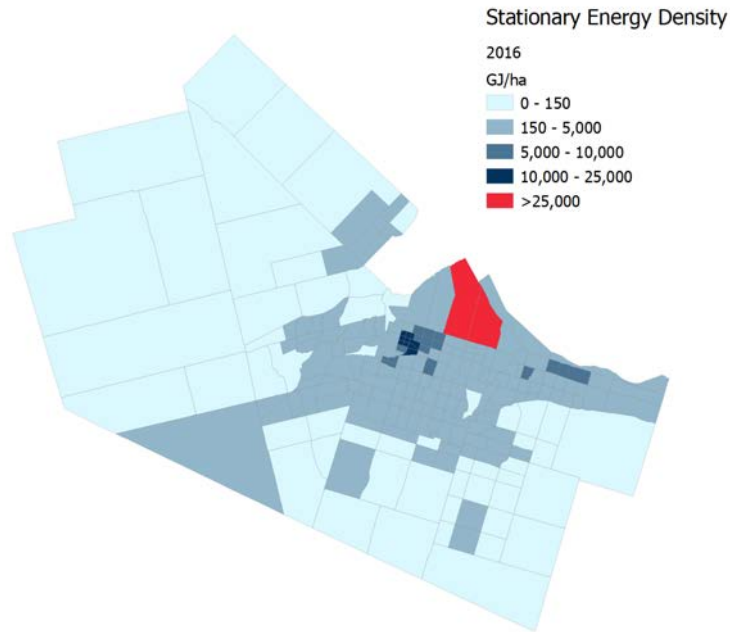


Figure 8. Stationary energy density in Hamilton (GJ/ha) in 2016, by traffic zone.

Geographically, energy density (TJ/ha) is concentrated in the industrial neighborhoods, and also around the downtown area and into the south-west (see Figure 8). Energy density is a critical factor for the economic feasibility of district energy systems, which can be powered renewably and produce local economic benefits. In the BAP, energy density patterns are projected to remain similar, with some increases in the downtown area, as seen in Figure 9.

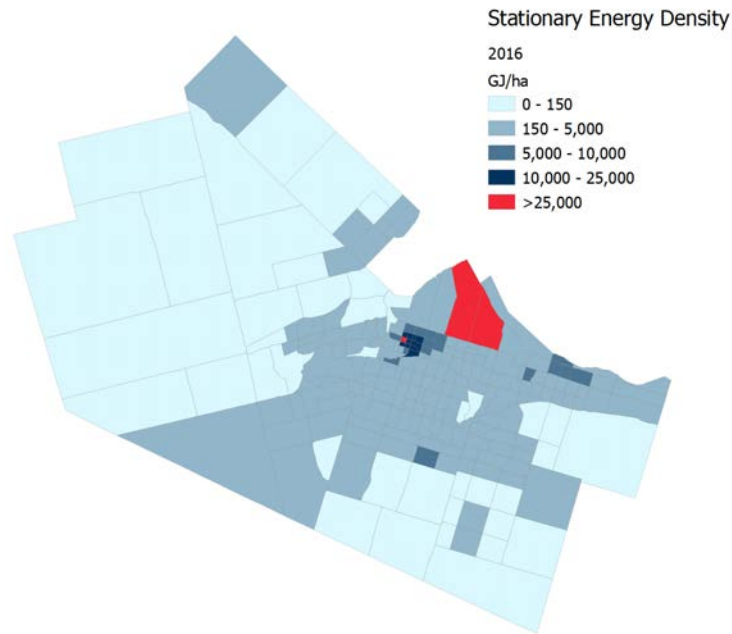


Figure 9. Energy density in Hamilton (TJ/ha) in 2050, by traffic zone.

Generally, population and employment growth drive energy use increases, offset by energy efficiency gains.

ENERGY BY FUEL

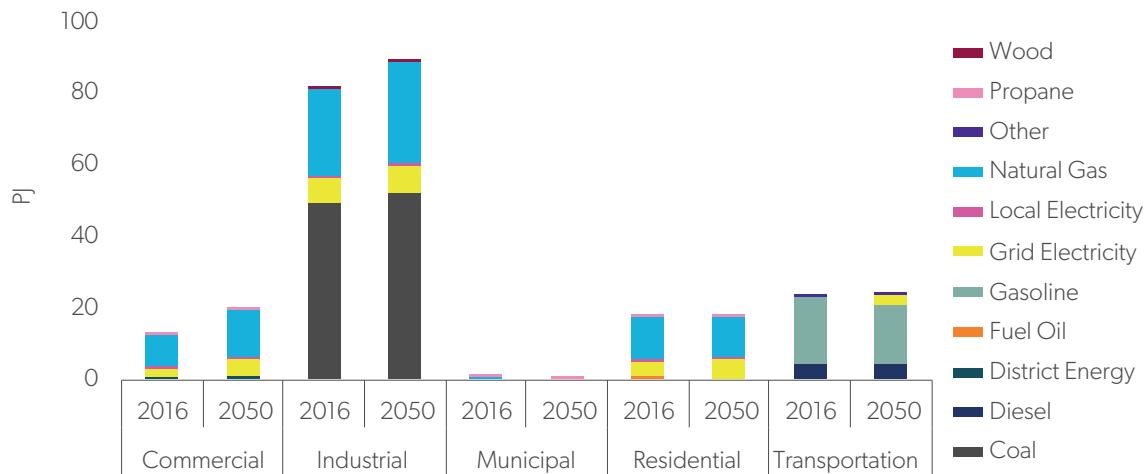


Figure 10. Projected BAP energy consumption (PJ) by sector and fuel, 2016-2050.²

The significant coal use seen in Figure 10 (49 PJ in 2016, up 6% to 52 PJ in 2050) is primarily due to Hamilton’s steel sector; coal use increases in parallel with the projected growth in the industrial sector.

² ‘Other’ includes geothermal, waste-heat, petroleum-coke, water storage, uranium, ethanol, biodiesel, renewable diesel, cold water, non-energy.

The largest increase in fuel use (41%) is seen with electricity, across all sectors. Its use is projected to increase from 15 PJ to 21 PJ. This growth is driven not only by population and employment growth, but also by the expected shift to electric vehicles, and the increased cooling demands of a warming climate. Natural gas use is expected to grow at a slower rate (12% from 47 PJ to 53 PJ), partly due to declining heating demands.

Gasoline reductions (19 PJ to 17 PJ) reflect the improved efficiency in the transportation sector described above.

Per Capita Energy Use

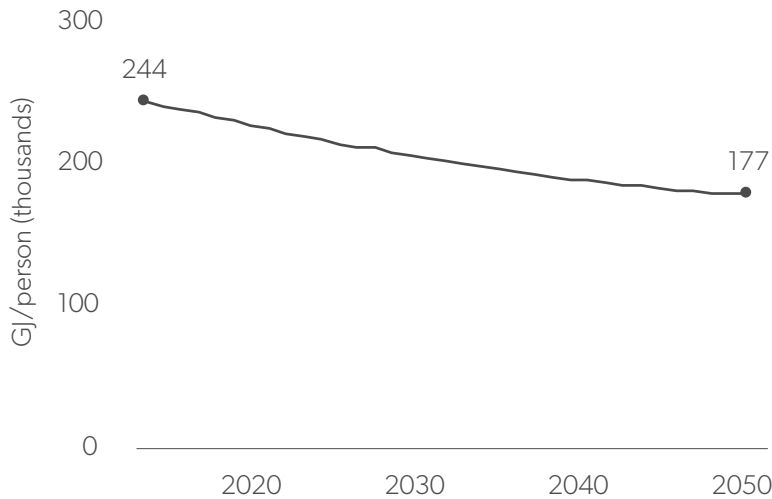


Figure 11. Projected BAP energy per capita (TJ/person), 2016 and 2050.

Per capita, each resident of Hamilton is projected to use 28% less energy in 2050. Energy use will fall from 244.2 GJ/person in 2016 to 175.3 GJ/person in 2050.

Refer to Table 1 in the Appendix for tabulated results of energy by sector and fuel.

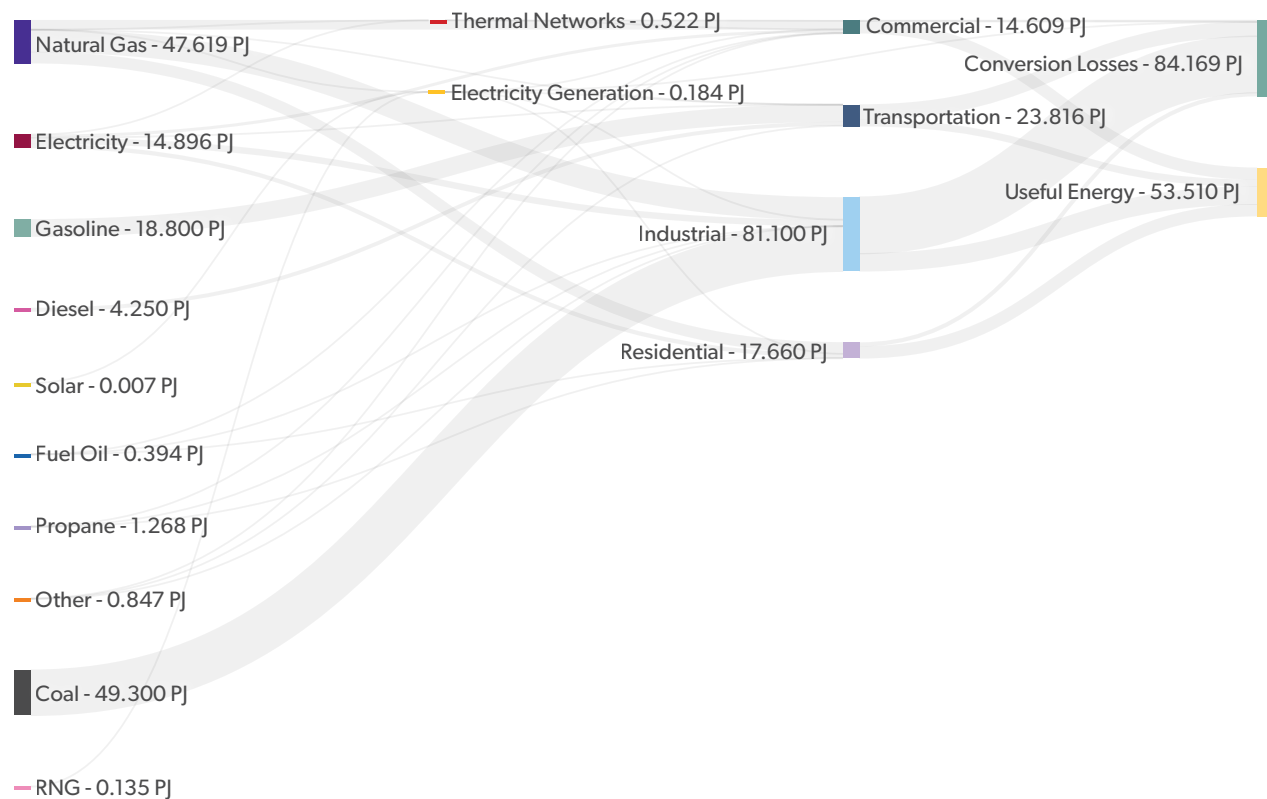


Figure 12. 2016 energy flows and conversions for the city.

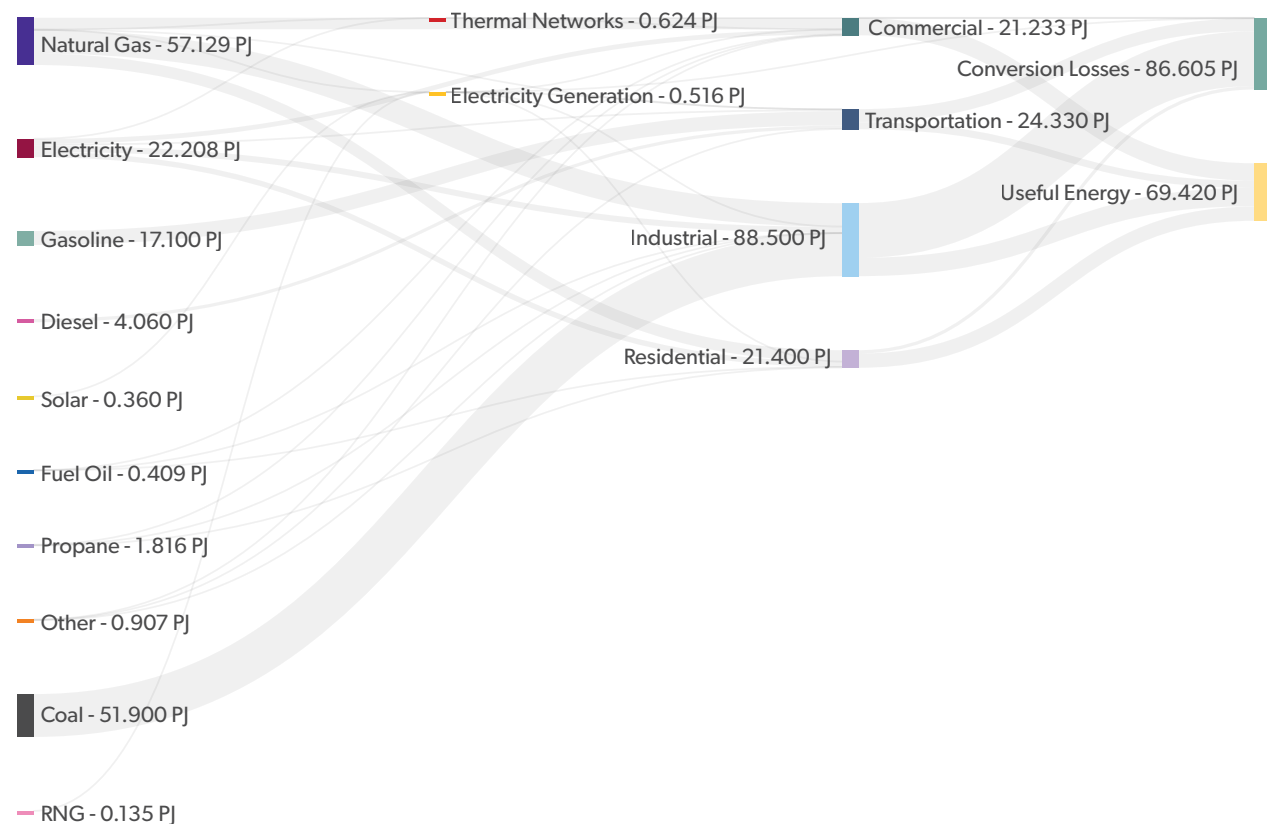


Figure 13. 2050 energy flows and conversions for the city.

ENERGY FLOW AND CONVERSION

Sankey diagrams are particularly useful at identifying opportunities for improved efficiency, as they clearly identify energy waste (i.e. conversion losses). The Sankey diagrams shown in Figures 12 and 13 depict the energy flow by fuel and sector through Hamilton in 2016, and in the 2050 BAP scenario.

In 2016, the conversion losses represented 61%, driven mostly by industrial processes that generate waste heat, and then by inefficient internal combustion engine vehicles and older, inefficient housing stock.

This percentage slightly decreases through to 2050 in the BAP, to 57%. This is due to increased electrification of buildings and transportation. This improved efficiency occurs despite the growth of highly inefficient fossil fuel combustion in the industrial sector.

Local Energy Production

In 2016, Hamilton produced just over 0.221 PJ of local energy (i.e. energy produced within city boundaries, whether in district energy systems or single building installations). This represents less than one percent of local energy demand.

Combined heat and power is treated as local energy generation, despite the fact that it is often fueled by the central power grid and natural gas distribution system. This explains how in 2016, 58% of local energy was generated by natural gas and 12% was generated from electricity procured from provincial distribution systems.

In 2016, almost a third of local energy was generated from renewable sources, primarily methane captured at the landfill and wastewater treatment plant (28%) and a small fraction from solar installations (2%).

In the BAP scenario, local energy generation is expected to increase to 0.689 PJ, driven solely by projected growth of solar installations, which end up representing almost 50% of local energy production. Notwithstanding this increase, in 2050 local energy still represents less than 1% of Hamilton's energy use.

Community Emissions

EMISSIONS BY SECTOR AND BY FUEL

Hamilton's greenhouse gas emissions are projected to increase 10% from 8.7 MtCO₂e in 2016 to 9.6 MtCO₂e in 2050.

The largest increase in emissions, 547 ktCO₂e by 2050 (i.e. the difference between annual emissions in 2016 and the projected annual emissions in 2050), is seen in Hamilton's industrial sector. The commercial sector is also projected to have a large increase in emissions, 315 ktCO₂e more in 2050 than in 2016. Projected employment growth drives increased emissions in both sectors, the larger industrial sector increase is due to its dependence on carbon-intensive coal.

The transportation sector is projected to see a decrease in emissions of 70 ktCO₂e through 2050. This results from fuel efficiency standards and expected incremental uptake of electric vehicles. Nonetheless, the sector remains Hamilton's second largest source of GHGs at 1.6 Mt CO₂e in 2050.

The residential sector sees its overall GHG emissions increased through to 2050 by 70 ktCO₂e compared to 2016 (a 10% increase), despite 53% population growth. In the commercial sector, efficiency improvements and reduced need for space heating do little to offset projected growth.

The above-noted trends are assessed in more detail in the Buildings, Industry and Transportation sections below.

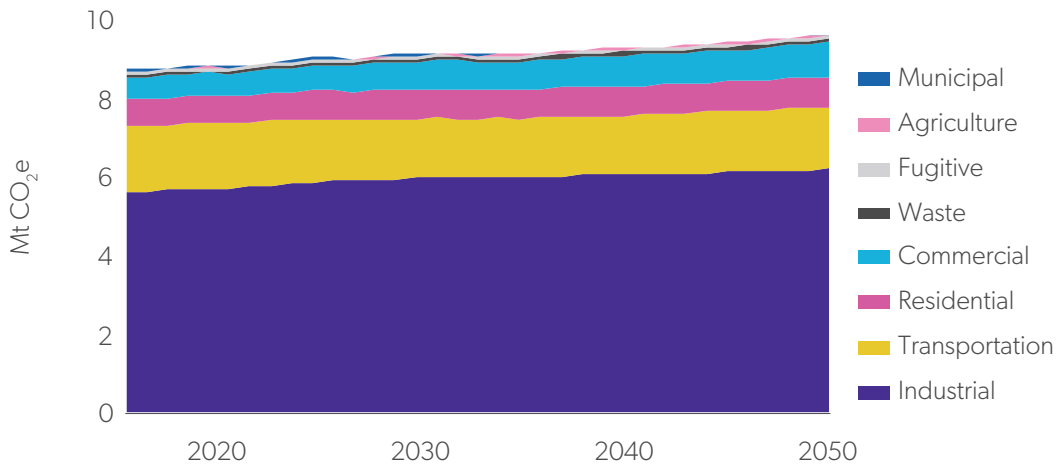


Figure 14. Projected BAP emissions (Mt CO₂e) by sector, 2016-2050

Of the city’s fuel use, grid electricity sees the largest GHG emissions increase, from 156 ktCO₂e/year in 2016 to 514 ktCO₂e/year in 2050. The electricity grid is expected to be more carbon intensive in 2050, and electricity use increases, for cooling and electric vehicles.

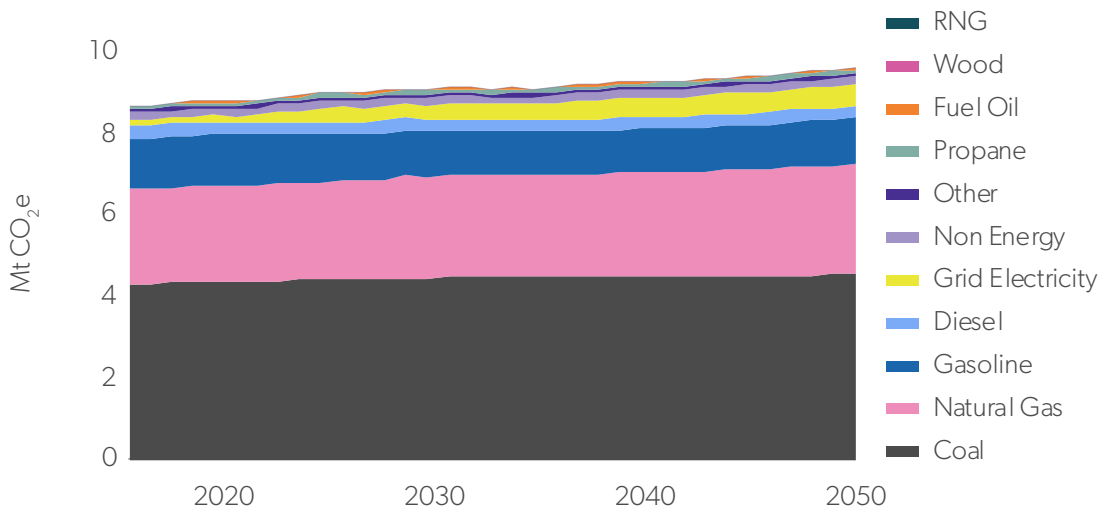


Figure 15. Projected BAP emissions (ktCO₂e) by fuel type, 2016-2050.

PER CAPITA EMISSIONS

Per capita emissions are projected to decrease 28% from 15.5 tCO₂e/person per year in 2016 to 11.2 tCO₂e/person in 2050.

Per capita GHG emissions vary widely from municipality to municipality. In 2016 Sudbury’s per capita emissions were 7.4 tCO₂e per year, Saskatoon’s were 12 tCO₂e, Thunder Bay’s emissions

were 11 tCO₂e/person, and Edmonton's were 19.6 tCO₂e/person. Edmonton and Sakatoon's per capita emissions are so high in large part due to their electricity system's reliance on coal. Thunder Bay's are high, despite the relatively clean Ontario electricity grid, because of the pulp and paper industry. Hamilton was on the higher side of this spectrum due to the steel manufacturing in the city, which is one of Canada's most carbon-intensive industries.

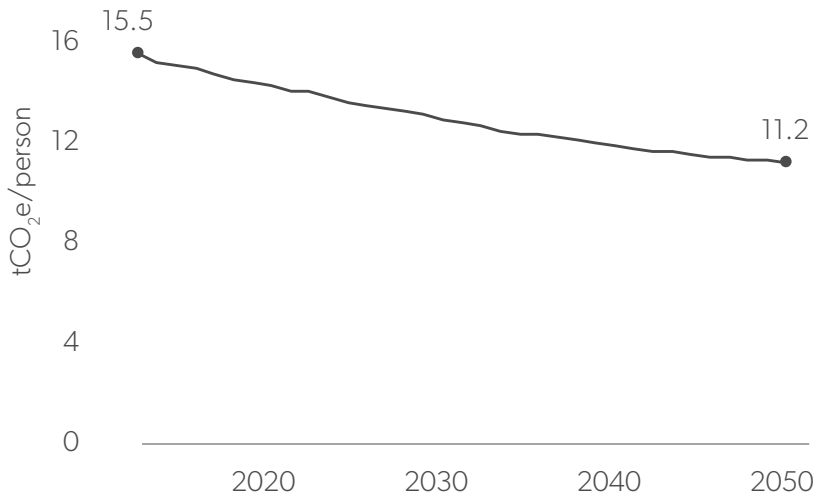


Figure 16. Projected BAP emissions per capita (tCO₂e/person), 2016-2050.

Refer to Appendix 1 for tabulated results of emissions by sector and fuel.

COMMUNITY EMISSIONS BY ZONE, 2050

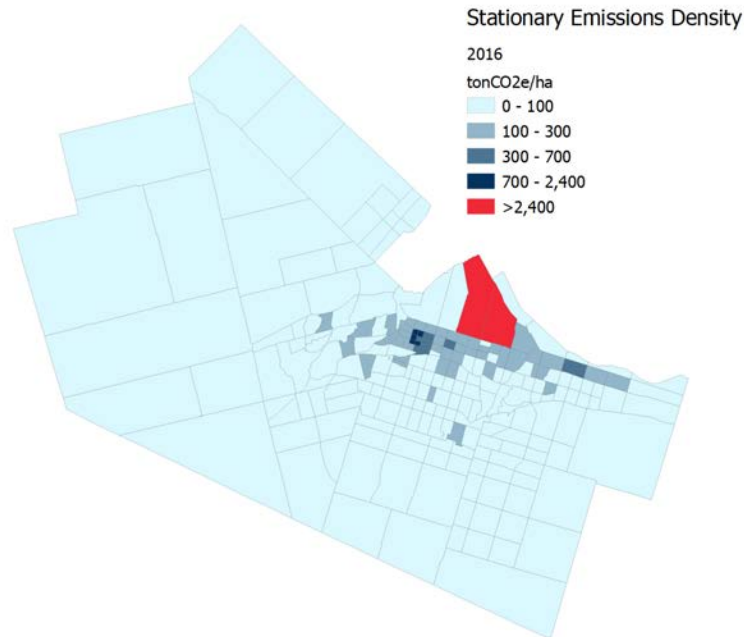


Figure 17. Stationary GHG emissions per hectare, by traffic zone, Hamilton 2016.

Figures 17 and 18 illustrate how GHG emissions from stationary energy consumption vary across Hamilton’s traffic zones in 2016 and in 2050. Here stationary energy consumption includes buildings, industry, and energy generation, as well as waste and fugitive sources.³

Similar to the community energy map, these maps highlight how GHG emissions in the inner areas differ greatly from the city’s outer and rural areas. Emission levels in inner areas reflect mixed-uses and the large industrial emitters, while outer areas mostly reflect residential emissions. GHG emissions are larger in the inner areas reaching more than 700 tCO₂e per hectare in some zones (see Figure 17).

In contrast, emissions are lower in the outer areas, relative to the rest of the city, due to lower density and newer housing stock that is more energy efficient. This distribution is likely to continue through 2050 with only minor changes in some zones.

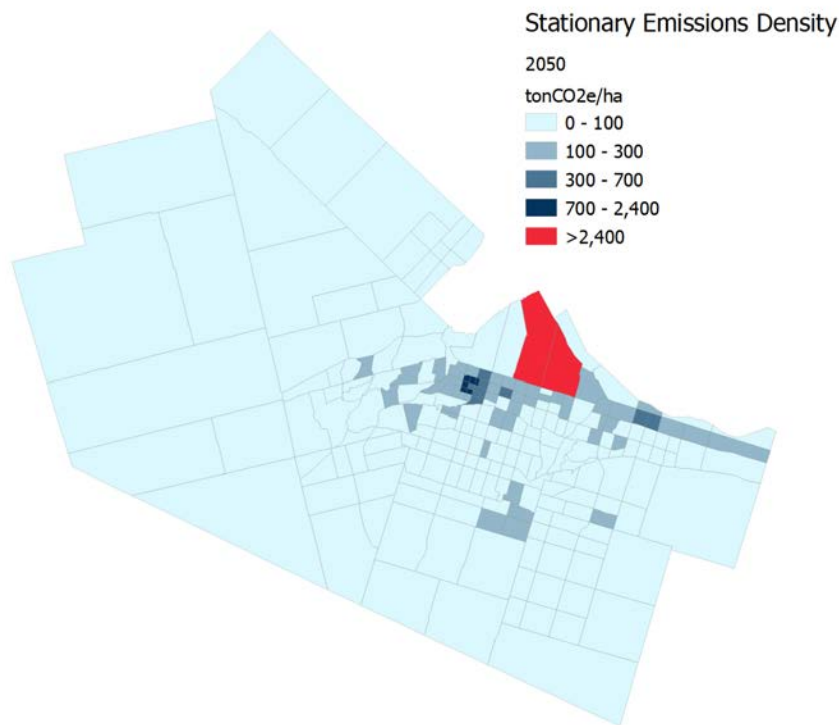


Figure 18. Stationary GHG emissions per hectare, by traffic zone, Hamilton 2050.

Buildings

BUILDING ENERGY USE

Hamilton’s buildings consumed 23% of the city’s energy in 2016, accounting for 32 PJ (shown in purple in Figure 19). This energy use is split between the residential, municipal and commercial sectors, with a higher energy profile for residential buildings.

³Waste and fugitive sources are only displayed on GHG emissions maps, not on energy maps, for an example, see Figure 8.

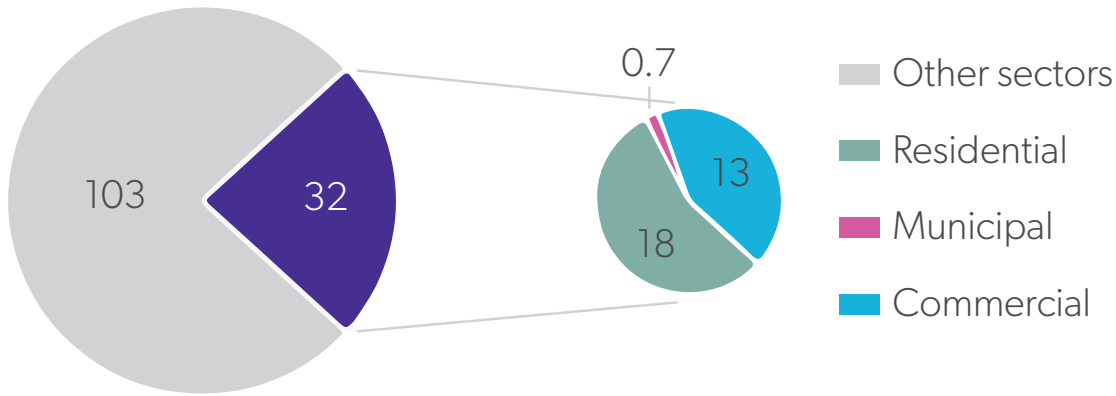


Figure 19. Overall city energy consumption in PJ in 2016. The purple portion represents building sector energy use.

Through 2050 in the BAP scenario, building energy use is projected to increase by 11%, to 36.6 PJ (see Figure 20). The main driver of this growth is commercial buildings, which are projected to increase their annual energy use by 42% in 2050 as compared to 2016. In contrast, energy consumption decreases by 3% in the residential sector.

Most notably, the municipal sector sees building energy use decrease by 53%. This projection is based on the City’s Corporate Energy Plan, and is indicative of the scale of energy efficiency potential in Hamilton’s broader building stock. This potential will be further explored in the Low-Carbon modelling scenario.

All buildings are projected to become more energy efficient, as older buildings undergo incremental retrofits and new buildings are subject to more stringent energy efficiency requirements. However, the residential sector is expected to see less floor space expansion than the commercial sector, and the commercial sector is also more energy intensive.

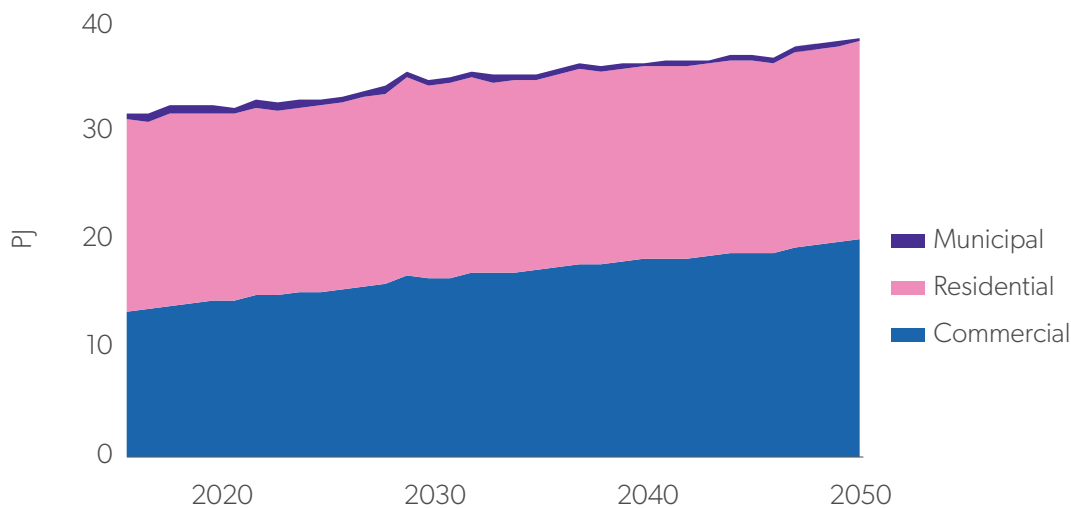


Figure 20. Projected BAP energy consumption for buildings (PJ) by sector, 2016-2050.

As shown in Figure 21, building sector fuel use in a 2050 BAP scenario is expected to see an increase in consumption of grid electricity (26% or 3.8 PJ), followed by natural gas (11% or 5.4 PJ). The relatively small increase in natural gas is partly due to the projected warming from climate change, which will reduce the number of days requiring building heating and increase the number of days requiring electric air conditioning.

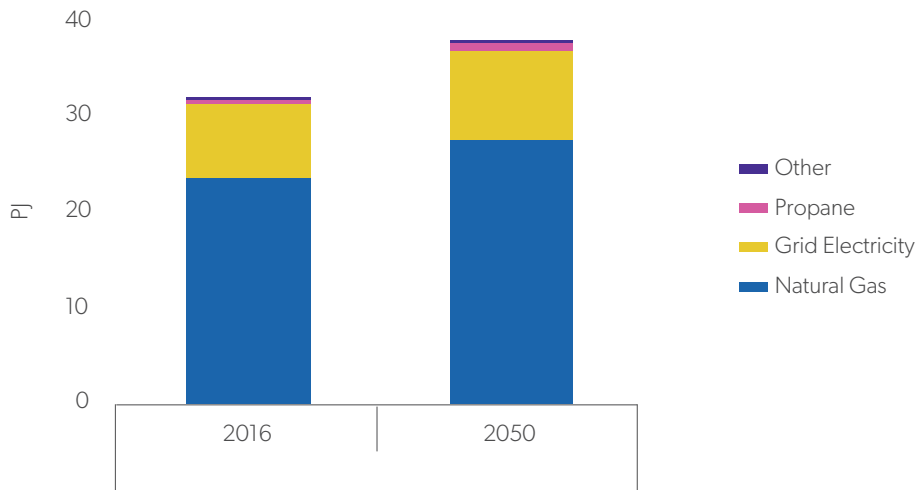


Figure 21. Energy consumption in PJ in 2016 and 2050, by fuel type.⁴

When broken down by sector (Figure 22), it is apparent that natural gas and grid electricity consumption is distributed similarly between commercial and residential buildings in 2016. The increase in buildings’ natural gas use by 2050 is driven by the commercial sector, whereas the growth in grid electricity consumption is explained by both the residential and commercial sectors.

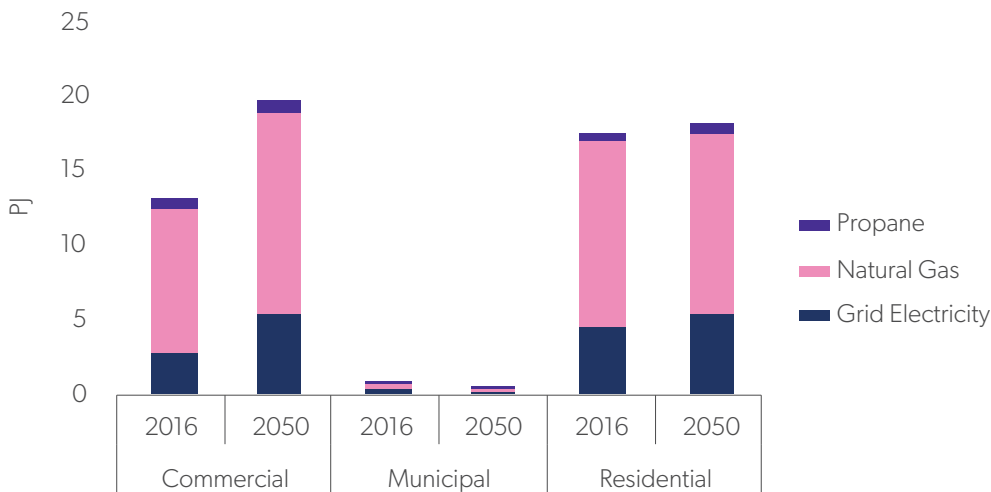


Figure 22. Energy consumption in PJ in 2016 and 2050, by sector and fuel type.⁴

As the number of households in Hamilton grows, it would be logical to expect total residential energy consumption to rise. However, each household is projected to use 36% less energy by 2050, due to incremental retrofits, increasingly stringent building codes and a warming climate. The chart below shows the relatively constant growth in households (orange line) and decrease in household energy intensity expected in the BAP through to 2050.

⁴ ‘Other’ includes district energy, fuel oil, and local electricity.

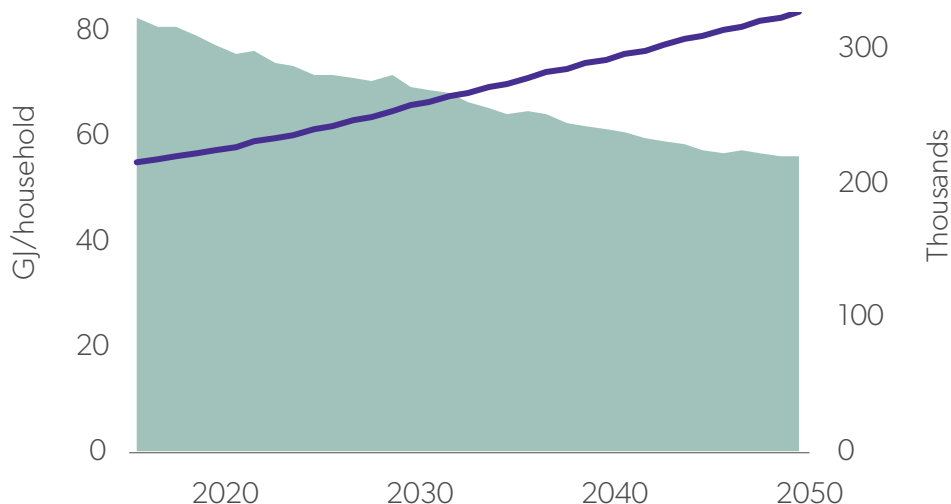


Figure 23. Average household energy intensity (GJ/household) compared with the number of households, 2016-2050.

Space heating is the building sector’s largest energy end use. In the residential sector the second largest energy use is water heating, whereas in the commercial sector, the largest end-use source is plug load, followed by lighting and cooling.

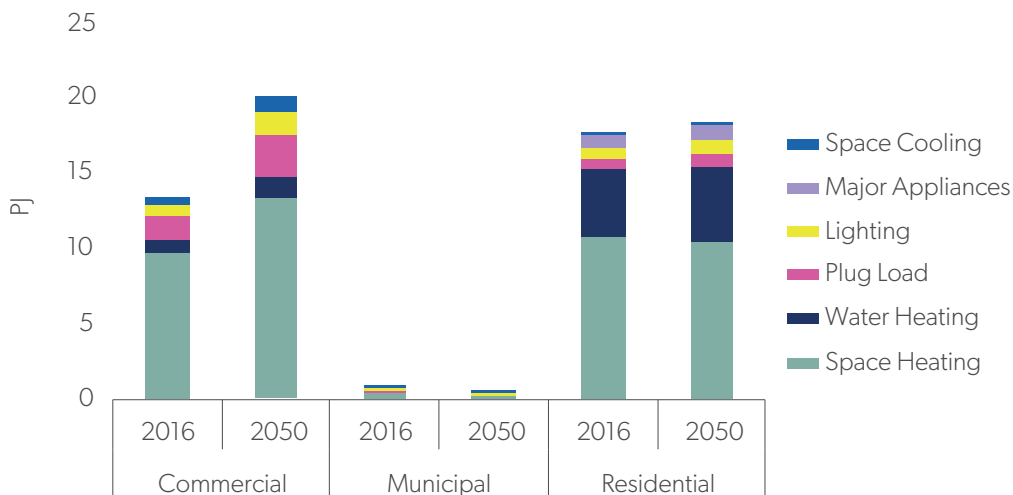


Figure 24. Building energy consumption for 2016 and 2050 (PJ), by end use and sector.

BUILDING EMISSIONS

Similar to energy use trends, GHG emissions from buildings are expected to increase by 29%, from 1.4 MtCO₂e in 2016, to 1.8 MtCO₂e in 2050. This growth is again driven primarily by the commercial sector, which increases its emissions by 56%, being responsible for 53% of all building emissions in 2050, compared to 44% in 2016.

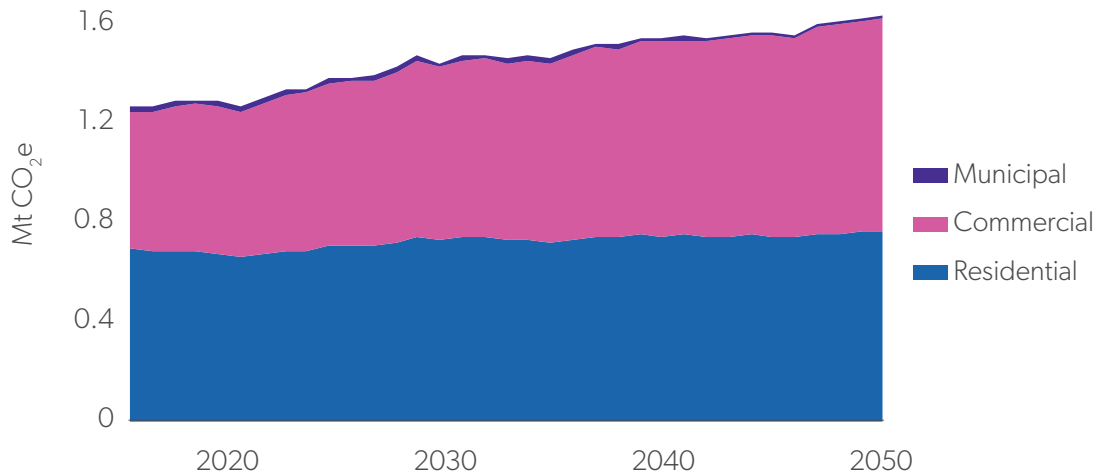


Figure 25. Buildings GHG emissions projection, 2016-2050 (MtCO₂e), by sector.

When analyzing this sector’s GHG emissions by fuel type, electricity from the grid accounts for a smaller share of the total emissions, as it is primarily produced by non-fossil fueled energy sources.

Space heating has the highest share of emissions by end use in the residential sector, followed by water heating. Plug load and space cooling have a higher presence in the commercial sector, however, much lower than its end use shares represented in terms of energy.

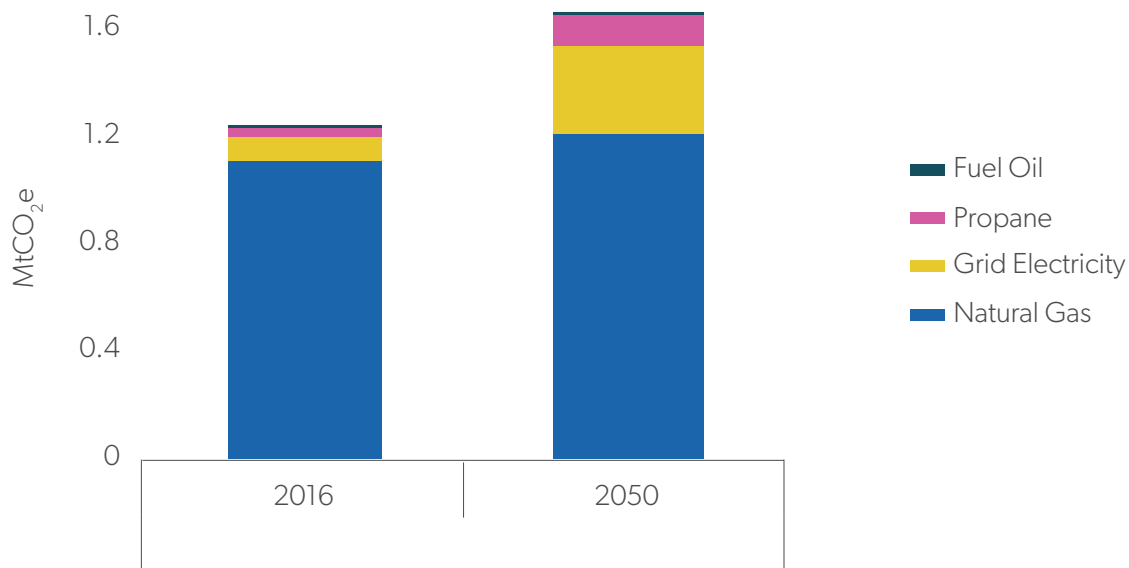


Figure 26. Buildings GHG emissions in 2016 and 2050, by fuel type (Mt CO₂e).

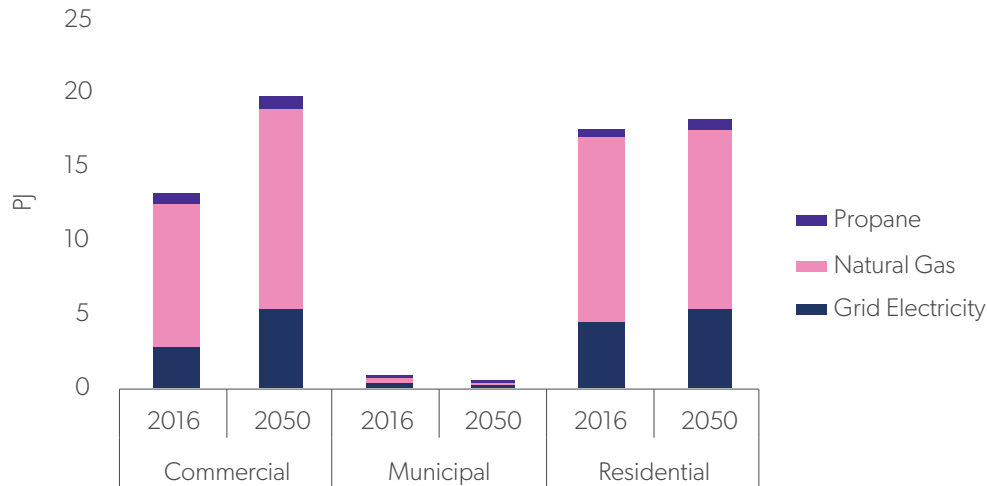


Figure 27. Buildings GHG emissions for 2016 and 2050 (Mt CO₂e), by end use and sector.

Industry

INDUSTRY ENERGY USE

In 2016, 60% of the city’s total energy consumption was due to industrial processes, accounting for 82 PJ. Steel is the sector’s largest consumer of energy and source of emissions. Steel manufacturing relies on burning fossil fuels, primarily coal and natural gas.

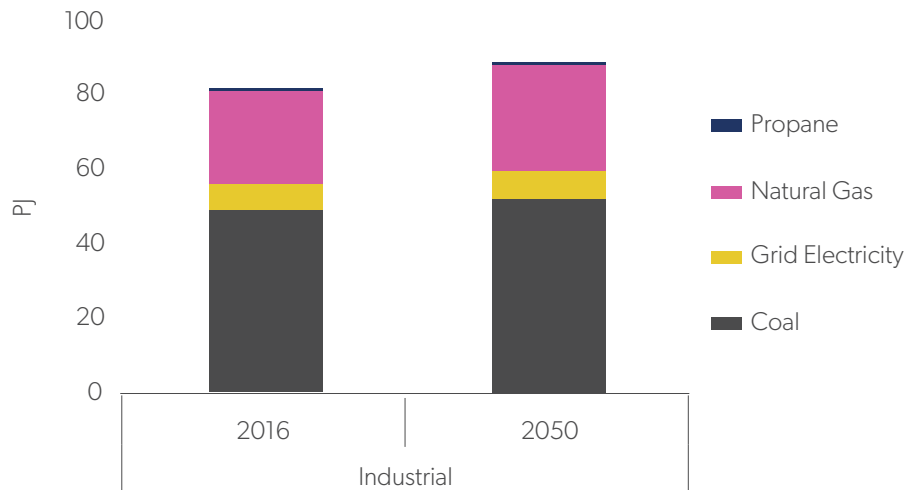


Figure 28. Industrial energy consumption in 2016 and 2050, by fuel type (PJ).⁵

In 2050, industrial process energy use is expected to ramp up 9% with respect to the base year, reaching 87 PJ and maintaining a similar fuel share. Energy use in the industrial sector increases in proportion to employment. In a BAP scenario, by 2050, energy consumption in the industrial sector accounts for 60% of Hamilton’s total energy consumption.

⁵ Other’ includes diesel, propane, local electricity, district energy, wood, geothermal, waste-heat, petroleum-coke, water, storage, uranium, ethanol, biodiesel, renewable diesel, cold water, and fugitive emissions.

INDUSTRY EMISSIONS

In the BAP scenario, industry emissions are projected to increase by 10%, going from 5.6 MtCO₂e in 2016 to 6.1 MtCO₂e in 2050. It is apparent that coal is the primary source of this sector’s emissions. Coal is used to produce extreme heat in steel smelters.

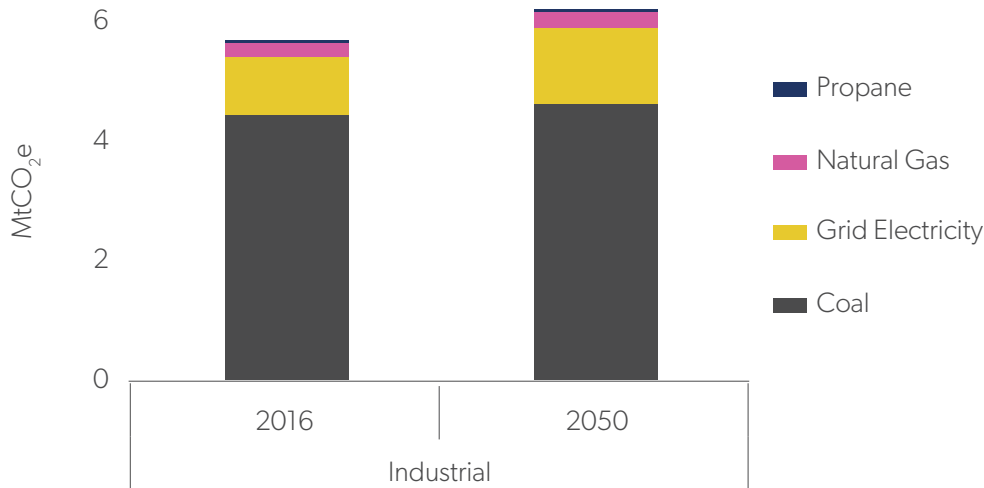


Figure 29. Industrial CO₂e emissions in 2016 and 2050, by fuel type (MtCO₂e).⁶

Industry is expected to represent 64% of Hamilton’s GHG emissions in 2050

Transportation Sector Energy

TRANSPORTATION ENERGY BY FUEL AND VEHICLE TYPE

In 2016, approximately 17% (23.3 PJ) of Hamilton’s energy use occurred in the transportation sector, which includes cars, trucks, transit, rail, and marine in this energy analysis (see Part 2 for more on how transportation energy and emissions are allocated to the city).⁷

Passenger vehicles, including cars and light trucks account for 70% of that total. By 2050, overall transportation energy use increases by 2% to 23.7 PJ. This is due to fuel efficiency improvements and incremental uptake of electric vehicles.⁸

The map in Figure 30 shows the distribution of total vehicle kilometers traveled by personal vehicles, by zone, for Hamilton in 2016. The highest values are concentrated near the boundaries of the urban area, and also near the external rural boundary. In these zones residents need to travel longer distances to work and other essential services.

VKT are projected to increase in 2050, intensifying travels near rural and urban boundaries, but also in inner areas, even in and around downtown (see Figure 31). However, as will be shown below, this significant increase in VKT does not result in an equivalent increase in energy or emissions.

⁶ ‘Other’ includes wood, fuel oil, and propane.

⁷ Aviation fuels are only included in the emissions analysis.

⁸ In the BAP scenario, a modest 14% uptake of electric vehicles is assumed. This reflects the decreasing cost of EVs and subsidies for purchasing EVs being made available by the federal government.

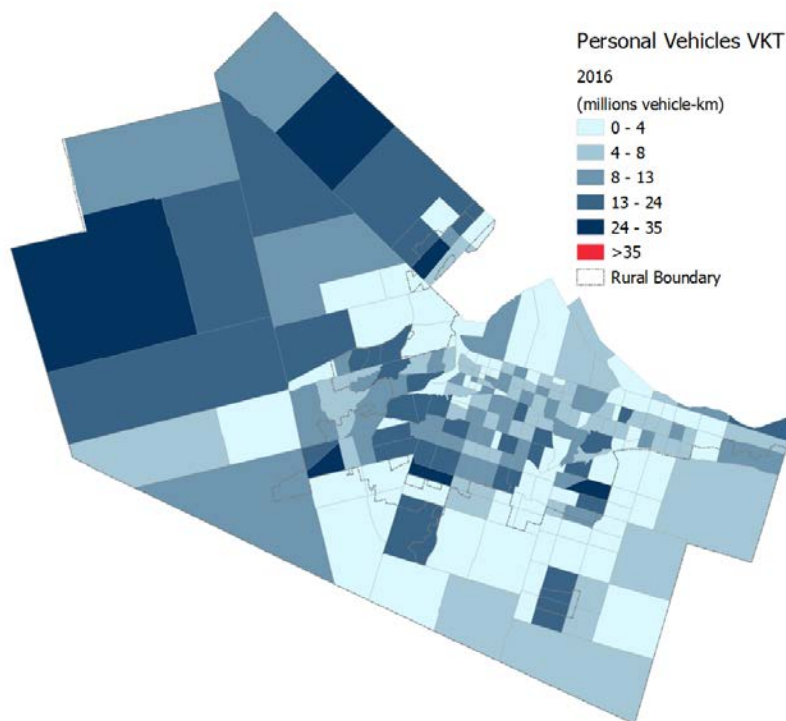


Figure 30. VKT for personal vehicles in Hamilton (millions vehicle-km) in 2016.

Gasoline is the primary fuel source for transportation energy in 2016, accounting for 81% of the sector’s energy use, but gasoline is projected to fuel a smaller portion of transportation energy by 2050, accounting for 73% of total energy use. Electric vehicles and charging are anticipated to grow by 2050, from less than 1% of transportation sector energy use in 2016 to 10% in 2050.

There is a noted decline in energy demand in the on-road transportation sector between 2016 and 2035. This is primarily as a result of the projected fuel efficiency standards for vehicles assumed in the BAP, rather than a decrease in vehicle kilometres travelled (VKT). Vehicle fuel consumption rates in the BAP reflect the implementation of the U.S. Corporate Average Fuel Economy (CAFE) fuel standard for light-duty vehicles and phase 1 and phase 2 of EPA HDV fuel standards for medium- and heavy-duty vehicles.⁹

⁹ On March 31, 2020, the U.S. replaced the CAFE standards with less stringent fuel efficiency standards. To date the Federal Government of Canada has not followed course on these reduced standards.

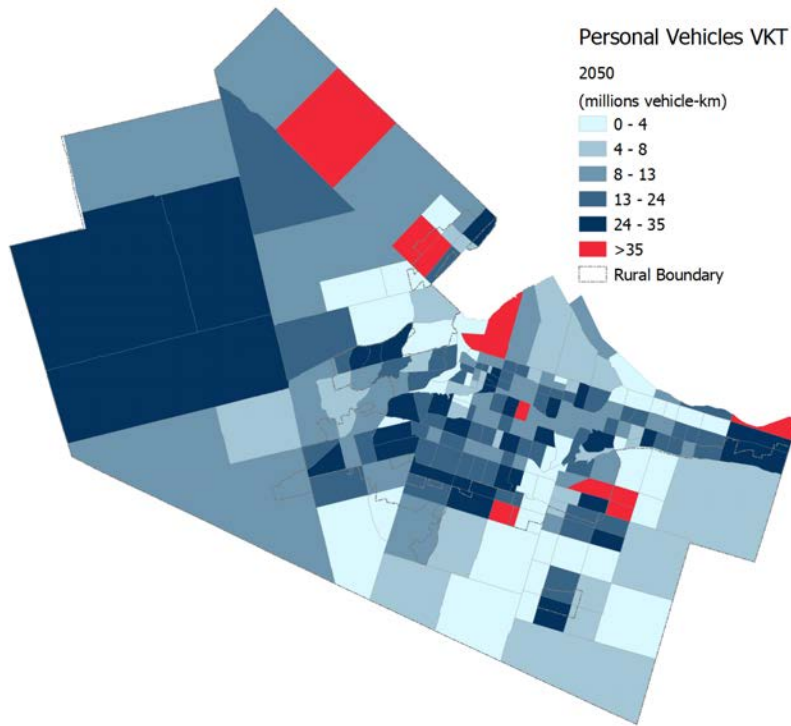


Figure 31. VKT for personal vehicles in Hamilton (millions vehicle-km) in 2050.

No changes in marine and rail transportation traffic or efficiency were assumed in this BAP scenario.

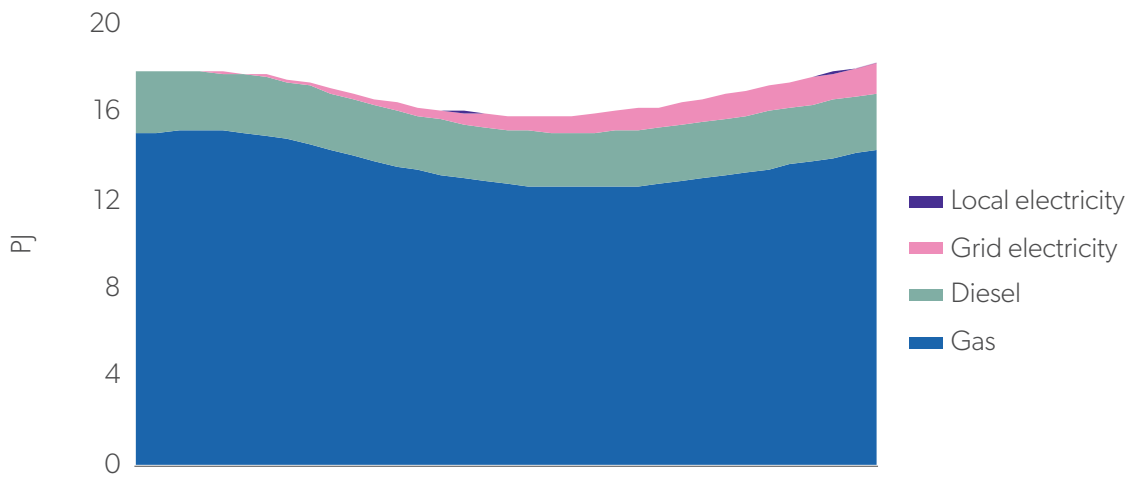


Figure 32. Projected BAP transportation energy use (PJ) by fuel, 2016-2050.¹⁰

¹⁰ Note: Here diesel includes marine fuels.

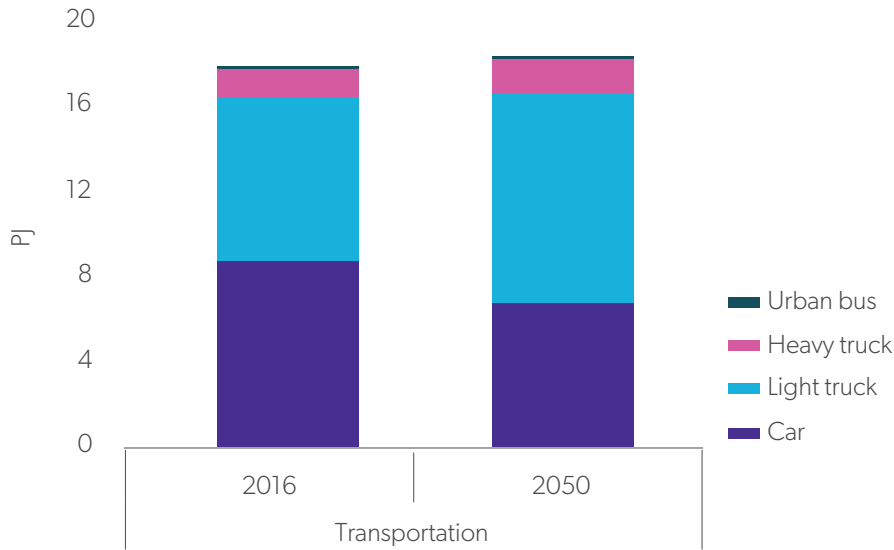


Figure 33. Projected BAP transportation energy use (PJ) by vehicle type, 2016-2050.

Between 2016 and 2050, there is a noticeable decline in energy demand for cars. This decline is driven by three major projected shifts: more stringent vehicle fuel efficiency standards, an increase in the number of electric vehicles (which are more energy efficient than combustion engine vehicles), and a projected shift away from cars to light trucks.

A shift in fuel use to electricity as well as increased efficiency are assumed across all vehicle types, other than marine and rail. Energy consumption in the marine and rail sectors was assumed to be constant from 2016 to 2050.

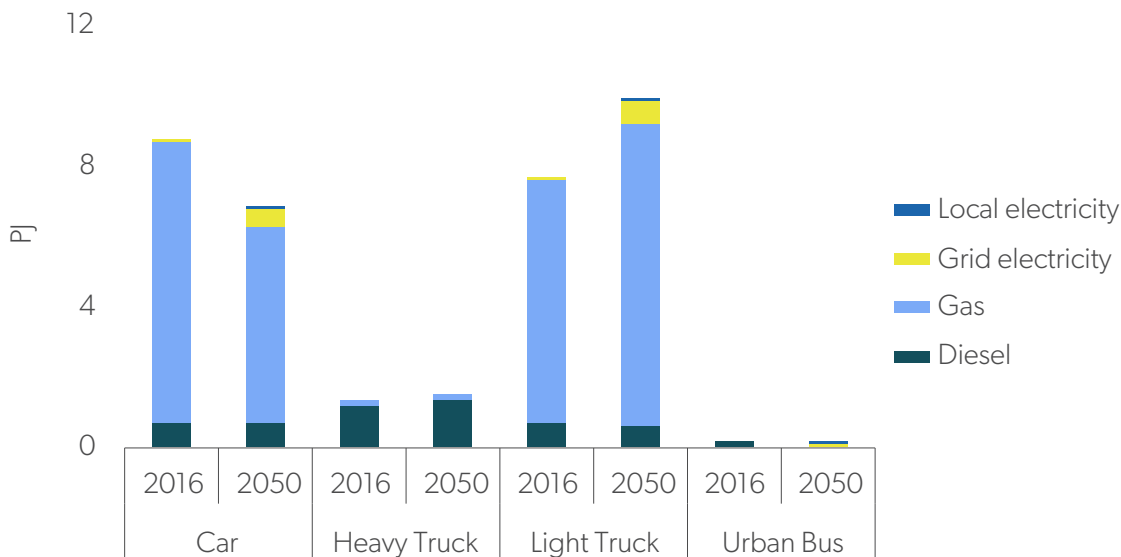


Figure 34. Projected BAP transportation energy use (PJ) by vehicle type and fuel, 2016-2050.

Transportation Sector Emissions

TRANSPORTATION EMISSIONS BY SOURCE AND VEHICLE TYPE

Transportation GHG emissions follow a somewhat different trajectory to transportation energy demand, staying relatively constant between 2016 and 2050. This is due to the fact that in the transportation emissions analysis we include the municipal share of three additional sectors for which we do not have energy use data: rail, marine, and aviation.¹¹

GHG emissions from transportation account for 19% of the total emissions for Hamilton in 2016 (1,671 ktCO₂e), and decrease to 17% in 2050 (1,600 ktCO₂e). This difference is due to the sector’s projected increased use of the province’s low-GHG electricity, as well as the expected improvements in efficiency noted above.

Emissions from gasoline dominate GHG emissions in 2016 for the transportation sector, with 76% of the total arising from gasoline in 2016, 19% from diesel and 6% from aviation fuel. The share of emissions from gasoline decreases slightly over time until it accounts for 73% of transportation emissions in 2050. Electric vehicle charging begins to increase towards 2050 but will only represent 3% of transportation GHG emissions (versus its 10% share of energy demand).

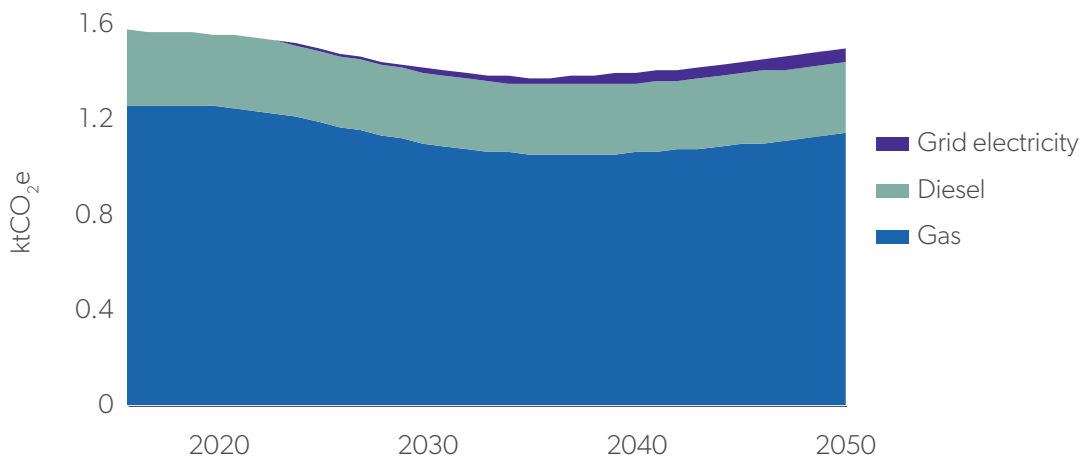


Figure 35. Projected BAP transportation emissions (kt CO₂e) by source, 2016-2050.

¹¹ Marine, rail and aviation fuel GHG emissions are allocated to the city of Hamilton according to the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) protocol. For more information see the Data, Methods and Assumption Manual in Part 2.

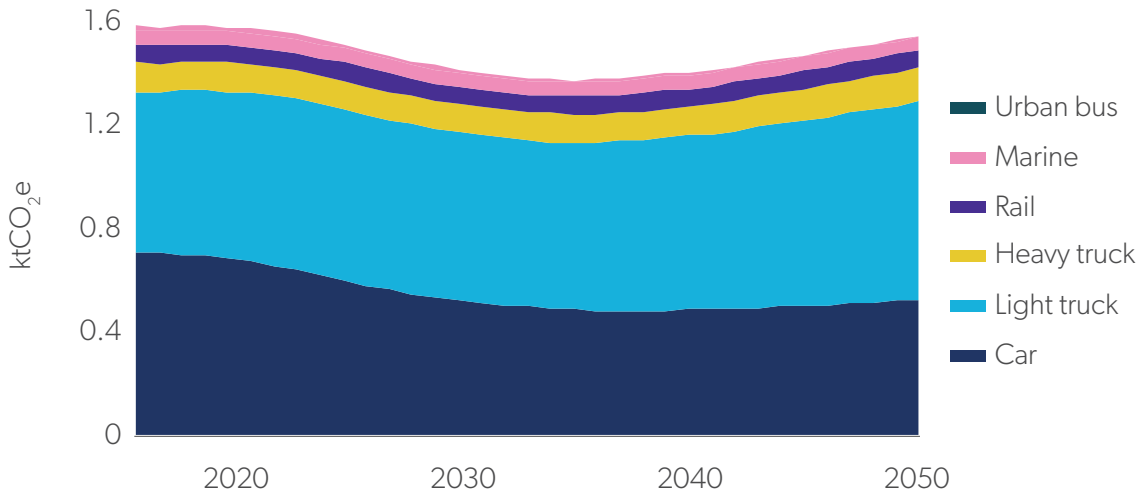


Figure 36. Projected BAP transportation emissions (ktCO₂e) by vehicle type, 2016-2050

Waste Sector Emissions

WASTE EMISSIONS BY TYPE

In 2016, Hamilton produced approximately 215 kt of solid waste, the majority of which was sent to a landfill (52%). This number is projected to increase in step with population and employment growth, to approximately 338 kt per year in 2050, with 45% still expected to go to landfill.

Waste emissions in Hamilton amounted to 58 ktCO₂e in 2016 and are projected to increase to 97 ktCO₂e by 2050; an increase of 67% over the period. Waste emissions include both emissions produced from solid waste and wastewater treated at the central wastewater plant.

Emissions from landfill significantly outweigh emissions from wastewater and compost ('biological'). This is despite the current landfill gas-capture system which is estimated to capture 75% of methane emissions produced at the landfill. The growing population results in additional waste going to landfill, as well as the ongoing decay of existing waste in landfill (that has been added over many years in the past) which continues to produce methane. Wastewater emissions represent approximately 8% of the sector's emissions in 2016. Wastewater emissions are projected to increase from 4.7 kt ktCO₂e to 7.1 ktCO₂e in 2050.

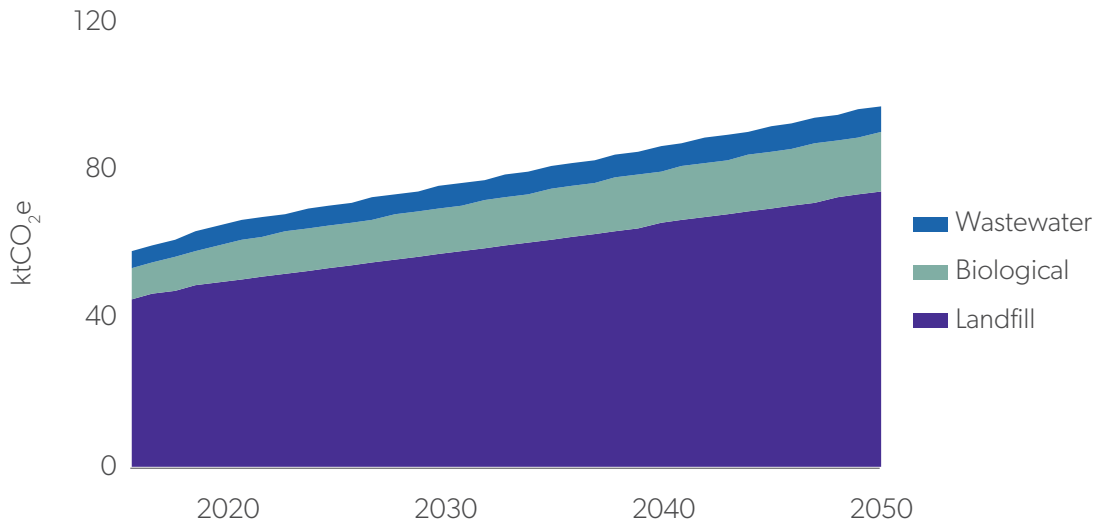


Figure 37. Projected BAP waste GHG emissions (ktCO₂e), 2016-2050.

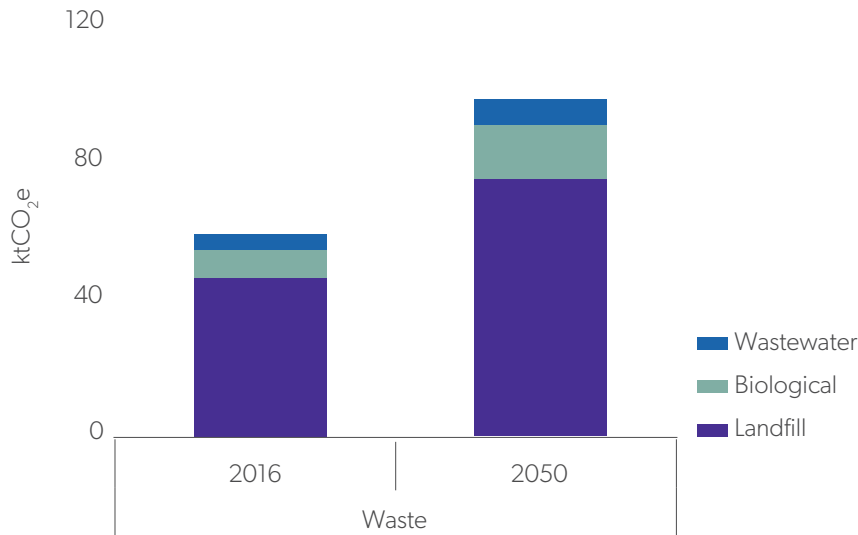


Figure 38. Waste GHG emissions by treatment type (ktCO₂e), in 2016 and 2050.

Agriculture and Carbon Sequestration

Hamilton has a large land base dedicated to nature (open and forested lands) as well as agriculture. This section provides an analysis of GHG emissions from livestock ('agriculture') and carbon reductions ('sequestration') due to land-use changes.

The estimation of carbon sequestration is not added to the final total of the city's GHG emissions. It is provided here as a discussion point.

Agriculture

For the baseline year, GHG emissions originating from livestock totaled 32 ktCO₂e, less than 1% of total community emissions.

The number of livestock in Hamilton is held constant towards 2050, as a plateau has been reached from 2013 onwards according to Ontario statistics on agricultural activities.¹² As a result, annual GHG emissions from livestock are held constant at 32 ktCO₂e until 2050.

Carbon Sequestration

Projected sequestration from land use changes in the BAP, decreases community GHG emissions in 2050 from 9,623 to 9,309 ktCO₂e.

Carbon sequestration and releases are projected to occur throughout the study period. However, in this analysis we are only discussing them as a snapshot in the year 2050. In other words, the 2050 carbon does not capture sequestration or releases projected to occur earlier in the study period.

In a BAP scenario, land use changes are projected to result in -314 ktCO₂e (negative emissions) in the year 2050 due to increased carbon sequestration due to urban and rural forests.

Carbon sequestration represents removal of carbon from the atmosphere, for example from trees and healthy soil. In this model, release of sequestered carbon is measured based on the conversion of forests, grasslands, wetlands to settlement areas, or of agricultural land to developed areas, or of agricultural land transitioning from no-till to till soil management practices. Carbon sequestration is modeled based on forested areas remaining forested. No data was provided on projected tree planting in the City of Hamilton.

Table 1. Net GHG emissions for Hamilton in the BAP scenario, 2050.

SECTOR	GHG EMISSIONS, 2050 (KTCO ₂ E)
Community-wide emissions	9,623
Sequestration	-314
Net total	9,309

In the BAP, Hamilton's largest source of sequestration in 2050 is forested land, with an estimated

¹² Using cattle as an indicator for livestock; the number of cattle has largely remained unchanged from 2013-2019, with approximately 13,300 cattle in the province. "Livestock and Poultry Statistics." 2019. Ministry of Agriculture, Food and Rural Affairs, Ontario. www.omafra.gov.on.ca/english/stats/livestock/index.html

sequestration of -272 ktCO₂e.¹³ The second-largest carbon sequestration category are trees in developed areas, sequestering approximately -73 ktCO₂e in 2050.

In terms of carbon releases in 2050, the BAP projects a small but steady increase towards tilling, based on historic trends, which results in 23 ktCO₂e of carbon release in 2050. Finally, a very small amount of agricultural land is expected to be developed in 2050, resulting in a release of 8 kt CO₂e.

For more information see the annual results in the Appendix.

Looking to the Low-Carbon Scenario

Hamilton has committed to act on the climate crisis by establishing a community-wide 2050 net-zero GHG emissions target. In order to achieve this target, actions will need to be taken quickly to address the drivers of community emissions. The BAP scenario reveals the following key sources of emissions:

- 98% of GHG emissions in 2050 in the community are due to fossil fuel use for energy.
- About 57% of Hamilton's energy use is wasted in conversion losses.
- Ontario's mostly fossil fuel-free electricity grid is expected to become increasingly carbon-intensive out to 2050.
- Local renewable energy generation is the only source of fossil-fuel free energy available in Hamilton. Currently Hamilton produces less than 1% of its energy from local renewable energy, and this is projected to increase marginally to 1% in the BAP.
- The industrial sector is by far the largest source of GHG emissions in the community due to the use of coal in its steel smelters, single handedly representing more than half of the city's emissions in 2016. Though the steel industry has set an aspirational goal of achieving net-zero by 2050, the BAP does not incorporate this goal.
- Gasoline and diesel for cars and trucks is likely to remain the city's second largest source of emissions out to 2050, despite increased fuel efficiency standards and incremental uptake of EVs.
- Commercial and residential buildings are the city's third and fourth largest source of emissions, primarily from natural gas for space and water heating. However, electricity is projected to represent a larger share of emissions for both out to 2050, due to the increasing carbon intensity of the electricity grid and increasing cooling demand.
- Improved energy efficiency requirements for new buildings, incremental retrofits, and reduced need for space heating will do little to change this sector's carbon footprint out to 2050.
- With current solid waste generation and diversion rates, emissions from waste will continue to grow with a growing population.

The next phase of modelling will explore potential actions to curb these emissions, and will form the basis of Hamilton's Community and Emissions Energy Plan (CEEP).

¹³ A negative symbol means that GHG emissions are reduced.

Part 2: Data, Methods, and Assumptions Manual

1. Summary

The Data, Methods and Assumptions (DMA) manual has been created for Hamilton to illustrate the modeling approach used to provide energy and emissions benchmarks and projections. The DMA will also provide a summary of the data and assumptions being used as the foundation for the energy and emissions modeling. This allows for the elements of the modelling to be fully transparent, as well as lay a foundation for the scope of data required for future modelling efforts that the City can build upon.

2. Accounting and Reporting Principles

The GPC is based on the following principles in order to represent a fair and true account of emissions:

- **Relevance:** The reported GHG emissions shall appropriately reflect emissions occurring as a result of activities and consumption within the Hamilton boundary. The inventory will also serve the decision-making needs of Hamilton, taking into consideration relevant local, subnational, and national regulations. Relevance applies when selecting data sources and determining and prioritizing data collection improvements.
- **Completeness:** All emissions sources within the inventory boundary shall be accounted for. Any exclusions of sources shall be justified and explained.
- **Consistency:** Emissions calculations shall be consistent in approach, boundary, and methodology.
- **Transparency:** Activity data, emissions and factors, and accounting methodologies require adequate documentation and disclosure to enable verification.
- **Accuracy:** The calculation of GHG emissions should not systematically overstate or understate actual GHG emissions. Accuracy should be sufficient enough to give decision makers and the public reasonable assurance of the integrity of the reported information. Uncertainties in the quantification process should be reduced to the extent possible and practical.

3. Assessment Characteristics

3.1 GEOGRAPHIC BOUNDARY

The geographic boundary for this assessment consists of the City as shown in Figure 39.

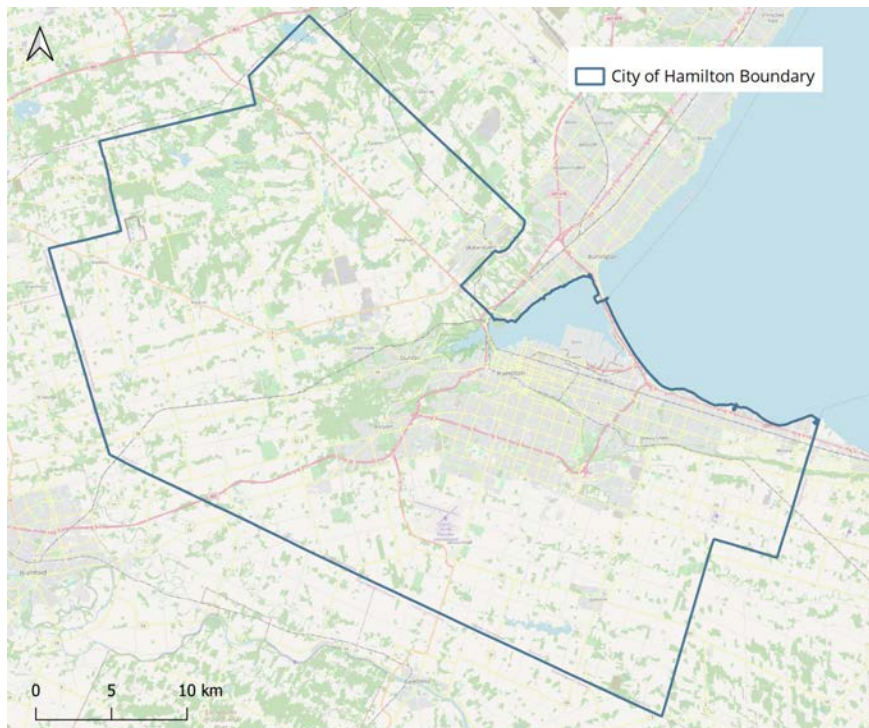


Figure 39. Hamilton geographic boundary.

3.2 TIME FRAME OF ASSESSMENT

The time frame for assessment of Hamilton will be from 2016-2050, with 2016 as a baseline year. The census of 2016 is a key data source used to establish the baseline year. Further, the baseline year is based on model calibration which uses as much observed data as possible in order to provide the most accurate and consistent snapshot as possible.

Refer to Section 6. Scenario Development for more information on Model Calibration and Data and Assumptions.

3.3 ENERGY AND EMISSIONS STRUCTURE

The total energy for a community is defined as the sum of the energy from each of the aspects:

$$\text{Energy}_{\text{city}} = \text{Energy}_{\text{transport}} + \text{Energy}_{\text{buildings}} + \text{Energy}_{\text{wastegen}}$$

Where:

Energy_{transport} is the movement of goods and people.

Energy_{buildings} is the generation of heating, cooling and electricity.

Energy_{wastegen} is energy generated from waste.

The total GHG for a community is defined as the sum of the GHG from each of the aspects:

$$GHG_{landuse} = GHG_{transport} + GHG_{energygen} + GHG_{waste} + GHG_{agriculture} + GHG_{forest} + GHG_{landcover}$$

Where:

$GHG_{transport}$ is the movement of goods and people.

$GHG_{energygen}$ is the generation of heat and electricity.

GHG_{waste} is liquid and solid waste produced.

$GHG_{agriculture}$ is the production of food.

GHG_{forest} is the area of forest land.

$GHG_{landconvert}$ is the area of land in natural or modified conditions.

3.4 SCOPE

The inventory will include Scope 1, 2, and 3 emissions. Refer to Appendix 3 for a list of GHG emission sources by scope that are included.

Table 2. GPC Scopes

SCOPE	DEFINITION
1	All GHG emissions from sources located within the City boundary.
2	All GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the City boundary.
3	All other GHG emissions that occur outside the City boundary as a result of activities taking place within the City boundary.

3.5 EMISSION FACTOR

In order to compile a baseline of emissions within Hamilton, inputs such as energy use, activities by citizens and businesses, and waste products need to be converted to recordable emissions. The following table displays those conversions and their source

Table 3. Emissions Factors for the Hamilton Baseline and Future Scenario

CATEGORY	DESCRIPTION	COMMENT
Natural gas	49 kg CO ₂ e/GJ	Environment and Climate Change Canada. National Inventory Report 1990-2015: Greenhouse Gas Sources and Sinks in Canada. Part 2. Tables A6-1 and A6-2, Emission Factors for Natural Gas.

CATEGORY	DESCRIPTION	COMMENT
Electricity	2016: 50.8 gCO ₂ e/kWh 2050: 83.7 gCO ₂ e/kwh 2016: CO ₂ : 28.9 g/kWh CH ₄ : 0.007 g/kWh N ₂ O: 0.001 g/kWh 2050: CO ₂ : 82.32 g/kWh CH ₄ : 0.02 g/kWh N ₂ O: 0.00 g/kWh	IESO, Annual Planning Outlook January 2020.
Gasoline	g/L CO ₂ : 2316 CH ₄ : 0.32 N ₂ O: 0.66	Environment and Climate Change Canada. National Inventory Report 1990-2015: Greenhouse Gas Sources and Sinks in Canada. Part 2. Table A6-12 Emission Factors for Energy Mobile Combustion Sources
Diesel	g/L CO ₂ : 2690.00 CH ₄ : 0.07 N ₂ O: 0.21	Environment and Climate Change Canada. National Inventory Report 1990-2015: Greenhouse Gas Sources and Sinks in Canada. Part 2. Table A6-12 Emission Factors for Energy Mobile Combustion Sources
Fuel oil	Residential g/L CO ₂ : 2560 CH ₄ : 0.026 N ₂ O: 0.006 Commercial g/L CO ₂ : 2753 CH ₄ : 0.026 N ₂ O: 0.031 Industrial g/L CO ₂ : 2753 CH ₄ : 0.006 N ₂ O: 0.031	Environment and Climate Change Canada. National Inventory Report 1990-2015: Greenhouse Gas Sources and Sinks in Canada. Part 2. Table A6-4 Emission Factors for Refined Petroleum Products

CATEGORY	DESCRIPTION	COMMENT
Propane	g/L Transport CO ₂ : 1515.00 CH ₄ : 0.64 N ₂ O: 0.03 Residential CO ₂ : 1515.00 CH ₄ : 0.027 N ₂ O: 0.108 All other sectors CO ₂ : 1515.00 CH ₄ : 0.024 N ₂ O: 0.108	Environment and Climate Change Canada. National Inventory Report 1990-2015: Greenhouse Gas Sources and Sinks in Canada. Part 2. Table A6-3 Emission Factors for Natural Gas Liquids Table A6-12 Emission Factors for Energy Mobile Combustion Sources
Agricultural: Livestock	Varies per animal Type Kg CH ₄ / head	Environment and Climate Change Canada. National Inventory Report 1990-2016: Greenhouse Gas Sources and Sinks in Canada. Part 2 Table A3-30 CH ₄ Emission Factors for Enteric Fermentation for Cattle from 1990 to 2016 Table A3-37 Emission Factors to Estimate CH ₄ Emissions from Manure Management for Cattle Subcategories
Waste	Landfill emissions are calculated from the first order decay of degradable organic carbon deposited in landfill. Derived emission factor in 2016 = 0.015 kg CH ₄ / tonne solid waste (assuming 75% recovery of landfill methane); 0.050 kg CH ₄ /tonne solid waste not accounting for recovery. Incineration Emissions: CO ₂ emissions are derived from the IPCC method presented in the 2006 Guidelines, Volume 5, Chapter 5, section 5.2.1.1. Composted Biological Emissions Factors: 4 gCH ₄ /kg solid organic waste and 0.3 gN ₂ O/kg solid organic waste.	Methane gas capture is occurring at the landfill in Hamilton. Landfill emissions: IPCC Guidelines Vol 5. Ch 3, Equation 3.1 ICI Waste tonnage was estimated using per capita numbers for Ontario from Statistics Canada, Table 38-10-0032-0: Disposal of waste, by source.
Wastewater	CH ₄ : 0.48 kg CH ₄ /kg BOD N ₂ O: 3.2 g / (person * year) from advanced treatment 0.005 g /g N from wastewater discharge	CH ₄ wastewater: IPCC Guidelines Vol 5. Ch 6, Tables 6.2 and 6.3; MCF value for anaerobic digester N ₂ O from advanced treatment: IPCC Guidelines Vol 5. Ch 6, Box 6.1 N ₂ O from wastewater discharge: IPCC Guidelines Vol 5. Ch 6, Section 6.3.1.2

4. Modelling

For this project, CityInSight will be used as the main modelling tool.

4.1 ABOUT CITYINSIGHT

CityInSight is an integrated energy, emissions and finance model developed by Sustainability Solutions Group and whatIf? Technologies. It is an integrated, multi-fuel, multi-sector, partially-disaggregated energy systems, emissions and finance model for cities. The model enables bottom-up accounting for 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).

Energy and GHG emissions are derived from a series of connected stock and flow models, evolving on the basis of current and future geographic and technology decisions/assumptions (e.g. EV penetration rates). The model accounts for physical flows (i.e. energy use, new vehicles by technology, vehicle kilometres travelled) as determined by stocks (buildings, vehicles, heating equipment, etc.).

CityInSight incorporates and adapts concepts from the system dynamics approach to complex systems analysis. For any given year within its time horizon, CityInSight traces the flows and transformations of energy from sources through energy currencies (e.g. gasoline, electricity, hydrogen) to end uses (e.g. personal vehicle use, space heating) to energy costs and to GHG emissions. An energy balance is achieved by accounting for efficiencies, conservation rates, and trade and losses at each stage in the journey from source to end use.

Table 4. Characteristics of CityInSight.

CHARACTERISTIC	RATIONALE
Integrated	CityInSight is designed to model and account for all sectors that relate to energy and emissions at a city scale while capturing the relationships between sectors. The demand for energy services is modelled independently of the fuels and technologies that provide the energy services. This decoupling enables exploration of fuel switching scenarios. Physically feasible scenarios are established when energy demand and supply are balanced.
Scenario-based	Once calibrated with historical data, CityInSight enables the creation of dozens of scenarios to explore different possible futures. Each scenario can consist of either one or a combination of policies, actions and strategies. Historical calibration ensures that scenario projections are rooted in observed data.
Spatial	The configuration of the built environment determines the ability of people to walk and cycle, accessibility to transit, feasibility of district energy and other aspects. CityInSight therefore includes a full spatial dimension that can include as many zones - the smallest areas of geographic analysis - as are deemed appropriate. The spatial component to the model can be integrated with City GIS systems, land-use projections and transportation modelling.
GHG reporting framework	CityInSight is designed to report emissions according to the GHG Protocol for Cities (GPC) framework and principles.

CHARACTERISTIC	RATIONALE
Economic impacts	CityInSight incorporates a full financial analysis of costs related to energy (expenditures on energy) and emissions (carbon pricing, social cost of carbon), as well as operating and capital costs for policies, strategies and actions. It allows for the generation of marginal abatement curves to illustrate the cost and/or savings of policies, strategies and actions.

4.2 MODEL STRUCTURE

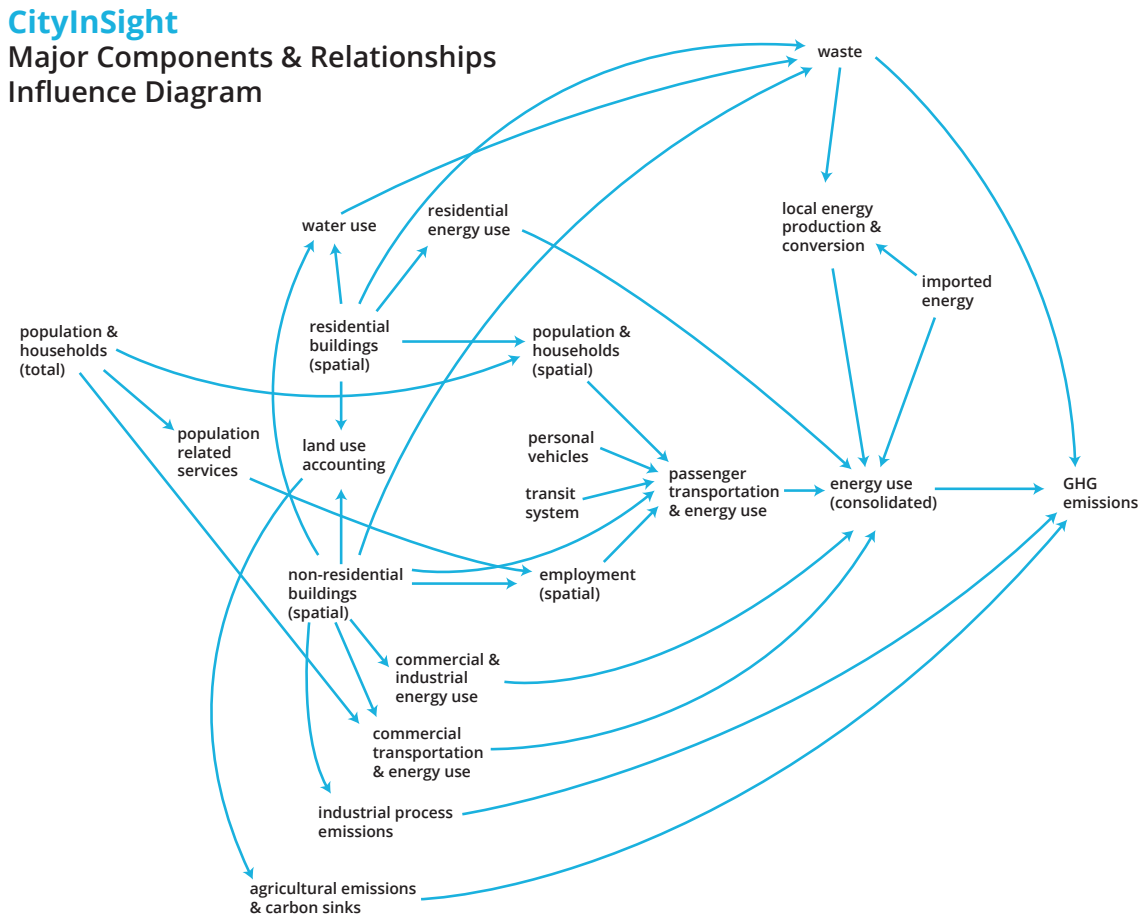


Figure 40. Representation of CityInSight’s structure.

The major components of the model, and the first level of modelled relationships (influences), are represented by the blue arrows in Figure 42. Additional relationships may be modelled by modifying inputs and assumptions - specified directly by users, or in an automated fashion by code or scripts running “on top of” the base model structure. Feedback relationships are also possible, such as increasing the adoption rate of non-emitting vehicles in order to meet a particular GHG emissions constraint.

The model is spatially explicit. All buildings, transportation and land use data are tracked within the model through a GIS platform, and by varying degrees of spatial resolution. A zone type system is applied to break up the City into smaller configurations. This enables consideration of the impact of land-use patterns and urban form on energy use and emissions production from a baseline year to future dates using GIS-based platforms. CityInSight’s GIS outputs can be integrated with the City’s mapping systems.

4.3 STOCKS AND FLOWS

For any given year various factors shape the picture of energy and emissions flows, including: the population and the energy services it requires; commercial floorspace; energy production and trade; the deployed technologies which deliver energy services (service technologies); and the deployed technologies which transform energy sources to currencies (harvesting technologies). The model makes an explicit mathematical relationship between these factors—some contextual and some part of the energy consuming or producing infrastructure—and the energy flow picture.

Some factors are modelled as stocks—counts of similar things, classified by various properties. For example, population is modelled as a stock of people classified by age and gender. Population change over time is projected by accounting for: the natural aging process, inflows (births, immigration) and outflows (deaths, emigration). The fleet of personal use vehicles, an example of a service technology, is modelled as a stock of vehicles classified by size, engine type and model year, with a similarly-classified fuel consumption intensity. As with population, projecting change in the vehicle stock involves aging vehicles and accounting for major inflows (new vehicle sales) and major outflows (vehicle discards). This stock-turnover approach is applied to other service technologies (e.g. furnaces, water heaters) and also harvesting technologies (e.g. electricity generating capacity).

4.4 SUB-MODELS

Population and demographics

City-wide population is modelled using the standard population cohort-survival method, disaggregated by single year of age and gender. It accounts for various components of change: births, deaths, immigration and emigration. The age structured population is important for analysis of demographic trends, generational differences and implications for shifting energy use patterns. In CityInSight these numbers will be calibrated against existing projections developed for the City. New population data was provided by Hamilton planning department

Residential buildings

Residential buildings are spatially located and classified using a detailed set of 30+ building archetypes capturing footprint, height and type (single, double, row, apt. high, apt. low), in addition to year of construction. This enables a "box" model of buildings and the estimation of surface area. Coupled with thermal envelope performance and degree-days the model calculates space conditioning energy demand independent of any particular space heating or cooling technology and fuel. Energy service demand then drives stock levels of key service technologies (heating systems, air conditioners, water heaters). These stocks are modelled with a stock-turnover approach capturing equipment age, retirements, and additions—exposing opportunities for efficiency gains and fuel switching, but also showing the rate limits to new technology adoption and the effects of lock in. Residential building archetypes are also characterized by number of contained dwelling units, allowing the model to capture the energy effects of shared walls and the urban form and transportation implications of population density.

Non-residential buildings

These are spatially located and classified by a detailed use/purpose-based set of 50+ archetypes, and the floorspace of these non-residential building archetypes can vary by location. Non-residential floorspace produces waste and demand for energy and water, and also provides an anchor point for locating employment of various types.

Spatial population and employment

City-wide population is made spatial by allocation to dwellings, using assumptions about persons-per-unit by dwelling type. Spatial employment is projected via two separate mechanisms: population-related services and employment, which is allocated to corresponding building floorspace (e.g. teachers to school floorspace); and floorspace-driven employment (e.g. retail employees per square metre).

Passenger Transportation

The model includes a spatially explicit passenger transportation sub-model that responds to changes in land use, transit infrastructure, vehicle technology, travel behavior changes and other factors. Trips are divided into four types (home-work, home-school, home-other, and non-home-based), each produced and attracted by a different combination of spatial drivers (population, employment, classrooms, non-residential floorspace). Trips are distributed - that is, trip volumes are specified for each zone of origin and zone of destination pair. For each origin-destination pair trip are shared over walk/bike (for trips within the walkable distance threshold), public transit (for trips whose origin and destination are serviced by transit) and automobile. Following the mode share step, along with a network distance matrix, a projection of total personal vehicles kilometres travelled (VKT) is produced. The energy use and emissions associated with personal vehicles is calculated by assigning VKT to a stock-turnover personal vehicle model. The induced approach is used to track emissions. All internal trips (trips within Hamilton's boundary) are accounted for, as well as half of the trips that terminate or originate within the City's boundary. This approach allows Hamilton to better understand its impact on the peripheries.

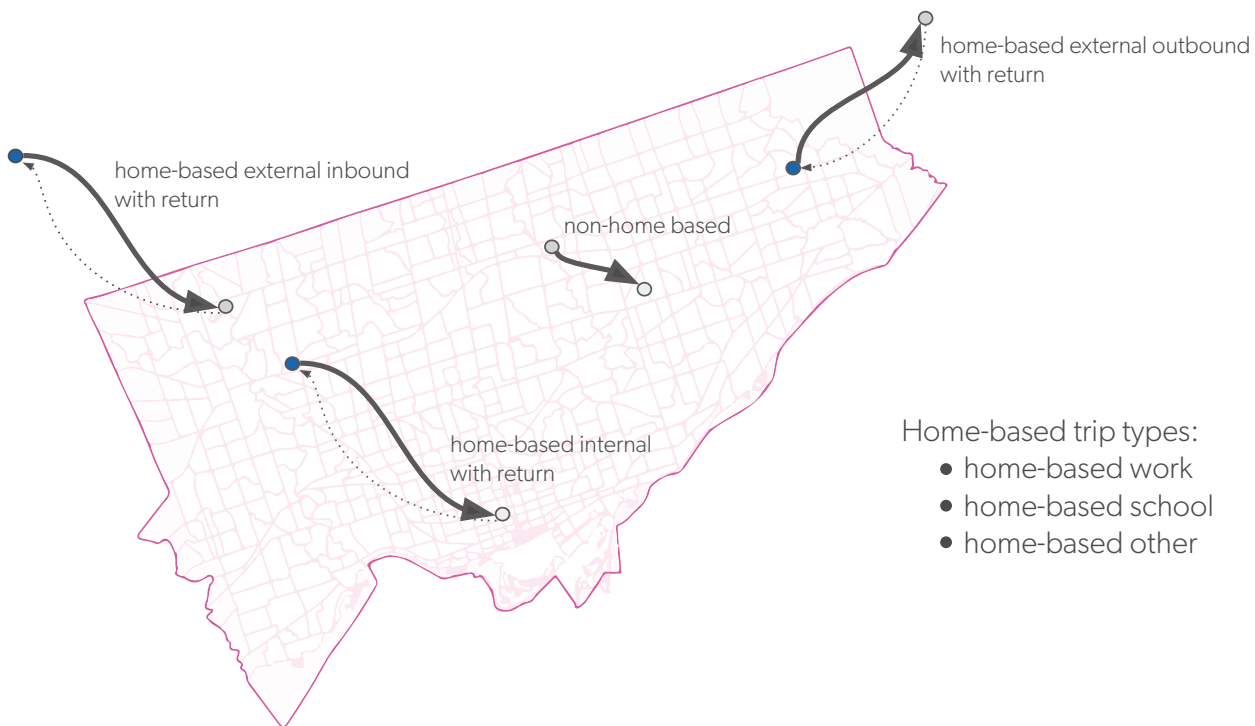


Figure 41. Conceptual diagram of trip categories.

Waste

Households and non-residential buildings generate solid waste and wastewater, and the model

traces various pathways to disposal, compost and sludge including those which capture energy from incineration and recovered gas. Emissions accounting is performed throughout the waste sub-model.

Energy flow and local energy production

Energy produced from primary sources (e.g. solar, wind) is modelled alongside energy converted from imported fuels (e.g. electricity generation, district energy, CHP). As with the transportation sub-model, the district energy supply model has an explicit spatial dimension and represents areas served by district energy networks.

Finance and employment

Energy related financial flows and employment impacts—while not shown explicitly—are captured through an additional layer of model logic. Calculated financial flows include the capital, operating and maintenance cost of energy consuming stocks and energy producing stocks, including fuel costs. Employment related to the construction of new buildings, retrofit activities and energy infrastructure is modelled. The financial impact on businesses and households of the strategies is assessed. Local economic multipliers are also applied to investments.

Land Based and Agriculture Emissions

Data used to calculate Agriculture, Forestry, and other Land Use (AFOLU) emissions was found in Statistics Canada Census of Agriculture CANSIM tables of livestock for Hamilton for 2016. Environment Canada's 2016 National Inventory Report was used to obtain emissions factors for livestock and croplands, and the total area classified as woodland was estimated from GIS mapping provided by Hamilton.

Agricultural and land based emissions are calculated as change of activities, uses, and land over time. In the BAP and in future scenarios, land that is predominantly forested or agricultural that is projected to be developed will have population and floor space per person associated with it. Floorspace is assigned through building type, and the resulting net loss of open or undeveloped land results in a net increase in GHG emissions associated with that land.

Carbon Sequestration

In the model, carbon sequestration, or the capture and storage of GHG emissions, is a net effect of growing increased woodlands, forests, and street trees. An absorption factor is added to a type of tree, or land that is recovered and then provided as a total sequestration figure, or in other words as a GHG emissions reduction. This total is kept separate from the total GHG emissions produced in the community, then provided as net GHG emissions for the community.

Carbon absorption factors vary depending on the age of a forest, where an older forest is considered to be a carbon sink that already contains a maximum amount of carbon, whereas a newly planted or developing forest will continue to absorb increasing GHGs as it matures.

The calculation of the sources and sinks involves tracking changes in land use; a net increase in area of forest, wetland, or grassland represents a greater GHG sink and vice versa.

The Intergovernmental Panel on Climate Change's (IPCC, 2019) Guidelines for National Greenhouse Gas Inventories recommend reporting sequestration based on changes within and conversions between land-use types, including: forest land, cropland, grassland, wetlands, and settlements.

4.5 DATA AND ASSUMPTIONS

A detailed table is available under Appendix 2 showing the data used and assumptions made to develop the BAP scenario for Hamilton. A separate breakdown of how the inventory complies with the GHG protocol can be found under Appendix 3.

5. Scenario Development

CityInSight is designed to support the use of scenarios as a mechanism to evaluate potential futures for communities. A scenario is an internally consistent view of what the future might turn out to be—not a forecast, but one possible future outcome. A good set of scenarios is both plausible and surprising, but scenarios can also be misleading if, for example, there are too few so that one scenario is “good” and the other “bad”.

Another consideration is to ensure that the name of the scenario does not bias the audience. Lastly, scenarios must represent serious considerations defined not only by planning staff, but also by community members.

Scenarios are generated by identifying population projections into the future, identifying how many additional households are required and then applying those additional households according to existing land-use plans and/or alternative scenarios. A simplified transportation model evaluates the impact of the new development on transportation behaviour, building types, agricultural and forest land and other variables.

5.1 BUSINESS-AS-PLANNED SCENARIO

At this stage, using current and future planned policies, it is time to create the first scenario from our assumptions.

The business-as-planned (BAP) scenario will offer a scenario moving towards the year 2050, where there is an absence of new substantive policy measures.

Methodology:

1. Calibrate model and develop 2016 baseline using observed data and filling in gaps with assumptions where necessary;
2. Input existing projected quantitative data to 2050 where available:
 - Population, employment and households’ projections from City by transport zone;
 - Build out (buildings) projections from City by transport zone;
 - Transport modelling from City;
3. Where quantitative projections are not carried through to 2050 (e.g. completed to 2041), extrapolate the projected trend to 2050;
4. Where specific quantitative projections are not available, develop projections through:
 - Analyzing current on the ground action in the City (reviewing actions plans, engagement with staff etc.), and where possible, quantifying the action;
 - Analyzing existing policy that has potential impact for the city, and where possible, quantifying the potential impact.

A list of BAP data sources and assumptions can be found in the BAP Data and Assumptions Table in Appendix 2.

5.2 LOW-CARBON SCENARIO

Using the business-as-planned scenario as a jumping-off point, we now create the low-carbon scenario, mapped out to the target year (usually 2050). All potential actions are identified.

CityInSight is designed to project how the energy flow picture and emissions profile will change in the long term by modelling potential change in the context (e.g. population, development patterns), projecting energy services demand intensities, and projecting the composition of energy system infrastructure, often with stocks.

Policies, actions and strategies

Throughout the CityInSight accounting framework there are input variables—for user assumptions and projections—which collectively comprise an interface to controlling the physical trajectory of the urban energy system and resultant emissions. Different settings for these inputs can be interpreted as alternative behaviour of various actors or institutions in the energy system (e.g. households, various levels of government, industry, etc.). This interface can be directly set or controlled by the model user, to create "what if" type scenarios. The modelling platform upon which CityInSight is built allows for a "higher layer" of logic to operate at this physical-behavioural interface, in effect enabling a flexible mix-and-match approach to behavioral models which connect to the same constraining physical model. CityInSight is able to explore a wide variety of policies, actions and strategies. The resolution of CityInSight enables the user to apply scenarios to specific neighbourhoods, technologies, building or vehicle types or eras, and configurations of the built environment.

Methodology

1. Develop list of potential actions and strategies from consultant expertise, input from city staff and community engagement (i.e. catalogue);
2. Identify the technological potential of each action (or group of actions) to reduce energy and emissions by quantifying actions:
 - a. Firstly, if the action or strategy specifically incorporates a projection or target; or,
 - b. Secondly, if there is a stated intention or goal, review best practices and literature to quantify that goal;
 - c. Thirdly, identify any actions that are either overlapping and/or include dependencies on other actions;
3. Translate the actions into quantified assumptions over time;
4. Apply the assumptions to relevant sectors in the model to develop a low-carbon scenario (i.e. apply the technological potential of the actions to the model);
5. Analyze results of the low-carbon scenario against the GHG reduction target;
6. If the target is not achieved, identify variables which can be scaled up and provide a rationale for doing so;
7. Iteratively adjust variables to identify a pathway to the GHG target;

8. Develop marginal abatement curve for the low-carbon scenario;
9. Define criteria to evaluate low carbon scenario (i.e. identify criteria for multi-criteria analysis);
10. Prioritize actions of low carbon scenario through multi-criteria analysis (along with other criteria e.g. health, prosperity etc.);
11. Revise scenario to reflect prioritization for final low carbon scenario, removing and scaling the level of ambition of actions according to the evaluation results.

6. Addressing Uncertainty

There is extensive discussion of the uncertainty in models and modelling results. The assumptions underlying a model can be from other locations or large data sets and do not reflect local conditions or behaviours, and even if they did accurately reflect local conditions, it is exceptionally difficult to predict how those conditions and behaviours will respond to broader societal changes and what those broader societal changes will be (the "unknown unknowns").

An analysis of land-use models used to assess climate change impacts for Sydney, Australia, emphasized that the models should be used only for scenario testing and not forecasting because of limits to the possible precision. The importance of this point is demonstrated by the fact that the models considered in this analysis can generate a range of outcomes from the same starting point (Oydell et al., 2007, pg. 10).

The modelling approach identifies four strategies for managing uncertainty applicable to community energy and emissions modelling:

1. Sensitivity analysis: From a methodological perspective, one of the most basic ways of studying complex models is sensitivity analysis, quantifying uncertainty in a model's output. To perform this assessment, each of the model's input parameters is described as being drawn from a statistical distribution in order to capture the uncertainty in the parameter's true value (Keirstead, Jennings, and Sivakumar, 2012).

Approach: Each of the variables will be adjusted to illustrate the impact that an error of that magnitude has on the overall total.

2. Calibration: One way to challenge the untested assumptions is the use of 'back-casting' to ensure the model can 'forecast' the past accurately. The model can then be calibrated to generate historical outcomes, which usually refers to "parameter adjustments" that "force" the model to better replicate observed data.

Approach: Variables for which there are two independent sources of data are calibrated in the model. For example, the model calibrates building energy use (derived from buildings data) against actual electricity data from the electricity distributor.

3. Scenario analysis: Scenarios are used to demonstrate that a range of future outcomes are possible given the current conditions that no one scenario is more likely than another.

Approach: The model will develop a reference scenario

4. Transparency: The provision of detailed sources for all assumptions is critical to enabling policy-makers to understand the uncertainty intrinsic in a model.

Approach: The assumptions and inputs are presented in this document.

Appendix D.1: Data Tables

COMMUNITY ENERGY

Table 5. Community energy consumption tabulated results, 2016 and 2050 (BAP).

ENERGY BY SECTOR (PJ)	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- 2016-2050
Commercial	13,428,789	10%	19,038,002	13%	42%
Industrial	81,571,437	60%	89,169,966	60%	9%
Municipal	724,732	1%	340,281	0%	-53%
Residential	17,671,871	13%	17,185,473	11%	-3%
Transportation	23,251,634	17%	23,719,708	16%	2%
Total	136,648,464	100%	149,453,431	100%	9%
Energy by fuel (PJ)					
Coal	49,294,380	36%	51,941,550	35%	5%
Diesel	4,249,736	3%	4,054,917	3%	-5%
District Energy	127,260	0%	167,620	0%	32%
Fuel Oil	394,323	0%	401,744	0%	2%
Gasoline	18,843,170	14%	17,070,310	11%	-9%
Grid Electricity	14,824,855	11%	20,956,082	14%	41%
Local Electricity	93,277	0%	132,975	0%	43%
Natural Gas	47,312,496	35%	52,872,359	35%	12%
Other	204,687	0%	276,059	0%	35%
Propane	1,268,582	1%	1,522,535	1%	20%
Wood	35,697	0%	57,014	0%	60%
Total	136,648,464	100%	149,453,431	100%	9%
Energy per Capita (GJ)	243,182		174,202		-28%

COMMUNITY EMISSIONS

Table 6. Per capita emissions, 2016 and 2050 (BAP).

EMISSIONS BY SECTOR (TCO ₂ E)	2016	2050 (BAP)	% +/- (2016-2050)
Emissions per capita (tCO ₂ e/person)	15.5	11.2	-28%

Table 7. Community emissions tabulated results, 2016 and 2050 (BAP).

EMISSIONS BY SECTOR (TCO ₂ E)	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Agriculture and Livestock (AFOLU)	32,070	0%	32,070	0%	0%
Commercial	565,821	6%	881,018	9%	52%
Energy Production	21,475	0%	12,053	0%	-44%
Fugitive ¹⁴	16,553	0%	19,776	0%	19%
Industrial	58,178	1%	67,226	1%	16%
Municipal	5,594,389	64%	6,141,107	64%	10%
Residential	691,884	8%	761,726	8%	10%
Transportation	1,671,042	19%	1,600,565	17%	-4%
Waste	58,155	1%	97,209	1%	67%
Total	8,709,567	100%	9,612,750	100%	10%
EMISSIONS BY FUEL (TCO ₂ E)	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Coal	4,313,227	50%	4,544,853	47%	5%
Diesel	315,710	4%	301,292	3%	-5%
Fuel Oil	28,054	0%	29,140	0%	4%
Gasoline	1,263,391	15%	1,142,987	12%	-10%
Grid Electricity	155,960	2%	514,348	5%	230%
Natural Gas	2,319,682	27%	2,694,368	28%	16%
Non-Energy	148,403	2%	196,504	2%	32%
Other	87,433	1%	87,433	1%	0%
Propane	77,591	1%	101,653	1%	31%
RNG	38	0%	38	0%	0%
Wood	79	0%	133	0%	69%
Total	8,709,567	100%	9,612,750	100%	10%

¹⁴ Fugitive emissions account for unintentional emissions associated with the transportation and distribution of natural gas within the city (through equipment leaks, accidental releases etc.) that is used within the buildings sector.

BUILDING SECTOR

Table 8. Buildings sector energy tabulated results, 2016 and 2050 (BAP).

BUILDINGS ENERGY (PJ) BY BUILDING TYPE	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- 2016-2050
Commercial	13,428,789	12%	19,037,997	15%	42%
Industrial	81,571,440	72%	89,169,966	71%	9%
Municipal	724,732	1%	340,281	0%	-53%
Residential	17,671,872	16%	17,185,473	14%	-3%
Total	113,396,833	100%	125,733,718	100%	11%
BUILDINGS ENERGY (PJ) BY FUEL	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- 2016-2050
Coal	49,294,383	43%	51,941,548	41%	5%
Diesel	394,323	0%	401,744	0%	2%
District Energy	127,260	0%	167,620	0%	32%
Grid Electricity	14,824,533	13%	18,668,506	15%	26%
Local Electricity	93,276	0%	125,923	0%	35%
Natural Gas	47,234,017	42%	52,649,565	42%	11%
Other	124,761	0%	199,263	0%	60%
Propane	1,268,582	1%	1,522,535	1%	20%
Wood	35,697	0%	57,014	0%	60%
Total	113,396,833	100%	125,733,718	100%	11%
BUILDINGS ENERGY (PJ) BY END USE	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- 2016-2050
Industrial Processes	78,259,977	69%	86,689,744	69%	11%
Lighting	1,768,558	2%	2,519,603	2%	42%
Major Appliances	893,432	1%	1,055,109	1%	18%
Plug Load	2,414,420	2%	3,745,207	3%	55%
Space Cooling	769,309	1%	1,513,064	1%	97%
Space Heating	21,710,682	19%	22,094,113	18%	2%
Water Heating	7,580,454	7%	8,116,879	6%	7%
Total	113,396,833	100%	125,733,718	100%	11%

Table 9. Buildings sector emissions tabulated results, 2016 and 2050 (BAP).

BUILDINGS EMISSIONS (KTCO₂E) BY BUILDING TYPE	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Commercial	565,821	8%	881,018	11%	56%
Municipal	21,475	0%	12,053	0%	-44%
Industrial	5,594,389	81%	6,141,107	79%	10%
Residential	691,884	10%	761,726	10%	10%
Total	6,873,569	100%	7,795,904	100%	100%
BUILDINGS EMISSIONS (KTCO₂E) BY FUEL	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Coal	4,313,227	63%	4,544,853	58%	6%
Diesel	28,054	0%	29,140	0%	4%
Grid Electricity	155,956	2%	458,284	6%	-100%
Natural Gas	2,298,623	33%	2,661,802	34%	16%
Propane	77,591	1%	101,653	1%	29%
Wood	42	0%	67	0%	61%
Total	6,873,494	100%	7,795,800	100%	7%
BUILDINGS EMISSIONS (TCO₂E) BY END USE	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Industrial Processes	5,443,892	79%	6,025,759	77%	8%
Lighting	18,389	0%	62,592	1%	-100%
Major Appliances	13,655	0%	28,865	0%	-53%
Plug Load	32,006	0%	101,406	1%	-66%
Space Cooling	14,785	0%	35,631	0%	-59%
Space Heating	1,010,611	15%	1,168,979	15%	9%
Water Heating	340,157	5%	372,568	5%	3%
Total	6,873,494	100%	7,795,800	100%	7%

TRANSPORTATION SECTOR¹⁵

Table 10. Transportation sector energy tabulated results, 2016 and 2050 (BAP).

TRANSPORTATION ENERGY (GJ) BY FUEL	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Diesel	4,329,662	19%	4,131,714	17%	-5%
Gas	18,921,647	81%	17,293,101	73%	-9%
Grid electricity	323	0%	2,294,893	10%	709525%
Total	23,251,632	100%	23,719,708	100%	2%

TRANSPORTATION ENERGY (GJ) BY VEHICLE TYPE	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Car	8,724,935	38%	6,760,249	29%	-23%
Heavy truck	1,347,873	6%	1,532,758	6%	14%
Light truck	7,625,298	33%	9,883,913	42%	30%
Marine	561,482	2%	561,482	2%	0%
Off Road	3,981,927	17%	3,981,927	17%	0%
Rail	718,298	3%	718,298	3%	0%
Urban Bus	291,820	1%	281,081	1%	-4%
Total	23,251,632	100%	23,719,708	100%	2%

Table 11. Transportation Emissions, tabulated results, 2016 and 2050 (BAP).

TRANSPORTATION EMISSIONS (TCO₂E) BY FUEL	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Diesel & marine fuel	315,710	19%	290,255	18%	-5%
Gas	1,263,391	76%	1,177,009	73%	-9%
Grid electricity	3	0%	55,618	3%	1685297%
Aviation Fuel	91,938	6%	87,433	5%	0%
Total	1,671,042	100%	1,610,315	100%	-4%

TRANSPORTATION EMISSIONS (KTCO₂E) BY VEHICLE TYPE	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Car	582,925	35%	442,949	28%	-26%
Light Truck	509,566	30%	107,398	7%	14%

¹⁵ Please note the totals in these transportations tables are slightly higher (<1%) than the transportation sector totals in the community-wide tables above.

TRANSPORTATION EMISSIONS (TCO ₂ E) BY FUEL	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Heavy Truck	93,977	6%	647,437	40%	23%
Urban Bus	19,466	1%	39,454	2%	0%
Rail	55,408	3%	222,699	14%	-16%
Marine	44,317	3%	50,472	3%	0%
Aviation	87,433	5%	12,472	1%	-34%
Off Road	277,949	17%	87,433	5%	0%
Total	1,671,041	100%	1,610,314	100%	-4%

WASTE AND WASTE WASTER

Table 12. Waste Sector Emissions, 2016 and 2050

WASTE EMISSIONS (KTCO ₂ E) BY FUEL	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Biological	8,302	14%	15,921	16%	92%
Landfill	45,172	78%	74,140	76%	64%
Wastewater	4,681	8%	7,148	7%	53%
Total	58,155	100%	97,209	100%	67%

CARBON SEQUESTRATION

Table 13. Land Use Change Emissions in KtCO₂e per year 2021-2050

LULUCF CATEGORY	SUBCATEGORY	(T/HA/YR)	2021	2026	2031	2036	2041	2046	2050
A. Forest land	1. Forest land remaining forest land	-7.92	-272	-272	-272	-272	-272	-272	-272
B. Cropland	1. Cropland remaining cropland	0.64	23	23	23	23	23	23	23
E. Settlements	1. Settlements remaining settlements	-5.76	-69	-69	-70	-71	-71	-72	-73
E. Settlements	2.1 Forest land converted to settlements	274.48	0	0	0	0	0	0	0
E. Settlements	2.2 Cropland converted to settlements	54.08	1	1	9	1	4	7	8
	Total		-317	-317	-310	-318	-316	-313	-314

Appendix D.2: Key BAP Assumptions

CATEGORY	DATA/ASSUMPTION	SOURCE	SUMMARY APPROACH/METHODOLOGY
Population & employment	Population: 561,919 (2016) 696,356 (2031) 781,203 (2041) Employment: 206,205 (2016) 275,233 (2031) 321,132 (2041) In both cases, linearly projected through to 2050	Population and employment per traffic zone as per City projections and draft estimates through to 2041	Population and employment projections by zone to 2050 are applied and spatially allocated in the model. Post 2041 projections and spatial allocation were not available from the City. The population and employment trends for 2017-2041 were extrapolated to get totals for 2050. Spatial allocation of post 2041 population and employment was distributed according to similar patterns of growth exhibited between 2017-2041.
INDUSTRIAL PROCESS ENERGY			
Industrial energy consumption	Assume energy use intensity and emissions profile stays constant from 2016-2050.	Canadian Energy and Emissions Data Centre: https://cieedacdb.rem.sfu.ca/	
Steel (AMD)	Assume energy use intensity and emissions profile stays constant.	Basic Facility Information for Toxics Reduction Act (TRA) 455/09, ArcelorMittal Dofasco, July 13, 2018 For process fuel and energy intensities: Best Available Techniques (BAT) Reference Document for Iron and Steel Production Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control) 2013. Rainer Remus, Miguel A. Aguado-Monsonet. Serge Roudier, Luis Delgado Sancho	Assume energy use intensity and emissions profile stays constant from 2016-2050. ArcelorMittal Dofasco (AMD)'s steel production uses three blast furnaces which uses coal, coke, oil, natural gas and electricity to turn iron ore into hot metal in a blast furnace, and then this hot metal is turned into steel in a basic oxygen furnace, which uses electricity, natural gas and coke and some produced gasses to fire its operation.

CATEGORY	DATA/ASSUMPTION	SOURCE	SUMMARY APPROACH/METHODOLOGY
LAND USE PROJECTIONS			
Residential and non-residential floor space projections	Population and employment per zone, as per City projections through to 2041. 2041-2050: population and employment trends per zone are projected linearly (based on 2031-2041 data from City).	Places to Grow; GRIDS II consultant presentation to City Council, Q4 2019; Information provided by the City	<p>New building floorspace (residential & non-residential) by zone to 2050 was derived using the population and employment projections provided by the City.</p> <p>New residential floorspace (households/ dwellings) is derived by allocating new dwellings based on the existing persons per unit. New dwellings by type are allocated to zones:</p> <ul style="list-style-type: none"> - if zone already has dwellings, the existing dwelling type share is used for new builds - if zone does not have dwellings, existing dwelling type share from nearby zones is used for new builds - if population in a zone is projected to decrease, dwellings are removed - greenfield vs. infill designation is based on GIS data provided by the City <p>New non-residential floorspace is derived by allocating new non-residential floorspace according to gross floor area per employee/job. New non-residential floorspace by type is allocated to zones</p> <ul style="list-style-type: none"> - if zone already has employment, the existing employment sector shares are used along with gross floor area per employee - if zone does not have any employment, the employment shares from nearby zones are used along with gross floor area per employee - if employment in a zone decreases, non-residential buildings are removed - greenfield vs. infill designation is based on GIS data provided by the City

CATEGORY	DATA/ASSUMPTION	SOURCE	SUMMARY APPROACH/METHODOLOGY
BUILDINGS			
New buildings energy performance			
Residential	Starting in 2017: 15% energy improvement from the 2016 baseline for residential, and 13% for MURBs, C&I.	Adapted from Report by Environmental Commissioner of Ontario. Conservation: Let's Get Serious 2015-2016. And, based on correspondence with Brendan Hayley , Policy Director at Efficiency Canada.	The Let's Get Serious report forecasts a building energy performance of 15% for low-rise housing, and 13% for large buildings. As of 2019, the province of Ontario has proposed abandoning the Ontario Building Code's more stringent energy efficiency standards in favour of harmonization with the National Building Code, which does not contain energy efficiency requirements. It is unclear whether Ontario will adopt the energy efficiency requirements contained in the National Energy Code. As such, a slightly more conservative 10% energy improvement every 5 years is used.
Multi-residential	As of 2019: new construction is 10% more efficient every 5 years.		
Commercial & Institutional			
Industrial			
Existing buildings energy performance			
Residential	Starting in 2020, retrofit existing building stock exponentially until in 2050 a total of 6% achieve 10% electricity and 10% heating savings	Pembina, Pathway Study on Existing Residential Buildings in Ottawa, 2019 (at 22).	Baseline efficiencies for each building type are derived in the model through calibration with observed data; for existing buildings, a 10% improvement in efficiency is applied.
Multi-residential			
Commercial & Institutional			
Industrial			
Municipal buildings	Starting in 2020, reduce energy intensity in all corporate facilities by 60% by 2050, with an interim goal of 45% by 2030 (against a 2005 base year, retrofits assumed to be implemented linearly)	City of Hamilton Corporate Energy Policy (2014); City of Hamilton Corporate Annual Energy Report (2016)	

CATEGORY	DATA/ASSUMPTION	SOURCE	SUMMARY APPROACH/METHODOLOGY
Fuel share by end use			
Space heating	Stays constant through to 2050	Canadian Energy Systems Analysis Research. Canadian Energy System Simulator. http://www.cesarnet.ca/research/caness-model .	Within the model, the starting point for fuel shares by end use is an Ontario average value for the given building type, which comes from CanESS. From there, the fuel shares are calibrated to track on observed natural gas and electricity use. Once calibrated, end use shares are held constant through the BAU.
Water heating	Stays constant through to 2050		
Space cooling	Stays constant through to 2050		
Projected climate impacts			
Heating & cooling degree days	Heating degree days (HDD) decrease and cooling degree days (CDD) increase from 2016-2050.	Climate Projections taken from Climate Atlas Canada. https://climateatlas.ca/data/city/444/plus30_2030_85/line	To account for the influence of projected climate change, energy use was adjusted according to the number of heating and cooling degree days. Average HDD and CDD values across all models for Hamilton in the RCP8.5 scenario is used. Climate projections are categorized in two representative concentration pathways (RCP) scenarios: a moderate emissions increase (RCP4.5), and a business as usual emissions scenario (RCP8.5).
Grid electricity emissions			
Grid electricity emissions factor	2016: 37.4 gCO ₂ e/kWh 2050: 83.7 gCO ₂ e/kWh 2016: CO ₂ : 35.0 g/kWh CH ₄ : 0.001 g/kWh N ₂ O: 0.001 g/kWh 2050: CO ₂ : 82.32 g/kWh CH ₄ : 0.02 g/kWh N ₂ O: 0.00 g/kWh	IESO, Annual Planning Outlook January 2020.	Emissions are expected to increase due to greater reliance on natural gas.

CATEGORY	DATA/ASSUMPTION	SOURCE	SUMMARY APPROACH/METHODOLOGY
Local energy generation			
Biogas (CHP, wastewater treatment plant electricity generation)	1.6 MW (69% capacity factor)	HRPI	CHP capacity is held constant to 2050.
Landfill gas	3.2 MW (36% capacity factor)	HRPI	Landfill gas capacity held constant to 2050.
Solar PV	1.7 MW (15% capacity factor) Starting in 2021, incrementally scale up to 10% of all buildings by 2050, solar PV systems which provide on average 30% of consumption for building electrical load for less than 5 storeys; 10% for multi-unit and commercial buildings	IESO Contracted Renewable Generation list (as of September 30 2019, updated quarterly). Growth assumption was made by SSG to reflect ongoing uptake of solar PV in net metering arrangements.	9.93418 MW Scale up to 10% of all buildings by 2050 have solar PV systems which provide on average 30% of consumption for building electrical load for less than 5 storeys; 10% for multi-unit and commercial buildings
Solar PV - ground mount	2.0 MW per year between 2018 and 2050 (~80 Ha) resulting in 66 MW	Assumption was made by SSG to reflect a base level of investments in commercial solar PV.	
Energy Storage	No storage deployed.		
District energy (CHP)	Staying constant from 2016: 4.1 eMW CHP, 17.18 MW heating, 19.9 MW cooling), Portlands DE coming online from 2019: 2 eMW CHP, 9.8 MW heating	HCE Inc.	

CATEGORY	DATA/ASSUMPTION	SOURCE	SUMMARY APPROACH/METHODOLOGY
TRANSPORTATION			
Transit			
Expansion of transit	Incremental increase in bus service from 2016 transit service to keep up with population growth through to 2050. Mode share assumed to stay constant to 2016-2050.	Transportation Tomorrow Survey, http://www.transportationtomorrow.on.ca/ In addition to data provided from the City.	Incremental increase in bus service from 2016 transit service to keep up with population growth through to 2050. Mode share assumed to stay constant to 2016-2050.
CNG/ Electric vehicle transit	Fleet turnover reflects increasing transition to CNG and electric. 50% electric and 50% CNG by 2050 (diesel stock completely phased out by 2050)	Transit fleet age and fuel provided by the City up to 2019.	
Clean Fuel Standard	10 g CO ₂ e/MJ by 2030 - staying constant till 2050.		The Clean Fuel Standard (CFS) will reduce carbon intensity standards for gaseous, liquid, and solid fossil fuels, incentivizing the development of cleaner fuel technologies and low-carbon alternatives. Detailed regulations are outstanding.
Active			
Cycling & walking infrastructure	Active transportation mode share is held constant to 2050.	Transportation Master Plan, review and update (2018)	No change in active transportation mode share assumed 2016-2050.

CATEGORY	DATA/ASSUMPTION	SOURCE	SUMMARY APPROACH/METHODOLOGY
Private & commercial vehicles			
Vehicle kilometers travelled	No data from City or other, derived from the model.	Expert estimates derived from location of residents, jobs, schools, and other services; Average trip lengths derived from Statistics Canada; Car registrations. (see text of DMA for further details)	Vehicle kilometres travelled projections are driven by buildings projections. The number and location of dwellings and non-residential buildings over time in the BAU drive the total number of internal and external person trips. Person trips are converted to vehicle trips using the baseline vehicle occupancy. Vehicle kilometres travelled is calculated from vehicle trips using the baseline distances between zones and average external trip distances. This estimate is calibrated against Kent Fuel Sales data within the City from 2016-2019.
Vehicle fuel efficiencies	Vehicle fuel consumption rates reflect the implementation of the U.S. Corporate Average Fuel Economy (CAFE) Fuel Standard for Light-Duty Vehicles, and Phase 1 and Phase 2 of EPA HDV Fuel Standards for Medium- and Heavy-Duty Vehicles.	EPA. (2012). EPA and NHTSA set standards to reduce greenhouse gases and improve fuel economy for model years 2017-2025 cars and light trucks. Retrieved from https://www3.epa.gov/otaq/climate/documents/420f12050.pdf http://www.nhtsa.gov/fuel-economy	Fuel efficiency standards are applied to all new vehicle stocks starting in 2016.

CATEGORY	DATA/ASSUMPTION	SOURCE	SUMMARY APPROACH/METHODOLOGY
Vehicle share	Personal vehicle stock share changes between 2016-2050. Commercial vehicle stock unchanged 2016-2050.	CANSIM and Natural Resources Canada's Demand and Policy Analysis Division.	The total number of personal use and corporate vehicles is proportional to the projected number of households in the BAU.
Electric vehicles (personal/commercial)	Starting in 2020, 14% new sales by 2030; share holds constant to 2050	Reaching 30% plug-in vehicle sales by 2030: Modeling incentive and sales mandate strategies in Canada (Jon Axsen; Michael Wolinetz, Transportation Research Part D: Transport and Environment Volume 65, December 2018, Pages 596-617)	Conservative estimate from study used. Moving out to 2050, we assume subsidies do not stay in place, and new sales are held constant.
Electric vehicles (commercial)	25% of new commercial vehicle sales are electric by 2050.	Fleet details provided by the City.	
Electric vehicles (corporate)	25% of new vehicle sales are electric by 2030.	Fleet details provided by the City.	
WASTE			
Waste generation	Existing per capita waste generation rates unchanged. (215,000 tonnes in 2016)	City Website	Waste generation per capita held constant from 2018-2050.
Waste diversion	48% of total waste diverted from landfill in 2016 (diversion of organics/paper/plastic), increasing incrementally to 55% by 2021.	2014 Solid Waste Management Master Plan	Waste diversion rates increase slightly from 2016-2021, then held constant to 2050.
Waste treatment	Existing waste treatment processes unchanged.	Waste details provided by the City.	No change in waste treatment processes assumed 2016-2050.
Wastewater	Natural gas fueled pelletization system (as of 2021)	Details provided by the City.	Natural gas fueled pelletization system (as of 2021), 500 GJ, on the corporate side.

CATEGORY	DATA/ASSUMPTION	SOURCE	SUMMARY APPROACH/METHODOLOGY
FINANCIAL			
Energy costs	Energy intensity costs by fuel increase incrementally between 2016-2050 per projections.	National Energy Board. (2019). Canada’s Energy Future 2016. Government of Canada.	NEB projections extend until 2040; extrapolated to 2050. Energy cost intensities are applied to energy consumption by fuel, derived by the model, to determine total annual energy and per household costs.
Carbon price	April 2019 (\$20/tonne); April 2020 (\$30/tonne); April 2021 (\$40/tonne); April 2022 (\$50/tonne). April 2030 (\$170/tonne)	Federal government determines the report.	Held constant after 2030. Only applies to combustion emissions (i.e. not waste); and to small emitters (i.e. below 10kt/year). Large emitters (25kt+) are subject to a cap & trade-type system, where they could potentially profit. Medium emitters can opt in (10kt-25kt) and are likely to do so as it is likely to be financially advantageous.
Agricultural / Natural Systems			
Agricultural: Live Stock	Varies per animal Type Kg CH ₄ / head Assume no change towards 2050 in livestock.	Agricultural Census; Environment and Climate Change Canada. National Inventory Report 1990-2016: Greenhouse Gas Sources and Sinks in Canada. Part 2 Table A3-30 CH ₄ Emission Factors for Enteric Fermentation for Cattle from 1990 to 2016 Table A3-37 Emission Factors to Estimate CH ₄ Emissions from Manure Management for Cattle Subcategories	

CATEGORY	DATA/ASSUMPTION	SOURCE	SUMMARY APPROACH/METHODOLOGY
Agricultural Land Use & Forest Carbon Storage	128,532 acres of farmland area within the city boundary in 2016. It is reduced to reflect increased area developed for housing and non-residential development. No data provided on urban and rural forest cover, assumed to stay constant through to 2050.	Agricultural Census; Hamilton Agriculture Profile and Economic Impact Report; Hamilton Urban Forest Strategy (draft workplan) 2019; 2019 Refinement to the 2006 IPCC Guidelines on National Greenhouse Gas Inventories (2019 Refinement), Volume 4, Chapter 4, Table 4.9 (Updated), Temperate, Continental, Secondary > 20 years 2019 Refinement to the 2006 IPCC Guidelines on National Greenhouse Gas Inventories (2019 Refinement), Volume 4, Chapter 4, Table 4.4 (Updated), Temperate, Continental, North and South America, Natural (Other Broadleaf) 2006 IPCC Guidelines on National Greenhouse Gas Inventories, Volume 4, Chapter 4, Table 4.3, Temperate, All (No Refinement in 2019)	Land that is currently mostly forested or agricultural and is projected to be developed, will have an increase in GHG emissions associated with it due to assumed release of sequestered carbon, which is calculated using IPCC methodology.

Appendix D.3: GPC Emissions Scope

REASONS FOR EXCLUSION	
N/A	Not Applicable, or not included in scope
ID	Insufficient Data
NR	No Relevance, or limited activities identified
Other	Reason provided in other comments

GPC REF NO.	SCOPE	GHG EMISSIONS SOURCE	INCLUSION	REASON FOR EXCLUSION (IF APPLICABLE)
I		STATIONARY ENERGY SOURCES		
I.1		Residential buildings		
I.1.1	1	Emissions from fuel combustion within the city boundary	Yes	
I.1.2	2	Emissions from grid-supplied energy consumed within the city boundary	Yes	
I.1.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	Yes	
I.2		Commercial and institutional buildings/facilities		
I.2.1	1	Emissions from fuel combustion within the city boundary	Yes	
I.2.2	2	Emissions from grid-supplied energy consumed within the city boundary	Yes	
I.2.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	Yes	
I.3		Manufacturing industry and construction		
I.3.1	1	Emissions from fuel combustion within the city boundary	Yes	
I.3.2	2	Emissions from grid-supplied energy consumed within the city boundary	Yes	
I.3.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	Yes	
I.4		Energy industries		
I.4.1	1	Emissions from energy used in power plant auxiliary operations within the city boundary	Yes	

GPC REF NO.	SCOPE	GHG EMISSIONS SOURCE	INCLUSION	REASON FOR EXCLUSION (IF APPLICABLE)
I.4.2	2	Emissions from grid-supplied energy consumed in power plant auxiliary operations within the city boundary	Yes	
I.4.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption in power plant auxiliary operations	Yes	
I.4.4	1	Emissions from energy generation supplied to the grid	Yes	
I.5		Agriculture, forestry and fishing activities		
I.5.1	1	Emissions from fuel combustion within the city boundary	No	ID
I.5.2	2	Emissions from grid-supplied energy consumed within the city boundary	No	ID
I.5.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	No	ID
I.6		Non-specified sources		
I.6.1	1	Emissions from fuel combustion within the city boundary	No	ID
I.6.2	2	Emissions from grid-supplied energy consumed within the city boundary	No	ID
I.6.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	No	ID
I.7		Fugitive emissions from mining, processing, storage, and transportation of coal		
I.7.1	1	Emissions from fugitive emissions within the city boundary	No	ID
I.8		Fugitive emissions from oil and natural gas systems		
I.8.1	1	Emissions from fugitive emissions within the city boundary	Yes	

GPC REF NO.	SCOPE	GHG EMISSIONS SOURCE	INCLUSION	REASON FOR EXCLUSION (IF APPLICABLE)
II		TRANSPORTATION		
II.1		On-road transportation		
II.1.1	1	Emissions from fuel combustion for on-road transportation occurring within the city boundary	Yes	
II.1.2	2	Emissions from grid-supplied energy consumed within the city boundary for on-road transportation	Yes	

GPC REF NO.	SCOPE	GHG EMISSIONS SOURCE	INCLUSION	REASON FOR EXCLUSION (IF APPLICABLE)
II.1.3	3	Emissions from a portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption	Yes	
II.2		Railways		
II.2.1	1	Emissions from fuel combustion for railway transportation occurring within the city boundary	Yes	
II.2.2	2	Emissions from grid-supplied energy consumed within the city boundary for railways	Yes	
II.2.3	3	Emissions from a portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption	Yes	
II.3		Water-borne navigation		
II.3.1	1	Emissions from fuel combustion for waterborne navigation occurring within the city boundary	Yes	
II.3.2	2	Emissions from grid-supplied energy consumed within the city boundary for waterborne navigation	Yes	
II.3.3	3	Emissions from a portion of transboundary journeys occurring outside the city boundary, and transmission and distribution losses from grid-supplied energy consumption	Yes	

GPC REF NO.	SCOPE	GHG EMISSIONS SOURCE	INCLUSION	REASON FOR EXCLUSION (IF APPLICABLE)
III		WASTE		
III.1		Solid waste disposal		
III.1.1	1	Emissions from solid waste generated within the city boundary and disposed in landfills or open dumps within the city boundary	Yes	
III.1.2	3	Emissions from solid waste generated within the city boundary but disposed in landfills or open dumps outside the city boundary	Yes	
III.1.3	1	Emissions from waste generated outside the city boundary and disposed in landfills or open dumps within the city boundary	No	NR
III.2		Biological treatment of waste		
III.2.1	1	Emissions from solid waste generated within the city boundary that is treated biologically within the city boundary	Yes	

GPC REF NO.	SCOPE	GHG EMISSIONS SOURCE	INCLUSION	REASON FOR EXCLUSION (IF APPLICABLE)
III.2.2	3	Emissions from solid waste generated within the city boundary but treated biologically outside of the city boundary	No	ID
III.2.3	1	Emissions from waste generated outside the city boundary but treated biologically within the city boundary	No	NR
III.3		Incineration and open burning		
III.3.1	1	Emissions from solid waste generated and treated within the city boundary	No	NR
III.3.2	3	Emissions from solid waste generated within the city boundary but treated outside of the city boundary	No	NR
III.3.3	1	Emissions from waste generated outside the city boundary but treated within the city boundary	No	NR
III.4		Wastewater treatment and discharge		
III.4.1	1	Emissions from wastewater generated and treated within the city boundary	Yes	
III.4.2	3	Emissions from wastewater generated within the city boundary but treated outside of the city boundary	No	NR
III.4.3	1	Emissions from wastewater generated outside the city boundary	No	NR

GPC REF NO.	SCOPE	GHG EMISSIONS SOURCE	INCLUSION	REASON FOR EXCLUSION (IF APPLICABLE)
IV		INDUSTRIAL PROCESSES AND PRODUCT USE (IPPU)		
IV.1	1	Emissions from industrial processes occurring within the city boundary	Yes	ID
IV.2	1	Emissions from product use occurring within the city boundary	No	ID

GPC REF NO.	SCOPE	GHG EMISSIONS SOURCE	INCLUSION	REASON FOR EXCLUSION (IF APPLICABLE)
V		AGRICULTURE, FORESTRY AND LAND USE (AFOLU)		
V.1	1	Emissions from livestock within the city boundary	Yes	NR
V.2	1	Emissions from land within the city boundary	Yes	NR
V.3	1	Emissions from aggregate sources and non-CO2 emission sources on land within the city boundary	Yes	NR

GPC REF NO.	SCOPE	GHG EMISSIONS SOURCE	INCLUSION	REASON FOR EXCLUSION (IF APPLICABLE)
VI		OTHER SCOPE 3		
VI.1	3	Other Scope 3	No	N/A

Appendix D.4: Methodology for adjusting 2005 baseline energy use intensity targets relative to 2016 energy use intensities

ISSUE

The current CityInSight Community model uses a time horizon that spans a range of 2016 – 2050, with 2016 serving as the baseline conditions for the modeled community. As such, energy use intensity projections made with the model for the city’s corporate portfolio will be relative to its 2016 baseline performances. However, the city of Hamilton’s energy use intensity targets for their corporate portfolio were made based on their 2005 energy use intensity performances, which is not modelled within the CityInSight Community model’s time horizon.

IMPLEMENTED SOLUTION

By using the City of Hamilton’s Annual Energy Report for 2016, we were able to calculate the progress made between 2005 and 2016 in the City’s corporate energy use intensity: a reduction of 24.1%. Based on this, the City’s energy performance targets for their corporate portfolio, originally based on their 2005 energy performance evaluation, were adjusted to their 2016 energy performance evaluation. The result of this adjustment is as shown in Table 1.

Table 14. Comparison of energy use reduction targets for City of Hamilton's corporate portfolio

	2005	2016	2030	2050
2005 Baseline	0%	-24.1%	-45%	-60%
translates to the following energy use reduction with a 2016 Baseline		0%	-28.5%	-48%

APPENDIX E: Net-Zero Modelling Results

June 2021

Purpose

This document reports the energy use and greenhouse gas (GHG) emissions modelling results for the net-zero by 2050 scenario designed for the City of Hamilton. The net-zero assumptions that feed into the model were produced in consultation with the City and stakeholders and are outlined in a separate document.

The model results are shown in comparison to the base year (2016) and business-as-planned (BAP) energy use and emissions projections to 2050. The final results of the base year and BAP model were provided to the City in November 2020.

Disclaimer

Reasonable skill, care and diligence has been exercised to assess the information acquired during the preparation of this analysis, but no guarantees or warranties are made regarding the accuracy or completeness of this information. This document, the information it contains, the information and basis on which it relies, and the associated factors are subject to changes that are beyond the control of the author. The information provided by others is believed to be accurate but has not been verified.

This analysis includes strategic-level estimates of energy efficiency and greenhouse gas reduction potential represented by the proposed Community Energy and Emissions Plan (CEEP). The intent of this analysis is to help inform project stakeholders about the potential savings represented by the CEEP in relation to the modeled Business-as-Planned scenario. It should not be relied upon for other purposes without verification. The authors do not accept responsibility for the use of this analysis for any purpose other than that stated above, and do not accept responsibility to any third party for the use, in whole or in part, of the contents of this document.

This analysis applies to the City of Hamilton and cannot be applied to other jurisdictions without further analysis. Any use by the City of Hamilton, its sub-consultants or any third party, or any reliance on or decisions based on this document, are the responsibility of the user or third party.

Contents

Introduction	129
Method	129
Net-Zero Pathway: Overall Energy + Emissions Outcomes	130
Net-Zero Pathway: Sector-by-Sector Energy + Emissions Outcomes	135

Acronyms

BAP	business-as-planned
CEEP	Community Energy and Emissions Plan
CO ₂ e	carbon dioxide equivalent
EUI	energy use intensity
EV	electric vehicle
GHG	greenhouse gas
ICE	internal combustion engine
MT	megatonne
PJ	petajoule
PUV	personal use vehicle
REC	renewable electricity certificate
RNG	renewable natural gas

Units

GHG emissions

1 MtCO ₂ e =	1,000,000 tCO ₂ e
1 ktCO ₂ e =	1,000 tCO ₂ e
1 tCO ₂ e =	1,000 kgCO ₂ e
1 kgCO ₂ e =	1,000 gCO ₂ e

Energy

1 MWh =	1,000 kWh
1 MWh =	3.6 GJ
1 GJ =	278 kWh
1 GJ =	1,000,000 J
1 MJ =	0.001 GJ
1 TJ =	1,000 GJ
1 PJ =	1,000,000 GJ

Introduction

This report outlines the modelling results of a technically-feasible and community-informed net-zero greenhouse gas (GHG) emissions pathway by 2050 for the entire city of Hamilton. It provides the technical analysis that underpins the city's Community Energy and Emissions Plan.

Net-zero carbon emissions means that any emissions that are released within the geographic boundary of the city in 2050 are offset by sequestration or the purchase of carbon offsets from other jurisdictions. This net-zero scenario maximizes local GHG reduction efforts before turning to sequestration and the purchase of offsets. It does so by:

1. First seeking to avoid unnecessary greenhouse gas emitting behaviour (e.g. sending organics to landfill);
2. Then turning to avoid unnecessary energy use (the primary source of the city's GHG emissions) and improving the efficiency of remaining energy uses; and
3. Finally, switching any remaining fossil fuel use to renewable energy sources.

The emphasis on energy conservation and efficiency helps reduce the need for costly additional energy generation capacity.

This report begins with an overall description of the community's energy and GHG emissions reduction from 2016 to 2050 by fuel and sector in the net-zero scenario, followed by more detailed sector-by-sector analysis.¹ This analysis includes a description of each modelled action and its associated GHG reduction in 2050 as compared to a business-as-planned scenario.

It is important to note that some actions have little or no emissions reductions associated with them but are critical to reducing the overall energy demand of the net-zero scenario and maximizing co-benefits like social wellbeing, public health, and local economic benefits.

All data associated with figures included in the body of the report can be found in the data tables at the end of this document.

Method

The modelling software used for this project is CityInSight, an energy, emissions, and finance model developed by SSG and whatIf? Technologies. The model supports the use of scenarios as a mechanism to evaluate potential futures for communities. A scenario is an internally consistent view of what the future might turn out to be—not a forecast, but one possible future outcome. Scenarios must represent serious considerations defined by City staff and community members. In order to build a scenario, critical input from stakeholders is needed to define the scope and magnitude of the carbon-reducing targets set in the model. More details about the engagement process can be found in the Final Report.

The municipal greenhouse gas inventory included for the baseline in the model is aligned with the Global Protocol for Community-Scale GHG Emissions Inventories (GPC).

For further information on modeling methodology, see the Baseline and Business-as-Planned 2016-2050 Energy and Emissions Report (Nov. 2020), at Part 2: Data, Methods and Assumptions Manual.

¹ 2016 is used as a base year as it is the most recent year available of the Federal Government's Census, which is a key data source for the model.

Net-Zero Pathway: Overall Energy + Emissions Outcomes

ENERGY REDUCTION, EFFICIENCY + FUEL SWITCHING

In order to reduce GHG emissions it is essential to reduce energy use and switch remaining fuel consumption from fossil fuels to clean energy sources. The net-zero pathway for Hamilton fosters an impressive shift in energy use by 2050 (see Figure 1), reducing the overall consumption by 24% compared with the BAP scenario.

Whereas natural gas in 2016 accounted for more than one third of energy use in the city, by 2050 it is completely removed from Hamilton’s energy matrix. On the other hand, coal, gasoline, electricity from the grid, and diesel consumption, which combined account for 64% of total energy consumption in 2016, are dramatically reduced to only 4%. These are replaced primarily by renewable electricity, emissions-free biochar, green hydrogen, and renewable natural gas (see Table 1 at the end of this report for more detailed data).

In a net-zero scenario, the city’s main energy sources become: carbon-free (or ‘green’) hydrogen (33% of the total), followed by biochar (24%), renewable electricity (29%),² as well as renewable natural gas (‘RNG’, 9%). This is a major transformation on how the community uses energy.

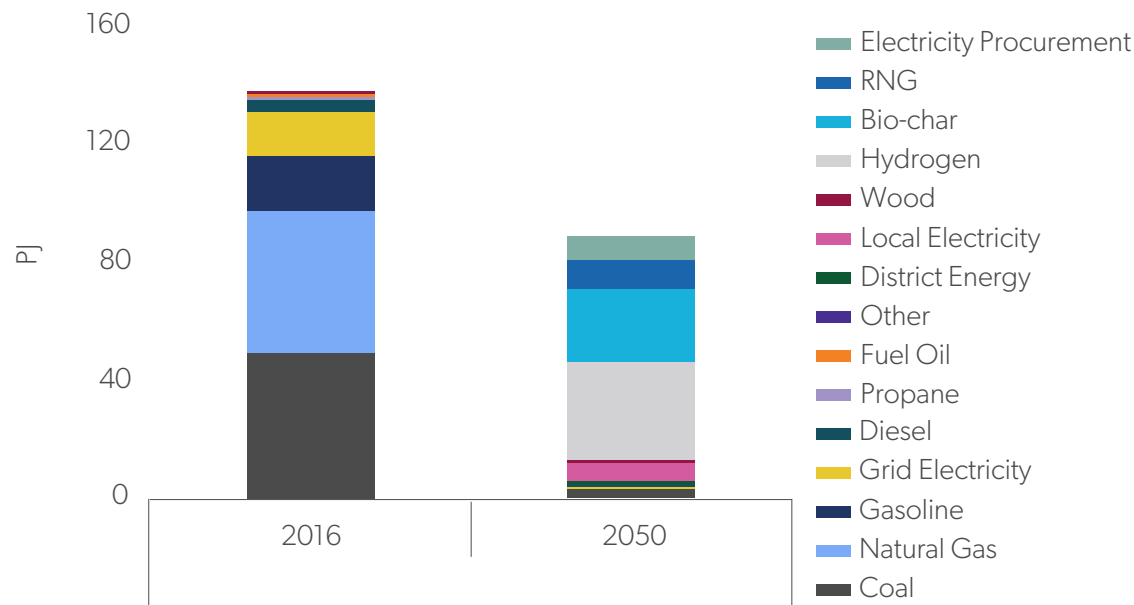


Figure 1. Hamilton’s energy consumption in petajoules, by source, in the base year and the net-zero scenario in 2050.³

² Renewable electricity includes installations owned by the community (labelled as Local Electricity in Figure 1) and also from the purchase of renewable energy credits (labelled as RECs in Figure 1).

³ ‘Other’ category in this chart includes propane, wood, district energy, fuel oil, and waste heat mainly.

WHERE ENERGY IS USED

Remaining the main energy consumer in Hamilton, the industrial sector reduces its energy demand by 15% by 2050 (see Figure 2). Transportation energy use in 2050 reduces more significantly, 50% by 2050, mostly due to the impressive energy efficiency of EVs,⁴ and reduction in personal use vehicles. Residential buildings use 23% less energy in 2050 than in 2016; commercial buildings use 30% less. The municipal sector is projected to only consume 0.1% of community energy in 2050, as such it is not visible in Figure 2.

All sectors are analyzed in more detail below.

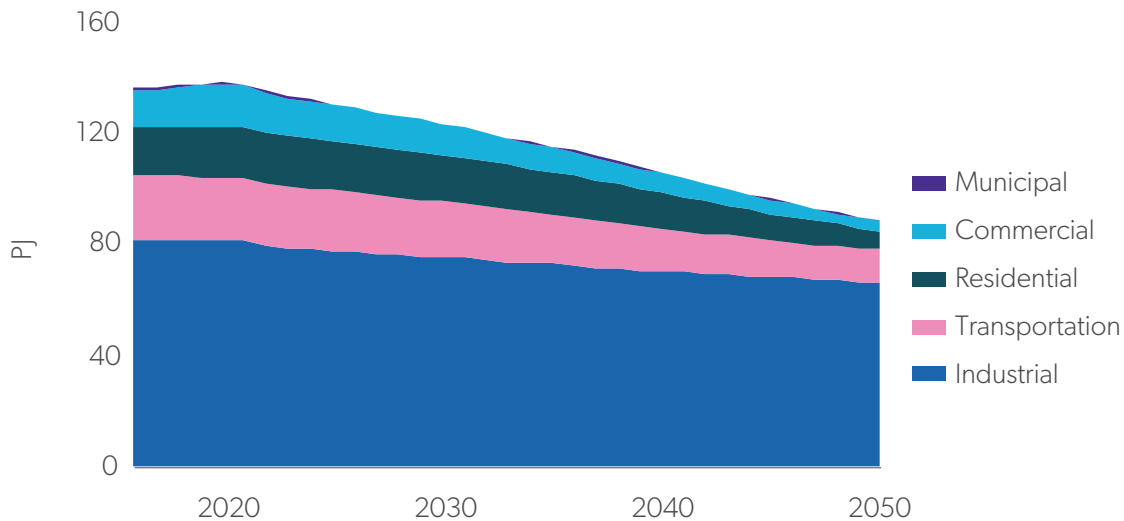


Figure 2. Net-zero pathway community energy use by sector (petajoules), 2016-2050.

HOW ENERGY IS USED

Transportation, space heating, and industrial process efficiency improvements drive major reductions in energy consumption in the net-zero scenario (see Figure 3), showing a 50%, 46%, and 12% reduction from their 2016 energy use respectively. The rest of the end-use categories play a much smaller role in overall energy reduction.

⁴ Electric vehicles convert over 77% of the electrical energy from the grid to power at the wheels, whereas the internal combustion energy vehicles convert about 12%–30%. U.S. Department of Energy (n.d.) All-electric vehicles. Retrieved from: <https://fueleconomy.gov/feg/evtech.shtml>.

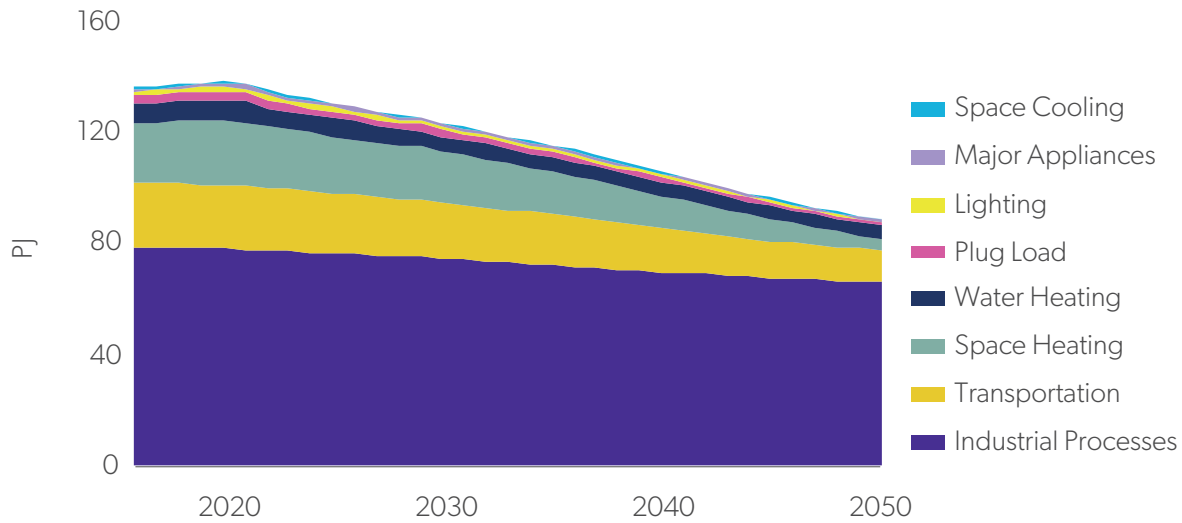


Figure 3. Net-zero pathway community energy use by end use (petajoules), 2016-2050.

EMISSION REDUCTIONS

By 2050, the net-zero pathway reduces GHG emissions by 95% compared to 2050 BAP levels (see Figure 4). This is an impressive outcome over a 30-year time period in an energy supply market currently dominated by fossil fuels.

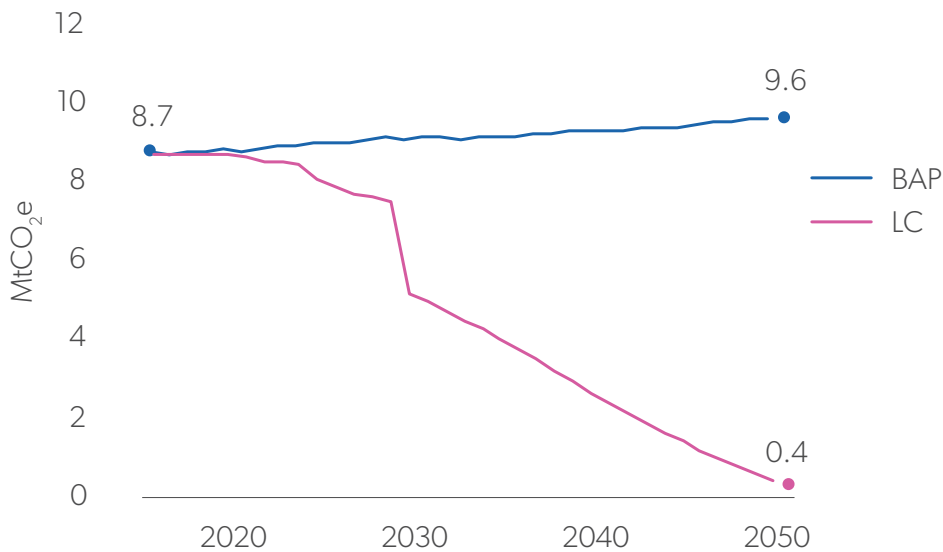


Figure 4. Net-zero pathway (blue) vs BAP scenario (orange) total community emissions (megatonnes of CO₂e), 2016-2050.

The following wedge chart shows how the dozens of net-zero pathway actions (or ‘targets’) build on one another to reduce the 2050 BAP emissions by 95%. A comprehensive table of modelled actions is provided in the separate document: “Table of Business-as-Planned and Low-Carbon Actions.”

In order to achieve net-zero emissions by 2050, the remaining carbon gap will need to be addressed via the purchase of offsets or in future CEEP iterations via new technological developments, regulations or policies.

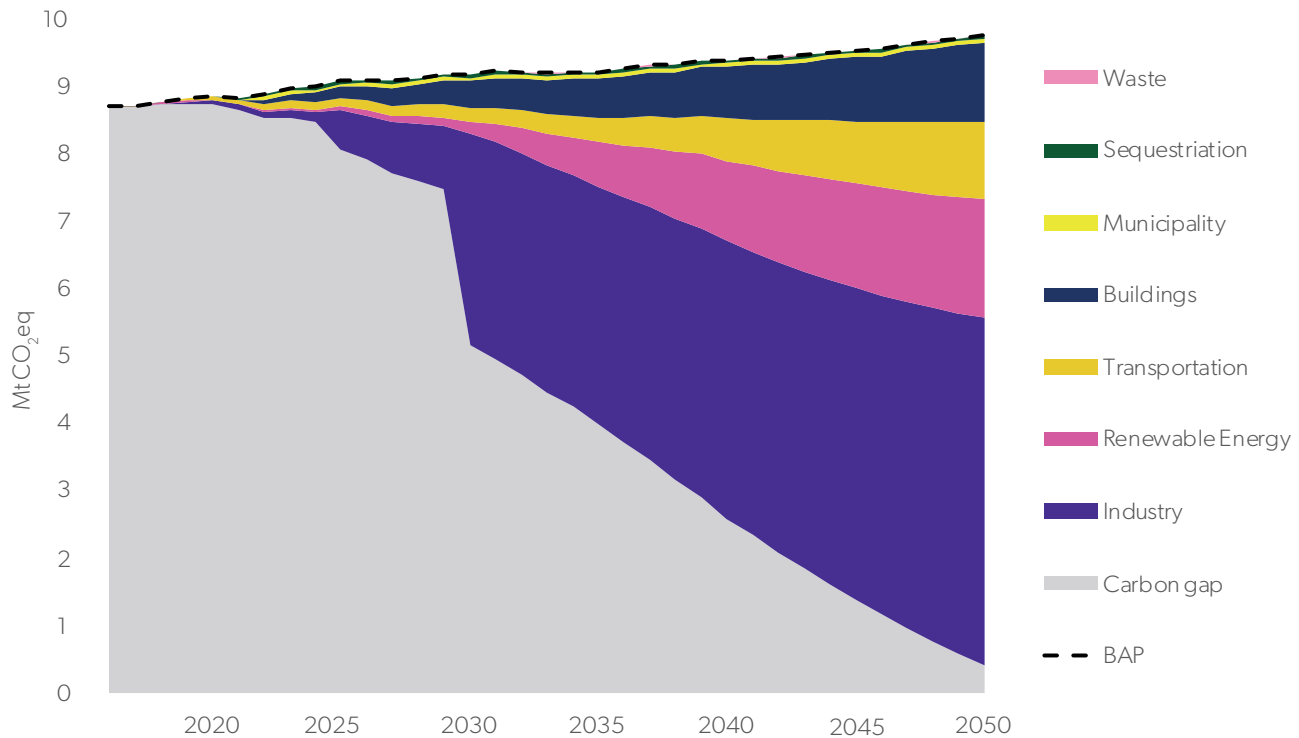


Figure 5. A wedges diagram illustrating the emissions reductions from a business-as-planned scenario associated with net-zero pathway actions (megatonnes of CO₂e). Note: For visual clarity, modelled actions have been grouped together by sector. A complete list of modelled actions is provided in Appendix A.

The emissions reduction of each modelled action is interdependent with other modelled actions. The wedges diagram shows the emissions reduction effect of implementing all actions considered. Only implementing some will affect the emissions reduction effectiveness of the others.

Industrial actions account for the biggest GHG reduction in the net-zero pathway, followed by the use of renewable energy sources such as RNG, renewable electricity, and green hydrogen.

Figure 5 includes the introduction of a carbon capture and sequestration (CCS) system in 2030 addressing GHG emissions from the steel mill; however, as the consumption of coal and natural gas at the steel mill is projected to decline through to 2050, the CCS becomes less relevant. Nevertheless, it is important for reducing cumulative emissions between 2030 and 2050.

The dramatic expansion of renewable and low-carbon energy use in the community ensures remaining energy consumption generates as few emissions as possible.

EMISSIONS BY ENERGY SOURCE

Natural gas emissions are completely removed from Hamilton’s inventory in 2050, and emissions from coal, gasoline, diesel, and grid electricity are reduced by 97%, 95%, 75% and 99% respectively compared with 2016 (see Figure 6). The introduction of blue hydrogen (i.e.,

hydrogen produced from natural gas combustion) in the industrial sector in 2030 does reduce the sector's GHG emissions profile, but not completely, until it is replaced with zero-emissions green hydrogen by 2050. In contrast, the increase in biochar, RNG, and renewable electricity consumption does not translate into higher overall emissions as they are free or low emissions.

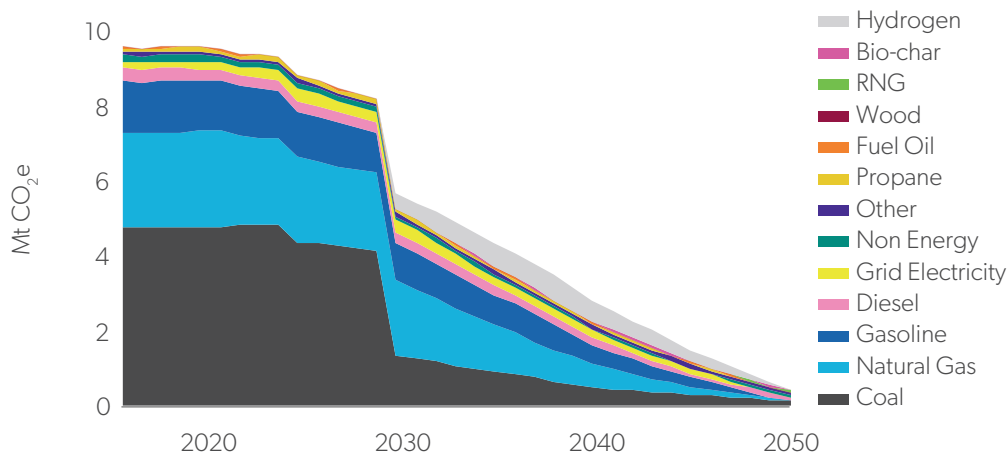


Figure 6. Net-zero pathway emissions by energy source (megatonnes of CO₂e), 2016-2050.⁵

EMISSIONS BY SECTOR

The net-zero pathway reduces emissions in all sectors. The greatest decrease in terms of net emissions comes from the industrial sector (5.4 Mt CO₂e, 97% compared with 2016) followed by transportation (1.5 Mt CO₂e, 88% compared with 2016), see Figure 7. Residential and commercial sectors come next with reductions of 0.7 and 0.5 MtCO₂e respectively (98% and 99% reductions compared with 2016). Transportation becomes the largest source of GHG emissions in 2050, with mainly aviation emissions remaining, but accounting only for 0.2 Mt CO₂e.

Waste emissions are reduced by 62%. The municipal sector reduces its emissions by 99%.

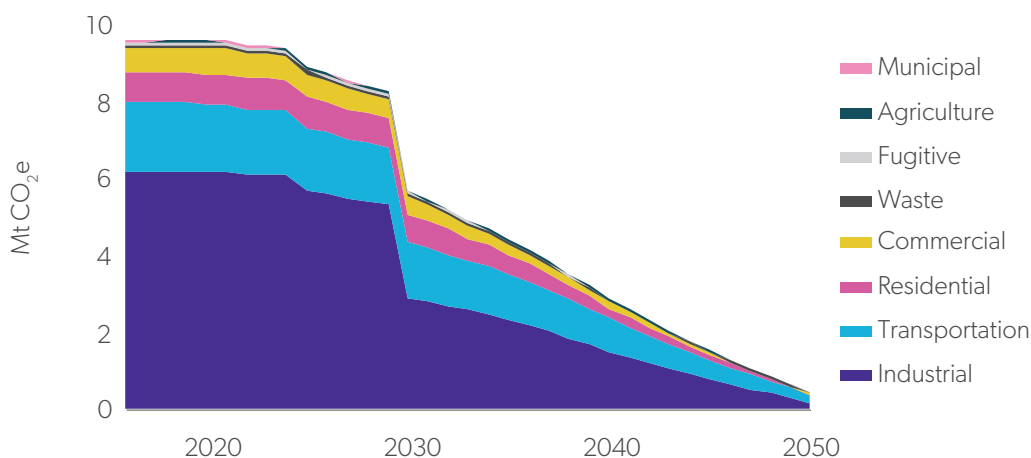


Figure 7. Net-zero pathway emissions by sector (megatonnes of CO₂e), 2016-2050.

⁵ The 'Other' category includes emissions mainly from fuel oil, wood, propane, and biochar.

Net-Zero Pathway: Sector-by-Sector Energy + Emissions Outcomes

INDUSTRY

MODELLED ACTION	DESCRIPTION	% GHG REDUCTIONS NET-ZERO VS. BAP 2050
Steel mill carbon capture	In 2030 a carbon capture and storage system is installed at the steel mill with 50% of coal emissions reduced.	1.0%* (*note: an important source of cumulative GHG reductions between 2030-2050)
Steel fuel switch	Fuel switching at the steel mill: <ul style="list-style-type: none"> • Biochar replaces 10% of coal in 2025, up to 50% by 2050. • Blue hydrogen replaces 30% (relative to 2016) of coal use in 2030, increasing to 50% by 2040. • Blue hydrogen is replaced by green hydrogen starting in 2035 and 100% is achieved by 2050. 	43.9%
Industrial efficiency	Improve industrial efficiency by 50% by 2050 in secondary industry facilities (non-steel).	8.0%

The industrial sector is the main energy consumer and GHG emitter in Hamilton in 2016. Steel is the primary industry in Hamilton, and specific actions were modelled for it. The priority was switching coal consumption to clean energy sources (see Figure 8), mainly hydrogen and biochar. Hydrogen comes first as ‘blue’ hydrogen in 2030, replacing 30% of total coal in 2016. This means that producing this energy source is still using fossil fuels but CO₂ emissions are being captured and sequestered. The transition to green hydrogen was assumed starting in 2035, achieving a 100% share in 2050. The remaining energy needs are met with the use of biochar which is a renewable fuel with low GHG emissions.

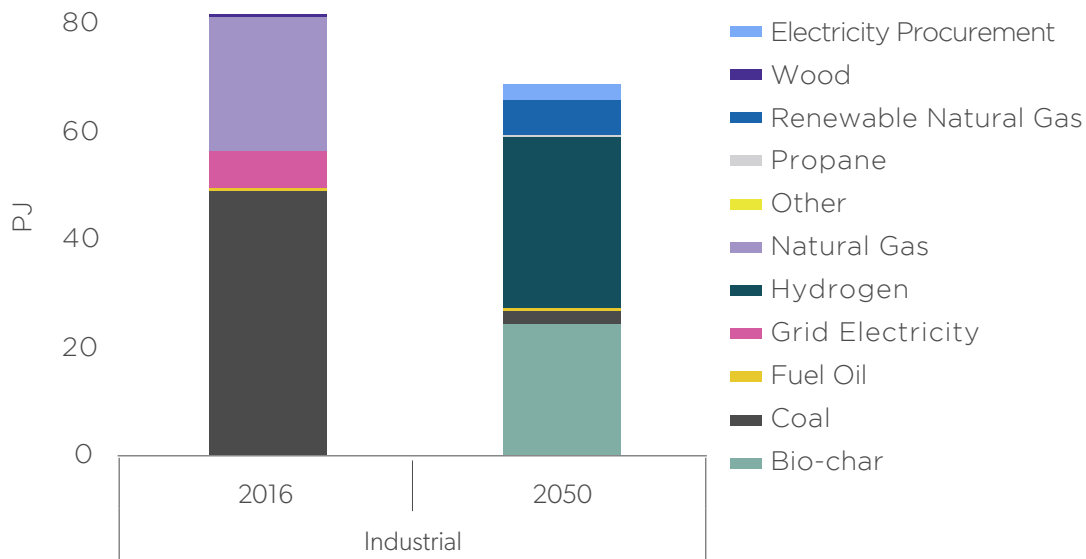


Figure 8. Industrial energy consumption by fuel type (petajoules), 2016 vs 2050.

For the remaining industry (a.k.a., secondary industry), 50% energy efficiency targets help explain a reduction in the overall industrial energy consumption of 15% shown in Figure 8. The Ontario 2019 Conservation Achievable Potential Study describes numerous measures that can be applied across the industrial sector to achieve deep energy efficiency improvements. However, no specific measures were modelled in CityInSight.

Industrial emissions show a dramatic reduction in 2050 (97% compared with 2016), as in addition to the decrease in energy consumption, new energy sources are zero- or low-emissions (see Figure 9).

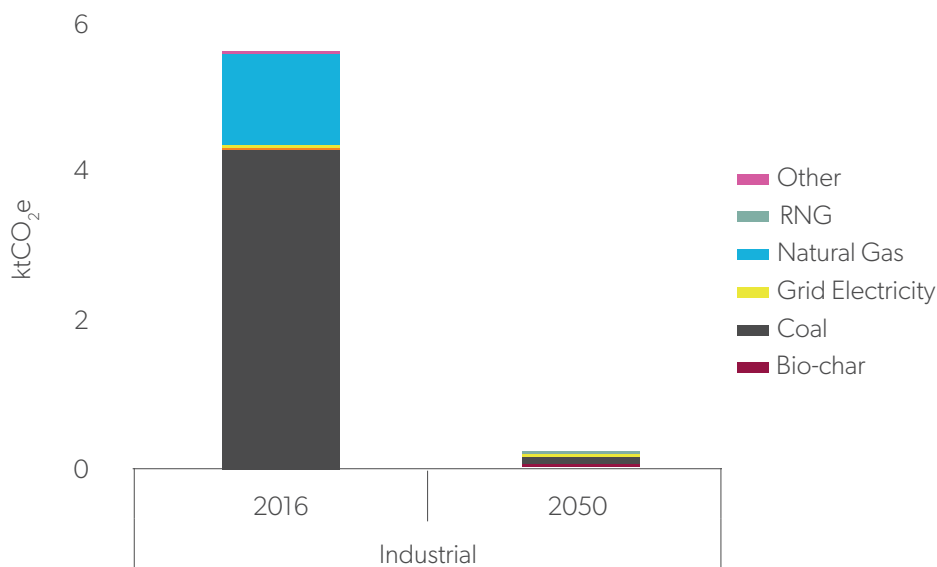


Figure 9. Industrial emissions by fuel type (megatonnes of CO₂e), 2016 vs 2050.

TRANSPORTATION

MODELLED ACTION	DESCRIPTION	% GHG REDUCTIONS NET-ZERO VS. BAP 2050
PUV electrification	10% of light-duty vehicles sales per year by 2025 are net-zero emissions; 30% by 2030; and 100% by 2040.	6.6%
Commercial fleet electrification	By 2050: <ul style="list-style-type: none"> All heavy-duty vehicles are green-hydrogen based; and Light-duty commercial vehicles are 100% electric. 	4.0%
Trip reduction	<ul style="list-style-type: none"> Private vehicle trips decline by 9% per person and vehicular trip lengths declined 6% by 2050. All areas of Hamilton are affected. 	0.9%
Marine efficiency	Increase efficiency by 50% by 2050.	0.2%
Electrify transit system	<ul style="list-style-type: none"> Existing CNG fleet transitioned to RNG by 2025. All other buses to be electric by 2035. 	0.1%
E-bikes & EV car-share	By 2050, 10% of trips up to 10km are completed by E-Bike or EV Car-Share.	0.1%
Increase transit mode share	Increase transit mode share to 12% by 2031, then 15% by 2050 in the urban and whitebelt zones.	0.02%
Active mode shift	By 2050, mode shift 50% of 2km trips to walking and 5km to cycling in the urban and whitebelt zones.	0.00%

The transformation of the transportation sector over the 2016-2050 time period results in 88% reduced emissions (Figure 10).

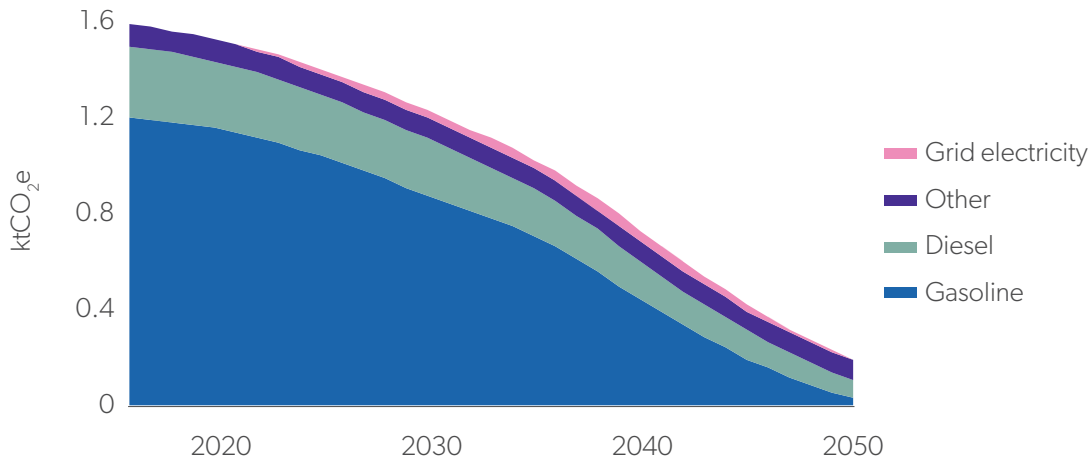
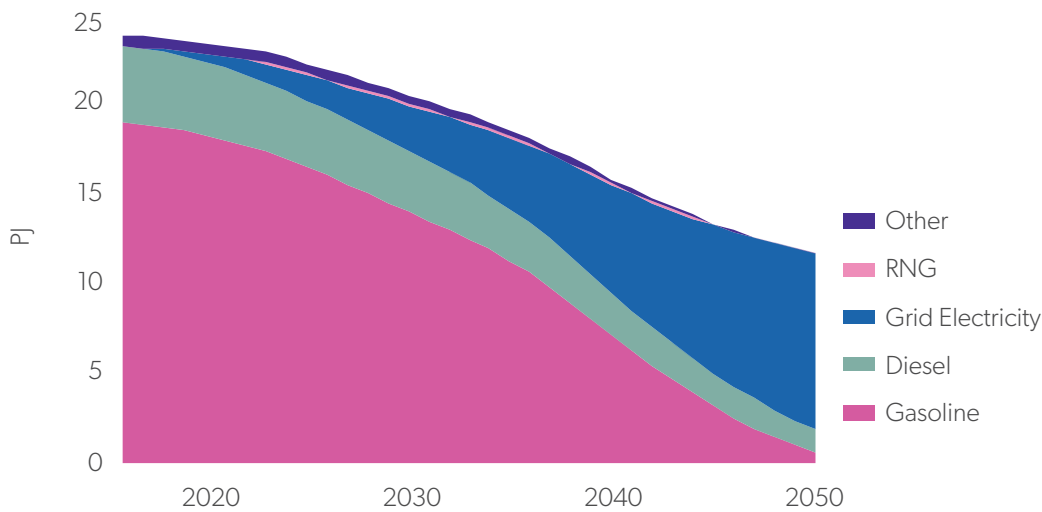


Figure 10. Transportation emissions for the net-zero pathway by fuel type, 2016-2050.⁶

The main driver for this decrease (89%) is the shift from internal combustion engines (ICE) to electric vehicles (EV), replacing gasoline and diesel demand with electricity. While originally coming from the provincial grid, this electricity is increasingly replaced with local renewable sources. Actions that avoid trip generation and trip distance also help reduce GHG emissions in Hamilton, accounting for 7% of the reductions in the transportation sector.

In addition to increased transit and active modes share in the urban and whitebelt zones (see Figure 12), the replacement of gasoline by electricity involves an important decrease in energy consumption (see Figure 11), as electric vehicles are much more efficient than their ICE counterparts.



Transportation energy consumption for the net-zero pathway by fuel type, 2016-2050.⁷

⁶ 'Other' category includes aviation fuel and natural gas.

⁷ 'Other' includes natural gas, ethanol, biodiesel, hydrogen, and RNG. Aviation fuel is not included in this chart as there was no data available for the energy analysis; 'Grid electricity' includes purchase of renewable energy certificates.

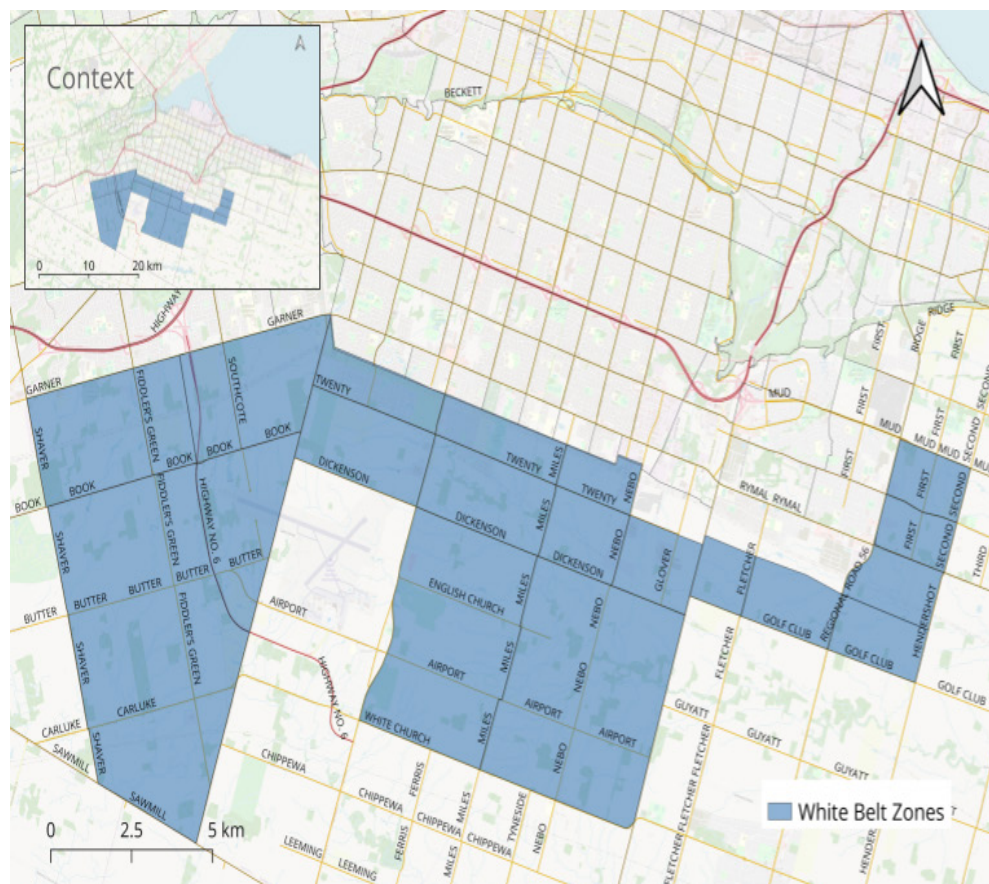


Figure 11. Traffic zones containing whitebelt zones.

(Note: Some whitebelt zones only cover a portion of the traffic zone they are in.)

COMMERCIAL AND RESIDENTIAL BUILDINGS

MODELLED ACTION	DESCRIPTION	% GHG REDUCTIONS NET-ZERO VS. BAP 2050
Heat pumps (for space and water heating)	<ul style="list-style-type: none"> 90% of all pre-1980 dwellings switch to heat pumps by 2050. 100% for all post-1980 dwellings switch to heat pumps by 2050. 	4.3%
Retrofit non-residential	Starting in 2022, increase efficiency for 100% of commercial buildings by 50% by 2050.	2.7%
New non-residential EUI	<ul style="list-style-type: none"> In 2026, new buildings are 30% more efficient. In 2031, new buildings are 60% more efficient. 	1.4%

MODELLED ACTION	DESCRIPTION	% GHG REDUCTIONS NET-ZERO VS. BAP 2050
Retrofit dwellings	<ul style="list-style-type: none"> Starting in 2022, by 2050, all existing dwellings built before 1980 achieve average thermal savings of 50%; electrical savings of 50% (not including electrification of space and water heating). Starting in 2035, retrofit 100% of all dwellings built between 1980 and 2016 by 2050 (following pre-1980 dwellings). Achieve on average thermal savings of 50%; electrical savings of 50% (not including electrification of space and water heating). 	2.8%
New dwelling EUI	<ul style="list-style-type: none"> Only 20% of new dwellings to be single-detached by 2050 (a steady decline from rates in 2016). In 2026, new buildings are 30% more efficient. In 2031, new buildings are 60% more efficient. 	0.4%

Commercial and residential buildings in Hamilton account for 23% of energy consumption and 14% of GHG emissions in 2016. Energy efficiency is the main priority in the building sector via implementation of new building energy performance guidelines and deep energy retrofits of existing buildings. Along with the incorporation of highly energy-efficient heat pumps, these actions help drive energy consumption from buildings down by 23% between 2016 and 2050 (see Figure 13).

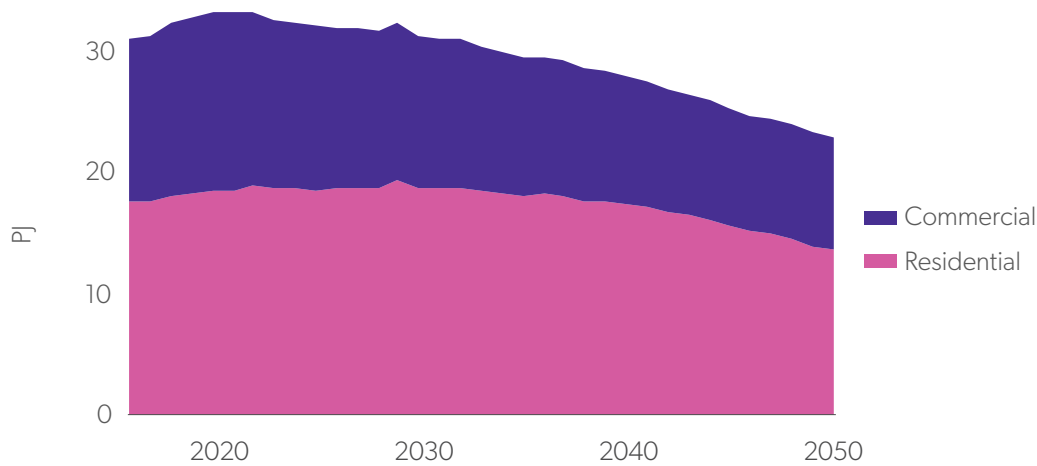


Figure 12. Buildings energy consumption by sector, 2016-2050.

The identification of buildings built before 1980, which are typically less energy efficient, can be useful for implementation planning purposes. The following figure shows how much pre-1980 residential and non-residential floor space is in each of the city’s traffic zones.

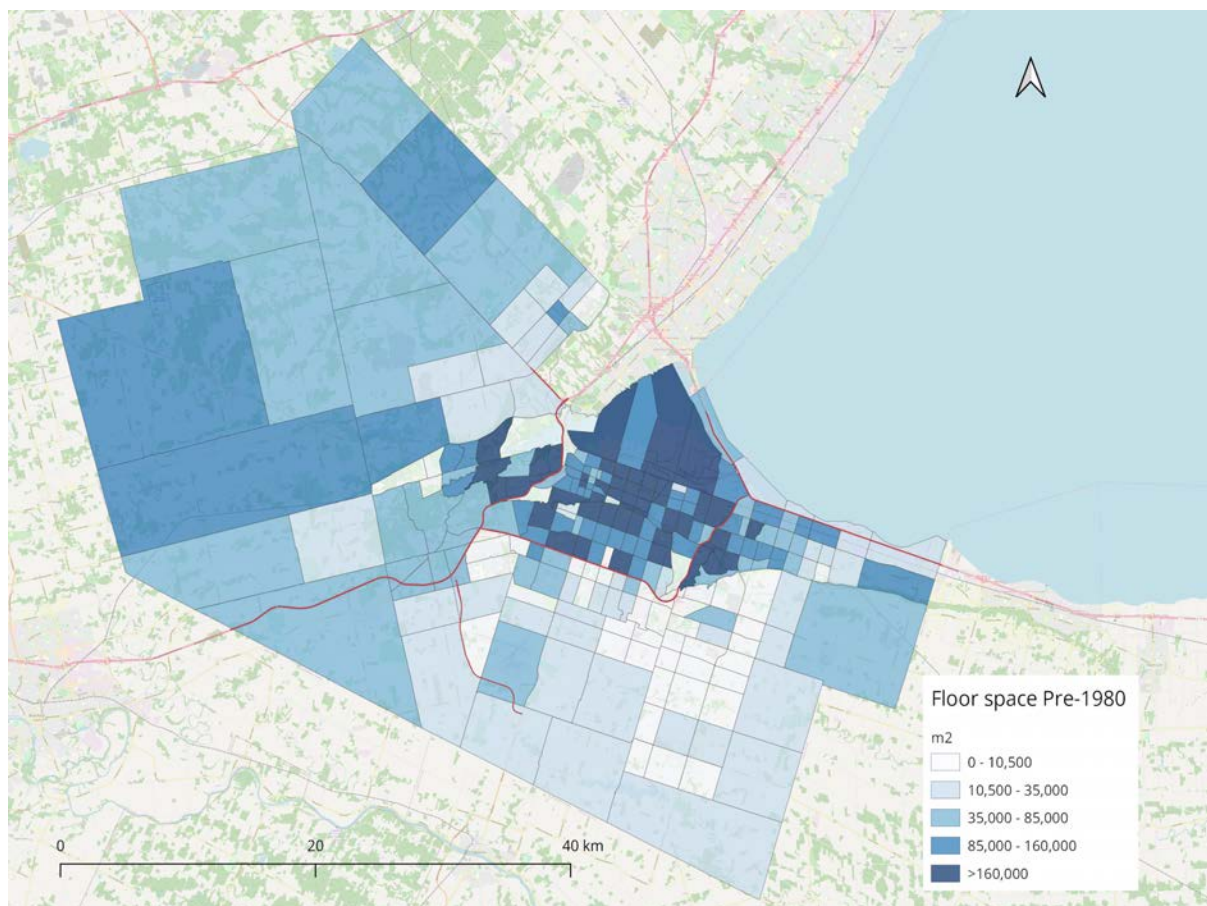
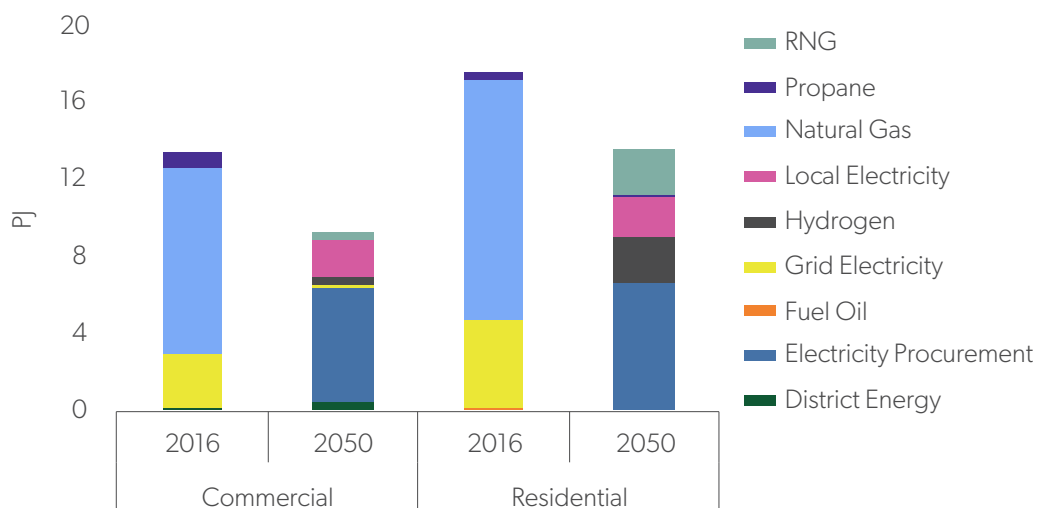


Figure 13. Floor space (m²) for buildings pre-1980 in Hamilton in 2016.

Whereas in 2016 the dominating energy source for commercial and residential buildings is natural gas and electricity from the provincial grid, by 2050 green hydrogen, renewable electricity and RNG become the sector’s predominant sources (see Figure 15).



Commercial and residential buildings energy consumption by sector and fuel type (petajoules), 2016 and 2050.

(Note: "Electricity Procurement" refers to the purchase of renewable energy certificates. District Energy has been allocated 100% to commercial floor space, but in reality it is likely to be used by a mix of commercial and residential spaces.)

This shift in the energy mix results in a 99% and 98% emissions reduction in the commercial and residential sectors respectively by 2050 (see Figure 16).

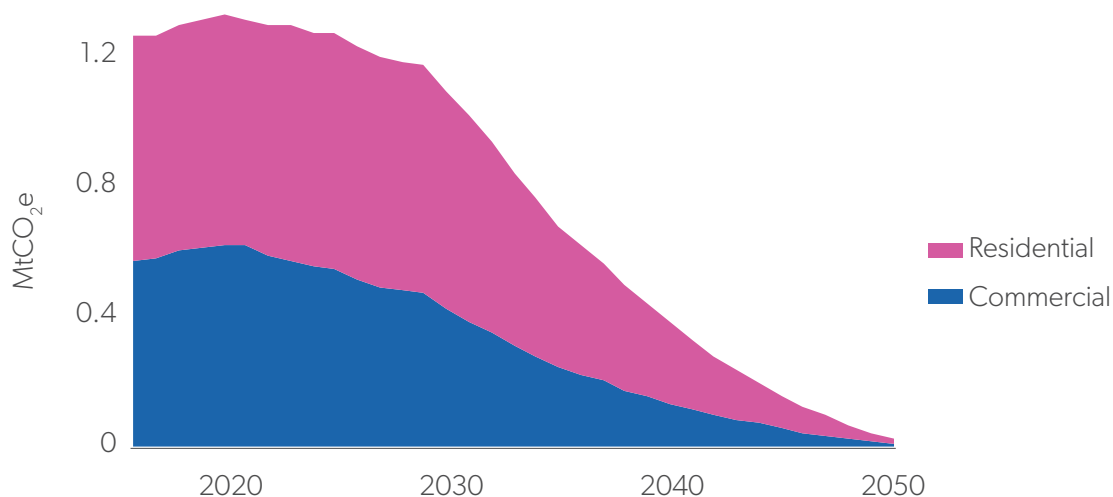


Figure 14. Commercial and residential buildings emissions by sector 2016 through 2050.

MUNICIPAL

MODELLED ACTION	DESCRIPTION	% GHG REDUCTIONS NET-ZERO VS. BAP 2050
New municipal EUI	By 2050, all new municipal buildings achieve net-zero emissions.	0.5%
Retrofit municipal	By 2050, <ul style="list-style-type: none"> all municipal buildings are retrofitted to achieve 50% thermal efficiency and 50% electrical efficiency, then switch to heat pumps for space and water heating. 	0.04%
Electrify municipal fleet	<ul style="list-style-type: none"> 100% of new small and light-duty vehicles are electric by 2040 100% of new heavy-duty vehicles switch to clean hydrogen in 2040 	0.04%

Although the City of Hamilton Corporation GHG emissions account only for 0.2% of the total city emissions in 2016, it plays an important leadership role in the community. A zero-emissions municipal fleet will be operating in 2040, and all municipal buildings will be net-zero by 2050. Under this scenario, municipal energy use decreases by 65% by 2050 compared to 2016.

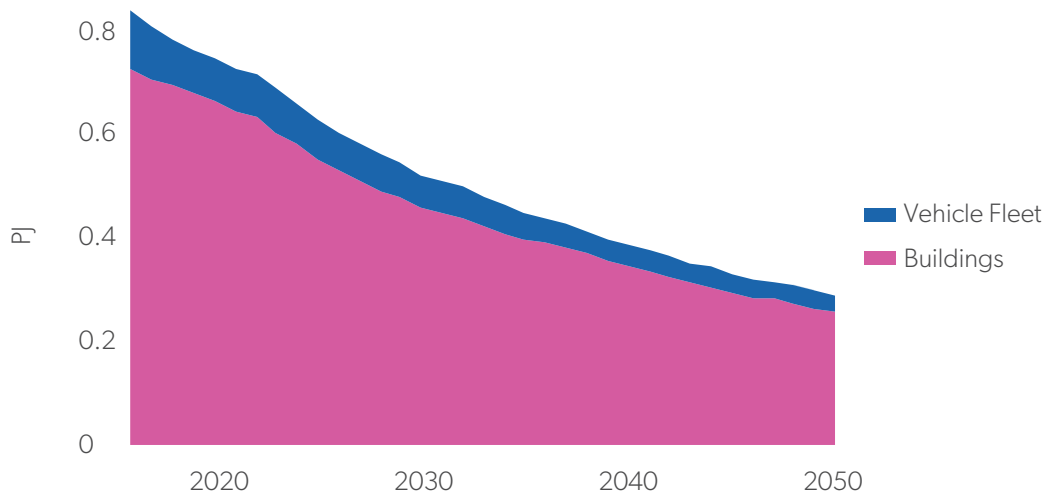


Figure 15. Municipal energy consumption by subsector (petajoules), 2016 - 2050.

Accordingly, emissions in the municipal sector decrease by 99% by 2050 (see Figure 18).

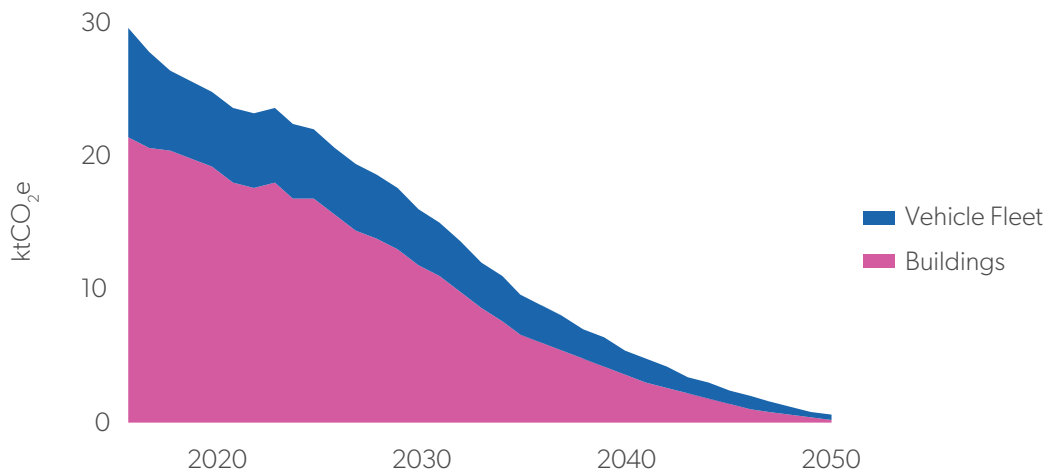


Figure 16. Municipal emissions by subsector (kilotonnes), 2016 - 2050.

WASTE, WATER, AND WASTEWATER

MODELLED ACTION	DESCRIPTION	% GHG REDUCTIONS NET-ZERO VS. BAP 2050
RNG and anaerobic digestion	<ul style="list-style-type: none"> By 2050, 95% of organic waste is sent to anaerobic digestion for local energy use. Purchase remaining RNG needed to replace all remaining natural gas demand by 2050, starting in 2025. 	5.8%
Water efficiency	By 2050, 25% reduction in water consumption (behaviour change, leak detection system, greywater reuse).	0.03%
Wastewater efficiency	Increase efficiency by 30% by 2050.	0.02%

Waste and wastewater emissions reduce by 62% over the 2016 to 2050 period (see Figure 19), primarily due to 95% of organic waste being rerouted to anaerobic digestion. This strategy enables local renewable natural gas generation and avoids landfill methane emissions. Notwithstanding this significant shift in organic waste treatment, historic landfill is expected to continue to produce methane at the landfill through 2050 (the landfill gas capture system is assumed to capture 75% of emissions).

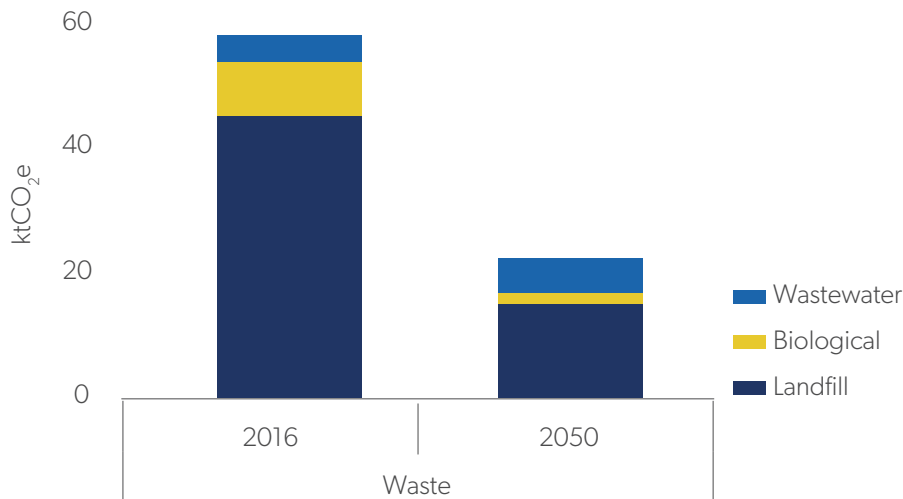


Figure 17. Waste and wastewater emissions by treatment type (kilotonnes of CO₂e), 2016 vs 2050.

RENEWABLE ENERGY

MODELLED ACTION	DESCRIPTION	% GHG REDUCTIONS NET-ZERO VS. BAP 2050
Renewable Energy Certificate (RECs)	In 2050, for each MWh of central electricity demand remaining after local renewable energy production, purchase a Renewable Energy Certificate (REC).	6.1%
Green Hydrogen	In order to replace remaining natural gas in the city, starting in 2030, green hydrogen (produced via renewable energy) is pumped into the natural gas distribution system.	5.0%
Wind	Installation of 250 MW by 2050 inside or outside the city, starting in 2022 with 50 MW installed every 4 years, starting in 2030.	0.7%
Ground mount solar PV	Installation of 280 MW, 10 MW every year from 2022 to 2050, inside or outside city boundary (prioritizing inside).	0.3%
District energy expansion	<ul style="list-style-type: none"> • Additional 25.4 MW of industrial waste heat for heating is added. • Additional 7.1 MW of industrial waste heat for cooling is added. • Corresponding expansion of the downtown DE network to service an additional 232,000 m² of commercial floor space (in reality this could be allocated to a mix of residential and commercial spaces.) 	0.1%
Rooftop solar PV - existing buildings	<ul style="list-style-type: none"> • Starting in 2022, installation of solar PV on pre-2016 buildings, achieving on average 30% of building electric load (not including any potential increased electricity load from fuel switching to electric space and water heating). • Solar PV is scaled up to 50% of the electric load of these buildings by 2050. 	0.2%
Rooftop solar PV - New residential buildings	As of 2031, all new homes have 30% annual load coverage by solar PV (not including additional electricity demand due to fuel switching in space and water heating).	0.2%
Rooftop solar PV - New non-residential buildings	In 2026 new commercial buildings include solar PV panels.	0.2%
Rooftop solar PV - Existing municipal buildings	50% of municipal building square footage adds PV to 50% of rooftop area, covering 30% of the related building area's electrical load.	0.01%

As a final critical step to achieve net-zero by 2050, remaining fossil fuel energy uses need to be replaced by renewable energy. Due to the expected continued and increased reliance on fossil fuels by the provincial electricity grid, the switch to renewable energy will require directly generating renewable energy or purchasing renewable energy from outside of city boundaries to offset remaining emissions in the city. The City has strategic opportunities to increase local production of renewable energy via solar energy, RNG from local organic waste, as well as capturing waste heat from the industrial sector. Some potential areas for district energy expansion fuelled by industrial waste heat from the steel industry are identified in Figure 20. These areas are based on a cost-benefit analysis undertaken of available waste heat. The waste heat source was identified in a Hamilton Community Energy Inc. and Hamilton Chamber of Commerce study (see the document: "Table of Business-as-Planned and Low-Carbon Actions").

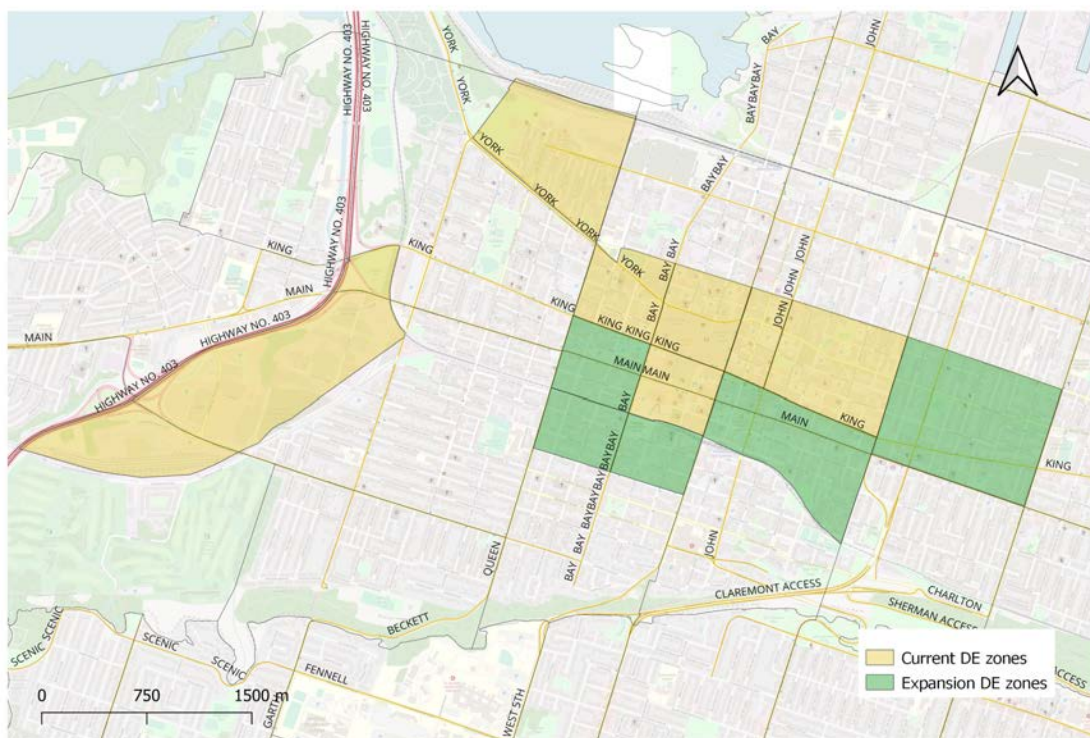


Figure 18. Current district energy and potential expansion zones.

CARBON SEQUESTRATION

MODELLED ACTION	DESCRIPTION	% GHG REDUCTIONS NET-ZERO VS. BAP 2050
Tree planting	From 2022 to 2050, 50,000 trees are planted each year.	0.03%

In order to capture and sequester some portion of the remaining community GHG emissions, the net-zero scenario also includes an ambitious tree planting action. Although in 2050 this action represents a small share of the community’s reduction from its projected business-as-planned GHG emissions, this action represents important cumulative GHG emissions reductions in years leading up to 2050 (about 1.1 MtCO₂e). This action also represents many important co-benefits, including increased resilience to extreme weather events, cleaner air, and community wellbeing.

Sensitivity Analysis

Changing key parameters in the model will affect the net-zero emissions pathway for Hamilton. Uncertainty is inherent in the projection of future emissions, it is naturally present when modelling future scenarios. A sensitivity analysis can help understand how these uncertainties could affect the overall results.

The net-zero pathway is made of countless assumptions, this sensitivity analysis shows what happens when you change the inputs of one of several key inputs, namely:

- The methane global warming potential (from 34 to 84),
- The heating degree day (HDD) assumption,
- The provincial electricity grid emissions factor,
- The vehicle kilometre travelled (VKT) assumption,
- The residential retrofit assumption.

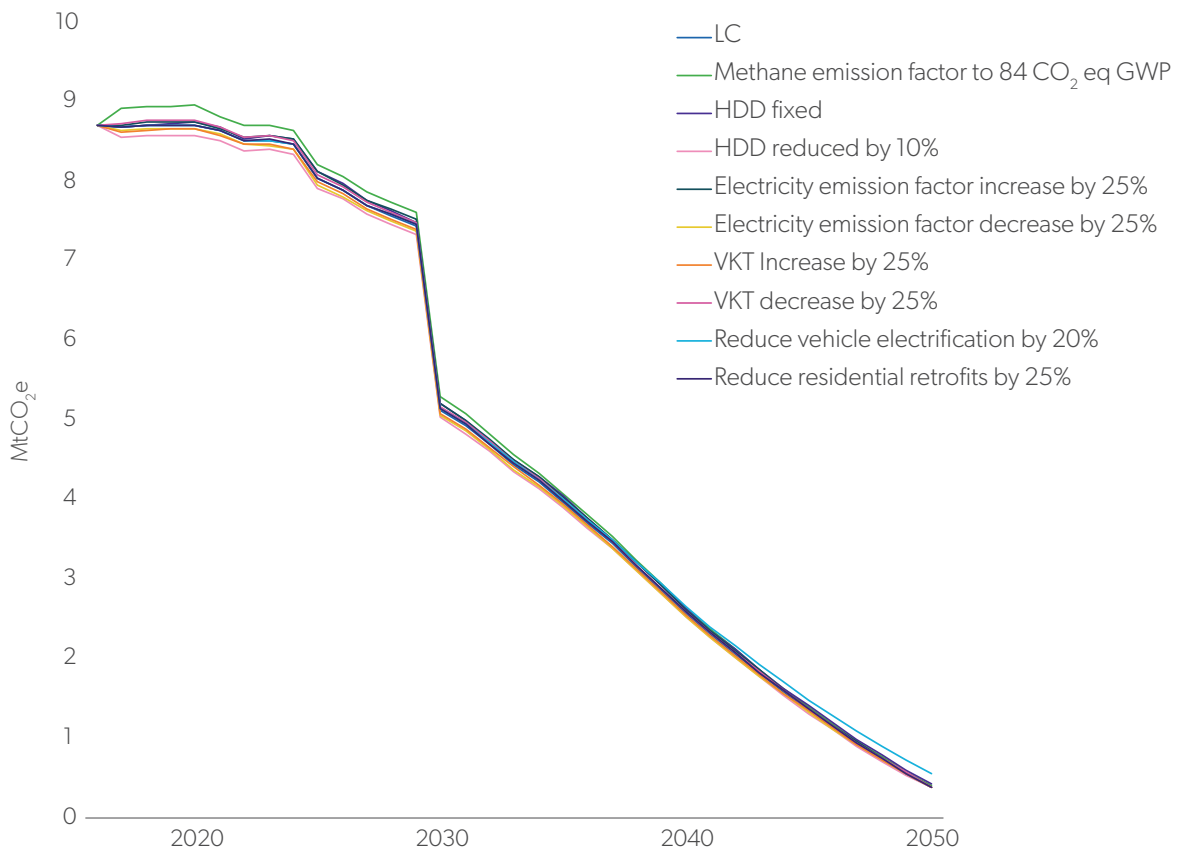


Figure 19. Sensitivity analysis of Hamilton’s net-zero scenario emissions, when various individual inputs are changed.

Figure 22 shows that the maximum variation is seen when vehicle electrification is reduced by 20%, increasing emissions in 2050, which would imply reducing emissions by 93.5% instead of 95.5% in 2050 as compared to BAP emissions.

Countless other variables could have also been assessed. This analysis is illustrative to give a sense of the impact of individual assumptions in the net-zero scenario modelled. If many different assumptions are adjusted at once, the impact would be greater. For this reason, the Implementation Strategy that forms part of the CEEP, includes incremental CEEP reviews and updates based on annual reports of community emissions and program implementation metrics. This regular, transparent review process will enable adaptive management, that is, it will enable changes based on new information that arises.

Data Tables

COMMUNITY ENERGY

Table 1. Community energy consumption tabulated results, 2016 and 2050 (net-zero).

ENERGY BY SECTOR (PJ)	2016	SHARE 2016	2050	SHARE 2050	% +/- 2016-2050
Commercial	13,428,789	10%	9,361,685	9%	-30%
Industrial	81,571,437	60%	69,568,176	67%	-15%
Municipal	724,732	1%	256,871	0%	-65%
Residential	17,671,871	13%	13,650,850	13%	-23%
Transportation	23,251,634	17%	11,658,511	11%	-50%
Total	136,648,464	100%	104,496,093	100%	-24%
ENERGY BY FUEL (PJ)	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
Bio-char	0	0%	24,653,280	24%	100%
Coal	49,294,380	36%	2,452,162	2%	-95%
Diesel	4,249,736	3%	1,272,432	1%	-70%
District Energy	127,260	0%	388,187	0%	205%
RECs	0	0%	27,359,940	26%	100%
Fuel Oil	394,323	0%	173,695	0%	-56%
Gasoline	18,843,170	14%	515,429	1%	-97%
Grid Electricity	14,824,855	11%	66,310	0%	-100%
Hydrogen	0	0%	34,376,767	34%	100%
Local Electricity	93,277	0%	3,212,663	3%	3344%
Natural Gas	47,312,496	35%	0	0%	-100%
Other	204,687	0%	114,803	0%	-44%
Propane	1,268,582	1%	281,605	0%	-78%
RNG	0	0%	9,700,687	10%	100%

ENERGY BY SECTOR (PJ)	2016	SHARE 2016	2050	SHARE 2050	% +/- 2016-2050
Wood	35,697	0%	28,134	0%	-21%
Total	136,648,464	100%	104,496,093	100%	-23%
Energy per Capita (GJ)	244		112		

COMMUNITY EMISSIONS

Table 2. Per capita emissions, 2016 and 2050.

EMISSIONS BY SECTOR (TCO ₂ E)	2016	2050 (BAP)	% +/- (2016-2050)
Emissions per capita (tCO ₂ e/person)	15.5	0.6	-96%

Table 3. Community emissions tabulated results, 2016 and 2050.

EMISSIONS BY SECTOR (TCO ₂ E)	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
Agriculture and Livestock (AFOLU)	32,070	0%	32,070	8%	0%
Commercial	565,821	7%	7,826	2%	-99%
Energy Production	16,553	0%	0	0%	-100%
Tree Planting	0	0%	-37,624	-9%	100%
Fugitive ⁸	58,178	1%	0	0%	-100%
Industrial	5,594,389	64%	159,435	40%	-97%
Municipal	21,475	0%	174	0.04%	-99%
Residential	691,884	8%	12,386	2%	-98%
Transportation	1,671,042	19%	200,476	50%	-88%
Waste	58,155	1%	22,360	4%	-62%
Total	8,709,567	100%	397,102	100%	-95%

EMISSIONS BY FUEL (TCO ₂ E)	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
Bio-char	0	0%	30,406	8%	100%
Coal	4,313,227	50%	115,865	29%	-97%
Diesel	315,710	4%	78,208	20%	-75%
Fuel Oil	28,054	0%	12,367	3%	-56%
Gasoline	1,263,391	15%	34,274	9%	-97%
Grid Electricity	155,960	2%	1,625	0%	-99%
Hydrogen	0	0%	0	0%	100%
Natural Gas	2,319,682	27%	0	0%	-100%

⁸ Fugitive emissions account for unintentional emissions associated with the transportation and distribution of natural gas within the city (through equipment leaks, accidental releases etc.) that is used within the buildings sector.

EMISSIONS BY SECTOR (TCO₂E)	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
Non Energy	148,403	2%	16,806	4%	-89%
Other	87,433	1%	87,433	22%	0%
Propane	77,591	1%	17,224	4%	-78%
RNG	38	0%	2,838	1%	7305%
Wood	79	0%	57	0%	-28%
Total	8,709,566	100%	397,102	100%	-95%

BUILDINGS SECTOR

Table 4. Buildings sector energy tabulated results, 2016 and 2050.

BUILDINGS ENERGY (GJ) BY BUILDING TYPE	2016	SHARE 2016	2050	SHARE 2050	% +/- 2016-2050
Commercial	13,428,789	12%	9,362,006	10%	-30%
Industrial	81,571,440	72%	69,566,820	75%	-15%
Municipal	724,732	1%	256,798	0%	-65%
Residential	17,671,872	16%	13,651,957	15%	-23%
Total	113,396,833	100%	92,837,582	100%	-18%

BUILDINGS ENERGY (GJ) BY FUEL	2016	SHARE 2016	2050	SHARE 2050	% +/- 2016-2050
Bio-char	0	0%	24,653,283	27%	100%
Coal	49,294,383	43%	2,452,162	3%	-95%
District Energy	127,260	0%	388,187	0%	205%
Fuel Oil	394,323	0%	173,695	0%	-56%
Grid Electricity	14,824,534	13%	18,951,672	17%	8%
Hydrogen	0	0%	34,353,968	37%	100%
Local Electricity	93,275	0%	1,755,861	5%	4994%
Natural Gas	47,234,017	42%	0	0%	-100%
Other	124,761	0%	98,328	0%	-21%
Propane	1,268,582	1%	281,605	0%	-78%
RNG	0	0%	9,700,686	10%	100%
Wood	35,697	0%	28,134	0%	-21%
Total	113,396,833	100%	92,837,582	100%	-18%

BUILDINGS ENERGY (GJ) BY END USE	2016	SHARE 2016	2050	SHARE 2050	% +/- 2016-2050
Industrial Processes	78,259,977	69%	69,119,054	74%	-12%
Lighting	1,768,558	2%	1,801,051	2%	2%
Major Appliances	893,432	1%	1,310,570	1%	47%
Plug Load	2,414,420	2%	2,938,393	3%	22%

BUILDINGS ENERGY (GJ) BY BUILDING TYPE	2016	SHARE 2016	2050	SHARE 2050	% +/- 2016-2050
Space Cooling	769,309	1%	888,290	1%	15%
Space Heating	21,710,682	19%	11,731,511	13%	-46%
Water Heating	7,580,454	7%	5,048,712	5%	-33%
Total	113,396,833	100%	92,837,582	100%	-18%

Table 5. Buildings sector emissions tabulated results, 2016 and 2050.

BUILDINGS EMISSIONS (TCO₂E) BY BUILDING TYPE	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
Commercial	565,821	8%	7,826	4%	-99%
Municipal	21,475	0%	174	0%	-99%
Industrial	5,594,389	81%	159,435	89%	-97%
Residential	691,884	10%	12,386	7%	-98%
Total	6,873,569	100%	179,821	100%	100%

BUILDINGS EMISSIONS (TCO₂E) BY FUEL	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Bio-char	0	0%	30,406	17%	100%
Coal	4,313,227	63%	115,865	64%	-97%
Fuel Oil	28,054	0%	12,367	7%	-56%
Grid Electricity	155,956	2%	1,064	1%	-99%
Hydrogen	0	0%	0	0%	100%
Natural Gas	2,298,623	33%	0	0%	-100%
Propane	77,591	1%	17,224	10%	-78%
RNG	0	0%	2,838	2%	100%
Wood	42	0%	34	0%	-21%
Total	6,873,494	100%	179,798	100%	-97%

BUILDINGS EMISSIONS (TCO₂E) BY END USE	2016	SHARE 2016	2050 (BAP)	SHARE 2050	% +/- (2016-2050)
Industrial Processes	5,443,892	79%	159,266	89%	-97%
Lighting	18,389	0%	88	0%	-100%
Major Appliances	13,655	0%	82	0%	-99%
Plug Load	32,006	0%	4,009	2%	-87%
Space Cooling	14,785	0%	46	0%	-100%
Space Heating	1,010,611	15%	6,033	3%	-99%
Water Heating	340,157	5%	10,275	6%	-97%
Total	6,873,494	100%	179,798	100%	-97%

TRANSPORTATION SECTOR⁹

Table 6. Transportation sector energy tabulated results, 2016 and 2050.

TRANSPORTATION ENERGY (GJ) BY FUEL	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
Diesel	4,329,662	19%	1,288,907	11%	-236%
Gas	18,921,647	81%	515,429	4%	-3571%
Grid Electricity	322	0%	8,374,580	72%	100%
Local Electricity	2	0%	1,456,802	12%	
Hydrogen		0 0%	22,794	0%	100%
Total	23,251,631	100%	11,658,512	100%	-99%

TRANSPORTATION ENERGY (GJ) BY VEHICLE TYPE	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
Car	8,724,935	38%	2,497,881	21%	-249%
Heavy truck	1,347,873	6%	24,972	0%	-5298%
Light truck	7,625,298	33%	3,762,945	32%	-103%
Marine	561,482	2%	561,482	5%	0%
Off Road	3,981,927	17%	3,981,927	34%	0%
Rail	718,298	3%	718,298	6%	0%
Urban Bus	291,820	1%	111,007	1%	-163%
Total	23,251,632	100%	11,658,512	100%	-99%

Table 7. Transportation Emissions, tabulated results, 2016 and 2050.

TRANSPORTATION EMISSIONS (TCO ₂ E) BY FUEL	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
Grid electricity	3	0%	561	0%	16458%
RNG	0	0%	0	0%	-
Diesel	315,710	19%	78,208	39%	-75%
Gas	1,263,391	76%	34,274	17%	-97%
Other	91,938	6%	87,433	44%	-5%
Total	1,671,042	100%	200,476	100%	-88%

TRANSPORTATION EMISSIONS (TCO ₂ E) BY VEHICLE TYPE	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
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⁹ Please note the totals in these transportations tables are slightly higher (<1%) than the transportation sector totals in the community-wide tables above.

TRANSPORTATION EMISSIONS (TCO ₂ E) BY FUEL	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
Car	582,925	35%	14,433	7%	-98%
Light truck	509,566	30%	20,534	10%	-96%
Heavy truck	93,977	6%	152	0%	-100%
Urban bus	19,466	1%	129	0%	-99%
Rail	55,408	3%	55,408	28%	0%
Marine	44,317	3%	22,157	11%	-50%
Aviation	87,433	5%	87,433	44%	0%
Off road	277,949	17%	227	0%	-100%
Total	1,671,041	100%	200,473	100%	-88%

WASTE AND WASTEWATER

Table 8. Waste Sector Emissions, 2016 and 2050.

WASTE EMISSIONS (TCO ₂ E) BY FUEL	2016	SHARE 2016	2050	SHARE 2050	% +/- (2016-2050)
Biological (i.e. compost)	8,302	14%	1,937	9%	-77%
Landfill	45,172	78%	14,715	66%	-67%
Wastewater	4,681	8%	5,707	26%	22%
Total	58,155	100%	22,360	100%	-62%

CARBON SEQUESTRATION

Table 9. Land-Use Change Emissions 2022-2050 (NZS).

(TCO ₂ E/YR)	2025	2030	2035	2040	2045	2050
Tree planting (50,000/year)	-37,432	-37,502	-37,530	-37,559	-37,596	-37,631

Appendix F: Large-Scale Renewable Energy Planning Practices

June 2021

Contents

Introduction	155
Context	155
The Promise and Risk of Green Hydrogen	158
Efficiency First	159
Renewable Energy Technologies: Land-Area Requirements	159
Solar Planning Considerations	161
Appendix F.1: Renewable Energy Technologies: Planning Considerations	166

ACRONYMS	
BAP	Business-as-planned [scenario]
GHG	Greenhouse gases
kWh	kilowatt-hour
IESO	Independent Electricity System Operator
LDC	Local distribution company
MW	Megawatt
NREL	National Renewable Energy Laboratory
NZS	Net-zero scenario
PJ	Petajoule
RNG	Renewable natural gas
TWh	terawatt hour

Introduction

This document builds on specific elements of the Actions Catalogue¹ by providing greater insight into renewable energy technologies, policies and best practices, with a focus on opportunities for the City of Hamilton and its key sectors. In particular, this document aims to inform the short-term implementation aspects of Hamilton’s Community Energy and Emissions Plan.

The deployment of renewable energy is critical to the City’s target of net-zero emissions by 2050. A core question that arises is on which land, or surface should these activities be located. Land is a constrained resource subject to competing demands for food security, housing, biodiversity, and access to water, amongst others. This brief begins with a discussion of policies that expedites the deployment of renewable energy while maintaining or enhancing other assets that land provides to the community, such as agricultural production.

Context

To provide greenhouse gas emissions (GHG)-free energy to the city of Hamilton, based on the current and increasing central provincial grid emissions, renewable energy technologies will need to be deployed by the City, residents and businesses. Figure 1 illustrates the changing fuel mix out to 2050 in the Hamilton net-zero scenario (NZS). Note that green hydrogen is also generated by renewable electricity.

In the NZS, despite the fact that total energy consumption falls from the 2016 total of 137 PJ (Figure 2) to 107 PJ by 2050 (Figure 3), imported electricity increases from 15 PJ to 27 PJ, and local renewable electricity generation increases from 0.2 PJ to 3.5 PJ. District energy increases from 0.5 PJ to 1.8 PJ. While there is an increase in electricity use between 2016 and 2050, the difference is moderate, increasing from 22 to 27 PJ.² Local electricity generation increases by a factor of 20 by 2050 in the NZS when compared to the BAP. In order to achieve net-zero emissions there will be extensive activity in local renewables between 2020 and 2050. It is therefore important to develop planning policy that enables renewable generation.

¹ Produced for the City of Hamilton’s Community Energy and Emissions Plan by SSG in April 2020.

² Note that local renewable energy and renewable energy certificates (RECs) replace all grid electricity in the NZS in 2050.

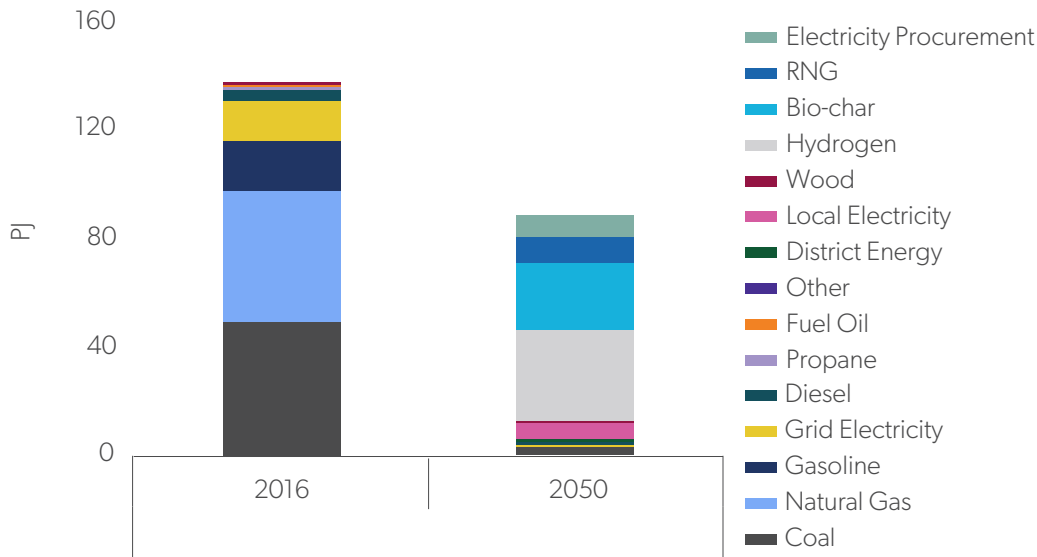


Figure 1. Energy transition in Hamilton

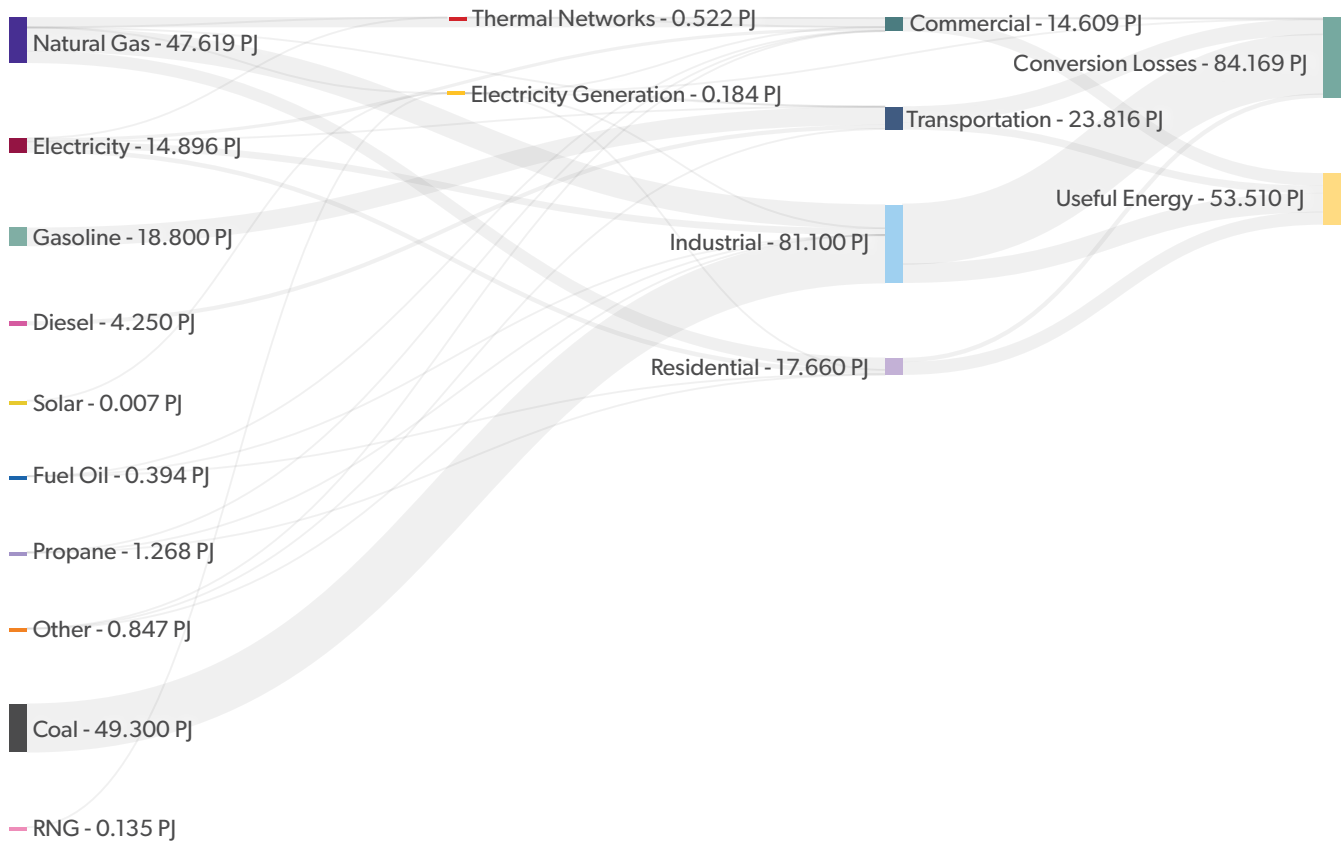


Figure 2. Sankey diagram of energy flows in Hamilton, 2016. (The 'Other' category includes emissions mainly from bio-energy.)

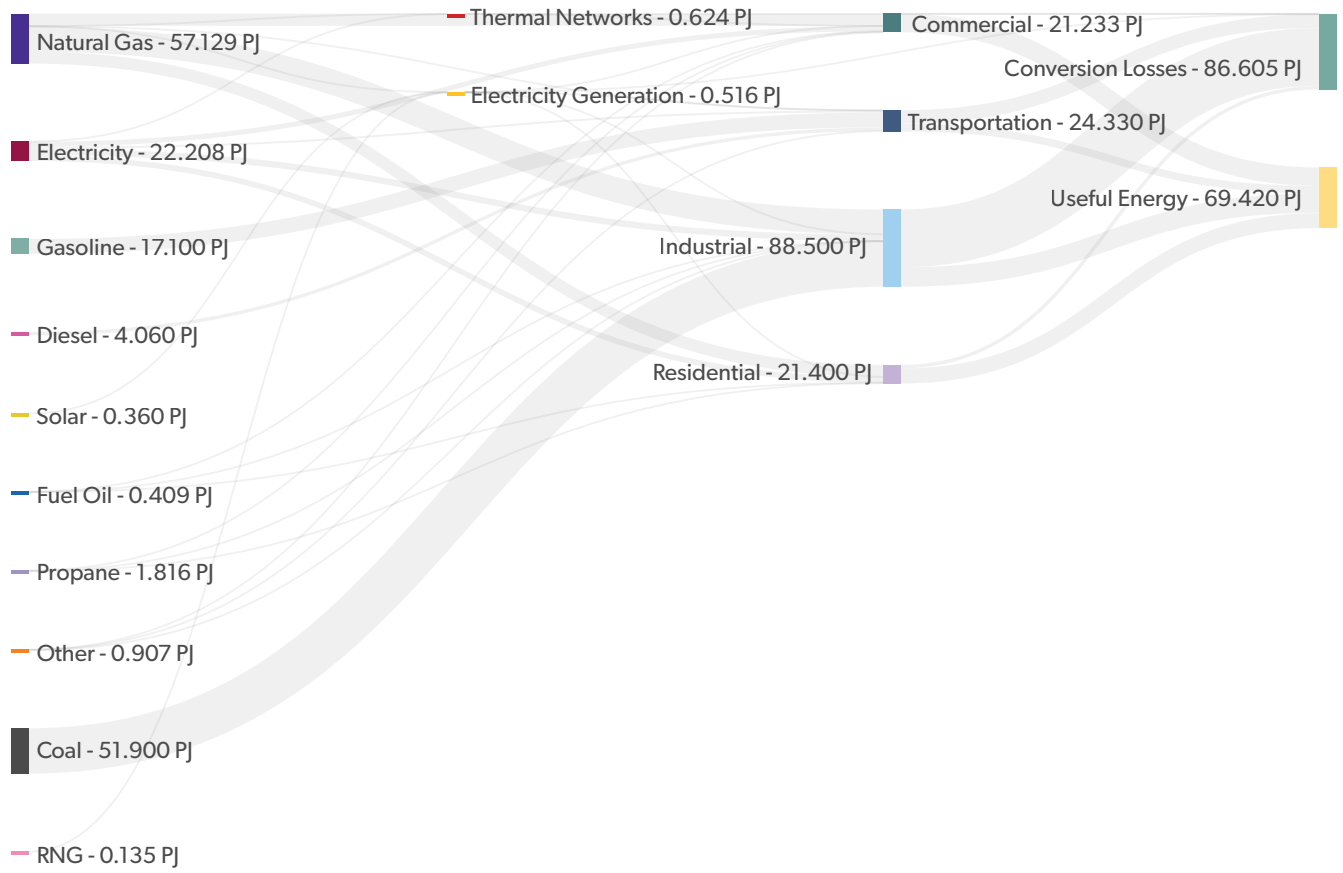


Figure 3. Sankey diagram of energy flows in the BAP, 2050. (The 'Other' category includes emissions mainly from bio-energy.)

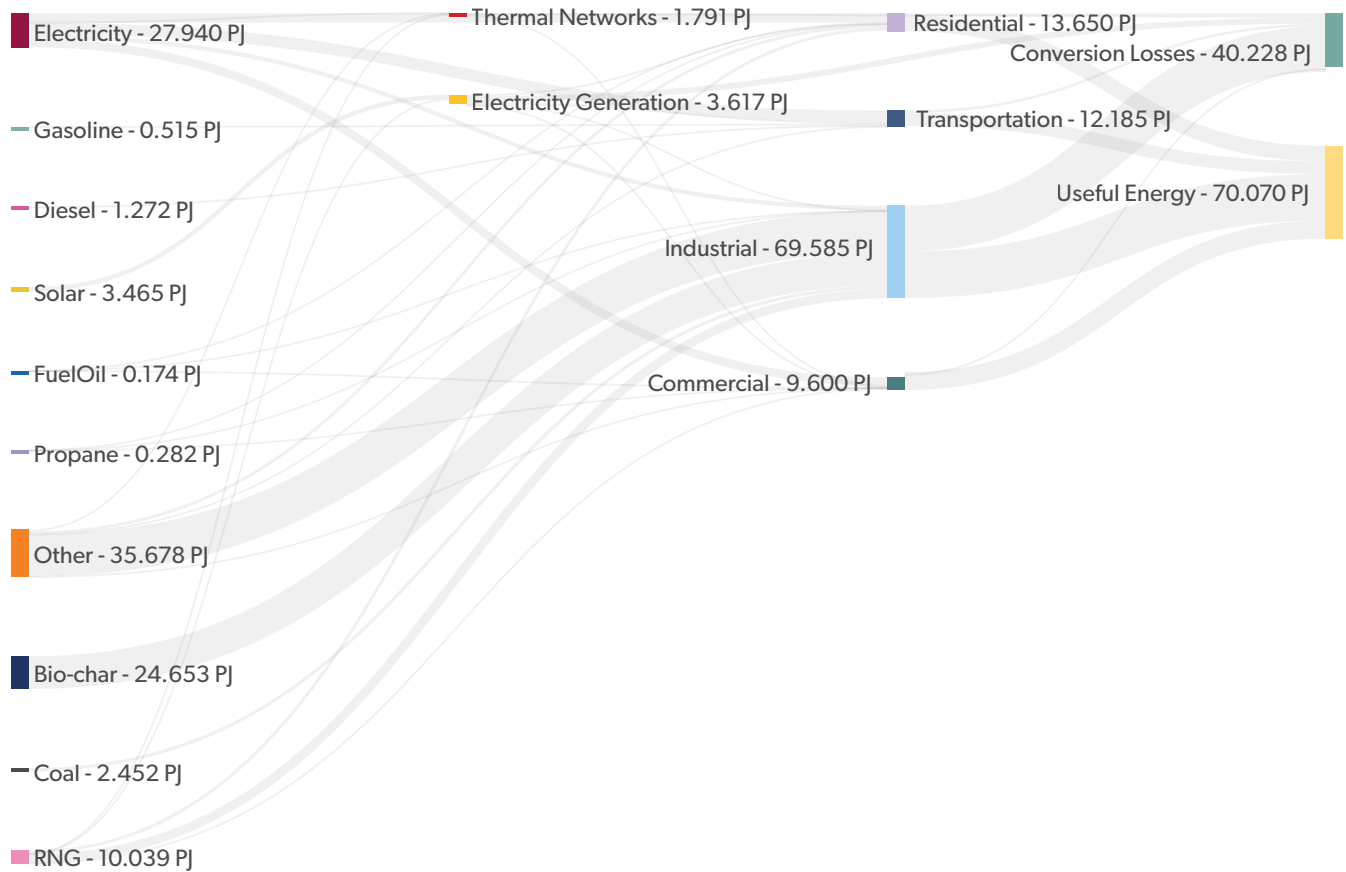


Figure 4. Sankey diagram of energy flows in the NZS, 2050. (The 'Other' category includes emissions mainly from bio-energy.)

The Promise and Risk of Green Hydrogen

Full electrification of heating is a major challenge and will likely create stranded assets for natural gas distributors. The deployment of hydrogen (main contributor to the increase of 'other' in Figure 4 as opposed to Figure 3) and renewable natural gas (RNG) are being explored to limit this impact.

The hydrogen future is constrained by the low efficiencies of manufacturing green hydrogen, which results in electricity generation requirements that are 2-14 times higher than direct electrification. This existing inefficiency risks that committing to hydrogen could lock in requirements for continued fossil fuel production with the promise of carbon capture (grey hydrogen). A recent paper in Nature Climate Change explains:

Betting on the future large-scale availability of hydrogen and e-fuels risks a lock-in of fossil-fuel dependency if their upscaling falls short of expectations. Hydrogen and e-fuels are a potential distraction from the urgent need for an end-use transformation towards wide-scale direct electrification, which is cheaper, more efficient and generally part of well-advanced available technology in many sectors, such as light-duty vehicles or low-temperature heating in buildings and industry.³

Despite the risks highlighted above of relying on green hydrogen as a pathway to net zero, green hydrogen will likely be critical in the effort to decarbonize industries such as steel manufacturing, which are otherwise difficult to electrify.

Efficiency First

The NZS electrifies the majority of the most significant energy consuming activities in society: heating and transportation. The way in which electrification is implemented and whether or not this process is accompanied by other actions will influence the extent to which new electric grid capacity is required, the speed at which the grid can be decarbonized, and the overall cost to society of the low-carbon transition. Growth in peak capacity in particular will drive the need for new generating capacity, which will increase the land requirement. The amount of land required can also be mitigated by the technology selected and the policies guiding the deployment of the technology.

Renewable Energy Technologies: Land-Area Requirements

The underlying approach to the NZS is to order the actions according to a priority of 'Reduce, Improve, Switch'. Avoiding energy consumption is the top priority, followed by maximizing energy efficiency improvements, and finally by switching to low-carbon energy sources for the remaining demand. The first two steps can be characterized as generating negawatts. One study calculated that every TWh decrease in annual electric power consumption suggests 7.6–28.7 km² of avoided land and for liquid fuel the reduction increases to 27.5–99.3 km² of avoided land per TW hr/yr because of the relatively large land-use intensity of biofuels (see Figure 5).⁴

³ Ueckerdt, F., Bauer, C., Dirnaichner, A. et al. (2021). Potential and risks of hydrogen-based e-fuels in climate change mitigation. *Nat. Clim. Change*. <https://doi.org/10.1038/s41558-021-01032-7>

⁴ McDonald, R. I., Fargione, J., Kiesecker, J., Miller, W. M., & Powell, J. (2009). Energy sprawl or energy efficiency: climate policy impacts on natural habitat for the United States of America. *PLoS one*, 4(8), e6802.

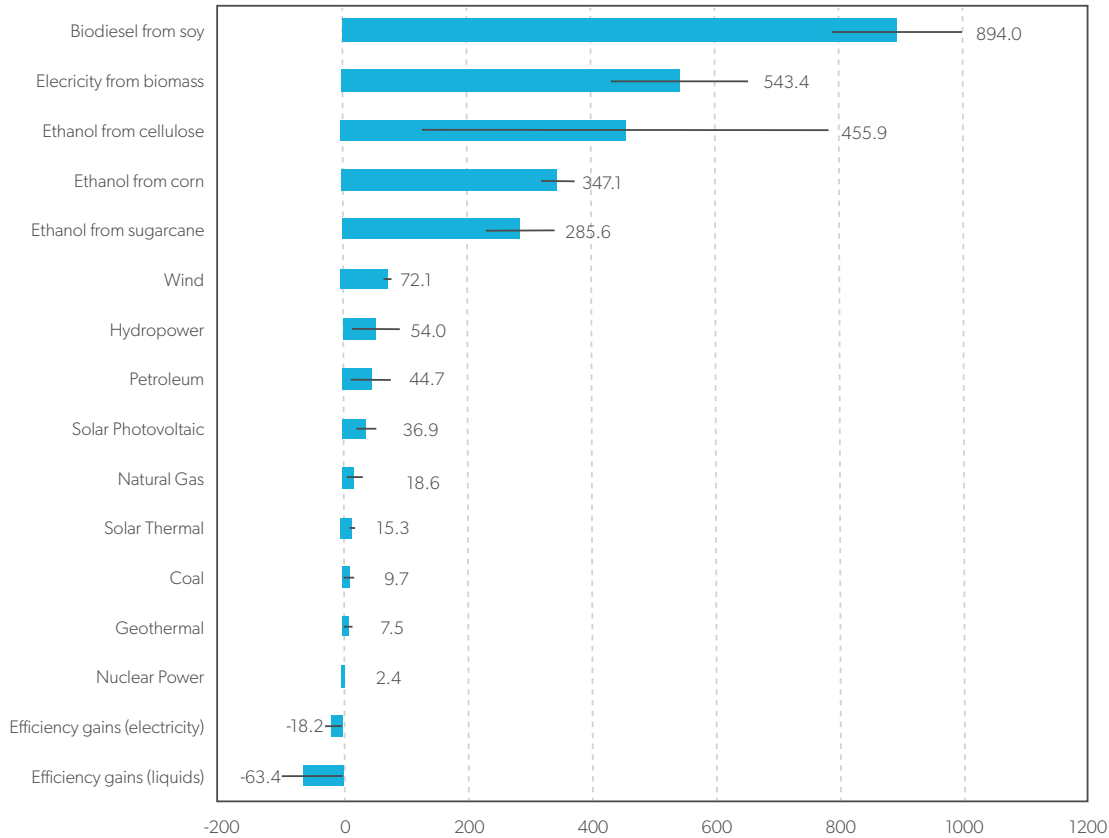


Figure 5. Land required for different sources of energy.⁵

From the perspective of land-use, each kWh of electricity which is saved through efficiency is a kWh that need not be generated and therefore land that need not be used for generation. In an electrified future, each trip shifted from a personal vehicle to transit or walking constitutes an efficiency gain, which reduces the burden on the landscape to provide energy. Efficiency gains can therefore be tied directly to a reduction in land consumption for energy generation.

The NZS switches from fossil fuels to electricity for most end uses, except for industry which becomes reliant on green hydrogen and bio-char. Using the assumptions from the study cited above, it is possible to assess the net impact of the NZS relative to the BAP on land requirements for energy production. Note that these calculations include upstream impacts such as pipelines for oil and gas and are based on US production.

The NZS reduces land for fossil fuel production by a total of 680 km² (286 km² for natural gas, 206 km² for gasoline, 34 km² for diesel, 17 km² for propane, 4 km² for fuel oil and 133 km² for coal), see Figure 6. For context, the land area of Hamilton is 1,138 km².

An additional 37 km² is required for solar generation. Imported electricity varies slightly between the scenarios, due to an increase in electricity demand from 22 to 27 PJ. This is expected to result in an additional 80 km² of land use. RNG and biochar are assumed to be sourced from waste streams, avoiding the need for additional land-use. In the case where biochar is produced

⁵ Ibid.

via agriculture or from forestry, the land area required is significant. Clean hydrogen for steel manufacturing requires extensive deployment of renewable energy and is assumed to be sourced from hydro in the calculations below. To account for the relative inefficiency of hydrogen production, the land area assumption for hydro was doubled from 54 to 108 km²/Twh/yr, which is still optimistic. As a result, the renewable energy production to generate the hydrogen requires a land area approximately equal to that of the entire city (1,100 km²). Most of the land impacts assessed here will not occur within the City boundaries, with the exception being solar generation.

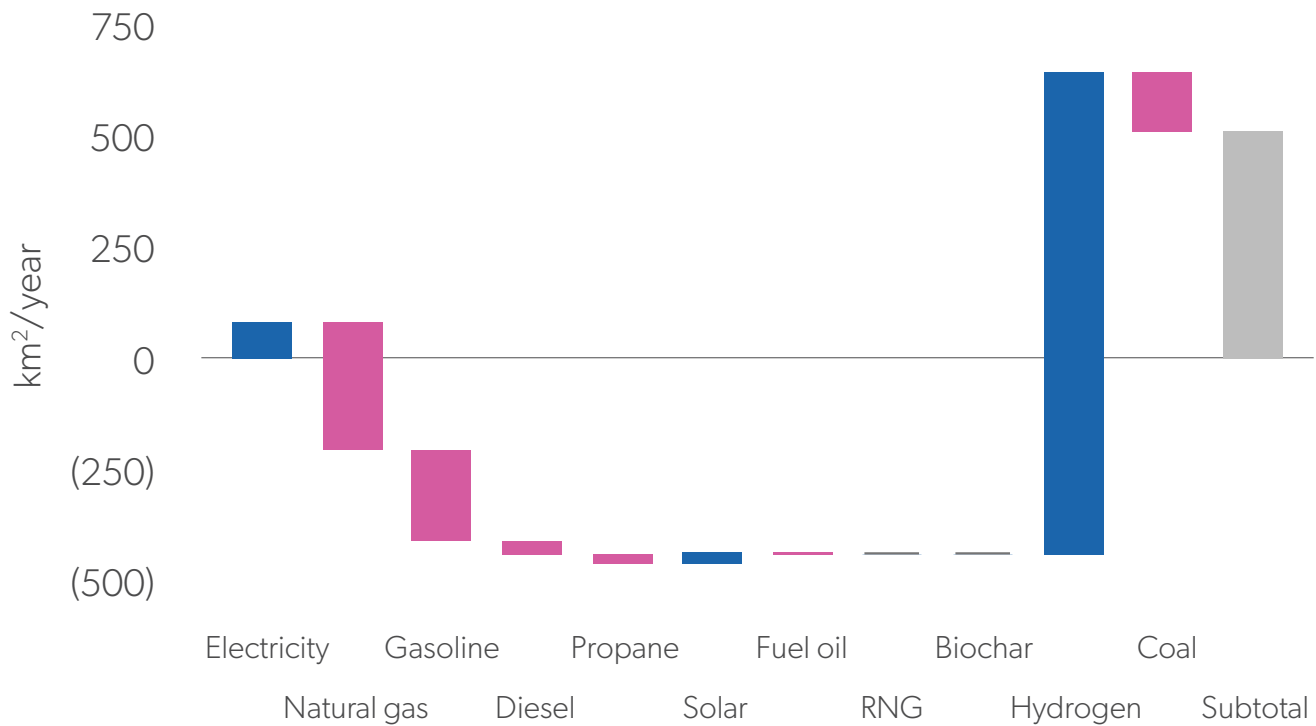


Figure 6. Impact of the NZS on land required for energy relative to the BAP in 2050.

Solar Planning Considerations

As land consumption associated with solar PV is expected to have the largest land-use impact on local lands, the section below provides some strategies for planning for and implementing solar PV within Hamilton.

The NZS will require solar PV installations on somewhere around 3,700 ha or 37 km² (including ground mount and rooftop installations). To minimize the land area required, this generation can be located on roofs, on industrial or disturbed sites or in locations with compatible uses.

1. Update Official Plan and Zoning By-law with Renewable Energy Enabling Policies and Regulations

A range of considerations need to be applied to provide certainty to project developers and ensure the best use of land. The following principles are a simplified version of a guide developed for the Hudson Valley.⁶

Prioritize development on previously disturbed areas & existing buildings: The preferred option is to situate renewable energy projects on marginal lands such as degraded or brownfield sites or on existing buildings, as the project can stimulate cleanup of the site, becoming known as a “brightfield”, generating additional employment opportunities and ensuring that generation is in proximity to demand. Renewable energy projects can also be sited over parking lots and on the roofs of large buildings. There are 130,000 roofs in Hamilton with 13 million m², which can support 1,985 MW of solar capacity.⁷ As many rooftops may not be suitable for solar PV mounting based on orientation, access to sun, snow load, and roof capacity, the NZS only models 50% of roof capacity.

Protect ecological resources: Wetlands, forests and other ecological features provide services including wildlife habitat, water treatment and filtration and carbon sinks, which enhance resilience to climate impacts. Areas which should be avoided include wildlife and other critical habitat, including intact and connected wildlife corridors and migratory bird flyways, parks and recreational lands, streams and stream corridors, wetlands and wetland buffer areas, river corridors and floodplains, sensitive geological and hydrogeological formations and contiguous forests.

Protect agricultural lands and promote co-location: The maintenance of agricultural land enables local production of food, as well as maintaining greenspaces and the rural landscape character of the land. Renewable energy installations and transmission and distribution infrastructure should avoid disrupting agricultural land. With careful design, solar facilities can be compatible with some agricultural activities including livestock grazing, beekeeping, cultivation of certain crops, or planting of pollinator-friendly vegetation under and around the panels.

Protect Views: Large-scale installations can transform the landscape. Maintaining specific viewsheds and reducing the impacts on the landscape, including associated infrastructure, is important to maintaining support for the projects. Guidance includes keeping facility components at a low profile, using natural screening and setbacks and locating installations on or within areas of low scenic value. Natural topography and vegetation can keep facilities out of sight from public roads, parks, historic sites and other sensitive viewing areas.

New York State has prepared a comprehensive guidebook on solar, including a model solar energy local law and a solar procurement toolkit.⁸ Policies which can be incorporated into a land-use bylaw to protect other uses and activities include:⁹

⁶ Friedrichsen, A. Clean Energy, Green Communities: A Guide to Siting Renewable Energy in the Hudson Valley. Scenic Hudson, Inc., Poughkeepsie, NY. Retrieved from: https://www.bloomfieldct.gov/sites/g/files/vyhllf2831/f/agendas/hudson_valley_guide_to_siting_renewable_energy_sshv-3b_friedrichsen-sh.pdf

⁷ Google Environment Insights Explorer (2020). Retrieved from: <https://insights.sustainability.google/places/ChIj3fej2yYLIgRIQ7f2Fbuais/download>

⁸ NYSERDA. (2020). New York Solar Guidebook for Local Governments. Retrieved from: www.nyserd.org/All-Programs/Programs/NY-Sun/Communities-and-Local-Governments/Solar-Guidebook-for-Local-Governments.

⁹ Ibid.

- Proper height and setback requirements, to help reduce visual and other potential impacts;
- Minimum or maximum lot size, to control density and meet a community's goals for total renewable energy development, based on the availability of eligible and suitable lands;
- Fencing requirements, including height and type, to reduce impacts to wildlife, promote security, and provide visual screening and noise attenuation;
- Buffer/screening requirements for visual and noise impact mitigation;
- Signage requirements and placement, for security and education;
- Undergrounding of on-site electrical interconnection and distribution lines;
- Vegetation removal/replacement and maintenance requirements, to reduce visual and other impacts of necessary infrastructure; and
- Decommissioning plan requirements, to facilitate the land's eventual return to other uses.

2. The integration of community energy/climate action policy directions into Secondary Plans

Secondary plans can support renewable energy deployment both for greenfield and infill locations. For greenfield locations, secondary plans can ensure roof space and orientation compatible with optimal solar installations, provide land for solar gardens, require EV charging stations and incorporate energy storage. The integration of community energy/climate action policy directions into Secondary Plans can support the development of a neighbourhood level net-zero strategy that incorporates district energy, and broader considerations such as mix of destinations, proximity of destinations, energy performance of buildings, greenspace for carbon sequestration and other aspects.

3. Integrate solar access into urban design guidelines

Urban design influences the availability of roof space for solar deployment and provides assurance that access to sun will be provided as the space develops. The City can require shading analysis for new developments to ensure that the performance of adjacent solar installations is not compromised.

4. Develop an expedited permitting process for solar installations

Consistent with the climate emergency and the NZS, a quick win for the City of Hamilton is to develop an expedited approvals process for solar PV installations. Table 2 describes elements of a permitting process. An additional strategy to incentivize solar installations is to void the fee for permits. The NREL has developed a SolarApp10 for several American jurisdictions which automates the permitting process and a similar approach could be considered for Hamilton.

¹⁰ See: solarapp.nrel.gov/.

Table 1. Solar PV permitting elements.¹¹

TOPIC	BEST PRACTICES
Development permit (rules for placement & aesthetics)	
Approach	Design permit to broadly allow solar PV systems. Provide prescriptive permit exemptions for each zone in the land use bylaw (This is preferable to only exempting residential projects.)
Projection into setbacks	Include specific exemption rules for placement of solar PV systems based on building height and setbacks for each zone, (e.g. residential, commercial, etc.)
Height	Include restrictions limiting height above roof ridge line for permit exemptions.
Ground	Ground-mounted solar systems require development permits although this is dependent upon zoning. For example, acreages should only require a development permit for ground-mounted systems with a footprint above 10 m ² .
Building permit (rules for mounting)	
Exemption for basic flush-mounted systems	Exempt flush-mounted solar PV systems if the following conditions are met: <ol style="list-style-type: none"> 1. Maximum weight does not exceed 5 lb/ ft² and weight is evenly distributed 2. Racking is directly attached to roof rafters and trusses and no parts extend above roof height 3. Pre-engineered and CSA/ULC approved mounting equipment is used
Racking	Where racking is not CSA/ULC approved, the building permit requires professional engineer stamped drawings. Where racking uses ballasts (e.g. gravel or concrete slabs), a building permit is required.
Flat roof	All flat-roof solar PV systems using ballasted racking require a building permit.
Ground-mount	Require a building permit for ground-mount racking attached to a building.
ELECTRICAL PERMIT (RULES FOR ELECTRICAL COMPONENTS & CONNECTION)	
Drawing	Prescribe a single-line diagram template with layout, components & circuit information (e.g. typical templates also require locating all components, how they are connected and operating voltages and current).
Component specifications	Permit applications must specify PV modules, inverters, controllers/optimizers, combiner boxes, shutdowns, disconnects, and grounding and bonding information.

¹¹ Municipal Climate Change Action Centre (2019). Solar Toolkit: Best practices for permits, taxes and solar access. Retrieved from: mccac.ca/app/uploads/SolarFriendlyMunicipalities-PermitTaxes.pdf.

ELECTRICAL PERMIT (RULES FOR ELECTRICAL COMPONENTS & CONNECTION)

Governance & process

Zone agnostic	Make the permit process the same regardless of the zoning of the property where the solar PV system is installed.
Application	<p>Include a checklist for all required forms and corresponding documentation in the solar PV system application.</p> <p>Streamline the permit application and review process for simpler systems to combine development, building and electrical permits into one application.</p> <p>Offer online applications, in addition to paper and in-person submissions.</p>
Timing	Aim to approve permits within three business days, or as soon as possible. Aim to schedule inspections within two business days, or as soon as possible. Schedule inspections using a two-hour timing window.
Guidance	Provide a "one-stop shop" website with guidance on how to navigate the permit process. Website should include a description of the process, links to online applications, and contact information for further assistance.
Fees	
Building	Use a flat fee; this is an easy way to partially subsidize solar PV systems.
Electrical	Use a flat fee for residential systems, and a tiered fee schedule with a price cap for all other systems.
Development	Use a flat fee (\$400 or less).

5. Coordinate electricity planning with IESO and LDCs

IESO convenes a Hamilton sub-region Technical Working Group with staff from Alectra Utilities, Hydro One Distribution, Hydro One Transmission and IESO. The City of Hamilton should work with the Technical Working Group to align the regional electricity planning with the NZS.

6. Assess potential sites for solar installations

Based on criteria outlined in this memo, and current land planning policy, the City should undertake a study in partnership with local utilities and other key stakeholders, to identify potential sites for ground mount solar installations.

7. Green hydrogen

Despite the fact that producing green hydrogen has significant land use impacts, it may well be critical to certain end use decarbonization in Hamilton, especially industrial end uses. As such, the City should consider supporting efforts to improve green hydrogen’s efficient and sustainable production, whether through research or pilot projects.

Appendix F.1: Renewable Energy Technologies: Planning Considerations

In terms of land-use planning policy within the City’s jurisdiction, the primary consideration in the NZS is solar and district energy. Unlike non-renewable sources which require expansion as resources are depleted, solar can use the same land for generation on an ongoing basis and can support simultaneous uses such as grazing and arable cropping.

Table 2. Renewable Energy Technologies in the NZS.

TECHNOLOGY	DESCRIPTION ¹²	MARKET READINESS	CAPACITY INSTALLED IN HAMILTON’S NZS (MW)		ABATEMENT COST (\$/TCO _{2E})
			2030	2050	
Negawatts	A watt of energy that you have not used through energy conservation or the use of energy-efficient products	Mature	485	1,627	Variable
Passive solar	Passive solar technologies convert sunlight into usable heat and cause air movement for ventilating to heat and cool living spaces without active mechanical or electrical devices.	Mature	n/a	n/a	Not evaluated
Large-scale solar (ground mount)	Photovoltaics (often shortened as PV) converts light (photons) to electricity (voltage). Large scale installations cover an acre of ground or more and are mounted on a support system.	Mature	90	280	(\$1,254)
Roof-mounted solar	Roof mounted PV systems are installed on houses and non-residential buildings and can vary in size.	Mature	180	425	\$597
Wind	Wind is used to produce electricity using the kinetic energy created by air in motion. Commercially available wind turbines have reached 13 MW capacity, with rotor diameters of up to 720 feet.	Mature	No wind capacity was installed within City boundaries in the NZS, instead wind power was included as part of the purchase of renewable energy certificates		\$51

¹² Descriptions are adapted from the National Renewable Energy Laboratory (www.nrel.gov/) and US Department of Energy www.energy.gov/.

TECHNOLOGY	DESCRIPTION ¹²	MARKET READINESS	CAPACITY INSTALLED IN HAMILTON'S NZS (MW)		ABATEMENT COST (\$/TCO ₂ E)
Renewable natural gas	Biogas that has been upgraded for use in place of fossil natural gas. The biogas used to produce RNG comes from a variety of sources, including municipal solid waste landfills, digesters at water resource recovery facilities (wastewater treatment plants), livestock farms, food production facilities and organic waste management operations.	Mature	14.5	26.7	\$60

Table 3. Energy carriers

TECHNOLOGY	DESCRIPTION	MARKET READINESS	CAPACITY INSTALLED IN HAMILTON'S NZS		ABATEMENT COST OVER THE PERIOD (\$/TCO ₂ E)
			2030	2050	
Green hydrogen	Hydrogen is a secondary source of energy. It stores and transports energy produced from other resources.	In development	4,049,507 MWh	9,551,362 MWh	\$816
Air source heat pumps	A heat pump's refrigeration system consists of a compressor and two coils made of copper tubing (one indoors and one outside), which are surrounded by aluminum fins to aid heat transfer. In heating mode, liquid refrigerant in the outside coils extracts heat from the air and evaporates into a gas. The indoor coils release heat from the refrigerant as it condenses back into a liquid. A reversing valve, near the compressor, can change the direction of the refrigerant flow for cooling as well as for defrosting the outdoor coils in winter.	Mature	1,060,428 MWh	2,776,073 MWh	\$451

TECHNOLOGY	DESCRIPTION	MARKET READINESS	CAPACITY INSTALLED IN HAMILTON'S NZS		ABATEMENT COST OVER THE PERIOD (\$/TCO ₂ E)
Ground source heat pumps	A geothermal heat pump takes advantage of this by exchanging heat with the earth through a ground heat exchanger. The heat exchanger is a system of pipes called a loop, which is buried in the shallow ground near the building. A fluid (usually water or a mixture of water and antifreeze) circulates through the pipes to absorb or relinquish heat within the ground.	Mature	Not evaluated	Not evaluated	Not evaluated
District energy	A mechanism for distributing heating and cooling between multiple buildings, using water. Next generation district energy systems use low temperature water combined with heat pumps and exchange heat and cold between buildings.	Mature	85 MW	85 MW	\$192

APPENDIX G: Memo - Impact of GRIDS 2 Scenarios on GHG Emissions and Addendum

October 2021

Contents

Impact of GRIDS 2 Scenarios on GHG Emissions	170
Addenda	181

City of Hamilton

Impact of GRIDS 2 Scenarios on GHG Emissions

Briefing V.1

October 26, 2021

Disclaimer  **SSC whatIf?**

The information in this analysis has been compiled to offer an assessment of the GHG emissions for the City of Hamilton. Reasonable skill, care and diligence have been exercised to assess the information acquired during the preparation of this analysis, but no guarantees or warranties are made regarding the accuracy or completeness of this information. This

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document, the information it contains and the information and basis on which it relies, are subject to changes that are beyond the control of the author. The information provided by others is believed to be accurate but has not been verified.

Context

This analysis is being undertaken as part of the City of Hamilton's GRIDS 2 / MCR growth management planning exercise to inform the choice of 'How Should Hamilton Grow?' to the year 2051. GRIDS 2 / MCR is examining how the City can accommodate forecasted population and employment growth in the period from 2021 to 2051. The 'How Should Hamilton Grow?' evaluation will evaluate two growth options – the Ambitious Density (AD) scenario which includes an urban boundary expansion of approximately 1,310 ha, while accommodating the majority of the growth in the existing urban boundary; and the No Urban Expansion (NUE) scenario which focuses all of the forecasted growth within the existing urban boundary.

On March 27th, 2019, Hamilton City Council passed a motion stating that the City of Hamilton declared a climate emergency.

As part of this motion, City Council directed Staff to investigate and identify a path for the entire city to achieve net-zero carbon emissions by 2050, including a process for measuring and reporting on progress towards that goal.

Hamilton's Community Energy and Emissions Plan (CEEP) is a major component of the City of Hamilton's strategy for responding to the climate emergency. With the input of local industry, academia, utilities, and local non-profits, this plan aims for Hamilton to achieve net-zero carbon emissions, citywide, by 2050 and become a prosperous, equitable, post-carbon city.

The technical analysis underlying the CEEP evaluated two scenarios to achieve Hamilton's GHG emissions reductions. A Business-As-Planned (BAP) scenario reflects current trends, while a net zero scenario evaluates actions to target net zero emissions by 2050.

In a BAP scenario, Hamilton's 2050 GHG emissions will be far from its net-zero GHG emissions target. In this scenario, by 2050, each Hamiltonian will represent the equivalent of 11.2 tonnes of GHG emissions. As a whole, the City will emit 9.6 Mt CO₂e, up from 8.7 Mt CO₂e in 2016. The CEEP also plots a pathway to net zero emissions by 2050. In the Net Zero scenario, the city implements ambitious actions in buildings, transportation, energy systems and industry to achieve deep emissions reductions. Each of these actions requires the mobilization of major investments and complex governance and implementation mechanisms.

Land-use policy is an important GHG emissions reduction strategy as it can avoid locking in infrastructure systems and activities that are costly to retrofit or to provide without generating GHG emissions. Conversely, land-use policy can enable cost effective emissions reductions. For example, it is more affordable to provide zero emissions transportation and zero emissions energy to a compact, complete community than to a distributed population. Electric buses can provide a service to more people with shorter routes and lower energy consumption. When destinations are in close proximity, people can walk or cycle. Houses tend to be smaller and share walls, which reduces energy consumption. District energy is more viable when heat loads are concentrated. Land-use policy is also the most cost-effective action a City can take, as it can enable GHG emissions reductions without requiring a direct investment by the City or society.

This analysis considers how the two different land-use scenarios impact patterns of energy consumption and GHG emissions, assuming current technologies and behaviours, by evaluating the impact of the land-use scenarios against the BAP scenario.

Methodology

Modelling Approach

Two land-use scenarios were evaluated for the City of Hamilton in the CityInSight model- Ambitious Density (AD) and No Urban Expansion (NUE). CityInSight is designed to project how the energy flow picture and emissions profile will change in the long term by modelling potential change in the context (e.g. population, development patterns), projecting energy services demand intensities, and projecting the composition of energy system infrastructure, often with stocks. Stock-turnover models enable users to directly address questions about the penetration rates of new technologies over time constrained by assumptions such as new stock, market shares and stock retirements. Examples of outputs of the projections include energy mix, mode split, Vehicle Kilometres Travelled (VKT), energy costs, household energy costs, GHG emissions and others.

The modelling evaluates scenarios that were developed for the City of Hamilton's GRIDS 2 / MCR growth management planning exercise. Both the scenarios evaluated in this analysis are built on the City's Business as Planned (BAP) Scenario used in the Community Energy and Emissions Plan.¹

In evaluating the scenarios, the following assumptions were applied:

Input data:

- Population, employment, and dwelling unit projections by zone were provided by the City.
- Data on technologies, energy and emissions was derived from the BAP scenario developed for the Community Energy and Emissions Plan.

Assumptions:

- Zonal employment growth is reflective of existing industrial/commercial activity currently taking place within the zone, as attributable to existing floor space attributable to an employment sector within Municipal Property Assessment Corporation (MPAC) data. For example, if employment in a zone is 50% industrial and 50% commercial, new employment will also receive the same share distribution.
- Zones within a modelled "superzone" were aggregated to reflect overall impact at a coarse level due to difference in zone systems used in GRIDS 2 work and the zonal system used in previous CityInSight modelling.
- Transportation modal shares for each zone were held constant across the time period. No additional transit interventions were modelled.
- Actions and assumptions in the BAP scenario are held constant for both of the scenarios.

¹ Additional details on the BAP scenario can be found in this document:

<https://www.hamilton.ca/sites/default/files/media/browser/2020-12-11/hamilton-baseline-bap-report-dec1-2020.pdf>

Method:

- Population, employment, dwelling unit, and non-residential floor space projections, as derived or inferred from the input data, were projected in the CityInSight framework at the zonal level.
- All BAP scenario assumptions and actions were modelled within the timeline to evaluate activity, energy, and emissions impacts of the integrated scenario.

Note that because of the modelling approach and data available, the GHG impact from transportation is likely understated; the City’s transportation model found vehicle kilometre travelled (VKT) reductions four times higher than those identified in this analysis. The reduction in vehicular travel will increase the GHG emissions reductions resulting from the NUE scenario over the AD scenario. A future update is planned to address these differences.

GHG Emissions

GHG emissions are lower in the NUE scenario in relation to the AD scenario (Figure 1), but the difference is subtle, illustrated by the closeness of the two curves. Part of the reason that the difference is subtle is because Hamilton’s GHG emissions are dominated by industrial emissions (63%) which are not impacted by land-use policy (Figure 2). Transportation emissions account for 19% of the total, while emissions from residential buildings account for 7.6% of the emissions. In order to better illustrate the difference between the two scenarios, the same lines are illustrated against a non-zero y-axis in Figure 3. There is a cumulative reduction of 1 MtCO₂e between 2022 and 2050 (Figure 4), which, for scale, is equivalent to 11% of the total annual GHG emissions in 2016.

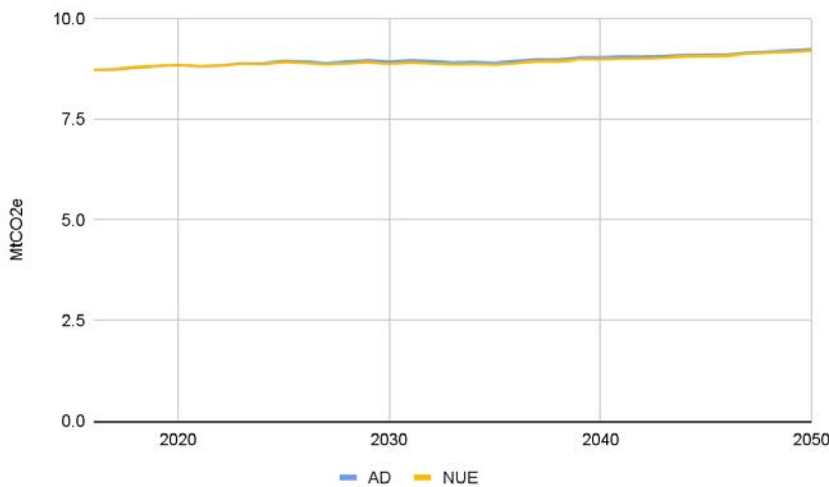


Figure 1: Annual GHG emissions of the AD and NUE scenarios

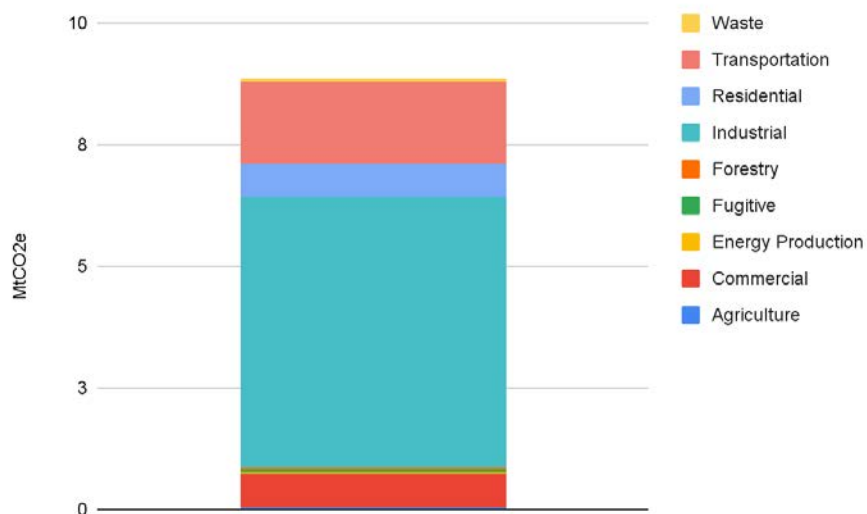


Figure 2: GHG emissions in the City of Hamilton by sector, 2020

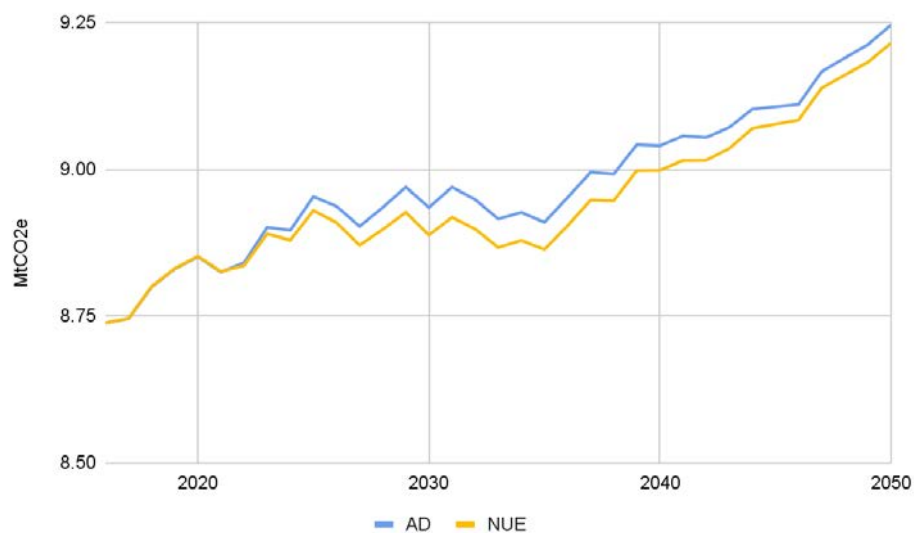


Figure 3: Annual GHG emissions of the AD and NUE scenarios, adjusted y-axis

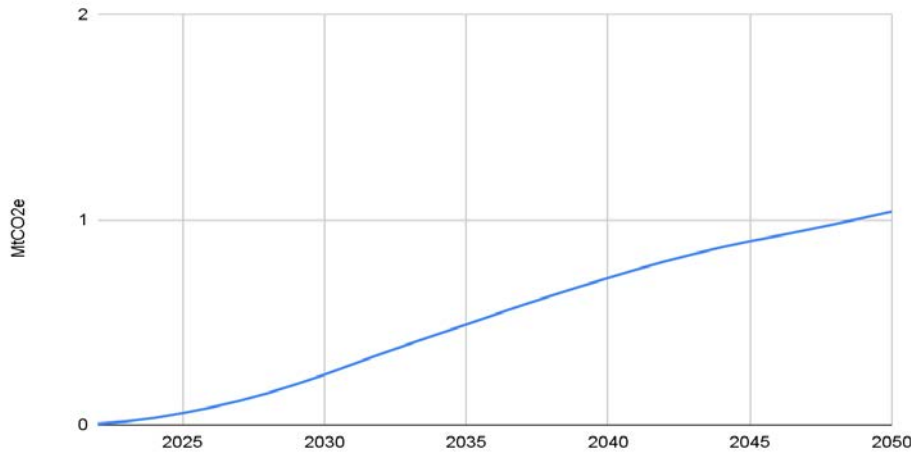


Figure 4: Cumulative emissions reductions of the NUE scenario relative to the AD scenario

While the reduction appears small in the context of the City’s total emissions, every tonne of GHG emissions reductions counts in a climate emergency, as each tonne imposes a social and economic cost on society. Further, the incremental cost of achieving these emissions reductions is negligible, since this is a planning decision that doesn’t require a direct investment by the municipalities, businesses or households. While there are major economic implications of the scenarios in terms of infrastructure, land costs and other considerations, these are outside of the scope of an analysis of GHG impacts.

Table 1: Summary of GHG Emissions Results

Scenario	Cumulative GHG Emissions (MtCO ₂ e) (2022-2050)	Annual Emissions in 2030 (MtCO ₂ e)	Annual Emissions in 2050 (MtCO ₂ e)
AD	261.3	8.93	9.24
NUE	260.2	8.89	9.21
Reduction over AD	1.0	0.05 (50,000 tCO ₂ e)	0.03 (30,000 tCO ₂ e)
Reduction over AD (%)	0.40%	0.53%	0.33%

To illustrate the drivers of GHG emissions, the differences are illustrated by sector, where negative numbers represent savings in the NUE scenario over the AD scenario. Residential emissions are reduced due to an increased share of more energy efficient apartments in the NUE scenario relative to a greater share of single family homes in the AD scenario. Transportation emissions are reduced as a result of shorter trips. Emissions from sequestration in agriculture, forests and land-use are also decreased due to reduced expansion of the City into greenfield locations.

Assuming the City adopts the CEEP, measures which decarbonise the energy system will reduce the GHG emissions differential between the scenarios, as vehicular travel becomes powered by clean electricity for example. Nevertheless, more energy efficient dwelling types and reduced driving in

turn reduce the burden of decarbonising the electrical grid and reduce the need for additional renewable energy generation.

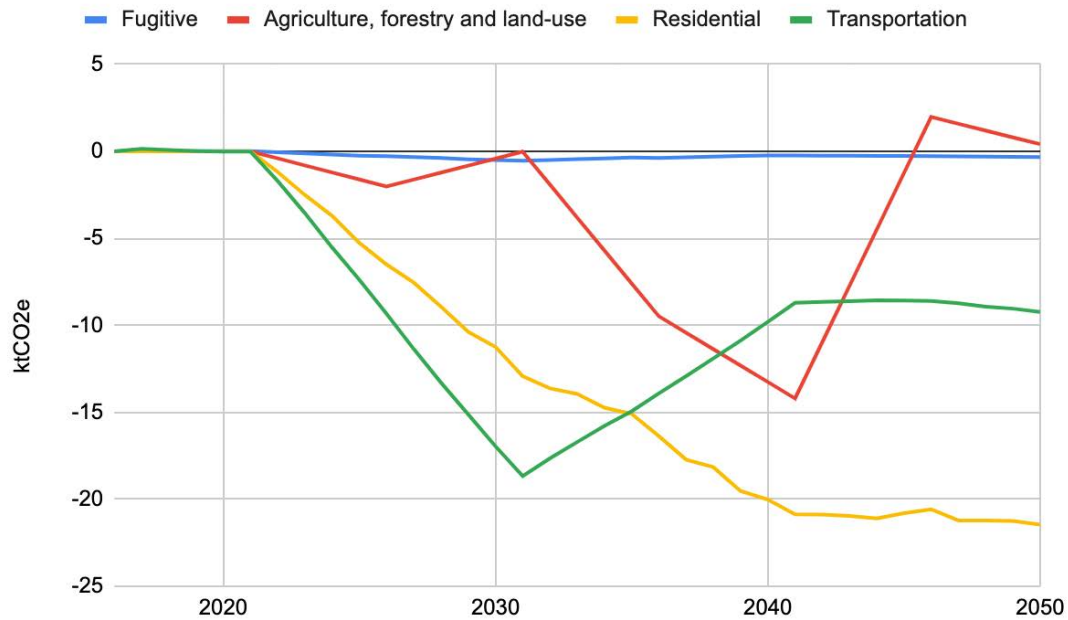


Figure 5: Change in GHG emissions by sector of NUE scenario relative to the AD scenario, (negative emissions equal emissions reductions).

The carbon price places a value on GHG emissions, climbing from \$50 per tonne in 2021 to \$170 per tonne by 2030. Applying this value to the reduced GHG emissions in the NUE scenario generates an avoided cost of \$166 million (undiscounted), or an average of \$6 million per year.

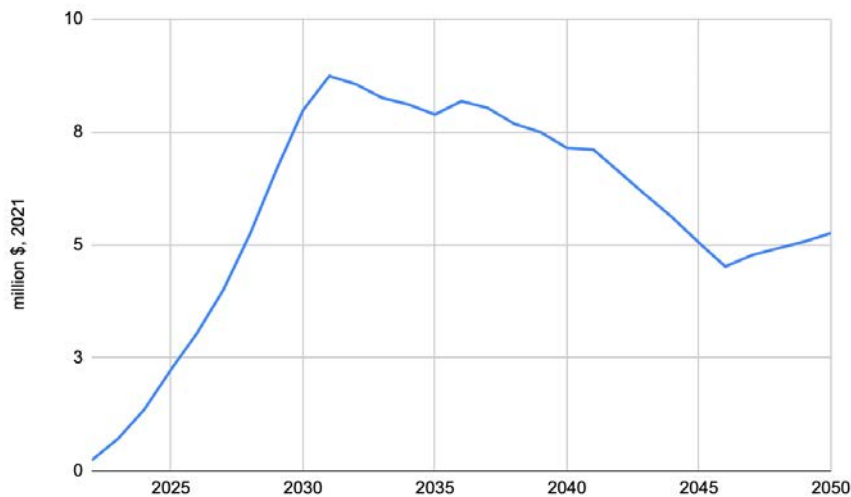


Figure 6: Avoided carbon price expenditure, NUE scenario over the AD scenario, 2022-2050

Table 2: Avoided carbon price expenditures, NUE scenario over the AD scenario

Scenario	Cumulative, 2022-2050 (not discounted, millions, 2021 \$)	Annual, 2040 (not discounted, millions, 2021 \$)	Annual, 2050 (not discounted, millions, 2021 \$)
Reduction over AD	\$166	\$7	\$5.3

Transportation Impacts

In 2020, Hamiltonians drove approximately 4.8 billion kilometres, and by 2040, this climbs to 6.98 billion kilometres. The NUE scenario decreases this total by 100 million or 1.5 percent in 2050 (Figure 7).² This reduction results in reduced household travel costs and reduces the burden on the electricity system when the vehicle fleet is electrified.

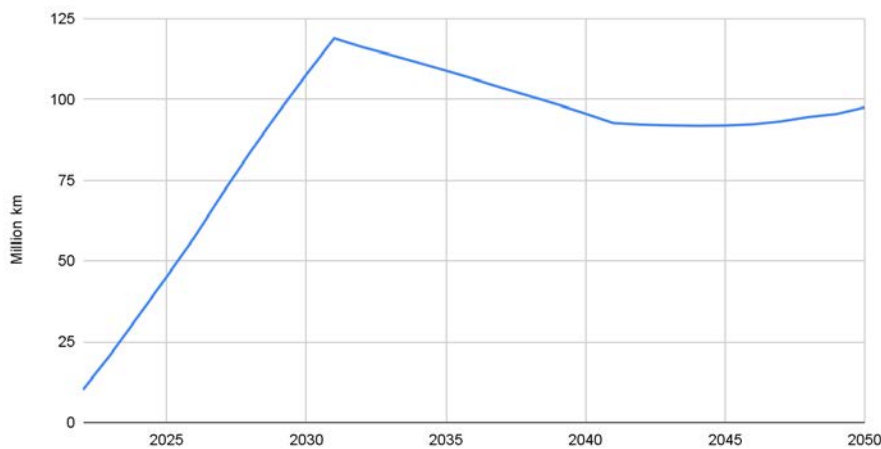


Figure 7: Annual reduction in VKT in the NUE scenario over the AD scenario, 2022-2050

As might be expected there is increased active transportation in the NUE scenario in comparison with the AD scenario. Figure 8 illustrates that there are nearly 2 million kilometres more of walking trips of 2 km length in the NUE scenario, an increase of 30%.

² Note that the City’s Transportation model identified savings of 400 million kilometres in 2050, or four times the reduction that was identified in this analysis. As a result, this analysis likely understates the GHG reduction from transportation. Additional analysis of the discrepancy in VKTs between the models is being undertaken, and if necessary, an addendum report will be provided which identifies the GHG reduction resulting from the increased GHG savings.

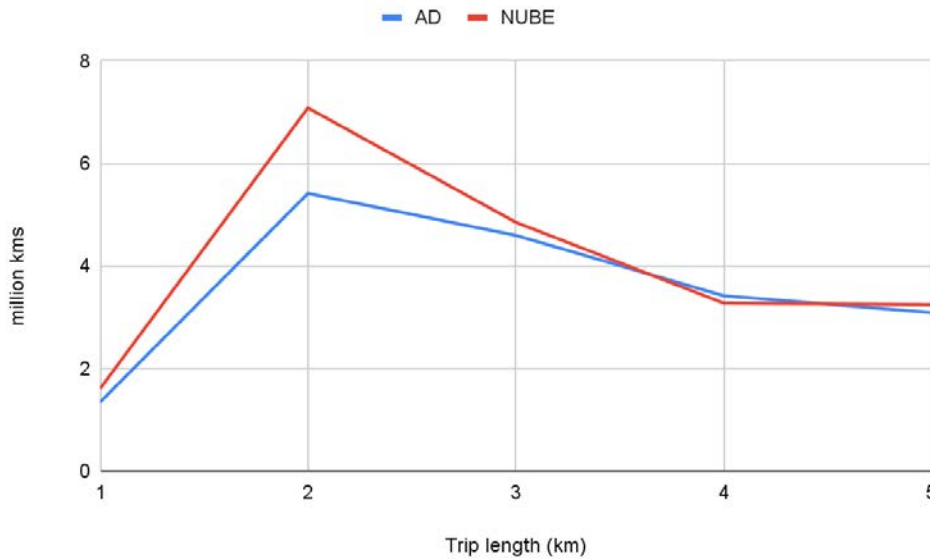


Figure 8: Walking kilometers by trip length, 2050

Energy Impacts

The NUBE scenario results in energy savings which climb to nearly 700,000 GJ per year by 2030 (0.7% of total energy consumption in that year). Much of these savings occur in the industrial sector, but Figure 9 illustrates the savings that occur in the residential and transportation sectors, directly benefiting households. The differential in energy consumption in the commercial sector is due to differences in employment rates of growth in the two scenarios as a result of the data sources; by 2050, commercial and industrial floor space are equal in both scenarios. Energy savings result in financial savings. Natural gas costs are approximately \$16 per GJ, electricity costs \$60 per GJ and gasoline costs \$38 per GJ. For illustrative purposes, assuming no increase in gasoline costs, avoided transportation costs total nearly \$10 million per year by 2030.

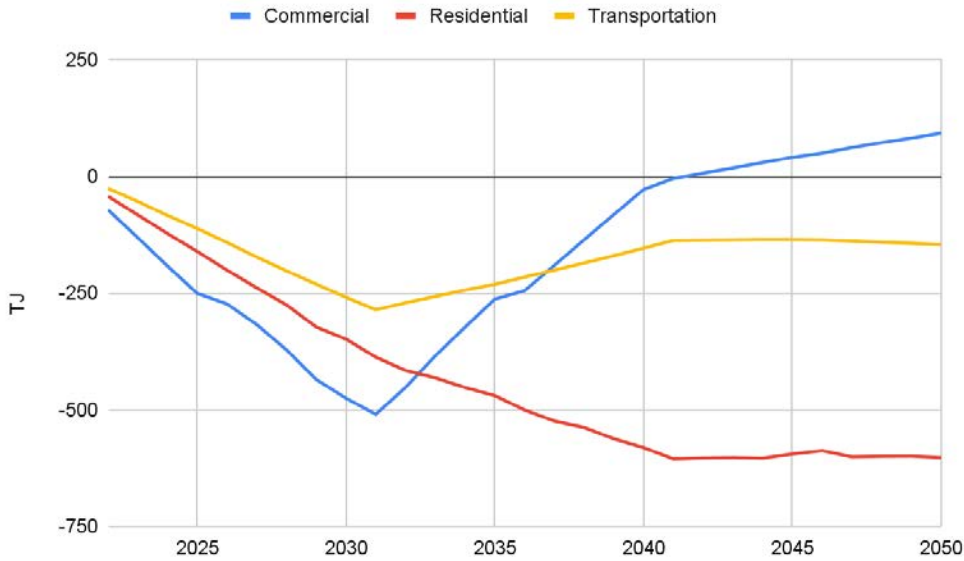


Figure 9: Energy savings by sector, NUE scenario over AD scenario (negative equals energy savings, 1 TJ equals 1,000 GJ), 2022-2050.

Conclusion

As is intuitive, there are GHG emissions reductions that result from concentrating new growth in the urban area; these reductions are primarily the result of reduced vehicular travel and more compact residential buildings. The impact of this change is muted by the inertia of the City’s existing building stock, travel activity, and industry, the latter of which accounts for 60% of the City’s emissions. While the GHG emissions reductions are relatively small, every tonne counts in the context of a net zero target, and in a climate emergency. These reductions are valuable because they are generated without an incremental investment and may enable additional future GHG reductions as measures such as district energy and new forms of public transit can be introduced.

document, the information it contains and the information and basis on which it relies, are subject to changes that are beyond the control of the author. The information provided by others is believed to be accurate but has not been verified.

Addenda – Nov. 17, 2021

Following the completion of this brief, further analysis has been completed to refine the results. First, updated transportation data was provided, specifically modal share projections for internal and external trips for 2051 by zone. Second, interim projections (between 2016 and 2050) were removed to provide better comparability between the two scenarios. Third, commercial and industrial employment distributions were assumed to be the same in both scenarios. These changes had the impact of reducing the cumulative GHG impact (2021-2050) from 1 MtCO₂e as described in this brief to 0.5 MtCO₂e.

An analysis of the VKT reduction resulting from the NUE scenario narrowed the difference between SSG's analysis and the City's transportation analysis to 100 million annual VKT in 2050. This variance is the result of the modelling treatment of pass-through trips. From a GHG accounting perspective, pass through trips are not counted as part of the City's GHG inventory and are therefore not reflected in the CityInSight model.

This finding provides three insights additional to those described in the briefing:

- The size of the GHG benefit of the NUE scenario will be influenced by the timing of, and location of, urban expansion.
- The sectoral distribution of future employment between the two scenarios will also impact the difference in emissions (these have been held constant in the two scenarios). For example, if one scenario included more employment in low rise office versus high rise office, this will impact the emissions.
- There are additional GHG benefits from reduced passthrough trips which do not show up in the CityInSight analysis.



Hamilton

CITY OF HAMILTON

CLIMATE CHANGE IMPACT ADAPTATION PLAN

An aerial photograph of the City of Hamilton, showing a mix of urban buildings, green spaces, and a large body of water in the background under a blue sky with scattered clouds. The foreground is dominated by lush green trees and foliage.

2022

Table of Contents

1. Land Acknowledgement	3
2. Executive Summary	4
3. Acknowledgements	7
4. Message from the Mayor	9
5. Glossary	10
Acronyms	13
6. Introduction	14
Adaptation vs. Mitigation	14
International Policy Direction on Climate Adaptation	14
Federal Policy Direction on Climate Adaptation	15
Provincial Policy Direction on Climate Adaptation	16
7. Climate Change and Hamilton	17
City of Hamilton’s Commitment to Climate Change	17
Intention of the Plan and Community Scope	19
8. Vision Statement	20
9. Climate Science, Local Impacts and Risks.....	21
ICLEI Canada’s Building Adaptive and Resilient Communities (BARC) Framework	21
Engagement and Outreach Approach.....	22
Climate Science and Projections.....	24
Impact Identification	24
Vulnerability Assessment.....	25
Risk Assessment	25
Priority Climate Change Impacts	26
Action Development and Prioritization.....	28
10. The Path to a Climate Resilient Hamilton: Themes, Objectives, and Actions	30
Enabling Actions	30
RESILIENT THEME #1: BUILT ENVIRONMENT	31
RESILIENT THEME #2: PEOPLE AND HEALTH	36

RESILIENT THEME #3: NATURAL ENVIRONMENT, AGRICULTURAL AND WATER	47
RESILIENT THEME #4: ENERGY AND ECONOMY	54
11. Implementation	57
Monitoring and Review	58
Indicators.....	58
Central Climate Change Office and Plan Review.....	58
Advancing Adaptation Project	60
12. Conclusion	61
13. Appendices	63
Appendix A: Implementation Schedule.....	63
Appendix B: Climate Science Infographic	82
14. References	85

List of Figures and Tables

Figure 1: Overlap and Differences Between Adaptation and Mitigation (Source: ICLEI Canada, 2019).....	14
Figure 2: City of Hamilton's Climate Change Work (1994 - present).....	19
Figure 3: BARC 5-Milestone Framework.....	21
Figure 4: Summary of CCIAP Engagement.....	24
Figure 5: Priority Climate Change Impacts for the City of Hamilton	28
Figure 6: Action Prioritization Criteria	29

1. Land Acknowledgement

The City of Hamilton is situated upon the traditional territories of the Erie, Neutral, Huron-Wendat, Haudenosaunee, and Mississaugas. This land is covered by the Dish With One Spoon Wampum Belt Covenant, which was an agreement between the Haudenosaunee and Anishinaabek to share and care for the resources around the Great Lakes. We further acknowledge that this land is covered by the Between the Lakes Purchase, 1792, between the Crown and the Mississaugas of the Credit First Nation.

Today, the City of Hamilton is home to many Indigenous people from across Turtle Island (North America) and we recognize that we must do more to learn about the rich history of this land so that we can better understand our roles as residents, neighbours, partners, and caretakers.



2. Executive Summary

Hamilton's Declaration of Climate Emergency in 2019 was a public recognition of a longstanding fact: the impacts of climate change are here in Hamilton and will increase over the 21st century. Hamilton is not alone in this; the impacts of climate change are becoming more apparent globally every year, with annual average temperature records toppling regularly and hurricanes that exceed in wind speed of our existing meteorological frameworks.

We've seen a world-record-breaking heat dome in British Columbia and catastrophic floods, prairie droughts that affect food availability and pricing for the whole country, far northern communities with their territory eroding into the ocean, dry-day flooding events in coastal communities on both coasts, and historic wildfires that burn entire communities to the ground. Here at home, we've seen extreme heat events, waterfront flooding, escarpment erosion, increases in vector-borne diseases, extended power outages, air quality impacts from wildfires thousands of kilometres away, and flooding.

Hamilton's commitment to climate action predates this Adaptation Plan. Staff have been developing and delivering programs such as expanded stormwater capacity, sewer separation, extreme temperature response programs, infrastructure improvements, and programs to assist homeowners in recovering from basement floods. But this Adaptation Plan represents the City's first effort in pulling together these existing efforts and extending them in new ways to address a carefully considered list of priority climate impacts through a comprehensive program, based on internal and external stakeholder consultation.

This Plan, created with ICLEI Canada through their Building Adaptive and Resilient Communities (BARC) framework, is based on up-to-date projections for Hamilton's climate throughout this century, relying on global and national climate models reflecting a range of GHG emissions scenarios. These projections were then used to create over 70 climate impact statements, reflecting all of the ways that climate change may affect City operations and the community at large.

Through the Vulnerability and Risk Assessment (VRA) process, staff consulted with every City Department and dozens of community organizations, including businesses, industry, environmental organizations, social service organizations, and institutions such as Hamilton Health Sciences, and our school boards and post-secondary academic institutions. These conversations developed a full picture of how these climate impacts will affect all of Hamilton's communities, and determined a list of thirteen high-priority climate impacts reflecting the most significant concerns of the City and the community,

which this Adaptation Plan will work to mitigate. This process is described in detail in the Vulnerability and Risk Assessment Report.

ICLEI then completed a best-practices review of Adaptation Plans from across the country to assemble a list of known adaptive actions already used to address these impacts; using contributions from staff and the community, this list of preliminary adaptive and supporting actions totaled over 130. Duplicated actions were removed, overlapping actions were combined, and actions already underway with dedicated budgets and staff time were removed. These existing actions are of course important and form a part of the City's Adaptation response, and new actions will reflect and add to them, but given that they are already demonstrated City priorities, it was considered a duplicated effort to include them in the Action Prioritization Exercise. We ended up with a list of 27 new adaptive actions that would protect the City and community from projected climate impacts.

These actions were then ranked in a Prioritization exercise by internal and external stakeholders, into three categories: urgent (under 2 years), high priority (3-5 years), and medium priority (5-10 years). This process is described in Action Development and Prioritization beginning on p. 28.

Staff then used these prioritized adaptive actions, sorted into four themes and eleven objectives, to undertake Implementation Planning focusing on scope, supporting actions, participants and leaders, resourcing gaps, next steps and monitoring metrics. An Implementation Schedule table summarizing these completed worksheets is included in Appendix A, and constitutes the scaffolding of the Adaptation Plan.

The four Resilient Themes of the Adaptation Plan are:

1. Built Environment
2. People and Health
3. Natural Environment, Water and Agriculture
4. Energy and Economy

The objectives relating to each of them and their related adaptive actions are shown starting on p. 31.

Staff and ICLEI realized the importance of two enabling actions (not related to a particular theme or objective, but underlying the success of the whole Plan) through Implementation Planning discussions internally and externally: the creation of a centralized Climate Change Office, and the development of a City-wide program to track

key climate impact metrics. The centralized Climate Change Office would have dedicated staff and resources to coordinate and carry out adaptation and mitigation projects and programs and take the lead on most of the actions in this Plan. As well, while information for key climate metrics often exists, it is not being collected or stored in a way that makes for easy sharing or use. Creating a process to address this would support the success of the entire program.

While the completion of this Plan is a substantial milestone for the City and staff, the hard work of implementation and monitoring is about to begin. The Implementation Schedules in Appendix A will guide and structure that work, in some cases for decades to come, and show a path to decreasing inequality, protecting residents and businesses from climate impacts, and improving quality of life for all in a sustained and coordinated effort across the City and community.



3. Acknowledgements

The Climate Change Impact Adaptation Plan forms a key part of the City of Hamilton's Climate Action Strategy, and its development was guided by a core team of internal and ICLEI Canada staff. Many thanks for your time and contributions.

Andrea McDowell (Project Manager, Air Quality and Climate Change, Healthy and Safe Communities)

Trevor Imhoff (Senior Project Manager, Air Quality and Climate Change, Healthy and Safe Communities)

Ewa Jackson (Managing Director, ICLEI Canada)

Hiba Kariem (Climate Change Project Coordinator, ICLEI Canada)

Adam Watson (Project Manager, Healthy and Safe Communities)

Connie Verhaeghe (Senior Emergency Management Coordinator, Healthy and Safe Communities)

Kirsten Marples (Emergency Management Coordinator, Healthy and Safe Communities)

Gavin Chamberlain (Risk Analyst, Corporate Services)

Christine Newbold (Manager Sustainable Communities, Planning and Economic Development)

Robert Lalli (Director Strategic Initiatives, Planning and Economic Development)

Andrea Vargas (Manager, Strategy and Continuous Improvement, Public Works)

We are very grateful for the extensive and generous contributions of time, insight and experience by the many community stakeholders who participated in this project. This Plan has benefited greatly from your input and we hope those benefits will be felt by the entire City for many years to come.

- Hamilton Regional Friendship Centre
- Green Venture
- Royal Botanical Gardens
- Union Gas
- Hamilton Industrial Environmental Association (HIEA)
- Sustainability Leadership
- McMaster University
- YWCA
- Hamilton Conservation Authority
- Environment Hamilton
- HCE Energy Inc
- Bay Area Climate Change Council (BACCC)
- West End Homebuilders Association
- Alectra
- Mohawk College
- Hamilton Chamber of Commerce
- Committee for Persons with Disabilities
- Faith and the Common Good
- Social Planning and Research Council of Hamilton
- Hamilton Halton Home Construction Association
- Wesley Urban Ministries
- CF Lime Ridge Mall
- Hamilton Health Sciences
- Hamilton Utilities Corporation
- Hamilton Airport
- ACORN Hamilton
- Welcome Inn
- Immigrant Working Centre
- Senior Advisory Council
- Hamilton-Oshawa Port Authority
- Hamilton Roundtable for Poverty Reduction
- United Way Halton and Hamilton
- EcoWHAM
- Community Response to Extreme Weather (CREW)



4. Message from the Mayor

5. Glossary

Adaptation: Includes any initiatives or actions in response to actual or projected climate change impacts and which reduce the effects of climate change on built, natural, and social systems.

Adaptive Capacity: The ability of built, natural and social systems to adjust to climate change (including climate variability and extremes), to moderate potential damage, to take advantage of opportunities, or to cope with the consequences.

Baseline: A climatological baseline is a reference period, typically three decades (or 30 years), that is used to compare fluctuations of climate between one period and another. Baselines can also be called references or reference periods.

Climate: The weather of a place averaged over a period of time, often 30 years. Climate information includes the statistical weather information that tells us about the normal weather, as well as the range of weather extremes for a location.

Climate Change: Climate change refers to changes in long-term weather patterns caused by natural phenomena and human activities that alter the chemical composition of the atmosphere through the build-up of greenhouse gases which trap heat and reflect it back to the earth's surface.

Climate Atlas of Canada: The Climate Atlas of Canada is an interactive tool that combines climate science, mapping, and storytelling to depict expected climatic changes across Canada to the end of the century. The 250-layer map is based on data from 12 global climate models. Users are shown a baseline period of warming trends by region that spans from 1950 to 2005 and can toggle between two future projection periods, 2021 to 2050 and 2051 to 2080.

Climate Data Canada: Offers local climate data and advanced customization options to allow for a better understanding of changes likely to be experienced by Canadian communities. Climate Data Canada is a collaboration between Environment and Climate Change Canada, the Computer Research Institute of Montréal, Ouranos, the Pacific Climate Impacts Consortium, the Prairie Climate Centre, and HabitatSeven.

Climate Projections: Climate projections are a projection of the response of the climate system to emissions or concentration scenarios of greenhouse gases and aerosols. These projections depend upon the climate change (or emission) scenario used, which are based on assumptions concerning future socioeconomic and

technological developments that may or may not be realized and are therefore subject to uncertainty.

Climate Change Scenario: A climate change scenario is the difference between a future climate scenario and the current climate. It is a simplified representation of future climate based on comprehensive scientific analyses of the potential consequences of anthropogenic climate change. It is meant to be a plausible representation of the future emission amounts based on a coherent and consistent set of assumptions about driving forces (such as demographic and socioeconomic development, technological change) and their key relationships.

Ensemble Approach: An ensemble approach uses the average of all global climate models (GCMs) for temperature and precipitation. Research has shown that running many models provides the most realistic projection of annual and seasonal temperature and precipitation than using a single model.

Extreme Weather Event: A meteorological event that is rare at a place and time of year, such as an intense storm, tornado, hailstorm, flood, or heat wave, and is beyond the normal range of activity. An extreme weather event would normally occur very rarely or fall into the tenth percentile of probability.

Greenhouse Gas (GHG) Emissions: Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation, emitted by the Earth's surface, the atmosphere itself, and by clouds. Water vapor (H₂O), carbon dioxide (CO₂), methane (CH₄), nitrous oxide (NO₂), ozone (O₃), and chlorofluorocarbons (CFCs) are the six primary greenhouse gases in the Earth's atmosphere in order of abundance.

Climate Impact: The effects of existing or forecast changes in climate on built, natural, and human systems. One can distinguish between potential impacts (impacts that may occur given a projected change in climate, without considering adaptation) and residual impacts (impacts of climate change that would occur after adaptation).

Impacts of a changing climate: means the present and future consequences from changes in weather patterns at local and regional levels including extreme weather events and increased climate variability.¹

Impact Statement: Climate-related impact statements are concise statements that outline locally-relevant projected threats and how those changes are expected to affect the built, natural, social, and economic systems of the municipality.

Mitigation: The promotion of policy, regulatory and project-based measures that contribute to the stabilization or reduction of greenhouse gas concentrations in the atmosphere. Renewable energy programs, energy efficiency frameworks and substitution of fossil fuels are examples of climate change mitigation measures.

Representative Concentration Pathways: Representative Concentration Pathways (RCPs) are four greenhouse gas concentration (not emissions) trajectories adopted by the IPCC for its fifth Assessment Report (AR5) in 2014. It supersedes the Special Report on Emissions Scenarios (SRES) projections published in 2000.

Resilience: The capacity of a system, community or society exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.

Risk: The combination of the likelihood of an event occurring and its negative consequences. Risk can be expressed as a function where $Risk = likelihood \times consequence$. In this case, *likelihood* refers to the probability of a projected impact occurring, and *consequence* refers to the known or estimated outcomes of a particular climate change impact.

Sensitivity: Measures the degree to which the community will be affected when exposed to a climate-related impact. Sensitivity reflects the ability of the community to function (functionality) as normal when an impact occurs.

Vulnerability: Vulnerability refers to the susceptibility of the community to harm arising from climate change impacts. It is a function of a community's sensitivity to climate change and its capacity to adapt to climate change impacts.

Weather: The day-to-day state of the atmosphere, and its short-term variation in minutes to weeks.

Acronyms

AR6 – Sixth Assessment Report

BARC – Building Adaptive and Resilient Communities

CDP – Carbon Disclosure Project

GcoM – Global Covenant of Mayors

GHG – Greenhouse Gas

ICLEI – International Council for Local Environmental Initiatives

IPCC – Intergovernmental Panel on Climate Change

RCP – Representative Concentration Pathways



6. Introduction

Adaptation vs. Mitigation

Climate change is defined as any change in global or regional climate patterns. While the Earth's climate has naturally fluctuated for millions of years, changes in climate from the mid-to-late 20th century onwards are largely attributed to increased levels of atmospheric carbon dioxide produced by burning fossil fuels. Climate change must be addressed in two ways. One set of strategies minimizes future changes to the climate; the other helps us prepare for the inevitable changes that are to come.

Climate change mitigation refers to the implementation of policy, regulatory, and project-based measures that stabilize and/or reduce greenhouse gas concentrations in the atmosphere, including transitioning to low-carbon emission sources, reducing consumption of goods, building retrofits to conserve energy, anti-idling by-laws, and increasing active transportation options.

Climate change adaptation, on the other hand, refers to measures that help us adjust to the impacts of a changing climate on our social, economic, built, and natural systems. This can include enhancing the capacity of our built environment (e.g. upgrades to infrastructure), educating the public about preparedness against climate change hazards and emergencies, protecting and enhancing our natural environment and ecological services, and business continuity planning.

As the effects of climate change are wide-ranging, a diverse set of responses is required. Adaptation is not meant to replace or undermine mitigation efforts, rather adaptation complements local government efforts to protect and improve long-term sustainability. Implementing both climate change mitigation and adaptation measures is important to respond to both the causes and effects of climate change.

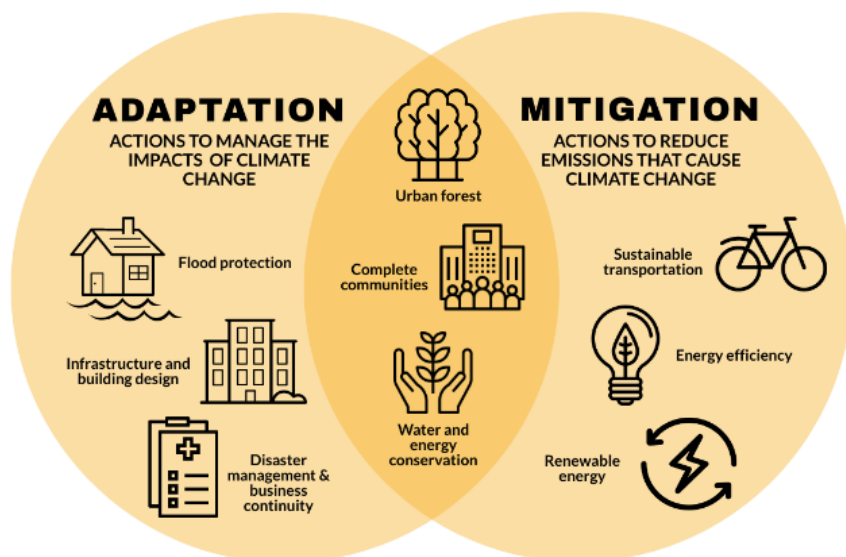


Figure 1: Differences and Overlap Between Climate Adaptation and Mitigation

International Policy Direction on Climate Adaptation

The United Nations (UN) Intergovernmental Panel on Climate Change (IPCC) is the UN institution tasked with assessing the scientific basis of climate change, its impacts and potential future risks, and potential response options. In its Sixth Assessment Report (AR6), released in 2022, the IPCC declared with certainty the widespread impact of human-caused climatic changes. The report stated:

“Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability. The rise in weather and climate extremes has led to some irreversible impacts as natural and human systems are pushed beyond their ability to adapt”.ⁱⁱ

The most urgent report to date, the AR6 Report states that even with major reductions of GHG emissions in the short-term (RCP2.5 scenario) there is greater than a 50% likelihood that global warming will reach or exceed 1.5°C in the near term. According to the report, “Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans. The level of risk will depend on concurrent near-term trends in vulnerability, exposure, level of socioeconomic development, and adaptation.”ⁱⁱⁱ Now more than ever, it is crucial that cities implement comprehensive, effective, and innovative responses between adaptation and mitigation efforts to advance sustainable development and to capitalize on the co-benefits these strategies can provide.^{iv}

Federal Policy Direction on Climate Adaptation

Canada was one of 195 countries to sign the Paris Agreement in December 2015. The Agreement aims to keep the global temperature to well below two degrees Celsius and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels. In terms of adaptation, the Agreement’s goals include enhancing adaptive capacity, strengthening resilience and reducing vulnerability to global climate change.

In addition to signing the Paris Climate Agreement, the Government of Canada produced several policy documents that inform and guide decision-makers on climate change adaptation. In 2016, the Government of Canada released its Pan Canadian Framework on Clean Growth and Climate Change, which includes adaptation considerations and actions to improve climate resiliency. Updated in 2020, the Government of Canada committed to developing Canada’s first National Adaptation Strategy with provincial, territorial, and municipal governments, Indigenous Peoples, and other key partners. A major focus has been put on the development of Expert Advisory Tables to focus on:

- Health and Wellbeing;

- Resilient Natural and Built Infrastructure;
- Thriving Natural Environment;
- Strong and Resilient Economy;
- Disaster Resilience and Security.

The framework recognizes the important role that municipalities will play in implementing climate solutions locally. The strategy is set to be completed in the summer of 2022. While federal and provincial governments provide strategic focus, standards, and potential funding streams for adaptation, it will be up to local governments to tailor climate change adaptation strategies to their local circumstances and the unique set of climate change impacts they are already experiencing or expect to face.

Other resources developed by the Government of Canada include the National Issues Report *Health of Canadians in a Changing Climate* to provide a national perspective on how climate is impacting Canadian communities, the environment, and its economies. The *Map of Adaptation Actions* is a repository of case studies from across Canada that explores how communities and sectors are adapting to a changing climate.

Provincial Policy Direction on Climate Adaptation

The Government of Ontario's 'A Made-in-Ontario Environment Plan' addresses climate change through both mitigation and adaptation strategies. These strategies include emissions performance standards and regulations to reduce emissions from the transportation sector, programs to enhance and expand public transit networks, funding for extreme-weather resistant infrastructure, a province-wide multi-sector provincial climate change impact assessment, and the *Protecting People and Property: Ontario's Flooding Strategy* to reduce flood risk. Additionally, the Provincial Policy Statement has been updated to include direction for planning authorities to prepare for the impacts of a changing climate, including climate change decision-making in land-use and development policy, and enhanced stormwater management policies to enhance climate resilience.

7. Climate Change and Hamilton

After the 2015 Paris Accord, in which national governments agreed to keep warming under 2°C and preferably under 1.5°C, the IPCC undertook an analysis of how and whether the global economy could decarbonize to support that goal. In 2018, the IPCC published this analysis as the Special Report: Global Warming of 1.5°C. This report made headlines internationally with its finding that, if the world did not reduce carbon emissions by at least 45% by 2030 and eliminate emissions entirely by 2050, it would not be possible to keep warming below 1.5°C (and even then, would very likely require carbon removal and sequestration technologies).

The IPCC's most recent report on impacts, vulnerabilities and adaptation was published in February 2022, specifically looking at what a 1.5°C temperature rise would mean. They found that:

“Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans (very high confidence). The level of risk will depend on concurrent near-term trends in vulnerability, exposure, level of socioeconomic development and adaptation (high confidence). Near-term actions that limit global warming to close to 1.5°C would substantially reduce projected losses and damages related to climate change in human systems and ecosystems, compared to higher warming levels, but cannot eliminate them all (very high confidence).” (Summary for Policy Makers)

The City of Hamilton is not immune to the impacts of climate change, and indeed we have seen them increasing in recent years: ice storms, power outages, recent waterfront flooding and the accompanying costly infrastructure repairs, increasing escarpment erosion and damage to escarpment access roads, basement flooding, increasing extreme heat events, wind storms, and vector-borne diseases such as Lyme. Businesses, livelihoods and education have been disrupted; people have been injured, made ill, and sometimes died. As the 2022 IPCC report makes clear, while it is imperative for every economy to decarbonize over the coming decades, it is equally imperative to adapt to and prepare for those climate impacts we can no longer avoid.

City of Hamilton's Commitment to Climate Change

Although climate change is a global issue, impacts are felt at a local level. While climate change efforts are necessary across all levels of government, local governments are especially well-positioned to take action. Municipal decision-makers have a unique opportunity to begin preparing for a changing climate as they will be on the front lines of responding to its impacts.^v Being responsible for key service areas that will be affected

by climate change: infrastructure, health, water, parks and recreation, and transportation – they have a responsibility to respond by utilizing the many planning and policy tools and mechanisms available to them.

Hamilton's work on climate change goes back to joining the FCM's Partner's for Climate Protection (PCP) program in 1994. In the years since this commitment has deepened becoming an extensive Climate Action Strategy including both a Community Energy and Emissions Plan to achieve net-zero emissions by 2050 and this Climate Change Impact Adaptation Plan to reduce climate consequences for Hamilton residents and businesses. Key milestones leading up to City Council's Climate Emergency Declaration can be found in Figure 2 below.

In October 2015, Council endorsed "Taking Action on Climate Change in Hamilton – A Community Plan (2015)." The Plan, developed as a collaborative effort from multiple City departments and community partners, identified ten "Priority Actions" including "Develop a Community Energy Plan to guide the Hamilton community's energy future," and "Conduct a local community vulnerability assessment of public health impacts from climate change." The Terms of Reference for the Community Energy Plan (later the Community Energy and Emissions Plan, or CEEP) was approved in 2018, with a successful application for funding to the province made in 2020.

On May 16, 2018, General Issues Committee (GIC) approved the Climate Reserve and Adaptation Planning motion, which directed Hamilton's Senior Leadership Team "to work with all City Departments to develop climate change adaptation plans that may be eligible for funding from a Climate Change Reserve and funding from the Provincial and Federal Governments."

On March 27, 2019, Council declared a climate change emergency and directed Staff to form a Corporate Climate Change Task Force (CCCTF) to investigate additional actions to reach net zero by 2050. In December 2019, the CCCTF completed the "Corporate Goals and Areas of Focus for Climate Change Mitigation and Adaptation." Goal 7, on Climate Adaptation, directed staff to complete an Adaptation Plan, including a Vulnerability and Risk Assessment through ICLEI's BARC) framework.

In 2022, Hamilton staff will be bringing the CEEP and Climate Change Impact Adaptation Plan (CCIAP) together under Hamilton's Climate Action Strategy (HCAS), a coordinated strategy to address mitigation and adaptation in support of the City's Vision, "To be the best place to raise a child and age successfully."

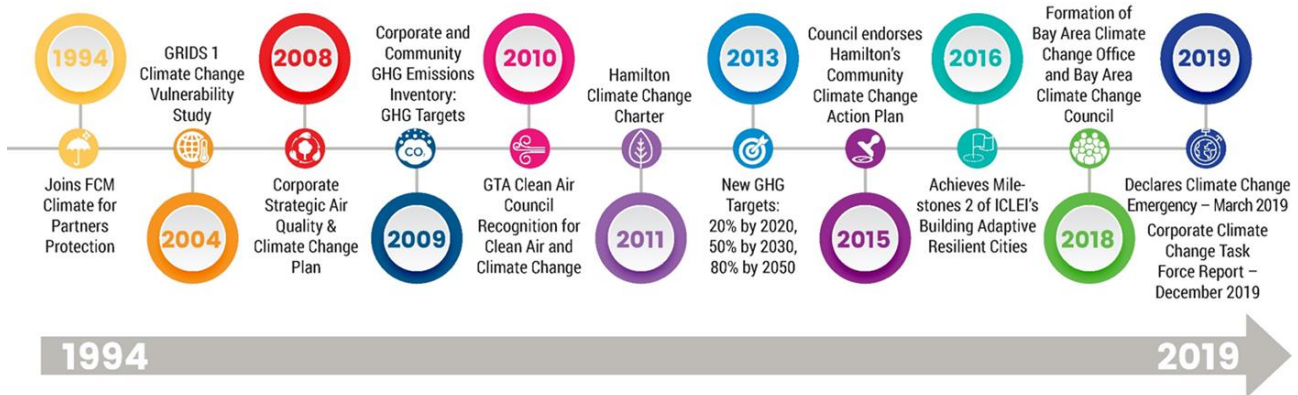


Figure 2: City of Hamilton's Climate Change Work (1994 - 2019)

The purpose of the Climate Change Impact Adaptation Plan (CCIAP) is to continually improve Hamilton's resilience to extreme weather and climate change impacts by increasing our local adaptive capacity and decreasing our sensitivity to these changes. This plan emphasizes a community-based adaptation approach to build resilience while reducing vulnerability via meaningful engagement of organizations and residents through the entire process of adaptation. By involving a wide range of stakeholders and individuals, Hamilton was able to collaboratively co-develop an adaptation plan that addresses climate risks across multiple sectors and systems. In employing this process, the City recognizes and aims to shift the power dynamics between decision-makers and other individuals within the participatory process. Local knowledge and assets of community members are incorporated and inform local adaptation planning and implementation.

8. Vision Statement

Drawing on the contributions from internal and external stakeholders and their priority values for a Climate Change Impact Adaptation Plan, we created the following Vision Statement to guide its implementation:

“The City of Hamilton will be a national leader on Climate Adaptation: a healthy, equitable, vibrant, and sustainable community that responds to the needs of residents, businesses and institutions, and is resilient in the face of a changing climate.”



9. Climate Science, Local Impacts and Risks

ICLEI Canada's Building Adaptive and Resilient Communities (BARC) Framework

Development of the City of Hamilton's CCIAP was guided by ICLEI Canada's Building Adaptive and Resilient Communities (BARC) Framework. BARC is a five-milestone planning framework for local governments aimed at preparing communities for the impacts of climate change. The comprehensive planning methodology guides municipalities through areas of research and climate impact assessment methods, plan development, action-setting processes, implementation planning, and monitoring and review strategies (see the figure below). Through this project, Hamilton worked through and completed Milestone 1, 2 and 3 of the framework, which culminated in the creation of a climate change impact adaptation plan.

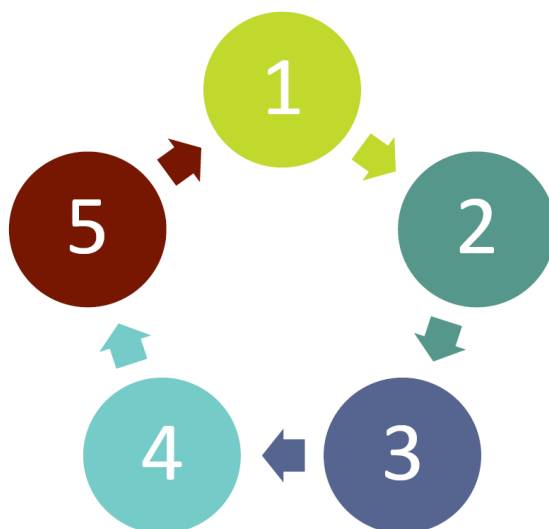


Figure 3: BARC 5-Milestone Framework

MILESTONE ONE - INITIATE

Within this milestone, communities identify stakeholders to review and understand existing knowledge on how the regional climate is changing, followed by a brainstorming exercise to identify potential climate change impacts.

MILESTONE TWO—RESEARCH

The second milestone is meant to further develop a community's understanding of climate change impacts and the major service areas which are likely to feel these impacts most acutely. Within this milestone, a municipality will scope the climate change impacts for the region and conduct both a vulnerability and risk assessment.

MILESTONE THREE - PLAN

The third milestone provides guidance on how to establish a vision, set adaptation goals and objectives, identify adaptation options, and examine possible constraints and drivers to various actions. From there, a community will draft a Local Adaptation Strategy. Baseline data is collected and recorded, financing and budget issues are addressed, an implementation schedule is drafted, implementation responsibilities are determined, and progress and effectiveness indicators are identified in the Plan.

MILESTONE FOUR - IMPLEMENT

In the fourth milestone, communities work to ensure that they have the approval and support of council, municipal staff and the community in order to move forward on implementation. Communities will also make sure they have the appropriate implementation tools to ensure the ongoing success of the Strategy.

MILESTONE FIVE – MONITOR & REVIEW

The fifth and final milestone serves to assess whether the goals and objectives of the Strategy have been achieved, and helps communities identify any problems that have been encountered and develop solutions. Additionally, the fifth milestone helps communities communicate their progress to council and the general public.

Engagement and Outreach Approach

The CCIAP was developed through an iterative and collaborative process, building upon the knowledge and expertise of Council, City staff, and local stakeholders, partners, and experts. As such, the CCIAP is reflective of the needs and priorities of our community as we move toward a new climate-adjusted reality.

2015-2017

The process originally commenced in 2016 and continued into 2017 with the completion of Milestone 1 and 2 of the BARC process. A Core Internal Group that made key decisions regarding the CCIAP and provided strategic direction to the overall development of the Plan was formed. This group was comprised of key staff across all City departments. A larger Climate Adaptation Team, made up of City staff and community representatives, worked closely with the Project Team to develop the Plan, contributing their knowledge, expertise and guidance to each step of the planning process.

It was quickly identified that the vulnerabilities and risks associated with climate change impacts would extend beyond just the City's Corporate assets and systems. Staff decided to pause the internal process to focus on bringing the entire community into the

climate adaptation work. City of Hamilton Staff participated in ICLEI Canada’s Training-the-Trainers project which helped municipalities convene local workshops learn and refine their climate adaptation facilitation skills. Throughout 2017 City Staff completed several community-based workshops on climate vulnerability and risk assessment to bring Hamilton’s community groups and organizations into the discussion.

In 2018 the project was put on pause due to Staff capacity to develop a regional climate change structure now known as the Bay Area Climate Change Council.

2020-2022

The process was resumed in 2020 where the City of Hamilton re-engaged in Milestone 2 of the project to ensure updated the Science of Climate Change Report to take into account update climate projections and more recent weather events in the City. The City worked to also rescore climate change impacts in the vulnerability and risk assessment.

During this time, the unforeseen circumstances brought forward by the COVID-19 pandemic continued to impact Ontario and the globe, and during this time, climate change did not halt. Over the past two years, we have seen flooding in parts of Canada, drought conditions and extreme heat in the summer, and more inclement weather in the fall. The impacts of climate change tend to disproportionately impact our most vulnerable community members and reinforce existing demographic inequities – highlighting an unfortunate commonality between climate change and COVID-19. For this reason, it is important that we continue to learn from this pandemic and identify ways in which we can apply these lessons in the fight against climate change.

Once it was appropriate to slowly resume planning efforts during the COVID-19 pandemic, the Project Team pivoted to using a variety of online platforms and mechanisms (i.e. online workshops, meetings surveys, interactive applications, etc.) to ensure ample meaningful opportunities were provided to stakeholders and staff to contribute to the overall vision, objectives, and actions within the Plan.

Throughout the adaptation planning process, the Project Team provided a number of engagement opportunities and hosted several workshops and meetings. A summary of this engagement is provided below.

Year	Type of Engagement	Number of sessions/ opportunities
2015-2017	Internal Vulnerability and Risk Assessment Workshop	1

	Internal Working Group Meetings	Multiple
	Community Workshops	2
	Standalone Meetings	4
	Committee Presentations	3
2020-2022	Internal Adaptation Core Team Meetings	15
	Community Workshops	7
	Standalone Workshops Tools	2
	Feedback Worksheets	1
	Corporate Workshops	1
	Focused Departmental Meetings	11
	Combined Corporate and Community Workshop	1
	Community Stakeholder Meetings	21
	Committee Presentations	3
	Targeted Online Surveys	2

Figure 4: Summary of CCIAP Engagement

Climate Science and Projections

ICLEI Canada relied on national and global climate models as incorporated into Canada's Climate Atlas, using several different emissions scenarios, to paint a picture of what Hamilton's climate might be through the 21st century, and described these in their *Science of Climate Change* report. An infographic summarizing these projections can be found in Appendix B to this report.

Readers will notice that projections from a near-term decarbonization scenario and a Business-as-Planned scenario do not differ substantially in climate impacts until the 2070s. This is because the global carbon cycle is very slow, and it takes time for the natural biological and geological processes to draw carbon down from the atmosphere and store it permanently. Any carbon emitted now, in the absence of widescale carbon removal and sequestration technology, is effectively permanent and will continue to affect the climate for at least several decades to come.

Impact Identification

Changes to the climate affect weather patterns, and these weather pattern changes affect people's lives, their properties, it affects the built environment including buildings and transportation systems, as well the natural environment and ecosystem functioning, disease vectors, and so on. It is these effects that are described as *climate change impacts*.

From the BARC perspective, climate change impact statements are concise statements that outline locally relevant projected threats and how those changes are expected to

affect the built, natural, social, and economic systems across the city. Based on the City of Hamilton's Climate Science Report, these statements are the foundation of the Vulnerability and Risk Assessments and are formed by answering the following questions:

- What are the climatic changes?
- What are the outcomes of these changes?
- What are the consequences associated with these outcomes?

City staff consulted widely internally and externally, with institutional, commercial and social stakeholders, to fully understand how local climate impacts would affect different communities. Hamilton then compiled an initial set of internal climate change impact Statements in 2016, and added to them several community impact statements through 2017. In 2020, this list was revisited and revised as needed.

Vulnerability Assessment

Vulnerability is a function of two criteria – the **sensitivity** of the community to a given climate change impact, and its **adaptive capacity** (ability to respond, recover and/or cope). To determine sensitivity, how the functionality of the community would be affected should the impact occur today is considered. This includes considering how the impact would affect the community's ability to deliver and access services, continue regular functionality, etc. Adaptive capacity refers to the ability of systems, institutions, humans, and other organisms to adjust to potential damage, take advantage of opportunities, or respond to consequences.^{vi} To determine adaptive capacity, we consider the time and resources required to restore the community to its previous functionality should the impact occur today, as well as consider any plans, policies, and actions already in place to address this issue.

The City conducted two separate vulnerability assessments, one in 2016/17 and one in 2021.

Ultimately, a combined 73 impacts statements were considered through a vulnerability assessment.

Risk Assessment

The next step in the process was to carry out a risk assessment. Similar to vulnerability, risk is a function of two criteria – namely the **likelihood** of the impact occurring and its negative **consequences**. It can be expressed as a function of risk = likelihood x consequence. Likelihood refers to the probability of a projected impact occurring, and consequence refers to the known or estimated consequences of a particular climate change impact.

Based on the results of both assessments, the project team prioritized 13 impacts to move forward into planning. These are impacts that had an overall score of Medium or higher, as identified through the corporate vulnerability and risk assessment, as well as those that posed a high risk for the community, identified through qualitative discussions with community stakeholders as well as through the community vulnerability and risk assessment process. The full list of prioritized impacts is included in the next section.

A full explanation of the Vulnerability and Risk Assessment process can be found in the Vulnerability and Risk Assessment report, available on the City of Hamilton’s website here: <https://www.hamilton.ca/city-initiatives/strategies-actions/climate-change-action>

Priority Climate Change Impacts

Through the vulnerability and risk assessment process and results, we arrived at a list of *priority climate change impacts*, described in Figure 5.0 below. It is these impacts that this first iteration of the Climate Change Impact Adaptation Plan will primarily address. Other climate impacts are, of course, still important, and for some residents and businesses will be the most important; we are compiling additional reporting on these to allow interested residents, businesses and organizations to work towards addressing them in complement to this overall plan.

Some impacts are inherently more or less negative or consequential than others and can vary widely for different demographic groups. For the list of priority impacts outlined below, Examples of particular vulnerabilities for some impacts have been included in the table below. This is not an exhaustive explanation but is meant to help readers understand the complexity of addressing climate impacts and the necessity of doing so through an equity lens.

Flooding	
1. Reduced capacity of flood protection measures and water storage caused by an increase in rainfall intensity leading to flooding.	Low-income tenants of basement apartments are particularly vulnerable, especially if displaced by repairs and renovations.
2. Changes in the frequency of extreme rainfall events will result in increased instances of flooding on private and public properties.	
Extreme Heat	
3. Increased instances of heat-related issues due to extreme heat.	
4. Drier, hotter and longer summers may affect the health and safety of local vulnerable populations.	Seniors, unhoused, and residents with some medical

5. More frequent and intense heatwaves will increase instances of heat-related health and safety issues, particularly for households without access to reliable air conditioning and the homeless.	conditions are more vulnerable to health impacts from extreme heat.
6. Rising summer temperatures and extreme heat will increase energy demand for air conditioning, causing a financial burden for low-income households.	Low-income households will struggle most to pay increased electricity bills, or go without a/c.
Water Quality	
7. Increased intensity of rainfall leading to increasing runoff into rivers and lakes, and washing of sediment, nutrients, pollutants and other materials.	
8. More intense summer precipitation combined with increasing temperatures lowering water supply as well as increasing water demand for drinking, landscaping, and irrigation (rural).	
Health and Safety	
9. Increased intensity and frequency of ice storms leading to increased hazardous roads, pathways and sidewalk conditions.	Residents using mobility devices and new parents with children in strollers will be more vulnerable to poor sidewalk conditions.
10. Increased temperatures and changes in precipitation increasing incidences of infectious diseases and vector borne diseases as result of longer transmission periods of changes in geographic distribution of disease vectors.	Unhoused residents more exposed to vectors such as ticks and mosquitoes.
Erosion and Infrastructure Damage	
11. Changes in precipitation resulting in erosion of natural systems (i.e. water banks, escarpment erosion) leading to washouts of bridges and roadways.	Residents and businesses dependent on escarpment access roads will be more vulnerable.
Power Outages	
12. Prolonged power outages during winter months due to an increase in ice storms resulting in public safety concerns.	Residents depending on electricity for medical or mobility needs (respiration, electric wheelchairs, etc.) will be more vulnerable to power outages.
Food Insecurity	

<p>13. Increase in average annual temperatures (especially in the summer) leading to increased food insecurity in the region (i.e. decrease in local crop yield, food cost fluctuations, etc.).</p>	<p>Low-income households are more vulnerable, and this will also affect community resources attempting to address this need (e.g. food banks).</p>
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Figure 5: Priority Climate Change Impacts for the City of Hamilton

Action Development and Prioritization

Adaptative actions identify how the community will overcome the impacts of climate change. There are a variety of these actions, including activities that are taken before an impact is observed (anticipatory) or after an impact has occurred (reactive). In most instances, anticipatory adaptation action will be more effective and result in lower costs in the long term.^{vi}

ICLEI conducted a best practices review of Adaptation Plans throughout Canada, and workshops and consultations with City staff and external stakeholders were held to identify ideas for objectives and actions, both big and small, to reduce these risks and build resilience in our community. A total of 71 action options were identified through the community actions workshop and over 200 action options were identified through the corporate actions workshop. In reviewing these actions, the Project Team shortlisted commonly identified actions and made sure to fill any gaps that existed.

Once actions were shortlisted, they were further evaluated using action prioritization criteria adapted from the Canadian Communities Guidebook for Adaptation to Climate Change. These criteria are shown in Figure 6 below. The purpose of this activity was to identify if the actions shortlisted were effective/urgent, affordable, feasible, acceptable, equitable, and flexible. Internal stakeholders were asked to rank adaptive actions relevant to their work on all six criteria; community organizations ranked actions on three: feasibility, acceptability and equity. In turn, through ranking these actions across these five criteria, the Project Team was able to determine which actions should be categorized as “urgent” priority (i.e. in the community’s best interest to complete this over the short-term, which is 2 years or less), “high” priority (i.e. completed over the medium-term, which is between 2 to 5 years) or “medium” priority (i.e. completed over the long-term, which is 5+ years).

Next, a strategic analysis was conducted with City of Hamilton staff to ensure the anticipated timing of each action identified through the action prioritization exercise was achievable. In doing so, some actions were updated to more accurately reflect the

timelines needed to secure any necessary funding and carry out the projects or initiatives themselves.

The results highlighted 2 actions as “Urgent” priority, 19 actions as “High” priority, and 6 actions as “Medium” priority.

Criteria	Score			
	1	2	3	4
Effectiveness/ Urgency	Minor contribution to management of risk; Not urgent	←→		Vital to effective management of risk and achievement of objectives; High urgency
Affordability	Requires significant budget for implementation	←→		Can be completed within planned budgets
Feasibility	Lack of human, legal, knowledge, technical or administrative capacity to implement	←→		Sufficient human, legal, knowledge, technical and administrative capacity to implement
Acceptability	Significant pushback likely from specific stakeholders, elected officials	←→		Supported by the majority of stakeholders, elected officials
Equity	Minimal improvement in the livelihood of equity-seeking groups*	←→		Provides clear and distinct benefits for equity-seeking groups*
Flexibility	Difficult to reverse, inflexible	←→		Easy to scale up or down, flexible, no- regret

Figure 6: Action Prioritization Criteria

***Equity-seeking groups:** are communities that face significant collective challenges in participating in society. This marginalization could be created by attitudinal, historic, social, and environmental barriers based on age, ethnicity, disability, economic status, gender, nationality, race, sexual orientation and transgender status, etc. Equity-seeking groups are those that identify barriers to equal access, opportunities, and resources due to disadvantage and discrimination and actively seek social justice and reparation.

10. The Path to a Climate Resilient Hamilton: Themes, Objectives, and Actions

The prioritized Adaptive Actions were grouped into four themes and eleven objectives to meet the identified priority Climate Impacts. These groupings are shown below. Under each proposed action contains additional information that builds and supports that action including:

- **Action Details** – Description of the intent of the action, what it hopes to achieve, and its relative scope;
- **Supporting Actions** – Actions to help support the implementation of the actions, or steps that need to be taken before the action itself can be considered; and
- **Current Practice** – Related initiatives, programs, or policies that are currently happening in the community or corporation that speak to, are in alignment with, or are coordinated with this action.

In addition, through the Implementation Planning process, two enabling actions were identified as critical to support the success of the other 27.

Enabling Actions	
E.1	Establish a Climate Change Office with staff dedicated to implementing and tracking the Climate Change Impact Adaptation Plan.
E.2	Designate key metrics for climate impacts in the City and task staff with collecting and tracking data over time (e.g. traffic accident reports, basement flood reports, etc.).

RESILIENT THEME #1: BUILT ENVIRONMENT

Objective 1: Incorporate climate change into future land use, development and construction

Action 1.1 (ID#1) – Develop requirements for the incorporation of Low Impact Development (LID) features and green infrastructure into new development and redevelopment projects, and consider watershed and landscape scales in the development of plans and objectives.

Supporting Actions

- Identify and prioritize green infrastructure sites as part of stormwater management planning, including a vulnerability assessment.
- Incorporate Green Infrastructure into asset management plans with multi-year budgets.

ACTION DETAILS

Low Impact Development (LID) and green infrastructure encompasses a range of strategies (infrastructure, land-use features, etc.) to increase the infiltration of rainwater into the ground to reduce runoff and risk of flooding. LID features also provide social and economic benefits, including health benefits, and improved property aesthetics and property value.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
2021 assessment using global climate modelling and IDF technical analysis.	Canadian Water Resources Association and McMaster University rain garden design
Currently developing Green Development Standards and Guidelines for Stormwater Management	Some Conservation Authorities offer small grants to homeowners for LID projects
Environmental Assessment data collection is used to inform Sub-Watershed Master Plans	

Action 1.2 (ID#2): Develop guidelines and incentives for homeowners and landlords to improve the resilience of residential buildings to climate-related risks through upgrades and/or retrofits.

Supporting Actions

- Low-cost or no-cost flood-proofing retrofits are identified and provided to residents through future building retrofit program(s).
- Investigate the possibility of offering rebates and resources and implementing a stormwater fee rate system.
- Facilitate and promote conversion of lawns to naturalization to reduce runoff and capture moisture.

ACTION DETAILS
The creation of guidelines and incentives to improve the resilience of homeowners and landlords can help reach and encourage community members to reduce risk from flooding, extreme heat, wind, and other climate-related hazards to their buildings and property.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
City has existing zoning bylaw(s) that limits the amount of impervious surfaces	Green Venture's DePave Paradise Program: https://greenventure.ca/depave-paradise/
Protective Plumbing Program: https://www.hamilton.ca/home-property-and-development/water-sewer/protective-plumbing-program	Many annual free tree giveaways from non-profits/community organizations (i.e. Environment Hamilton, Hamilton Naturalist Club etc.)
Beach Blvd flood mitigation Environmental Assessment	Mohawk College disability/aging-in-place retrofit research

Action 1.3 (ID#3): Conduct more studies or reviews to determine flooding and other risks throughout the City & develop plans (e.g. relocating sites where appropriate) to improve the resilience of infrastructure (i.e. buildings, roads, water/wastewater infrastructure, etc.) to climate-related risks from extreme weather and temperatures.

Supporting Actions

- Conduct frequent inspections and monitoring of mountain access and waterfront trail systems.
- Re-run recently developed climate modelling and conduct specific risk/vulnerability assessments on existing infrastructure using standard protocols (e.g. PIEVC) to quantify impact and flooding ‘hotspots’.

ACTION DETAILS
 It is important to continuously conduct studies and reviews to spatially map and better understand the risks of climate change on our built environment. In doing so, we determine how flooding, fluctuating and overall warmer temperatures, wind, and other climate hazards will continue to impact our City and what steps we can take to ensure their protection and resilience into the future.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Asset Management rock scaling program	Hamilton Conservation Authority flood mapping updates
Hamilton Water Environmental Assessment's urban flooding and other available/ongoing studies.	McMaster University's monitoring and modelling research



Objective 2: Reduce transportation disruptions due to extreme weather events and improve the safety of travel on roads, sidewalks, and trails (i.e. including washouts)

Action 2.1 (ID#4): Improve winter travel conditions through further expanding sidewalk clearing.

Supporting Actions

- Monitor outcomes of revised sidewalk clearing to determine feasibility and necessity of further expanding it.
- Explore revamping the ‘Snow Angels’ program (i.e. recruit volunteers, identify what areas are not being services, etc.)

ACTION DETAILS

Snowy and icy conditions in the winter season make travel much more challenging for everyone. Slippery conditions on walkways and paved areas can cause major safety concerns (i.e. slips, falls, reduced ability to go outside, etc.). With the climate science indicating an increase in fluctuating temperatures and extreme weather, there is a greater need to improve winter travel conditions and for pedestrians and sidewalk users through expansion of the City’s existing sidewalk clearing efforts.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Existing Snow Angel Program	Just Recovery Network’s ongoing advocacy
Active and Sustainable School Travel Planning identifying routes and what can be done to support sidewalk shoveling/safety.	McMaster University’s monitoring and modelling research

Action 2.2 (ID#5): Encourage and promote safer travel practices, choices, and alternatives through considering all users of Hamilton's transportation network and by working with local groups to create a communications campaign around the benefits of work-from-home

Supporting Actions

- Continue to consider all users of Hamilton's transportation networks using an equity and inclusions lens.

ACTION DETAILS
 Debris from storm damage, icy roads, strong winds, flooding, and other instances of extreme weather can make it dangerous to travel within Hamilton.

- Work with local groups to create a communication campaign outlining the benefits of work-from-home option during extreme weather and consider safer transportation options for essential works who must be on-site.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Current Light Rail Transit planning	Environment Hamilton's Friendly Streets Project
Hamilton @ Work – flexible work models for City staff	Ongoing neighbourhood audits being done by various groups



RESILIENT THEME #2: PEOPLE AND HEALTH

Objective 3: Help vulnerable populations (i.e. seniors, youth, outdoor workers, those experiencing homelessness, with pre-existing health conditions, etc.) avoid or reduce health-related impacts of extreme weather and temperatures (including flooding).

Action 3.1 (ID#6): Develop and implement a response program for vulnerable populations to protect residents from climate-related risks (i.e. extreme cold, extreme heat, etc.)

Supporting Actions

- Work with local non-profits, tenants’ groups, landlords and other relevant stakeholders in the planning and implementation of site-specific extreme weather-related emergency management plans.
- Work with financial assistance bodies and upper-levels of government to explore provisions of low, or zero-carbon, electrical back-up to those with essential medical devices.

ACTION DETAILS

Marginalized communities typically experience varying and overlapping barriers when accessing emergency services and supports (e.g. physical accessibility, language barriers, operating hours, etc.). This action will investigate and reduce these barriers over time by proposing and implementing response programs that meet the needs of marginalized communities.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Public Health Extreme Heat and Extreme Cold Alerts	Environment Hamilton’s City Lab and City Staff heat mapping of larger towers
Emergency Management work with City Housing Hamilton on emergency preparedness.	Community Resilience to Extreme Weather (CREW) and Environment Hamilton working with faith-based organizations on emergency preparedness.

Action 3.2 (ID#7): Consolidate existing vulnerable persons’ contact lists and update/expand them to guide emergency response and/or other assistance programs.

Supporting Actions

- Identify who is vulnerable to climate-related risks through vulnerable population mapping (e.g. urban heat island, flood plains etc.), building on maps that already exist.
- Consider separating lists to be separated by type of extreme weather event/climatic threat (e.g. flooding, extreme heat, ice/wind storms etc.) and variety of location.

ACTION DETAILS

Extreme weather events often come with great public health and safety concerns, especially to vulnerable populations including children, the elderly, those experiencing homelessness, and those with special existing health conditions. To better guide emergency response and other assistance programs during extreme weather events (i.e. flooding, extreme heat, ice/wind storms, etc.), the City will work towards consolidating existing vulnerable persons contact lists. In doing so, efforts will be made to house them under one central database that can be used to further update these lists and expand them as necessary.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Homelessness and Encampment team created at City of Hamilton	Landlords keeps list of vulnerable populations in building
Housing Services Dashboard	Many social organizations working with vulnerable populations across the City with expertise
City has list of social organizations – distribution list via Extreme Heat/Cold Alerts	

Action 3.3 (ID#8): Coordinate local efforts to address excessive indoor temperatures in rental housing

Supporting Actions

- Establish community working group to investigate and pilot measures to provide safe housing for all during extreme heat events.
- Develop plans for both short-term (e.g. cooling rooms) as well as long-term solutions including policies and/or by-laws regarding excessive heat as regulatory trigger.

ACTION DETAILS
 Excessive indoor temperatures can cause significant health concerns to building occupants, especially to vulnerable populations (i.e. older adults and seniors, children, etc.). As summer temperatures and extreme heat days are projected to increase throughout the 2050s and 2080s, there is an increased need to coordinate efforts throughout the City and work towards improving summer indoor temperatures. In doing so, pilot measures, and both short- and long-term measures will be investigated.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Public Health Services Extreme Heat Alerts	Cooling Centres across Hamilton
Public Health Services promotional webinars to landlords	Green Venture tree and canopy inventory project(s) at social housing properties

Action 3.4 (ID#9): Align ongoing efforts within the City to continue expanding affordable housing to protect vulnerable populations to reduce climate-related impacts from extreme weather and temperatures.

Supporting Actions

- Investigate incentives for green developers to build more affordable housing.
- Examine availability of shelter space and work towards expansion and accessibility.

ACTION DETAILS
 Access to affordable housing is a necessary way in which people and families can reduce their exposure to extreme temperatures and extreme weather events. The City has been conducting ongoing work to continue and expand the provision of safe and stable shelters so vulnerable populations are less exposed and/or less affected by climatic impacts now and into the future. As well, plans are underway to expand long-term, permanent affordable housing.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Ongoing City work of ~55 units/ year with stretch goal of 300 units per year.	Hamilton Alliance for Tiny Shelters (HATS)
Ongoing work in City Shelter Space	Indwell and City Housing collaborations and ongoing work.

Objective 4: Improve community preparedness and resilience to respond to climate-related risks from extreme weather and temperatures, including flooding.

Action 4.1 (ID#10): Create educational campaigns on communicating the risks associated with climate change (i.e. health impacts, property damage, etc.) and what residents can do to prepare (GDS, LID, etc.)

Supporting Actions

- Launch public health education campaign(s) based on feedback received during adaptation planning to target vulnerable population (e.x. outdoor workers, low-income, BIPOC).
- Utilize existing channels for communication and/or distribution (e.g. EarlyON Centres, child care, public health nurses etc.) and work towards reducing barriers that prevent vulnerable populations from access this information.

ACTION DETAILS

Given the expected increase in weather-related emergencies and hazards, community members need to be better informed on what the various risks associated with climate change are and how they can prepare. The City will employ various communications channels and methods to develop and launch education campaigns targeted at residents highlighting existing and future climate change impacts, with an emphasis on ensuring information is reaching more vulnerable community members.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Public Health Services Nurses and other front line staff interacting with vulnerable populations on a daily basis	Enbridge programming to ensure low-income community members have equitable access to energy

Children and Community Services distribution channels	ADC/Climate Action Team previous education events
Public Health Services Healthy Families Hamilton Facebook groups	Seniors for Climate Sanity

Action 4.2 (ID#11): Evaluate and select programs for making emergency preparedness kits accessible to all residents, regardless of income (e.g. means-tested programs, subsidies or free distribution campaigns)

Supporting Actions

- Update or create communications on what emergency kits are, different types of kits, why people need them and how to access it etc.
- Support distribution of emergency preparedness kits through existing channels (e.g. EarlyON and Family Centres, home visits, clinics etc.).

ACTION DETAILS

In a weather-related emergency, people may be without basic services (i.e. electricity, water, food, etc.) for an extended period. To maintain the safety of community members, they need to be aware of what items are needed to ensure households can be self-sufficient for at least 72 hours. In addition to these efforts, the City will also work towards increasing the accessibility of emergency preparedness kits through supporting the distribution of free kits through existing partners and channels.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
72hr kit promotion by Hamilton Fire – Emergency Management	United Way Halton & Hamilton kit assembly workshops with donated goods
Some distribution channels already setup	Existing Snow Angels Program

Action 4.3 (ID#12): Establish buddy systems/help-your-neighbour programs to implement during extreme weather events.

Supporting Actions

- Together, in partnership with community groups and other local institutions, establish social networks that increase awareness of climate risks and enable/support neighbourhood check-ins during extreme weather event of vulnerable/isolated residents.

ACTION DETAILS
 Extreme temperatures and extreme weather events will affect some community members more than others. Residents and community members need to be aware of their responsibility to take individual action to proactively participate in collective responses to maintaining the safety of their neighbours and community. Establishing buddy systems/help-your-neighbour programs better enable neighborhood connections and could greatly reduce the risk of illness and injury within a community.

- Investigate existing information and lists from Paramedics and other agencies for residents that have medical equipment or potential for isolation.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
City of Hamilton Housing door-to-door wellness check through COVID-19	Snow Angel Program
Neighbourhood Action Strategy work	Neighbour-to-Neighbour App
	Faith and the Common Good resiliency hubs

Objective 5: Monitor and plan for the potential introduction of new vectors and increased vector-borne illnesses in the community.

Action 5.1 (ID#13): Work with local partners to ensure vulnerable groups are informed about and have the means to be adequately protected from vector-borne diseases (e.g. West Nile Virus, Lyme Disease, etc.).

Supporting Actions

- Conduct education campaign(s) to the public and builder owners on measures to decrease risk of exposure to applicable vector species.
- Supporting sharing messages through existing channels (e.g. television screen at clinics, EarlyON & Family Centres etc.) to target interventions to marginalized and racialized communities.

ACTION DETAILS

Over the coming decades, climate change will bring an increased risk and spread of vector-borne diseases. These are diseases that are spread to humans from other living creatures. The most commonly occurring disease vectors in Ontario are mosquitoes (carriers of West Nile Virus) and black-legged ticks (carriers of Lyme Disease). The City will continue to work with local partners to ensure community members have increased knowledge and understanding of vector-borne diseases and the steps they can take to protect themselves.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Public Health Services Healthy Hazards & Vector-Borne Disease Programming	YWCA expertise in infection control in congregate settings.
Existing signs at parks and natural spaces	Hamilton Conservation Authority education programming

Action 5.2 (ID#14): In conjunction with the Biodiversity Action Plan, develop an Open Space Management Plan to guide City of Hamilton Natural Open Space Stewardship, including placement and design of natural spaces to minimize contact with vectors (e.g. plants and animals, such as mosquitoes, that can bring diseases to human communities (e.g. Rabies, West Nile, Lyme Disease).

Supporting Actions

- Conduct research and best practices on native plant species and design that maximizes biodiversity while minimizing exposure and/or conflicts with humans.
- Continue to support the Biodiversity Action Plan and ensure there are no conflicting goals in other Master Plans (e.g. forthcoming Parks Master Plan) and other relevant management plans, policies and procedures.

ACTION DETAILS

Over the coming decades, climate change will bring an increased risk and spread of vector-borne diseases. These are diseases that are spread to humans from other living creatures. The most commonly occurring disease vectors in Ontario are mosquitoes (carriers of West Nile Virus) and black-legged ticks (carriers of Lyme Disease). The City will continue to work with local partners to ensure community members have increased knowledge and understanding of vector-borne diseases and the steps they can take to protect themselves.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Public Health Services Healthy Hazards & Vector-Borne Disease Programming	Hamilton Naturalist Club community engagement and involvement with Biodiversity Action Plan
Existing signs at parks and natural spaces	Hamilton Conservation Authority education programming

Objective 6: Create conditions to minimize health and safety risks to outdoor workers and community members.

Action 6.1 (ID#15): Continue to update existing municipal plans and policies to decrease health and safety risks associated with extreme weather and temperatures to outdoor workers.

Supporting Actions

- Review existing guidelines, by-laws and policies, and plans in conjunction with climate risk and future scenarios to identify gaps and any additional measures required.
- Develop/update additional by-laws, policies and plans (e.g. climate standards by-law, alternate working hours protocol) to protect workers and provide guidance.

ACTION DETAILS

Outdoor workers who are exposed to extreme weather (i.e. heat, cold, hazardous conditions from ice, snow, wind, etc.) are at risk of injury, illness, and reduced productivity. This risk is magnified as summer temperatures, heavy rainfall, and other extreme weather are expected to increase. Though worker safety best practices are already developed and disseminated to employers and employees by Provincial and Federal government agencies, there is a role for the City to continuously update existing plans, procedures, and policies to minimize health and safety risks to all outdoor workers from climate hazards.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Existing City of Hamilton policies and procedures for outdoor workers	Ongoing work and policies in the construction sector
Joint Health and Safety Committees	LEED standards for reducing asphalt

Action 6.2 (ID#15): Explore opportunities to expand current cooling & warming centre programming and interventions.

Supporting Actions

- Increase the presence and maintenance of back-up electrical supply (such as storage/batteries) for buildings greater than 3 story's.
- Understand obstacles in accessing or enjoying cooling/warming centres (e.g. lack of transport, entertainment, pet-friendly etc.) and create strategies to overcome them.

ACTION DETAILS
 Extreme heat and cold can pose significant health risks to residents in Hamilton, especially vulnerable populations. Given the projected increase in extreme heat and extreme weather events, pursuing various cooling and warming strategies within the City will help to reduce the risk of injury/illness. The City will continue to explore opportunities to provide improved and/or additional spaces for extreme temperature relief.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
City Libraries and Recreation Centres used for cooling	Hamilton Airport has cooling centre for nearby communities
Healthy and Safe Communities protocols during extreme heat/cold events	

Action 6.3 (ID#15): Improve monitoring, data collection, and notification surrounding flooding & extreme weather/temperatures.

Supporting Actions

- Advocate for provincial-wide extreme heat related health surveillance through existing ministry and health associations.

ACTION DETAILS
 Climate change adaptation planning is an iterative process and a constantly evolving field. As such, it is important to enable a culture and process within the City to continuously improve data collection, monitoring, and notification surrounding flooding, extreme temperatures, and extreme weather.

- Develop local surveillance during/after extreme weather events with connection to marginalization index/heat vulnerability index and work towards improving real-time communications to the community.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
City's real time Combined Sewer Overflow (CSO) monitoring and reporting	Environment and Climate Change Canada meteorology
Public Health Services existing surveillance and data sources	Conservation Authorities' riverine flooding warning system and duty officers



RESILIENT THEME #3: NATURAL ENVIRONMENT, AGRICULTURE AND WATER

Objective 7: Proactively conserve and protect surface water and groundwater resources.

Action 7.1 (ID#18): Continue to enhance the management and restoration of existing natural areas and seek opportunities to dedicate land and natural areas for conservation.

Supporting Actions

- Implement flood and erosion protection measures for parks, trails, and other outdoor recreational spaces.
- Complete city-wide assessment and prioritization list of sites to acquire, manage, enhance in coordination with stakeholders and use that to inform future updates to official planning policies and master plans.
- Review and implement strategies to improve management practices and allocation of proper and consistent resources (e.g. staffing and funding).

ACTION DETAILS

In addition to educational, economic, and recreational benefits, protected and restored natural areas can help address climate change by conserving biodiversity, capturing and storing carbon, and protecting ecosystem services (e.g. erosion control, water infiltration and flood control, etc.). While natural landscapes may be low maintenance and self-renewing, they do still require ongoing maintenance to keep valuable ecological functions intact.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
City of Hamilton existing natural heritage mapping	Hamilton Conservation Authority land securement strategy
City of Hamilton existing Natural Areas Acquisition Fund	Hamilton Naturalist Club Land Trust

Objective 8: Monitor, maintain and improve the diversity and resiliency of urban trees and forests.

Action 8.1 (ID#19): Work with local partners to continue tree planting and preservation, explore community partnerships and naturalization programs to reduce urban heat island and enhance ecosystem function.

Supporting Actions

- Continue and expand the protection of corridor/connected tree canopy within the public and private spaces (e.g. urban streets, commercial shopping centres, hydro-corridors etc.) to improve areas of shade cover and ecological connectivity.

ACTION DETAILS

Natural and forested areas offer many community benefits including helping reduce the urban heat island effect, better manage stormwater runoff, strengthen the protection of watercourse corridors, create habitat for local wildlife and pollinators, and provide intangible benefits to communities, such as improved psychological and social well-being. The City will look to continue to work with local partners and organizations to increase tree planting efforts and explore opportunities to protect and enhance Hamilton’s natural landscape.

- Review education practices with tree-planting organizations (e.g. Environment Hamilton, Green Venture, Hamilton Naturalist Club etc.) to increase more uptake of trees and encourage diversity in planting and conduct community outreach through additional staff hiring.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
City Forestry replacement tree requirements	Hamilton Conservation Authority tree planting and iTree analysis programming
Developing Watershed Action Plan	Naturehoods rebates program

Action 8.2 (ID#20): Implement the Urban Forest Strategy and consider additional measures to support it or expand its impact.

Supporting Actions

- Using appropriate planning measures and controls, work towards achieving the 3-30-300 urban forest rule (i.e. each resident has access to 3 trees, 30% canopy cover within their neighbourhood, and is within 300 metres of green space).
- Revisit private tree protection by-law and the inclusion/designation of heritage trees.

ACTION DETAILS

The City of Hamilton’s Urban Forest Strategy will provide tools for growing and maintaining a healthy and resilient urban forest. This includes trees in ROWs, parks, and natural areas. The strategy will look to provide direction on all aspects of the maintaining an urban forest, identify challenges and opportunities for improving the urban forest, set goals and objectives for the long-term sustainability, recommend actions including programs, policies, and partnerships, and project short and long-term resource requirements and monitoring indicators.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
City Forestry Street Tree Program	Many Non-Profit Organizations tree planting and free tree giveaways
Existing tree protection by-laws and tree preservation requirements	Naturehoods rebates program



Objective 9: Strengthen food security in the City.

Action 9.1 (ID#21): Educate and encourage the community to participate in growing food locally (e.g. lot level or urban farms/gardens).

Supporting Actions

- Advocate, plan and implement community food production strategies and projects (e.g. hydroponics, rooftop greenhouses etc.) through new and existing programs (e.g. EarlyON & Family Centres) that includes increase dissemination of additional resources.
- Utilize the Food Strategy as a guide to create additional supporting actions and other needed initiatives to improve food security (e.g. income supports) should be investigated over time.

ACTION DETAILS

Climate change represents an important health concern as it relates to food system impacts and food insecurity. Improving education, allowing residents to grow their own food (i.e. through backyard/community gardens, urban farms, etc.) and working to address vulnerable and low-income populations will all serve to improve food security throughout the Hamilton community. Food systems are susceptible to climate change impacts not only on production, but also on processing facilities, distribution networks, marketing venues, consumption sites like homes and restaurants, and on effective waste and organics collection. A climate resilient food system is one with support for a variety of innovative, economically viable and environmentally sensitive activities in all of these broad categories.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
McQuesten Urban Farm	Neighbour to Neighbour Hamilton Community Garden
City helps to manage and develop community gardens	Green Venture seed programming

Action 9.2 (ID#22): Expand rain water capture (i.e. rain barrels, cisterns, etc.) as an irrigation source for more localized food production (i.e. backyard farming, urban gardens, soft landscapes, etc.).

Supporting Actions

- Explore pilot projects at multi-residential buildings and/or schools for water capture/irrigation and food gardening.
- Investigate and enact potential incentive programs (e.g. funding call outs at licensed child care centres) to promote the development of food gardens, natural playgrounds, and rain gardens.

ACTION DETAILS
 Climate change is expected to cause short and intense micro-bursts of precipitation with also potential for long periods with out rain. This will make capturing and storing water very important for stormwater management but can also be used as source of irrigation. By utilizing rain water capture this can reduce pressure of water demand during drought periods and potential to reduce costs for water treatment and distribution

Snap Shot of Current Practices

City Current Practices	Community Current Practices
City rain barrel sale through rainbarrel.ca	Sustainability Leadership’s water management framework
	Naturehoods program installing many forms of green infrastructure



Action 9.3 (ID#23): Engage with local agricultural leaders to understand existing resources for farmers in addressing climate adaptation, and how the City can support or expand on those efforts.

Supporting Actions

- In collaboration with City's Agricultural & Rural Affairs Committee and local, provincial and national farming associations develop inventory of resources and guides and determine best dissemination strategies.
- Engage local agricultural community and identify greater collaboration opportunities (e.g. funding applications, promoting agritourism/agribusinesses) in the City.

ACTION DETAILS

Farming has always required adaptation to seasonal variability and changing growing conditions, however, farmers and farm businesses are facing increasingly larger climate change-related challenges in the operation of their farms. Localized impacts of wetter winters, heavy rainfall, and increased temperature variability can affect crop and livestock loss, increased pest survival rates, washouts and runoff issues, and more. Often recognized as environmental stewards, farmers have also been adopting best practices and implementing adaptive measures to combat some of these impacts.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Hamilton Food Advisory Strategy	Ontario Federation of Agriculture Benefit Program
City's Agricultural & Rural Affairs Sub-Committee of Council	Golden Horseshoe Food and Farming Alliance ongoing research

Action 9.4 (ID#24): Develop an educational campaign directed at restaurant and grocery industries, local farms and other possible food sources to better reduce and divert food waste and explore opportunities to reduce food waste.

Supporting Actions

- Establish a Community Working Group focused on food waste and insecurity involving restaurant, grocery, market industries and relevant community partners, and PHS; including a mandate for food waste diversion & uptake.

ACTION DETAILS
 Reducing food waste from landfills will help to reduce methane emissions, which are a very potent greenhouse gas (GHG) that contributes to climate change. By reducing food waste and throwing less of it away can help reduce the carbon footprint of food, but also help to save money and reduce food insecurity.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Hamilton Central Compost Facility diverts food waste and turns it into Renewable Natural Gas (RNG) for transit.	Environment Hamilton's food waste webinars
Municipal Waste Association	Food for Life, food recovery and distribution



RESILIENT THEME #4: ENERGY AND ECONOMY

Objective 10: Enable local businesses and organizations to plan for climate-related risks.

Action 10.1 (ID#24): Provide guidance to local businesses on how to maintain business continuity (e.g. supply chain) during extreme weather (i.e. through business continuity planning, green business practices, adaptation measures, etc.).

Supporting Actions

- Gauge local businesses' interest in establishing/ participating in a local best practices network (e.g. business continuity emergency planning, green business practices, adaptation measures) that meets annually (e.g. through business breakfast/open house event) to discuss adaptation measures in business operation.

ACTION DETAILS
Climate change is having, and will continue to have, a large impact on many businesses. In particular business continuity can be threatened in the event of power outages, or if local transportation networks are disrupted by extreme weather. By considering climate change in managing their business, local business owners in Hamilton can identify and mitigate risks and minimize disruption to operations in the face of increased weather-related disturbances and hazards.

- Investigate existing training opportunities (e.g. Sustainability Leadership) on business community climate risks and how to further support and enhance.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
Hamilton Fire – Emergency Management business continuity policy	Chamber of Commerce work with businesses
Economic Development Action Plan	United Way Halton & Hamilton ConnectEd programs

Objective 11: Improve the resilience of energy infrastructure to weather-related disruptions.

Action 11.1 (ID#24): Work with local partners to conduct vulnerability and risk assessments on local energy systems and identify opportunities to increase local energy generation (e.g. microgrids) to increase reliability (potentially as part of planned CEEP priority actions around identifying renewable energy generation sites within the City).

Supporting Actions

- Establish working group with local utilities and the Independent Electricity System Operator to develop Terms of Reference for a city-wide project and investigate possible funding opportunities.

ACTION DETAILS

Climate change has and will continue to impact electrical utilities and all partners need to work together build the resiliency by identifying where and how local energy generation can be increased so as to import less energy and become more energy secure in the event of weather-related disruptions.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
City of Hamilton 330 Wentworth solar rooftop	Rechargeables Inc work on microgrids
	Geothermal heating and cooling in construction industry

Action 11.2 (ID#24): Establish low-carbon back-up power systems in all City-owned facilities to serve as community hubs during emergencies, and create a policy to support and promote the use of low-or no-carbon emergency energy supplies such as batteries or energy storage for residents and businesses.

Supporting Actions

- Research and consider innovative opportunities/technology for low-carbon emergency power (e.g. small-scale hydrogen, 2-way electric vehicle power, micro-grids etc.) to develop education/communication campaign on available options.

ACTION DETAILS

Climate change poses a major threat to electricity infrastructure, including damage to power generation, distribution, and storage. The City will review existing practices and ensure all City-owned buildings and assets delivering critical services to the community have reliable low-carbon back-up power. Further, it will be important to increase the knowledge and capacity of residents and businesses to acquire low- or no-carbon emergency energy supplies to ensure their own health, safety, and business continuity during or following an extreme weather event.

- Identify and map community-hubs and mobility space requirements across the City in conjunction with socio-demographic mapping to maximize benefits.

Snap Shot of Current Practices

City Current Practices	Community Current Practices
City existing cooling/warming centres	Community Resilience to Extreme Weather (CREW)
	Existing faith-based climate resiliency hubs

11. Implementation

The Climate Change Impact Adaptation Plan is intended to guide the City of Hamilton and community agencies to prepare for the impacts of climate change. As such, a strong focus on implementation, governance, and monitoring is essential to the Plan's success. Changes to federal and provincial legislation and regulations, continued lived experience of the impacts of climate change, and technological advances are anticipated over the Plan horizon; this will impact the long-range strategies, underscoring the importance of periodic review and adjustments to the CCIAP. The flexibility will ensure the City is not constrained to certain parameters should new opportunities for implementation arise.

A preliminary implementation schedule has been developed to identify the considerations required to carry out the actions. This schedule was the result of extensive feedback and consultation with City staff and external stakeholders and is highly dependent on staff capacity and financial considerations. Additionally, actions that address higher risk impacts often require more resources. Therefore, actions identified as a higher priority may not always be completed first. The following implementation schedule does not include programmatic details explaining how each initiative will be delivered; in many cases, feasibility studies and further program design will be required. Programs and projects that are already underway are not included in this table, but will be described elsewhere as contributing to the overall success of the Plan.

Furthermore, the implementation schedule is a living document that is subject to changes due to new information, new adaptation priorities being identified, and new funding sources becoming available. The implementation schedule can be found in Appendix A. For each action, the Schedule includes:

Action and Approximate Timelines: Provides the key action and association timeline for how long implementation of that action will take (i.e. short-term = <2 years, medium-term = 2-5 years, and long-term = >5 years)
Immediate Next Steps: Immediate, specific next step(s) that would need to happen to begin implementation.
Lead Organization(s): The department(s)/organization(s) leading implementation of action.
Monitoring Metric(s): Metric(s) to monitor the action and evaluate progress.
Priority Impact(s) Addressed: Identification of which priority impact(s) (previously developed through the Vulnerability and Risk Assessment) are being addressed through these actions.

Monitoring and Review

Monitoring and review are an integral part of the adaptation planning process. In order to assist and ensure the actions in this plan are effectively implemented, we need to build in opportunities to examine the lessons learned throughout the development and implementation of the adaptation actions. In doing so, the City can continue to evaluate whether the context of the risks and vulnerabilities has changed, and can integrate these insights into future adaptation strategies.

Tracking progress enables the City to assess whether the actions outlined in this Plan are producing the desired results, while also providing an opportunity to communicate and celebrate our successes and accomplishments on the journey towards adapting to climate change.

Indicators

Indicators used in this Plan can be categorized into two types: process-based indicators and outcome-based indicators. Process-based indicators can be used to measure or track progress towards achieving a specific target, activities, or output, while outcome-based indicators can be used to measure whether expected effects or changes are being achieved. Many indicators in this Plan are process-based and where feasible, outcome-based indicators have been identified – especially those that capitalize on indicators that the City or community are already tracking^{vii}.

Central Climate Change Office and Plan Review

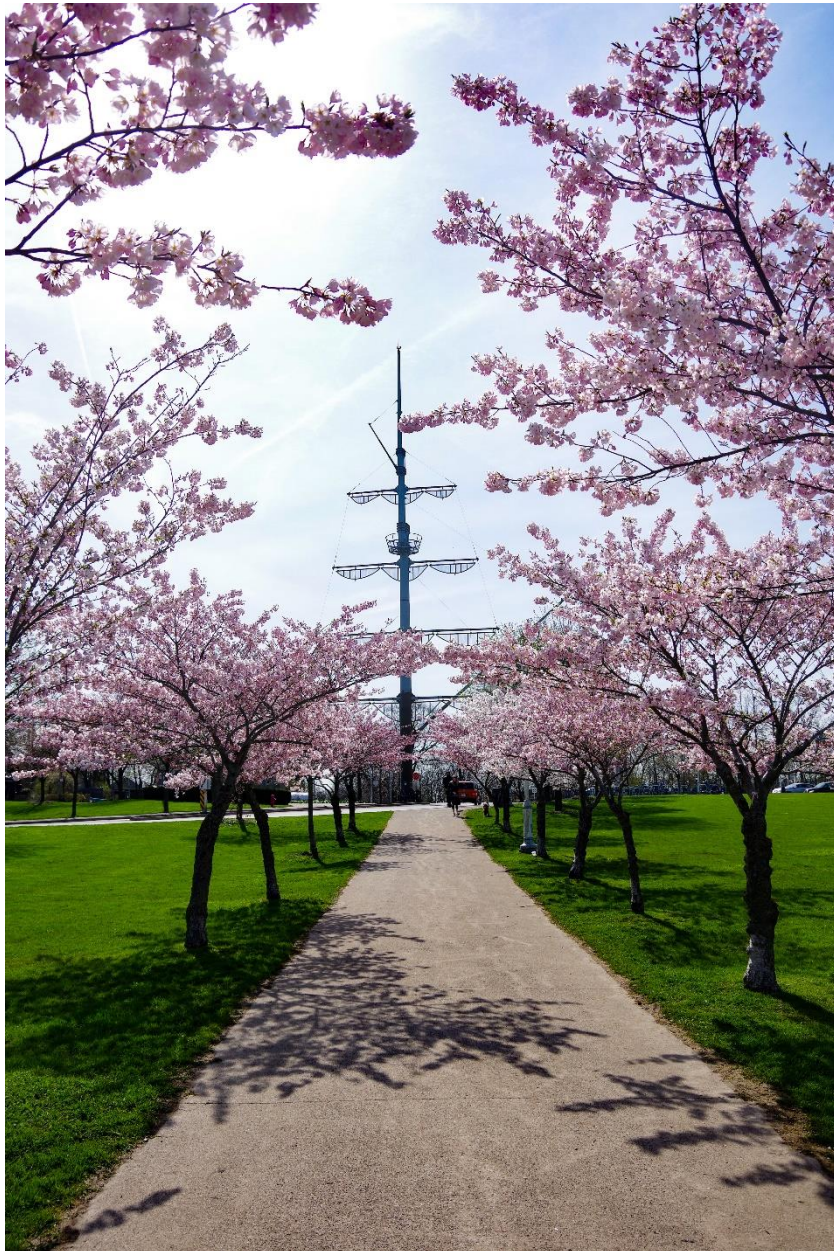
The recommended organizational model for implementing the CCIAP is a ‘City-led and Community Supported’ model. This model enables the City to take a leadership role while sharing responsibilities for implementation with community organizations and other external stakeholders, leveraging community capital to implement actions that are beyond municipal control or responsibility or those that would be better supported through the involvement of the community.

To coordinate and guide the implementation of the CCIAP, the City of Hamilton is proposing a multi-faceted governance model comprised of the following elements:

- A Central Climate Change Office (as per Enabling Action ##) that will lead the implementation and overall coordination of Hamilton’s Climate Change Action Strategy comprised of both the Community Energy and Emissions Plan (CEEP) and Climate Change Impact Adaptation Plan (CCIAP).
- A Director-level Multi-Departmental Working Group to help coordinate the implementation and ongoing reporting of the actions within both CEEP and CCIAP; and
- A Climate Advisory Committee(s) comprised of a diverse and equitable representation across Hamilton’s community.

It is recommended that within the proposed Central Climate Office there are adequate resources through designated staff that would be responsible for overseeing and coordinating the CCIAP's implementation, facilitating and coordinating meetings with the multi-department working group and other relevant internal and external stakeholders. They would be coordinating with lead and supporting organizations, as well as serving as the main point of contact for the CCIAP's implementation.

In addition, a formal review of the Climate Change Impact Adaptation Plan is planned to occur every three to five years, or as new information and technology become available. It is anticipated that a report to Council will occur every year once implementation begins.



Advancing Adaptation Project

Hamilton was selected as part of a group of 32 Ontario Municipalities to work with ICLEI Canada to increase climate change resilience over an 18-month period, as part of the 'Implementation through Collaboration' cohort. This project enabled local governments to take action on one of their adaptation actions or solutions already identified through a community-oriented project. ICLEI provided financial support and guidance on implementation issues, such as overcoming obstacles, building local support, and identifying performance indicators.

In addition to working on a significant climate impact for the Hamilton community, this project was seen as a way to test collaborative community implementation models, including Terms of Reference, shared decision making, engagement and consultation.

Extreme Heat Working Group: Consultation, Targeted Information, and In-Building Cooling

The Hamilton project team knows that extreme heat is the number one problem in the community and that relying on cooling centres, which are largely going unused during heat events, is not enough to save lives. An Extreme Heat Working Group, including representatives of four organizations on the city's Just Recovery Network (Environment Hamilton, ACORN Hamilton, the Hamilton Roundtable for Poverty Reduction, and Social Planning Research Council), and managers and residents of the city-owned apartment buildings, have been meeting monthly and contributing essential advice and insight to the structure and design of the program.

Hamilton has been moving ahead with impressive stakeholder engagement to address extreme heat in four City Housing downtown apartment complexes. This has been accomplished with thoughtfully planned surveys, in-person interactive engagements, and subsequent action identification to address issues identified. The project began with getting to know what the experiences are of residents during extreme heat events. On-site cooling features such as furniture for and promotions about in-building cooling rooms, in-room air conditioners, outdoor shade, identifying the closest public cooling centres, and more have been identified as actions in a layered approach to respond to what the project team has been hearing.

This project valued the time and effort of all project participants by providing gift cards to those who contributed to the survey or workshops, as well as providing food and drink. Significant time and effort were allocated to planning for the most effective means of communicating, virtually, by mail and in-person, around this project and this climate impact making this community-engaged climate adaptation action equitably delivered.

One-on-one discussions with participating community groups over the summer have confirmed that the Terms of Reference, collaborative decision-making models, meeting structure and timing, and level of effort all work well and participants have a high degree

of enthusiasm about the project. These should be used as templates for further community adaptation collaborative projects.

Acknowledgements

The Advancing Adaptation Project is made possible with funding from the Ontario Ministry of the Environment, Conservation and Parks (MECP) alongside financial support from the Government of Canada through the federal Department of Environment and Climate Change Canada.

12. Conclusion

City staff and community participants showed remarkable agreement on their Vision for a successful Adaptation Plan; all agreed that health, sustainability, prosperity and equity were important components and reflections of success, and the principles around which the Plan should be organized. Participants also recognized the importance of collaboration both within the City and with other regions and municipalities by valuing the necessity of leadership: working with ourselves and others to break the trails necessary to navigate the uncertain decades ahead. These values are reflected in our Adaptation Vision Statement:

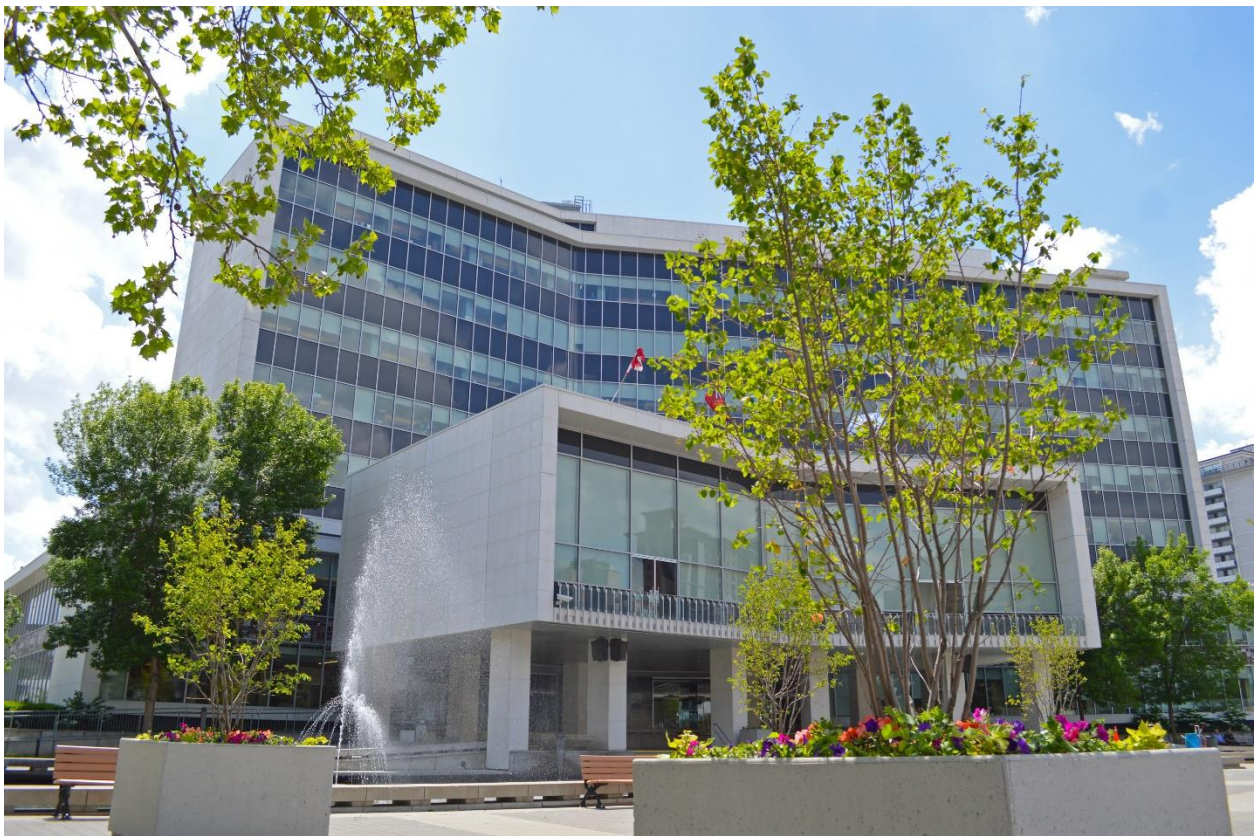
“The City of Hamilton will be a national leader on Climate Adaptation: a healthy, equitable, vibrant, and sustainable community that responds to the needs of residents, businesses and institutions, and is resilient in the face of a changing climate.”

While the City recognizes its need to lead and support the implementation of the Plan and the majority of its adaptive actions, its success will depend on participation by the entire community: our businesses and industry, institutions and social organizations, business and neighborhood improvement associations, schools, and families and individuals. Homeowners and property owners will need to participate in adaptation building retrofit programs, land owners will need to landscape and manage their lands differently to reduce flood risks and biodiversity loss, landlords will need to develop plans to assist tenants during extreme weather and heat events, community gardens and the urban forest will need to grow, and we all can get to know our neighbours and offer support when needed.

A healthy city is one in which climate health impacts are prevented or cured; a vibrant community is one in which joy and prosperity are supported through and by mitigation and adaptive actions; a sustainable community is one in which the solutions to the climate emergency can continue to exist for decades or centuries to come; and an equitable community is one in which the protections and benefits of adaptive actions are

most accessible to those who most need them. The actions in our Plan and the implementation schedule will support these important goals.

We hope everyone in the City sees themselves and their needs reflected in this Plan, and a role to play in its implementation.



13. Appendices

Appendix A: Implementation Schedule

Objective 1: Incorporate climate change into future land use, development, and construction

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
<p>Action 1.1 (ID#1): Develop requirements for the incorporation of Low Impact Development (LID) features and green infrastructure into new development and redevelopment projects and consider watershed and landscape scales in the development of plans and objectives.</p> <p>Long-term (>5 years)</p>	<ul style="list-style-type: none"> Identify and set a baseline metric. Map where LID features should be prioritized for installation Meet with relevant external Potential Supporting Organization(s) to determine scope of the program and what guidelines are already available 	<ul style="list-style-type: none"> Co-led between Public Works (Hamilton Water) and Planning and Economic Development (Planning-Growth Planning) 	<ul style="list-style-type: none"> Other applicable Dept/Div. (Parks, Landscape Architecture, Planning etc.) Academics (Mohawk and McMaster) Environmental Organizations (e.x. Green Venture and Environment Hamilton) Bay Area Restoration Council Conservation Authorities Large Building and Property Owners Social Organizations and Affordable Housing Providers (e.x. Indwell, YWCA, Kiwanis Homes) 	<ul style="list-style-type: none"> City of Hamilton Official Plan updates that include LID implementation Diversion of stormwater (amount measured) Number of LID features implemented Locations of LID features reported in site plans Private property flooding reports Watershed conditions in priority areas (i.e. water quality, erosion sites, etc.)
<p>Action 1.2 (ID#2): Develop guidelines and incentives for homeowners and landlords to improve</p>	<ul style="list-style-type: none"> Compile list of existing incentives and organizations offering them 	<ul style="list-style-type: none"> Proposed Climate Change Office (CCO) 	<ul style="list-style-type: none"> Other applicable City Depts/Div. (Public Health, Municipal Law Enforcement, Planning) Bay Area Climate Change Council Insurance companies 	<ul style="list-style-type: none"> Number and type of incentives offered Number and type of retrofits (e.x. backflow

<p>the resilience of residential buildings to climate-related risks through upgrades and/or retrofits.</p> <p>Short-term (<2 years)</p>	<ul style="list-style-type: none"> • Use research and best practices from University of Waterloo Intact Centre, as well as other research to develop best practices/guidelines document • Continue to develop HERO retrofit incentive and explore adaptation retrofit options 		<ul style="list-style-type: none"> • Social Organizations (e.x. ACORN, Hamilton Round Table for Poverty Reduction, YWCA, Community Benefits Network) • Environmental Organizations (e.x. Green Venture • Conservation Authorities • Faith Based Organizations (e.x. Faith and the Common Good, Association of Dundas Churches/Climate Action Team, St. Paul's Presbyterian Church, Faith Footprints/United Church of Canada) • Mohawk College – Centre for Climate Change Management • Alectra • Hamilton Community Foundation 	<p>valves, downspout disconnections etc.)</p> <ul style="list-style-type: none"> • Number change in Protective Plumbing Program numbers • Building permit data
<p>Action 1.3 (ID#3): Conduct more studies or reviews to determine flooding and other risks throughout the City & develop plans (e.g. relocating sites where appropriate) to improve the resilience of infrastructure (i.e. buildings, roads, water/wastewater infrastructure, etc.) to climate-related</p>	<ul style="list-style-type: none"> • Conduct a review of existing relevant studies and identify where the gaps may exist. • Organize meetings with relevant external partners to discuss program scope and requirements and work towards joint work plans and proposals. 	<ul style="list-style-type: none"> • Proposed Climate Change Office (CCO) 	<ul style="list-style-type: none"> • All other applicable City Departments/ Divisions • McMaster Centre for Climate Change (MCCC) • Conservation Authorities • Niagara Escarpment Commission • Bay Area Restoration Council 	<ul style="list-style-type: none"> • Percentage of the City that has been studied (geographic metric) • Number of flood-related calls • Sites along the waterfront that are mitigated

risks from extreme weather and temperatures.				
Medium-term (2-5 years)				

Objective 2: Reduce transportation disruptions due to extreme weather events and improve the safety of travel on roads, sidewalks, and trails (i.e. including washouts)

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
<p>Action 2.1 (ID#4): Improve winter travel conditions through further expanding sidewalk clearing.</p> <p>Short-term (<2 years)</p>	<ul style="list-style-type: none"> Investigate where there is a need to fill in the gaps in the ‘Snow Angels program’. Analyze sidewalk clearing expansion in 2022/23 to determine successes and remaining gaps/issues 	<ul style="list-style-type: none"> Public Works Department (Roads Maintenance) 	<ul style="list-style-type: none"> Other City Departments/Divisions (E.x. Municipal Law Enforcement/PED) YWCA Social Planning and Research Council of Hamilton (SPRC) through Just Recovery Network 	<ul style="list-style-type: none"> Kilometres of sidewalks cleared Number of requests from ‘Snow Angels’ program Number of “angels” part of ‘Snow Angels’ program Number of slip/fall complaints
<p>Action 2.2 (ID#5): Encourage and promote safer travel practices, choices, and alternatives through considering all</p>	<ul style="list-style-type: none"> Engage with local organizations to form a working group to co-create communications campaign Review and update (as necessary) the 	<ul style="list-style-type: none"> Planning and Economic Development (Transportation Planning) 	<ul style="list-style-type: none"> Other applicable City Departments (e.x. Corporate Communications, Public Works, HSR etc.) Sub-Committees of Council (e.x. LRT, Cycling etc.) Environmental and Social Organizations (e.x. Environment 	<p>Formation of working group</p> <p>Number of meetings with local groups that receive communication campaign</p> <p>Traffic count numbers</p> <p>Number of road accidents</p>

<p>users of Hamilton's transportation network and by working with local groups to create a communications campaign around the benefits of work-from-home</p> <p>Medium-term (2-5 years)</p>	<p>inclement weather communication templates used by City of Hamilton's Communications Department and ensure that they encompass all climatic events</p>		<p>Hamilton, Cycle Hamilton, New Hope Community Bikes, Hamilton Bike Share, YWCA)</p> <ul style="list-style-type: none"> • Hamilton Transit Riders Union • Neighborhood groups/associations 	
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Objective 3: Help vulnerable populations (i.e. seniors, youth, outdoor workers, those experiencing homelessness, with pre-existing health conditions, etc.) avoid or reduce health-related impacts of extreme weather and temperatures (including flooding).

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
<p>Action 3.1 (ID#6): Develop and implement a response program for vulnerable populations to protect residents from climate-related risks (i.e. extreme cold, extreme heat, etc.)</p> <p>Medium-term (2-5 years)</p>	<ul style="list-style-type: none"> • Develop program for in-building cooling rooms for high-rise residential buildings • Distribute resources/toolkits on benefits of emergency preparedness to landlords • Investigate/renew previous contact list(s) of those on medical devices 	<ul style="list-style-type: none"> • Proposed Climate Change Office (CCO) 	<ul style="list-style-type: none"> • Other applicable City Dept/Div. (e.x. Hamilton Fire – Emergency Management Hamilton, City Housing Hamilton etc.) • Social Organizations (e.x. YWCA, Networks of seniors/long-term care homes, Energy Justice, Disability Justice Network of Ontario, Hamilton Coalition on Aging, Immigrants Working Centre, Social Planning and Research Council of Hamilton, 	<ul style="list-style-type: none"> • Number of annual weather-related (e.g., heat related, cold related) emergency room visits for residents of Hamilton. • Number of annual weather-related (e.g., heat related, cold related) deaths for resident of Hamilton. • Number of weather-related calls (e.g., heat related, cold related) paramedic calls for residents of Hamilton.

			Welcome Inn, United Way Halton & Hamilton <ul style="list-style-type: none"> McMaster University Private Home Builders/Developers 	
Action 3.2 (ID#7): Consolidate existing vulnerable persons' contact lists and update/expand them to guide emergency response and/or other assistance programs. Medium-term (2-5 years)	<ul style="list-style-type: none"> Investigate similar programming in other municipalities (e.g. City of Montreal) Map areas that will need to be contacted and look to create lists based on climate hazard (e.g. extreme heat, extreme cold, flooding, wind, etc.) 	<ul style="list-style-type: none"> Healthy and Safe Communities 	<ul style="list-style-type: none"> Other applicable City Dept/Div (e.x. Public Health, Communications, Hamilton Fire-Emergency Management, Housing Services, City Housing Hamilton) Social Organizations (e.x. Just Recovery Hamilton, Social Planning Research Council, United Way, Welcome Inn, CareMongering/ Disability Justice Network of Ontario, Hamilton Immigration, Partnership Council) Environment Hamilton City Councillors City Enrichment Fund Hamilton Community Foundation Landlords Tenant groups Welcome Inn 	<ul style="list-style-type: none"> Registry created Number of users of registry Number of people reached during a climate emergency
Action 3.3 (ID#8): Coordinate local efforts to address excessive indoor	<ul style="list-style-type: none"> Conduct research on other what similar work has been done by other 	<ul style="list-style-type: none"> Healthy and Safe Communities (Public Health Services) 	<ul style="list-style-type: none"> Other applicable City Dept/Div. (Communications, Hamilton Fire - Emergency Management, Housing 	<ul style="list-style-type: none"> Number of health promotion sessions delivered, number of attendees and number of resources provided for heat-related response (i.e. number

<p>temperatures in rental housing</p> <p>Medium-term (2-5 years)</p>	<p>communities (e.g. City of Toronto)</p> <ul style="list-style-type: none"> • Determine with building managers to what extent heat response plans exists 		<p>Services City Housing Hamilton)</p> <ul style="list-style-type: none"> • Social Organizations (e.x. Just Recovery Hamilton, Social Planning Research Council, United Way, CareMongering/ Disability Justice Network of Ontario, United Way, Welcome Inn, Hamilton Immigration Partnership Council • Environment Hamilton • City Councillors • City Enrichment Fund • Hamilton Community Foundation • Landlords • Tenant groups • Hamilton Immigration Partnership Council (HIPC) 	<p>of graphics, posters distributed, etc.)</p> <ul style="list-style-type: none"> • Creation and/or implementation of heat-related response plan • Website metrics (number of downloads/views) • Number of media releases on heat-related topics
<p>Action 3.4 (ID#9): Align ongoing efforts within the City to continue expanding affordable housing to protect vulnerable populations to reduce climate-related impacts from extreme weather and temperatures</p>	<ul style="list-style-type: none"> • Support council to continue their lobbying/advocacy to upper levels of government • Develop resources (e.g. factsheets, white papers etc.) on linkages between climate change and vulnerable populations • Determine how to collect data on 	<ul style="list-style-type: none"> • Healthy and Safe Communities (Housing Services), Planning and Economic Development • Public Health Services (Epidemiology Wellness & Communicable Diseases) 	<ul style="list-style-type: none"> • Social Organizations (e.x. Hamilton Community Benefits Network, Hamilton is Home Coalition, ACORN, Round Table for Poverty Reduction, Ontario Non-Profit Housing Association, Social Planning and Research Council, Sacajawea Non-Profit Housing, YWCA, Kiwanis) • Province and Federal Govt. for funding 	<ul style="list-style-type: none"> • Number of affordable housing units • Shelter expansion/Number of individuals who are more vulnerable served through expansion • Number of units with cooling interventions (fans, AC, awnings, etc.) • Housing prices in the City • Number on annual weather related (e.g. heat-related, cold-related) emergency visits, paramedic calls, and morbidity

Long-term (>5 years)	health – for particular climatic events, of homeless populations, etc. and leverage existing data where possible.		<ul style="list-style-type: none"> Hamilton Community Foundation 	and mortality rates, with focus on vulnerable populations where possible.
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Objective 4: Improve community preparedness and resilience to respond to climate-related risks from extreme weather and temperatures, including flooding.

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
<p>Action 4.1 (ID#10): Create educational campaigns on communicating the risks associated with climate change (i.e. health impacts, property damage, etc.) and what residents can do to prepare (GDS, LID, etc.)</p> <p>Short-term (<2 years)</p>	<ul style="list-style-type: none"> Engage appropriate subject matter experts to inform content in the communications campaign(s). Look to existing City efforts to see where efforts can be combined (e.g. Emergency Preparedness Week) Review and update existing City communications materials to include climate 	<ul style="list-style-type: none"> Proposed Climate Change Office (CCO) 	<ul style="list-style-type: none"> Other applicable City Dept/Div. (e.x. Hamilton Fire – Emergency Services, Children & Community Services, Corporate Communications, Public Works, Public Health) Environmental Organizations (e.x. Environment Hamilton, Sustainability Leadership) Utilities (e.x. Alectra, Enbridge) Academics (e.x. Mohawk College, McMaster University) Hamilton Health Sciences School boards Personal Support workers Social Organizations (e.x. Immigrants Working Centre (IWC), ADC/ Climate Action Team, Seniors for Climate Sanity, Dundas Works/ Rotary Dundas Community Services, YWCA, Welcome Inn, 	<ul style="list-style-type: none"> Launch of campaigns City website analytics (e.g. number of visits, material downloads, etc.)

	change-related information		<p>Social Research Planning Council, United Way</p> <ul style="list-style-type: none"> • Private Large Building Owners (e.x. Lime Ridge Mall, • Insurance Providers • Conservation Authorities • Sub-Committees of Council (Seniors Advisory, Communications) 	
<p>Action 4.2 (ID#11): Evaluate and select programs for making emergency preparedness kits accessible to anyone, regardless of income (e.g. subsidies or free distribution campaigns)</p> <p>Medium-term (2-5 years)</p>	<ul style="list-style-type: none"> • Determine what kit contents are needed • Determine who/where community members can connect with during climate-related emergencies to help support them • Determine who can fund kit creation and distribution 	<ul style="list-style-type: none"> • Healthy and Safe Communities 	<ul style="list-style-type: none"> • Applicable other City Dept/Div (e.x. Corporate Communications, Hamilton Fire - Emergency Management Hamilton, Tourism and Culture, Recreation, Facilities, Ontario Works) • United Way Halton & Hamilton • Social Housing Providers • Food banks (to distribute during times of crisis) • Red Cross • Museums • Libraries • Service Centres • School boards 	<p>Number of programs/organizations delivering emergency preparedness kits</p>
<p>Action 4.3 (ID#12): Establish buddy systems/help-your-neighbour programs to implement</p>	<ul style="list-style-type: none"> • Map what community groups cover what areas/locations in the City • Organize a meeting with 	<ul style="list-style-type: none"> • Healthy and Safe Communities • Possibly in partnership with United Way Halton & 	<ul style="list-style-type: none"> • Other applicable City Dept/Div. (Hamilton Fire-Emergency Management Hamilton, Neighbourhood Development) • Faith Based Organizations (e.x. Faith and the Common Good, Hamilton/Dundas Jewish Services) 	<ul style="list-style-type: none"> • Number of Neighbourhood organizations/groups (i.e. participating/ registered) • Number of people reached within each organization

<p>during extreme weather events</p> <p>Short-term (<2 years)</p>	<p>groups who have previously carried out similar work and determine what resources are needed to support them</p> <ul style="list-style-type: none"> • Networks of staff (built from vaccine ambassadors) 	<p>Hamilton (depending on scale and availability)</p>	<ul style="list-style-type: none"> • Social Organizations (e.x. Home Management Client Group program, Dundas Works, Dundas Community Services, Welcome Inn, Social Planning Research Council) • Cultural Organizations (e.x. African Canadian Caribbean Association (ACCA)) • Community Resilience to Extreme Weather • https://ca.nextdoor.com/ • Neighbourhood Facebook groups & Neighbour-to-Neighbour App – for communication • ADC/Climate Action Team • Hamilton Community Foundation 	
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Objective 5: Monitor and plan for the potential introduction of new vectors and increased vector-borne illnesses in the community.

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
<p>Action 5.1 (ID# 13): Work with local partners to ensure vulnerable groups are informed about and have the means to be adequately protected from vector-borne</p>	<ul style="list-style-type: none"> • Determine what physical assets are needed (e.g. bug nets, mulching lawn edging, DEET, etc.) • Review property standards by-law 	<ul style="list-style-type: none"> • Healthy and Safe Communities (Public Health Services) 	<ul style="list-style-type: none"> • Other applicable City Dept/ Div. (e.x. Corporate Communications) • School boards • Hamilton Health Sciences • Social Organizations (e.x. United Way Halton & Hamilton, YWCA) • Local health providers • Pharmacists 	<ul style="list-style-type: none"> • City website analytics (i.e. number of views/downloads, etc.) • Number of cases of vector-borne disease related illnesses

<p>diseases (e.g. West Nile Virus, Lyme Disease, etc.)</p> <p>Long-term (>5 years)</p>	<p>for implications on disease vectors</p>		<ul style="list-style-type: none"> • Hamilton Community Foundation • McMaster University (Centre for Climate Change) 	
<p>Action 5.2 (ID# 14): In conjunction with the Biodiversity Action Plan, develop an Open Space Management Plan to guide City of Hamilton Natural Open Space Stewardship, including maintenance schedules to minimize ideal conditions for vectors (e.g. plants and animals, such as mosquitos, that can bring diseases, such as rabies, Lyme disease, to human populations)</p> <p>Long-term (>5 years)</p>	<ul style="list-style-type: none"> • Investigate ways in which capacity-related issues can be addressed in reviewing/updating an Open Space Management Plan 	<ul style="list-style-type: none"> • Public Works (Environmental Services) as open space management lead • Healthy and Safe Communities (Public Health Services - as education/ awareness lead) 	<ul style="list-style-type: none"> • Other applicable City Dept/Div. (e.x. Corporate Communications, Hamilton Water, Roads) • Hamilton Naturalists Club • Conservation Authorities • Agricultural societies upstream • Ontario Ministry of Natural Resources and Forestry • Bruce Trail Conservancy • Niagara Escarpment Commission • McMaster University (Centre for Climate Change) 	<p>Number of complaints/requests to cut grass</p> <p>Number of ticks submitted to public health per year</p>

Objective 6: Create conditions to minimize health and safety risks to outdoor workers and community members.

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
<p>Action 6.1 (ID#15): Continue to update existing municipal plans and policies to decrease health and safety risks associated with extreme weather and temperatures to outdoor workers</p> <p>Medium-term (2-5 years)</p>	<ul style="list-style-type: none"> Determine how to collect data on health – for particular climatic events, of outdoor workers Review existing guidelines, by-laws and policies, and plans (e.g. extreme heat/cold work plans in response to an emergency) and identify gaps 	<ul style="list-style-type: none"> Human Resources Proposed Climate Change Office (CCO) 	<ul style="list-style-type: none"> Other applicable City Dept/Div. (e.x. Public Health, Human Resources, Joint Health and Safety Committees etc.) Ontario Ministry of Labour West End Home Builders Association Private businesses across the community 	<ul style="list-style-type: none"> Number of extreme weather-related injuries/deaths for outdoor workers Number of updated or new policies created
<p>Action 6.2 (ID#16): Explore opportunities to expand current cooling & warming centre programming and interventions.</p> <p>Short-term (<2 years)</p>	<ul style="list-style-type: none"> Connect with other municipalities who have done work around this (e.g. Toronto Public Health and their cooling/warming centre improvement) 	<ul style="list-style-type: none"> Healthy and Safe Communities (Public Health Services) 	<p>Buildings Owners and Locations with congregate floor area (e.x. Art Gallery of Hamilton, Hamilton Convention Centre, Churches, Malls, Museums, Public Libraries etc.)</p> <p>Academics (e.x. Mohawk College/ McMaster University)</p> <ul style="list-style-type: none"> Organizations with drop-in spaces Landlords Social workers Welcome Inn 	<ul style="list-style-type: none"> Number of facilities Number of users Quality of programming at facilities (to indicate improvement) Community feedback on cooling/warming centres (i.e. through surveys) Percentage of vulnerable populations that live within an accessible distance of a cooling/warming station/centre

<p>Action 6.3 (ID#17): Improve monitoring, data collection, and notification surrounding flooding & extreme weather/temperatures</p> <p>Long-term (>5 years)</p>	<ul style="list-style-type: none"> Determine threshold to execute communication strategy (i.e. what the triggers are, number of triggers, etc.) Prepare a plan to establish the feasibility, necessary components and ongoing resources required to establish an ongoing weather-related health event monitoring system for the City of Hamilton Consider making real-time City-collected rainfall data available to the Public as open data 	<ul style="list-style-type: none"> Healthy and Safe Communities (Public Health Services) 	<ul style="list-style-type: none"> Other applicable City Dept/Div. (Corporate Communications, Public Health Services, Paramedic Services etc.) Applicable Provincial Agencies across Ontario Ontario Farmer's Association Media Outlets City Councillors Conservation Authorities McMaster University (Centre for Climate Change) 	<ul style="list-style-type: none"> Number of heat alerts Number of users of splash pads, parks, community centres, etc. Flow and level meters in creeks and municipal sewer networks Time lapsed between communication to community and extreme weather event
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Objective 7: Proactively conserve and protect surface water and groundwater resources.

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
<p>Action 7.1 (ID#18): Continue to enhance the management and restoration of existing natural areas and seek opportunities to dedicate land and</p>	<ul style="list-style-type: none"> Convene a working group with other managers/owners of natural lands (such as Conservation Authorities) to discuss current practices, priority 	<ul style="list-style-type: none"> Planning and Economic Development (Natural Heritage Planning) Public Works (Environmental Services) 	<ul style="list-style-type: none"> Other applicable City Dept/Div. (Hamilton Water), Planning Division, Economic Development, Public Health, etc.) Hamilton Naturalists Club Conservation Authorities 	<ul style="list-style-type: none"> Enhancement of natural areas identified in plan Acquisition of space to convert into natural areas to enhance core areas and linkages

<p>natural areas for conservation.</p> <p>Medium-term (2-5 years)</p>	<p>areas, and identify gaps</p> <ul style="list-style-type: none"> • Establish and support a Circle of Indigenous Knowledge Keepers to advise and consult on this initiative 		<ul style="list-style-type: none"> • Applicable Provincial Agencies (e.x. OMAFRA, OMNR etc.) • Save our Streams Hamilton • Royal Botanical Gardens • Joint Stewardship Board • Indigenous Water Protectors • Hamilton Community Land Trust • Red Hill Family Centre • Real Estate Boards and Associations • McMaster University (Centre for Climate Change) 	
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Objective 8: Monitor, maintain and improve the diversity and resiliency of urban trees and forests.

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
<p>Action 8.1 (ID#19): Work with local partners to continue tree planting and preservation, explore community partnerships and naturalization programs to reduce urban heat island and enhance</p>	<ul style="list-style-type: none"> • Identify priority tree planting locations in urban Right of Ways, and commercial streets within dense urban areas. • Review funding and staffing gaps to increase capacity to undertake community tree planting initiatives 	<ul style="list-style-type: none"> • Public Works (Environmental Services) 	<ul style="list-style-type: none"> • Other applicable City Depts/Div. (e.x. proposed central climate change office, Economic Development, Healthy and Safe Communities, Transportation Planning, Engineering Services, Roads Operation/Maintenance etc.) 	<ul style="list-style-type: none"> • Number of trees planted and locations • Number of community tree planting events hosted • Compensation costs for public trees • Enforcement stats (e.x. # site visits, fines issues, complaints etc.)

<p>ecosystem function.</p> <p>Medium-term (2-5 years)</p>	<ul style="list-style-type: none"> • Review education component related to species diversity and public awareness • Review plantable spaces appropriate for community planting and naturalization plantings • Promote the Community Planting Program to expand number of events and build upon current successes • Develop consistent metric/measurement methods for trees & urban forest 			<ul style="list-style-type: none"> • Fees for/from contractor services to complete work on private property
<p>Action 8.2 (ID#20): Implement the Urban Forest Strategy (UFS), and consider additional measures to support it or expand its impact.</p> <p>Medium-term (2-5 years)</p>	<ul style="list-style-type: none"> • Establish interdepartmental working group including Circle of Indigenous Knowledge Keepers to consult on implementation • Implement short term actions identified within the UFS and strategically plan to implement medium and long-term action items • Determine a consistent metric and monitoring method to use going forward (e.g. LIDAR), and a 	<ul style="list-style-type: none"> • Public Works (Environmental Services) 	<ul style="list-style-type: none"> • Other applicable City Dept/Div (e.x. Municipal Law Enforcement, Proposed Interdepartmental Working Group etc.) • Environmental Hamilton • Hamilton Naturalists Club • McMaster University (Centre for Climate Change) 	<ul style="list-style-type: none"> • As proposed in UFS. • Percentage of equitable canopy cover* • Woodlot health* • Invasive Species Distribution* <p>*If not proposed currently in UFS</p>

	funding model to support it's continued use <ul style="list-style-type: none"> • Revisit private tree by-law; may include Heritage Trees 			
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Objective 9: Strengthen food security in the City.

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
Action 9.1 (ID#21): Educate and encourage community to participate in growing food locally (e.g. lot level or urban farms/gardens). Short-term (<2 years)	<ul style="list-style-type: none"> • Determine a group/entity to lead this work • Investigate Official Plan amendments to allow for large-scale urban agricultural production 	<ul style="list-style-type: none"> • TBD (potential for Public Health Services – with additional staff resources) 	<ul style="list-style-type: none"> • Determine a group to lead this work • Other applicable City Dept./Div (e.x. Healthy and Safe Communities, Public Works, Planning and Economic Development • Food Advisory Committee • Environmental Organizations (e.x. Green Venture, ADC/Climate Action Team) • Social Organizations (e.x. Dundas Works/Rotary, Dundas Community Services, YWCA, Good Shepherd, Social Planning Research Council, Unity Way Halton & Hamilton) • Farming and Food Production Organizations (e.x. Micro Fruit Orchards, Neighbour to Neighbour (N2) Community Garden Network, Aqua 12 permaculture Urban Farmers etc.) • Hamilton Victory Gardens • Neighbourhood Associations 	<ul style="list-style-type: none"> • Number of community gardens & users • User surveys from N2N garden network

<p>Action 9.2 (ID#22) : Expand rain water capture (i.e. rain barrels, cisterns, etc.) as an irrigation source for more localized food production (i.e. backyard farming, urban gardens, soft landscapes, etc.)</p> <p>Medium-term (2-5 years)</p>	<ul style="list-style-type: none"> • Identify organizations to lead this initiative • Conduct scan of existing rain water capture programs, incentives across Hamilton and identify gaps and potential additional resourcing needs 	<ul style="list-style-type: none"> • TBD • Potential Public Works (Hamilton Water) • Potential Green Venture (for community/homeowner with supporting resources) 	<ul style="list-style-type: none"> • Other applicable City Dept/Div. (e.x. Environmental Services, Growth Management, Neighbourhood Development, Chronic Disease Prevention etc.) • Green Venture (NaturHoods) • Sustainability Leadership • McMaster University (Centre for Climate Change) • Conservation Authorities 	<ul style="list-style-type: none"> • Number of rain barrels and cisterns installed • N2N survey • Number of community gardens with rainwater capture
<p>Action 9.3 (ID#23): Engage with local agricultural leaders to understand existing resources for farmers in addressing climate adaptation, and how the City can support or expand on those efforts.</p> <p>Medium-term (2-5 years)</p>	<ul style="list-style-type: none"> • Bring forward request to engage with the Agricultural & Rural Affairs Committee for detailed planning of this action • Research and Engage agricultural organizations (e.x. Ontario Federation of Agriculture, Hamilton-Wentworth Federation of Agriculture etc.) to index current and upcoming 	<ul style="list-style-type: none"> • City of Hamilton Agricultural and Rural Affairs Committee 	<ul style="list-style-type: none"> • Other applicable City Dept/Div. (e.x. Public Health, Economic Development, etc.) • Ontario Ministry of Agriculture and Rural Affairs • Academics (e.x. University of Guelph, Niagara College) • Ontario Fruit and Growers' Association • Farmers markets and road farm sellers • Golden Horseshoe food and farming alliance • Food Advisory Committee • Hamilton-Wentworth Federation of Agriculture • Ontario Federation of Agriculture 	<ul style="list-style-type: none"> • Creation of resource guide/dedicated digital link or webpage

	resources available to farmers <ul style="list-style-type: none"> Develop resource inventory 			
Action 9.4 (ID#24): Develop an educational campaign directed at restaurant and grocery industries, local farms and other possible food sources to better reduce and divert food waste and explore opportunities to reduce food waste. Medium-term (2-5 years)	<ul style="list-style-type: none"> Get up and running again post-pandemic- report to community/council Look at Ottawa Food Bank farm (& farmer on staff) and consider rural area potential Discuss with food retailers/grocery stores Check with Hamilton Emergency Food Network/Food on current status/program stats 	<ul style="list-style-type: none"> Public Works (Waste Management); and/or Food Strategy Working Group 	<ul style="list-style-type: none"> Other applicable City Dept/Div. (e.x. Public Health, Corporate Communications etc.) Business Improvement Areas (BIA) with restaurants Farmers market Hamilton Health Sciences School boards Long Term Care homes Second Harvest Ontario Food Collaborative Municipal Waste Association’s Food Reduction Working Group Hamilton Emergency Food Network Hamilton Food Share YWCA McMaster University (Centre for Climate Change) 	<ul style="list-style-type: none"> Percent food waste diverted Number of retailers/businesses/ organizations participating

Objective 10: Enable local businesses and organizations to plan for climate-related risks.

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
Action 10.1 (ID#25): Provide guidance to local businesses on how to maintain business continuity	<ul style="list-style-type: none"> Develop an emergency preparedness guides for businesses 	<ul style="list-style-type: none"> Planning and Economic Development 	<ul style="list-style-type: none"> Other applicable City Dept/Div. (Proposed Central Climate Change Office, Public Health etc.) Sustainability Leadership 	<ul style="list-style-type: none"> Uptake in programs being offered

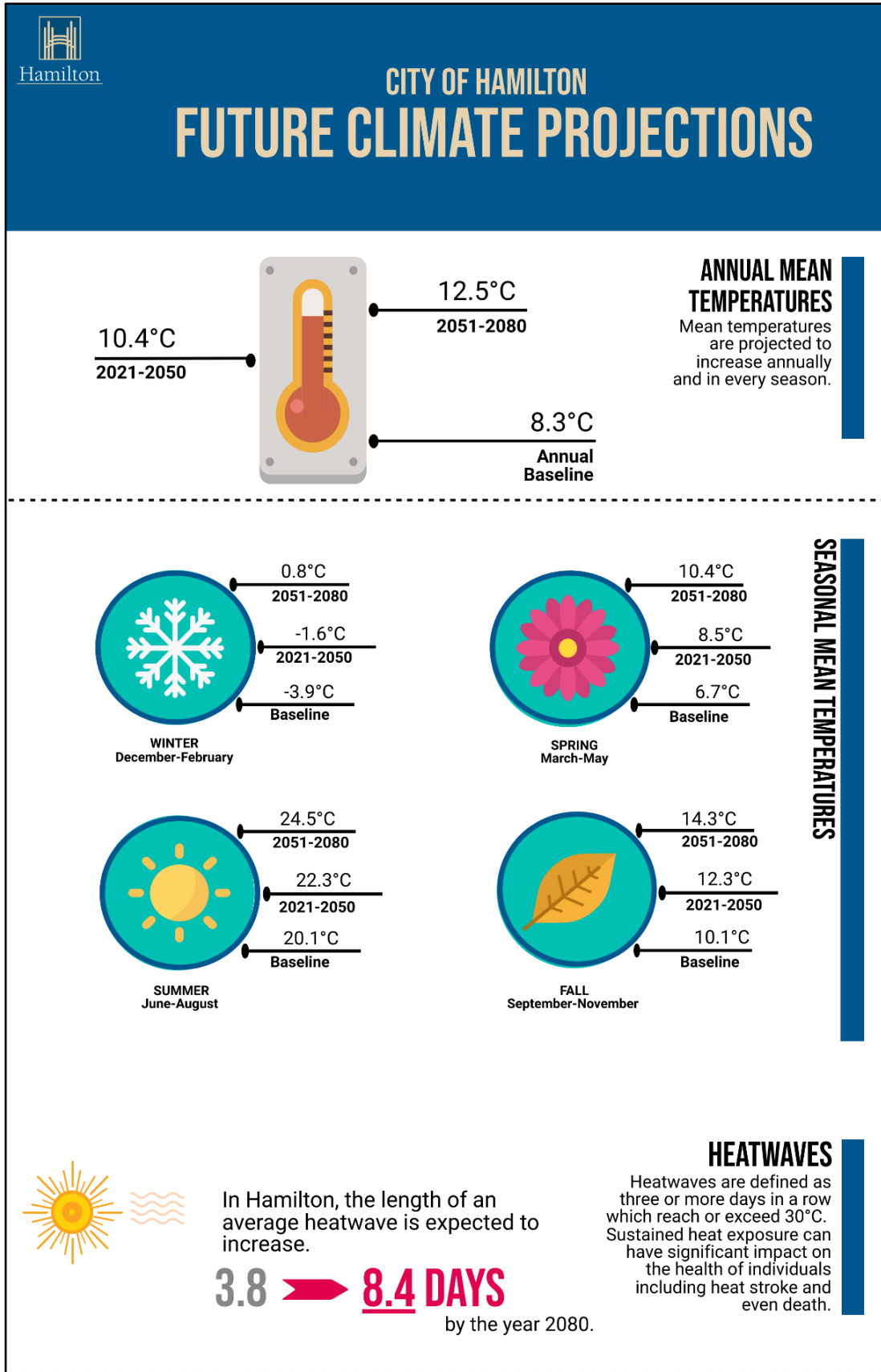
<p>(e.g. supply chain) during extreme weather (i.e. through business continuity planning, green business practices, adaptation measures, etc.)</p> <p>Long-term (>5 years)</p>	<ul style="list-style-type: none"> • Host Webinars on Disaster Preparedness & Economic Recovery 		<ul style="list-style-type: none"> • Chamber of Commerce – 3 Chambers • CF Lime Ridge • Business Improvement Areas • Innovation Factory • Business Investment & Sector Development • Hamilton Business Centre • Mohawk College (IDEAWorks-Energy & Power Innovation Centre) • Bay Area Climate Change Council (BACCC) • Hamilton Industrial Environmental Association (HIEA) • Supply Chain Canada • McMaster University (Centre for Climate Change) • United Way Halton & Hamilton 	<ul style="list-style-type: none"> • Number of businesses interested in a local best practice network
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Objective 11: Improve the resilience of energy infrastructure to weather-related disruptions.

Action + Timelines for Completion	Immediate Next Steps	Lead Organizations	Potential Supporting Organizations	Potential Monitoring Metrics
<p>Action 11.1 (ID#26): Work with local partners to conduct vulnerability and risk assessments on local energy systems and identify opportunities to</p>	<ul style="list-style-type: none"> • In coordination with Community Energy and Emissions Plan implementation-Transformation 4 (Revolutionizing Renewables), establish a baseline 	<ul style="list-style-type: none"> • Utilities (Alectra, Hydro-One, Enbridge) 	<ul style="list-style-type: none"> • Other applicable City Dept/Div. (e.x. proposed Central Climate Change Office, Public Works, Planning and Economic Development) • Hamilton Community Enterprises • Hamilton Renewable Power Inc. 	<ul style="list-style-type: none"> • Local energy produced (private and public capacity of renewables within City) • Number of retrofits (that are being tracked) that include renewables

<p>increase local energy generation (e.g. microgrids) to increase reliability (potentially as part of planned CEEP priority actions around identifying renewable energy generation sites within the City).</p> <p>Medium-term (2-5 years)</p>	<p>for local energy production within the City and potential for near-future renewable projects in combination with energy storage</p>		<ul style="list-style-type: none"> • Sustainability Leadership • Rechargeables Inc. • Academics (e.x. Mohawk College - Energy & Power Innovation Centre, McMaster University- Centre for Climate Change) 	
<p>Action 11.2 (ID#27): Establish low-carbon back-up power systems in all City-owned facilities to serve as community hubs during emergencies, and create a policy to support and promote the use of low- or no-carbon emergency energy supplies such as batteries or energy storage for residents and businesses.</p> <p>Long-term (>5 years)</p>	<ul style="list-style-type: none"> • Through Economic Development's Corporate Calling – develop a program(s)/marketing material to capture all programming to share and educate the business community • Take stock of City's existing generators • Take stock of existing in-building cooling rooms in the City 		<ul style="list-style-type: none"> • Other applicable City Dept/Div. (Ex. Housing Services, Recreation, Facilities, Corporate Communications, Public Health, Economic Development etc) • Utilities (e.x. Alectra. Hydro-One) • Large building/land owners and institutional organizations (e.x. CF Lime Ridge, YWCA etc.) • Academics (e.x. Mohawk College- Energy & Power Innovation Centre, McMaster University – Centre for Climate Change) • Bay Area Climate Change Council (BACCC) • Sustainability Leadership 	<ul style="list-style-type: none"> • Number of zero and/or low carbon back-up retrofits • Annual Greenhouse gas emissions estimates from generators

Appendix B: Climate Science Infographic



Night-time temperatures above 20°C are expected to see a **fivefold increase** by 2080.



TROPICAL NIGHTS

Typically cooler nights can mitigate exposure to extreme heat, however, an increased number of tropical nights eliminates the possibility for relief and magnifies health risks, especially to vulnerable populations such as infants, older adults, and those who work outdoors.

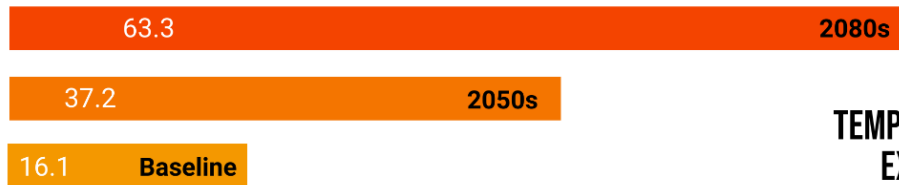
DAYS WITH FREEZE-THAW CYCLES



FREEZE-THAW CYCLES

A decrease in freeze-thaw days is expected.

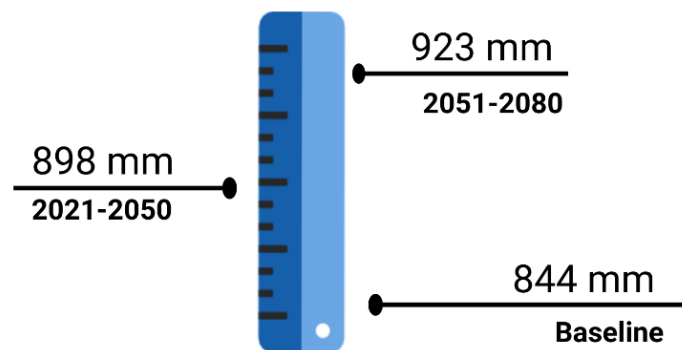
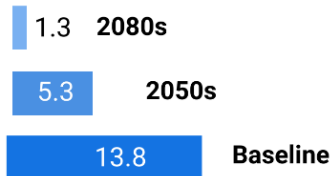
DAYS AT OR ABOVE 30°C



TEMPERATURE EXTREMES

More hot days, fewer cold days.

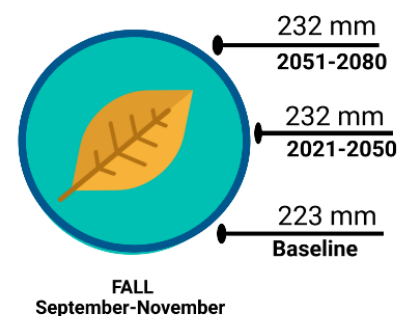
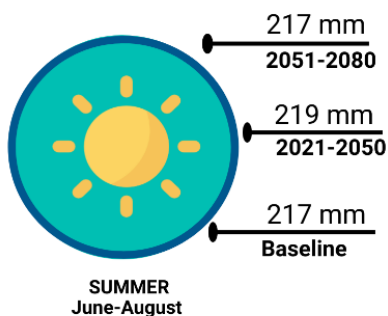
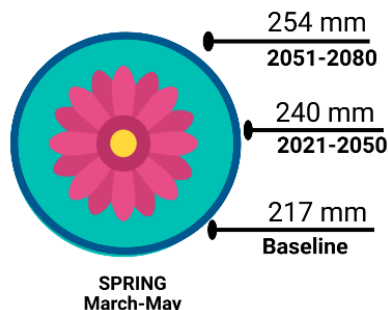
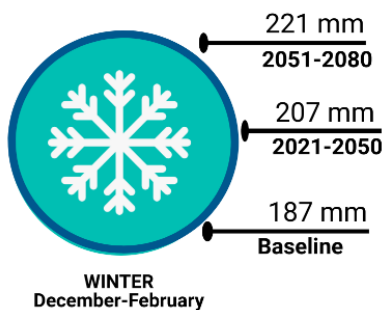
DAYS AT OR BELOW -15°C



ANNUAL MEAN PRECIPITATION

Increased precipitation can cause flooding, damage to infrastructure, and decreases to water quality.

SEASONAL MEAN PRECIPITATION



Precipitation will fall at a faster rate (mm/h)



Shorter storms will have an increasingly high intensity

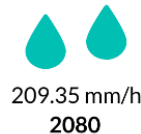
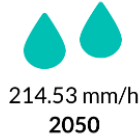


Return periods of heavy storms will shorten, meaning increased frequency

PRECIPITATION EVENTS

Precipitation events in general are projected to become more intense and extreme.

For Instance, 100-year rainfall events will see precipitation rates increase substantially from baseline in Hamilton. 5-minute downpour rates shown



Sources:

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- ⁱⁱⁱ Intergovernmental Panel on Climate Change. (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability Summary for Policy Makers. <https://www.ipcc.ch/report/ar6/wg2/resources/spm-headline-statements/>
- ^{iv} Intergovernmental Panel on Climate Change. (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability Summary for Policy Makers. <https://www.ipcc.ch/report/ar6/wg2/resources/spm-headline-statements/>
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Hamilton’s Climate Action Strategy Departmental Resource Considerations

This Appendix presents resource considerations for the City of Hamilton to implement the actions identified in *ReCharge Hamilton - Our Community Energy and Emissions Plan* and *Hamilton’s Climate Impact Adaptation Plan*. Resource needs identified are considered preliminary and will be subject to further refinement.

Where additional resources are identified these estimates would be further refined and a financing strategy would be brought forward for Council consideration through the annual budget process or through separate Committee reports.

Community Energy and Emissions Plan (CEEP) – Estimated Resources for City-Led or Supported Actions (0-5 Years)

Transformations, Resilient Themes and Proposed Actions	Comments on Resource Implications
<p>Action 1: Establish an Industrial Energy Efficiency and Decarbonization Working Group.</p> <p>Action 2: Establish a Clean-tech Accelerator.</p> <p>Action 11: Establish a Commercial Decarbonization Working Group</p> <p>Action 18: Technical analysis of green hydrogen potential and creation of a Hamilton ‘hydrogen hub’</p>	<p>It is anticipated that industry stakeholders will play a lead role in implementing these actions. Report CM22012/ HSC22046/ PED22176 is recommending that Hamilton partner in the funding of a Regional Decarbonization Hub in the amount of \$240,000 over 4 years. Any additional City initiatives in support of these actions would be brought forward through the regular annual budgeting process.</p>

Transformations, Resilient Themes and Proposed Actions	Comments on Resource Implications
Action 4: Develop and implement Green Standards for new buildings/moving toward net zero buildings	Estimated one-time cost for the development of a new Green Standard is \$250,000 for consulting costs. Implementation would be through the development approvals process. It is anticipated that staff with specialized knowledge of green standards may be needed in the development approvals functions, which would be development fee funded positions
Action 5: Encourage solar PV on new buildings	Estimate \$50,000 to assess the impact of adding solar PV to construction program and project budget for 330 Wentworth Transit Building. Outcome of this assessment will identify additional costs and feasibility for consideration for this and future projects. Additional projects to be determined through the annual budget process.
Action 6: Design and plan for a mass deep energy retrofit program (may include retrofit delivery centre)	The development of the scope of the retrofit program is currently underway. Implementation of the program, and confirmation of scope, will be subject to future Council approval. The preliminary estimate to deliver a pilot program is \$1.35 M for 540 homes (over 4 years and dependent on delivery strategy and market penetration). This estimate will be refined as program details are developed and other funding opportunities become available. Any budget approval will be subject to the annual budget process.
Action 7: Expand and connect active transportation networks	Several active transportation projects have already been approved through the capital budget, including projects with federal funding contributions. In 2022, the City invested just over \$5 million in cycling infrastructure projects. Future projects will be subject to approval through the annual capital budget. Additional staff resources would be required to increase the rate at which projects are constructed (estimate 3.0 FTE for project management and technical staff to undertake design and construction).
Action 8: Decarbonize transit (bus fleet)	Estimated one-time cost for a technical analysis of transit infrastructure needs for electrification of bus fleet is \$150,000. Analysis would indicate future capital and/or operating costs.

Transformations, Resilient Themes and Proposed Actions	Comments on Resource Implications
Action 10: Establish a city-wide EV strategy	Estimated one-time cost for consultants to complete an EV Strategy is \$200,000. Strategy would identify future actions and initiatives that may have resourcing implications.
Action 14: Developing the next generation electrical grid	One-time cost of \$50,000 is estimated as a first step to prepare a background report and terms of reference for a Long-Term Electricity Needs Study.
Action 15. Encourage local, alternative renewable energy ownership structures (e.g. co-ops)	Expected to be a community-led initiative. Potential resourcing implications for the Climate Change Office to support this work.
Action 16. Implement strategic renewable solar energy installations	Estimated one-time cost of \$150,000 for consultant to develop siting criteria or guidelines for solar energy installations. Estimated one-time cost of \$200,000 for a technical siting/feasibility study for a large solar energy installation.
Action 17: Technical feasibility study of expanded anaerobic digestion facilities	Estimated one-time cost of \$150,000 to undertake this study.
Action 23: Set community-wide tree planting target of 50,000 trees per year and expand tree planting programs.	Capital costs and staffing needs to be determined through further development of this action in coordination with Urban Forest Strategy, proposed Climate Change Office and community organizations. Potential costs associated with communication and education components.
Investigate and design a carbon accounting framework (carbon budget and sustainable procurement policy)	Estimating a one-time cost of \$750,000 for consulting resources and staffing for program design, and to determine ongoing staffing and resourcing needs to implement a carbon budget process.

Climate Change Impact Adaptation Plan (CCIAP) – Estimated Resources for City-Led or Supported Actions (0-5 Years)

Transformations, Resilient Themes and Proposed Actions	Comments on Resource Implications
Resilient Theme 1: Built Environment	
Action 1.1: Develop requirements for the incorporation of Low Impact Development (LID) features and green infrastructure into new development and redevelopment projects, and consider watershed and landscape scales in the development of plans and objectives	Project is underway with existing resources.
Action 1.2: Develop guidelines and incentives for homeowners and landlords to improve the resilience of residential buildings to climate-related risks through upgrades and/or retrofits	Work will be incorporated into existing design work of building retrofits program. Any additional implementation costs will be identified through development of the program and brought forward for Council approval and through annual budget process.
Action 1.3: Conduct more studies or reviews to determine flooding and other risks throughout the City & develop plans (e.g. relocating sites where appropriate) to improve the resilience of infrastructure (i.e. buildings, roads, water/wastewater infrastructure, etc.) to climate-related risks from extreme weather and temperatures.	<p>Flooding and Drainage Master Servicing Study includes an assessment of the impact of planned growth, land use intensification and climate change on Hamilton's flood risk, conveyance, wet weather management etc. Resourcing needs will be developed through this process and brought forward for Council review.</p> <p>A study of geotechnical and hydrologic condition of the escarpment will identify further actions and cost estimates will be prepared and brought to Council for consideration.</p> <p>An Escarpment Resilience Study is planned by Public Works (Environmental Services) with support through the Federal Disaster</p>

Transformations, Resilient Themes and Proposed Actions	Comments on Resource Implications
	Mitigation and Adaptation Fund. The City's share of the cost will be approximately \$15M if the application is successful.
Action 2.1: Improve winter travel conditions through further expanding sidewalk clearing	In November 2021 Council approved Report PW19022(d) related to enhanced level of service for sidewalk clearing. Review of Pilot project approved for 2022/2023 season will inform application to other areas and additional costs would be assessed at that time.
Action 2.2: Encourage and promote safer travel practices, and alternatives through considering all users of Hamilton's transportation network (e.g. motorists, pedestrians, cyclists, transit etc.) and working with local groups to create a communications campaign around the benefits of work-from-home.	Complete Streets framework has been approved by Council and will guide future capital projects. Individual project costs will be brought forward through annual capital budget process. Costs associated with communications and public education to be led by the Sustainable Mobility Group within Transportation Planning and Parking Division, Planning and Economic Development Department, utilizing existing resources.
Resilient Theme 2: People and Health	
<p>Action 3.1: Develop and implement a response program for vulnerable populations to protect residents from climate-related risks (i.e. extreme cold, extreme heat, etc.)</p> <p>Action 3.2: Consolidate existing vulnerable persons' contact lists and update/expand them to guide emergency response and/or other assistance programs.</p>	Further discussion and coordination on these four actions is needed to identify the resources needed, integration with goals and objectives of corporate wide initiatives such as Equity, Diversity and Inclusion work and Urban Indigenous Strategy. There is potential to align 3.1, 3.2, 4.2 and 4.3. Any additional resources required for approval will be brought forward in future budget approval process.

Transformations, Resilient Themes and Proposed Actions	Comments on Resource Implications
<p>Action 4.2: Evaluate and select programs for making emergency preparedness kits accessible to all residents, regardless of income (e.g. means-tested programs, subsidies or free distribution campaigns)</p> <p>Actions 4.3: Establish buddy systems/help-your-neighbour programs to implement during extreme weather events</p>	
<p>Action 3.3: Coordinate local efforts to address excessive indoor temperatures in rental housing.</p>	<p>Work is ongoing with existing resources. No additional resources are currently required. Potential future costs associated with building retrofits or education/enforcement activities.</p>
<p>Action 3.4: Align ongoing efforts within the City to continue expanding affordable housing to protect vulnerable populations to reduce climate-related impacts from extreme weather and temperatures.</p>	<p>Work is ongoing across divisions and would be further enhanced through the proposed development of a Housing Sustainability and Investment Plan. Any additional resources required for approval will be brought forward in future budget approval process.</p>
<p>Action 4.1: Create educational campaigns on communicating the risks associated with climate change (i.e. health impacts, property damage, etc.) and what residents can do to prepare.</p>	<p>Estimated \$50,000 per year (over 4 years) to undertake educational campaign by the proposed Climate Change Office. Further refinement of costs will be developed and brought forward to Council for approval through annual budgeting process.</p>
<p>Action 5.1: Work with local partners to ensure vulnerable groups are informed and adequately protected from vector-borne disease.</p>	<p>Work is ongoing with existing resources. No additional resources are currently required.</p>

Transformations, Resilient Themes and Proposed Actions	Comments on Resource Implications
Action 5.2: In conjunction with the Biodiversity Action Plan, develop an Open Space Management Plan to guide City of Hamilton Natural Open Space Stewardship, including placement and design of natural spaces to minimize contact with vectors (e.g. plants and animals (e.g. mosquitoes) that can bring diseases to human communities (e.g. Rabies, West Nile, Lyme Disease).	Action and resourcing to be identified in conjunction with forthcoming Parks Master Plan and/or Biodiversity Strategy. Resource requirements any budget approvals will be brought forward in future budget approval process.
Action 6.1 Continue to update existing municipal plans and policies to decrease health and safety risks associated with extreme weather and temperatures.	Cross departmental initiatives. Additional resourcing needs for individual projects to be brought forward through future budget processes.
Action 6.2: Explore opportunities to expand current cooling and warming centre programming and interventions.	Work is ongoing in several Healthy and Safe Communities Divisions. Any expansion of existing programs and initiatives will be identified through a multi-stakeholder working group led by existing staff resources. Approval of additional resources will be brought forward in future budget approval process.
Action 6.3: Improve monitoring, data collection, and notification surrounding flooding and extreme weather/temperatures.	Substantial coordination efforts required. A feasibility plan to determine components, thresholds and ongoing resources will need to be brought forward for approval in future budget approval process.
Resilient Theme 3: Natural Environment, Agriculture and Water	
Action 7.1: Continue to enhance the management and restoration of existing natural areas and seek opportunities to	Cross-connections with goals and objectives of Hamilton's Urban Indigenous Strategy. The implementation plan includes the development of a Circle of Indigenous Knowledge Keepers to help

Transformations, Resilient Themes and Proposed Actions	Comments on Resource Implications
dedicate land and natural areas for conservation	inform and collaborate on these actions. Cost estimates to be determined and will be brought forward in future budget approval process.
Action 8.1: Work with local partners to continue tree planting and preservation, explore community partnerships and naturalization programs to reduce urban heat island and enhance ecosystem function	Capital costs and staffing needs to be determined through further development of this action in coordination with Urban Forest Strategy, proposed Climate Change Office and community organizations. Any budget approvals will be brought forward in future budget approval process.
Action 8.2 Implement the Urban Forest Strategy, and consider additional measures to support it or expand its impact	Capital costs and staffing needs to be determined through further development of this action in coordination with Urban Forest Strategy, proposed Climate Change Office and community organizations. Any budget approvals will be brought forward in future budget approval process.
<p>Action 9.1: Educate and encourage community to participate in growing food locally (e.g. lot level or urban farms/gardens)</p> <p>Action 9.2: Expand rain water capture (i.e. rain barrels, cisterns, etc.) as an irrigation source for more localized food production (i.e. backyard farming, urban gardens, soft landscapes, etc.)</p> <p>Action 9.3 Engage with local agricultural leaders to understand existing resources for farmers in addressing climate</p>	Food systems-wide approach be taken to implement actions (9.1, 9.2, 9.3 and 9.4). Additional capital and staffing needs to be determined further through Hamilton Food Strategy review. Any budget approvals will be brought forward in future budget approval process.

Transformations, Resilient Themes and Proposed Actions	Comments on Resource Implications
<p>adaptation, and how the City can support or expand on those efforts.</p> <p>Action 9.4: Develop an education campaign directed at restaurant and grocery industries, local farms and other possible food sources to better reduce and divert food waste and explore opportunities to reduce food waste.</p>	
<p>Resilient Theme #4: Energy and Economy</p>	
<p>Action 10.1: Provide guidance to local businesses on how to maintain business continuity (e.g. supply chain) during extreme weather (i.e. through business continuity planning, green business practices, adaptation measures, etc.)</p>	<p>It is currently estimated this action will be led with existing staffing in Planning and Economic Development with support from Climate Change Office and support and potential being led by external community organizations. Any additional funding approvals/requests for the City will be brought forward in future budget approval processes.</p>
<p>Action 11.1: Work with local partners to conduct vulnerability and risk assessments on local energy systems and identify opportunities to increase local energy generation (e.g. microgrids) to increase reliability (potentially as part of planned CEEP priority actions around identifying renewable energy generation sites within the City)</p>	<p>Capital costs and staffing to be determined through further development of this action in coordination with external stakeholders, including the Independent Electricity System Operator, local utilities, District Energy providers, etc. Any budget request would be brought forward through a future budget approval process.</p>

Transformations, Resilient Themes and Proposed Actions	Comments on Resource Implications
Action 11.2: Establish low-carbon back-up power systems in all City-owned facilities to serve as community hubs during emergencies, and create a policy to support and promote the use of low- or no-carbon emergency energy supplies such as batteries or energy storage for residents and businesses	Existing resources are available for components of this action but further review of this action is needed to determine resource needs and future capital costs. Budget request for any future studies to be brought forward in future budget approval process.



HAMILTON'S CLIMATE ACTION STRATEGY IMPLEMENTATION RESOURCES AND GOVERNANCE

General Issues Committee

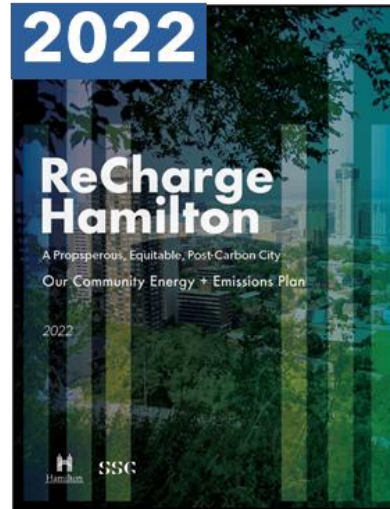
August 8, 2022

Historical Action on Climate Change

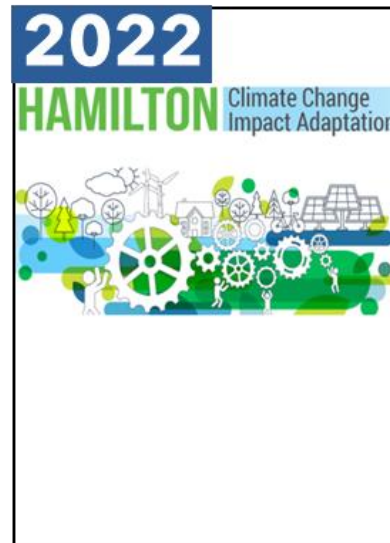
- 2019 – 2021 Tax and Rate **Climate Change positive investments of ~\$57.3 M including:**
 - Bicycle Infrastructure - \$6.46 M
 - Park/Forestry/Tree Planting - \$37.38 M
 - Vehicle/Equipment Electrification - \$596 K
 - Stormwater Flooding and Drainage - \$9.0 M
 - Bay Area Climate Change Council - \$320 K
- **Corporate** total (tCO₂) estimated **reduction of 51% in 2020** based on 2005 baseline*
- **Community** total (tCO₂) estimated **reduction of 40% in 2020** based on 2006 baseline* (based on preliminary utility data provided; subject to change)

*2020 GHG emissions are an anomaly from result of pandemic related shut-downs reducing transportation demand and industrial output. Community-wide emissions across GTHA rose 2% between 2015 and 2019 (Source: <https://taf.ca/gtha-carbon-emissions/>)

Background



**Climate Mitigation –
Community Energy and
Emissions Plan (CEEP)**



**Climate Adaptation –
Climate Change Impact
Adaptation Plan**

Council Direction

General Issues Committee June 1, 2022 (GIC 22-011)

- Directed staff to undertake final public and stakeholder consultations on CEEP and CCIAP and report back to GIC with results.
- Directed staff to report back to GIC on recommended approach for establishing an advisory committee structure for Hamilton's Climate Action Strategy with a deadline of August 8, 2022.
- Directed staff to report back to GIC on a recommended scope, governance and organizations structure, and resourcing for centralized implementation, monitoring and reporting of Hamilton's Climate Action Strategy with a deadline of August 8, 2022.

Recommendations

(a) & b) Recommending approval of Hamilton's Climate Action Strategy consisting of the two final plans:

- Appendix "C" - ReCharge Hamilton – Our Community Energy + Emissions Plan (CEEP); and
- Appendix "D" - Hamilton's Climate Change Impact Adaptation Plan

(c) Recommending receiving supporting studies and reports including:

- Appendix "A" – Final Consultation Report;
- Appendix "B" – Costs of Climate Change Report; and
- Appendix "E" – Resource Considerations.

(d) Recommending staff be directed to prepare Draft Terms of Reference for Climate Change Advisory Committee of Council for the 2022-2026 Council Term

Recommendations Cont'd...

(e) Recommending to establish a Climate Change Office within the Planning and Economic Development (PED) Department, and implement following changes:

- I. Create a Director of Climate Change Initiatives position with estimated annual costs of \$215,000 inclusive of salary and non-salary costs (1 permanent FTE); and
- II. Transfer the Senior Project Manager, Public Health Services to the Climate Change Office, with no impact on the levy.

(f) Recommending directing staff to bring forward in 2023 Operating Budget for Council's consideration for the creation of two additional permanent positions within the Climate Change Office

Recommendations Cont'd...

(g) Recommending staff be directed to review function and role of Energy Office within the Energy, Fleet and Facilities Management Division, and any other potential service areas, and report back to Council with any recommended organizational changes for alignment and integration with Climate Change Office.

(h) Recommending referral of the City of Hamilton's annual contribution of \$160,000 to the Bay Area Climate Change Office to the 2023 Operating Budget for Council's consideration.

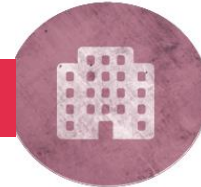
(i) Recommending removal of associated Outstanding Business List Item (OBL) relating to Hamilton's Climate Action Strategy and associated departmental resource considerations for climate mitigation and adaptation.

CEEP: 5 Low-Carbon Transformations for City and Community

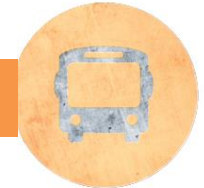
TRANSFORMATION 1: Innovating our Industry



TRANSFORMATION 2: Transforming Our Buildings



TRANSFORMATION 3: Changing How We Move



TRANSFORMATION 4: Revolutionizing Renewables



TRANSFORMATION 5: Growing Green



CCIAP: 4 Theme Areas for Climate Change Impact Adaptation Actions

THEME 1: Built Environment/Systems



THEME 2: People and Health



THEME 3: Natural Environment, Agriculture and Water

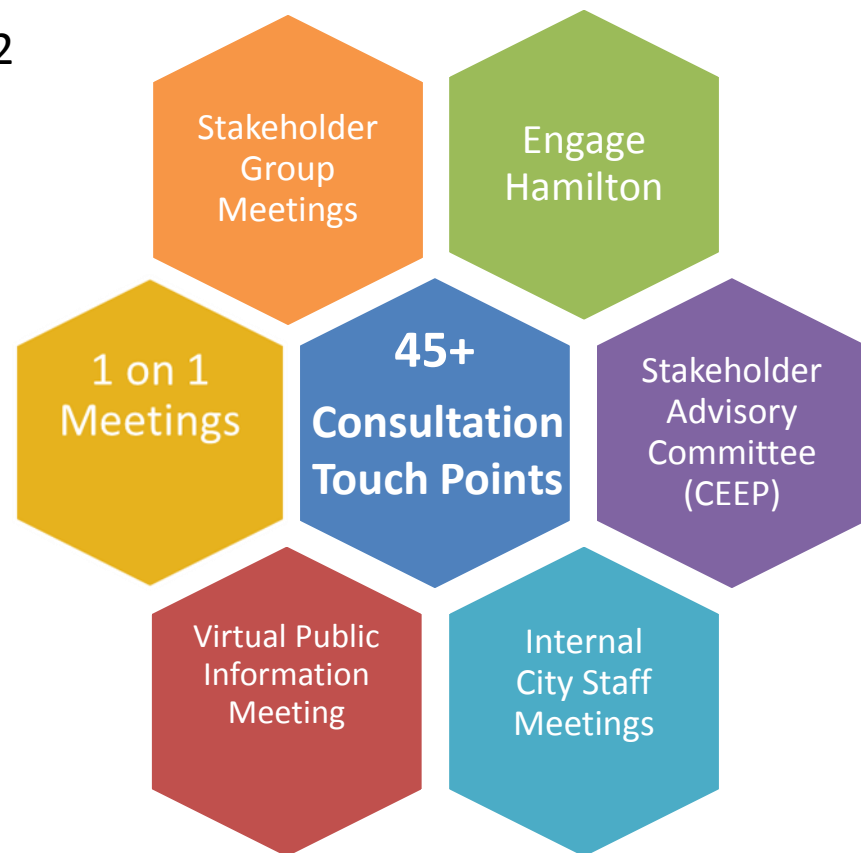


THEME 4: Energy and Economy



Final Engagement and Consultation

- Final engagement period - June-mid July 2022
- Meetings with stakeholders, community organizations and individuals
- General public engagement – virtual
- Internal City staff engagement
- CEEP and CCIAP engagement was tandem where possible
- Implementation and governance-focused



Appendix “A” – Final Consultation Report

What We Heard

On the Climate Action Strategy...

- **Appreciation** for the depth of research and analysis and overall work completed on the plans
- Need to **be bold** in decisions on actions and implementation needs to be accelerated.
- High level of interest in advancing **green building and development standards**
- Many **organizations are excited and willing to contribute** and support actions. Many asked “how can we help?”
- **Natural area protection and tree planting** and tree protection is important for mitigation and adaptation
- Need to pursue **on-going, meaningful engagement** on actions with Indigenous communities

What We Heard

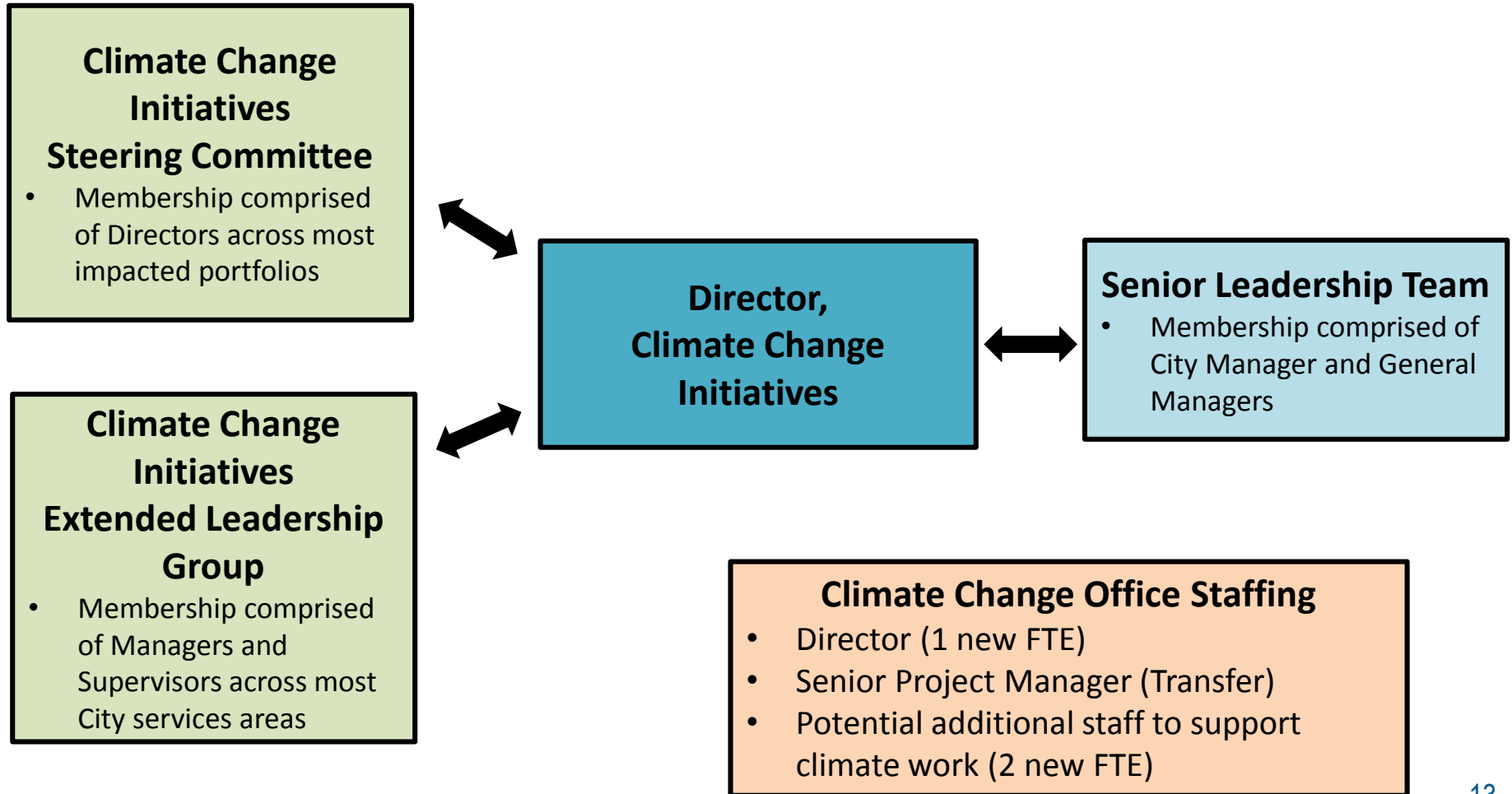
On the Proposed Climate Change Office...

- Relationship between departments and climate change office still needs to be clarified and should have regular connection with department heads.
- Needs to play large role in education and information on actions and have sufficient budget to maintain functions.
- Should have a strong, passionate director and qualified staff.

On the Climate Change Advisory Committee...

- Membership should include representation from community members including BIPOC, equity-seeking communities and have racial and economic diversity.

New Climate Change Office

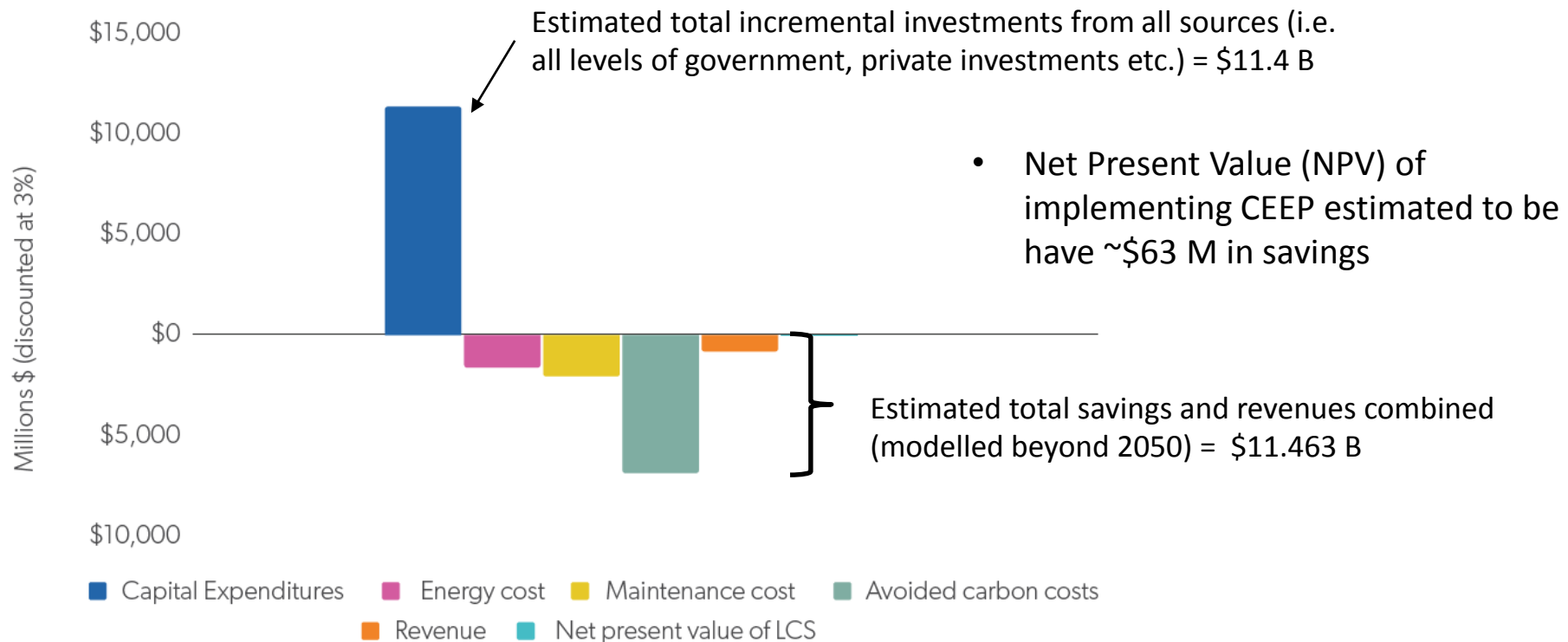


Climate Change Advisory Committee of Council

- Advisory Committee to Council
- Representative of Hamilton's diversity with equity and inclusion embedded through-out
- Terms of Reference to be developed for 2022-2026 Council Term
- Supported by Climate Change Office

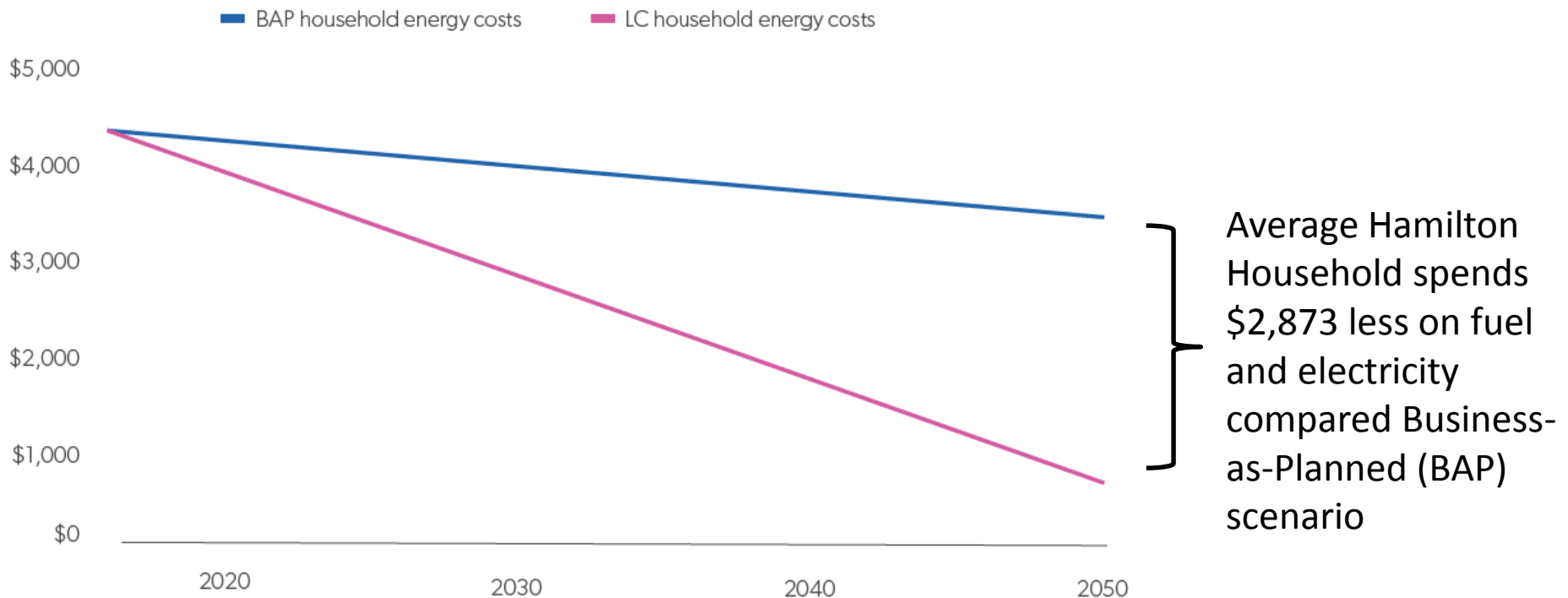
Economic and Financial Analysis - CEEP

Figure 7. Present values of net-zero scenario costs, savings, and the net present value of the scenario (Adapted from Appendix “C” p. 79)



Economic and Financial Analysis - CEEP

Figure 7. Average annual household energy costs in the net-zero and business-as-planned scenarios, 2021-2050 (Adapted from Appendix “C” p. 82)



Climate Change Costs to Canadian Communities - CCIAP

ICLEI Canada developed a municipal, provincial and national assessment and research report as Appendix “B” on 4 (of the 13) climate risks Hamilton is likely to experience:

RISK 1: Increasing frequency of extreme precipitation events leading to overland flooding and damage to buildings and homes

Related Cost to this Risk:

- Climate change projected to add an **additional \$47 B** in operating and maintenance costs to Ontario buildings and facilities by end of the century (The Financial Accountability Office of Ontario Report) (Appendix “B” p. 16)

RISK 2: Increasing temperature and precipitation leading to increased replacement and maintenance cost of roads and transportation infrastructure

Related Costs to this Risk:

- Temperature-related damage is projected to be the costliest of climate impacts on transportation infrastructure, accounting for 87% of expected costs (Ness et al., 2021).
- At the municipal level, projections indicate climate change-induced damage to road maintenance and repairs could cost an **additional \$3.1 B annually** by 2050 (CICC, 2021) (Appendix “B” p. 27)

Climate Change Costs to Canadian Communities - CCIAP Cont'd...

RISK 3: Increasing frequency of extreme precipitation events leading to overland flooding and loss of local business and public services.

Related Cost to this Risk:

- Estimated across Canada there are over 5,000 healthcare centres across Canada (1,440 in Ontario) at risk of flooding that can disrupt medical supply chains and critical services (Clark et al., 2021)
- In 2013 Alberta floods estimated workforce was unable to work over two-weeks; equivalent of **5.1 M hours of lost work and \$601 M of lost economic output** (Sawyer et al., 2020) (Appendix “B” p. 33)

RISK 4: Increasing frequency of extreme heat resulting in negative health outcomes, particularly to vulnerable populations, from reduced air-quality and increased heat-stress.

Related Costs to this Risk:

- In Quebec there are estimates of health expenditures attributed to climate change (e.g. increased vector-borne diseases, extreme heat events and aeroallergens) at **just under \$1 B over 50 years** through 2065. (Boyd & Markandya, 2021).
- Climate change can increase mental health stressors (e.g. grief, worry, anxiety etc.) and some medications including those for schizophrenia, increase heat sensitivity and likelihood of negative health outcomes (Government of Canada, 2011) (Appendix “B” p. 39)




Hamilton

THANK YOU



CITY OF HAMILTON
CITY MANAGER'S OFFICE
Digital and Innovation Office
and
HEALTHY AND SAFE COMMUNITIES DEPARTMENT
Public Health Services - Healthy Environments Division
and
PLANNING AND ECONOMIC DEVELOPMENT DEPARTMENT
Economic Development Division

TO:	Mayor and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	Hamilton Region Decarbonization Hub (CM220013/HSC22046/PED22176) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Cyrus Tehrani (905) 546-2424 Ext. 2261 Trevor Imhoff (905) 546-2424 Ext. 1308 Norm Schleeahn (905) 546-2424 Ext. 2669
SUBMITTED BY: SIGNATURE:	Cyrus Tehrani Chief Digital Officer & Director of Innovation City Manager's Office 
SUBMITTED BY: SIGNATURE:	Kevin McDonald Director, Healthy Environments Division Healthy and Safe Communities Department 
SUBMITTED BY: SIGNATURE:	Norm Schleeahn Director, Economic Development Planning and Economic Development Department 

RECOMMENDATION(S)

OUR Vision: To be the best place to raise a child and age successfully.

OUR Mission: To provide high quality cost conscious public services that contribute to a healthy, safe and prosperous community, in a sustainable manner.

OUR Culture: Collective Ownership, Steadfast Integrity, Courageous Change, Sensational Service, Engaged Empowered Employees.

**SUBJECT: Hamilton Region Decarbonization Hub (CM220013/HSC22046/
PED22176) (City Wide) - Page 2 of 9**

- (a) That the Hamilton Region Decarbonization Hub, as outlined in Report CM220013/HSC22046/PED22176 and detailed in Appendix “A” and Appendix “B” to Report CM220013/HSC22046/PED22176 be approved;
- (b) That should Transition Accelerator be successful in acquiring funding from the other partners in the Hamilton Region Decarbonization Hub as outlined in Appendix “A” to Report CM220013/HSC22046/PED22176 that staff be authorized to contribute 7.5 percent of total 4-year funding, or up to a maximum of \$240,000 for the Hub, to be funded equally between the Economic Development Investment Reserve Account 112221, Climate Change Reserve Account 108062 and Smart City Capital Project Account 3381959501; and
- (c) That should the Transition Accelerator be successful in obtaining the funding as outlined in Appendix “A” to Report CM220013/HSC22046/PED22176, Council approve the single source procurement, pursuant to Procurement Policy #11 – Non-competitive Procurements, for technical and expert consulting services for Hamilton Regional Decarbonization Hub, at the upset limit of \$240,000 and that the City Manager be authorized to negotiate, enter into and execute a Funding Agreement / Memorandum of Understanding and any ancillary documents required to give effect there to with Transition Accelerator and any additional partners in relation to the Hamilton Region Decarbonization Hub, in a form satisfactory to the City Solicitor.

EXECUTIVE SUMMARY

Attaining a net-zero society is a massive undertaking and one of the most critical challenges facing humanity in the twenty-first century. To date, most solutions are being developed sector by sector. The Hamilton Region Decarbonization Hub (the “Hub”) will bridge the gap between a sector-specific emissions reduction paradigm to a regional approach where multiple sectors and sources of emissions are reduced/eliminated. This strategic approach allows for optimal design of supply or value chains for clean energy, while accelerating economic development opportunities and driving decarbonization.

The Hamilton Region Decarbonization Hub presents an evolution sector-based reduction target concepts into a full, regional Decarbonization Hub, centred on both low carbon hydrogen and low carbon electricity and their interconnections. Transition Accelerator will work to leverage City of Hamilton funding contributions to secure higher levels of government and other private funding sources. This funding will be used to create this Decarbonization Hub that will work through The Transition Accelerator’s Blue Print for Change that includes an iterative methodology that aims to:

- Understand the systems that is being transformed, the strengths, weaknesses, technology, business model and social innovations poised to disrupt existing systems;

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**SUBJECT: Hamilton Region Decarbonization Hub (CM220013/HSC22046/
PED22176) (City Wide) - Page 3 of 9**

- Codevelop technical feasibility pathways in concert with key stakeholders and innovators drawn from industry, government, Indigenous communities, academia, and other groups which is informed by the first step;
- Analyse and prioritize pathways to assess costs, benefits, trade-offs, to create compelling and credible business cases that include major GHG emission reductions;
- Advance the journey of the most capable decarbonization pathways by informing innovation strategies, engaging partners and helping to launch consortia-led projects within a Hub formation.

The Hamilton Region Decarbonization Hub proposes that the challenge of decarbonizing, be reframed from sector-specific decarbonization into a system level change, where solutions to decarbonize local industry can also help decarbonize other sectors and emissions sources such as transportation, buildings, and other industries (i.e. Advanced Manufacturing). These sectors represent Hamilton's three largest sources of emissions with industrial, transportation and residential/commercial representing 64%, 19%, and 14% respectively from Hamilton's 2016 community energy and emissions baseline year.

This initiative falls in line with the City of Hamilton's mission to reach net-zero carbon emissions by 2050, which was borne out of the City Council's approved motion declaring a climate change emergency in 2019. In addition, it aligns across various city priorities specifically – Economic Development Action Plan, pending Advanced Manufacturing Strategy, Climate Change Action Strategy, the Community Energy and Emissions Plan technical pathway to net-zero, and the Smart City/Intelligent Community focus areas.

Alternatives for Consideration – Not Applicable

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: There is a \$240,000 financial implication to be supported, equally split between Economic Development Investment Reserve Account 112221, Climate Change Reserve Account 108062 and Smart City Capital Project Account 3381959501. There are no additional budgetary requirements.

Staffing: There are no additional staffing implications for the city to support the Hub. Resource support will be supported by existing staffing compliment within Digital, Innovation and Strategic Partnerships, Economic Development and Healthy & Safe Communities.

Legal: Legally, the Hub will be accountable to the individual funding entities as prescribed in the legal documents formalizing the relationship between the

**SUBJECT: Hamilton Region Decarbonization Hub (CM220013/HSC22046/
PED22176) (City Wide) - Page 4 of 9**

Hub and the funder. The Hub's Management/Leadership Team will discuss effective progress against Key Performance Indicators (KPIs) detailed in legal documents, agree on desired changes and that those and any changes have final sign-off authority by the City Manager.

HISTORICAL BACKGROUND

The Transition Accelerator (The Accelerator), is a not-for-profit entity that was created to work with researchers, industry, government, elected officials, and Indigenous and civil society leaders to direct disruptions to solve business and social challenges, while building emissions reductions and elimination into the solutions. (Refer to <https://transitionaccelerator.ca/blueprint-for-change/>)

Using the four-step methodology, The Accelerator works with groups to create visions of what a socially and economically desirable net-zero future will look like and build out transition pathways that will enable Canada to get there. The Accelerator's role is that of an enabler, facilitator, and force multiplier that forms coalitions to take steps down these pathways and get change moving on the ground.

In working with communities across Canada, the Accelerator has further refined its methodology and improved its utility while minimizing the cost and time required. Experience that the Accelerator has gained in establishing and operationalizing Canada's first Hydrogen Hub in the Edmonton Region -- Edmonton Region Hydrogen Hub (<https://erh2.ca/>), and in working to explore the feasibility of hubs in other regions across Canada (South-eastern Alberta Calgary, Regina, Moose Jaw, Sarnia-Lambton, Quebec) has propelled the organization to be a trusted body and a voice of authority in creating these solutions.

The Accelerator proposes to launch a Hamilton Region Decarbonization Hub – a first of its kind in Canada. A pilot with a potential of national and international interest and scale, addressing key industries and applicable sectors, is at the intersection of multiple government priorities, including large-scale decarbonization, 2050 net-zero targets, and private and public investment to drive an equitable and sustainable economy in Canada.

This initiative aligns with the City of Hamilton's mission to reach net-zero carbon emissions by 2050, which was borne out of City Council's approved motion declaring a climate change emergency in 2019. The declaration directed staff to start to work on a plan to achieve net-zero carbon emissions by 2050, in line with Intergovernmental Panel on Climate Change (IPCC) recommendations on how to limit global warming to 1.5 degrees Celsius. The Draft Climate Change Action Strategy was received by Council on June 1st, 2022. Within this strategy includes the Community Energy and Emissions Plan (CEEP) which details implementation actions that will transition the entire community to net-zero carbon emissions by 2050.

**SUBJECT: Hamilton Region Decarbonization Hub (CM220013/HSC22046/
PED22176) (City Wide) - Page 5 of 9**

Climate change action is not just an environmental opportunity, but also a social and economic opportunity. The Hub touches on many priority areas identified in the 2021-2025 Economic Development Action Plan received by Council October 20th, 2021. Specific alignment to the Draft Climate Change Action Strategy, Community Energy and Emissions Plan and Economic Development Action Plan are outlined in Appendix “B”.

Focusing on environmental and economic opportunities will accelerate Hamilton’s climate change action to reduce greenhouse gas emissions, while supporting economic vitality and global competitiveness. Supporting this innovative Hub will help to improve Hamilton’s environmental and economic resiliency, which in turn will help Hamilton continue now, and in the future, to be the best place to live, play and work.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

The proposed single source procurement of technical and expert consulting services to create the Hamilton Region Decarbonization Hub with Transition Accelerator is in accordance with By-law 20-205 as amended, the City’s Procurement Policy, Policy 4.11 Non-Competitive Procurement.

RELEVANT CONSULTATION

Relevant consultations were held with the following parties internally and within the City of Hamilton:

- Digital, Innovation and Strategic Partnerships, City Manager’s Office
- Government Relations and Community Engagement, City Manager’s Office
- Air Quality and Climate Change, Healthy and Safe Communities
- Economic Development, Planning and Economic Development
- Legal and Risk Management, Corporate Services

Relevant consultations held with the following external parties include:

- Arcelor Mittal Dofasco (AMD)
- Bay Area Climate Change Council
- Canadian Steel Producers Association (CSPA)
- Energy suppliers: Atura, Air Liquide, Mitsui, Suncor
- Federal Economic Development Agency for Southern Ontario (FedDev Ontario)
- Hamilton Anchor Institutions Leadership (HAIL)
- Hamilton Chamber of Commerce
- Hamilton Utilities Corporation & Hamilton Community Enterprise
- Ontario Ministry of Energy

**SUBJECT: Hamilton Region Decarbonization Hub (CM220013/HSC22046/
PED22176) (City Wide) - Page 6 of 9**

- Ontario Ministry of Economic Development, Job Creation and Trade (MEDJCT)
- Ontario Ministry of the Environment, Conservation and Parks (MECP)
- McMaster University
- Mohawk College
- Natural Resources Canada (NRCAN)
- Stelco

ANALYSIS AND RATIONALE FOR RECOMMENDATION(S)

The Government of Canada passed the Canadian Net-Zero Emissions Accountability Act, which has adopted by Parliament in June 2021, which requires the development of emission reduction targets to drive Canada to a net-zero society by 2050. For some sectors like personal transportation, there are already viable commercial offerings like electric passenger vehicles and existing net-zero compatible energy supplies like clean electricity grids. Governments have recognized this opportunity for early action and are implementing policy, regulation, and funding to speed the transition to zero emitting vehicles.

However, sector specific emissions reduction plans, the staple of a 30-year phase of emissions reductions, are increasingly being understood to be insufficient to drive Canada to net-zero emissions by 2050 in the world's current paradigm of emissions elimination. In response, leaders including the Federal Minister of Natural Resources have been calling for the development of new decarbonization models that recognize the interconnectivity of the value chains of sectors like heavy industry, transportation, energy and buildings.

Further, the global consumers will soon require the decarbonization of full supply chains, not simply the decarbonization of product production processes. Global businesses now understand this is a must. For example, Toyota is asking suppliers to report Carbon Dioxide (CO₂) emissions on an annual basis and commit to an annual reduction of at least 2%, in addition to other environmental initiatives that focus on carbon, water, materials and biodiversity. Another example is Volvo Group, who within the partnership with SSAB (a Swedish steel company), has launched a way for a more sustainable transport and infrastructure system adopted for the future by collaboration with SSAB on development, serial production, and commercialization of the world's first vehicles made of fossil-free steel.

For companies committed to limiting their footprint and decarbonizing, it is imperative to look beyond one's own operations to identify opportunities for improvement both up and down the supply chain. By demanding better, more sustainable products, customers can be the impetus for change.

**SUBJECT: Hamilton Region Decarbonization Hub (CM220013/HSC22046/
PED22176) (City Wide) - Page 7 of 9**

Additional and accelerated action to transition to a prosperous net-zero carbon community is an environmental, health and economic opportunity. The Hamilton Region Decarbonization Hub proposes an innovative coalition to address Hamilton's largest greenhouse gas emission sources. According to the Draft Hamilton's Climate Change Action Strategy, specifically the Community Energy and Emissions Plan (CEEP), if Hamilton continues on its 'Business-as-Planned' scenario, it is expected community-wide emissions will increase by approximately 10% from the 2016 modelled baseline.

Industrial emissions are currently Hamilton's largest greenhouse gas emission sources, representing 64%, or 5,594,389 tonnes of Carbon Dioxide Equivalent (CO₂). By and large steel production represents the vast majority of these emissions. The Hamilton Region Decarbonization Hub is an innovative coalition that will bring together leading expertise and talent to address these, and other emission sources. This work will form an important part of Hamilton's Climate Action implementation strategy as it relates to the Low-Carbon Transformations within the CEEP. Although the agreements and/or memorandum of understandings still need to be created, it is intended the Hub will help to achieve the following actions:

Low-Carbon Transformation #1: Innovating Our Industry

- Establish a net-zero industrial working group and zero emissions industry program
- Establish and support a clean-tech accelerator

Low-Carbon Transformation #3: Changing How We Move

- Establish a commercial fleet decarbonization working group

Low-Carbon Transformation #4: Revolutionizing Renewables

- Technical analysis of green hydrogen potential and creation of a hydrogen hub

Further alignment with the draft Hamilton's Climate Action Strategy and with the approved Economic Development Action Plan, including additional potential spin-off benefits for environmental, social and economic benefits see Appendix "B" attached Report CM22013/HSC22046/PED22176.

There is potential for innovative pilot projects and research that would be co-created within the Hub including (but not limited to):

- Low-carbon/net-zero carbon solutions for Steel sector logistics and transportation;
- Reducing/eliminating emissions in industrial on-site equipment fleets;
- Integrating hydrogen as complimentary to renewable energy power generation;
- Techno-economic analysis on assessing future clean electricity supply and demand requirements for decarbonization; and

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**SUBJECT: Hamilton Region Decarbonization Hub (CM220013/HSC22046/
PED22176) (City Wide) - Page 8 of 9**

- Techno-economic analysis on what economies of scale can be achieved in a clean hydrogen and Carbon Capture System (CCS) market that benefit industrial users.

Emissions elimination has also emerged recently as a dominant global investment paradigm. Jurisdictions that can convince investors that they have a credible, capable and compelling plan to drive to net zero emissions will quickly become preferred jurisdictions for investment. The model proposed here is purpose-fit designed to create pathways to net-zero emissions for Hamilton and creating a world leading jurisdiction that is driving emission-free economic development from theory to practice.

ALTERNATIVES FOR CONSIDERATION

Council may decide not to endorse the idea of Hamilton Regional Decarbonization Hub, or revise the total funding proposed from the City of Hamilton.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Community Engagement and Participation

Hamilton has an open, transparent and accessible approach to City government that engages with and empowers all citizens to be involved in their community

Economic Prosperity and Growth

Hamilton has a prosperous and diverse local economy where people have opportunities to grow and develop.

Healthy and Safe Communities

Hamilton is a safe and supportive City where people are active, healthy, and have a high quality of life.

Clean and Green

Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

Built Environment and Infrastructure

Hamilton is supported by state-of-the-art infrastructure, transportation options, buildings and public spaces that create a dynamic City.

APPENDICES AND SCHEDULES ATTACHED

Appendix “A” to Report CM220013/HSC22046/PED22176: Proposed Hamilton Region Decarbonization Hub Funding Breakdown

**SUBJECT: Hamilton Region Decarbonization Hub (CM220013/HSC22046/
PED22176) (City Wide) - Page 9 of 9**

Appendix “B” to Report CM220013/HSC22046/PED22176: Draft Climate Change Action Strategy, Community Energy and Emissions Plan and Economic Development Action Plan Alignment

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Appendix "A" to Report CM22013/HSC22046/PED22176

Page 1 of 1

Proposed Hamilton Region Decarbonization Hub Funding Breakdown

<u>Hamilton Regional Decarbonization Hub</u> <u>Proposed Funding Breakdown</u>	2022-2023	2023-24	2024-25	2025-26	TOTAL	Total %
Funding Source						
<i>Government funding</i>						
Federal Economic Development Agency for Southern Ontario (FedDev ON)	\$ 350,000	\$ 350,000	\$ 350,000	\$ 350,000	\$ 1,400,000	43.8
Transition Accelerator	\$ 100,000	\$ 100,000	\$ 100,000	\$ 100,000	\$ 400,000	12.5
Provincial (Ontario Ministry)	\$ 60,000	\$ 60,000	\$ 60,000	\$ 60,000	\$ 240,000	7.5
Municipal (City of Hamilton)	\$ 60,000	\$ 60,000	\$ 60,000	\$ 60,000	\$ 240,000	7.5
Hamilton Chamber of Commerce	\$ 2,500	\$ 2,500	\$ 2,500	\$ 2,500	\$ 10,000	0.3
Hamilton Community Enterprises	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 40,000	1.3
Private / Industry	\$ 117,500	\$ 117,500	\$ 117,500	\$ 117,500	\$ 470,000	14.7
<i>In-kind</i>						
Transition Accelerator	\$ 100,000	\$ 100,000	\$ 100,000	\$ 100,000	\$ 400,000	12.5
					\$ -	
Total	\$ 800,000	\$ 800,000	\$ 800,000	\$ 800,000	\$ 3,200,000	100%

Appendix “B” to Report CM22013/HSC22046/PED22176**Page 1 of 2****Draft Climate Change Action Strategy, Community Energy and Emissions Plan and Economic Development Action Plan Alignment**

Climate Change Action Strategy & Community Energy and Emissions Plan:

The actions related to industrial emission includes:

- Action 1: Establish an Industrial Energy Efficiency and Decarbonization Working Group;
- Action 2: Establish a Clean-tech Accelerator; and
- Action 3: Expand Local Industrial Energy Management Training Programs.

Setting up the Hub will work to directly achieve the first two actions, with several spin-off benefits including potential training programs and developing the technology to support other additional actions described in the CEEP including:

- Action 8: Decarbonize the City’s Transit;
- Action 11: Establish a Commercial Fleet Decarbonization Working Groups (aimed at decarbonizing commercial fleets across Hamilton)
- Action 18: Complete a Technical Analysis of Green Hydrogen; and
- Action 19: Decarbonize and Expand our District Energy Systems.

Economic Development Action Plan:

Under Growing Business and Investment Priority Area:

- Priority 22: Identify opportunities to increase “social”, “local” and “green” Procurement
- Priority 30: Initiate and Implement an updated Advanced Manufacturing Sector Strategy – including Aerospace, Electrical & Autonomous vehicle opportunities

Under Moving Goods and People Priority Area:

- Priority 41: Complete Feasibility Studies for A-line, S-Line and remaining Higher Order Transit (BLAST) Corridors
- Priority 42: Expand Micro-mobility travel options such as Bike Share and E-scooters
- Priority 44: Continue to investigate the potential for On-Demand Transit Services to provide or supplement regular public transit services to, from and within employment areas and community nodes, using the Flamborough On-Demand Service as a pilot
- Priority 46: Update the Goods Movement Sector Strategy
- Priority 50: Encourage new development within the Airport and AEGD to incorporate District Energy Systems to reduce environmental impacts

Appendix “B” to Report CM22013/HSC22046/PED22176**Page 2 of 2**

- Priority 51: Work with Port partners to introduce environmentally sustainable options for cargo movement through container service and increased rail and intermodal operations.

Under the Revitalizing Priority Areas and Placemaking Priority Area:

- Priority 60: Re-envision the existing Hamilton LEEDing the Way Community Improvement Plan to better incentivize environmentally sustainable development and investments
- Priority 62: Revise incentive programs to support the achievement of climate change targets (i.e. supporting the depaving of parking lots to green space, supporting charging stations)

Under the Building Transformational Projects Priority Area:

- Priority 73: Explore and implement decarbonization initiatives with Local Industry
- Priority 74: Promote Hamilton’s District Energy Systems to major construction projects as a climate change benefit and as a low carbon alternative to traditional energy systems
- Priority 75: Encourage new development within the Airport and AEGD to incorporate District Energy Systems to reduce environmental impacts

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Hamilton Region Decarbonization Hub

A new approach to speed progress to Net Zero



Outline:

- 1) The Transition Accelerator's approach and methodology
- 2) Hub concept and Examples
- 3) Hamilton Region Decarbonization Hub (HRDH)

Transition Accelerator Methodology

1

UNDERSTAND

- The history, strengths and weaknesses of existing systems;
- Identify compelling drivers of disruption (*technology, business model, policy & social innovations*)

2

CODEVELOP

- Engage innovative industry, academics, government, others,
- Define shared visions and possible pathways

3

ANALYZE

- Analyze and model pathway alternatives to make them more CREDIBLE, COMPELLING and CAPABLE

4

ADVANCE

- Start the journey:
- Inform innovation/ RD&D strategies
 - Advise decision makers
 - Participate in public debate
 - **Spin-out Consortia-led Projects within a Hub formation**

Engage **motivated** stakeholders including industry, governments, academia, other researchers

Iterative interactions to co-develop visions, chart pathways and validate direction

Empower innovators to drive transformative change. Shift terms of policy debate

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Why The Transition Accelerator?

The Accelerator's role is that of an **enabler, facilitator, and force multiplier** that forms coalitions to take steps down these pathways and get change moving on the ground.

In working with communities across Canada and gaining experience in establishing and operationalizing Canada's first Hub - the Edmonton Region Hydrogen Hub, the Accelerator has further **refined its methodology and improved its utility while minimizing the cost and time required.**

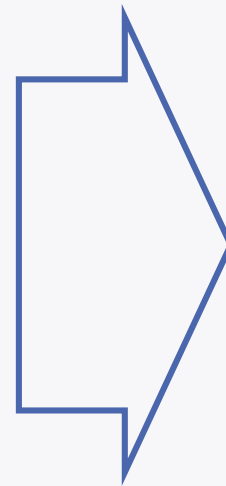
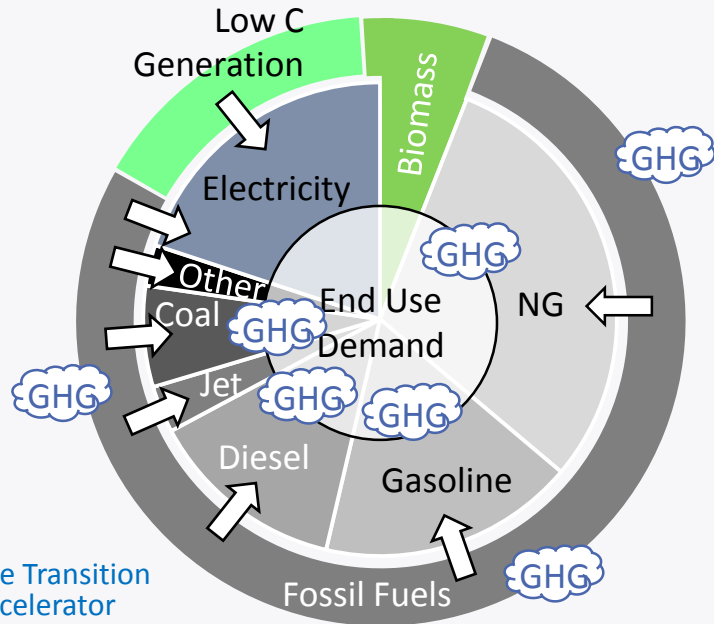
This has positioned the organization to be a **trusted, experienced organization in helping to catalyze these solutions.**



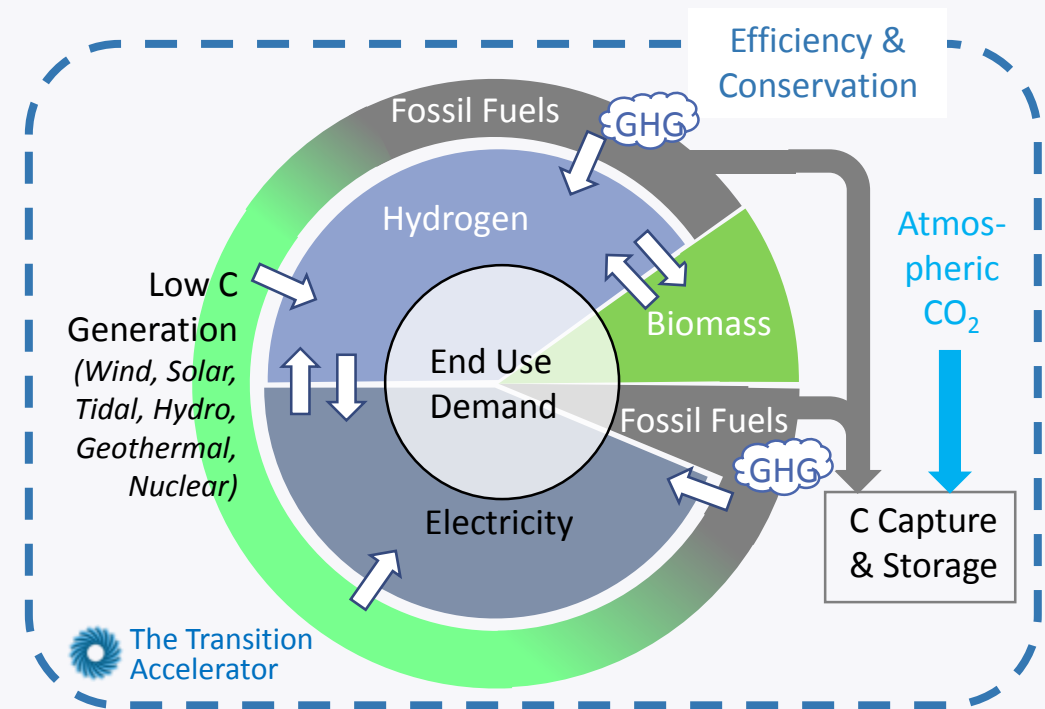
Net Zero Changes Everything

Many ways to reduce emissions
Few ways to eliminate emissions

Existing Energy System



Net-Zero Energy System



A Hub will help create new energy systems to position Hamilton to compete globally and attract investment in a net zero world!

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What is a Hub?

Hubs are coordinated, synergistic, regional initiatives for economic development to create an **economically viable value chains** where clean energy is a fuel and/or a novel industrial feedstock, thereby **achieving substantial reductions in greenhouse gas (GHG) emissions.**

A Hub is not a legal structure but a high-communication, high-trust, high-collaboration model that **leverages up** available funds across public and private sectors and focus investment decisions for all private and public sector actors.

The level of collaboration within a Hub will depend on the nature of the outcomes e.g.: the greater the complexity of the desired outcomes, the greater the level of collaboration required and expected.



Hamilton Region Decarbonization Hub Potential Outcomes



The City of Hamilton (and surrounding region):

- Becomes one of the world's first net-zero emission cities.
 - Leads the world in developing new net-zero value chains and business models that can be adopted by other jurisdictions.
 - Becomes a global example of creating economic development opportunities based on a new net-zero economy
 - Has a reputation as a global Environmental, Social and Governance (ESG) leader based on performance.
-
- **A preferred jurisdiction for public and private investment!**

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Hub Examples

- Joint Australia-Germany led **Energy Transition Hub** will generate collaborative and world-leading research to help the technical, economic and social transition to new energy systems and a low emissions economy.
- **EU Clean Hydrogen Partnership** to decarbonize industry, develop hydrogen 'valleys' to help foster a hydrogen economy
- US Government to invest \$8 billion to build at least **four hydrogen hubs in the US**
- **Lloyd's Register Maritime Decarbonization Hub** accelerates the sustainable decarbonization of the maritime industry, by enabling the delivery and operation of safe, technically feasible and commercially viable zero-emission vessels by 2030.
- **Edmonton Region Hydrogen Hub** – a fit for purpose hydrogen Hub to create a hydrogen value chain in the region and advance energy transition to low-carbon carriers.



Existing Example



EDMONTON REGION Hydrogen HUB

Launched in April 2021 - fit-for-purpose process that:

Breaks vicious cycle:

No Market



No Supply

1) Creates critical mass of new hydrogen markets at regional scale, using existing technology

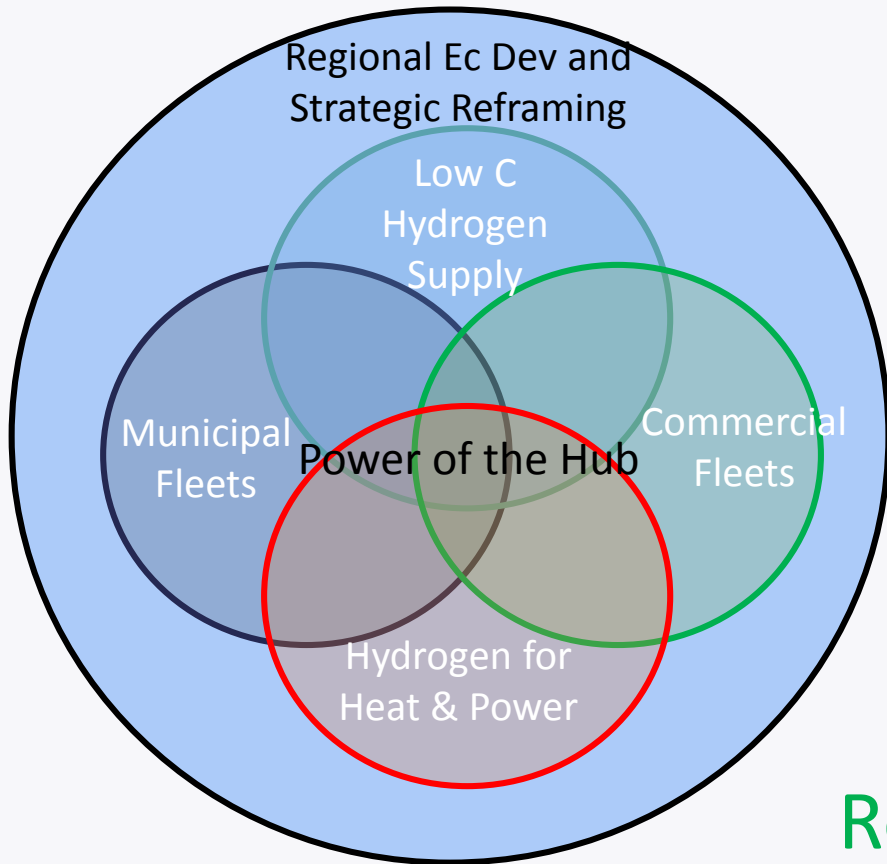
2) Couples new low-cost, low-C supply with new markets – creates hydrogen economy at scale

How?

- **Roles and Responsibilities of Teams** determined
- **Strategic dialogues and techno-economic analysis:** along full value chain
- **Transparency:** results are public, de-risking potential investment
- **Linkages:** Creates coalitions equipped to deliver full value chain solutions
- **Better decision making:** Informs but leaves any investment decisions to public/private investors

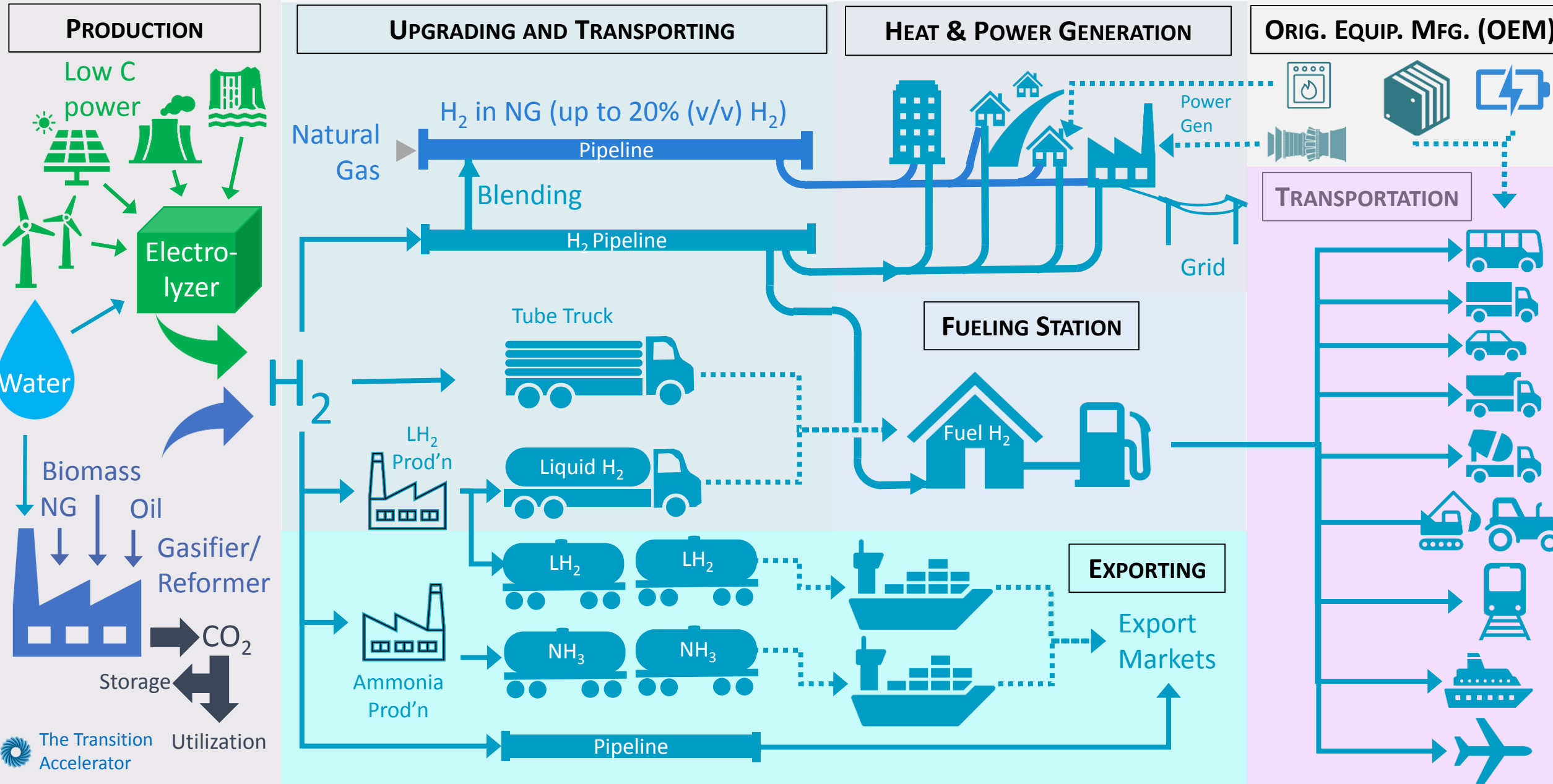
Results to Date: 5 municipalities, key industry, have endorsed new vision for 2032 hydrogen economy and steps need to get there.

Management and Leaders Team





Example of a New Hydrogen Value Chain



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Examples of Projects to Advance Decarbonization

- Replacing diesel to reduce/eliminate emissions in heavy transportation
- Reducing/eliminating emissions in public transportation
- Replacing/reducing natural gas to reduce emissions in buildings
- Reducing/replacing fossil-fuel based energy in industry
- Replacing fossil fuels in Port's operations
- Storing energy from renewable energy sources

Types of Projects to Advance a New Value Chain

<p>Alberta Zero-Emissions Truck Electrification Collaboration (AZETEC)</p> <ul style="list-style-type: none"> • >\$20 million 	      
<p>Fort Saskatchewan Natural Gas Blending Pilot</p> <ul style="list-style-type: none"> • \$5.7 million 	 
<p>Alberta Zero Emissions Hydrogen Transit (AZEHT)</p> <ul style="list-style-type: none"> • \$9.9 million 	       
<p>CP Line Haul H₂ Locomotive Program</p> <ul style="list-style-type: none"> • >\$33 million 	  
<p>H₂-Diesel Dual Fuel (co-combustion) Pilots</p> <ul style="list-style-type: none"> • Multiple projects 	          

Types of Projects to Advance a New Value Chain

<p>H2 Truck Demonstration Road Show</p> 	 <p>AMTA Road Show  Prairies Economic Development Canada / Développement économique Canada pour les Prairies  </p>
<p>Hydrogen Technology Testing</p> <ul style="list-style-type: none"> • In-Situ environmental Chamber • Legacy pipe material research 	 <p> Prairies Economic Development Canada / Développement économique Canada pour les Prairies   <small>A SUBSIDIARY OF ALBERTA INNOVATES</small></p>
<p>Feasibility of additional Hydrogen Fueling Stations</p> <ul style="list-style-type: none"> • Calgary • Mobile • Commercial Scale in Edmonton 	 <p>  • Plus Many Others</p>
<p>Hydrogen for Heat and CHP Microgeneration</p> <ul style="list-style-type: none"> • Exploring feasibility studies 	 <p>  </p>

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The Accelerator proposes to launch a **Hamilton Region Decarbonization Hub (HRDH)**

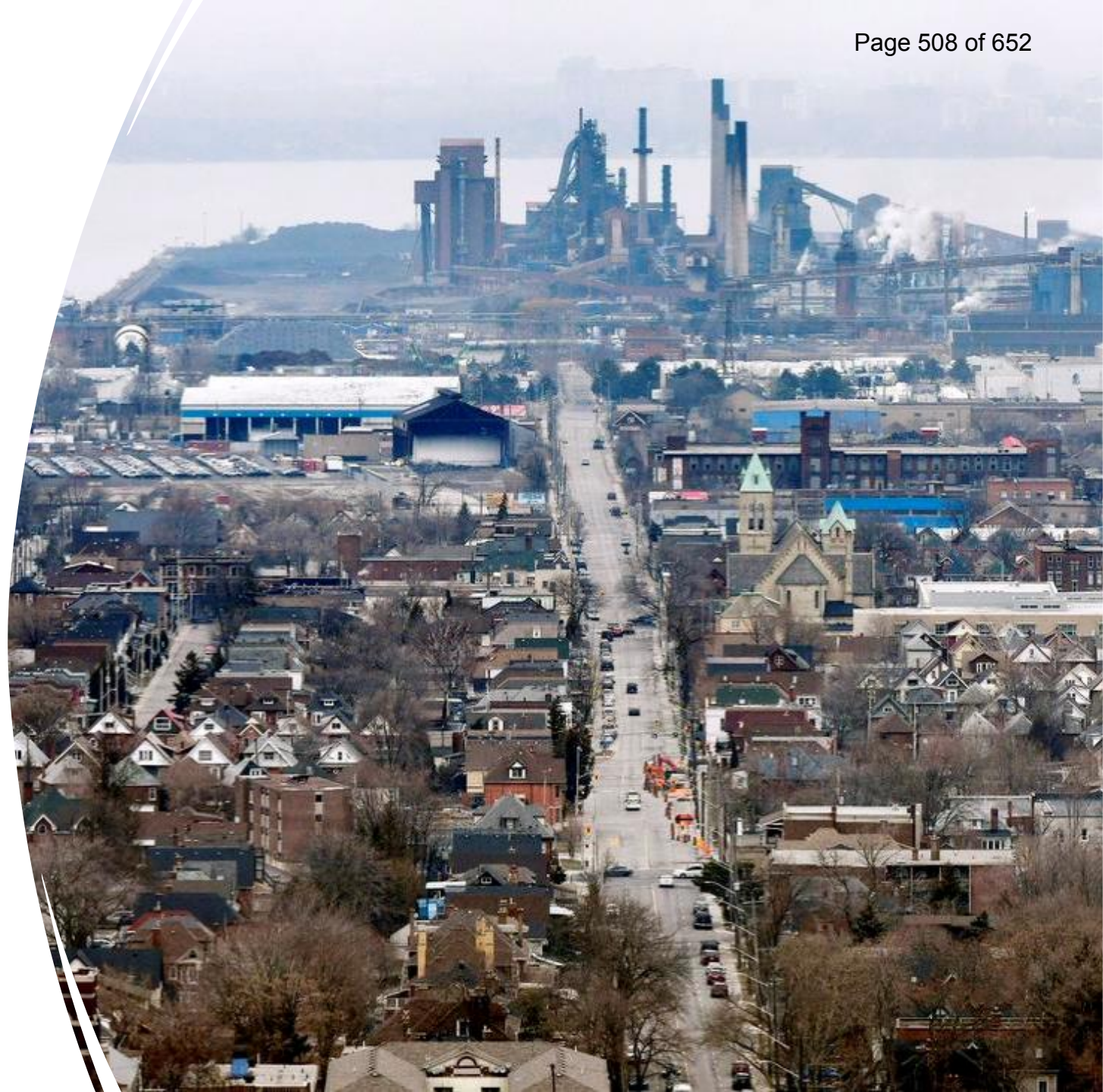
- An **integrated approach for a system level change**, where solutions to decarbonize local industry can also decarbonize other sectors and emissions sources such as transportation, buildings, and other industries (e.g., Advanced Manufacturing).
- A full, regional Decarbonization Hub, centred on **both low carbon hydrogen and low carbon electricity and their interconnections**.

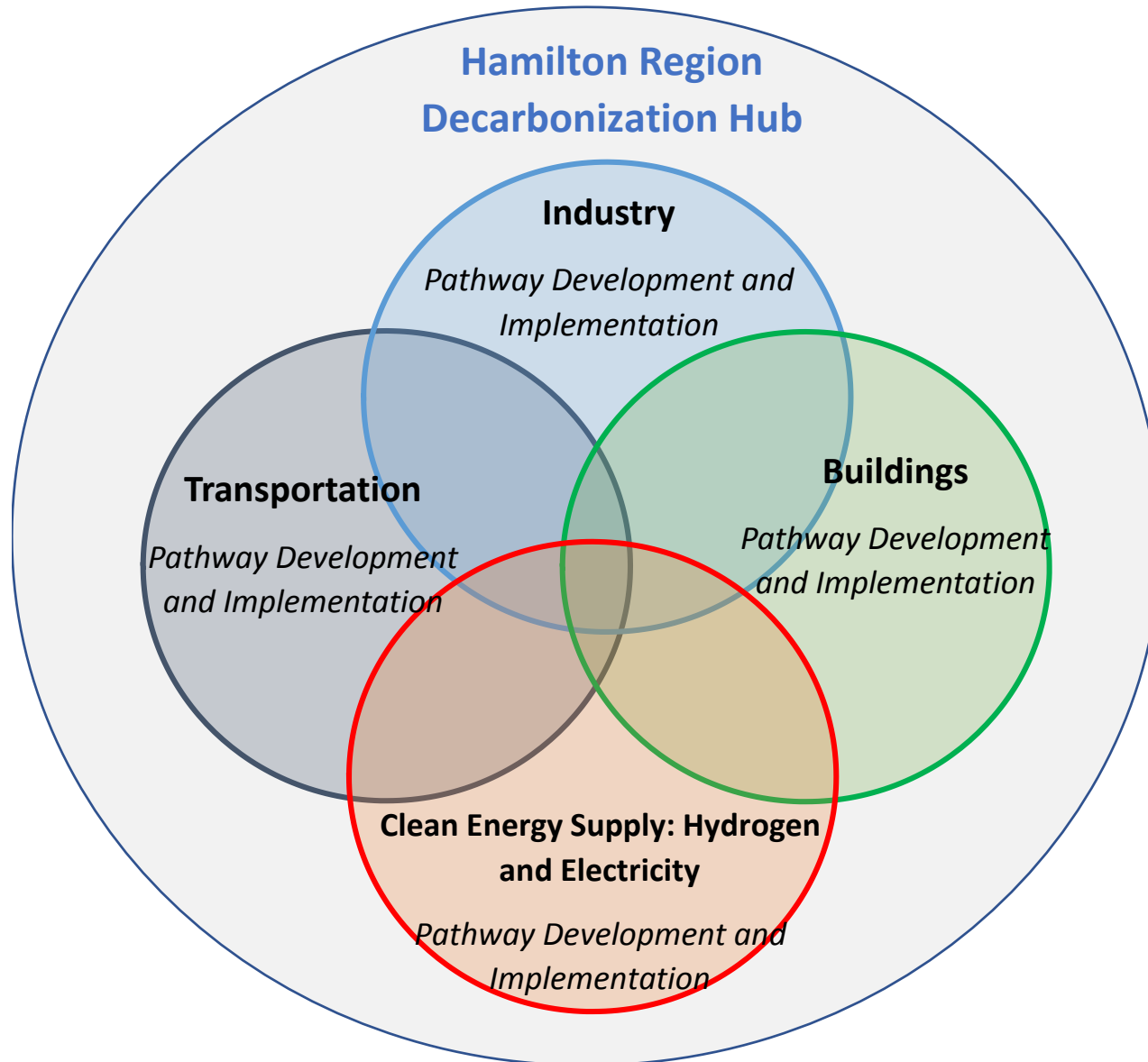
This initiative also falls inline with the City of Hamilton's mission to reach net zero carbon emissions by 2050!



Launching a Hamilton Region Decarbonization Hub

- **First of its kind in Canada!**
- Is a forward-thinking, proactive, and unsilo-ed solution to reach net zero goals
- Bridges the gap between a sector-specific emissions reduction/elimination paradigm to a regional approach where multiple sectors and sources of emissions are eliminated
- Provides a scale of a national project because it's tied to many supply chain industries that need to go to net zero across the country.
- Fits with government priorities of how to utilize government incentives to create a bigger impact from both decarbonization and economic development angles.
- Could service as an example for other regions!





Hamilton Region Decarbonization Hub: A new approach to speed progress to Net Zero

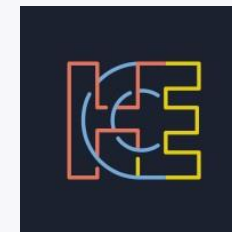
- Evolve from:
 - Sector specific decarbonization
- To:
 - Regional decarbonization
 - Systems based
 - Value chains
 - Market based
 - Synergies

The Transition Accelerator



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We are building the coalition now...



... leading to Hamilton Region Decarbonization Hub



CITY OF HAMILTON
CORPORATE SERVICES DEPARTMENT
Financial Planning, Administration and Policy Division

TO:	Chair and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	2023-2025 Multi-Year Outlook and Capital Financing Plan Update (FCS22064) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Duncan Robertson (905) 546-2424 Ext. 4744
SUBMITTED BY:	Mike Zegarac General Manager, Finance and Corporate Services Corporate Services Department
SIGNATURE:	

RECOMMENDATION(S)

- (a) That the City of Hamilton continue to seek opportunities to partner with senior levels of government in addressing ongoing recovery efforts related to the COVID-19 pandemic in 2022 and 2023;
- (b) That the City of Hamilton appeal to the Province of Ontario for added financial support to address the housing crisis, as well as, additional support for mental health and addiction programs;
- (c) That staff develop a communications action plan to assist ongoing education and advocacy efforts related to the challenges the City of Hamilton is facing in its COVID-19 recovery efforts.

EXECUTIVE SUMMARY

The 2023 budget process has begun internally for programs, services and infrastructure investments for the City of Hamilton's Tax and Rate Supported Operating and Capital Budgets. The purpose of Report FCS22064 is to provide a preliminary estimate of the 2023 to 2025 Tax and Rate Budget outlook, including some description of the factors contributing to the preliminary forecast.

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 2 of 17**

The 2023 to 2025 budget outlook presented to the General Issues Committee (GIC) and Council during 2022 budget deliberations, through Report FCS22002(a), has been updated with the most current information available. This preliminary forecast will continue to evolve as external factors such as inflation, COVID-19 recovery and supply channel challenges unfold and as information that contributes to budget assumptions continue to develop.

Current inflation, supply chain impacts and labour shortages in Ontario continue to pose an issue for municipalities, similarly as it does for households and businesses. The City of Hamilton has experienced many challenges in its ability to purchase items essential to operations such as fuel, chemicals, asphalt and contracted services, as well as, the City's labour, benefits and insurance negotiations. In an effort to combat inflation, the Bank of Canada has increased its overnight rate multiple times this year, most recently a 1.0% or 100 basis points on July 13, 2022, which will put upward pressure on the borrowing rate and the City's ability to finance capital infrastructure. Additionally, at this time, there have been no announcements from senior levels of government for financial support of municipalities in addressing the ongoing pressures and recovery efforts related to the COVID-19 pandemic beyond 2022.

Recognizing that the extraordinary impacts of inflation are also impacting residents and businesses in the community, the focus of 2023 budget preparation is to develop sustainable multi-year balanced budgets that capture the current economic conditions, given the limited tools municipalities have. Beyond the current economic conditions, the continuation of the COVID-19 recovery will require staff to monitor and report back on the expected impacts to the City in 2023 and the level of support from senior levels of government.

The preliminary outlook for the 2023 Tax Supported Budget is an estimated 5.6% municipal net levy increase in order to maintain existing services, provide for legislated changes and introduce enhancements to services that have been previously approved by Council. In addition, there are several projects and program changes that will come before Council for consideration in the 2023 budget that support Council's priorities and the City's Strategic Plan. Inclusive of all known factors, the forecasted total average residential tax increase would be 6.9% in 2023, based on an average assessed value of \$382,000. The preliminary outlook for the 2023 Rate Supported Budget is a 6.5% average increase for water and wastewater fees. Staff will continue to update and revise estimates throughout the budget process as more information comes available and efficiencies can be generated.

There are many financial challenges and opportunities in the multi-year outlook to consider in the development of the annual Budget and Financing Plan. Report FCS22064 provides background information on several factors faced by the City and initiatives underway to limit the financial impact on tax and rate payers, as well as, strategic investments to enhance or sustain municipal services that have been referred to the budget process. Key themes for the 2023 budget include:

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 3 of 17**

- COVID-19 recovery;
- Extraordinary inflation and supply chain impacts for municipal goods and services;
- Debt capacity and cost of borrowing;
- Amendments in provincial funding;
- Asset Management;
- Affordable housing and homelessness;
- Responding to climate change,
- Investments in emergency response services; and,
- Advancing the strategic priorities of Council.

Alternatives for Consideration – Not Applicable

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: The Preliminary Tax Supported Operating Budget pressures and risks identified within Report FCS22064 would result in a levy increase of approximately \$56.0 M or 5.6% for the maintenance of current municipal services, legislated changes and enhancements to services previously approved by Council. Additionally, the Preliminary Rate Supported Operating Budget would result in a forecasted combined average rate increase of 6.5%.

Through the approval of Report FCS22064, there are no financial implications. The General Issues Committee (GIC) and Council will deliberate on the 2023 budget and multi-year outlook in accordance with the 2023 budget schedule to be announced later this year.

Staffing: There are no staffing implications as a result of Report FCS22064. During the budget process, staffing changes are highlighted for Council approval.

Legal: N/A

HISTORICAL BACKGROUND

Council, at its meeting on July 14, 2017, approved GIC Report 17-015 and Multi-Year Budget Planning Sub-Committee Report 17-001 (Report FCS17066) adopting the Multi-Year Business Planning and Budget Policy (“Policy”) for City Departments and forwarding the Policy to Hamilton Police Service, Hamilton Public Library and Hamilton Farmers’ Market Boards for consideration.

Multi-year budgeting strengthens the link between budgeting and strategic priorities and enables Council to implement a multi-year vision, assessing the long-term financial implications of current and proposed operating and capital budgets and policies.

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 4 of 17**

During the 2022 budget process, staff prepared a 2023-2025 Multi-Budget Year Outlook, which was included in the budget book Appendix “A” to Report FCS22002, 2022 Budget Overview and presented by the General Managers and City Manager to GIC and then, later amended as a result of decisions made during 2022 budget deliberations and included as Appendix “G” to Report FCS22002(a), 2022 Tax Supported Operating Budget – Recommendations.

The 2023 Tax Supported outlook prepared during the 2022 budget process projected a levy increase of \$41.2 M and a 4.1% municipal tax increase. The information in Report FCS22064 provides an updated estimate of those preliminary numbers, taking into consideration opportunities and pressures that have materialized since the preparation of the initial outlook during the 2022 budget process, such as, negotiated contractual agreements, legislated changes and pre-approved impacts. During the 2023 budget process, the multi-year budget outlook will also be updated to include the 2026 budget year.

The 2023 forecast for the Rate Supported Operating Budget approved, in principle, through Report FCS21088, 2022 Recommended Water, Wastewater and Stormwater Budget, projected a combined average rate increase of 6.49%. Similarly, to the Tax Supported Budget, this preliminary estimate will be updated during the 2023 budget process.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

N/A

RELEVANT CONSULTATION

Staff has consulted with operating departments and senior leadership in determining the projected tax and rate budget pressures for 2023.

ANALYSIS AND RATIONALE FOR RECOMMENDATION(S)

Budget Direction

Due to the end of this term of Council and the upcoming municipal election, staff is not seeking a recommended budget direction for 2023, which is an approach reflective of what other municipalities have taken. Staff will be preparing the preliminary 2023 Budget and Financing Plan in accordance with the principles outlined in the “Budget Principles” section on page 6 of Report FCS22064 and the multi-year budget and financing plans approved, in principle, through the 2022 budget process.

The preliminary budget will reflect an increase required to maintain existing levels of service and finance previously approved service enhancements, as well as, recommend business cases that advance the strategic goals of the City, in alignment with the

**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 5 of 17**

2016-2025 Strategic Plan and other corporate initiatives. This will be done in consideration of the overall impact on tax and water / wastewater rates, recognizing the financial impact the current economic environment has had on residents and businesses in the community.

There are still many unknown variables related to the impact of COVID-19 on municipal service delivery for the remainder of 2022 and into future years. Staff is monitoring the impacts of COVID-19 and the recovery plan while preparing the 2023 tax and rate supported budgets and will continue to review all City provided services in an effort to generate efficiencies and reduce costs.

As detailed in Report FCS22042, Tax and Rate Operating Budgets Variance Report as at April 30, 2022, presented to the Audit, Finance and Administration Committee on July 7, 2022, the City is forecasting a Tax Supported Operating Budget deficit of \$23.7 M and a Rate Supported Operating Budget deficit of \$2.9 M with both being driven by impacts of the COVID-19 pandemic on municipal services and a lack of funding from senior levels of government to address continued pressures. City staff will continue to work with other municipalities to pursue emergency funding provisions from senior levels of government to address both pressures in the current and ongoing pressures resulting from the pandemic.

Should advocacy efforts be unsuccessful, the City will be required to address the current year deficit and ongoing pressures related to the pandemic through the 2023 budget process. In accordance with the *Municipal Act, 2001*, section 289, the City must prepare a balanced budget and provide for any deficit in the previous year's budget. City Council has set aside \$35.6 M in discretionary funding over the past two years into the COVID-19 Emergency Reserve, resulting from operating surpluses in 2020 and 2021, to address ongoing impacts of the pandemic on municipal operations and recovery efforts. In preparation of the 2023 budget, staff will utilize these funds to the extent possible in order to limit the financial impact of the pandemic response on the 2023 tax rate.

2023 Budget Process Timeline

The Rate Operating and Capital Budgets and Tax Capital Budget are currently scheduled to be presented and deliberated on November 24, 2022 and November 25, 2022, respectively. The Tax Supported Operating Budget deliberations (which sets the tax increase) will commence in January 2023 with an expected approval in March 2023. All budgets will be deliberated at meetings of the General Issues Committee and a detailed budget schedule will be published to the City website (<https://www.hamilton.ca>) and local print media later this year.

Budget Principles

Staff will begin preparations of the Preliminary 2023 Budget, 2024-2026 Multi-Year Outlook and 10-year Capital Financing Plan in accordance with the following principles:

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 6 of 17**

- The annual budget reflects and supports the 2016-2025 Strategic Plan and Term of Council Priorities;
- The annual budget is aligned with the financial policies approved by Council;
- The City's strong financial position and prudent financial management of debt is prioritized to ensure the City's AAA credit rating is maintained;
- All growth-related infrastructure costs that can be recovered under the *Development Charges Act, 1997* will be supported from development charge revenue, including dedicated development charge exemption funding for Council approved exemptions and interim financed through debt or reserves, as necessary;
- The annual budget accounts for the investment required to transition to the expected outcomes of the Strategic Asset Management Policy and the Asset Management Plan;
- All grant funding available to municipalities will be investigated;
- Reserves are maintained per policy in order to repair / replace infrastructure, fund identified priorities and ensure long-term sustainability;
- Maximizes use of the Tax Supported Capital Levy and debt capacity is leveraged to finance capital infrastructure projects in order to limit the impact on taxpayers;
- Total tax and rate supported debt as a percentage of City own-source revenues does not exceed 60% unless approved by Council;
- Total development charge supported debt as a percentage of the total development charge eligible costs for the forecast period of the latest Development Charge Background Study does not exceed 25% unless approved by Council;
- Ongoing expenses are funded from sustainable revenue sources to ensure continuity of services;
- New services, service level enhancements or reductions, increases or decreases to the full-time equivalent staff complement and changes in user fees that have not been previously approved by Council require a Business Case to be deliberated by Council as part of the annual budget process; and
- All proposed 2023 capital projects require an accompanying Capital Detail Sheet to be considered by Council as part of the annual budget process.

2023 – 2025 Tax Supported Operating Budget

Based on updated information, the initial projection for 2023 has been revised to a potential levy increase of \$56.0 M or 5.6% for the maintenance of current municipal services, legislated changes and enhancements to services previously approved by Council. Inclusive of known Business Cases, Council Referred Items and unfunded COVID-19 recovery, the net levy requirement would be \$80.9 M or 8.1% with a total average residential tax impact of 6.9% after factoring in assumptions for growth, education and tax policy.

Table 1 provides the most up-to-date projections for 2023 through 2025, by department, showing the total net levy requirement by year based on assumptions for assessment growth, reassessment, tax policy changes and education tax adjustments.

**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 7 of 17**

TABLE 1

CITY OF HAMILTON UPDATED TAX SUPPORTED 2023-2025 MULTI-YEAR OUTLOOK							
DEPARTMENT	2022 Council Approved	2023 Outlook	%	2024 Outlook	%	2025 Outlook	%
Planning & Economic Development	31,304,660	32,244,430	3.0%	33,012,380	2.4%	33,747,920	2.2%
Healthy and Safe Communities	266,826,350	280,679,800	5.2%	290,470,000	3.5%	301,079,360	3.7%
Public Works	278,758,310	299,555,506	7.5%	311,500,996	4.0%	323,590,996	3.9%
Legislative	5,284,590	5,389,090	2.0%	5,484,680	1.8%	5,582,750	1.8%
City Manager	13,652,960	14,002,450	2.6%	14,290,590	2.1%	14,556,580	1.9%
Corporate Services	38,824,160	40,394,910	4.0%	41,204,270	2.0%	41,942,470	1.8%
Corporate Financials	22,984,458	32,631,878	42.0%	33,209,868	1.8%	33,278,738	0.2%
Non-program Revenues	(51,256,190)	(51,188,290)	-0.1%	(51,125,010)	-0.1%	(51,057,940)	-0.1%
Hamilton Entertainment Facilities	2,337,710	-	-100.0%	-	0.0%	-	0.0%
Hamilton Police Service	183,542,540	187,415,288	2.1%	193,037,747	3.0%	198,828,879	3.0%
Other Boards & Agencies	55,589,870	57,216,750	2.9%	58,457,600	2.2%	59,649,610	2.0%
Capital Financing	145,688,310	151,159,310	3.8%	163,968,310	8.5%	175,002,310	6.7%
Maintenance and Pre-Approved Net Levy	993,537,728	1,049,501,122	5.6%	1,093,511,430	4.2%	1,136,201,673	3.9%
Business Cases and Council Referred Items		13,882,760	100.0%	15,194,660	9.4%	17,194,620	13.2%
Cumulative Net Levy	993,537,728	1,063,383,882	7.0%	1,108,706,090	4.3%	1,153,396,293	4.0%
Potential COVID-19 Recovery	-	22,920,000	100.0%	17,110,000	-25.3%	12,800,000	-25.2%
Contribution from COVID-19 Reserve		(11,903,000)	100.0%	-	-100.0%	-	0.0%
Cumulative Net Levy	993,537,728	1,074,400,882	8.1%	1,110,621,430	4.8%	1,149,001,673	3.6%
Assessment Growth			-1.0%		-1.0%		-1.0%
Impact of Levy Restrictions / Re-assessment			0.1%		0.6%		0.6%
Tax Policy			0.0%		0.2%		0.0%
Education			-0.3%		-0.3%		-0.3%
Average Total Residential Tax Impact			6.9%		4.3%		2.9%

Increases to the net levy are required in order to maintain municipal services, advance strategic priorities that have been identified by Council, provide for requirements of outside boards and agencies and the local school boards, as well as, finance capital infrastructure.

As outlined in Table 2, approximately 45% of the projected increase for 2023 \$36.8 M or 3.7% is related to maintaining existing municipal services. Additional information on the services provided by the City can be found on the City's website at <https://www.hamilton.ca/government-information/trust-and-confidence-report/service-profiles>. The 3.7% maintenance increase is relatively higher than past years (1.6% in the 2022 Tax Supported Operating Budget) as a result of extraordinary inflation pressures in key drivers such as fuel, contracted services, insurance and employee related expenses.

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 8 of 17**

TABLE 2

CITY OF HAMILTON UPDATED PRELIMINARY 2023 TAX SUPPORTED BUDGET OUTLOOK									
	2022	2023 Outlook			Change				
	Council Approved	Maintenance	Strategic Priorities	Preliminary	Maintenance vs. Council Approved		Preliminary vs. Council Approved		
City Departments	608,717,008	640,036,434	34,889,300	674,925,734	31,319,426	5.1%	66,208,726	10.9%	
Boards & Agencies	239,132,410	244,632,038	1,200,000	245,832,038	5,499,628	2.3%	6,699,628	2.8%	
Capital Financing*	145,688,310	145,688,310	7,954,800	153,643,110	-	0.0%	7,954,800	5.5%	
Net Levy	993,537,728	1,030,356,782	44,044,100	1,074,400,882	36,819,054	3.7%	80,863,154	8.1%	
Assessment Growth						(1.0%)		(1.0%)	
Impact of Levy Restrictions / Re-assessment						0.1%		0.1%	
Tax Policy						0.0%		0.0%	
Education Impact						(0.3%)		(0.3%)	
Total Average Residential Tax Impact						2.5%		6.9%	

Several strategic priorities will be coming before Council for consideration in the 2023 budget process that will enhance the current services provided by the City. In total, strategic investments are forecasted to be \$44.0 M or a 4.4% net levy increase for 2023. When combined with the cost of maintaining existing levels of service, the total net levy requirement would be \$80.9 M or 8.1%.

Other factors impacting the total average residential tax rate include the City's rate of growth, levy restrictions for protected property classes and the education rate for the district school boards. Inclusive of the assumptions for these items, the total average residential tax impact would be 6.9% for 2023, inclusive of all Business Cases and Council Referred Items yet to be deliberated by Council.

Net Levy Pressures and Opportunities

Staff is forecasting net levy pressures of \$56.0 M (5.6%), \$44.0 M (4.2%) and \$42.7 M (3.9%) for the years 2023 through 2025, respectively, in order to maintain existing services, provide for legislated requirements and fund enhancements to services previously approved by Council. Additionally, staff has identified strategic investments and recovery programs for Council's consideration in adopting the 2023 budget and multi-year outlook that support the City's Strategic Plan. The following pressures and opportunities outline key themes in the development of the updated multi-year outlook.

- A. Extraordinary Inflation, Supply Chain and Labour Shortages** – The City is experiencing significant inflationary pressures in primary resources such as fuel, asphalt, contracted services and employee related costs. The annual budget for fuel is anticipated to increase approximately 50%. Staff is reviewing long-term projections and available options to reduce the impact in 2023 through temporary reserve financing.

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 9 of 17**

Inflation impacts of fuel have also significantly impacted contracted services secured by the City, such as, waste collection which further adds to the pressures the City will face in 2023. Fuel and asphalt prices, as well as, supply chain issues within the construction industry are expected to continue to impact the City's ability to finance capital works.

Low levels of unemployment and increasing inflation have resulted in a very competitive labour market for employers in Hamilton. Staff is looking into various options in order to remain competitive as an employer of choice. While the City continues to see strong candidate interest in many roles at the City, there are some areas that have identified roles that are particularly difficult to fill caused by a shortage in qualified available applicants. Appendix "A" to Report FCS22064 includes a list of current vacancies at the City and the immediate impact those vacancies have on the delivery of municipal services.

- B. Asset Management** – Through Report PW22048, Core Asset Management Plan, Council approved Asset Management Plans for transportation and waterworks assets in accordance with the provincial regulations introduced through Ontario Regulation 588/17. An annual funding gap of \$94.7 M for tax supported programs was identified based on asset renewal needs and planned operations and maintenance. A \$101.1 M annual funding gap was identified for rate supported programs.

During 2022 budget deliberations, City Council approved the 2023-2031 Capital Financing Plan, in principle, which had included a 0.5% tax levy increase (\$4.8 M) to primarily address deficiencies in state-of-good-repair within the road network. Additionally, the Capital Financing Plan was updated with new allocations for discretionary block funding across all other City programs, increasing annual block allocations by approximately 30% to reflect cumulative inflation over the past decade. The increases in capital block allocations are funded through the reprioritization of debt that will be retired over the next few years. The Capital Financing Plan also included a 0.07% tax levy increase for annual debt repayments of West Harbour strategic investments.

Even with planned increases to the Capital Levy included in the Capital Financing Plan, there will be a significant funding gap for the renewal of assets within the road network and engineered structures portfolios of approximately \$900 M over the 10-year capital plan. The Capital Financing Plan has been updated to reflect a phase-in approach to increase the annual funding amounts for those assets over the 10-year planning period beginning in 2024. This results in an additional \$6.2 M or 0.6% to the 0.5% annual increase that had previously been included in the Capital Financing Plan for a total Capital Levy increase of 1.1% in years 2024 through 2033 to address the annual funding gap.

- C. Affordable Housing and Homelessness** – On December 13, 2013, City Council approved the City's 10-year Housing and Homelessness Action Plan (HHAP), which

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 10 of 17**

was revised through the endorsement of the five-year review reported to Council in August of 2020 through Report CS11017(d). The five-year review of the HHAP was a comprehensive overhaul and refocusing of the HHAP necessary due to significant changes in Hamilton's housing system and its context. As provincial and federal programs evolve, and requests for municipal co-investment in housing projects increase, unprecedented pressures on every segment of the housing continuum are felt as a result of increasing costs, our current economic landscape and unprecedented demand for services and supports in order for individuals to be housed successfully, comprehensive strategies across city government and in partnership with upper levels of government and the community are required to address challenges arising since this five year review was completed.

Significant investments in the multi-year outlook and capital forecast have been endorsed by City Council over the past several years in an effort to combat homelessness and address ongoing concerns of housing affordability. Through the 2023 budget process, there will be additional investments put forward with sustainable financing strategies for Council's consideration in order to keep up with demand for service. The initiatives listed below provide a snapshot of the issues faced in this area and is not an exhaustive list. Staff are seeking Council's support in advocacy efforts with the Provincial government to provide financial contribution in addressing current challenges across all sections of the housing continuum. The housing crisis has led to significant demand for local contributions, which can exacerbate the issue in trying to address social reform issues with regressive taxation tools like property taxes. Increases to the property tax rate will further hinder the issue of housing affordability within the community. Furthermore, additional mental health and addiction support is required to ensure successful tenancies for homeless individuals with significant needs.

The Roxborough Housing Incentive Program (RHIPP) was approved through Report HSC19034, which allows developers of affordable rental or ownership housing units to receive grants to offset the cost of the City's development charges and parkland dedication fees for 10 years after the issuance of a building permit. Total cost of the program is estimated at \$10.47 M over five years. A total pressure of \$1.0 M is required for 2023 to fulfill annual budget requirements of meeting the program.

Through Report HSC22040, Service and Exit Agreements for Community Housing Providers and End of Mortgage, staff has recommended providing additional subsidy to social housing providers for either rent supplements or operating / capital works with an annual net levy impact of \$1.1 M. This item will come before Council in 2023 budget deliberations.

Additionally, development charge exemptions are forecasted as a significant and ongoing challenge faced by non-profit developers and staff will be reporting back to Council in 2023 with program guidelines and financing strategy to provide financial assistance to affordable housing developments by non-profit developers as outlined in

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 11 of 17**

Report HSC22050/FCS22073, Approaches to Addressing the Challenges of Financing Non-Profit Housing Developments.

As identified through Report HSC20020(f), Adaptation and Transformation of Services for People Experiencing Homelessness Update 6, staff has recommended key actions to support the implementation of the first phase of a transition plan until the end of Q1-2023 for the homeless-serving system to support COVID-19 recovery efforts in a planned and gradual manner. It is expected that the phased transition to a more permanent shelter system will occur over the next twenty months and annualized costs associated will be referred to the 2023 budget process.

Since March 2020, there has been unprecedented adaptation to Hamilton's emergency shelter system to work toward better meeting the needs of unhoused residents in Hamilton through various phases of the COVID-19 pandemic. The annual cost of services and supports associated with proposed ongoing service levels for the shelter system emerging out of the pandemic will come before Council in 2023 budget deliberations.

- D. Climate Change** – City Council declared a climate change emergency in March 2019, at that time, joining 435 municipalities world-wide. Since then, the total number of municipalities has reached more than 800 cities around the world, as well as, the Government of Canada, all acknowledging the scale of the climate crisis and the need for accelerated action.

To support the Corporate Climate Change Task Force and Hamilton's Climate Change Action Strategy, City Council established a Climate Change Reserve and Policy with initial funding of \$1.5 M in the disposition of the 2020 tax operating budget surplus. However, to advance the climate change action goals established by the City of Hamilton, consideration of a sustainable funding source for the reserve must be given in future budget years. An estimated 0.25% special levy (\$2.5 M) has been factored into the 2023 budget outlook, which would be contributed towards the Climate Change Reserve, but final determination will come before Council in the 2023 budget deliberations. Additional information on the City's Climate Change Action Strategy is available in Report PED22058 / HSC22030, Hamilton's Climate Change Action Strategy.

- E. Ten-Year Local Transit Strategy** – The annualization of year six and implementation of years seven through ten of the Ten-Year Local Transit Strategy have been incorporated into the multi-year outlook and capital plan as approved through Report PW14015(a). For 2023, a net levy pressure of \$3.3 M is anticipated to support the continuation of the Ten-Year Local Transit Strategy.
- F. Provincial Funding** – Changes in Provincial Funding Agreements are expected to continue to represent a significant budget pressure for 2023. Through 2022, the City has received one-time mitigation funding for Public Health, as well as, Children's

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 12 of 17**

Services and Neighbourhood Development, but there has been no commitment from the Province for 2023 or beyond. In order to ensure service continuity, the City of Hamilton will need to absorb the \$3.6 M of lost annual funding for these programs.

- G. Hamilton Fire Department 10-Year Service Delivery Plan** – Through Report HSC19026, City Council endorsed the Hamilton Fire Department Ten-Year Service Delivery Plan, which includes additional costs for volunteer staffing and equipment, as well as, outfitting and staffing for the Waterdown Station. Based on construction timelines, the outfitting of the Waterdown station will likely occur beyond 2023.

Additionally, at its meeting on May 12, 2021, Council approved a two-year phase-in for the impact of rural fire area rating, which amended the 2021 Tax Operating Budget with a \$1.4 M contribution from the Tax Stabilization Reserve and a corresponding reduction in the 2021 net levy. During 2022 budget deliberations, staff proposed to continue with the \$1.4 M contribution from reserve to provide time for an equitable solution to be presented to Council for consideration during the 2023 budget.

- H. Hamilton Police Service 10-Year Plan** – Hamilton Police Services presented a 10-year plan commencing with the 2022 tax supported operating budget to enhance its overall staff complement by 13 officers in each of the next 10 years. The strategy was proposed in order to bring City services up to a benchmark standard of officers per population, taking into consideration projected growth rates over the planning period. This investment in emergency support services represents approximately \$1.2 M each year.
- I. Hamilton Paramedic Service Master Plan** – City Council adopted the Hamilton Paramedic Service Master Plan on May 26, 2022 through Report HSC22012. This plan provides direction for the service over the next 10 years through technology advancements, innovation, resource allocation and optimization of operations. The plan identifies 29 objectives with corresponding actions to address current and future needs to ensure optimal service delivery under three scenarios. Assuming Model A, the anticipated net levy impact of implementing the plan in 2023 would be \$2.9 M, which includes staffing and outfitting requirements to meet service demand for growth and existing deficiencies as outlined in the plan.
- J. Hamilton Entertainment Facilities (HEF)** – The City of Hamilton has entered into an agreement with the Hamilton Urban Precinct Entertainment Group (HUPEG) to redevelop the First Ontario Centre, Hamilton Convention Centre and First Ontario Concert Hall. In addition to taking on all capital costs for the renewal of Hamilton's downtown entertainment facilities, HUPEG will take over responsibility for operations and maintenance, which is expected to yield a net reduction to the annual tax levy of \$3.0 M. Net levy savings of \$1.9 M was factored into the 2022 tax supported operating budget and the remaining savings will be annualized in the 2023 tax supported operating budget.

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 13 of 17**

- K. **User Fees** – For the purposes of preparing the preliminary multi-year outlook, staff has estimated user fee increases of 2% per year for 2023 to 2025, as well as, planned additional user fees pertaining to the implementation of the Ten-Year Local Transit Strategy.

However, throughout the 2023 budget process, staff will investigate all fees to ensure that user fees are commensurate with the cost of providing the service. As in past years, program areas will work towards full cost recovery, while taking into consideration affordability and equity challenges through targeted subsidy programs.

- L. **COVID-19 Recovery** – The COVID-19 pandemic has resulted in many changes affecting human behavior and impacting the world's economic condition. Municipalities were hit particularly hard as they managed service continuity for essential services and infrastructure during the lockdown period. While financial pressures for the City were fully mitigated in 2020 and 2021 through the historic Safe Restart Agreement, Social Services Relief Fund and many other funding announcements, the City currently faces a substantial deficit of \$23.7 M related principally to the COVID-19 pandemic response and less financial support from senior levels of government. Currently, senior levels of government have not made any financial commitments beyond 2022 to fund ongoing recovery efforts for municipalities related to COVID-19.

The provincial and federal governments were essential partners in tackling the social and economic issues posed by the pandemic as the City of Hamilton has leveraged funding of approximately \$61.3 M in 2020 and \$99.8 M in 2021, as well as, forecasting \$44.7 M in 2022, for essential programs and services needed throughout the pandemic. However, pandemic recovery efforts still pose a major issue for the City, principally within Housing Services and Public Health as detailed in Report FCS22042, Tax and Rate Operating Budget Variance Report, as at April 30, 2022.

It is recommended that Council and staff continue to work with other municipal partners to educate and seek additional support from senior levels of government to address the continued pressures and important role that municipalities play in economic recovery in the aftermath of the COVID-19 pandemic.

In accordance with the *Municipal Act, 2001*, section 289, the City must prepare a balanced budget and provide for any deficit in the previous year's budget. City Council has set aside \$35.6 M in discretionary funding over the past two years into the COVID-19 Emergency Reserve, resulting from operating surpluses in 2020 and 2021, to address ongoing impacts of the pandemic on municipal operations and recovery efforts. Should advocacy efforts be unsuccessful, staff will utilize these funds to the extent possible in order to limit the financial impact of the pandemic response on the 2023 tax levy. However, such an impact would not only require a substantial investment from the community but would also limit flexibility to finance strategic initiatives moving forward.

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 14 of 17**

Boards and Agencies

Based on multi-year budgets submitted by the Hamilton Public Library and Hamilton Police Service, as well as, historical trends for all other Boards and Agencies, staff has projected a net levy requirement of \$6.7 M or 2.8% for Boards and Agencies in 2023. The Police budget pressures are inclusive of an additional 13 officers as indicated in their 10-year plan.

TABLE 3

CITY OF HAMILTON					
UPDATED PRELIMINARY 2023 OUTLOOK FOR BOARDS & AGENCIES					
Board/Agency	2022 Council Approved	2023 Outlook	Change		
			\$	%	
Conservation Authorities	\$ 8,651,200	\$ 8,821,910	\$ 170,710	2.0%	
MPAC	\$ 6,979,670	\$ 7,119,260	\$ 139,590	2.0%	
Hamilton Beach Rescue Unit	\$ 132,870	\$ 135,560	\$ 2,690	2.0%	
Hamilton Farmers' Market	\$ 242,360	\$ 261,110	\$ 18,750	7.7%	
Royal Botanical Gardens	\$ 647,410	\$ 660,620	\$ 13,210	2.0%	
Hamilton Police Services	\$ 183,542,540	\$ 188,615,288	\$ 5,072,748	2.8%	
Hamilton Public Library	\$ 32,848,020	\$ 34,129,950	\$ 1,281,930	3.9%	
City Enrichment Fund	\$ 6,088,340	\$ 6,088,340	\$ -	0.0%	
Net Levy Requirement inclusive of Capital Financing	\$ 239,132,410	\$ 245,832,038	\$ 6,699,628	2.8%	

Not included in the preliminary outlook is an increase to the City Enrichment Fund. At its meeting on June 22, 2022, the Audit, Finance and Administration Committee approved that an increase to the City Enrichment Fund be forwarded to the 2023 budget process for consideration. An updated budget submission will come before Council for deliberation.

Capital Financing

The multi-year outlook for Capital Financing includes an annual tax levy increase of 0.5% in 2023 for discretionary block funding related to state-of-good-repair asset replacement, as well as, additional increases for debt servicing requirements for the municipal share of the Investing in Canada Infrastructure – Public Transit Stream (ICIP) and West Harbour Waterfront Development strategic initiatives. Additionally, a 10-year phase-in has been incorporated to address the annual funding gap identified in the Transportation Asset Management Plan of \$94.7 M starting in 2024. Table 4 provides the forecasted net levy pressures related to the financing of the Tax Capital Budget from 2023 to 2025.

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 15 of 17**

TABLE 4

CITY OF HAMILTON						
UPDATED PRELIMINARY 2023-2025 OUTLOOK FOR CAPITAL FINANCING						
Capital Financing	2023		2024		2025	
	(\$)	(%)	(\$)	(%)	(\$)	(%)
Asset Management	\$ 4,800,000	3.3%	\$ 10,980,000	7.1%	\$ 10,980,000	6.6%
West Harbour Development	\$ 626,000	0.4%	\$ 1,773,000	1.2%	\$ 54,000	0.0%
ICIP - Transit	\$ 45,000	0.0%	\$ 56,000	0.0%	\$ -	0.0%
Climate Change	\$ 2,483,800	1.7%	\$ -	0.0%		0.0%
Net Levy Requirement	\$ 7,954,800	5.5%	\$ 12,809,000	8.3%	\$ 11,034,000	6.6%

The Capital Financing Plan has been updated with new assumptions around the cost to borrow given recent changes in the investment market and the Bank of Canada's response to rising inflation. In 2023 and 2024, an interest rate of 5.5% has been assumed, based on current market rates, with a return to the previously forecasted 3.0% for years 2025 through 2032. This results in approximately \$6.0 M of additional financing costs related to debt.

Preparation of the Capital Financing Plan prioritizes that the City maintain its AAA credit rating. This is an important aspect of the overall budget as it reduces the City's cost to borrow and limits the tax impact on residents and businesses. The Capital Financing Plan balances the financial obligations required for the effective management of infrastructure in a state-of-good-repair, support growth and development and advance Council's and the City's strategic priorities while limiting the overall impact of taxpayers and staying within Council's approved debt limits.

2023-2025 Preliminary Rate Supported Budget

The 2022 Rate Supported Budget approved by Council in December 2021, resulted in a combined rate increase of 4.98%. The budget also included a projection for 2023 to 2025 that was approved in principle through the Rate Financing Plan. The Rate Supported Budget reflects Council's ongoing commitment and dedication to implement a sustainable financing plan while bridging the divide between the funding shortfalls for infrastructure with affordable rates. Table 5 provides detail on the rate supported budget approved in principle for 2023 through 2025.

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**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 16 of 17**

TABLE 5

CITY OF HAMILTON			
UPDATED RATE SUPPORTED 2023-2025			
RATE FINANCING PLAN (\$000's)	2023	2024	2025
Ave. Total Rate Increase	6.49%	6.45%	6.36%
Total Revenues Available	276,208	296,181	317,368
Debt Charges	28,195	34,380	41,687
DC Exemptions	9,000	9,000	9,000
Operating Expenditures	102,412	106,574	110,905
Net Operating	139,607	149,954	161,592
Required Capital Financing	127,566	141,062	155,458
Reserve Transfers	9,034	5,165	318
Net Capital	136,600	146,227	155,776

During 2021 budget deliberations, City Council directed staff to perform a comprehensive evaluation of all City stormwater programs to identify existing gaps, immediate needs, risks to the City, including risks from climate change and extreme weather, outline the levels of service that the City should strive to achieve, quantify funding requirements along with options for long-term maintenance, second cycle replacements and financing alternatives. A recent update of this work was provided through Report FCS22043, which detailed a proposed timeline of July 2022 through to January 2026 for the completion of the three phases outlined in the report: discovery, detailed analysis and implementation.

The City continues to face upward pressure on water rates to maintain infrastructure in a state-of-good-repair and sustain service delivery. In response, Hamilton Water is undertaking a review of the Water, Wastewater and Stormwater budget process to better understand long-term sustainability and provide greater transparency to customers and Council. The scope of work includes a review of the prioritization process and risk portfolio for decision making, impacts of corporate strategic priorities and sustainable infrastructure investment needs to maintain the desired level of service.

The Waterworks Asset Management Plan identified an annual funding shortfall of \$101.1 M towards capital renewal needs. Through the 2022 budget, staff had incorporated additional debt financing and rate increases of approximately 6.5% over a four-year period in order to address the deficiency in capital financing. Staff will continue to review and revise the Rate Financing Plan throughout the 2023 budget process.

ALTERNATIVES FOR CONSIDERATION

N/A

**SUBJECT: 2023-2025 Multi-Year Outlook and Capital Financing Plan Update
(FCS22064) (City Wide) – Page 17 of 17**

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Community Engagement and Participation

Hamilton has an open, transparent and accessible approach to City government that engages with and empowers all citizens to be involved in their community

Our People and Performance

Hamiltonians have a high level of trust and confidence in their City government.

APPENDICES AND SCHEDULES ATTACHED

Appendix “A” to Report FCS22064 – Summary of Staff Vacancies

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CITY OF HAMILTON
SUMMARY OF STAFF VACANCIES
AS AT JUNE 30, 2022

Department / Division	2022 Council Restated Budget	Current Vacancy	Vacancy Rate	Comments
	FTE	FTE	%	
PLANNING AND ECONOMIC DEVELOPMENT				
General Manager	7.00	2.00	28.6%	2 temporary vacancies including one recently posted
Transportation, Planning and Parking	141.24	6.00	4.2%	Most in recruitment process with a couple being gapped and reassessing current needs. Vacancies impact HMPS revenues, supervisory capacity overseeing Crossing program & Parking Officers. Work being re-distributed and added workload creating risk of delayed responses in planning process. For one vacancy, operations found efficiencies through technology and closed counter services.
Building	101.32	14.33	14.1%	Out of the 14.33 vacant FTEs, 3 positions are temporary vacancies - 2 paternity leaves (one returning soon and 1 not filled), 1 COVID-19 non-compliance leave. The rest are vacant due to difficulties in finding qualified applicants. 2 job offers are pending reference checks. Applications approvals delayed due to vacancies.
Economic Development	51.41	9.00	17.5%	3 are temporary vacancies not filled, 2 are short-term leaves, and recruiting is in progress for the rest of positions Impact on service level: Lower number of appraisals completed, none of the appraisers on the Real Estate team have an AACI designation, need to seek outside appraisers for complicated transactions, which significantly increases the cost per transaction. Losing on some strategic acquisitions.
Growth Management	59.88	10.88	18.2%	1 position on hold due to LTD. 3 positions recently recruited for and unsuccessful, 4 positions currently in recruitment. The rest are temporary vacancies. Impact on service level: Longer processing times, work is delayed.
Licensing & By-Law Services	113.15	14.18	12.5%	Recent vacancies due to retirements and new Rental Housing Pilot positions to be filled. About half of these vacancies are in recruiting process and some soon to be with a few being gapped to reassess current needs. Work being reassigned and delayed.
Planning	96.00	18.00	18.8%	Majority of positions under recruitment, 3 Planner positions held vacant pending Province's decision on City's GRIDS2 MCR OPA, 1 position is currently reassessed. 2 paternity leaves. Impact on service level: impacts City's ability to undertake and complete policy initiatives in a timely fashion, including work on new and updates to neighborhood plan and other major policy work relating to official plan conformity. Delays in development approvals and time frames to deal with heritage designations, site plans and rezoning applications. This translates into lower assessment growth and uncertainty around investment decisions in Hamilton which can result in missed economic development opportunities in terms of urban renewal and completion of new neighborhoods
Tourism & Culture	74.04	8.25	11.1%	Vacancies due to re-org or reassessment under way, retirements, staff taken on temp assignments elsewhere. Impact on service: work delays, projects related to Cultural Plan delayed and work reassigned.

Department / Division	2022 Council Restated Budget	Current Vacancy	Vacancy Rate	Comments
	FTE	FTE	%	
SUBTOTAL PLANNING AND ECONOMIC DEVELOPMENT	644.04	82.64	12.8%	
HEALTHY AND SAFE COMMUNITIES				
HSC Administration	35.50	1.00	2.8%	Recruitment in process - during vacancy staff has taken on additional duties that resulted in delay in delivery and overtime.
Children's and Community Services	94.00	11.00	11.7%	Over the past few months, the CCS division has created a number of new positions to support the implementation of the new Canada-wide Early Learning and Child Care (CWELCC) agreement. Many of the vacancies in the division are a result of backfilling those individuals that are in new CWELCC roles. There are also new temporary roles being created to support the Indigenous Landmarks Review which are in the process of being created with input from HR. Recruitment is underway for most vacancies within the division. Vacancies have impacted the timelines and start dates of some projects. In many cases, staff are taking on additional workload to be able to maintain our existing service levels. This is having an impact on staff stress levels and is not sustainable long-term.
Ontario Works	210.00	35.60	17.0%	Overall impact is a delay in investigation of fraud allegations, and delays in providing benefits to clients or updates in client files.
Housing Services	58.00	3.00	5.2%	Increase in overtime to meet priorities.
Long Term Care	491.20	1.69	0.3%	Current recruitment: Clinical Dietician 0.69 (dietician is new position so was not existing previously and therefore we are enhancing the service by adding new FTE but already maintaining existing service levels without it) Infection Control Practitioner 1.00 (role is being absorbed by nurses and people leaders while recruiting) Other positions on the report showing as vacant are backfilled with casual pool staff and not actually vacant and therefore no service delivery impacts

Department / Division	2022 Council Restated Budget	Current Vacancy	Vacancy Rate	Comments
	FTE	FTE	%	
Recreation	449.98	70.00	15.6%	<p>Of the 70 Vacancies:</p> <ul style="list-style-type: none"> - Seasonal = 57 (no impacts/no mitigation required) <ul style="list-style-type: none"> Arenas = 29 (no programming until the Fall) Summer Programming = 27 (in recruitment) Food Service Delivery Clerk (vacant since COVID-19) = 1 (programming not being offered) - True Vacancies = 13 <ul style="list-style-type: none"> Sr Receptionists = 5 (positions in recruitment process and coverage is being provided by PT Receptionist staff) Managers = 2 (Senior Manager and various District Manager are providing coverage-alike vacation coverage-until recruitment process is complete) Sr Recreation Planner = 1 (no impact as scope of position is being re-evaluated - recruitment planned for August) Training Coordinator = 1 (no impact - budget being utilized by Training Support Coordinator - position to be converted) Admin Secretary = 1 (no impact - budget being utilized by Event Specialist-Recreation - position to be converted) District Support Clerk = 1 (position in recruitment process and coverage is being provided by PT District Support Clerk; all areas are not fully resumed at this time) Product & Inventory Coordinator Food Service Admin = 1 (pending recruitment; investigation of services and it's delivery within Food Services; no service impact as no services are offered due to COVID) Project Manager Sport Ops = 1 (recruitment underway; position created in a non-budgeted capacity to review/investigate all of Food Services in its delivery and programming) <p>1 FTE Chief Mechanical Officer - Interviews scheduled for July</p> <ul style="list-style-type: none"> - A Mechanic has been acting in the position which has reduced our capacity to repair vehicles in a timely manner. - Mechanical staff have shared the workload through taking one mechanic out of rotation. - Leadership Team resources had been deployed to assist. <p>1 FTE Assistant Deputy Chief - To be posted in September</p> <ul style="list-style-type: none"> - Deputy Chief has been providing some support/coverage when required. - 2 x temporary Senior Project Managers have been hired as part of a succession plan and to share the workload of the ADC - Plans to post the ADC position permanently in September of 2022 <p>7.86 FTE Volunteer Firefighters (56 of 280 Headcount)</p> <ul style="list-style-type: none"> - Vacancies in stations putting pressure on existing staff. Concerns for burnout and low staff turnout. - Utilizing additional Volunteer Stations to provide backup when turnout to emergency calls is low. - Looking to hire another 30 volunteer firefighters before the end of the year with at least three recruit classes (hiring's) planned in 2023.
Hamilton Fire Department	599.30	9.86	1.6%	<p>1 FTE Supervisor - Recent retirement (end of May) - to be backfilled and then filled permanently</p> <ul style="list-style-type: none"> - Minimal impact on service delivery – retirement was at the end of May 2022 - Position has been backfilled temporarily through overtime or part time shift replacement, and plans to hire permanently are in place.
Hamilton Paramedic Service	368.36	1.00	0.3%	

Department / Division	2022 Council Restated Budget	Current Vacancy	Vacancy Rate	Comments
	FTE	FTE	%	
Public Health Services	736.40	196.11	26.6%	Review the Chronic Disease Prevention Program (on-hold since March 2020) to assess the needs within the Hamilton community and to adapt the program to meet those needs. This will include a health equity component that incorporates and builds on lessons learned through the pandemic. Review of mental health and addictions initiatives to ensure they meet the current needs of the community, especially those who experiencing the most significant health impacts and inequities. Ramp-up support for population health assessment related to health equity and other public health priorities. Develop and implement a health equity strategy that incorporates and builds on lessons learned through the pandemic. Ramp-up infant and early years mental health initiatives to help address the disproportionate impact the pandemic has had on toddlers and young children resulting from extremely limited opportunities for social interaction and social/emotional development. Ramp-up supports for parents and caregivers (particularly for those with children aged 3.8 years to 6 years) including opportunities for screening, interventions and developmental support referrals. Catch-up on dental screenings in schools – approximately 23,000 in need of screening (on-hold since March 2020). To identify those who were not screened in JK or SK screen all grade one students at all schools. At high and medium intensity schools screen grade 8 students to ensure those who were not screened in grade 7 are identified before going to high school. Catch-up on Healthy Smiles Ontario preventive services – approximately 278 children on the waitlist (on-hold since March 2020). Ramp-up mental health and wellbeing supports in schools and school communities experiencing the most significant health impacts and inequities. 2 FTE Supervisors, 4.5 FTE Public Health Nurses, 15 FTE School Nurses, 3 FTE Data Clerks, 1 FTE Outbreak Specialist, 1.5 FTE Public Health Inspector and the remaining FTE are no longer required as the COVID-19 disease control response has been scaled down. The effect the vacancies are having on COVID-19 response are part time staff are being asked to work additional hours to support services delivery primarily in sexual health, Managers are working additional hours to compensate for the supervisor vacancies, some lower priority data entry work is being delayed and policy and procedure review and development in the Outbreak team and sexual health is being delayed.
SUBTOTAL HEALTHY AND SAFE COMMUNITIES	3,042.74	329.26	10.8%	
PUBLIC WORKS				
PW-General Administration	7.30	-	0.0%	
Energy Fleet and Facilities	182.21	17.00	9.3%	The division has a vacancy rate of 9.3% and a total of 17.00 vacant FTEs of which 5.00 are on leave, 2.00 retirements, 2.00 terminations, 7.00 transferred to other roles within the City and 1.00 new position approved via PW22016 Report. Vacancy length mainly falls within the less than 3 months length category representing 14.00, with 1.00 greater than 9 months but less than 12 months and 2.00 greater than 12 months. Service level implications have been mitigated using a combination of temporarily disbursing work load resulting in over-time and in some cases no additional OT required.
Engineering Services	123.33	14.00	11.4%	The division has a vacancy rate of 11.4% and a total of 14.00 vacant FTEs of which 1.00 is on leave, 1.00 retirement, 10.00 transferred to other roles within the City and 2.00 new positions approved via the Variance Reporting process. Length of vacancy of the 14.00 vacant FTEs are spread out across the categories and comprised of 6.00 within the less than 3 months vacancy Length of vacancy category, 2.00 greater than 3 months but less than 6 months, 3.00 greater than 6 months but less than 9 months, 1.00 greater than 9 months but less than 12 months and 2.00 greater than 12 months. Service level implications have been mainly mitigated by incurring OT to cover distributed workloads.

Department / Division	2022 Council Restated Budget	Current Vacancy	Vacancy Rate	Comments
	FTE	FTE	%	
Environmental Services	397.12	28.21	7.1%	The division has a vacancy rate of 7.1% and a total of 28.21 vacant FTEs of which 6.00 are on leave, 1.16 retirements, 6.97 terminations, 13.58 transferred to other roles within the City and 0.50 new position approved via Operating Impacts from Capital process. Vacancy length largely falls within the less than 3 months Length category representing 21.55, with 2.00 in the greater than 3 months but less than 6 months, 2.16 greater than 6 months but less than 9 months, and 2.50 greater than 12 months. Service level implications have been mainly mitigated by incurring OT to cover distributed workloads. The division has identified 13.19 vacant FTEs at a vacancy rate of 8.8% (13.19 vacant FTE/150.2 approved FTE) as hard to fill related to hiring and subsequently retaining seasonal students and hiring seasonal workers.
Waste Management	406.71	37.80	9.3%	The division has a vacancy rate of 9.3% and a total of 37.80 vacant FTEs of which 11.64 are on leave, 5.00 retirements, 2.00 terminations, 17.16 transferred to other roles within the City and 2.00 new positions approved via the Operating Impacts from Capital process or converted via the Variance Reporting process. Vacancy length largely falls within the less than 3 months length category representing 19.64, with 8.58 in the greater than 3 months but less than 6 months, 6.58 greater than 6 months but less than 9 months, 1.00 greater than 9 months but less than 12 months and 2.00 greater than 12 months. Service level implications have been mitigated using a combination of temporarily disbursing work load resulting in overtime and in some cases no additional OT required as well as externally contracted work. Further, delays have been experienced as well as the reduced ability to meet service levels mainly related to Provincially legislated MMS, scheduling work, and resolving Councillor and resident issues. The division has identified 8.00 vacant FTE as hard to fill related to hiring concrete finishers. The TOM division will reduce its concrete program to provide better value for the City and convert these positions to other positions which are required. More routinely scheduled work will be shifted to a contracted program due to better value for money for large stretches of work.
Transit	825.41	51.12	6.2%	The division has a vacancy rate of 6.2% and a total of 51.12 vacant FTEs of which 12.00 are on leave, 13.00 retirements, 2.00 terminations, 12.00 transferred to other roles within the City and 12.12 new positions mainly related to Year 6 of the 10 Year Local Transit Strategy implementation planned for September 2022. The largest vacancy length of 14.00 FTEs fall within the greater than 12 months, followed by 13.12 greater than 3 months but less than 6 months, 11.00 greater than 9 months but less than 12 months, 10.00 less than 3 months and 3.00 greater than 6 months but less than 9 months. It is important to note that Transit currently have FTEs that are part of the Wind Down Program which forms part of the Collective Agreement. This program allows retired staff to support operations on an ongoing basis for up to 7 years as determined by Transit Management. The program is unbudgeted therefore in order to help mitigate the pressure where feasible vacant FTEs are used to offset. Service level implications have been mitigated using a combination of temporarily disbursing work load resulting in overtime and in some cases no additional OT required, casual workers and winddown program specific to Transit Union. The division has identified 19.58 FTEs as hard to fill positions related to technical position of Truck & Coach Technician due to the ongoing labour shortage for skilled workers

Department / Division	2022 Council Restated Budget	Current Vacancy	Vacancy Rate	Comments
	FTE	FTE	%	
Transportation Operations & Maintenance	117.01	8.32	7.1%	The division has a vacancy rate of 7.1% and a total of 8.32 vacant FTEs of which 3.58 are on leave, 1.58 retirements and 3.16 transferred to other roles within the City. Vacancy length largely falls within the less than 3 months length category representing 4.74, with 1.00 in the greater than 3 months but less than 6 months and 2.58 greater than 12 months. Service level implications have been mainly mitigated by externally contracted work to cover workloads.
Hamilton Water	347.65	44.15	12.7%	The division has a vacancy rate of 12.7% and a total of 44.15 vacant FTEs of which 9.00 are on leave, 7.00 retirements, 9 terminations, 14.65 transferred to other roles within the City and 4 new positions approved via the 2022 Budget process. Vacancy length largely falls within the less than 3 months length category representing 20.55, with 8.00 in the greater than 3 months but less than 6 months, 5.00 greater than 6 months but less than 9 months, 2.00 greater than 9 months but less than 12 months and 8.65 greater than 12 months. Service level implications have been mitigated using a combination of temporarily disbursing work load resulting in over-time and in some cases no additional OT required as well as externally contracted work. Further, some non-critical has been deferred as well as delays in strategic project work has been experienced. The division has identified 9.58 FTEs as hard to fill positions related to technical positions consisting of electricians, millwrights and instrumentation technicians due to the ongoing labour shortage for skilled workers.
SUBTOTAL PUBLIC WORKS	2,406.74	200.60	8.3%	
CITY MANAGER				
Office of the City Auditor	7.00	-	0.0%	
CMO - Admin	2.00	-	0.0%	
Communications and Strategic Initiatives	22.00	-	0.0%	
Digital and Innovation Office	7.00	-	0.0%	
Government & Community Relations	5.00	-	0.0%	
Human Resources	79.00	2.00	2.5%	EDI Bus Partner - new position for 2022, posted in May and recruitment is underway. Snr Proj. Mgr. has been filled starting July 18
SUBTOTAL OFFICE OF THE CITY MANAGER	122.00	2.00	1.6%	
CORPORATE SERVICES				
City Clerk's Office	29.00	1.00	3.4%	Shortfall has been managed with part-time staff. The vacancy has cause some delays in processing print and postage requests. Vacancy is due to retirement.
Customer Service, POA and Fin'l Integration	96.97	7.00	7.2%	Staff vacancies have put pressure on call volumes, ask city, tax support and counter services resulting in increased wait times for internal requests and resident in-person or over the phone. The pressure has resulted in increased stress on staff. Other impacts have been on project delivery, call consolidation process, Payment Provider strategy, and the expanded roll-out of the customer experience platform have been delayed. Vacancies are due to staff turnover.
Financial Serv, Taxation and Corp Controller	80.00	11.00	13.8%	Vacancies have delayed Municipal Act Appeals, COH taxation purchases/sales, review of assessment roll/building permits, non-critical payroll processes, and procurement response times. Other impacts have been on project delivery, PW Info EAM alignment and PSAB3280 ARO regulatory requirements. Vacancies are due to paternity leave, staff turnover, candidates turning down position due to pay.

Department / Division	2022 Council Restated Budget	Current Vacancy	Vacancy Rate	Comments
	FTE	FTE	%	
Legal Services and Risk Management	78.00	8.00	10.3%	Staffing shortfall has been managed by redistributing workloads, or outsourcing to external firms (specifically in Real Estate). The impact has been overtime required to work on and complete files and respond to internal requests. As well, staff have experienced increased stress. Vacancies are due to paternity leave, paternity leave, staff transferred to LRT, backfilling for City Solicitor, Deputy City Solicitors (DR & CDP), Manager, and leave of absence.
Corporate Services - Administration	2.00	-	0.0%	No impact
Financial Planning, Admin & Policy	84.58	4.00	4.7%	Staff vacancies have resulted in workload being shared by other FAILs and FAIs. Vacancies are due to employee transfers and FAIL/FAI recruitment process not finding staff.
Information Technology	126.00	19.00	15.1%	Staffing shortfall has been managed by redistributing workloads. Vacancies have delayed service requests to the Service Desk, for the Amanda system and for Business Intelligence. Daily support and maintenance have also been effected, specifically network security and transit operations. Other impacts have been on project delivery, City data asset management, PeopleSoft HCM upgrade, security audit action plan, cloud foundation development, and updated IT Contract and Vendor management have been delayed. Vacancies are due new positions that have been difficult to fill due to market conditions (missing skill-set in market and budget) and to staff turnover.
SUBTOTAL CORPORATE SERVICES	496.55	50.00	10.1%	
TOTAL CITY DEPARTMENTS	6,712.07	664.50	9.9%	



Hamilton

**2023 – 2025 MULTI-YEAR OUTLOOK
AND CAPITAL FINANCING PLAN UPDATE**

FCS22064

Mike Zegarac
General Manager, Finance and Corporate Services

August 8, 2022
General Issues Committee

AGENDA

1. 2023 Budget Process
2. Emerging Themes of the 2023 Budget
3. 2023 Tax Supported Operating Budget Preliminary Outlook
4. 2023 Rate Supported Operating Budget Preliminary Outlook
5. Overview of Report Recommendations

2023 BUDGET PROCESS

- A. Budget Direction:** not seeking a recommended guideline from Council for 2023
- B. Balanced Budget:** in accordance with the *Municipal Act, 2001, section 289*, the City must prepare a balanced budget and provide for any deficit in the previous years' budget
 - i. 2022 Tax Supported Operating Budget is forecasted at a \$23.7M deficit
 - ii. 2022 Rate Supported Operating Budget is forecasted at a \$2.9M deficit
 - iii. 2023 Preliminary COVID-19 Response and Recovery projected at \$23.0M
- C. Budget Process Timeline:** an updated budget process will be communicated later in 2022

2023 BUDGET PROCESS

- D. Budget Principles:** staff will prepare the 2023 budget based on the City's budget principles
- i. Supports the City's Strategic Plan and Term of Council Priorities
 - ii. Alignment with the financial policies approved by Council
 - iii. Ensure the City's AAA credit rating is maintained
 - iv. Growth related infrastructure is supported from DCs / CBCs
 - v. Accounts for investment required to transition to the expected outcomes of the Strategic Asset Management Policy and Asset Management Plans
 - vi. Grants available to municipalities will be investigated
 - vii. New services, enhancements or reductions, changes to the full-time equivalent complement require a Business Case

EMERGING THEMES OF THE 2023 BUDGET

- A. COVID-19 Recovery:** insufficient funding to address forecasted pressures related to pandemic response and recovery efforts
- B. Extraordinary Inflation, Supply Chain and Labour Shortages:** the City is experiencing significant pressures in resources such as fuel, contracted services and employee contractual and benefits obligations
- C. Debt Capacity and Cost of Borrowing:** managing growth-related and replacement infrastructure in conjunction with Council's approved debt limits, maintaining the City's AAA credit rating and rising interest rates
- D. Amendments in Provincial Funding:** changes in Provincial Funding Agreements are expected to continue to represent a significant budget pressure in 2023

EMERGING THEMES OF THE 2023 BUDGET

- E. Asset Management:** an annual funding gap of \$94.7M and \$101.1M for Tax and Rate supported infrastructure respectively was identified through the Core Asset Management Plan (PW22048)
- F. Affordable Housing and Homelessness:**
- i. HSC19034 – Roxborough Housing Incentive Program
 - ii. HSC22040 – Service and Exit Agreements for Community Housing Providers and End of Mortgage
 - iii. HSC22050/FCS22073 – Approaches to Addressing the Challenges of Financing Non-Profit Housing Developments
 - iv. HSC20020(f) – Adaptation and Transformation of Services for People Experiencing Homelessness Update 6
 - v. HSC22047 – Permanent Housing with Supports for Women, Transgender and Non-binary Community Members

EMERGING THEMES OF THE 2023 BUDGET

- G. Responding to Climate Change:** investment required to support Hamilton's Climate Change Action Strategy
- H. Investments in Emergency Response Services:**
 - i. HSC19026 – Hamilton Fire Department 10-Year Service Delivery Plan
 - ii. 21-133 – Hamilton Police Service 10-Year Plan
 - iii. HSC22012 – Hamilton Paramedic Service Master Plan
- I. Ten-Year Local Transit Strategy:** continuation of year seven of the Ten-Year Local Transit Strategy approved by Council

2023 TAX SUPPORTED OPERATING BUDGET

A. 2023-2025 Multi-Year Outlook

CITY OF HAMILTON							
UPDATED TAX SUPPORTED 2023-2025 MULTI-YEAR OUTLOOK							
DEPARTMENT	2022 Council Approved	2023 Outlook	%	2024 Outlook	%	2025 Outlook	%
Planning & Economic Development	31,304,660	32,244,430	3.0%	33,012,380	2.4%	33,747,920	2.2%
Healthy and Safe Communities	266,826,350	280,679,800	5.2%	290,470,000	3.5%	301,079,360	3.7%
Public Works	278,758,310	299,555,506	7.5%	311,500,996	4.0%	323,590,996	3.9%
Legislative	5,284,590	5,389,090	2.0%	5,484,680	1.8%	5,582,750	1.8%
City Manager	13,652,960	14,002,450	2.6%	14,290,590	2.1%	14,556,580	1.9%
Corporate Services	38,824,160	40,394,910	4.0%	41,204,270	2.0%	41,942,470	1.8%
Corporate Financials	22,984,458	32,631,878	42.0%	33,209,868	1.8%	33,278,738	0.2%
Non-program Revenues	(51,256,190)	(51,188,290)	-0.1%	(51,125,010)	-0.1%	(51,057,940)	-0.1%
Hamilton Entertainment Facilities	2,337,710	-	-100.0%	-	0.0%	-	0.0%
Hamilton Police Service	183,542,540	187,415,288	2.1%	193,037,747	3.0%	198,828,879	3.0%
Other Boards & Agencies	55,589,870	57,216,750	2.9%	58,457,600	2.2%	59,649,610	2.0%
Capital Financing	145,688,310	151,159,310	3.8%	163,968,310	8.5%	175,002,310	6.7%
Maintenance and Pre-Approved Net Levy	993,537,728	1,049,501,122	5.6%	1,093,511,430	4.2%	1,136,201,673	3.9%
Business Cases and Council Referred Items		13,882,760	100.0%	15,194,660	9.4%	17,194,620	13.2%
Cumulative Net Levy	993,537,728	1,063,383,882	7.0%	1,108,706,090	4.3%	1,153,396,293	4.0%
Potential COVID-19 Recovery	-	22,920,000	100.0%	17,110,000	-25.3%	12,800,000	-25.2%
Contribution from COVID-19 Reserve		(11,903,000)	100.0%	-	-100.0%	-	0.0%
Cumulative Net Levy	993,537,728	1,074,400,882	8.1%	1,110,621,430	4.8%	1,149,001,673	3.6%
Assessment Growth			-1.0%		-1.0%		-1.0%
Impact of Levy Restrictions / Re-assessment			0.1%		0.6%		0.6%
Tax Policy			0.0%		0.2%		0.0%
Education			-0.3%		-0.3%		-0.3%
Average Total Residential Tax Impact			6.9%		4.3%		2.9%

8

2023 TAX SUPPORTED OPERATING BUDGET

B. 2023-2025 Capital Financing Plan

CITY OF HAMILTON UPDATED PRELIMINARY 2023-2025 OUTLOOK FOR CAPITAL FINANCING						
Capital Financing	2023		2024		2025	
	(\$)	(%)	(\$)	(%)	(\$)	(%)
Asset Management	\$ 4,800,000	3.3%	\$ 10,980,000	7.1%	\$ 10,980,000	6.6%
West Harbour Development	\$ 626,000	0.4%	\$ 1,773,000	1.2%	\$ 54,000	0.0%
ICIP - Transit	\$ 45,000	0.0%	\$ 56,000	0.0%	\$ -	0.0%
Climate Change	\$ 2,483,800	1.7%	\$ -	0.0%		0.0%
Net Levy Requirement	\$ 7,954,800	5.5%	\$ 12,809,000	8.3%	\$ 11,034,000	6.6%

- i. Inflation and supply chain pressures
- ii. Rising interest rates
- iii. Approaching debt ceiling
- iv. Asset Management
- v. Responding to Climate Change

2023 RATE SUPPORTED OPERATING BUDGET

A. 2023-2025 Multi-Year Outlook

CITY OF HAMILTON UPDATED RATE SUPPORTED 2023-2025			
RATE FINANCING PLAN (\$000's)	2023	2024	2025
Ave. Total Rate Increase	6.49%	6.45%	6.36%
Total Revenues Available	276,208	296,181	317,368
Debt Charges	28,195	34,380	41,687
DC Exemptions	9,000	9,000	9,000
Operating Expenditures	102,412	106,574	110,905
Net Operating	139,607	149,954	161,592
Required Capital Financing	127,566	141,062	155,458
Reserve Transfers	9,034	5,165	318
Net Capital	136,600	146,227	155,776

2023 RATE SUPPORTED OPERATING BUDGET

B. Key Drivers of the Rate Supported Budget and Financing Plan

- i. PW22048 – Waterworks Asset Management Plan
- ii. FCS22043 – Stormwater Funding Review
- iii. PW19008(o) – Watershed Action Plan
- iv. Flooding and Drainage Improvement Framework
- v. Water, Wastewater, and Stormwater Master Plan
- vi. Woodward Wastewater Treatment Plant Upgrades
- vii. Water, Wastewater, and Stormwater Budget Process Review

OVERVIEW OF RECOMMENDATIONS

- A. That the City of Hamilton continue to seek opportunities to partner with senior levels of government in addressing ongoing recovery efforts related to the COVID-19 pandemic in 2022 and 2023;
- B. That the City of Hamilton appeal to the Province of Ontario for added financial support to address the housing crisis, as well as, additional support for mental health and addiction programs;
- C. That staff develop a communications action plan to assist ongoing education and advocacy efforts related to the challenges the City of Hamilton is facing in its COVID-19 recovery efforts.
- D. Appendix A – Summary of Staff Vacancies provided as requested and committed by staff

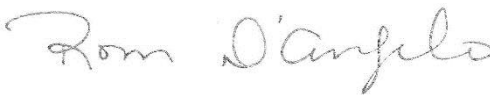


THANK YOU





INFORMATION REPORT

TO:	Mayor and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	Update to the City's Green Fleet Strategy and Action Plan (PW03147(f)) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Tom Kagianis (905) 546-2424 Ext. 5105
SUBMITTED BY:	Rom D'Angelo Director, Energy, Fleet and Facilities Management Public Works Department
SIGNATURE:	

COUNCIL DIRECTION

At the Public Works Committee meeting on May 31st, 2021, Fleet Services presented the Green Fleet Strategy Report & Action Plan (PW03147(e)) (City Wide).

Recommendation (e) stated "That staff provide annual information updates (accompanied by the Annual Energy Report) on progress of executing the Green Fleet Action Plan".

The Green Fleet Strategy Report & Action Plan report included 30 recommendations. Provided below is the status of some of the key deliverables.

INFORMATION

Grant Funding for Electric Vehicle (EV) charging stations from National Resources Canada (NRCan) under the Zero Emission Vehicle Infrastructure Program in the amount of \$300,000 has been approved.

A contract for 47 level 2 stations(2 plugs on each) and 2 level 3 charging stations(1 plug on each) to be installed over the next 2.5 years, is currently out to market. Staff expect to secure a vendor and begin installations later in 2022.

OUR Vision: To be the best place to raise a child and age successfully.

OUR Mission: To provide high quality cost conscious public services that contribute to a healthy, safe and prosperous community, in a sustainable manner.

OUR Culture: Collective Ownership, Steadfast Integrity, Courageous Change, Sensational Service, Engaged Empowered Employees.

**SUBJECT: Update to the City's Green Fleet Strategy and Action Plan
(PW03147(f)) (City Wide) - Page 2 of 2**

The global supply chain has had a serious impact on vehicle supplies and particularly on EV's. Our target for EV pickup trucks cannot be met. Fleet Services is considering alternative options until supply chain challenges are corrected which include Plug in Hybrid Electric Vehicles (PHEV's) and Hybrid Electric Vehicles (HEV's). Unfortunately, shorter term solutions for leasing or renting EV's are also impacted by supply challenges and are also not a viable option at this time.

The solicitation for EV SUV's and Vans is out for competitive bid and Staff expect to secure vendors by Q3 2022.

Fleet Services is working with Corporate Communications to provide the materials for delivering the Anti-idling campaign that includes:

- Actions displayed on TV monitors that remind drivers of techniques to help reduce idling with both work and personal vehicles;
- Vehicle stickers, staging area posters and parking location signage that will remind staff to minimize idle time.

The Biodiesel trial has been completed. There were concerns realized during the winter season use of the Biodiesel Blend 5% (B5) that will prevent future use of Biodiesel during cold weather months. The summer use of B20 did not present any challenges.

Biodiesel is a renewable fuel made from Plant oils, vegetable oil, waste cooking oil, animal fats such as beef tallow, fish oil and even algae oil. Our current supplier is Suncor who has been experiencing some supply problems of biodiesel however we anticipate city-wide use of Biodiesel Blend 20% (B20) by the end of this summer.

An extensive review of warranty coverage was performed by our consultant. All major diesel engine manufacturers investigated approve use of B20.

The Eco Driver training course started in late summer 2021 and has been delivered virtually to several hundred city staff. Continued high demand for the training from operating departments will see hundreds more trained in 2022.

Fleet Services has also engaged CityLab to assist in performing a global search on emerging technologies that would help reduce fleet vehicle emissions beyond our current Green Fleet Strategy term of 2024.

APPENDICES AND SCHEDULES ATTACHED

Appendix "A" to Report PW03147(f) - Green Fleet Strategy Action Plan

GREEN FLEET STRATEGY ACTION PLAN

Item	Recommendations	Implementation Timelines	Statement	Cost Impacts	GHG	Progress
1	Follow a historical data-driven lifecycle cost assessment, which is completed by modelling repair, maintenance, fuel, and cost of capital over the vehicle's entire lifecycle to determine the optimal replacement age of vehicles.	Previously Implemented/ Immediate	<u>Previously Implemented:</u> Fleet's current process for determining the optimal replacement age of an asset takes into consideration factors such as high maintenance cost, kilometres and replacement year. <u>Immediate:</u> Fleet will utilize the tools provided by Richmond Sustainability to enhance how data is analyzed. Applying this methodology will establish a more accurate approach to determining the optimal replacement cycles for each fleet classification	Costs will be monitored. Impacts to both capital and operating costs are possible	This recommendation may result in shorter or longer replacement cycles. GHG reduction will be impacted by changes in replacement cycles	Utilized in 2021. Working with the data to streamline the process for generation of reporting.
2	Consider implementing the green fleet asset management best practices recommended by RSI-FC as illustrated in the process flow chart (Page 25). With these processes the fleet will become green and right-sized.	Previously Implemented/ Immediate	<u>Previously Implemented:</u> Fleet will continue to communicate with the operating departments in determining fit for purpose assets and advise on the availability of BEV assets. <u>Immediate:</u> Fleet will focus on becoming green and right-sizing the fleet by following the recommended best practices identified in the process flow chart (Page 25). Fleet will identify criteria to establish: what the corporate minimum will include, roles and responsibilities and determine what operational justification and level of authorization is required to go outside the corporate minimum	Costs will be monitored. Impacts to both capital and operating costs are possible	GHG reduction will be impacted by determined replacements	Fleet has utilized Richmonds Process Flow Chart for Optimized Green Fleet Planning as a template and created a City of Hamilton specific process flow
3.1	1) Employ a total cost of ownership (TCO) approach to optimize the use of capital.	Previously Implemented/ Immediate	<u>Previously Implemented:</u> Currently the driving factor when considering replacement is high maintenance cost <u>Immediate:</u> Fleet will apply the tools provided by RSI to enhance how TCO is calculate and apply a data driven approach to optimize the use of capital	Costs will be analyzed by utilizing the tools provided by RSI. Impacts to both capital and operating costs are possible	GHG reduction will be impacted by determined replacements	Current data is not sufficient to provide accurate TCO for the variety of vehicle classifications. 1.We've identified areas that the new maintenance management system will improve the data collection process to support the required accuracy level of a TCO calculation 2.Yards study recommendations will allow for consolidation of fleet operation where data entry will be consistent and accurate.
3.2	2) Consider Total Cost of Ownership(TCO) in competitive bidding proposal structures instead of the lowest compliant bid approach.	Long Term	TCO Procurement- Review in consultation with Procurement and align to the procurement bylaw. This approach provides a narrow view of costs associated with the initial purchase of an asset and factors such as planned maintenance. However, many variables with respect to unplanned work will need to be considered to confidently build this concept into the bidding process while remaining fair and transparent	No direct cost impacts associated with the implementation of this recommendation	No direct GHG reduction impacts associated with the implementation of this recommendation	
4	Create an education piece for idling reduction, operating efficiently, and reducing fuel consumption.	Immediate	Creation of posters for display in common areas. Have stickers made up for dashboards in vehicles. Create communication for display on monitors	Minimal	Reduction to GHG's specific to improved driver behaviours will be difficult to determine however it is a generally accepted principal that driver behaviours and awareness as they contribute to fuel consumption will result in favourable changes to fuel economy.	Through corporate communicatins, designs have been developed and approved. Material for distribution and posting are expected in Fall 2022
5	Add a driver eco-training module to existing Professional Driver Improvement Course (PDIC) safe driver training and consider eco-driver training for all drivers.	Immediate	Compliance section has added an anti-idling segment to the Driver Safety & Compliance Manual Training presentation. Met with the provider used to update our Driver Improvement Course content to include an eco driving segment. We can purchase an update to our program that contains a module which is approx. 50 minutes in length.	\$3,000	Reduction to GHG's specific to improved driver behaviours will be difficult to determine however it is a generally accepted principal that driver behaviours and awareness as they contribute to fuel consumption will result in favourable changes to fuel economy.	Eco driver training course was implemented in September 2021 and to date approximately 300 employees have taken the training.
6	Measure and track fuel consumption and GHGs at the Department/Division/Section/Group levels to track progress and set tangible goals.	Immediate	Staff will develop an ongoing fuel usage report to calculate total GHG's by Department/Division/Section/Group level and vehicle classification.	No direct cost impacts associated with the implementation of this recommendation	No direct GHG reduction impacts associated with the implementation of this recommendation	Anti-Idling report developed with the assistance of AVL provider. Consumption report in development for Department/Division/Section/Group level and vehicle classification. Confirming accuracy of benchmark data.
7	Modernize and/or retrofit Fleet facilities to obtain LEED certification.	Long Term	Will seek opportunities to implement as part of the Non-Public Facing Yards Review	Unknown at this time	Unknown at this time	
8	Invite frontline employees to take BEV test drives to build an affinity towards electric vehicles.	Previously Implemented	Fleet schedules demonstrations to remain current with the industry and an opportunity for operating departments to test new technology and provide feedback. Since 2019 Fleet has arranged demonstrations of the following BEV units: Chevy Bolt EV, Kina Niro EV, Hyundai Ionic EV, Kia Soul EV, Mitsubishi PHEV, Toyota Hybrid. Fleet will continue to arrange demonstrations and communicate new technologies to the operating departments	No direct cost impacts associated with the implementation of this recommendation	No direct GHG reduction impacts associated with the implementation of this recommendation	

GREEN FLEET STRATEGY ACTION PLAN

Item	Recommendations	Implementation Timelines	Statement	Cost Impacts	GHG	Progress
9	If possible, avoid buying Internal Combustion Engine replacement vehicles until suitable BEVs become available.	Immediate	If possible, Fleet will avoid procuring ICE replacement vehicles until suitable BEVs become available. Fleet is recommending deferring ICE replacements for a maximum of two (2) years in the classifications where BEVs will be available within this timeframe. Fleet will provide options to the User Groups such as 1) rental units 2) short term leases 3) extended use (dependent on availability). However, as stated in recommendation 2 Fleet will identify criteria to establish: what the corporate minimum will include, roles and responsibilities and determine what operational justification and level of authorization required to go outside the corporate minimum	Cost impacts will result in increase to operating budgets (lease/rentals).	GHG reduction will be impacted by determined replacements. For each gas powered vehicle replaced with a BEV the GHG reduction per unit will be approximately •SUV: 3 tonnes annually •1/2 ton Pick Up: 5 tonnes annually	Fleet is adjusting vehicle replacements to align to classifications of electric vehicles currently available on the market. To remain on target with the commitments stated in the Green Fleet Strategy, Fleet has created an electric vehicle purchase strategy with a focus on replacement vehicles being electric as long as there is a fit for purpose vehicle on the market. If a BEV is not an option or not available the replacement vehicle shall be the lowest GHG option on the market meeting operational requirements.
10	Strictly through a lens of fiscal planning, prioritize replacement of units with BEVs only if they would deliver return-on-investment (ROI).	Additional Analysis	Fleet will review and develop replacement criteria that will consider a return-on-investment strategy along with other impacts such as GHG reductions, manufacturers build schedules and available charging infrastructure.	Costs will be monitored. Impacts to both capital and operating costs are possible	GHG reduction will be impacted by determined replacements	The cost impacts include fuel prices and vehicle prices. As these factors continue to change quickly we will continue to monitor these costs to do a accurate periodic assessments.
11	Allocate capital for charging infrastructure in the near-future to meet the demand in the mid- to long-term.	Immediate	Based on the BEV replacement schedule Fleet Planning worked with the operating departments to determine appropriate charging locations. To provide charging stations to the 89 scheduled purchases of BEV's city staff are recommending 47 Level 2 Charging stations and 2 Level 3 charging stations. Fleet will partner with City Departments (IT, Energy Initiatives) to determine appropriate procurement method for short term and long-term supply. Ensure system will have the ability to communicate with various software platforms and have the capability to accommodate light/medium and heavy-duty fleet	Supply and installation of all 49 stations is expected to cost \$593,000.00. Successful Grant funding application will reduce this amount by 50%	Based on historical average annual fuel consumption the city can realize a reduction of 335 tonnes of GHG's by replacing all 89 vehicles with a BEV option	Fleet was successful in securing funds through the NRCAN grant application which will contribute 50% of the project cost. Fleet has identified hub locations to install the infrastructure which aligns to vehicle replacements and is finalizing the supply and install agreement with the charging station provider.
12	Consider adopting the Richmond Sustainability's -Fleet Challenge recommended lifecycle analysis (LCA) approach to extract maximum value from each vehicle.	Immediate	By utilizing the Lifecycle Analysis tools provided by RSI-FC this will provide a component not previously available to Fleet Planning. The tool will provide algorithms using the RSI database resulting in enhanced accuracy in predicting optimal vehicle lifecycles and the ability to analyze/predict maintenance costs past a vehicles current expected life. Leveraging this tool will allow Fleet to schedule replacements prior to spikes in maintenance and downtime.	Costs will be monitored. Impacts to both capital and operating costs are possible	GHG reduction will be impacted by determined replacements. Affects could be mixed as a result of extending or reducing replacement cycles	Challenges with data population has not allowed for full use of this tool. We are working on developing data implementation tools that we can use going forward.
13	Consider balancing go-forward capital budgets as part of Long Term Capital Planning by deferring replacement of any units evaluated as being in above average, serviceable condition to later fiscal years.	Additional Analysis	Fleet will consider a balance go forward capital replacement approach utilizing evaluation based criteria. Fleet will create a defined process that will include a ranking system, defined evaluation criteria, how it will be reported and applied to asset replacements	No direct cost impacts associated with the implementation of this recommendation	No direct GHG reduction impacts associated with the implementation of this recommendation	Our current maintenance management system does not have the functionality to support the requirements of this recommendation. We intend on noting this requirement in the new mms.
14	When the fleet's average age and uptime rates are determined to be at acceptable levels, consider re-investing in the fleet at the rate of depreciation.	Additional Analysis	Further analysis is required for this recommendation. Several factors to consider when addressing average age and uptime rates such as: acquiring newer vehicles or ensuring there is a highly-effective preventive maintenance (PM) program is in place. EAM system is expected to provide additional tools which will give Fleet the ability to address this recommendation	Additional analysis required to show impacts to capital and operating budgets	No direct GHG reduction impacts associated with the implementation of this recommendation	subject to EAM implementation
15	Consider job suitability of vehicles before proceeding with light weighting enhancements.	Previously Implemented	Fleet currently and will continue to work with the operating departments to develop an understanding of the operational needs when developing specifications for replacement assets. Fleet provides recommendations to ensure the assets are fit for purpose, downsize where possible and investigate lighter weight materials used in asset construction (i.e.: changing steel trailers to aluminum). Fleet will continue to research light weighting enhancements by staying in contact with manufacturer reps, virtual trade shows and communication with other municipalities	Costs will be monitored. Impacts to both capital and operating costs are possible	GHG will be difficult to determine however it is a generally accepted principal that lighter vehicles will contribute to favourable fuel economy.	
16	In conjunction with driver training, consider route planning software, idling reduction initiatives and maintenance checks by integrating GPS tracking software to monitor driver activity and fuel consumption.	Additional Analysis	Met with our Automated Vehicle Location(AVL) provider and they are looking into different options that may be available for monitoring driver activity & fuel consumption	Unknown at this time	Reduction to GHG's specific to improved driver behaviours will be difficult to determine however it is a generally accepted principal that driver behaviours and awareness as they contribute to fuel consumption will result in favourable changes to fuel economy.	initial discussions with avl provider identified areas where product development will provide the data needed. Working towards a solution.0
17	Consider a fuel-efficient driver incentive program in which drivers are incentivized to improve behaviours or reduce their travel.	Additional Analysis	This type of program may be difficult to implement. Monetary incentives would be costly. Determining who would receive any incentives may be challenging to ensure equality.	Unknown at this time	Unknown at this time	

GREEN FLEET STRATEGY ACTION PLAN

Item	Recommendations	Implementation Timelines	Statement	Cost Impacts	GHG	Progress
18	E85 Usage Consider the challenges associated with switching to E85, including supply, any additional infrastructure costs, and whether the potentially greater fuel cost is financially prudent. Should the City proceed with this solution, consider a pilot project with several units switched to E85 at first, and if successful a phased-in approach for other appropriate units	Additional Analysis	This recommendation will require installation of dedicated fuel storage tanks for this fuel type. Analysis required to decide where and how many tanks will be required to accommodate reasonable accessibility by the vehicles currently capable of using this fuel type. E85 contains about 27% less energy than gasoline per unit volume. Given this energy loss, about 37% more E85 is required to achieve the same amount of work as gasoline. Also need to consider cold weather ignition challenges.	Estimated 16% costlier than conventional gasoline, capital fuel storage tanks and dispenser infrastructure costs	4% reduction when compared to energy equivalent of gasoline	The data to determine cost of tanks and fuel site upgrades has been collected. Automotive market for new vehicles continues to be unstable and availability of E85 vehicles are scarce. We will continue to monitor the market however this option is not recommended at this time.
19	Biodiesel Some precautions must be taken before making the switch to biodiesel, including using a lower blend due to viscosity issues at cold temperatures. We recommend using a blend of 5% in winter and 20% in the summer and shoulder months. Consider a pilot project with several units switched to B10 at first, and if successful a phased in approach for other appropriate units.	Immediate	Trial of 20% blend for the summer and a 5% blend for the winter in two locations for one year.	Minor cost to perform due diligence service to fuel storage tanks and dispensers	Average annual GHG reductions expected to be between 10-12%	Reduced GHG's by 106 tonnes as a result of biodiesel use in 2021. Concerns realized during the winter season use of the B5 blend that will prevent future use of Biodiesel during cold weather months. The summer use of B20 did not present any challenges and we anticipate city wide use of B20 by the end of this summer.
20	CNG If CNG is of interest to the City, we recommend investigating subsidies for CNG upgrades and a CNG vehicle fuelling station. Consider a small-scale pilot project with several high-mileage units switched to CNG, and if successful a phased-in approach for other appropriate units	Additional Analysis	This recommendation will require installation of natural gas compressor stations. The infrastructure required for a Natural gas refuelling stations along with the mandated periodic maintenance and inspections are costly resulting in an increase to capital and operating budgets. Converting to natural gas on a large scale will require several fuelling stations throughout the City to accommodate reasonable accessibility for refuelling. The possibility of concentrated areas of natural gas vehicles with a short term refuelling equipment lease or "pay per use" arrangement may have some benefit for a short term until electric or other more efficient options become available.	Diesel Litre Equivalent cost difference is 75% less. CNG compressor station can cost between \$2-4 million depending on volume and flow requirements	Approximately 17% reduction compared to Diesel	The data to determine cost of compressors and storage tanks has been collected. Additional investigation into "fuel as a service" option was analysed. Currently in process of finalizing specifications for natural gas powered waste collection trucks. The lead time for natural gas powered chassis is 1-2 years with final completion of truck up to 2.5 years away. Typical builds were 9month-1 year.
21	Liquified Petroleum Gas(LPG) aka Propane If a strong business case for LPG can be shown for high-mileage units, consider a small scale pilot project with several high-mileage units switched to LPG, and if successful a phased-in approach for other appropriate units.	Additional Analysis	This recommendation will require installation of Propane dispensing stations. The infrastructure required for a Propane stations along with the mandated periodic maintenance and inspections are costly resulting in an increase to capital and operating budgets. Converting to Propane on a large scale will require several fuelling stations through the City to accommodate reasonable accessibility for refuelling.	A propane fuelling station is approximately \$15,000	Approximately 30% reductions compared to gasoline	This option requires a fairly significant capital investment for widespread use. The configuration of vehicles that would be considered for conversion to propane power are currently available in fully electric albeit in lower quantities than anticipated. It is Fleets recommendation to continue to source fully electric vehicles rather than converting vehicles to Propane.
22	Consider a pilot project for several BEVs when they become available (e.g., pickups) to track range capabilities and cost Immediate & short-term savings and assess the units' performance for all seasons and varying weather conditions. Assuming the pilot project is successful, consider acquiring BEVs in bulk to replace units that would provide the greatest ROI.	Previously Implemented/ Immediate	<u>Previously Implemented:</u> Licensing & By-law Services is currently piloting two (2) Kia Souls EV. <u>Immediate: Fleet has drafted a 3 year forecast of 89 vehicles that can be replaced with BEV's and will be replaced as scheduled.</u> Fleet will continue to investigate and survey the market for availability of demo models as new BEVs become available.	Two wheel drive SUV's are the only BEV's currently being sold. The cost increase is approximately 60% more than a gas powered SUV.	Based on historical average annual fuel consumption the city can realize a reduction of 335 tonnes of GHG's by replacing all 89 vehicles with a BEV option	
23	Continue to closely monitor the acquisition costs for BEVs and re-evaluate the business case (cost-benefit) for individual units as prices come down. Also continue to monitor the future availability of electric work/cargo vans, which are currently anticipated to be offered in battery-electric versions in the near future.	Previously Implemented	Fleet will continue to regularly monitor the industry and meet with manufacturer representatives annually for an update on estimated pricing, configurations and BEV release dates into the market. Fleet will utilize this information when preparing the capital budget annual replacement	Costs will be monitored. Impacts to both capital and operating costs are possible	GHG reduction will be impacted by determined replacements	
24	If relying on overnight charging infrastructure, consider supplying power to the charging equipment on two separate feeds from the grid to reduce the risk of local failure taking power away from the whole site.	Long Term	This recommendation will require further analysis and alignment to the yard rationalization review	No direct cost impacts associated with the implementation of this recommendation	No direct GHG reduction impacts associated with the implementation of this recommendation	


GREEN FLEET STRATEGY ACTION PLAN

Item	Recommendations	Implementation Timelines	Statement	Cost Impacts	GHG	Progress
25	Consider high-voltage training for technicians and closely monitor the launch of new BEV training programs.	Short Term	Staff will research available high voltage training.	This could impact both the operating budget as well as the capital. Operating budget impacts for training courses \$1000/Technician. Possible diagnostic tooling and equipment's costs.	No direct GHG reduction impacts associated with the implementation of this recommendation	
26	Hydrogen Fuel Cell Summary Fuel cell technology has a very high potential for future applications for vehicles in all classes. Nevertheless, the technology currently is still very expensive, lifecycle emissions are high and Fuel Cell Vehicles (FCVs) as well as fuelling stations are not yet available. As a result, any projections of fuel cell application in the future must be approached with caution and understanding of the inherent limitations. Therefore, it is recommended that a fleet monitor the development and availability of fuel cell technology for future applications in fleet operations	Additional Analysis	Currently there are very limited number of vehicles available to consider hydrogen as a viable option. Additionally refueling infrastructure does not exist in the City of Hamilton and a large scale implementation would be required to show a reasonable ROI to fund the refuelling infrastructure. Other challenges include repair facility infrastructure and support.	Capital cost for refuelling infrastructure is estimated to be in excess of \$2 million per site.	Currently most if not all hydrogen is produced from the burning of fossil fuels known as "Grey Source". Hydrogen from "Grey Sources" will have little to negative impacts to GHG's. Future hydrogen is expected from solar or wind "Green Source" which will show a favourable impact to GHG's	The data to determine cost of a hydrogen fuel station varies significantly by region. The lack of experienced trades in this region would make a firm budget estimate challenging and the securing of a qualified vendor a significant challenge. The Automotive market for new vehicles continues to be unstable and availability of hydrogen vehicles in Canada is scarce. We will continue to monitor the market however this option is not recommended at this time.
27	Renewable Natural Gas	Additional Analysis	A City wide strategy will be developed and implemented by Energy for the best use of RNG across City assets and operations.	Natural Gas compressor stations can cost between \$2-4 million depending on volume and flow requirements	Use of RNG is determined to have net zero impact to GHG's	Cost and availability are contributing factors however at this time we do not have any natural gas vehicles for which Fleet supplies fuel. The pending purchase of natural gas powered waste collection vehicles will allow for a more detailed cost analysis. Scheduled for 2023-2024
28	Rolling Resistance	Additional Analysis	This recommendation requires further analysis and testing. Fleet will consider including this technology in contract documents for new replacement vehicles where applicable. Further Analysis and involvement from tire provider and possible pilot on various types of vehicles and weather conditions to establish baseline	Exact cost associated with technology can not be directly identified. Cost benefit analysis will be performed on a case by case basis	Each solution will vary in its magnitude of GHG reductions, it is generally accepted that any reduction in rolling resistance will have a direct impact on GHG's reduction	Initial discussion with new tire supply vendor in September 2021. Considering test group of vehicles for a pilot program through all four seasons to determine benefits.
29	RSI-FC recommends expert legal review of the Electronic Logging Device(ELD) matter prior to the June 2021 deadline	Previously Implemented	Contacted Ministry of Transportation to confirm ELD's are not required for our Fleet as we are exempt from using logs to capture hours of service as a municipality that operates within a 160 km radius and we do not cross any borders.	None	None	
30	Anti-Idling Technologies	Previously Implemented/ Additional Analysis	<u>Previously Implemented:</u> Anti-Idling technology is currently being utilized in accessories installed in Fleet assets such as cab heaters, inverters, shut down systems, LED lights. <u>Additional Analysis:</u> Fleet will continue to investigate technology to aid in anti idling to determine the optimal solution and process for educating operating departments	Exact cost associated with technology can not be directly identified. Cost benefit analysis will be performed on a case by case basis	Each solution will vary in its magnitude of GHG reductions. Any reduction in idling will have a direct impact on GHG's reduction	

Previously Implemented
Immediate less than 1 year
Short Term 1-3 years
Long Term 3 years +
Additional Analysis Required



INFORMATION REPORT

TO:	Mayor and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	Response to the Bay Area Climate Change Council's Options for Travel Report (PED22181) (Ward 1) (Outstanding Business List Item)
WARD(S) AFFECTED:	Ward 1
PREPARED BY:	Trevor Jenkins (905) 546-2424 Ext. 1797
SUBMITTED BY:	Brian Hollingworth Director, Transportation Planning and Parking Planning and Economic Development Department
SIGNATURE:	

COUNCIL DIRECTION

On May 11, 2022, Council approved the following:

That the General Manager of the Planning and Economic Development Department be directed to work with staff to review how each recommendation in the Bay Area Climate Change Council's Options for Travel Report could be actioned, and report back to the General Issues Committee by September 21, 2022.

INFORMATION

The Bay Area Climate Change Council (BACCC) presented their Options for Travel Report at the May 4, 2022, General Issues Committee (GIC) meeting. The Report "aims to improve the [travel] choices available to Bay Area residents, ensuring they can opt for low carbon transportation, should they want to."

The Report offers recommendations that BACCC states will "improve low carbon options in the Bay Area, to help reduce transportation emissions," related to transit, cycling, pedestrian & mobility devices, and the overall transportation network."

OUR Vision: To be the best place to raise a child and age successfully.

OUR Mission: To provide high quality cost conscious public services that contribute to a healthy, safe and prosperous community, in a sustainable manner.

OUR Culture: Collective Ownership, Steadfast Integrity, Courageous Change, Sensational Service, Engaged Empowered Employees.

SUBJECT: Response to the Bay Area Climate Change Council's Options for Travel Report (PED22181) (Ward 1) - Page 2 of 2

Staff have provided information on the City's existing practices and policies for each recommendation and have identified actions that Council can take for each item as shown in Appendix "A" attached to Report PED22181.

Many of the Recommendations are actions already being done or planned to be done in some capacity, guided by Council approved Master Plans such as the Transportation Master Plan, the Ten-Year Local Transit Strategy, and the Community Energy and Emissions Plan. Enhancing existing or planned programs, services and campaigns will typically require additional funding and/or staff to deliver. A preliminary assessment resource requirement associated with some of the actions is provided in Report PED22058(a)/HSC22030(a) Hamilton's Climate Change Action Strategy Implementation Resources and Governance.

Two Recommendations are suggested to be referred to other bodies, if additional information or action is required:

- Number 21 relates to the new bicycle registry program that Hamilton Police Services operates. This item is suggested to be referred to the Hamilton Police Services Board; and,
- Number 31 relates to reporting to the Greater Bay Area Sub-Committee. It is suggested to be referred to the sub-committee for its consideration.

As this Report addresses the matter to review how each recommendation in the Bay Area Climate Change Council's Options for Travel Report could be actioned, Item II on the General Issues Committee Outstanding Business List, it is appropriate to be identified as complete and removed from the list.

APPENDICES AND SCHEDULES ATTACHED

Appendix "A" to Report PED22181 - Response Table to the Recommendations
Contained in Options for Travel

Appendix A - Response Table to the *Options for Travel Recommendations*

ID	Bay Area Climate Change Centre Recommendation	Existing City of Hamilton Action, Practice or Policy	Potential Action for the City of Hamilton
Transit Recommendations			
1	Improve the frequency of public transit routes, with more consistently timed service.	<p>Enhancing the frequency of public transit routes has been a core focus in recent years of the Ten-Year Local Transit Strategy with investment improvements being made annually in years four through six to support ridership growth, both in the near- and long-terms.</p> <p>Route frequencies are governed by Council-approved service standards and in most cases, operate at, or better than a minimum of 30 minutes during most time periods, except during evenings where the minimum frequency is at, or better than, 60 minutes.</p>	<p>Frequencies enhancements along routes with the highest ridership potential are planned as part of Ten-Year Local Transit Strategy, subject to the budget process. This includes the BLAST network.</p> <p>Without substantial additional investment, it is unlikely that all route frequencies would be set at a minimum of every 15 minutes during weekday base periods and during the day on weekends, as proposed in the text of this recommendation, due to not meeting service standards for productivity. However, route frequencies are under review within the (Re)envision the Hamilton Street Railway (HSR) project, which is based on broad customer, stakeholder and staff engagement, guided by a series of guiding principles developed through customer surveys.</p>
2	Review arrival schedules for public transit buses for better alignment with GO train services.	Improving inter-regional connectivity continues to be a focus of the City's transit planning, both in the near- and long-terms. At present, HSR service connecting to GO stations typically operates at higher frequencies than GO service. For example, at West Harbour GO station, HSR currently has 14 buses per hour in peaks servicing the station compared to one GO train. In fall 2022, this will increase to 18 buses per hour in peaks compared to one GO train. Similar HSR-to-GO frequency comparisons can be made at all GO stations to which HSR connects.	Year six enhancements being introduced in September 2022 will support improved connectivity to West Harbour GO and Hamilton GO Centre, via route 20 A Line service span expansion. HSR will review further enhancements and route restructuring to support inter-regional connectivity within the (Re)envision the HSR project.
3	Complete a feasibility analysis for express routes or improved public transit service to business parks.	Connecting to business parks has been a core focus in recent years of the Ten-Year Local Transit Strategy with investment improvements being made in connecting to the Ancaster Business Park, AEGD, RHBP, WHID, East Hamilton, and Flamborough Business Park in years four through six.	Further investments and enhancements are expected during the remaining years of the Ten-Year Local Transit Strategy, both at the local service and express service levels. The pilot on-demand transit pilot in Waterdown is ongoing, and lessons learned could be applicable to business parks. Ongoing consultation with employer stakeholders in business parks will be undertaken as part of the (Re)envision the HSR project.

Appendix A - Response Table to the *Options for Travel Recommendations*

ID	Bay Area Climate Change Centre Recommendation	Existing City of Hamilton Action, Practice or Policy	Potential Action for the City of Hamilton
4	Complete audits of all City bus stops to determine safety improvements for transit riders, particularly women. Track the number of improvements flagged and completed over time.	The City recently invested in the replacement of all shelters in the transit network to ensure quality, safety, accessibility and state of good repair. HSR staff continuously track the quality, safety and state of repair for stops and associated amenities, in collaboration with other internal City divisions. In addition, the City received ICIP funding to fill in gaps in the sidewalk network leading to major transit stops across the City.	<p>HSR recently completed an audit of all stops to determine where pedestrian connectivity gaps exist for future safety improvements. HSR is undertaking upgrades to many non-compliant stop locations to become ADOA-compliant by 2025.</p> <p>HSR is currently undertaking an update on their stop inventory data and will be reviewing several potential improvements and pilots to support safety for customers. The data can be tracked and improvements made reported over time.</p>
5	Ensure all public transit staff complete diversity and anti-bias training.	<p>One of the six Guiding Principles in (Re)envision the HSR is “We honour equity, diversity and inclusion.”</p> <p>The 2022/2023 (Re)envision Action Plans include several activities supporting advancing equity-focused desired outcomes. One such area is with respect to the diversity of HSR’s workforce. HSR continues to review staff complement through an equity lens, and has focused recent recruitment efforts on increasing representation from women and diverse communities, particularly for Operators.</p>	<p>HSR is exploring training opportunities for mandatory corporate training initiatives (e.g. gender protocol).</p> <p>In addition to mandatory training, HSR is exploring pilot projects to provide equity-focused training to administrative staff including: Dementia-friendly communities; Anti-racism/anti-oppression; Truth and Reconciliation and history of residential schools; LGBTQ+ service delivery; and applying a gender-equity lens to transit planning and operations. The goal of these pilots would be to explore opportunities to deliver timely and relevant training and information to all staff in transit, while balancing operational requirements.</p>
6	Collect data on snow removal for bus stops and release it in real time on an open data platform.	(Re)envision the HSR revealed that snow clearance of stops is an important driver of customer satisfaction. Customer service complaints related to snow-clearing within areas of the transit network are actioned based on the City’s service standards.	The new City of Hamilton program for snow-clearing on sidewalks along transit routes (commencing in November of 2022) is expected to improve HSR’s customer experience in the winter months.
7	Collect data on the number of bus stops with seating and strive to increase the percentage of stops with seating for users to rest, particularly pregnant women and the elderly.	<p>HSR is currently undertaking an update on their stop inventory data to determine total coverage of seating at bus stops in the current state.</p> <p>HSR is currently piloting alternative solutions for seating at dozens of bus stops where space within the public right-of-way is limited, constraining the ability to implement traditional benches. When determining the appropriate location for seating amenities, several factors are considered, including surrounding land uses and social/community considerations (e.g. senior’s housing, community centres, hospitals/clinics etc.).</p>	Based on the results of the pilot initiative, there is an opportunity to increase the number of stops with this alternative seating solution, where feasible. Staff will investigate opportunities where alternative seating may be an option.

Appendix A - Response Table to the *Options for Travel Recommendations*

ID	Bay Area Climate Change Centre Recommendation	Existing City of Hamilton Action, Practice or Policy	Potential Action for the City of Hamilton
8	Provide clarity to post-secondary institutions on whether student bus passes will be accepted on the new light rail transit (LRT) line.	N/A	Decisions regarding fare structure will be communicated when finalized.
9	Meaningfully and respectfully consult Six Nations on their views and preferences regarding a public transit connection between Six Nations and Hamilton.	Through (Re)envision the HSR, HSR engaged with the City's volunteer Indigenous Advisory Committee and this opportunity was expressed as a potential area of improvement.	<p>It may be appropriate to refer this item to Metrolinx/GO Transit given this is a route that is regional in nature. Six Nations, Brant County and Haldimand County are within Metrolinx's expanded mandate area.</p> <p>A public transit connection between Six Nations and/or New Credit and Hamilton would be outside of HSR's current Council-directed mandate for urban boundary service. Staff can be directed to begin conversations with Six Nations, Haldimand County, and Brant County/Brant Transit to begin discussions about their interest about a possible service.</p> <p>Ongoing consultation in the context of the City's Urban Indigenous Strategy may be relevant, and respectful engagement with the urban Indigenous community and the First Nation communities of Six Nations and Mississaugas could be undertaken.</p>
10	Review the feasibility of offering free public transit during the Holiday Season, to complement the existing program for free parking downtown to encourage local shopping.	Hamilton Municipal Parking System staff are currently undertaking a review of the holiday free-parking program. Based on a review of other municipalities, it appears that most municipalities either do not offer free holiday parking, or have much shorter durations for implementation.	Further analysis is required to determine the business case to support this recommendation. If directed by Council, staff could conduct a benchmark scan with other Ontario and Canadian municipalities to determine if similar programs currently exist that demonstrate a positive outcome. Alternatively, Council could direct that the free holiday parking program be eliminated or reduced to restore parity with transit.
Cycling Recommendations			
11	Improve cycling infrastructure to improve connectivity and safety for residents.	The City is building new cycling facilities and enhancing/renewing existing facilities on an annual basis, guided by the Council-approved Cycling Master Plan. From 2018 to 2021, the City has delivered 79 km of new and enhanced cycling facilities, at a cost of \$13.1 million (\$7.7 million in City funds, \$5.4 million in grants). Staff report annually to Council on projects completed in the previous year and projects planned to initiate in the next year, and provides monthly updates to the Hamilton Cycling Advisory Committee.	Council can provide additional funding and staff resources to accelerate the implementation of the Cycling Master Plan.

Appendix A - Response Table to the *Options for Travel Recommendations*

ID	Bay Area Climate Change Centre Recommendation	Existing City of Hamilton Action, Practice or Policy	Potential Action for the City of Hamilton
12	Determine intersections that have poor safety records for protection upgrades. Implement enhanced safety features at the identified locations, complimented by an education campaign for travelers.	The City approved the Hamilton Strategic Road Safety Program and Vision Zero Action Plan for 2019-2025 in February 2019. A component of that program is the development of an Annual Collision Report. The Annual Collision Report provides the City of Hamilton with information that is used to identify priority roadway safety issues, develop initiatives to improve roadway safety, provide evidence about the effectiveness of safety improvements and undertake targeted education campaigns. In-Service Roadway Safety Reviews are undertaken at specific intersections and road segments to identify enhanced safety features to improve roadway safety within the City for implementation. The City has applied for funds through the National Active Transportation Fund to undertake functional design of some protected intersections.	On-going.
13	Collect data on snow removal for bike lanes and release them in real time on an open data platform, like the City of Ottawa.	The City tracks snow clearing on roadways, but the data isn't currently separated for on street bike lanes since work is completed simultaneously with the road clearing.	Separated snow clearing data for bike lanes is currently not available in real time, and a new process would need to be developed prior to implementation. Staff could be directed to develop a process, but additional resources may be required.
14	Create a priority cycling network to be plowed, de-iced, and cleared in winter months.	The cycling network is currently cleared to the requirements set out in the Provincial Minimum Maintenance Standards (O. Reg 239/02). The City's entire cycling network is currently cleared, not just a priority section, assuming the bicycle facility falls within the MMS regulations.	On-going.
15	Develop a marketing campaign to encourage and normalize winter cycling.	Currently, there is an annual Winter Commute Month in February (previously Winter Commute Week), with each week themed around using a different mode of transportation. The cycling week corresponds with international Bike to Work Day (typically the second Friday of February). Through Winter Commute Month, tips on winter cycling through social media channels, newsletters, and outreach events at Smart Commute workplaces. The City has financially supported the Winter Bike Day event at Gore Park.	On-going.
16	Complete a comprehensive update to the Cycling Master Plan, utilizing a gap analysis and the recommendations listed herein.	The current Cycling Master Plan was approved in 2018. The next update is scheduled to begin in 2023, following the release of results of the 2021 Canada Census and Transportation Tomorrow Survey. The recommendations contained in the BACCC report can be considered as part of the update.	A budget sheet for the Integrated Active Transportation Master Plan will be submitted as part of the 2023 budget. The study will bring together the Cycling Master Plan, Recreational Trails Plan and Pedestrian Mobility Plan. Council can support the budget request.

Appendix A - Response Table to the *Options for Travel Recommendations*

ID	Bay Area Climate Change Centre Recommendation	Existing City of Hamilton Action, Practice or Policy	Potential Action for the City of Hamilton
17	Fund promotional campaigns to encourage cycling generally.	Sustainable Mobility hosts a number of cycling-related campaigns, with Bike Month (June) being the premiere event of the year. The event typically attracts close to 1,000 registrants, with 15 to 20% being new to cycling. The City organizes the Bike Day kick-off on the last Friday of May at City Hall and some pop-up events, and community organizations host a number of events throughout June including workshops, group rides, and a bike-in movie night. Funding is provided by the City and the Cycling Committee to support community and Smart Commute workplace events. Other campaigns that support cycling in general include Winter Commute Month (February) and Smart Commute Month (September). The Cycling Advisory Committee also funds community events and campaigns through its budget.	Ongoing.
18	Expand secure bike parking infrastructure by developing detailed secure bike parking guidelines for developers and employers, similar to other cities.	The City's Transportation Demand Management and Land Use Guidelines requires secured bike parking in most employment developments and higher density residential developments, and provides direction on rates.	Staff could be directed to review the Zoning- By-Law requirements and directed to report back with revisions, such as parking sizes and requirements for e-bike charging stations.
19	Consider expanding bikeshare infrastructure across Hamilton, to better serve residents.	The Hamilton Shared Micro-Mobility Report (Appendix "A" to PED20109(c)) was undertaken to identify the areas that would best support bikeshare expansion. The City and Hamilton Bike Share Inc. (HBSI) continue to work together to identify potential funding opportunities that could support future expansion and renewal of the bike share infrastructure.	The Micro-Mobility Report estimated that an expansion on the north Mountain is estimated at \$2.3 million for equipment and approximately \$680,000 a year in operating costs (2020\$). These costs would need to be reconfirmed.
20	Improve access to free publicly accessible bike repair stations.	The City of Hamilton owns and maintains five bike repair stations that are available and free to the community, complemented by other stations that are owned and managed by other organizations (e.g. McMaster, Mohawk). In recent years, the City has installed one to two new stations each year, based on feedback from the community, land availability, and proximity to major cycling facilities.	The sites recommended by BACCC will be reviewed and considered by the City as part of future installations.
21	Prevent bike theft by bolstering existing bike registry programs.	Hamilton Police Services operates the online bike theft registry program, which allows individuals to proactively register their bike in case it is stolen. The online system was launched in spring 2021. The City provides promotional information on the program at Hamilton.ca/cycling , and promotes it through events.	Hamilton Police Services is responsible for the existing bike theft registry program. This item could be referred to the Police Services Board for consideration.

Appendix A - Response Table to the *Options for Travel Recommendations*

ID	Bay Area Climate Change Centre Recommendation	Existing City of Hamilton Action, Practice or Policy	Potential Action for the City of Hamilton
22	Seek the Bike Friendly Community Gold designation, operated by the Share the Road Cycling Coalition.	The City of Hamilton renewed at the 'Silver' level in 2021, and the feedback we received to work towards achieving Gold. Share the Road, who administers the program in Ontario, is working with the League of American Bicyclists to review and update the application and process so no new applications are being accepted at this time.	Staff will review the new application process and evaluate appropriate actions at that time.
23	Enlist TransLAB, under the supervision of Dr. Darren Scott at McMaster University to analyze cycling data to prioritize network improvements and expansion.	The City has been directed to enter into an agreement with TransLAB (PED20109(d)) to analyze bikeshare and e-scooter data.	Findings will be used in the development of the Integrated Active Transportation Master Plan.
Walking and Mobility Device Recommendations			
24	Complete walk audits surrounding all schools to determine safety improvements for pedestrians, particularly children. Track the number of improvements flagged and completed over time.	Walkabout audits of local schools are completed as part of the School Travel Planning program, operated by Planning and Economic Development, and Public Health. The walkabouts inventory existing multi-modal infrastructure and identify any safety concerns, and then develop an action list that becomes part of the School Travel Plan and are reviewed as part of the plan. There are 112 schools involved at different phases of the process.	Staff can consolidate comments into a central dashboard to track progress on items, and report annually on the number of completed items as part of the Sustainable Mobility Annual report that Council receives.
25	Assess and improve the 'sidewalk to road ratio' across the City, aiming for 1:1, where feasible.	<p>The 1:1 sidewalk to road ratio refers to providing a sidewalk on at least one side of a street. The City's existing policies aim to meet or exceed the 1:1 ratio. In new developments, the Comprehensive Development Guidelines and Financial Policies Manual (2019) requires sidewalks on both sides of new roads within the urban boundary. Along existing roads, the City's Pedestrian Mobility Master Plan established a 'Routine Accommodation Policy' that requires pedestrian infrastructure be implemented as part of ongoing streetscaping and road improvement projects.</p> <p>The City also has an ongoing sidewalk in-fill program that aims to address gaps in areas where no capital projects are planned in the near future. A request for a new FTE dedicated to the sidewalk program is being submitted as part of the 2023 budget process.</p>	On-going.

Appendix A - Response Table to the *Options for Travel Recommendations*

ID	Bay Area Climate Change Centre Recommendation	Existing City of Hamilton Action, Practice or Policy	Potential Action for the City of Hamilton
26	Improve safety by completing City-wide lighting studies for pedestrians.	An outdoor lighting study was completed in 2010, which was inclusive of pedestrian lighting levels. That study led to the adoption of the City's Policy for Sidewalk and Roadway Lighting.	Staff can be directed to undertake a review of the policy and determine if additional studies are warranted.
Overall Network Recommendations			
27	Commit to open data, wherever possible. Update these data sets regularly.	The Hamilton Open Data portal has a number of transportation-related datasets available on the Open Data portal, with more being shared as they become available. They are updated annually at a minimum, depending on the content of the datasets and if changes are made.	Staff should continue to identify datasets that could potentially be made available on the Open Data portal.
28	Develop data sharing agreements with local school boards to optimize public transit routes for schools.	HSR staff work directly with school boards each year to understand relevant bell times, in order to determine when peaks in ridership surrounding schools may occur. HSR provides additional service during peak times to minimize crowding.	HSR will discuss opportunities to use aggregate data for additional transit planning activities in future.
29	Invite CityLab and MacChangers to work on the low carbon mobility initiatives listed herein, to find innovative solutions and reduce the burden on City staff.	<p>Since Fall 2017, the City has collaborated with CityLab students on 37 projects related to improving mobility options. These projects provide value and align with the City's strategic priorities, while providing students with an experiential learning environment for students. Projects that CityLab students and City staff have collaborated on since 2020 include:</p> <ul style="list-style-type: none"> • A Consultation Framework for Cycling Projects; • Don't Miss the Bus: HSR Reliability and Improving Real-Time Information; • Parking for a Modern City; • Complete Streets Ward 1 Intersection Makeover Project; • Transit's Role in Enhancing Community Sustainability and Improving Quality of Life; • Creating A Vision for A Minimum Grid Cycling Network; • Wellness Through Active Mobility; • Rural Transportation Options For 55+; • Walking School Bus Feasibility Study; and, • Cycling Tourism Routes. 	Staff can continue to identify projects that support low carbon mobility and, collaborate with CityLab students to find solutions.

Appendix A - Response Table to the *Options for Travel Recommendations*

ID	Bay Area Climate Change Centre Recommendation	Existing City of Hamilton Action, Practice or Policy	Potential Action for the City of Hamilton
30	Invite the MacData Institute to host a hackathon competition with collected transportation data, to find innovative solutions and reduce the burden on City staff.	The City does not currently host any transportation related hackathons.	Staff can be directed to work with the MacData Institute on potential collaborations, including funding for a potential hackathon event.
31	Commit to including a standing item on all Greater Bay Area Sub-Committee meetings to review each city's respective transportation data trends and allow for discussions of collaboration and shared learnings.	N/A	<p>This recommendation could be referred to the Greater Bay Area Sub-Committee for consideration.</p> <p>Staff can be directed to make this a standing item at future Bay Area Transportation Summit, an event organized jointly by staff from the cities of Burlington and Hamilton.</p>



INFORMATION REPORT

TO:	Mayor and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Ailish Brooke (905) 546-2424 Ext. 6875 Gloria Rojas (905) 546-2424 Ext. 6247
SUBMITTED BY:	Kirk Weaver Acting Director, Financial Planning, Administration and Policy Corporate Services Department
SIGNATURE:	

COUNCIL DIRECTION

Not Applicable

INFORMATION

Executive Summary

The City of Hamilton has participated in an annual tax competitiveness study since 2001. Report FCS22061 provides information for 2021 with comparison to prior years and other municipal comparators.

Consistent with the data presented in prior years, the 2021 data suggests that Hamilton's relative tax burden continues to trend positively towards the comparator groups and is becoming more competitive across metrics in the residential, commercial and industrial property classes.

Residential: While the City's property taxes in the residential property class are considered high overall, they have continued to converge with comparator groups. In 2015, Hamilton's detached bungalow property taxes were 17.57% higher than the 10 most proximate municipalities, in 2021 the difference has decreased to 9.35%.

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**SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) –
Page 2 of 12**

The City has a residential tax rate of 4.61% of average household income. The effective residential property tax rate is a representation of the tax rate as a percentage of property value. The effective residential property tax rate has continued to fall from 1.38% in 2015 to 1.21% in 2021, though this represents a slight increase from 1.19% in 2020. Overall, Hamilton is trending in a competitive direction in this property class.

Commercial: The City is very competitive in the Commercial property class, especially when examining the taxes paid for office buildings. Taxes paid for office buildings in Hamilton (\$3.22 / square foot) are lower than the average of the 10 most proximate municipalities (\$3.36 / square foot) and the average of the municipalities with the most comparable populations (\$3.54 / square foot).

Industrial: The City's property taxes are very competitive in the large industrial property class (53.19% below the 10 most proximate municipalities in 2021). The trend has been improving for the industrial property class, as the taxes paid per square foot in 2021 were 17.84% higher than the 10 most proximate municipalities which is an improvement from being 32.16% higher in 2015.

Non-Residential versus Residential Split: Hamilton's assessment is comprised primarily of residential properties. The proportion of non-residential assessment as a percentage of the total assessment is 11.86% and the residential assessment as a percentage of the total assessment is 88.14%. This translates to a large tax burden borne by the residential property class. Hamilton's proportion of non-residential assessment is 3.65% lower than the average of the 10 most proximate municipalities.

Analysis

The City of Hamilton participates annually in the Municipal Study conducted by BMA Management Consulting Inc. which examines the relative property tax competitiveness of 129 municipalities in Ontario. Report FCS22061 provides an overview of the City of Hamilton's tax burden in 2021 and preceding years relative to other comparator municipalities. The complete Municipal Study has been made available through the City's website (<https://www.hamilton.ca/home-property-and-development/property-taxes/municipal-tax-competitiveness-study>).

Staff has conducted an analysis of the City of Hamilton's tax burden relative to two primary comparator municipality groups based on population similarity and geographic proximity. The 28 participating municipalities with the most similar population to the City of Hamilton were selected for the population similarity comparator group. The 10 most proximate municipalities to the City of Hamilton participating in the Municipal Study were selected for the geographic proximity comparator group.

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**SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) –
Page 3 of 12**

The comparator groups will vary slightly year over year due to changes in the participating municipalities and populations. All comparative measures presented in Report FCS22061 are presented based on the comparators identified in Appendix “A” to Report FCS22061.

Appendix “A” to Report FCS22061 lists the municipalities included in each comparator group. The selection of comparators utilized in Report FCS22061 follows the same methodology applied to the 2020 Municipal Tax Competitiveness Study (FCS21083), which represents a systematic enhancement of the methodology utilized previously. While the analytical conclusions are consistent with previous reports, Report FCS21083 and FCS22061 display slightly different and more accurate comparator results than presented in previous reports.

The objective of Report FCS22061 is to identify general trends in the municipal tax competitiveness of the City of Hamilton. Several factors impact a municipalities tax burden and many municipalities included in the Study are affected differently. Factors that influence the tax burden may include:

- Variations in the specific type sample properties included in the Study
- Tax policies (e.g. tax ratios, Provincial levy restrictions on the Multi-Residential, Commercial and Industrial property classes)
- Optional property classes, area ratings
- Non-uniform education tax rates in the non-residential property classes
- Differences in level of municipal service provided
- Municipal access to other sources of revenue (provincial subsidies, gaming and casino revenue, etc.)

Report FCS22061 examines Hamilton’s relative tax burden in the Residential, Multi-Residential, Commercial and Industrial property classes. Overall, the data suggests that Hamilton’s relative tax burden is becoming more competitive.

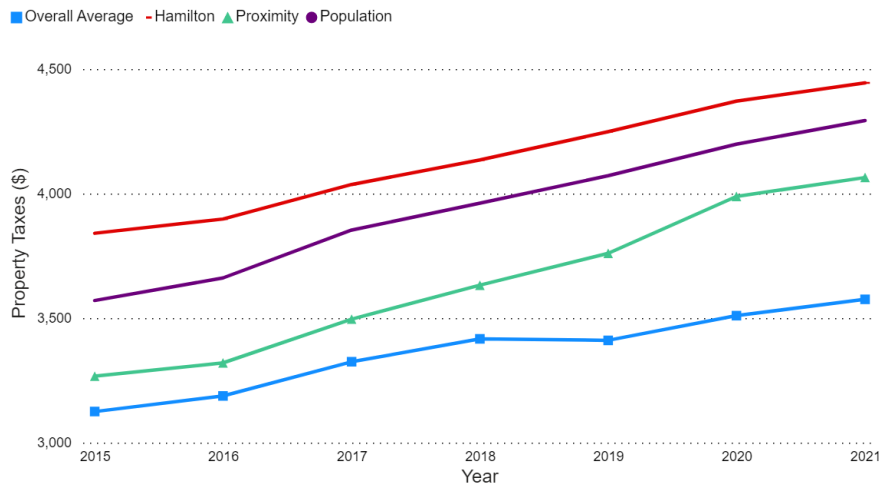
Residential Property Class

Tax Competitiveness for the residential property class is represented by the taxes paid on a detached bungalow. Figure 1 to Report FCS22061 depicts the relative stability of Hamilton’s residential property taxes as depicted by a detached bungalow property in relation to the comparator groups. In 2015, Hamilton’s taxes were 17.57% higher than the proximity comparator group, whereas in 2021, the difference had decreased to 9.35%. In 2021, Hamilton’s taxes for a detached bungalow were 3.52% higher than municipalities with comparable populations, but 24.30% higher than the overall average of all study participants.

**SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) –
Page 4 of 12**

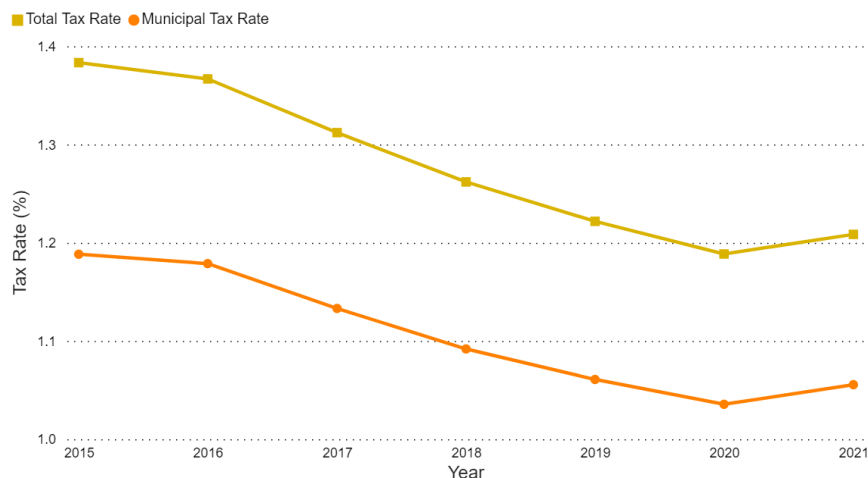
The Municipal Study has categorized Hamilton’s residential property taxes as high in comparison to other study participants.

Figure 1: Residential Property Taxes – Detached Bungalow



The effective residential property tax rate is a representation of the tax rate as a percentage of property value. This indicator demonstrates the capacity level municipalities may have to increase taxes. Those with the lowest effective property tax rates have the greatest capacity while those at the higher end have less capacity. Figure 2 to Report FCS22061 depicts the year-to-year relative stability of Hamilton’s total effective tax rate, which was 1.21% in 2021 and has had a slight downward trend since 2017, which is related to the fact that reassessment has increased at a greater rate than the levy (reassessment was about 6% each year of the 2017-2020 cycle). The municipal effective tax rate follows a similar trend, since the education portion of the tax bill has remained stable since the last reassessment cycle.

Figure 2: Effective Residential Property Tax Rate – Hamilton



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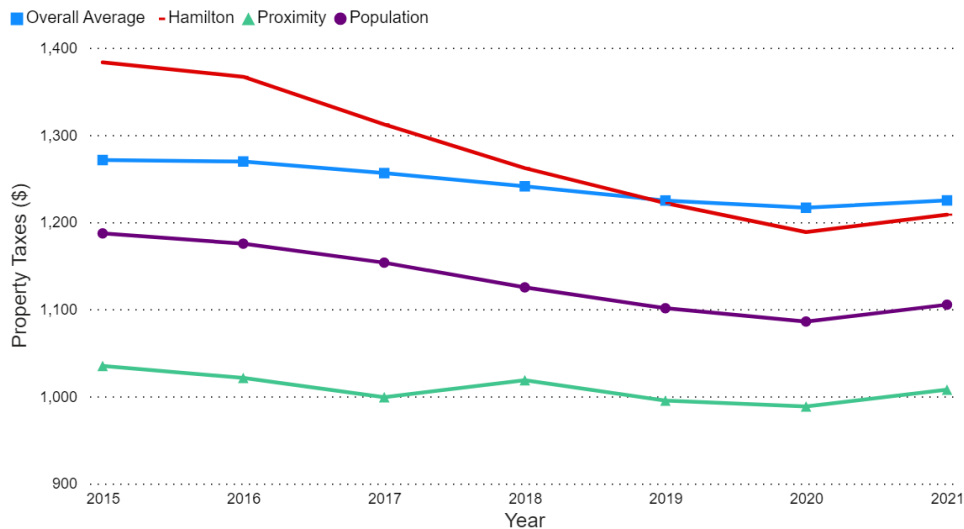
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**SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) –
Page 5 of 12**

Residential Property Taxes per \$100,000 of Assessed Value

Figure 3 to Report FCS22061 depicts Hamilton's average residential property taxes for every \$100,000 of assessed value. Hamilton's residential taxes per \$100,000 of assessed value have been steadily trending down since 2015. As of 2021, Hamilton's residential taxes per \$100,000 of assessed value remain 19.94% higher than proximity comparators and 9.35% higher than population comparators but since 2020, has remained below the overall average of study participants.

Figure 3: Residential Property Taxes per \$100,000 of Assessed Value



Residential Property Taxes as a Percentage of Income

Average household income is an indication of a community's ability to pay for services. The Municipal Study last provided data on average household income for 2019 as part of the 2020 Municipal Study. The 2019 figures are utilized for the purposes of the following analysis. As shown in Figure 4 to Report FCS22061, Hamilton's residential property taxes represent a residential property tax burden of 4.61% of the average household income of approximately \$98,500. The overall average household income of all 2021 study participants is approximately \$108,500 with an average residential property tax burden of 3.80%. Figure 5 to Report FCS22061 compares Hamilton's residential property tax burden to municipalities with the most similar average household incomes and demonstrates that even when adjusting for household income, Hamilton continues to have one of the highest residential property tax burdens as the average for these municipalities is 3.94%.

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SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) – Page 6 of 12

Household income is one measure of a community’s ability to pay for services. However, it can be a difficult measure for municipalities to affect change. To improve this measure, expenditures need to be reduced (possibly impacting services to residents) or incomes need to increase. Income is a long-term factor influenced by broader economic conditions.

Figure 4: Residential Property Taxes and Average Household Income – Hamilton

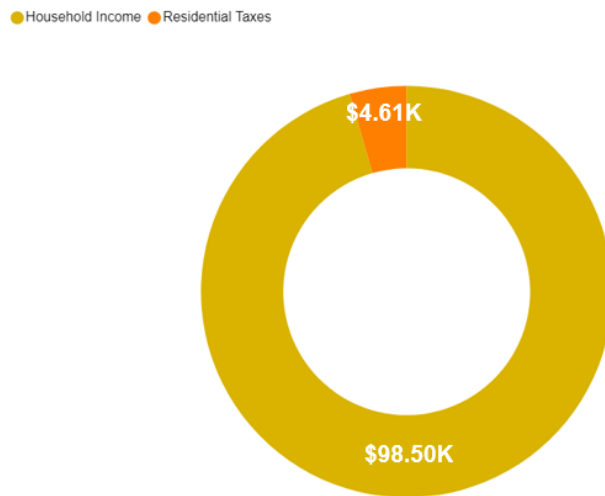
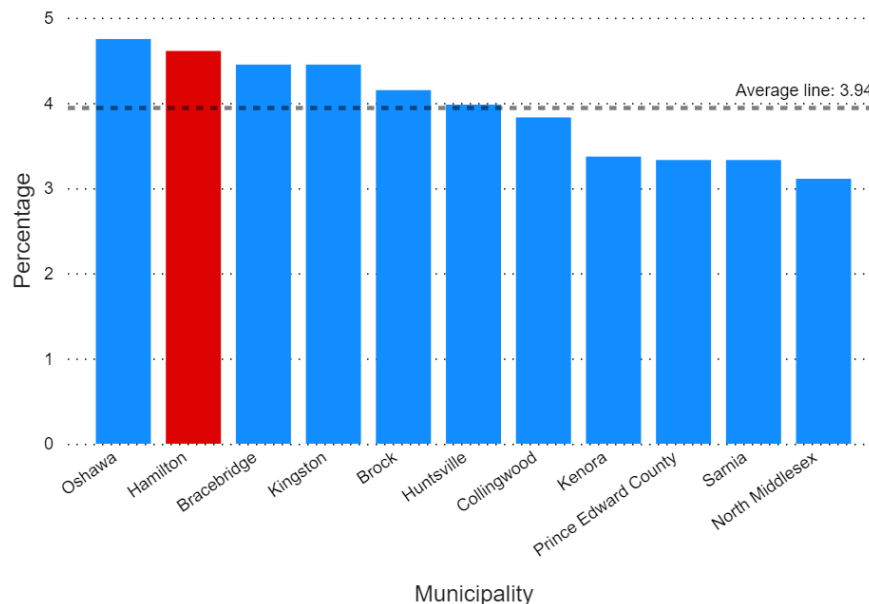


Figure 5: Residential Property Taxes as a Percentage of Household Income



SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) – Page 7 of 12

Hamilton has made progress towards being more competitive in the residential property class as a result of the relatively low tax increases passed by City Council in recent years, despite the City continuing to be negatively impacted by the Provincial levy restrictions on the Industrial and Multi-Residential property classes. The reassessment cycle that was scheduled to start in 2020 has been postponed until at least 2023. The results of the next reassessment and how Hamilton assessment values compare to the rest of the Province will be a key factor on whether the positive trend continues.

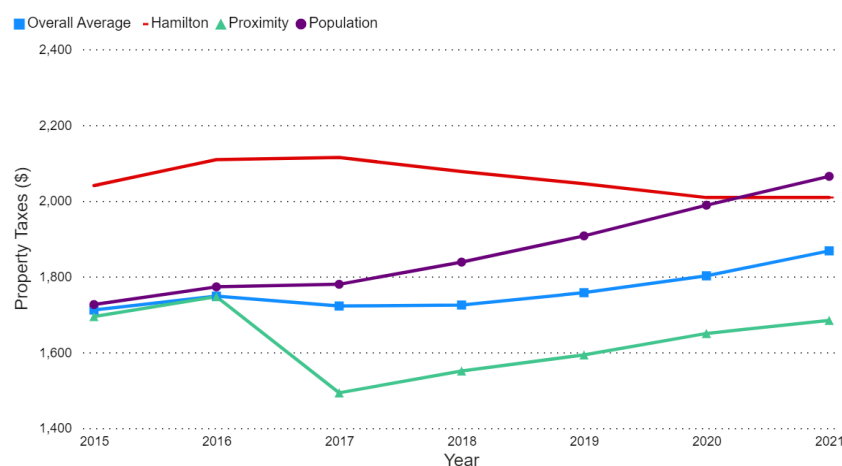
Multi-Residential Property Taxes

The tax competitiveness for the broader multi-residential property class is measured by taxes imposed on high-rise apartment buildings. Figure 6 to Report FCS22061 depicts property taxes for high-rise apartments on a per unit basis. Hamilton's property taxes in this class are converging with the overall study average and comparator groups. The average of each comparator group has been increasing and Hamilton trends downwards. Hamilton's taxes are currently 19.24% above the proximity comparator group, 2.70% below the population comparator group and 7.54% above the overall average.

Ongoing reductions in the tax burden of the multi-residential property class are expected due to the 2017 legislation enacted by the Province of Ontario to freeze the tax burden for multi-residential properties in municipalities where the tax ratio is above 2.0. As of 2022, the multi-residential tax ratio in Hamilton was 2.3594. Additional information on the multi-residential property class is available in Report FCS18002, "Update Respecting Multi-Residential Taxation".

The Municipal Study has categorized Hamilton as having mid-range property taxes for the multi-residential property class in comparison to the overall average of study participants.

Figure 6: Multi-Residential Property Taxes – High-Rise Apartment



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**SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) –
Page 8 of 12**

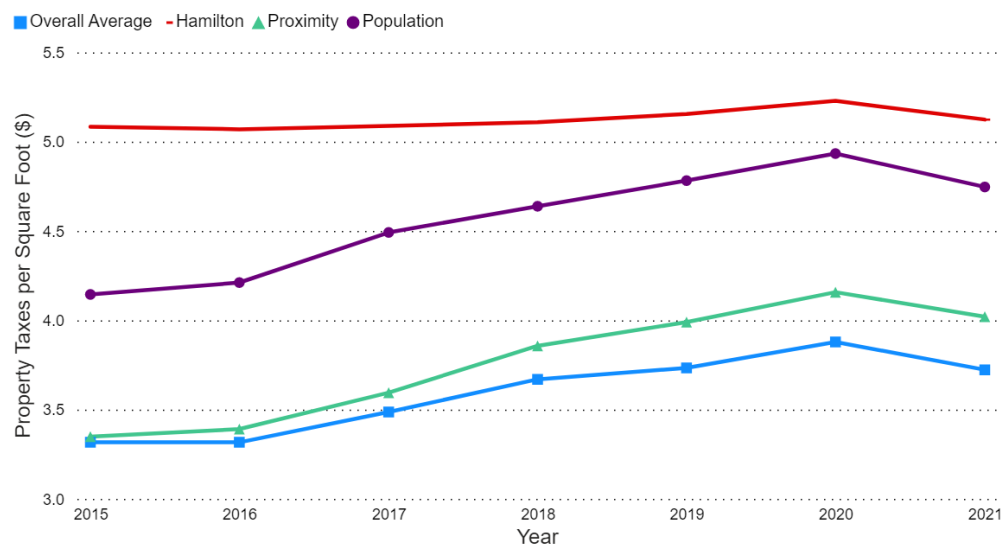
Commercial Property Class

There are several challenges to consider when measuring the competitiveness of the Commercial property class across the Province. Challenges due to the evolving economic landscape include:

- Closure of major anchor retailers
- Entry of new, high-end international retailers into the Canadian marketplace
- Changing shopping patterns of Canadian consumers (including online shopping)
- Volume of appeals filed by owners / operators

Figure 7 to Report FCS22061 summarizes the dollar value of the property taxes per square foot imposed for neighbourhood shopping centres. Neighbourhood shopping centres have been defined as small centres which are comprised of retail tenants who cater to everyday needs (including pharmacies, convenience stores, hardware stores etc.) and range in size from approximately 4,000 to 100,000 square feet. Hamilton's property taxes per square foot have been relatively stable since 2015 while other comparator groups have increased. Hamilton's taxes per square foot in 2021 was 27.36% higher than the proximity comparator group compared to 51.64% higher in 2015.

Figure 7: Commercial Property Taxes – Neighbourhood Shopping Centre



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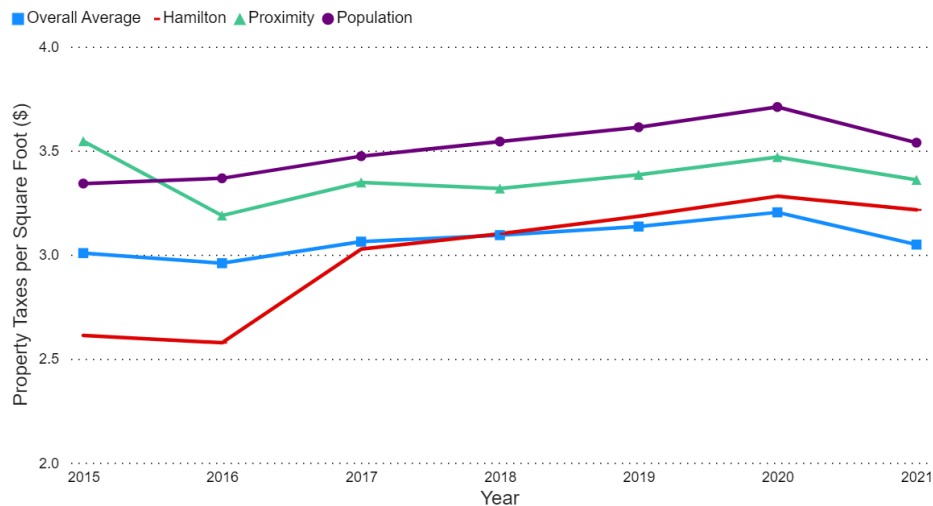
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**SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) –
Page 9 of 12**

Figure 8 to Report FCS22061 summarizes the dollar value of the property taxes per square foot of gross leasable area in office buildings. Office building data is focused on buildings in prime locations within each municipality. Hamilton's property taxes for this property type is quite competitive in comparison to proximate municipalities being 4.17% lower than the proximity comparator group in 2021 and 9.04% lower than the population group. Hamilton's property taxes in this category first surpassed the overall average in 2018 and remains 5.57% higher than the overall average in 2021.

Figure 8: Commercial Property Taxes – Office Building



Industrial and Large Industrial Property Class

Figure 9 to Report FCS22061 summarizes the dollar value of property taxes per square foot in the industrial property class. Buildings in the industrial property class are less than 125,000 square feet. Since 2015, the taxes in Hamilton and the overall average have been relatively stable. In 2021, Hamilton's industrial taxes per square foot was 17.84% higher than the proximity comparator group and 25.50% higher than the population group. The general trend is improving for the City in this class, as in 2015 Hamilton's taxes were 32.16% higher than the proximity comparator group. Hamilton's industrial taxes are, however, 60.90% higher than the overall average.

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SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) – Page 10 of 12

Figure 9: Industrial Property Taxes –Industrial

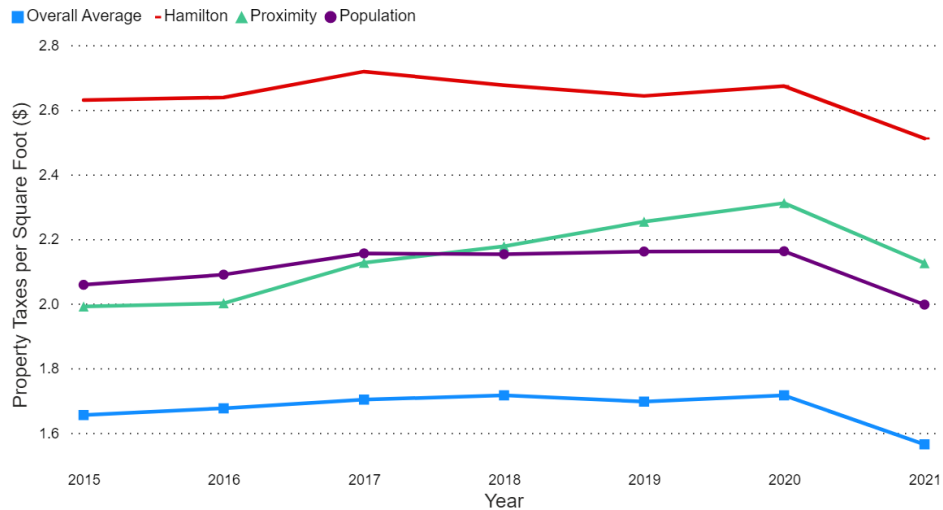
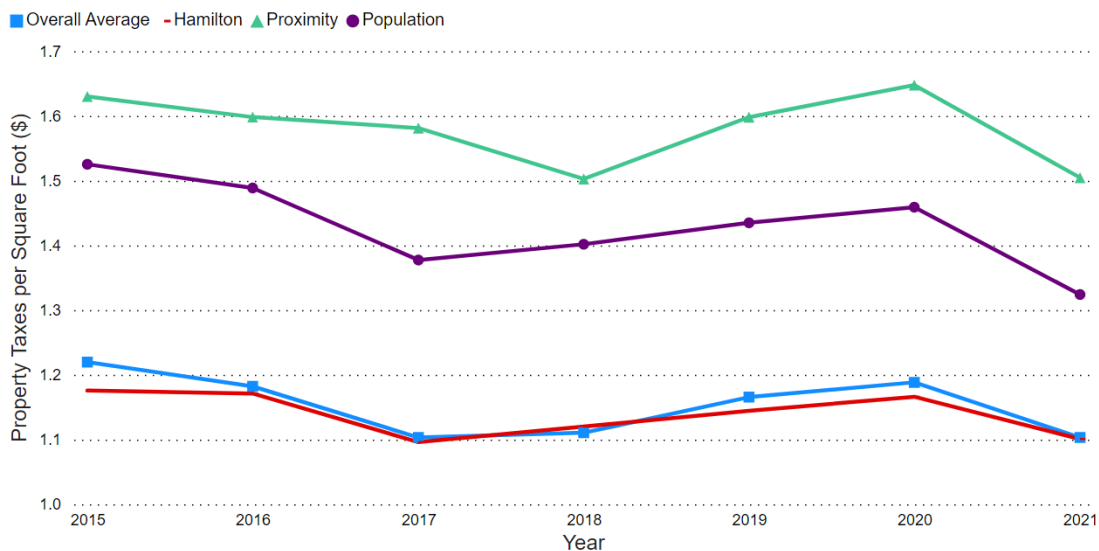


Figure 10 to Report FCS22061 summarizes the dollar value of property taxes imposed per square foot for buildings in the large industrial property class. Large industrial buildings are greater than 125,000 square feet. Hamilton is exceptionally competitive in the large industrial property class where Hamilton’s tax rate is below the comparator groups and at the overall average. In 2021, Hamilton’s tax rate was 36.36% below the proximity comparator group. The slight downward trend for Hamilton and all comparator groups between 2020 and 2021 is due to the standardization of Business Education Taxes in 2021.

Figure 10: Industrial Property Taxes – Large Industrial



**SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) –
Page 11 of 12**

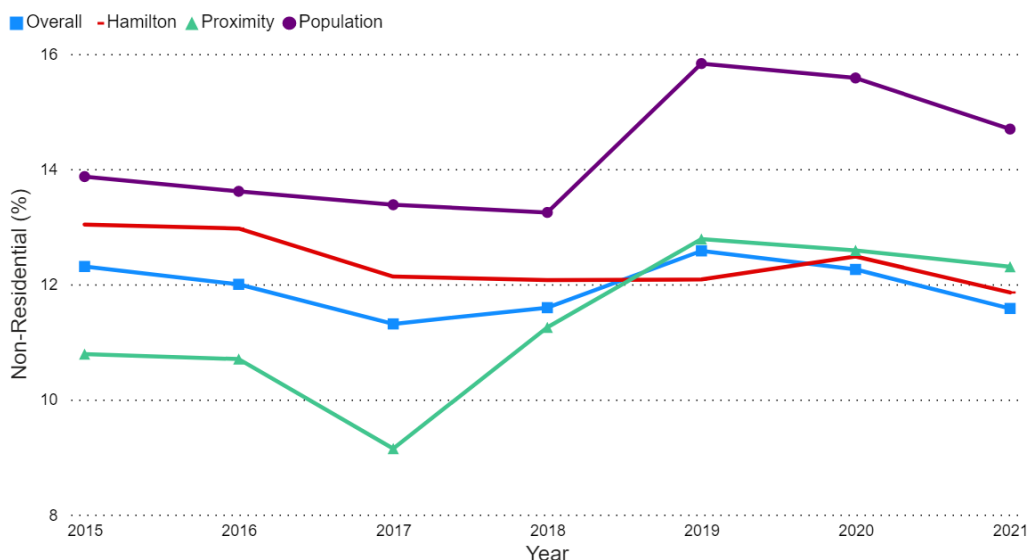
The gap between the comparators and Hamilton can be attributed to a variety of factors including the overall decline of the manufacturing industry in Ontario which has left many municipalities with a reduced assessment base. In addition, successful appeals of assessment contribute to a reduced assessment base. Additional details on the quantity and results of assessment appeals in the City can be found in Report FCS22010, “Annual Assessment Appeals as of December 31, 2020”.

In 2020, the Business Education Taxes (BET) were reduced across the Province for properties in the commercial and industrial property classes beginning in 2021. For Hamilton, this meant a reduction of 10% in the rate for the commercial property class and a reduction of 25% in the rate for the industrial property class. Nevertheless, some other municipalities had a more significant reduction. The impact on how this decision impacts Hamilton and the comparator groups will be clearer in the coming years.

Residential versus Non-Residential Split

Hamilton’s proportion of non-residential assessment as a percentage of the total assessment is 11.86% and the residential assessment as a percentage of the total assessment is 88.14%. The non-residential assessment percentage figure is lower than most comparator groups as shown in Figures 11 and 12 to Report FCS22061. This translates to a larger proportional tax burden borne by the residential property class than in other municipalities.

Figure 11: Non-Residential Assessment as a Percentage of Total Assessment



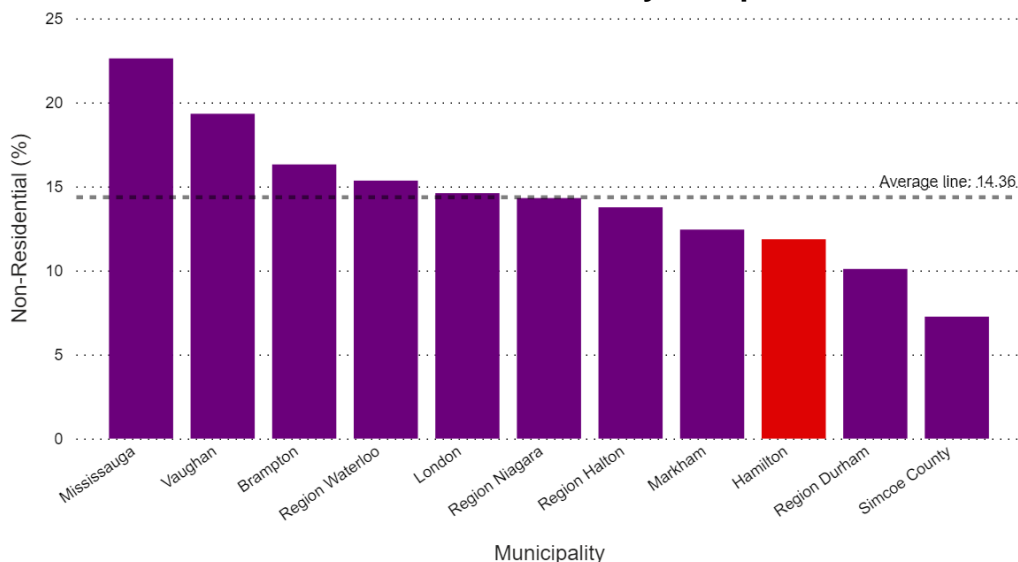
OUR Vision: To be the best place to raise a child and age successfully.

OUR Mission: To provide high quality cost conscious public services that contribute to a healthy, safe and prosperous community, in a sustainable manner.

OUR Culture: Collective Ownership, Steadfast Integrity, Courageous Change, Sensational Service, Engaged Empowered Employees.

**SUBJECT: 2021 Municipal Tax Competitiveness Study (FCS22061) (City Wide) –
Page 12 of 12**

Figure 12: Non-Residential Assessment as a Percentage of Total Assessment – Proximity Comparators



Hamilton has experienced significant total assessment growth in the last several years, with building permits exceeding \$1 B in the last nine years, including surpassing the \$2 B threshold in 2021. The majority of the growth continues to occur in the residential property class and while there has been significant industrial and commercial growth in the City, the large number of appeals negatively impact the assessment base of these classes, reducing their share of total assessment. Additional details on the assessment growth in the City can be found in Report FCS22014, “2021 Assessment Growth”.

APPENDICES AND SCHEDULES ATTACHED

Appendix “A” to Report FCS22061 – Comparator Groups

AB/GR/dt

Comparator Groups

Geographic Proximity

The 10 most proximate municipalities to the City of Hamilton participating in the Municipal Study were selected for the geographic proximity comparator group.

The geographic proximity comparator group contains the following municipalities, listed alphabetically:

- Brant County
- Brantford
- Burlington
- Grimsby
- Lincoln
- Milton
- Oakville
- Puslinch
- Region Halton
- West Lincoln

Population Similarity

The 28 participating municipalities with the most similar population to the City of Hamilton were selected for the population similarity comparator group. The City of Hamilton’s population for the purposes of this study is 576,618.

The population similarity comparator group contains the following municipalities listed alphabetically:

- Ajax (138,858)
- Barrie (151,875)
- Brampton (718,062)
- Burlington (193,934)
- Cambridge (138,949)
- Essex County (427,783)
- Greater Sudbury (169,634)
- Guelph (146,558)
- Kingston (135,969)
- Kitchener (267, 945)
- London (428,083)
- Markham (351,681)
- Middlesex County (508,162)
- Milton (124,994)
- Mississauga (780,176)
- Oakville (213,854)
- Oshawa (176,121)
- Ottawa (1,038,348)
- Region Durham (708,603)
- Region Halton (611,270)
- Region Niagara (483,022)
- Simcoe County (353,553)
- St. Catharines (140,859)
- Vaughan (334,763)
- Waterloo (121,788)
- Whitby (139,371)
- Windsor (232,873)

Note: The population comparator group differs from that utilized in FCS21083 “2020 Municipal Tax Competitiveness Study” due to changes in study participant and variation in population.



CITY OF HAMILTON
CORPORATE SERVICES DEPARTMENT
Financial Planning, Administration and Policy Division

TO:	Chair and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	Increase in Capital Project Expenses (FCS22067) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Matt Hilson (905) 546-2424 Ext. 1444
SUBMITTED BY:	Kirk Weaver Acting Director, Financial Planning, Administration and Policy Corporate Services Department
SIGNATURE:	

RECOMMENDATION(S)

- (a) That Appendix "A" attached to Report FCS22067 detailing work-in-progress capital projects requiring additional funding as a result of extraordinary inflation and supply chain impacts be received;
- (b) That the financing plan recommending total additional funding of \$27,322,634 outlined in Appendix "B" to Report FCS22067 to address budgetary shortfalls in work-in-progress capital projects be approved;
- (c) That the General Issues Committee direction to report back on any and all approved Capital Projects that will require additional funding related to the economy and correlated supply and demand issues that have created the current economic crisis be removed from the Outstanding Business List;
- (d) That the General Manager, Finance and Corporate Services, be authorized to negotiate and confirm the terms, placement and issuance of all debenture issue(s), and / or private placement debenture issue(s), in either a public or private market and / or bank loan agreements and debenture issue(s) and / or variable interest rate bank loan agreements and debenture issue(s), in an amount not to exceed \$13,098,000 Canadian currency in Development Charges funded municipal debt for the projects outlined in Appendix "B" to Report FCS22067;

OUR Vision: To be the best place to raise a child and age successfully.

OUR Mission: To provide high quality cost conscious public services that contribute to a healthy, safe and prosperous community, in a sustainable manner.

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**SUBJECT: Increase in Capital Project Expenses (FCS22067) (City Wide) –
Page 2 of 7**

- (e) That the General Manager, Finance and Corporate Services, be authorized to engage the services of all required professionals to secure the terms and issuance of the debenture issue(s) described in Recommendation (d) including, but not limited to, external legal counsel, fiscal agents and Infrastructure Ontario's Loan Program and the cost of such services be funded from one of the following sources as deemed appropriate by the General Manager, Finance and Corporate Services: Development Charge Reserves, Non-Obligatory Reserves, and other approved funding sources;
- (f) That the General Manager, Finance and Corporate Services, is authorized and directed to enter into and administer, on behalf of the City of Hamilton, all agreements and necessary ancillary documents to implement Recommendation (d) and in order to secure the terms and issuance of the debenture issue(s) described in Recommendation (e), on terms and conditions satisfactory to the General Manager, Finance and Corporate Services, and in a form satisfactory to the City Solicitor;
- (g) That the additional \$298,750 required from the Investment Stabilization Reserve for the completion of the Waterfalls Viewing project (#4401856819) be added to the principal outstanding on the existing internal loan;
- (h) That the additional \$1,014,300 required from the Investment Stabilization Reserve for the completion of the Dewitt – Highway 8 to Barton project (#4031911025) be added to the principal outstanding on the existing internal loan.

EXECUTIVE SUMMARY

At its meeting on May 16, 2022, the Public Works Committee directed staff to report back on any and all approved capital projects that will require additional funding related to the economy and correlated supply and demand issues that have created the current economic crisis.

Appendix "A" to Report FCS22067 presents all approved work-in-progress capital projects that staff has identified as requiring additional funds due to the economy and correlated supply and demand issues. The list does not include projects where additional funding is expected to be needed but is unable to be quantified at this time. The additional funding is unable to be quantified due to uncertainty surrounding input costs and current project timelines.

Appendix "B" to report FCS22067 outlines the recommended financing plan to address the expected variances in each capital project. In most cases, the financing plan recommends funding from the original funding source where funds are available in accordance with the Capital Closing Policy for funding projects in a deficit position. Additional funding was applied at the specific Ward Councillor's discretion for projects that were originally funding

**SUBJECT: Increase in Capital Project Expenses (FCS22067) (City Wide) –
Page 3 of 7**

from the Area Rating Special Capital Re-Investment Reserves. Any remaining deficit was funded by the Unallocated Capital Reserve (#108020).

Alternatives for Consideration – See Page 7

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: As outlined in Appendix “A” to Report FCS22067, a total of \$27,322,634 in additional funding requirements has been identified due to the economy and correlated supply and demand issues that have created the current economic crisis.

Table 1 represents the additional funding requirements by variance category.

**Table 1
City of Hamilton
Projects Requiring Additional Funds by Variance Explanation**

	Number of Projects	Approved Budget (\$)	Estimated Final Project Cost (\$)	Estimated Variance (\$)
Project deferred due to lack of funds	0	-	-	-
Tendered and awarded with additional funding required	2	4,094,705	5,352,000	(1,257,295)
Tendered and not awarded due to lack of funds	2	1,854,000	3,354,000	(1,500,000)
Projects in progress with estimated shortfalls due to inflation or supply chain issues	20	111,296,530	127,265,918	(15,969,388)
Funding Commitments required to address supply chain concerns	5	44,340,000	52,240,000	(7,900,000)
Project is funded through grants (e.g. ICIP) that require the City to fund cost overruns	3	3,548,928	3,795,223	(246,295)
Project has been changed in scope as a result of inflationary pressures	4	1,495,344	1,945,000	(449,656)
TOTAL	36	166,629,507	193,952,141	(27,322,634)

**SUBJECT: Increase in Capital Project Expenses (FCS22067) (City Wide) –
Page 4 of 7**

Table 2 represents the projects requiring additional funds by Department.

**Table 2
City of Hamilton
Projects Requiring Additional Funds by Department**

	Approved Budget (\$)	Estimated Final Project Cost (\$)	Estimated Variance (\$)
Healthy and Safe Communities	8,521,650	9,178,196	(656,546)
Planning and Economic Development	42,152,858	50,766,000	(8,613,142)
Public Works	115,954,999	134,007,945	(18,052,946)
TOTAL	166,629,507	193,952,141	(27,322,634)

As outlined in Appendix “A” to Report FCS22067, the total additional funding required in the amount of \$27,322,634 only includes funding requirements that can be quantified at this time. Appendix “A” does not include projects where additional funding is expected to be needed but is unable to be quantified. The additional funding is unable to be quantified due to uncertainty surrounding input costs and current project timelines. The expectation is that additional funding beyond the amount outlined in Appendix “A” will be required in the future and submitted in future capital budgets.

Appendix “B” to Report FCS22067 recommends the projects to receive additional financing, totalling \$27,322,634 and the following sources required to fund the budget variance:

- Development Charges \$1,570,650;
- Development Charges Supported Debt \$13,098,000;
- Area Rating Special Capital Reserves \$125,000;
- Internal Loans from Investment Stabilization Reserve \$1,313,050;
- Unallocated Capital Levy Reserve \$4,769,047; and
- Other Reserves \$6,446,887.

If approved, the uncommitted balance in the Unallocated Capital Levy Reserve would be \$11.9 M versus a target balance of \$33.0 M. In accordance with the Capital Closing Policy, any surplus balances remaining at the time of completion of the capital projects identified in Appendix “B” to Report FCS22067 would be returned to the source reserve.

Staffing: N/A

Legal: N/A

**SUBJECT: Increase in Capital Project Expenses (FCS22067) (City Wide) –
Page 5 of 7**

HISTORICAL BACKGROUND

At its meeting on May 16, 2022, the Public Works Committee directed staff to report back on any and all approved capital projects that will require additional funding related to the economy and correlated supply and demand issues that have created the current economic crisis.

At its meeting on July 6, 2022, the Public Works Committee referred this Outstanding Business List item to the General Issues Committee.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

Report FCS22067 meets the requirements of the City of Hamilton's Debt Policy, whereby Council authority is required to issue debt.

The proposed financing plan in Appendix "B" to Report FCS22067 recommends funding from the original source where funds are available in accordance with the Capital Closing Policy for funding projects in a deficit position.

RELEVANT CONSULTATION

Staff from the following departments provided the information summarize in Report FCS22067 and the details in the appendices:

- Public Works Department
- Planning and Economic Development Department
- Corporate Services Department
- Healthy and Safe Communities Department

ANALYSIS AND RATIONALE FOR RECOMMENDATION(S)

Staff has identified a list of approved work-in-progress capital projects outlined in Appendix "A" to Report FCS22067 where additional funds are required to continue with the approved scope due to the economy and correlated supply and demand issues that have created the current economic crisis. The list does not include projects where additional funding is expected to be needed but is unable to be quantified at this time.

An estimated final project cost, an estimated variance and an explanation for the variance has been provided for each of the capital projects in the listing. Staff has identified seven categories for variance explanations to summarize the requirements for additional funds:

**SUBJECT: Increase in Capital Project Expenses (FCS22067) (City Wide) –
Page 6 of 7**

- Project deferred due to lack of funds;
- Tendered and awarded with additional funding required;
- Tendered and not awarded due to lack of funds;
- Projects in progress with estimated shortfalls due to inflation or supply chain issues;
- Funding Commitments required to address supply chain concerns;
- Project is funded through grants (e.g. ICIP) that require the City to fund cost overruns; and,
- Project has been changed in scope as a result of inflationary pressures.

Staff is recommending additional capital financing of \$27,322,634 to provide sufficient budget to the projects outlined in Appendix “B” to Report FCS22067 necessary for work to continue as planned.

The capital financing plan, outlined in Appendix “B” to Report FCS22067, recommends the following sources of additional funding:

- Development Charges \$1,570,650;
- Development Charges Supported Debt \$13,098,000;
- Area Rating Special Capital Reserves \$125,000;
- Internal Loans from Investment Stabilization Reserve \$1,313,050;
- Unallocated Capital Levy Reserve \$4,769,047; and
- Other Reserves \$6,446,887.

The recommended financing plan was arrived at upon the basis of availability of original source funding. Where Development Charges Reserves are not available, Development Charge Supported Debt has been recommended. Projects originally funded from internal loans are recommended to have the loan principal increased to fund the deficit in the project.

According to Ontario Regulation 403/02, Council shall, before giving authorization for capital that would require a long-term debt or financial obligation, have the City Treasurer calculate an updated Annual Repayment Limit (ARL) using the most recent Annual Repayment Limit determined by the Ministry. The most recent ARL, determined and sent in writing by the Ministry to the City Treasurer, is the 2022 ARL in the amount of \$293.3 M and is based on the 2020 Financial Information Return.

The City Treasurer has calculated an updated ARL of \$194.2 M, included as Appendix “C” to Report FCS22067, which adjusts the 2022 ARL for approximately \$1,135.9 M of debt which has been approved by Council but not yet issued, as well as, debt that has been assumed or discharged in 2020 and 2021. The updated ARL of \$194.2 M is the maximum amount that the City has available to commit to annual debt servicing payments before the statutory limit is breached and corresponds to approximately \$2.1 B of additional borrowing that the City could undertake (assuming a 15-year term and 4.5% interest rate).

**SUBJECT: Increase in Capital Project Expenses (FCS22067) (City Wide) –
Page 7 of 7**

Within the City's Debt Policy, total tax and rate supported debt must not exceed 60% of City own-source revenues. For 2022, the current forecast of the City's issued long-term debt as a percentage of own-source revenues is 33%. Therefore, the debt required to complete this project will not significantly increase the risk of exceeding the Council approved limit in the short-term.

ALTERNATIVES FOR CONSIDERATION

As an alternative to approving the proposed financing plan outlined in Appendix "B" to Report FCS22067, City Council could choose to refer the decision on the financing strategy to the 2023 capital budget process. This would result in the deferral of all projects listed in Appendix "A" to Report FCS22067 to future years as determined through the approval of the 2023 Tax and Rate Capital Budgets.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN**Community Engagement and Participation**

Hamilton has an open, transparent and accessible approach to City government that engages with and empowers all citizens to be involved in their community.

Economic Prosperity and Growth

Hamilton has a prosperous and diverse local economy where people have opportunities to grow and develop.

Built Environment and Infrastructure

Hamilton is supported by state-of-the-art infrastructure, transportation options, buildings and public spaces that create a dynamic City.

Our People and Performance

Hamiltonians have a high level of trust and confidence in their City government.

APPENDICES AND SCHEDULES ATTACHED

Appendix "A" to Report FCS22067 – Approved Capital Projects Requiring Additional Funds

Appendix "B" to Report FCS22067 – Financing Plan

Appendix "C" to Report FCS22067 – City of Hamilton Treasurer's Updated 2021 Annual Repayment Limit

City of Hamilton
Approved Capital Projects Requiring Additional Funds

YEAR APPROVED	PROJECT ID	DESCRIPTION	APPROVED BUDGET (\$)	ESTIMATED FINAL PROJECT COST (\$)	ESTIMATED VARIANCE (\$) c = a - b	Project Manager	EXPLANATION OF VARIANCE
			a	b	c		

HEALTHY & SAFE COMMUNITIES

2022	7402251101	Annual Vehicle Replacement	3,554,000	3,704,000	(150,000)	S. Welton	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2022	7642251100	Annual Vehicle Replacement	1,659,780	2,157,716	(497,936)	C. Eggleton	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2022	7642251101	Annual Equipment Replacement	3,307,870	3,316,480	(8,610)	C. Eggleton	Projects in progress with estimated shortfalls due to inflation or supply chain issues

TOTAL HEALTHY & SAFE COMMUNITIES			8,521,650	9,178,196	(656,546)		
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PLANNING & ECONOMIC DEVELOPMENT

2012	4031280288	Mountain Brow Rd-Waterdown	6,610,000	7,932,000	(1,322,000)	T. Sergi / G. Norman	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2013	4031380360	Waterdown-Burlington Rd Upgrade	24,720,000	29,664,000	(4,944,000)	T. Sergi / G. Norman	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2017	4901751700	Parking Payment Equipment	1,117,000	1,150,000	(33,000)	A. McIlveen	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2018	7201841803	St. Mark's Interior Restoration	4,002,705	5,200,000	(1,197,295)	C. Samko	Tendered and awarded with additional funding required
2019	4901945900	Waterproof Convention Parking	1,550,000	2,000,000	(450,000)	A. McIlveen	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2019	4901957900	Online Parking Module	100,000	150,000	(50,000)	S. Carias	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2019	4901957901	Pay-on-Foot System Replacement	550,000	650,000	(100,000)	S. Carias	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2019	7201941902	Battlefield Park Bridge Replacement	500,000	700,000	(200,000)	C. Samko	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2019	7201941903	Gage House Porch & Exterior Cladding	645,344	720,000	(74,656)	C. Samko	Project has been changed in scope as a result of inflationary pressures
2020	7202041201	Griffin House Stabilization	446,809	500,000	(53,191)	J. Summers	Project is funded through grants (e.g. ICIP) that require the City to fund cost overruns
2020	7202041204	Children's Museum Expansion Ph2	1,721,000	1,900,000	(179,000)	J. Summers	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2021	7202141213	Dundurn HVAC Replacement	190,000	200,000	(10,000)	J. Summers	Projects in progress with estimated shortfalls due to inflation or supply chain issues

TOTAL PLANNING & ECONOMIC DEVELOPMENT			42,152,858	50,766,000	(8,613,142)		
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PUBLIC WORKS

2015	5161596855	Royal to Main-King CSO (WW-22)	24,880,000	26,080,000	(1,200,000)	S. Jacob / H. Krinas	Funding commitments required to address supply chain concerns
2018	4401856803	RHV Trails Mstr Plan The Nest	300,000	500,000	(200,000)	C. Graham	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2018	4401856819	Waterfalls Viewing	2,402,500	3,000,000	(597,500)	C. Graham	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2018	4941851100	Fleet Vehicle&Equipment Replace Program	7,272,350	7,837,350	(565,000)	T. Kagianis	Projects in progress with estimated shortfalls due to inflation or supply chain issues

City of Hamilton
Approved Capital Projects Requiring Additional Funds

YEAR APPROVED	PROJECT ID	DESCRIPTION	APPROVED BUDGET (\$)	ESTIMATED FINAL PROJECT COST (\$)	ESTIMATED VARIANCE (\$) c = a - b	Project Manager	EXPLANATION OF VARIANCE
			a	b	c		
2019	4031911025	Dewitt - Highway 8 to Barton	900,000	1,914,300	(1,014,300)	S. Jacob / G. Wuisman	Tendered and not awarded due to lack of funds
2019	4941951100	Fleet Vehicle&Equipment Replace Program	9,243,030	9,547,772	(304,742)	T. Kagianis	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2020	4032019103	Marion - Longwood to Dromore	1,850,000	2,520,000	(670,000)	E. Waite / S. Jacob	Funding commitments required to address supply chain concerns
2020	4402056918	BeasleyPk RehabPh2-KellySt Ped	2,067,119	2,195,223	(128,104)	C. Graham	Project is funded through grants (e.g. ICIP) that require the City to fund cost overruns
2020	4942051100	2020 Central Fleet Replacement	9,230,000	10,679,975	(1,449,975)	T. Kagianis	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2020	5142096520	Garner Rd Trunk Watermain	16,940,000	22,640,000	(5,700,000)	E. Waite / H. Krinas	Funding commitments required to address supply chain concerns
2021	4242109204	Curb Extension - MacNab & Barton	92,000	152,000	(60,000)	M. Field / M. Rahman	Tendered and awarded with additional funding required
2021	4402156117	Victoria Prk Spray Pad Replace	1,035,000	1,100,000	(65,000)	C. Graham	Project is funded through grants (e.g. ICIP) that require the City to fund cost overruns
2021	4942151100	Fleet Vehicle & Equipment	20,319,000	23,006,625	(2,687,625)	T. Kagianis	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2021	5142171303	Marion - Longwood to Dromore	490,000	720,000	(230,000)	E. Waite / H. Krinas	Funding commitments required to address supply chain concerns
2021	5162171015	Sewer Lateral Replace-Roads	954,000	1,439,700	(485,700)	E. Waite / H. Krinas	Tendered and not awarded due to lack of funds
2021	5162271303	Marion - Longwood to Dromore	180,000	280,000	(100,000)	E. Waite / H. Krinas	Funding commitments required to address supply chain concerns
2021	5302185804	Bus Stop Shelter Rehab	250,000	325,000	(75,000)	S. Stula	Project has been changed in scope as a result of inflationary pressures
2021	5302185902	Transit Shelter Expansn Prgm	300,000	450,000	(150,000)	S. Stula	Project has been changed in scope as a result of inflationary pressures
2022	4402256102	Stadium Precinct Community	16,800,000	19,000,000	(2,200,000)	C. Graham	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2022	4402256110	Golf Links Park Ice Rink	150,000	170,000	(20,000)	C. Graham	Projects in progress with estimated shortfalls due to inflation or supply chain issues
2022	5302249001	Operator Washroom Conveniences	300,000	450,000	(150,000)	S. Stula	Project has been changed in scope as a result of inflationary pressures
TOTAL PUBLIC WORKS			115,954,999	134,007,945	(18,052,946)		
TOTAL ALL DEPARTMENTS			166,629,507	193,952,141	(27,322,634)		

**City of Hamilton
Financing Plan**


Financing Sources											
Project ID	Description	Estimate Variance	Development Charges	Development Charges Debt	Area Rating Funds	Source Reserves	Unallocated Capital Reserve	Debt	Total Additional Funding	Estimated Variance Remaining	Source Reserves
7402251101	Annual Vehicle Replacement	(150,000)				150,000			150,000	-	110021 - Vehicle Replacement Fire
7642251100	Annual Vehicle Replacement	(497,936)				497,936			497,936	-	110022 - Vehicle Replacement Ambulance
7642251101	Annual Equipment Replacement	(8,610)				8,610			8,610	-	100033 - EMS Equipment Reserves
4031280288	Mountain Brow Rd-Waterdown	(1,322,000)	1,255,900				66,100		1,322,000	-	
4031380360	Waterdown-Burlington Rd Upgrade	(4,944,000)		4,944,000					4,944,000	-	
4901751700	Parking Payment Equipment	(33,000)				33,000			33,000	-	108021 - Parking Capital Reserve
7201841803	St. Mark's Interior Restoration	(1,197,295)					1,197,295		1,197,295	-	
4901945900	Waterproof Convention Parking	(450,000)				450,000			450,000	-	108021 - Parking Capital Reserve
4901957900	Online Parking Module	(50,000)				50,000			50,000	-	108021 - Parking Capital Reserve
4901957901	Pay-on-Foot System Replacement	(100,000)				100,000			100,000	-	108021 - Parking Capital Reserve
7201941902	Battlefield Park Bridge Replacement	(200,000)					200,000		200,000	-	
7201941903	Gage House Porch & Exterior Cladding	(74,656)					74,656		74,656	-	
7202041201	Griffin House Stabilization	(53,192)					53,192		53,192	-	
7202041204	Children's Museum Expansion Ph2	(179,000)					179,000		179,000	-	
7202141213	Dundurn HVAC Replacement	(10,000)					10,000		10,000	-	
5161596855	Royal to Main-King CSO (WW-22)	(1,200,000)		1,200,000					1,200,000	-	
4401856803	RHV Trails Mstr Plan The Nest	(200,000)					200,000		200,000	-	
4401856819	Waterfalls Viewing	(597,500)	298,750			298,750			597,500	-	112300 - Investment Stabilization Res
4941851100	Fleet Vehicle&Equipment Replace Program	(565,000)				565,000			565,000	-	110025 - Vehicle Replace Central Garage
4031911025	Dewitt - Highway 8 to Barton	(1,014,300)				1,014,300			1,014,300	-	112300 - Investment Stabilization Res
5162171015	Sewer Lateral Replace-Roads	(485,700)					485,700		485,700	-	
4941951100	Fleet Vehicle&Equipment Replace Program	(304,741)				304,741			304,741	-	110025 - Vehicle Replace Central Garage
4032019103	Marion - Longwood to Dromore	(670,000)					670,000		670,000	-	
4402056918	BeasleyPk RehabPh2-KellySt Ped	(128,104)					128,104		128,104	-	108020 - Unallocated Capital Levy
4942051100	2020 Central Fleet Replacement	(1,449,975)				1,449,975			1,449,975	-	110025 - Vehicle Replace Central Garage
5142096520	Garner Rd Trunk Watermain	(5,700,000)		5,700,000					5,700,000	-	
4242109204	Curb Extension - MacNab & Barton	(60,000)			60,000				60,000	-	108052 - Ward 2-Capital Infrastructure
4402156117	Victoria Prk Spray Pad Replace	(65,000)			65,000				65,000	-	108051 - Ward 1-Capital Infrastructure
4942151100	Fleet Vehicle & Equipment	(2,687,625)				2,687,625			2,687,625	-	110025 - Vehicle Replace Central Garage
5142171303	Marion - Longwood to Dromore	(230,000)					230,000		230,000	-	
5162271303	Marion - Longwood to Dromore	(100,000)					100,000		100,000	-	
5302185804	Bus Stop Shelter Rehab	(75,000)					75,000		75,000	-	
5302185902	Transit Shelter Expansn Prgrm	(150,000)				150,000			150,000	-	112204 - Transit Prov Gas Tax Reserve
4402256102	Stadium Precinct Community	(2,200,000)		1,254,000			946,000		2,200,000	-	
4402256110	Golf Links Park Ice Rink	(20,000)	16,000				4,000		20,000	-	
5302249001	Operator Washroom Conveniences	(150,000)					150,000		150,000	-	
TOTAL FINANCING PLAN		(27,322,634)	1,570,650	13,098,000	125,000	7,759,937	4,769,047	-	27,322,634	-	

**City of Hamilton Treasurer's Updated 2022
 Annual Repayment Limit**

Annual Repayment Limit - <i>effective January 1, 2022, as prepared by the Ministry of Municipal Affairs and Housing on March 3, 2022, based on 2020 Financial Information Return</i>	\$293,261,529
Annual debt service charges on City Municipal debt approved to-date 2022 and prior years but not yet issued (\$831.5 M @ 4.25% for 15-year term)	-\$76,097,019
Annual debt service charges on City Municipal debt in respect of ICIP Transit debt approved but not yet issued (\$91.3 M @ 4.25% for 15-year term)	-\$8,354,854
Annual debt service charges on City Municipal debt in respect of West Harbour debt approved but not yet issued (\$48.8 M @ 4.25% for 15-year term)	-\$4,466,856
Annual debt service charges on City Housing Hamilton debt approved but not yet issued and guaranteed by City of Hamilton (\$135.9 M @ 5% for 30-year term)	-\$8,840,490
Annual debt service charges on Municipal and Tax Supported Development Charges debt approved but not yet issued - Police Station 40 (\$11.6 M @ 4.25% for 15-year term)	-\$1,060,264
Annual debt service charges on Municipal and Tax Supported Development Charges debt approved but not yet issued - Stadium Precinct (\$16.8 M @ 4.25% for 15-year term)	-\$1,537,543
Annual debt service charges in 2022 for debenture issue of \$51.705 M;	-\$4,093,313
Annual debt service charges on debentures discharged in 2019-2022	\$5,038,633
Adjustment for annual debt service charges on outstanding City Housing Hamilton mortgages and City of Hamilton Tangible Capital Leases	\$357,797
Updated 2021 Annual Repayment Limit - a calculation by the Treasurer representing an estimate of the maximum amount available to commit to annual debt service charges	\$194,207,620



CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Hamilton Water Division

TO:	Chair and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	Chedoke Creek Order - Procurement Update PW19008(p) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Tim Crowley (905) 546-2424 Ext. 5063
SUBMITTED BY:	Cari Vanderperk Director, Watershed Management Public Works Department
SIGNATURE:	

RECOMMENDATION

That Purchase Order #97465 for Wood Canada Ltd. be increased by \$780,156 and funded from Project ID. No. 5162168777, pursuant to Procurement Policy #11 (Non-competitive Procurements), for consultant services including project management, contract administration, and post construction monitoring services for the implementation of the Targeted Dredging of Chedoke Creek.

EXECUTIVE SUMMARY

The January 12, 2022, Report PW19008(n) provided the General Issues Committee (GIC) with status updates on the Chedoke Creek and Cootes Paradise Workplans, costs to-date and the City of Hamilton's (City) response to the Ministry of the Environment, Conservation, and Parks (MECP) Director's Order No.1-PE3L3 (Order). The Order relates to the Main/King Combined Sewer Overflow (CSO) discharge that occurred between January 2014 and July 2018. The purpose of Report PW19008(p) is to address and update the Procurement Policy under which the project team has been operating to procure Wood Canada Ltd. (Wood) as the Qualified Person required by the Order.

The General Manager of Public Works, upon receipt of the Order in December 2020, initiated an emergency declaration authorizing staff to utilize a Procurement Policy #10 (Emergency Procurements) to retain the services of Wood, to act as the Qualified

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**SUBJECT: Chedoke Creek Order - Procurement Update
(PW19008(p)) (City Wide) – Page 2 of 6**

Person as required by the Order. The emergency declaration expedited the City's response to the original Order deadline of October 31, 2021. Under Procurement Policy #10 (Emergency Procurements) Wood continues to act as the Qualified Person and has completed the planning, design, and permitting process along with supporting community partner engagement and the tendering of the Targeted Dredging of Chedoke Creek. Since December 2020, Wood has completed the abovementioned tasks under Purchase Order #97465 at a value of \$791,144.

The General Manager of Public Works and staff recommend that the emergency declaration can end as a result of the project team having:

- A greater understanding of the overall requirements of the Order;
- the dredging deadline extended by the MECF from October 31, 2021 to December 31, 2022; and
- the project is moving from the MECF approved design into the construction phase.

In order to maintain the current schedule and complete the targeted dredging by December 31, 2022, it is recommended that Wood continue to be retained as the Qualified Person through to the end of the targeted dredging project schedule, which includes construction and post-construction monitoring and contract administration. The basis of this recommendation is that Wood has intimate constructability and technical knowledge of the project and its team of engineers and scientists/biologists is already mobilized and able to effectively complete this assignment.

The recommendation in Report PW19008(p) is to increase the Wood Purchase Order #97465 by \$780,156 to fund the remainder of Wood's consulting services. Sufficient budget is available in the existing Project ID. No. 5162168777. Council approval is required under Procurement Policy #11 (Non-competitive Procurements), for the Purchase Order increase as the total value exceeds \$250,000.

As previously reported through the July 12, 2022 Chedoke Creek Remediation Communications Update (HW.22.05), the project team completed the design and tendering of the project with the subsequent tender awarded on July 8, 2022 to Milestone Environmental Contracting Inc. with a corresponding bid price of \$5,919,992.00. Construction mobilization has begun, and the targeted dredging is on track to be completed by the December 31, 2022 Order deadline.

Alternatives for Consideration – See Page 5

**SUBJECT: Chedoke Creek Order - Procurement Update
(PW19008(p)) (City Wide) – Page 3 of 6**

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: Report PW19008(p) is recommending that \$780,156 be added to Wood's Purchase Order #97465 for additional project management, contract administration and post construction monitoring services in order to meet the deadline for the targeted dredging of Chedoke Creek of December 31, 2022. Project ID No. 5162168777 has sufficient budget to cover this work, therefore no additional funds are required. Council's approval is required for this Purchase Order increase under Procurement Policy #11 (Non-competitive Procurements) as the total value exceeds \$250,000.

Wood Purchase Order Summary:

Approved Policy #10 Expenditures (excl. contingency)	\$ 791,144.13
Recommended Increase under Policy #11	<u>\$ 780,156.00</u>
TOTAL	\$1,571,300.13

Staffing: N/A

Legal: N/A

HISTORICAL BACKGROUND

The City was served a Director's Order by the MECP on December 4, 2020, as a result of the Main/King CSO discharge that occurred between January 2014 and July 2018. The goal of the Order is to improve the condition of Chedoke Creek and Cootes Paradise.

Upon receipt of the Order, and to expedite the City's response to the MECP and comply with the Order deadlines, the General Manager of Public Works under Procurement Policy #2 (Approval Authority) initiated an emergency declaration authorizing staff to initiate a Procurement Policy #10 (Emergency Procurements) to retain the services of Wood to act as the Qualified Person as required by the Order. Since that time, Wood has completed the following tasks under Purchase Order #97465 at a value of \$791,144.

- Development of the Chedoke Creek Workplan
- Development of the Cootes Paradise Report
- Development of the Cootes Paradise Workplan
- Conducted Field Work for Design of Chedoke Creek Targeted Dredge
 - Topography
 - Bathymetry
 - Sediment Quality Assessments
 - Species at Risk Investigations

**SUBJECT: Chedoke Creek Order - Procurement Update
(PW19008(p)) (City Wide) – Page 4 of 6**

- Targeted Dredge Design
- Indigenous and First Nations Consultation Support
- Public Consultation Support
- Permitting Support

In order to maintain the current schedule and complete the targeted dredging by December 31, 2022, it is recommended that Wood continue to be retained as the Qualified Person through to the end of the targeted dredging project schedule, which includes construction and post-construction monitoring.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

The policies that apply to this Report include:

- By-Law No. 20-205, as amended Procurement Policy #11 – Non-Competitive Procurements;
- By-Law No. 20-205, as amended Procurement Policy #10 – Emergency Procurements; and
- By-Law No. 20-205, as amended Procurement Policy #2 - Approval Authority.

Approval of the recommendations in Report PW19008(p) will not affect the corporate policies or legislative requirements listed above.

RELEVANT CONSULTATION

The following groups have been consulted:

- Communications and Strategic Initiatives Division, Communications Section;
- Finance and Corporate Services Department, Finance Planning Administration and Policy Division;
- Finance and Corporate Services Department, Legal and Risk Management Services Division; and
- Finance and Corporate Services Department, Financial Services and Taxation Division, Procurement Section has provided guidance as to adherence to the Procurement Policy.

ANALYSIS AND RATIONALE FOR RECOMMENDATION

The General Manager of Public Works under Procurement Policy #2 (Approval Authority) has ended the emergency declaration for the response to the MECP Director's Order as a result of the Main/King Combined Sewer Overflow discharge that occurred between January 2014 and July 2018. Now that the remediation project has

**SUBJECT: Chedoke Creek Order - Procurement Update
(PW19008(p)) (City Wide) – Page 5 of 6**

moved from engineering design, permitting, and consultation with community partners to the construction phase of targeted dredging, it is an appropriate time to end the emergency declaration and retain Wood under a Procurement Policy #11 (Non-competitive Procurements) in order for the City to complete the targeted dredging by the prescribed MECP deadline by December 31, 2022.

Wood has intimate constructability and technical knowledge of the project and its team of engineers and scientists/biologists is already mobilized and able to complete this assignment. It would not be in the City's best interests to remove or replace Wood on the project at this time, based on their unique knowledge and experience in this matter.

The recommendation in report PW19008(p) is to increase the Wood Purchase Order #97465 by \$780,156 to fund additional consulting services through the end of the Chedoke Creek targeted dredging project schedule. Sufficient budget is available in the existing Project ID. No. 5162168777. Council approval is required under Procurement Policy #11 (Non-competitive Procurements), for the Purchase Order increase since the total value exceeds \$250,000.

ALTERNATIVES FOR CONSIDERATION

The Purchase Order with Wood could be cancelled/closed-out and a new Request for Proposal for the necessary remaining consulting services (Project Management, Contract Administration and Post-Construction Monitoring) could be procured competitively.

This alternative is not recommended as the newly onboarded contractor would need to be put on hold until a new consultant is procured while a transfer of knowledge occurs, thus resulting in a significant delay to the project schedule of approximately four (4) months, which will conflict with the prescribed MECP deadline for the project's implementation.

Financial: This alternative will cause a delay to construction resulting in the completion of the project beyond the contract specifications, likely causing the City to incur an increase in costs.

Staffing: N/A

Legal: This alternative would cause the City to be unable to meet the MECP deadline of December 31, 2022 and result in possible exposure to liability.

The Purchase Order with Wood could continue to be managed under a Procurement Policy #10 (Emergency Procurements). The remaining consulting services would still

**SUBJECT: Chedoke Creek Order - Procurement Update
(PW19008(p)) (City Wide) – Page 6 of 6**

include additional project management, contract administration and post construction monitoring services. This alternative is not recommended as it is the opinion of the General Manager of Public Works and staff that an emergency no longer exists with respect to the services associated with complying with the Order.

Financial: This alternative would result in continuing with a declared emergency with the remaining costs of Wood's consulting services staying at \$780,156. However, it is the opinion of the General Manager of Public Works and staff that an emergency no longer exists with respect to complying with the Order, as the project is moving from the MECP approved design into the construction phase of the remediation project. As such, with the emergency declaration ending so too does procuring Wood's services under a Procurement Policy #10 (Emergency Procurements).

Staffing: N/A

Legal: N/A

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN**Community Engagement and Participation**

Hamilton has an open, transparent and accessible approach to City government that engages with and empowers all citizens to be involved in their community

Clean and Green

Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

Our People and Performance

Hamiltonians have a high level of trust and confidence in their City government.

APPENDICES AND SCHEDULES ATTACHED

N/A



CITY OF HAMILTON
CORPORATE SERVICES DEPARTMENT
Legal and Risk Management Services Division

TO:	Mayor and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	Red Hill Valley Parkway Inquiry Update (LS19036 (m)) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Patricia D'Souza (905) 546-2424 Ext. 4637
SUBMITTED BY:	Susan Nicholson, Acting Deputy City Solicitor, Legal & Risk Management Services
SIGNATURE:	

RECOMMENDATIONS

- a) That Council approve the revised estimated total cost of the Red Hill Valley Parkway Judicial Inquiry of up to \$26,000,000, to be funded through the Tax Stabilization Reserve (110046)

EXECUTIVE SUMMARY

On April 24, 2019 Council directed staff to provide regular updates on the costs to date of the Red Hill Valley Parkway (“RHVP”) Judicial Inquiry, to be paid from the Tax Stabilization Reserve.

This report provides both an update on the status of the Inquiry from the City’s external legal counsel and the costs to date of the Inquiry. Steps the City is taking to continue to monitor the costs of the Inquiry and particularly Commission Counsel’s legal fees are also outlined.

To date, the City has incurred approximately \$18 million in costs associated with the Inquiry, and based on the estimate of costs provided by Commission Counsel and the City’s external legal counsel (“Inquiry Counsel”), the City expects to incur an additional \$7.8 million to \$8.3 million in costs between July 2022 and March 2023, resulting in a total estimated cost to the City for the Inquiry of between \$26 million and \$28 million (including taxes), plus additional disbursement costs yet to be provided by Commission Counsel.

SUBJECT: Red Hill Valley Parkway Inquiry Update (LS19036(m) (City Wide)**Page 2 of 6**

The increase in costs is primarily due to Commission Counsel's rescheduling of several witnesses scheduled to be heard in July and August 2022 to September and October 2022 (described below), additional interviews requested by Commission Counsel and the privilege dispute process.

The City has limited visibility into the breakdown of Commission Counsel fees as it only receives a general description of Commission Counsel's work.

The City has requested that Commission Counsel provide additional details, while maintaining its solicitor-client privilege with the Commissioner, so the City can better monitor the increasing costs of the Inquiry.

Alternatives for Consideration – Not Applicable

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: The costs associated with the advancement of the RHVP Judicial Inquiry through the hearing and report stage are estimated to be in the range of \$26 million and \$28 million.

These costs are based upon current status, anticipated effort required and the current forecasted schedule, which are subject to change based upon the availability of individuals, documents and procedural decisions which may be outside the control of the City.

These costs will be recovered from the Tax Stabilization Fund.

Staffing: Not Applicable

Legal: As outlined in this Report

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

As outlined in this Report.

RELEVANT CONSULTATION

- Mike Zegarac – General Manager, Finance and Corporate Services Department
- Janette Smith – City Manager
- Eli Lederman and Delna Contractor, Lenczner Slaght LLP

ANALYSIS AND RATIONALE FOR RECOMMENDATION

SUBJECT: Red Hill Valley Parkway Inquiry Update (LS19036(m) (City Wide)**Page 3 of 6****STATUS OF INQUIRY**

As of July 31, 2022, the Inquiry has heard from the following witnesses:

No. of witnesses	Party	Description
2	Commission Counsel Expert witness	Dr. Gerardo Flintsch's and Russell Brownlee provided evidence regarding pavement design and friction.
15	Current and former City employees	The City witnesses gave evidence on their involvement on various topics related to the Red Hill, including the design and construction, friction testing, safety reviews and the resurfacing of the Red Hill.
10	Current and former employees of the Ministry of Transportation (MTO)	The MTO witnesses gave evidence on the friction testing completed on the Red Hill between 2007 and 2014 and the Province's friction management practices and policies.
4	Dufferin Construction	Dufferin Construction was engaged to pave the mainline of the Red Hill. These witnesses gave evidence regarding their involvement in the construction of the Red Hill
1	Highway 407 ETR	Craig White, the Vice President of Highway Operations for Highway 407 ETR, gave evidence regarding the friction management practises on Highway 407
1	NorJohn Contracting	NorJohn Contracting, a consultant engaged during the resurfacing of the Red Hill, gave evidence regarding their consultations with the City
4	Golder & Associates Ltd	Golder & Associates Ltd, the paving consultant for the Red Hill and the consultant engaged to conduct friction and other performance testing on the Red Hill, gave evidence regarding the testing and their consultations with the City.
2	CIMA	CIMA, engaged by the City to conduct safety reviews of the Red Hill, gave evidence regarding these safety reviews and their consultations with the City.

SUBJECT: Red Hill Valley Parkway Inquiry Update (LS19036(m) (City Wide)**Page 4 of 6**

No. of witnesses	Party	Description
1	Tradewind Scientific Ltd	Tradewind Scientific Ltd, the subcontractor engaged to complete the friction testing on the Red Hill in 2013, gave evidence regarding the friction testing and the subsequent report.
40	Total	

The Inquiry was initially scheduled to hear from the remaining witnesses in July and August. In or around June 23, 2022, Commission Counsel advised Inquiry Counsel that it intended to reschedule the majority of these witnesses to September and October 2022. The hearings were also adjourned unexpectedly from July 4 through July 12, 2022 due to the Commissioner's unavailability.

Based on the revised schedule, Phase One of the Inquiry, which involved hearing from fact witnesses, is now scheduled to be completed by October 31, 2022.

Phase Two of the Inquiry involves hearing from expert witnesses. The City has not received any details from Commission Counsel on the timing or process of Phase Two.

Costs of the Inquiry

The costs of the Inquiry to date are outlined in the following chart, representing external legal fees for the Commissioner and external legal fees for the City, as well as Deloitte services for data hosting, reviewing and producing documents and other associated expenses, including the digitizing of paper files, website hosting and consultants. These expenses are being funded from the Tax Stabilization reserve.

To June 30, 2022	
City's Expenses (e.g. data collection, hosting)	\$1,535,268.05
City's External Legal Counsel Fees and Disbursements	\$6,337,943.80
Commission Counsel Fees and Disbursements	\$9,396,847.51
Other Expenses (e.g. consultants, website hosting)	\$784,598.11
Total (inclusive of HST)	\$18,054,657.47

The Inquiry was previously estimated to cost between \$18 million and \$20 million. This estimate was based on the estimate of costs previously provided to the City by Commission Counsel.

SUBJECT: Red Hill Valley Parkway Inquiry Update (LS19036(m) (City Wide)**Page 5 of 6**

The City asked Commission Counsel for a revised estimate of costs after Commission Counsel exceeded their estimate of legal fees by approximately \$1 million from January to June 2022.

Commission Counsel's original estimate contemplated \$690,000 in legal fees between July 1, 2022 and the conclusion of the Inquiry (excluding taxes). The new estimate contemplates \$3.16 million from July 1, 2022 to the end of the Inquiry (excluding taxes).

Based on the revised estimate of Commission Counsel's legal fees, we expect the costs of the Inquiry to fall between \$26 million and \$28 million. This does not include the costs associated with all of Commission Counsel's disbursements, including the cost of expert witnesses. Inquiry Counsel has requested these costs from Commission Counsel but has not yet received them.

As Commission Counsel has not yet provided the requested information regarding process and timelines for Phase Two, Inquiry Counsel cannot provide an updated estimate of the City's costs for its own expert witness for Phase Two.

Monitoring the Costs of the Inquiry

The City receives detailed dockets from Inquiry Counsel which allows it to monitor and assess counsel's fees. However, as Commission Counsel stands in a solicitor-client relationship with the Commissioner, Commission Counsel does not provide the City with details in support of their invoices for legal fees. Commission Counsel does provide in general terms the topics their work focuses on, such as preparing for public hearing or collecting or reviewing documents.

To allow the City to better monitor the increasing costs of the Inquiry, the City will request that Commission Counsel provide an estimate of the hours and associated legal fees for specific categories of tasks, including:

- Communication and meetings with Expert Witnesses
- Preparation of Expert Reports (excluding communication with expert witnesses)
- Privilege Motion
- Additional Interviews
- Preparation for examinations at the hearing
- Hearing attendance
- Report preparation
- Communications with Media or the Public
- Website maintenance
- Hearing logistics
- Discussions with Participants' Counsel

The City will request that Commission Counsel alert the City if they expect to exceed their estimated legal fees.

SUBJECT: Red Hill Valley Parkway Inquiry Update (LS19036(m) (City Wide)

Page 6 of 6

The City will further request that Commission Counsel consider discounting their legal fees arising from any duplication of work resulting from the appointment of the lead Commission Counsel to the judiciary in May 2022.

ALTERNATIVES FOR CONSIDERATION

Not Applicable.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Our People and Performance


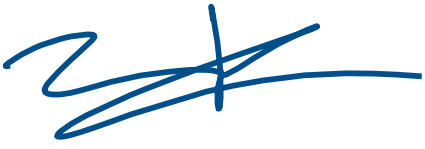
Hamiltonians have a high level of trust and confidence in their City government.

APPENDICES AND SCHEDULES ATTACHED

Not Applicable.



CITY OF HAMILTON
PLANNING AND ECONOMIC DEVELOPMENT DEPARTMENT
Economic Development Division

TO:	Mayor and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	Downtown Entertainment Precinct Master Agreement Update (PED18168(h)) (Ward 2)
WARD(S) AFFECTED:	Ward 2
PREPARED BY:	Joshua Van Kampen (905) 546-2424 Ext. 4592
SUBMITTED BY: SIGNATURE:	Judy Lam Acting Director, Economic Development Planning and Economic Development Department 
SUBMITTED BY: SIGNATURE:	Raymond Kessler Chief Corporate Real Estate Officer Planning and Economic Development Department 

RECOMMENDATION(S)

- (a) That staff be authorized and directed to amend the Master Agreement such that a non-HUPEG controlled entity, under the control of Oak View Group, could become the Tenant of a head lease contemplated in the Master Agreement, on terms satisfactory to the General Manager of Planning and Economic Development Department or their delegate;
- (b) That the Mayor and City Clerk be authorized and directed to execute any and all necessary documents related to the amended Master Agreement, in a form satisfactory to the City Solicitor.

EXECUTIVE SUMMARY

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OUR Mission: To provide high quality cost conscious public services that contribute to a healthy, safe and prosperous community, in a sustainable manner.

OUR Culture: Collective Ownership, Steadfast Integrity, Courageous Change, Sensational Service, Engaged Empowered Employees.

**SUBJECT: Downtown Entertainment Precinct Master Agreement Update
(PED18168(h)) (Ward 2) - Page 2 of 5**

On June 9, 2021, City Council approved the Master Agreement between the City and the Hamilton Entertainment Precinct Group (HUPEG), that among other things will see HUPEG take over all responsibility for the City's downtown entertainment assets, the FirstOntario Centre, the Hamilton Convention Centre, and the FirstOntario Concert Hall. In this regard, a HUPEG-controlled entity is to become the Head Tenant under a long-term lease for each of the Facilities.

HUPEG has been in discussions with Spectra/Global Spectrum (now owned by the Oak View Group), the current operators of the arena and concert hall, to form a partnership that would become the Tenant of the FirstOntario Centre and FirstOntario Concert Hall. This partnership will see the Oak View Group (OVG) inject a minimum of an additional \$50M, on top of the HUPEG \$50M investment, into the up-front arena renovations. However, due to the upfront investment and on-going operational management investment by OVG, the partnership will be controlled by OVG. In order for the City to enter into the subject head lease with such partnership, the Master Agreement will need to be modified to permit a non-HUPEG controlled entity to become the Tenant.

This Report seeks Council authorization to amend the Master Agreement accordingly.

Alternatives for Consideration – Not Applicable**FINANCIAL – STAFFING – LEGAL IMPLICATIONS**

Financial: N/A

Staffing: N/A

Legal: Legal staff have been directly involved in the negotiations and preparation of the Master Agreement with the assistance of external legal expertise and will continue to support the subject amendment.

HISTORICAL BACKGROUND

On December 1, 2017, Council approved a motion that directed staff to investigate the opportunities for a private sector-led redevelopment of the FirstOntario Centre, the Hamilton Convention Centre, and the FirstOntario Concert Hall.

On January 23, 2019, Council directed staff to commission an independent third party study which was to be guided by the Council-Approved Vision set out in the Downtown Secondary Plan, Economic Development Action Plan, Cultural Plan and Hamilton Tourism Strategy, which assessed various ownership and divestment models for the downtown entertainment assets.

**SUBJECT: Downtown Entertainment Precinct Master Agreement Update
(PED18168(h)) (Ward 2) - Page 3 of 5**

On October 23, 2019, Council directed staff to identify suitable arena development opportunities, to speak to surrounding landowners and others about any new arena opportunities, which may arise, and to consider the potential renovation/redevelopment of the current FirstOntario Centre site/facility.

On February 5, 2020, Council authorized and directed staff to simultaneously negotiate MOUs with each of Vrancor Group Inc. and Hamilton Urban Precinct Entertainment Group L.P., with respect to the redevelopment of Hamilton's Entertainment Venues. Council further directed staff to identify the proposal(s) which eliminates the City's ongoing subsidization of all three venues and best aligns with the Council Approved Terms and report back to GIC.

On July 6, 2020, Council authorized and directed staff to execute the Downtown Entertainment Precinct MOU put forward by HUPEG and to negotiate a Master Agreement based substantially on the terms outlined in the MOU for Council's consideration.

On June 9, 2021, Council approved the Master Agreement for the Downtown Entertainment Precinct Assets and directed staff to negotiate any agreements required to fulfil the objectives of the Master Agreement.

On September 29, 2021, Council approved The Revitalizing Hamilton's Commercial Districts Community Improvement Plan and the associated the Downtown Entertainment Precinct Advancement Program to approve tax-based incentives per the Master Agreement.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

City Council, at its meeting of November 24, 2004, adopted the City's Portfolio Management Strategy Plan, which established a formalized process to be consistently applied across all areas of the City to guide the management of the City's real property. The Recommendations of this Report are consistent with the City's Real Estate Portfolio Management Strategy Plan, as approved by Council on November 24, 2004, and the Sale of Land Policy By-law 14-204.

RELEVANT CONSULTATION

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**SUBJECT: Downtown Entertainment Precinct Master Agreement Update
(PED18168(h)) (Ward 2) - Page 4 of 5**

- Planning and Economic Development Department, Economic Development Division; and,
- Corporate Services Department, Legal and Risk Management Services Division, Financial Planning and Policy Division.

ANALYSIS AND RATIONALE FOR RECOMMENDATION(S)

As directed by Council, staff negotiated a Downtown Entertainment Precinct Master Agreement (Master Agreement) with the Hamilton Entertainment Precinct Group L.P. (HUPEG), which agreement was approved by Council on June 9, 2021. The Master Agreement anticipates the City entering into head lease agreements with HUPEG-controlled entities for the operation, management, and maintenance of each of the entertainment assets. It also anticipates HUPEG partnering with others in fulfilling its obligations under the Master Agreement and/or the Lease Agreements. Currently the FirstOntario Centre and the FirstOntario Concert Hall are operated by Spectra/Global Spectrum (Spectra), and the Convention Centre is operated by Carmen's Group (Carmen's). The Operating Agreements for these venues will be assumed by HUPEG under the head leases.

Subsequent to the Master Agreement being executed, two events transpired: HUPEG began to enter into discussions with Spectra with a view to the future management and operations of the arena and hall; and, Spectra was acquired by the Oak View Group (OVG). OVG is a development and investment company for sports and live entertainment industries and is considered the global leader in this field. In assessing the growing opportunities in the Hamilton marketplace, OVG expressed an interest in playing a larger role in the redevelopment of the FirstOntario Centre.

The Master Agreement obligates HUPEG to invest a minimum of \$50 Million into the redevelopment of FirstOntario Centre, involving the development and activation of street level commercial operations and opportunities on the north and west York/Bay street level retail spaces, and the significant predominantly event level and lower bowl transformation. HUPEG is seeking to partner with OVG for the redevelopment of FirstOntario Centre and FirstOntario Concert Hall, whereby OVG will increase the minimum investment of HUPEG's original \$50 Million to a minimum of \$100 Million for the redevelopment of the FirstOntario Centre, and will bring its considerable financial and more importantly market clout to the renovation and operation of the renovated facilities. While HUPEG will maintain a significant equity interest, the nature of the partnership between OVG and HUPEG necessitates that the head lessee be an OVG-controlled entity, which is currently not available to HUPEG under the Master Agreement. Staff are recommending a change in the Master Agreement to accommodate the proposed arrangement. The proposed new arrangement will significantly increase the investment into the arena. More importantly, the City will

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**SUBJECT: Downtown Entertainment Precinct Master Agreement Update
(PED18168(h)) (Ward 2) - Page 5 of 5**

benefit from what is anticipated to be increased levels of economic activity generated from the events attracted to the newly improved facilities.

OVG was founded by Timothy Leiweke, the former CEO of Maple Leaf Sports Entertainment, and Irving Azoff, the former chairman and CEO of Ticketmaster Entertainment and executive chairman of Live Nation Entertainment.

OVG's latest multi-purpose arena development projects of significance in the last few years:

- Climate Pledge Arena - Seattle, Washington (Home of the Seattle Kraken) - \$1.15 Billion USD;
- UBS Arena - Elmont, New York (Home of the New York Islanders) - \$1.5 Billion USD; and,
- Moody Centre, Austin, Texas (University of Texas Basketball Programs) - \$380 Million USD.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN**Economic Prosperity and Growth**

Hamilton has a prosperous and diverse local economy where people have opportunities to grow and develop.

APPENDICES AND SCHEDULES ATTACHED


N/A

JVK/RK/AK: jrb



Hamilton

INFORMATION REPORT

TO:	Mayor and Members of Council General Issues Committee
COMMITTEE DATE:	August 4, 2022
SUBJECT/REPORT NO:	City Hall Safety Plan (HUR22012) (City-Wide)
WARD(S) AFFECTED:	City-Wide
PREPARED BY:	David Lindeman (905) 546-2424 Ext. 5657 Martin Dambeau (905) 546-2424 Ext. 2855
SUBMITTED BY:	Lora Fontana Executive Director Human Resources
SIGNATURE:	 Acting for Lora Fontana

Discussion of this Confidential Appendix A in closed session is subject to the following requirement(s) of the City of Hamilton's Procedural By-law and the *Ontario Municipal Act, 2001*:

- (a) the security of the property of the municipality or local board;
- (b) personal matters about an identifiable individual, including municipal or local board employees;

COUNCIL DIRECTION

At the June 22, 2022 Council Meeting, the following motion was approved in response to the June 10, 2022 Integrity Commissioner's Report:

- (a) That the City of Hamilton Integrity Commissioner's Report Regarding Complaints Against Councillor Terry Whitehead, June 10, 2022, be received;
- (b) That the actions contained within the City of Hamilton Integrity Commissioner's Report Regarding Complaints Against Councillor Terry Whitehead, June 10, 2022, be supported;

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SUBJECT: City Hall Safety Plan (HUR22012) (City-Wide) Page 2 of 8

- (c) That staff be directed to develop a plan of action to fulfil our obligations under occupational health and safety act of Ontario, as it relates to the work environment of City Hall with respect to the issues raised in this Integrity Commissioners Report; and
- (d) That Councillor Whitehead inform staff and members of Council when he plans to attend City Hall, until a report back from staff in recommendation (c) is presented to Council.

INFORMATION

Background

Ontario's *Occupational Health and Safety Act* (the *Act*) requires employers to have workplace harassment policies and programs in place that cover all employees. The programs must include:

- measures and procedures for workers to report incidents of workplace harassment to the employer or supervisor, and to another person if the employer or supervisor is the alleged harasser; and
- how incidents or complaints of workplace harassment will be investigated and dealt with.

The City of Hamilton has three policies which align with the requirements under the *Act*:

1. Harassment and Discrimination Prevention Policy
2. Personal Harassment Prevention Policy
3. Workplace Violence Prevention Policy

The policies apply to all City of Hamilton employees and elected officials.

There are two accompanying procedures that apply to the above-mentioned policies: Procedure for Resolving Harassment and Discrimination Issues, and the Procedure for Workplace Violence Prevention.

Additionally, there is a Council Code of Conduct By-Law 16-290 which specifically outlines the expectations of Councillors.

A legislated Code of Conduct helps to ensure that the Members of Council share a common basis for acceptable conduct. The Council Code of Conduct By-Law 16-290 states as follows:

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SUBJECT: City Hall Safety Plan (HUR22012) (City-Wide) Page 3 of 8

- is designed to provide a reference guide and a supplement to the legislative parameters within which the Members must operate.
- serves to ensure public confidence that the City's elected representatives operate from a base of integrity, transparency, justice and courtesy.
- is administered by the City's Integrity Commissioner, appointed by Council by its By-law No. 16-288, who reports to Council and who is responsible for performing in an independent manner assigned functions with respect to the application of the Code of Conduct, and of procedures, rules and responsibilities of the City governing the ethical behaviour of Members of Council.

The Council Code of Conduct operates along with, and as a supplement to, in addition to other By-laws of the Council, statutes of the Provincial Legislature, and of the Parliament of Canada, that govern the conduct of Members of Council, including:

- the *Municipal Act, 2001*;
- the *Municipal Conflict of Interest Act*;
- the *Municipal Elections Act, 1996*;
- the *Municipal Freedom of Information and Protection of Privacy Act*;
- the *Ontario Human Rights Code*; and
- the *Criminal Code (Canada)*.

Of particular note, Sections 11 and 13 of the Council Code of Conduct regarding Conduct Respecting City Employees are relevant to this matter which state:

Section 11 (1) Every Member of Council, in accordance with his or her responsibilities as a Councillor; every City officer, in accordance with the terms of her or his appointment; and every City employee, in accordance with his or her employment agreement and responsibilities determined by Council; all subject to law, serve the City and are expected to act in the public interest and the interests of the City of Hamilton. Accordingly:

(a) every Member of Council shall be respectful of the role of City officers and employees to provide service and advice based on political neutrality and objectivity, and without undue influence from any one or more Members of Council;

(b) no Member of Council shall maliciously, falsely, negligently, recklessly, or otherwise improperly, injure the professional or ethical reputation, or the prospects or practice, of any one or more City employees; and

(c) every Member of Council shall show respect for the professional capacities and position of officers and employees of the City.

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SUBJECT: City Hall Safety Plan (HUR22012) (City-Wide) Page 4 of 8

(2) No Member of Council shall ask, expect or take any step to compel, any City officer or employee to engage in any partisan political activity, or be subjected to threat or discrimination for refusing to do so.

(3) No Member shall use, or attempt to use, the Member's authority or influence for the purpose of intimidating, threatening, coercing, or otherwise improperly influencing any City employee with the intent of interfering with that employee's duties, including the duty to disclose improper activity.

(4) It is the policy of the City that all persons be treated fairly in the workplace in an environment free of discrimination and of personal and sexual harassment and workplace violence. Accordingly:

(a) under this section, "harass" and "harassment" include any behaviour by a person that is directed at, or is offensive to, another person, on grounds of race, ancestry, place of origin, colour, ethnic origin, citizenship, creed, sex, age, handicap, sexual orientation, marital status, family status or any other improper ground;

(b) no Member of Council shall harass or engage in acts of workplace violence towards another Member of Council, any City officer or employee, or any member of the public; and

(c) every Member of Council shall:

(i) treat other Members, City officers and employees, and members of the public, appropriately, and without bullying, abuse, intimidation or violence; and

(ii) make all reasonable efforts to ensure that his or her work environment is free from discrimination, harassment and violence.

Section 13 (3) No Member of Council shall take a reprisal or make a threat of reprisal against a Complainant or any other person for providing information to the Integrity Commissioner.

The City upholds a zero tolerance to personal harassment and as such, does not condone personal harassment of or by any of its employees, in the workplace, and at any work-related functions, or in any other work-related circumstances.

Personal (Workplace) harassment as defined by the *Occupational Health and Safety Act* and our policy, "means engaging in a course of vexatious comment or conduct against a worker in a workplace that is known or ought reasonably to be known to be unwelcome or workplace sexual harassment."

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SUBJECT: City Hall Safety Plan (HUR22012) (City-Wide) Page 5 of 8

The intention of the policy and its procedure is to promote a healthy, respectful and supportive workplace by preventing personal harassment from taking place, and where necessary to act upon complaints of such behaviour in the most prompt, fair, and timely manner with due regard to confidentiality for all parties concerned.

Types of behaviour that may constitute personal harassment include, but are not limited to:

- Ongoing condescending comments or name calling
- Repeated offensive gestures or comments
- Practical jokes
- False accusations
- Repeatedly excluding or ignoring the victim
- Spreading malicious rumours or gossip
- Abuse of power or authority which negatively disrupts or prevents the performance of workplace duties or unduly influence workplace decisions, or requests to perform duties outside the scope of job requirements such as requests for personal errands
- Persistent, excessive or unjustified criticism and constant scrutiny beyond reasonable exercise of supervisory duties
- Intimidation
- Being coerced to engage in conduct that is not consistent with Workplace expectations of the City of Hamilton.
- Bullying
- Actions which create a “Poisoned Work Environment” which is hostile, intimidating or offensive

Issues Raised by the Integrity Commissioner’s Report

Council directed staff to develop a plan of action to address the issues identified in the Integrity Commissioner’s report dated June 10, 2022. In response, staff has developed a Safety Plan that will be communicated to Council members and affected City of Hamilton staff.

The Integrity Commissioner’s report stated that the evidence reveals a repeated pattern of unacceptable bullying and harassing behaviour directed at particular staff. The evidence discloses that, even in the face of efforts by other members of Council to curtail this conduct, the Councillor persists in engaging in unacceptable behaviour.

The Safety Plan is intended to provide specific guidance to Council and staff to ensure all parties are aware of their respective obligations and resources in addressing workplace harassment. The harassment may include in-person or virtual interactions, emails, and voicemails.

Council had also imposed sanctions on Councillor Whitehead on November 10, 2021 that included restrictions on direct communication with City staff below Senior Leadership Team, City Clerk, and City Solicitor:

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SUBJECT: City Hall Safety Plan (HUR22012) (City-Wide) Page 6 of 8

- (i) That Councillor Whitehead be restricted in his communications with City staff, outside of his own office staff, to communicating only with the City Manager, General Managers or designate; City Solicitor and City Clerk for the remainder of the 2018 – 2022 Council term;
- (ii) That Councillor Whitehead be obliged, during Council and Committee meetings, to confine his questions of staff by directing his questions to the Mayor or Chair and not directly addressing staff for the remainder of the 2018 – 2022 Council term; and
- (iii) That Councillor Whitehead be relieved of his responsibilities as Chair and Vice Chair of Committees of Council and local boards for the remainder of the 2018 – 2022 Council term.

The Safety Plan has been developed by Health, Safety and Wellness and Corporate Security staff. The Safety Plan will augment existing policies and procedures and the steps already taken to eliminate the potential for unwelcome interactions between Councillors, staff and others.

Objectives of the Safety Plan

1. To limit, control or eliminate situations that could lead to interactions between staff and an individual with a known history of harassing behaviour
2. To set out clear expectations and limits on in-person contact and other work-related interactions
3. To provide processes for reporting incidents or violations of any requirements set out in the Safety Plan.
4. To provide general guidance and recommendations for personal safety on and off the job.
5. To maintain confidentiality of employee information except where disclosure is required by legislation, tribunal or court of law.
6. To ensure all persons involved are able to fulfil their duties while complying with the terms of the Plan.

Elements of the Safety Plan

The Safety Plan will apply to areas of City Hall including the areas in the building that are exclusively used by Council Members and their staff, as well as the City Clerk's area.

The elements of the Safety Plan include:

- Roles and responsibilities for individuals covered by the Safety Plan

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SUBJECT: City Hall Safety Plan (HUR22012) (City-Wide) Page 7 of 8

- Councillors
- City Manager
- City Hall Security
- Human Resources
- City of Hamilton staff

- Protocols for reporting and responding to in-person interactions, incidents or messages that may constitute personal harassment
 - Who to contact?
 - Who will investigate?
 - Reporting findings

- Physical safety and security
 - Restrictions on access through key locks and swipe cards
 - Enhanced monitoring and patrolling by Security Staff

- Personal safety related to parking, entering and exiting City Hall, working in the building
 - Parking lot safety
 - After-hours access
 - Buddy systems (pairing with two or more co-workers and peers to provide support and to look out for each other)
 - Ability for staff to remove themselves from unwelcome interactions

- Personal safety outside of work
 - Tips and resources for personal time situational awareness, home and family security
 - Reporting incidents to responsible authorities

- Use of video monitoring technology
 - Review of existing CCTV locations and areas for enhancements with privacy impact and good governance application

- Summoning assistance
 - How to notify Security at City Hall
 - Protocols for notifying all staff
 - Calling 911

- Access to secured areas at City Hall
 - Protocols for alerting staff before anyone with restricted access due to sanctions can attend secure areas of City Hall including Councillors office area.
 - Protocols for entering, exiting and moving within restricted areas

- Communication to staff

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SUBJECT: City Hall Safety Plan (HUR22012) (City-Wide) Page 8 of 8

- Updating Council Members and affected City of Hamilton staff on details of the Safety Plan
- Providing information to others affected by the plan
- Provide updates on any changes to the plan

The Safety Plan will remain in place and may be revised at any time as circumstances change.

The detailed Safety Plan will be shared with Council Members as a confidential Appendix A to the report.

APPENDICES AND SCHEDULES ATTACHED

Confidential Appendix “A” – Detailed Safety Plan

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INFORMATION REPORT

TO:	Chair and Members General Issues Committee
COMMITTEE DATE:	August 8, 2022
SUBJECT/REPORT NO:	Definition of Affordable Housing (HSC22051/PED22183) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Al Fletcher (905) 546-2424 Ext. 4711
SUBMITTED BY:	Angela Burden General Manager Healthy and Safe Communities Department
SIGNATURE:	
SUBMITTED BY:	Jason Thorne General Manager Planning and Economic Development Department
SIGNATURE:	

COUNCIL DIRECTION

This information report is being provided in response to Council discussions arising from a development application at the July 8, 2022 Council Meeting, in which staff was asked to provide information regarding the definition of affordable housing.

INFORMATION

Depending on the context, “affordable housing” has been used, defined and interpreted in various ways. Often “affordable housing” is also used to describe “housing affordability” which can lead to confusion, depending on the audience. This report attempts to clarify the definitions of “affordable housing” that are typically used, and the contexts in which they are used.

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**SUBJECT: Definition of Affordable Housing (HSC22051/PED22183) (City Wide) -
Page 2 of 6**

The term “affordable housing” has historically had a specific connotation and was used in the context of social housing and supportive housing providing housing for lower income households. However, “affordable housing” addresses a spectrum of housing types and needs depending on the policy objective ranging addressing homelessness vs creating supportive housing vs creating new social housing/community housing vs programs to make first time homes more affordable. Historically, social housing includes housing built and operated under specific historical programs and managed according to the Housing Services Act, 2011. Supportive housing is purpose-built housing where programs are provided for residents to assist residents living on their own and to give best opportunity to live successful in their home. Down payment assistance programs have been used to assist low to moderate income households to purchase a home.

“Housing affordability” is a more general term, that is typically used to describe the ability of all households to be able to afford to rent or own a home. It is often based on measures of average house price relative to median household incomes. Generally, this term relates to those households, earning greater than the affordable housing income levels, but that still may be challenged to afford to rent or own a market rate home.

Recently, as more individuals and groups across a wider span of household income levels are challenged with housing affordability, the term “affordable housing” has been used outside its original context/definition, and this broader usage has made it difficult to have a shared conversation about what is meant by affordable housing.

The following information provides an overview of some of the definitions of affordable housing that are used locally, and the contexts in which they are used.

Federal and Provincial Funding Definitions – Canada Mortgage and Housing Corporation (CMHC)

Within the various Federal or Provincial funding programs, there are project criteria established which focus the funding on specific targeted populations and income levels creating a focussed definition of affordable housing for that funding.

CMHC considers affordable housing to include the following:

- *Affordability for an individual household = Housing costs are no more than 30% of their net income.*
- *Rent-Geared-to-Income is based on this calculation up to a certain household income (Household Income Limits).*
- *low end of market rental to be 80% of CMHC’s Average Market Rent.*

**SUBJECT: Definition of Affordable Housing (HSC22051/PED22183) (City Wide) -
Page 3 of 6**

CHMC has produced the following graphic which illustrates the housing continuum. Within the continuum, senior level government support is typically provided from the “Emergency Shelter” to the “Affordable Housing” categories to assist in the creation of new homes/rooms and for operating/programming costs. Where possible, the goal is to support and move residents through the continuum creating more opportunity for independence.

THE HOUSING CONTINUUM



There can be significant gaps in the housing continuum. At the one end of the continuum, senior levels of government fund deeper affordable housing units and at the other end of the continuum, the private market is building housing units to capture the higher-level household incomes. This creates a housing gap which is sometimes referred to as the “missing middle” or the housing normally associated with first time buyers, those trying to move up the housing ladder from “affordable housing,” or even those trying to downsize from larger family homes.

In the context of program funding, the new development of affordable housing is generally defined federally, provincially and municipally in the form of “eligibility criteria” by which an applicant can receive funding for a project. A project that provides housing to household incomes at the 60th income percentile or lower and provides rents at 80% of the Average Market Rent (AMR) is considered “affordable housing”. These new developments often are also provided rent supplements or housing allowances to reduce the rents for lower income percentiles, funded through different sources depending on the which programs are available such as Canada Ontario Community Housing Initiative (COCHI), Ontario Priority Housing Initiative (OPHI), Homeless Prevention Program (HPP), or where no funding is available off the tax levy. To access this senior level of government funding, the projects are required to be owned/operated by not-for-profits. Hamilton has not seen construction of affordable homeownership units in many years, except for Habitat for Humanity who develop a few small projects on a yearly basis.

Planning Definitions – Growth Plan for the Greater Golden Horseshoe and the Urban Hamilton Official Plan

Provincial and municipal land use planning documents also contain definitions of affordability.

**SUBJECT: Definition of Affordable Housing (HSC22051/PED22183) (City Wide) -
Page 4 of 6**

The provincial Growth Plan defines affordable as follows, and this definition is also carried forward in the City's Official Plan:

"Affordable: means:

a) in the case of ownership housing, the least expensive of:

i) housing for which the purchase price results in annual accommodation costs which do not exceed 30 percent of gross annual household income for low- and moderate-income households; or

ii) housing for which the purchase price is at least 10 percent below the average purchase price of a resale unit in the City of Hamilton; and,

b) in the case of rental housing, the least expensive of:

i) a unit for which the rent does not exceed 30 percent of gross annual household income for low- and moderate-income households; or

ii) a unit for which the rent is at or below the average market rent of a unit in the City of Hamilton (PPS, 2005 amended); and,

c) in the case of housing developments, at least 25 percent of either affordable ownership or affordable rental housing. For the purposes of the policies of this Plan, affordable housing developments may include a mix of affordable and market rate units, both ownership and rental."

The City's 10 Year Housing and Homelessness Action Plan (HHAP), developed and further updated by Council in 2020, includes a similar definition:

"The affordability of rental housing can be defined based on a proportion of a person or household's income or based on a percentage of the average or median market rent, for a defined area. Often, the definition includes a threshold in the position of households on the income spectrum, the most universal with low- and moderate-income households being at or below the 60th income percentile for renters living in a defined area. Different documents define affordable housing slightly differently. For the purposes of the HHAP and the City of Hamilton, generally, affordable housing means:

1. Housing that costs 30% or less of gross household income for households with a low to moderate income. Low to moderate income for renters is defined as income at or below the 60th income percentile for renters in the City of Hamilton, and for owners the 60th income percentile for all Hamiltonians; and/or,

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**SUBJECT: Definition of Affordable Housing (HSC22051/PED22183) (City Wide) -
Page 5 of 6**

2. Housing that is less than 125% of the CMHC average market rent for the same unit type and size, in the local housing market zone, or city-wide. Note that CMHC uses 80% of median market rent rather than the average for their programs..."

Real Estate Transaction Definitions

The City has proactively introduced various levels of affordable housing requirements within specific land sales or partnered developments. In these cases, the level, type and definition of affordability may vary depending on the nature and value of the real estate transaction, the priority housing needs in the area, and the objectives of the City and the community. The required level of affordability is approved by Council as part of the terms and conditions of the land sale or property transaction.

A definition that has often been used in real estate transactions is from the Municipal Housing Facilities By-law, which states:

- “affordable housing” means: (a) rental housing units with a rent at or below 125% of average market rent; (b) for affordable homeownership, housing units with a sale price of at least 10% below the median resale price of a home;
- “average market rent” means: (a) average monthly City rent or local area rent, whichever is higher, by unit and structure type, as determined in the annual fall survey of average market rents for the prior calendar year as provided to the City by CMHC; or (b) average market rent for a housing unit, by unit and structure type, for the prior calendar year as determined by the General Manager.

Some recent examples are provided below.

The Pier 8 development agreement states that not less than 5% of the units in the Project must meet the “affordable home ownership” standard outlined in section 1 of the City’s Municipal Housing Facilities By-law No. 16-233 being “a sale price that is at least 10% below the median resale price” applied to the sale of condominium units within the City of Hamilton, as reported monthly by the Realtors Association of Hamilton-Burlington

The Jamesville RFP indicates that an “Affordable Rental Unit” means a residential unit that is specifically marketed as a rental tenure property in accordance with Ontario’s *Rental Tenancies Act*, as amended from time to time, and for which the total actual gross rental revenue earned in a given 12-month period divided by the number of occupied months (or pro-rated to a smaller unit of time as appropriate) in that same 12-month period, does not exceed a threshold of 125% of monthly Median Market Rent for the respective unit type.

**SUBJECT: Definition of Affordable Housing (HSC22051/PED22183) (City Wide) -
Page 6 of 6**

The 60 Caledon land transaction requires the affordable housing rental unit offerings containing at least ten three-bedroom units with a maximum 80% Average Market Rent rate, and, an additional 20 three [1] bedroom units with a maximum 125% Average Market Rent rate.

Incentives and Fees Definitions

To incentivize the development of new affordable housing, Council has approved a Parkland Dedication By-law which permits waiving of cash-in-lieu of parkland payments where Housing Services is permitted to designate a project as “affordable housing” and the By-law then permits waiving of the fees.

A similar exemption exists for certain planning application fees, such as re-zoning and Official Plan Amendment fees.

The Development Charges By-law 19-142 exempts affordable housing developments where they do not receive upper level funding which permits DCs as an eligible expense:

“...until such time as the City’s Housing Services Division develops and implements a Development Charge Incentive Program, dwelling units within an affordable housing project that (a) either have been approved to receive construction funding from the Government of Canada or the Province of Ontario (including their Crown corporations) under an affordable housing program or have been approved by the City of Hamilton through an affordable housing program; and (b) such affordable housing dwelling unit is not eligible for funding for development charge liabilities from the Government of Canada or the Province of Ontario (including their Crown corporations);

“Affordable Housing Project” means a development or redevelopment that provides housing and incidental facilities for persons of low and moderate income.

APPENDICES AND SCHEDULES ATTACHED

N/A



Hamilton

**ADVISORY COMMITTEE FOR PERSONS WITH
DISABILITIES
REPORT 22-009**

3:30 p.m.

Tuesday, July 12, 2022

Room 264, 2nd Floor

Hamilton City Hall

71 Main Street West

Present: A. Mallett (Chair), J. Kemp (Vice-Chair),
S. Aaron, P. Cameron, M. Dent, L. Dingman,
A. Frisina, P. Kilburn, T. Manzuk, M. McNeil,
T. Murphy

Absent

with Regrets: Mayor F. Eisenberger, J. Cardno, L. Janosi,
C. McBride, K. Nolan, T. Nolan, R. Semkow

Chair Mallett called the meeting to order and recognized that the Committee is meeting on the traditional territories of the Erie, Neutral, HuronWendat, Haudenosaunee and Mississaugas. This land is covered by the Dish with One Spoon Wampum Belt Covenant, which was an agreement between the Haudenosaunee and Anishinaabek to share

and care for the resources around the Great Lakes. It was further acknowledged that this land is covered by the Between the Lakes Purchase, 1792, between the Crown and the Mississaugas of the Credit First Nation. The City of Hamilton is home to many Indigenous people from across Turtle Island (North America) and it was recognized that we must do more to learn about the rich history of this land so that we can better understand our roles as residents, neighbours, partners and caretakers.

THE ADVISORY COMMITTEE FOR PERSONS WITH DISABILITIES PRESENTS REPORT 22-009 AND RESPECTFULLY RECOMMENDS:

1. Items for Approval for the Accessibility Fair - Ability First, October 5, 2022 (Item 7.3(c))

WHEREAS, the Outreach Working Group of the Advisory Committee for Persons with Disabilities is planning an event, “Ability First”, in the Forecourt of City Hall on October 5th from 11:00 a.m. until 3:30 p.m. to promote accessibility for all, no matter your ability;

WHEREAS, Ability First will be an interactive event and attracting people to attend will be a key component to its success;

WHEREAS, the media and website currently under construction require Council approval before release to the public; and

WHEREAS, there are some details of the event that are still being finalized but the media's basic layout and website structure will not change after approval.

THEREFORE, BE IT RESOLVED:

- (a) That the draft media and website content, attached as Appendices "A" through "E" of Advisory Committee for Disabilities Report 22-009, for the Advisory Committee for Persons with Disabilities' "Ability First" event to be held October 5, 2022 from 11:00 a.m. to 3:30 p.m., be approved for release to the public; and
- (b) That the organizers of the "Ability First" event, to be held October 5 from 11:00 a.m. to 3:30 p.m., be granted to make minor changes to the media and website content to reflect changes to the event planning, subject to the approval by the Outreach Working Group of the Advisory Committee for Persons with Disabilities.

2. Motion respecting In-person and Virtual Collaborative Roundtable Meeting to Discuss Changes and Challenges to Public Transportation in Hamilton (Added Item 7.4 (c))

WHEREAS, the Transportation Working Group of the Advisory Committee for Persons with Disabilities respectfully requests permission to organize and host a meeting in collaboration with Accessible Transportation Services' Annual Accessibility Event in order to provide updated information and learning about the issues faced by Hamiltonians; and

WHEREAS, representatives of the Transportation Working Groups from other City Volunteer Advisory Committees as well as representatives from various community organizations, stakeholders (such as Canadian National Institute for the Blind, Multiple Sclerosis Society, Canadian Hard of Hearing Association, etc.), and the Accessible Transportation Services will benefit from the knowledge of the shared challenges faced during these challenging times.

THEREFORE, BE IT RESOLVED:

That members of the Transportation Working Group of the Advisory Committee for Persons with Disabilities be authorized to organize and host an in-person and virtual collaborative roundtable meeting

by the end of 2022 with key stakeholders and staff experts, for the purpose of discussing changes and challenges to public transportation in Hamilton in the new normal.

FOR INFORMATION:

(a) CHANGES TO THE AGENDA (Item 2)

The Committee Clerk advised of the following changes to the agenda:

7. CONSENT ITEMS

7.3 Outreach Working Group Update

7.3 (c) Items for Approval for the Accessibility Fair – Ability First, October 5, 2022:

- (a) Draft Media Release
- (b) Draft Banner for the City's Website
- (c) Draft Additional Signage
- (d) Draft Website

7.4 Transportation Working Group Update

7.4 (b) Transportation Working Group
Meeting Notes – June 22, 2022

7.5 Accessible Open Spaces and Parkland Working Group Update

7.5 (a) Accessible Open Spaces and
Parkland Working Group Meeting
Notes – June 28, 2022

8. PRESENTATIONS

8.1 Maureen Cosyn Heath, Director of Transit respecting Hamilton Street Railway and Accessible Transportation – presentation uploaded to the Agenda.

To be considered following Item 6.1.

8.2 Presentation by a representation from the Crisis Outreach and Support Team (COAST) (no copy)

To be considered following Item 8.1.

The agenda for the July 12, 2022 meeting of the Advisory Committee for Persons with Disabilities, was approved, as amended.

(b) DECLARATIONS OF INTEREST (Item 3)

There were no declarations of interest.

**(c) APPROVAL OF MINUTE OF PREVIOUS MEETING
(Item 4)**

- (i) June 14, 2022 (Item 4.1)**
- (ii) June 28, 2022 (Item 4.2)**

The above minutes of the Advisory Committee for Persons with Disabilities meeting, were approved, as presented.

(d) DELEGATION REQUESTS (Item 6)

- (i) Angelica Hasbon respecting Issues Related to Housing and Accessibility (Item 6.1)**

The delegation request from Angelica Hasbon respecting Issues Related to Housing and Accessibility was approved for a future meeting.

(e) CONSENT ITEMS (Item 7)

- (a) The following items were moved up on the Agenda to be considered following Item 8.2, the presentation by a representative from the Crisis Outreach and Support Team (COAST):**

- (i) Outreach Working Group Update (Item 7.3):
 - (1) Advisory Committee for Persons with Disabilities – Accessibility Fair Update (Item 7.3 (a));
 - (2) Outreach Working Group Meeting Notes – June 21, 2022 (Item 7.3 (b));
 - (3) Items for approval for the Accessibility Fair – Ability First, October 5, 2022 (Item 7.3 (c)); and

- (b) The following items, were deferred to the August 10, 2022 Advisory Committee for Persons with Disabilities meeting, due to time constraints:
 - (i) Built Environment Working Group Update (Item 7.1)**

 - (ii) Housing Issues Working Group Update (Item 7.2)**
 - (1) Housing Issues Working Group Meeting Notes – May 17, 2022 (Item 7.2 (a))

 - (iii) Transportation Working Group Update (Item 7.4)**

- (1) Resignation of Tim Murphy from the Transportation Working Group of the Advisory Committee for Persons with Disabilities (Item 7.4 (a))
- (2) Transportation Working Group Meeting Notes – June 22, 2022 (Item 7.4 (b))

(iv) Strategic Planning Working Group Update (Item 7.5)

- (1) Strategic Planning Working Group Meeting Notes – June 17, 2022 (Item 7.5 (a))

(v) Accessible Open Spaces and Parklands Working Group Update (Item 7.6)

- (1) Accessible Open Spaces and Parklands Working Group Meeting Notes – June 28, 2022 (Item 7.6 (a))

13. GENERAL INFORMATION / OTHER BUSINESS (Item 13)

- (1) Accessibility Complaints to the City of Hamilton (no copy) (Item 13.1)

- (2) Accessibility for Ontarians With Disabilities Act, 2005 (AODA) (no copy) (Item 13.2)
- (3) Presenters List for the Advisory Committee for Persons with Disabilities (no copy) (Item 13.3)

(i) Outreach Working Group Update (Item 7.3)

(1) Advisory Committee for Persons with Disabilities - Accessibility Fair Update (Item 7.3 (a))

The Advisory Committee for Persons with Disabilities - Accessibility Fair Update, were received.

(2) Outreach Working Group Meeting Notes - June 21, 2022 (Item 7.3 (b))

The Outreach Working Group Meeting Notes of June 21, 2022, were received.

(3) Items for Approval for the Accessibility Fair - Ability First, October 5, 2022 (Item 7.3 (c))

- (i) Draft Media Release (Item 7.3 (c)(a))

- (ii) Draft Banner for the City's Website (Item 7.3 (c)(b))
- (iii) Draft Additional Signage (Item 7.3 (c)(c))
- (iv) Draft Website (Item 7.3 (c)(d))
- (v) Draft Poster (Added Item 7.3 (c)(e))

J. Kemp provided an overview of the draft items for approval for the Accessibility Fair – Ability First, October 5, 2022, with the aid of a PowerPoint presentation.

For disposition of this matter, refer to Item 1.

(ii) Transportation Working Group Update (Item 7.4)

(1) In-person and Virtual Collaborative Roundtable Meeting to Discuss Changes and Challenges to Public Transportation in Hamilton (Added Item 7.4 (c))

S. Aaron introduced a Motion respecting In-person and Virtual Collaborative Roundtable Meeting to Discuss Changes and Challenges to Public Transportation in Hamilton.

For further disposition of this matter, refer to Item 2.

(f) PRESENTATIONS (Item 8)

(i) Maureen Cosyn Heath, Director of Transit respecting Hamilton Street Railway and Accessible Transportation (Item 8.1)

Michelle Martin, Manager of Accessible Transportation Services provided a presentation respecting the Accessible Transportation Services Performance Report 2019-21 and Q1 2022, with the aid of a PowerPoint presentation.

Maureen Cosyn-Heath, Director of Transit answered questions respecting Hamilton Street Railway and Accessible Transportation Services.

The presentation from Michelle Martin, Manager of Accessible Transportation Services respecting the Accessible Transportation Services Performance Report 2019-21 and Q1 2022, was received.

(ii) Presentation by a representative from the Crisis Outreach and Support Team (COAST) (Item 8.2)

P.C. Ryan Loft from the Crisis Response Branch, COAST Unit of the Hamilton Police Service and Katie Royle, Social Worker with COAST provided an overview of the services provided by COAST, with the aid of a PowerPoint presentation.

The presentation from P.C. Ryan Loft from the Crisis Response Branch, COAST Unit of the Hamilton Police Service and Katie Royle, Social Worker with COAST, was received.

(f) ADJOURNMENT (Item 15)

There being no further business, the Advisory Committee for Persons with Disabilities, be adjourned at 6:02 p.m.

Respectfully submitted,

Aznive Mallett, Chair
Advisory Committee for
Persons with Disabilities

Carrie McIntosh
Legislative Coordinator
Office of the City Clerk

To All Local Hamilton Organizations/Stakeholders,

On Wednesday October 5th, 2022, the Advisory Committee for Persons with Disability is putting on a major interactive event on the Forecourt surrounding City Hall. We are calling it ACPD's Accessibility Fair 2022 and the theme is "Ability First". It is from 11:00AM to 3:30PM

We cordially invite your organization to set up an informational table at the event and provide education to the public in attendance about what your organization does and how it affects or is affected by, persons with disabilities. The event should also provide a forum for you to converse with other like-minded groups. We are currently not allowed to sell product even for fundraising purposes.

Our interactive events are aimed at providing a fun or informative experience for all citizens of Hamilton whether they have a disability or not. We are planning to have various mobility device obstacle courses and other activities that highlight some of the difficulties we face. We are having the Steel City Wheelers perform a square dancing demonstration. We are talking to Mobility device providers about teaching of new equipment, or demonstrating how to properly maintain a mobility device. We are setting up a "Chair Wash" so people can get a quick wipe down of their device and maybe a quick tune up.

Do you have some ideas for an interactive activity? Please let us know as soon as possible and we will see what we can do to support your event. We also welcome you to send this release to other people and organizations you think may be interested in attending our event or setting up a station.

We will have a conventional bus and a DARTS bus on site so able bodied people can try to board them with mobility devices and perhaps understand why we need the space we do. It will also provide an opportunity for people with mobility devices to try to board both vehicles so they can experiment in a safe environment.

We look forward to hearing from you and know that together, we can make this event a success. Advertising and website will be available as soon as it is approved by Council. When it goes live, we invite you to provide a small bio of your organization, along with a logo if you would like to provide one, and we will list you on our Participants page. Website address is acpdaccessibilityfair2022.ca.

For more information, please contact the event organizer or the person that sent you this release. Event organizer can be reached at the following email address or phone number.

We can also be reached through the Clerk's office at clerk@hamilton.ca

Sincerely,

James Kemp

Event Organizer

jamesmpkemp@hotmail.com

Webmaster

jameskemp@acpdaccessibilityfair2022.ca



City of Hamilton Presents:

The Advisory Committee for Persons with Disabilities'

Accessibility Fair 2022



"Ability First"

What? An Interactive Event To Educate and Entertain Everyone.

Where? City Hall Forecourt, 171 Main St W.

When? October 5th, 2022 From 11:00 until 3:30.

Who? All Are Welcome To Attend, No Matter Your Ability.



For More Information, Please Visit Our Website at acpdaccessibilityfair2022.ca



International
Day of
Persons with
Disabilities
3 DECEMBER



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Accessibility Fair 2022



"Ability First"



Come and join the ACPD for an interactive event taking place on October 5th, 2022, from 11:00 AM until 3:30 PM on the Forecourt surrounding City Hall.

Learn how to maintain mobility devices, watch a square dancing demonstration, try to board a bus with a mobility device, attempt a white cane course, read lips, talk to local stakeholders about disability related issues and much more.



For More Information, Please Visit Our Website at acpdaccessibilityfair2022.ca



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City of Hamilton Presents:

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"Ability First"

October 5th, 2022 11:00AM - 3:30PM

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October
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October 5th,
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11:00AM -
3:30PM

City of Hamilton
Presents:



ACPD's Accessibility Fair 2022

Join Us On October 5th, 2022 From 11:00AM - 3:30PM

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October 5th, 2022 From 11:00AM - 3:30PM City Hall Forecourt

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October 5th, 2022
11:00AM - 3:30PM
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City of Hamilton Presents:

The Advisory Committee for Persons with Disabilities' Accessibility Fair 2022



"Ability First"



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Join us on October 5th, 2022 on the City Hall Forecourt for an interactive experience for all, no matter your abilities.

The Advisory Committee for Person with Disabilities for the City of Hamilton would like to invite all members of the public, no matter your abilities, to attend our Accessibility Fair on the Forecourt of City Hall on Wednesday October 5th, 2022 from 11:00 PM until 3:30 PM.

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Activities include:

Mobility Device Course

White Cane Course

Mobility Device
"Chair Wash"

Wheelchair Square Dancing
Demonstration with the
Steel City Wheelers

Local Organization/Stakeholder
Information Tables

Mobility Device Maintenance
Demonstrations

HSR and DARTS Vehicles On
Site for Experimenting With
Various Mobility Devices

Learn How To Find Ability
No Matter The Disability

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The Advisory Committee for Persons with Disabilities'
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What Is The ACPD?

The ACPD stands for the Advisory Committee for Persons with Disabilities.

What Does The ACPD Do?

The Advisory Committee for Person with Disabilities recommends to the City of Hamilton policy, procedure and standards that address the needs and concerns of all disabilities. Our task is to identify barriers in municipal programs and try to prevent new barriers from being created in accordance with the ODA (Ontarians with Disabilities Act) and the AODA (Accessibility for Ontarians with Disabilities Act) in matters of Customer Service, Employment, Transportation, Design of Public Spaces and Information and Communication.

Who Is The ACPD?

The Advisory Committee for Persons with Disabilities is comprised of citizens of the City of Hamilton with a diverse range of disabilities that strive to consider the needs of all in order to make this city a more equitable, diverse and inclusive place to live.



International Day for Persons with Disabilities December 03, 2020



International Day for Persons with Disabilities December 3rd, 2021

For More Information Please Visit the ACPD Page on the Hamilton.ca Website

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What Does IDPWD Stand For?

It means International Day for Persons With Disabilities.

When Is IDPWD?

It takes place on the December 3rd every year.

What Is IDPWD?

The annual observance of the International Day of Disabled Persons was proclaimed in 1992 by United Nations General Assembly resolution 47/3. It aims to promote the rights and well-being of persons with disabilities in all spheres of society and development, and to increase awareness of the situation of persons with disabilities in every aspect of political, social, economic and cultural life.

Why Are We Having Our Accessibility Fair on October 5th Instead Of December 3rd?

We wanted to hold the Accessibility Fair on the same day as International Day for Persons With Disabilities, but it is too cold and dark by December to have an enjoyable outdoor event. We hope to have good weather for the event as there is no rain date.

For More Information Please Visit the Following Link:

<https://www.un.org/en/observances/day-of-persons-with-disabilities>



IDPWD Logo



International Day of Persons with Disabilities
3 DECEMBER

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The Advisory Committee for Persons with Disabilities'
Accessibility Fair 2022



"Ability First"

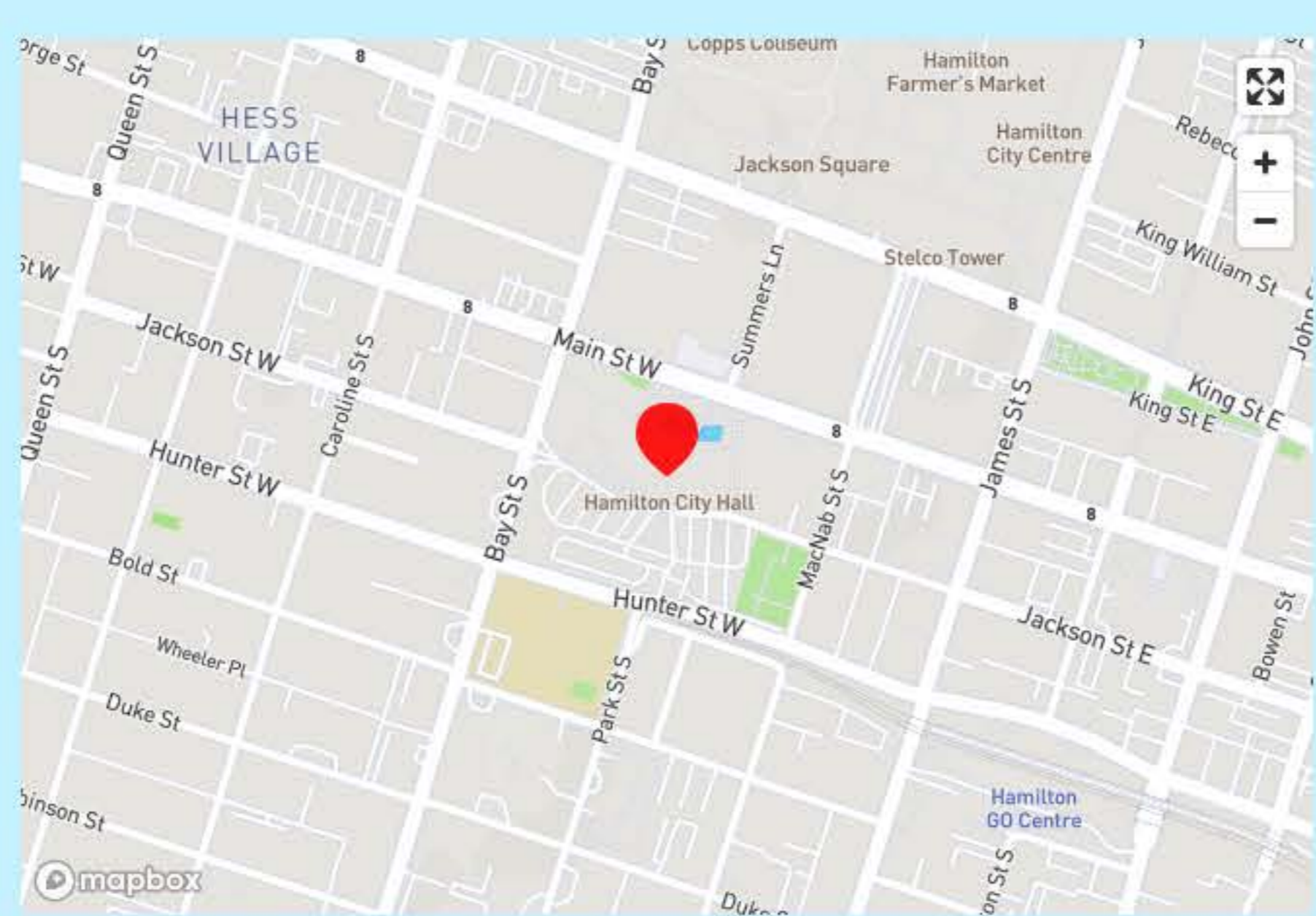
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ACPD's Accessibility Fair 2022 is being held on the Forecourt surrounding City Hall on Wednesday October 5th, 2022 from 11:00 AM until 3:30 PM



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Our Volunteers

McMaster University's IMPACT Initiative

Local Organizations / Stakeholders

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The City of Hamilton Presents:

ACPD's Accessibility Fair 2022

"Ability First"

Interactive Experience

Local Organization Information Tables

Wheelchair Square Dancing Demonstration

HSR And DARTS Vehicles On-Site

Experience Daily Disability Trials

"Chair Wash" Station

Mobility Vendor Product Demonstrations

Food Service

**For more information, please visit us at:
acpdaccessibilityfair2022.ca**

Wednesday October 5th, 2022

City Hall Forecourt
11:00 AM - 3:30 PM



Presents:

ACPD's Accessibility Fair 2022



"Ability First"



Interactive Experience



Local Organization/Stakeholder
Information Tables



Wheelchair Square Dancing Demonstration
With the Steel City Wheelers



HSR And DARTS Vehicles On-Site for
Mobility Device Experimentation



Learn to Find Ability No
Matter the Disability



"Chair Wash" Station



Mobility Device Maintenance
Demonstrations



For more information, please visit us at:
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Wednesday October 5th, 2022

City Hall Forecourt

11:00 AM - 3:30 PM



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"Ability First"



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