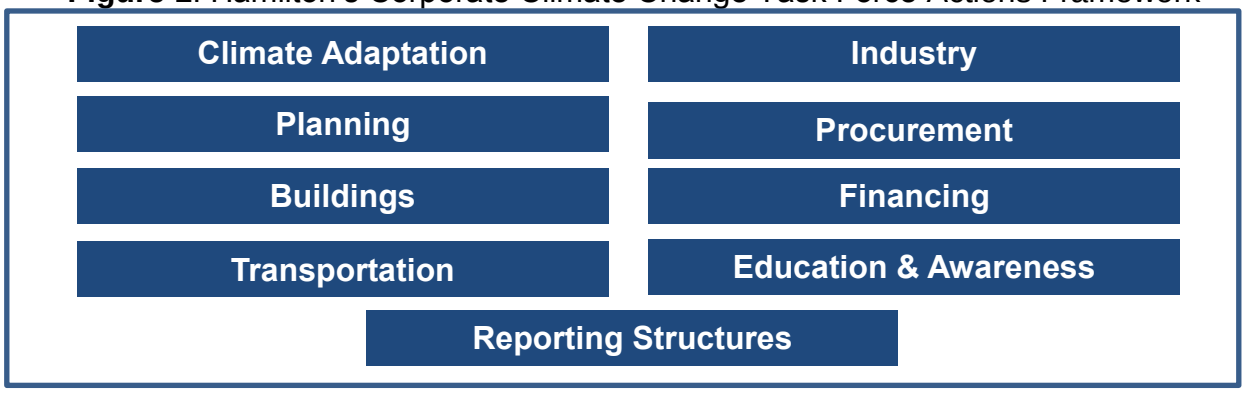
Hamilton's Corporate Climate Change Actions Framework

Climate change is an extremely complex problem that requires a holistic multi-disciplinary approach to address. It will require actions from all levels of government, including local municipalities, key anchor institutions, not-for-profit organizations, and individual citizen action. The below corporate climate change framework puts forward future actions that the City of Hamilton can take in order to help in the overall global effort to mitigate and adapt to climate change.

Figure 1: Hamilton's Corporate Climate Change Task Force Actions Framework



Several of the actions identified are taken from the low-carbon scenarios of Sustainability Solutions Group's (SSG) report completed for the Bay Area Climate Change Office titled "Hamilton and Burlington Low-Carbon Scenario and Technical Report 2016 to 2050, and is attached as Appendix "C" to Report BOH19022. The framework also builds off of Hamilton's historical and ongoing actions in order to leverage, as much as possible, existing staff resources and time.

Assessment for Climate Adaptation Actions

Within any climate change framework, climate adaptation is a critical component in order to prevent and mitigate climate change impacts. This can improve health outcomes of the population and save money through avoided costs of infrastructure damages and insurance claims. The insurance industry has consistently stated the importance of municipalities to conduct climate adaptation planning and more recently the investment industry has communicated the importance of climate action as well.

Due to the slow speed of the global carbon cycle, carbon previously emitted will last thousands of years within the world's atmosphere and, further contributing to global warming. This is why immediate decarbonisation of our civilization is required and why the impacts of climate change are inevitable and why climate adaptation is critical.

The Intergovernmental Panel on Climate Change (IPCC) defines adaptive capacity as "the ability of a system to adjust to climate change (including climate vulnerability and

extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences." Between 2013-2016, City staff underwent climate adaptation planning through International Council for Local Environmental Initiatives (ICLEI) Local Governments for Sustainability Canada's Building Adaptive & Resilient Cities (BARC) framework. Staff across the corporation worked with ICLEI Canada who developed The Science of Climate Change: Climate Data for the City of Hamilton. Using this report that projected future climate scenarios, staff developed approximately 52 climate change risk statements. Examples of risk statements include "Increase freeze-thaw cycles during the winter months leading to increased damage and mortality on the natural environment" and "Changes in precipitation resulting in decreased functionality of sewers, combined sewers and storm water ponds causing surcharge."

Utilizing these existing climate risk statements and projected climate scenarios, staff have begun researching historical meteorological data using Environment and Climate Change Canada's weather stations in Hamilton. In order to properly assess historical financial, social and environmental impacts of climate change, accurate meteorological data will need to be analyzed to begin identifying dates, or range of dates to assess what impacts occurred to the corporation and the community during that weather event. Meetings with internal and external subject matter experts across the corporation and community will take place to create standardized metrics and identification of databases in order to holistically determine the impacts of climate change.

The objective of this work is to conduct a comprehensive investigation into historical climate change impacts in order to properly recommend future climate adaptation actions. Staff are working across departments and looking to collaborate with other initiatives including the Smart City Initiative and the Enterprise Data Management project. Future budget recommendations will include costs, impact analysis including avoided costs and co-benefits in order for GIC to make an informed decision.

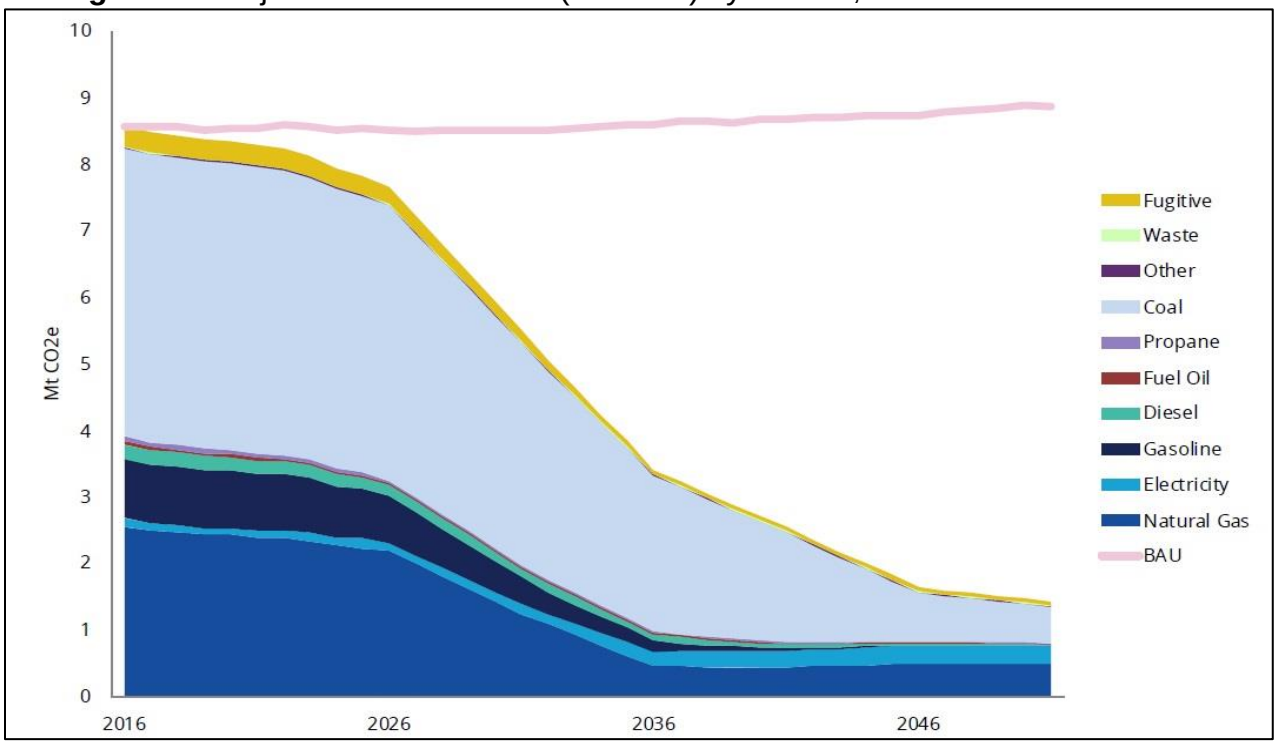
The outcome of this work will help the City achieve a Healthy and Safe Community, Economic Prosperity & Growth, and Built Environment & Infrastructure by helping our infrastructure and community prepare for and adapt to a changing climate.

Assessment for Climate Mitigation Actions

The majority of the actions outlined below for mitigation are described within the Hamilton and Burlington Low-Carbon Scenario and Technical Report 2016-2050, completed by Sustainability Solutions Group (SSG). SSG has worked on climate change planning and emissions inventories for municipalities across Canada including Toronto, Markham, Burlington, Guelph, Ottawa, Region of Peel, and most recently the Cities of Hamilton and Burlington through the Bay Area Climate Change Office. SSG's CityInSight model ensures low carbon (LC) scenarios are physically coherent and are a highly detailed representation of each scenario that is calibrated against local conditions.

In 2016, Hamilton's GHG emissions inventory was calculated at approximately 8.6 MtCO2e. This represents 87% of total emissions across the Bay Area (Hamilton and Burlington). Figure 2 below shows the LC pathway compared to the business-as-usual (BAU) by fuel type for the City of Hamilton to achieve an 83% reduction by 2050.

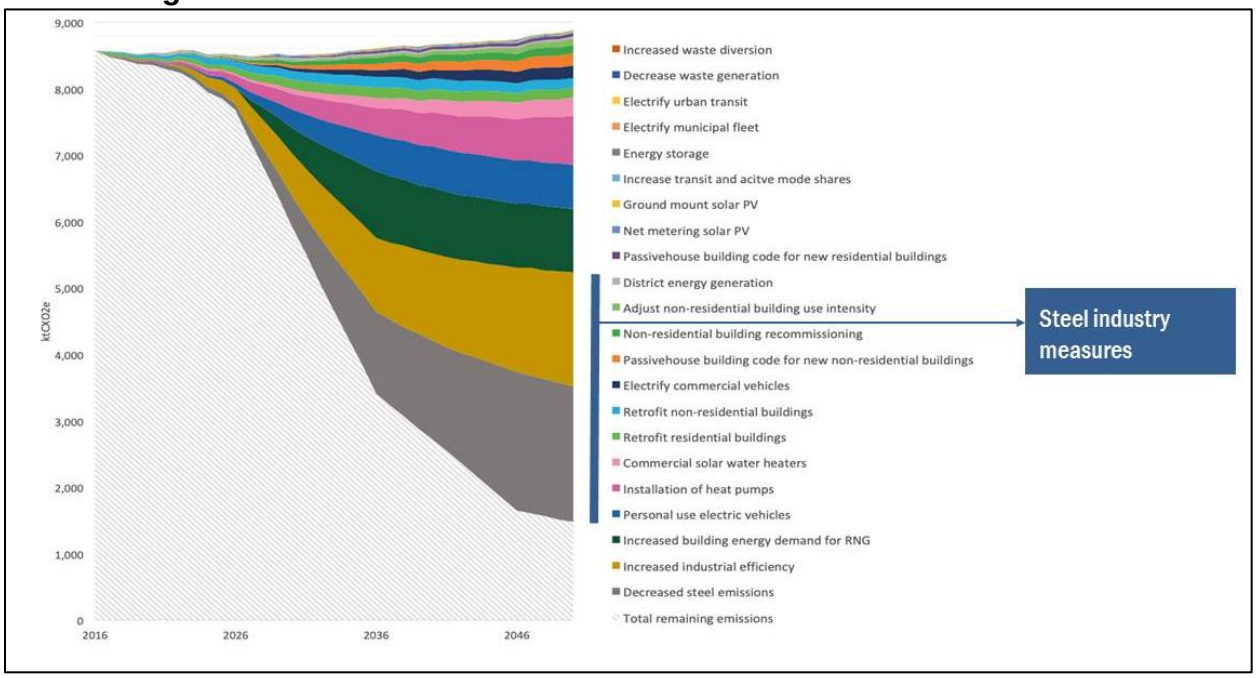
Figure 2: Projected LC Emissions (MtCO2e) by Source, in Hamilton 2016-2050



Note that a scenario is an internally consistent view of what the future might turn out to be — not a forecast, but one possible future outcome. It assumes that several policies, actions or strategies to address energy and emissions are implemented between 2017 and 2050.

Figure 3 below shows a widget table used to graphically represent the LC scenario and actions and the corresponding emission reductions for Hamilton. Although these actions are technologically feasible, they may or may not be economically feasible as the cost of the actions were out of the scope of this study.

Figure 3: Hamilton's LC Scenario Actions and Emissions Reductions



The above widget table shows that the majority of emissions reduction potential comes from the steel industry in Hamilton. Although this is an important source of emission reductions potential, industrial emissions are regulated by the Provincial and Federal governments. However, if you remove steel industry from consideration, Hamilton is similar to other municipalities where the majority of GHG emissions come from buildings and transportation. The sections below outline an overarching framework that details potential actions and policies that are within the direct control of Municipal Council and can greatly reduce corporate and community GHG emissions across Hamilton.

Planning

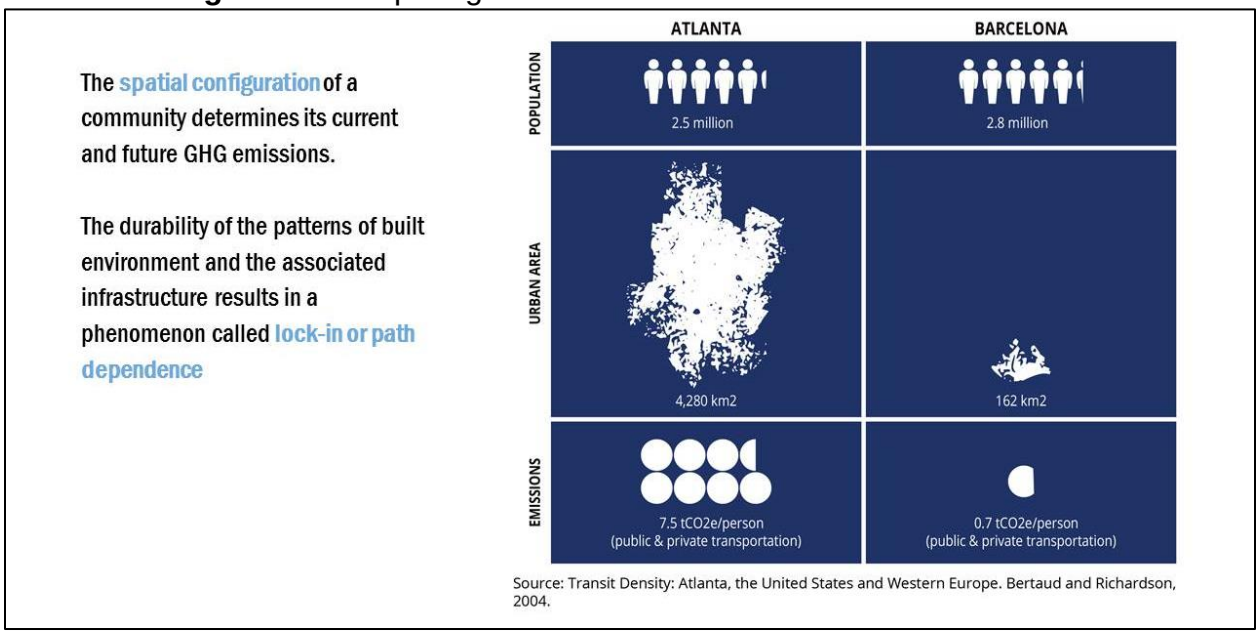
Land use planning affects almost every aspect of life in Ontario. How a city grows and how land is used has a direct impact on the GHG emissions the City produces and how resilient the community can be to extreme weather events caused by climate change.

An Official Plan (OP) is prepared by City Planners, with input from the community and helps to ensure that future planning and development will meet the specific needs of the community. Supportive language for climate change mitigation and adaptation should be incorporated into planning policies such as an OP and other primary decision-making processes such as GRIDS, Master Plans for Transportation, Water and Wastewater, and Stormwater.

The City of Hamilton is currently updating its Growth Management Strategy, known as GRIDS 2. The City will also be completing a Municipal Comprehensive Review (MCR) concurrently with GRIDS 2. These plans and decision-making processes will guide

growth over the next 10 years; however, it is vitally important that climate change be considered throughout the entire process. Figure 4 below is an example of two different global cities and how complete and connected communities and intensification can greatly influence the tonnes of carbon dioxide equivalent (tCO2e) per person.

Figure 4: Comparing Atlanta and Barcelona tCO2e Per Person



Climate change and air quality is mentioned throughout the existing Urban Hamilton Official Plan (UHOP) and Rural Hamilton Official Plan (RHOP); however, it is important to incorporate stronger language on climate change mitigation and adaptation to facilitate the transition to a zero carbon community.

Planning staff will participate on the Multi-Departmental Climate Change Task Force and will collaborate with other Planning Staff and the community to ensure a zero carbon community direction is properly communicated within GRIDS 2, the MCR and the UHOP and RHOP.

Buildings

In a report released by The Atmospheric Fund (TAF) in 2018 that calculated GHG emissions across the Greater Toronto Hamilton Area (GTHA), it was stated that the building sector contributed to 47% of GHG emissions. It also stated that 87% of those emissions come from natural gas use for water and space heating.

In Hamilton, SSG's report stated the top three emissions sources from building energy type is: coal at 61.0%, natural gas at 35.0% and electricity at 1.9% respectively. The emissions factor or emission intensity (i.e., how much carbon dioxide is emitted per unit of energy used) of any fuel source is very important. For example, coal has a much

higher emissions intensity compared to natural gas and therefore for every unit of coal burned to produce energy results in far more carbon dioxide released into the atmosphere compared to using natural gas. Furthermore because of Ontario's relatively clean electricity grid, electricity has far lower emission intensity than natural gas. These are important considerations when deciding on supply of fuel for the building sector.

There are potential municipal policy tools to encourage and facilitate lowering GHG emissions from the building sector. For example, municipalities across Ontario including Vaughan, Halton Hills, Clarington Township, Richmond Hill, Toronto, Mississauga, Brampton, and Whitby have either developed or have begun to develop what are being referred to as "Green Development Standards." These are either mandatory or voluntary design requirements with a focus on improved energy efficiency with all new private and city-owned developments. Municipal Green Development Standards will help facilitate local transition towards more energy efficient buildings.

However, a policy to address the existing building stock in Hamilton and across Ontario is required to reduce GHG emissions from existing buildings. Many of the buildings in Hamilton are very old, not energy efficient and require substantial maintenance. Policy initiatives that support the retrofit of existing buildings are growing in popularity across Canada. Similar programs such as Toronto's Home Energy Loan Program (HELP), City of London's Local Energy Efficiency Partnership (LEEP), or Nova Scotia's Property Assessed Clean Energy (PACE) are all examples of Municipal and Provincial programs aimed at retrofitting existing buildings to improve energy efficiency.

These two policies and additional policies to reduce energy and GHG emissions in buildings will be further researched and investigated through the development of the Community Energy Plan (CEP). Hamilton's Planning Committee approved the Terms of Reference for the development of the CEP in 2018, and submissions to the Request for Proposals have been received. Through the CEP, strategies will be developed for the implementation of the above-described policies and will be submitted to Planning Committee for approval.

Regional synergies may also exist for the development of a building retrofit program. One of the key strategic priorities of the Bay Area Climate Change Council is the implementation of a home energy retrofit program. Staff from both Hamilton and Burlington will be asked to participate on the implementation teams that will investigate the potential of bringing a regional approach to this type of policy program. There are also GTHA working groups through the Clean Air Partnership (CAP) also developing strategies for the creation of a building retrofit program. Ensuring that all Hamilton strategies for policy implementation align and complement regional objectives, rather than duplicate, will be an important consideration as the CEP is developed.

Although several energy conservation and fuel switching projects have reduced the City's GHG emissions, the reduction of Ontario's electricity emission factor has had

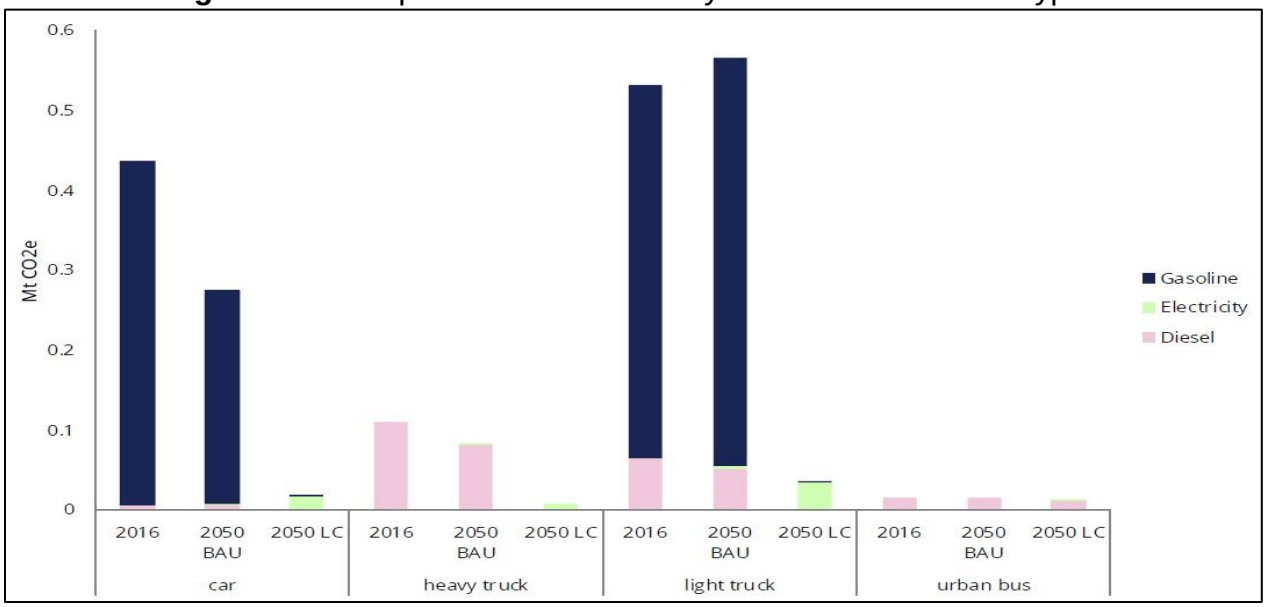
significant impact on reducing corporate GHG emissions. Staff across Public Works, including the Office of Energy Initiatives, have been participating in the CEP development and will participate in the Corporate Climate Change Task Force.

Energy efficient retrofits and high performance net zero energy buildings has the potential to create good paying, skilled trade jobs. The Canadian Green Building Council statistics show that in 2014, over 297,000 direct full-time workers were employed in the green building sector. This represents more Canadians employed than in the forestry, oil and gas, and mining industries combined.

Transportation

The transportation sector is the second largest source of GHG emissions with 1,096,430 tCO2e in Hamilton. This is consistent with many other municipalities across Ontario and Canada. TAF's research of GHG emission sources across the GTHA makes it clear that transportation sector emissions are a key area to target for emissions reduction strategies. Figure 5 below shows a representation of the emission sources in the transportation sector by vehicle type for Hamilton's 2016 emissions inventory completed by SSG.

Figure 5: Transportation Emissions by Source and Vehicle Type



The above bar graph shows that light trucks (e.g., Sport Utility Vehicles and Pick-Up Trucks), followed by cars are the two highest emission sources from transportation in Hamilton. This data shows the importance of supplying and increasing the availability of sustainable mobility networks across the City of Hamilton.

The City of Hamilton addresses several factors of transportation through the Transportation Master Plan (TMP). Several important aspects of reducing GHG emissions and improving health are detailed through sections of the TMP including:

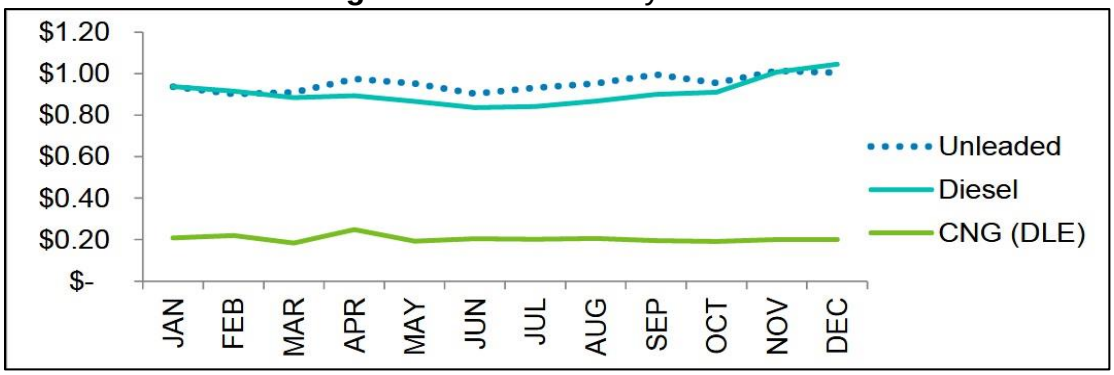
- Complete-Liveable-Better (CLB) Streets;
- The Role of Health in the Built Environment;
- Future Travel Demand Modelling;
- Sustainable Mobility Program Review; and,
- Cycling Master Plan Review and Update.

For example, an important part of achieving net carbon neutrality by 2050 will be the electrification and/or decarbonisation of our entire transportation sector. Within the TMP, actions include the requirement to provide electric vehicle (EV) charging stations as part of future zoning by-law amendments and the expansion of existing EV charging parking stations to create a network within all municipally-owned facilities, including public parking lots.

Efforts to accelerate and enhance these actions are needed to include requirements for EV charging stations at all new and renovated infrastructure projects including, but not limited to, buildings, parking lots, and service stations to prioritize the installation of EV charging stations.

The City of Hamilton's vehicle fleet represents the largest source of corporate emissions, according to the City of Hamilton's 2017 Annual Energy Report, at 38,040 tCO2e respectively. It is also the only sector of corporate emissions that have increased since the 2005 baseline year. Emission from the City's fleet is mainly attributed to the use of diesel fuel. The City has begun decommissioning diesel buses and transitioning to Compressed Natural Gas (CNG) buses. CNG has a much lower emission intensity (lower CO2e emission rate) compared to diesel. It also is far more cost effective with an average fuel cost per litre of $0.22 compared to diesel at $0.91. Figure 6 below shows the monthly fuel price of diesel, unleaded gasoline and CNG's diesel litre equivalent (DLE).

Figure 6: 2017 Monthly Fuel Prices in DLE



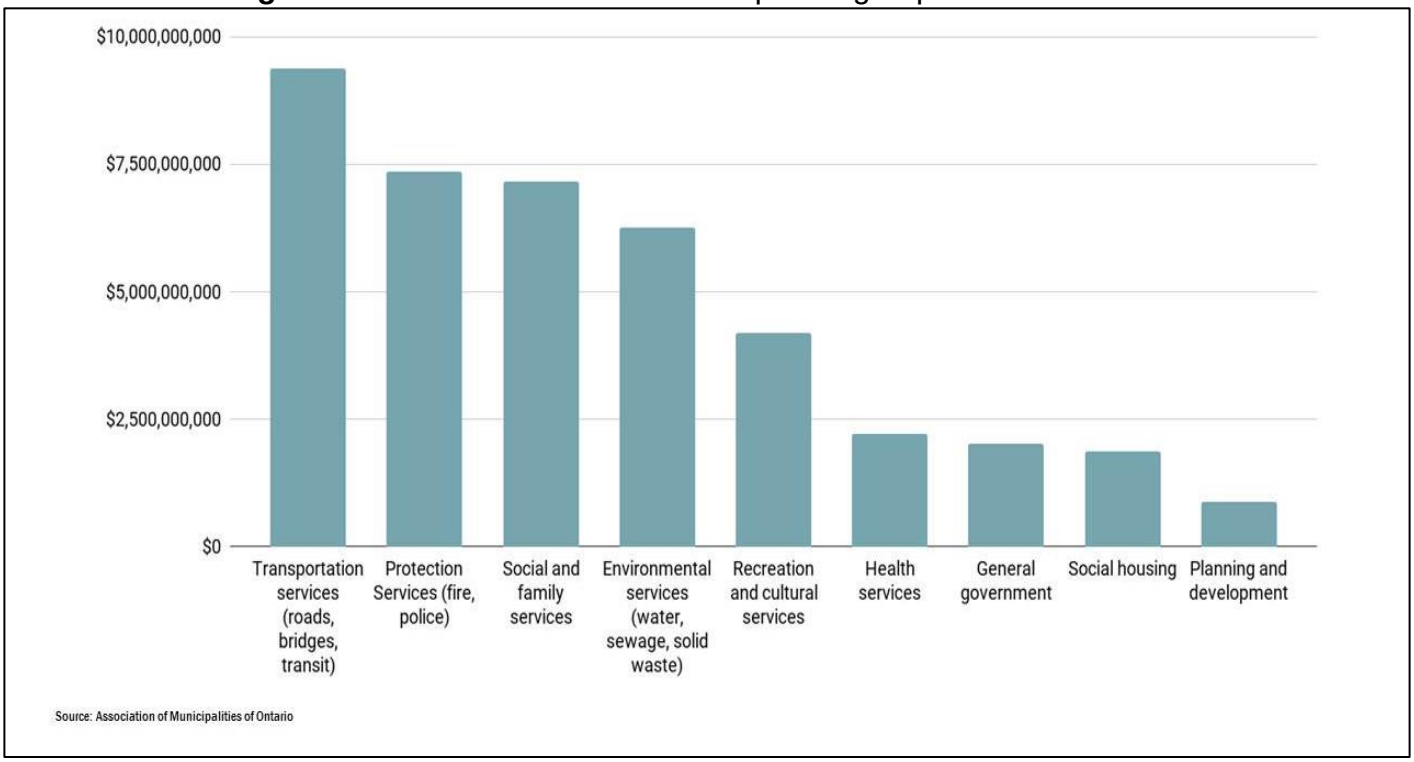
Vehicle fleet emissions in 2016 amounted to approximately 3.47% of total transportation emissions in Hamilton. However, fleet emissions have been growing since 2005 as our fleet gets larger. To remain a community leader in climate action, continued and enhanced efforts of decommissioning our diesel combustion engines through the transition to CNG vehicles should be prioritized.

Several co-benefits result in reducing GHG emissions in every sector, but the transition of people getting out of their personal vehicles, taking active and sustainable transportation and purchasing zero emission vehicles offers several health benefits. Diesel and gasoline combustion from vehicles results in the release of several harmful contaminants including fine Particulate Matter (PM2.5), Nitrogen Dioxide (NO2) and Benzene and Benzo(a)pyrene. By reducing GHG emissions from the transportation sector you are also reducing the exposure of Hamilton's population to these harmful contaminants. Furthermore, by providing citizens with the easy option of taking active and sustainable transportation, the City is promoting a healthy lifestyle that can reduce rates of obesity and other chronic illnesses.

Procurement

Municipal Governments across Ontario have the ability to impact sectors and markets by their large purchasing power. Figure 7 below shows statistics from Association of Municipalities of Ontario (AMO).

Figure 7: 2015 Local Government Operating Expenditures: $41.4B



Further information from AMO showed that in 2015 Ontario Gross Provincial Product (GPP) was $763 B, whereas local government accounted for $46.7 B (~6%). Local governments can use their purchasing power to help achieve the strategic priorities of the City and the Community through environmental and social strategic procurement.

The concept of environmental and social strategic procurement is that local governments can use the procurement process as a strategic function designed to align and support key social and environmental public policy goals. Social procurement has been used extensively across the world. In 2017, the European Commission adopted a public procurement strategy that includes the wider uptake of innovative, green and social procurement. In 2015, the Ontario provincial government passed the Community Benefit Clauses to infrastructure contracts awarded in Ontario.

Industry

Hamilton's industrial sector contributes the largest amount of GHG emission in the City at approximately 5,747,685 tCO2e, or 67% of total emissions. Hamilton has a very large industrial sector in the north end, supplying thousands of jobs and contributing millions of dollars to the local, provincial and federal tax base. Hamilton Chamber of Commerce CEO wrote in the Hamilton Spectator on August 31, 2018, that steel directly employs 10,000 people in dozens of companies in Hamilton's community and, through $2 B in local procurement, supports up to 40,000 additional jobs.

Sustainability Solutions Group's report does provide potential scenarios for the decarbonisation of the industrial sector in Hamilton. However it should be noted that these are one of several potential pathways towards decarbonisation. The SSG report details actions including increasing process motors and electrical efficiency, phasing out blast furnaces and switching to electric arc furnaces, and using more scrap metal and fuel shift away from coal, coke and oil to natural gas and electricity.

These actions may not be indicative of the direction of our local industrial partners. This is why continuing to grow our partnerships and collaborative efforts to investigating innovative low carbon solutions that maintains local companies' global competitiveness, is very important.

Examples of innovative technologies to lower industrial GHG emissions include Stelco's collaborative partnership in 2018 with Walker Environmental, who began using bio-carbon produced by Walker Environmental from recovered resources to replace a portion of coal in the coking process and, in turn, will provide 64,000 tCO2e reduction in GHG emissions. Another collaborative project, led by Hamilton Chamber of Commerce in partnership with local manufacturers, is McMaster University and the City of Hamilton will investigate the feasibility of utilizing waste heat and determining the potential efficient uses for it. This study hopes to enhance the competitive advantage of Hamilton's Bayfront Industrial Area while further reducing harmful emissions.

Ongoing partnership development and collective advocacy to higher levels of government for additional funding resources to investigate innovative low carbon technologies that allow industry to be globally competitive will be extremely important as Hamilton transitions to a prosperous net carbon neutral economy.

Finance

The transition to a zero carbon community will require an unprecedented initial amount of investment. It will require the re-prioritization of funding and alternative forms of financing mechanisms that have not been previously considered by local governments. The increased initial capital costs will be dramatic, however according to SSG's report, there could be a potential of $20 B in savings from energy costs alone.

Fortunately, the global financial sector is realizing the extreme importance and associated risks from climate change on investments. On April 16, 2019, The Guardian U.K. published an article quoting the governors of the Bank of England and France's central bank stating "As financial policymakers and prudential supervisors we cannot ignore the obvious physical risks before our eyes. Climate change is a global problem, which requires global solutions, in which the whole financial sector has a central role to play."

More and more investors are looking to invest in organizations and within cities that are leaders in climate change mitigation and adaptation. Investors realize the importance of climate change resiliency to improve business continuity when extreme weather events occur and that sustainability and energy efficiencies can save money and improve businesses triple bottom line.

A potential municipal financing mechanism growing in popularity across North America is a Green Bond. City of Toronto Manager of Capital Markets at the Bay Area Climate Change Summit defined Green Bonds as "debt securities where the proceeds are utilized to fund projects with specific environmental benefits." According to Sustainalytics, a local Hamilton investment research and ratings provider, the Green Bond market has grown 26% over the last year between 2018-2019. Approximately $8.3 B was issued last year through Green Bonds in Canada.

Currently Ottawa and Toronto are the only two municipalities in Ontario that have issued a Green Bond. Ottawa plans to use the $102 M raised to finance the light rail transit capital work requirements.

Although Green Bonds are still considered debt, there are several benefits of issuing a Green Bond including:

- An Environmental Social Governance (ESG) certified Green Bond will ensure funding is spent based on a Council approved framework which directs funding towards projects with a specific environmental benefit; and,

- Now due to demand, financing costs on average approximately one basis point cheaper than traditional debt ($100 M raised would equal approximately $100,000 in annual savings).

The issuance of a Green Bond may require costly administrative burdens that negate any annual savings realized. Finance staff will participate on the Corporate Climate Change Task Force in order to investigate and report back to the City Manager and Council on the cost benefit analysis of issuing a Green Bond.

Education and Awareness

City staff have engaged the community on climate change mitigation and adaptation priorities through several projects over the last five years, including:

- Let's Talk About The Weather, which consulted with hundreds of Hamilton residents in 2014, leading to the creation of Hamilton's first Community Climate Change Action Plan;
- Community Climate Change Adaptation workshops and meetings, which engaged with 20 prominent organizations on climate impacts of concern and gaps in coping with them;
- The Bay Area Climate Change Office engagement process in 2018, consulting with 32 organizations and 895 individuals on climate change priorities and the structure of the newly-formed Bay Area Climate Change Council; and,
- The first and second Bay Area Climate Change Summit, in 2018 and 2019 respectively, with over 400 attendees.

This has provided City staff with a good base of understanding of climate change mitigation and adaptation priorities in our community. In general, people want politicians at all levels to do more on climate change both in terms of reducing emissions and adapting our communities to expected impacts; however, it's worth noting that Hamilton residents haven't been specifically consulted on climate mitigation since the "Let's Talk About the Weather" campaign in 2014. Consultation efforts since that time have focused on regional initiatives with the City of Burlington as part of the Bay Area Climate Change Office, and on climate adaptation. Despite consulting with key environmental organizations such as Environment Hamilton, Hamilton 350, and members of the Bay Area Climate Change Council, no wide-spread community consultations on the concept of a Climate Emergency, or potential actions and policies resulting on the declaration, has taken place.

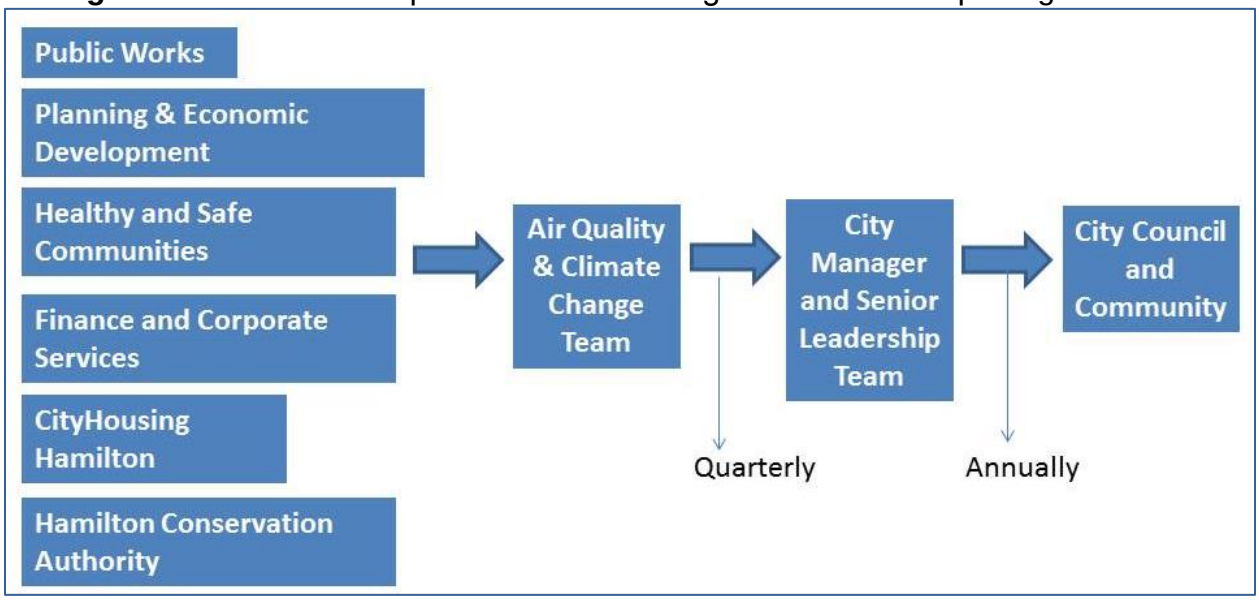
Through the Bay Area Climate Change Office, City of Hamilton staff will be partnering with Mohawk College, McMaster University and Mohawk College to continue their community awareness campaign that was funded by the federal government through the Climate Action Fund. The education and awareness campaign will be delivering a variety of community seminars, pop-up events and targeted educated strategies on a

variety of climate topics. Further to this, Hamilton and Burlington are also partnering with Youth Challenge International establishing cohorts of youth groups across Ontario to work on climate change action. It will be worthwhile to include further education and awareness on the climate change emergency within this ongoing planned engagement work.

Reporting

Climate change presents a great scientific, political, social and economic complexity that will require unprecedented GHG emission reductions that will impact the entire Corporation of the City of Hamilton and the community; therefore, a multi-disciplinary collaboration between all departments through the Corporate Climate Change Task Force will be created.

Figure 8: Hamilton's Corporate Climate Change Task Force Reporting Structure



This Task Force will report quarterly to all of the General Managers of each department through the Senior Leadership Team in order to ensure information and updates are shared in a timely manner. The Task Force will report directly the City Manager so oversight is from the highest level within the City of Hamilton. The information provided by the Corporate Climate Task Force will be used to prioritize annual capital and operating budgets in order to work towards meeting our new GHG reduction targets, while also becoming more resilient to the impact of climate change.

The Air Quality and Climate Change (AQ&CC) Team within the Healthy and Safe Communities Department will continue to act as the coordinating office for the Corporate Climate Change Task Force. The AQ&CC team will centralize climate change work and reporting of the Corporate Climate Change Task Force across the

corporation in order for the City Manager to update Municipal Council on the progress of climate change work on an annual basis.

City staff across the corporation will also be requested to participate on the regional Bay Area Climate Change Implementation Teams, to ensure alignment with regional priorities. Synergies will be identified and created that accelerate uptake of climate action across the cities of Hamilton and Burlington. These Implementation Teams will report back to the Bay Area Climate Change Council which in turn will report back annually to the community through public forums on the progress of regional climate action and each respective municipality to identify strengths and weaknesses.

It will be important to communicate clearly and often on what the priorities are, the actions to be taken, emerging scientific knowledge, and progress on achieving our goals. Every policy, plan and action will need to be dynamic in order to keep up with evolving technology and information. By working towards developing the above reporting frameworks, both Municipal council and the community will be able to stay up to date on the progress of climate change action across the cities of Hamilton and Burlington.