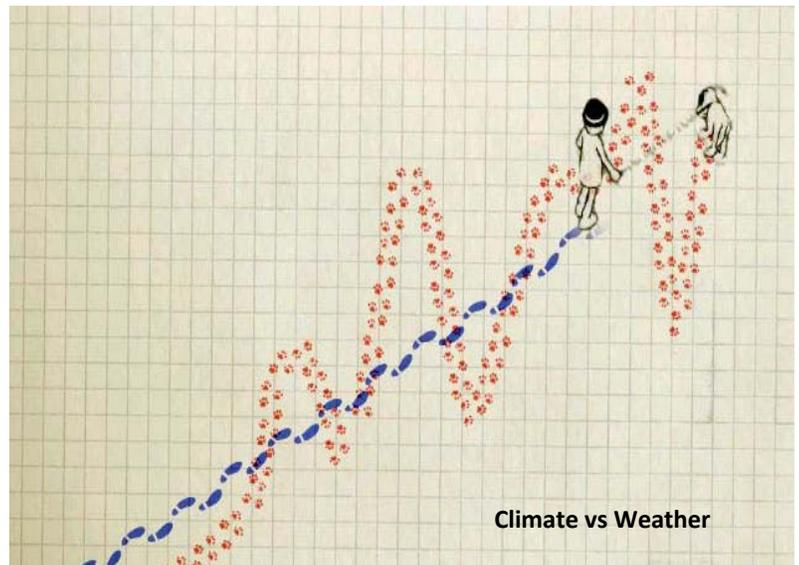


Appendix A

Climate Change 101 - Hamilton

What is Climate Change and What Does it Mean?

Climate change is the altering of long-term patterns of weather identified by changes in temperature, precipitation, wind and other indicators¹. The term 'weather' refers to what happens each day, while 'climate' is the trend over a long period of time. The image below illustrates the difference between weather and climate by showing the path taken by a man walking his dog. If you look at the path taken by the dog (representing 'weather'), at any point, he is travelling north, then south, then north. If you were just to look at the dog at a single point in time, or over a short period of time, you might conclude "he is moving south" or "he is moving north". However, if you look at the long distance path of the man (representing 'climate'), you would conclude that regardless of the dog's movements south and north, they are both moving in a northeast direction². This is the same difference between weather and climate.



It is natural for the climate to change slowly over thousands of years; however, in the last 100 years, we have experienced dramatic changes in the global climate³. The International Panel on Climate Change (IPCC) has concluded the following:

- The atmosphere and oceans have warmed;
- Snow and ice cover have decreased;
- Sea levels have risen; and
- Extreme weather events have occurred more frequently⁴.

¹http://www.mnr.gov.on.ca/en/Business/ClimateChange/2ColumnSubPage/STDPROD_090050.html

²<http://americablog.com/2013/06/uk-environment-minister-paterson-climate-change-denial.html>

³http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@climatechange/documents/document/stdprod_090231.pdf

⁴http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf

Potential Impacts of Climate Change in Hamilton

- Vulnerability of infrastructure to several types of extreme weather events
- Impacts on water supply and quality as a result of decreasing and variable average water levels in the Great Lakes
- Changes in the frequency of severe storms and associated safety risks
- Changes in agriculture (extreme droughts, floods, shifting produce, weeds and insects) affecting the supply of foods

While the rate of change for each indicator varies, the observed trends are consistent with climate warming and together demonstrate a change in the climate system. The observed trends of change are expected to continue over the coming decades and beyond.

While climate change is a global issue, the rate of change and impacts differ from one region to another. In Canada, changes in climate are affecting the natural environment, economy and health of citizens⁵. Climate change is a global issue, but the rate of change, the impacts, and influences differ from one region to another. Global trends will influence local responses.

GLOBAL INFLUENCE	LOCAL IMPACT
An increasing population results in global migration pressures to Canada from countries where climate impacts are severe.	The desire to constrain growth to urban areas, make communities more compact, and reduce sprawl through initiatives such as the Provincial Places to Grow Act. Municipalities like Hamilton are saddled with aging infrastructure designed for old weather conditions, with an increasing gap in funding for replacement and improvement to accommodate this legislated growth.
Energy security , ensuring that energy is readily available, affordable and able to provide a reliable source of power without vulnerability to long- or short-term disruptions, is threatened.	The forecast growth in energy demand and with increased local growth means that we will need a variety of energy sources now and into the future.
Water security , the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, public health, and preserving ecosystems are threatened.	Ensuring our local population is resilient to water-related hazards, including floods, droughts, and pollution in the Great Lakes Area has been an under-recognized challenge.
Food security , to ensure all people have access to an affordable, nutritional and sustainable diet is threatened by all of the above influences.	Our ability to and maintain the livelihoods of small and large scale producers and the day-to-day food needs in our community means less reliance on the global food supply-chains we have become accustomed to.

⁵http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Full-Report_Eng.pdf

<p>Economic growth and energy consumption will rise and fall in unison. The growth rate of atmospheric CO₂ depends on three classes of factors: global economic activity (generated from the use of fossil fuels and land-use change), the carbon intensity of the economy, and the functioning of unmanaged carbon sources and sinks on land and in oceans.</p>	<p>Economic activity and energy consumption of Hamilton will follow the global pattern, but the impacts can be lessened through economic and energy diversity.</p>
<p>The good news is there is hope. Energy-related CO₂ emissions actually flat-lined globally in 2014, while the world economy grew, indicating that economic growth could continue without the associated emissions through changing consumption patterns and focus on low carbon emitting practices and policies. Traditionally this occurred in the past due to recessional economies, but it is apparent that new economic realities are emerging.</p>	<p>The bad news is that even with a decrease in carbon emissions, the impacts of a changing climate and extreme weather will continue to be felt in through agriculture, infrastructure, the economy and health as current GHGs will still persist in the environment and continue to influence local weather and climate change impacts.</p>

How Has Climate Changed in the Hamilton Region?

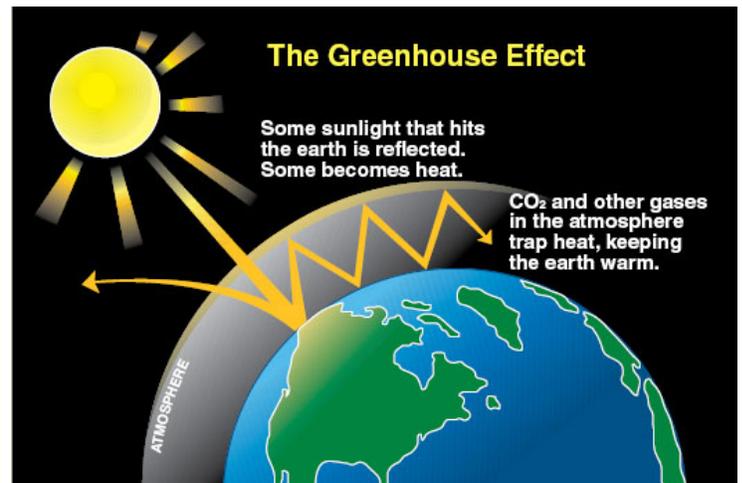
Since 1950, the average temperature over land in Canada has increased by 1.5⁰C, representing a rate of warming that is double the global average reported over the same time period⁶. More locally, changes in the climate system have been observed in Ontario and within the City of Hamilton. The Hamilton Conversation Authority Climate Change Strategy (2012) outlines the following observed changes in Ontario’s climate:

- Annual average air temperatures across the province has increased from 0 to 1.4°C; the greatest warming occurred in the spring for the period 1948 to 2006.
- Annual average mean temperature in Hamilton has increased by 0.9°C since 1970.
- Total annual precipitation increased 5-35% since 1900 and the number of days with precipitation (rain and snow) increased.
- Total annual precipitation in Hamilton increased 26mm; this equates to approximately 3% increase in annual average precipitation since 1970.
- Increased night-time temperatures in the summer has been linked to more intense convective activity and rainfall contributing to greater annual precipitation totals.
- Heavier, more frequent and intense rainfall events have been detected in the Great Lakes Basin since the 1970s.
- Precipitation as snow in the spring and fall has decreased significantly in the Great Lakes-St. Lawrence basin between 1895 and 1995, although total annual precipitation has increased.

⁶ http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Full-Report_Eng.pdf

What is Causing Climate Change?

There are two causes of global climate change: natural causes and human causes. Natural causes can be defined as factors that occur naturally and are external to the climate system, such as volcanic activity and the Earth's orbit around the sun⁷. In contrast, human causes do not occur naturally and are a result of human activity, such as the burning of fossil fuels⁸. Human influences on the climate system have significantly increased in correlation with rapid growth in industrialization. Human activities contribute to climate change primarily by emitting greenhouse gases (GHG) into the atmosphere. Common GHGs include carbon dioxide, methane and nitrous oxide. GHGs surround our planet and act as a barrier to prevent the loss of heat and energy into the outer space, in turn causing the atmosphere to warm. GHGs occur naturally and are required to support life on earth; however, in excess quantity, the gases can change the Earth's climate and negatively impact the health of the environment and humans⁹.



Source: State of Washington, Department of Ecology

How Much Greenhouse Gases Are We Emitting?

In 2012, Canada's total GHG emissions were estimated to be 699 megatonnes of carbon dioxide. The Energy Sector, which includes GHG emissions from stationary combustion sources (i.e. furnaces, heaters, dryers) and transportation sources, accounts for 81% (566 megatonnes) of the nation's emissions. The remaining 19% of total emissions are generated from the Agriculture Sector (8% of total emissions), Industrial Processes Sector (8%) and the Waste Sector (3%)¹⁰.

Ontario's main 2012 GHG sources are transportation (34%), industry (30%), buildings (17%), electricity (9%), agriculture (6%) and waste (4%).

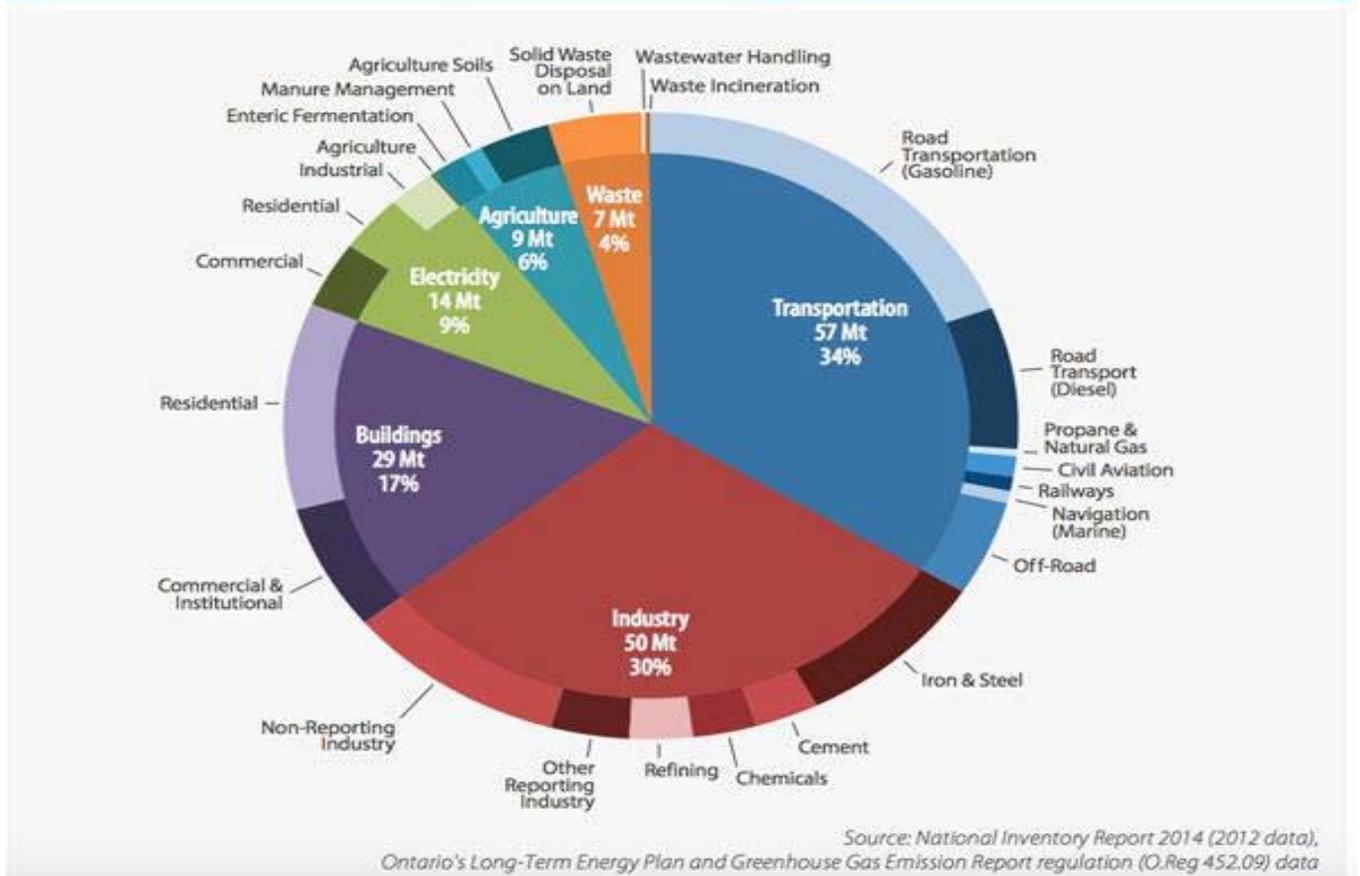
⁷ <http://www.climatechange.gc.ca/default.asp?lang=En&n=65CD73F4-1>

⁸ Ibid

⁹ <http://www.epa.gov/climatechange/basics/>

¹⁰ <http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=3808457C-1&offset=2&toc=show>

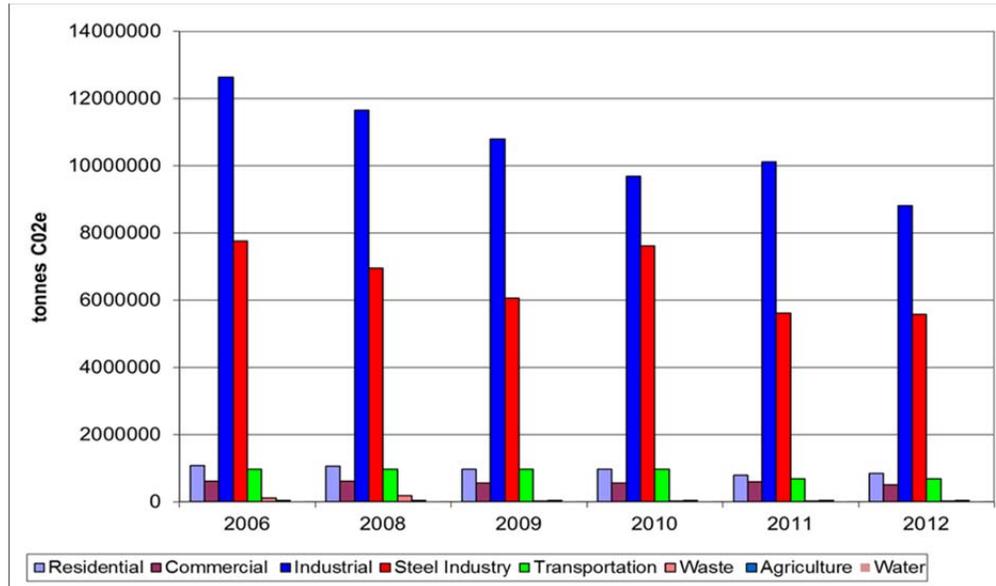
FIGURE 3 Ontario's 2012 Greenhouse Gas Emissions by Sector



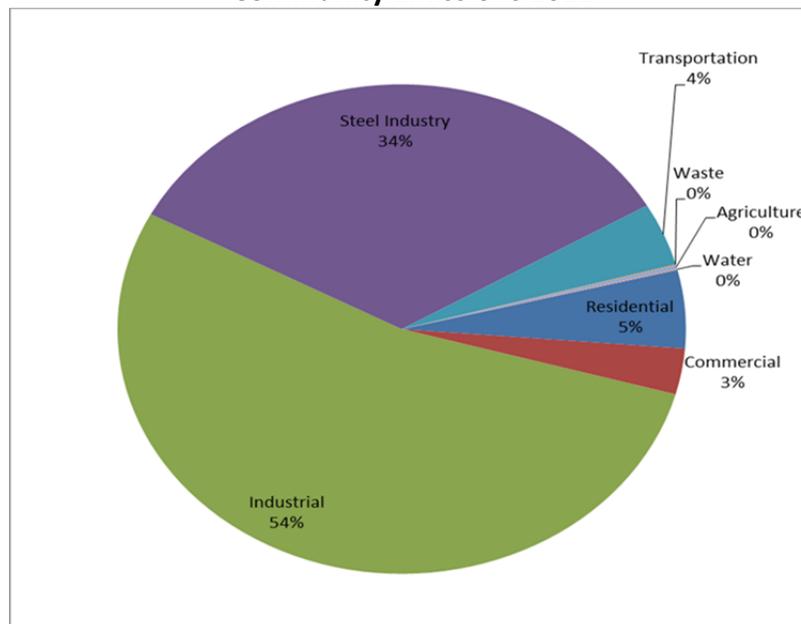
The City of Hamilton's total emissions from corporate operations (e.g. buildings and facilities, fleet, sewage treatment, etc.) in 2012 was 108,433 tonnes, down from 135,038 tonnes in 2005¹¹. Municipal operations account for 1% of local emissions. In contrast, residential emissions from household heating, electricity, and waste generation, contribute 5% of local emissions. Commercial and transportation account for 7% of local emissions. The rest is made up of energy usage and production in local industry. In 2012, the total emissions in the community were 16,481,699 tonnes, down 29% from 23,231,799 tonnes in 2006. The charts on the following page show the total greenhouse gas emissions sources and changes in the community in 2012.

¹¹ <http://climatechangehamilton.ca/the-city-of-hamilton>

Community Emissions Changes 2006-2012

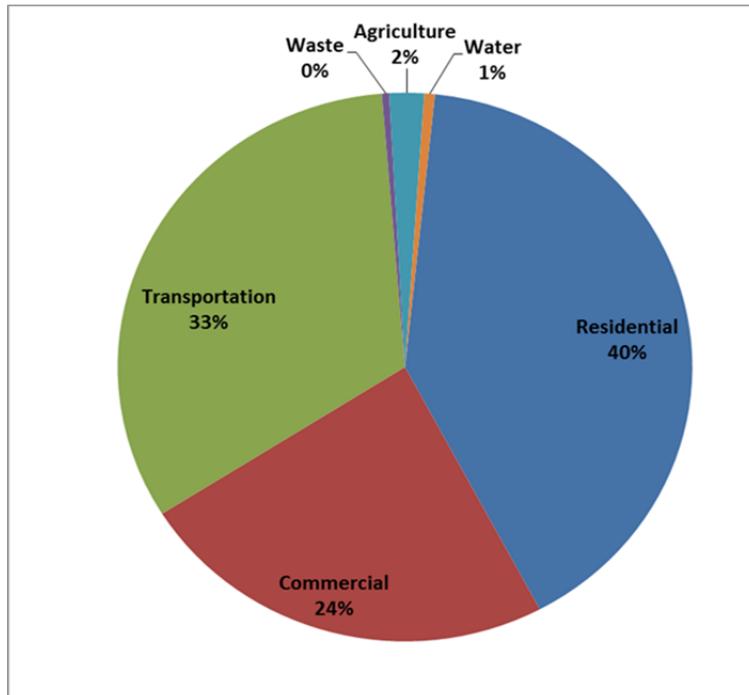


Community Emissions 2012



Industrial sources and energy usage makes up the bulk of emission sources in Hamilton, however these sources are regulated by the Province and the Canadian government. Where local action and reductions can occur in the community is in the transportation, residential, commercial, waste, water and agriculture sources. When local industrial sources are removed from the community climate picture, the following emissions values can be seen: residential at 40%, transportation at 33%, commercial at 24%, agriculture at 2% and water at 1% making up an estimated total of 2,097,166 tonnes of greenhouse gas emissions.

Community Emissions 2012 (minus industrial sources)



What Has Already Been Done in Hamilton?

Hamilton has been undertaking action on climate change through the work of organizations in the community and through community climate change initiatives and programs such as the Hamilton Climate Change Champions (2009), the Hamilton Climate Change Action Charter (2011) and the Hamilton Climate Change Action Map (2013).

In Hamilton, every October since 2009 has been Climate Change Action Month, raising awareness of climate change in Hamilton and recognizing the achievements and actions of the community. Every year since 2009, the City of Hamilton has reported annually on its corporate reductions and tracking the emissions in the Community.

Building upon the work and actions in the community, a Hamilton Community Climate Change Action Plan will help Hamilton address climate change further and become more resilient to the impacts of climate change that can be expected to occur in and around Hamilton over the coming decades. The plan focuses on adapting and preparing the community for the risks of climate change, such as more variable and extreme weather, more social and infrastructure stresses, risks to infrastructure, and insurance costs. It will also address reducing the community's contributions to climate change, such as the emission of greenhouse gases, a major contributor to climate change.

Spotlight on the City of Hamilton

The City of Hamilton was recognized as one of the Top 10 Canadian Cities tackling Climate Change by the World Wildlife Fund in 2011, and here are a few reasons why:

- ✓ In 2006, Council moved forward on Phase 1 of a Corporate Air Quality & Climate Change Action Plan
- ✓ In 2008, the city adopted a set of corporate and community-wide emission reduction targets, and by 2011-2012, community emissions had decreased by 23.1% based on 2006 levels
- ✓ In 2009 and every year since, the City undertook an emissions inventory of greenhouse gas emissions in Hamilton
- ✓ In 2011, Hamilton was the first municipality in Ontario to launch its' Community Climate Change Action Charter (<http://climatechangehamilton.ca/hamilton-climate-change-action-charter>)
- ✓ In 2013, Hamilton achieved Milestone 5 for its Corporate initiatives under the Federation of Canadian Municipalities Partners for Climate Protection Program and 5 Milestone Framework
- ✓ Hamilton has a new community target of 80% emission reductions by 2050, in line with other cities globally.