CHAPTER 4

Brampton Today

Living the Mosaic

KEY TAKEAWAYS

- The CEERP planning process began with understanding where Brampton was starting from in 2016 (Baseline) and where it would be in 2041 if no coordinated action is taken (Base Case; business as usual).
- Transportation is currently Brampton's biggest GHG emitter, energy user, and community cost, followed by the residential, industrial, commercial, and institutional sectors, respectively.
- The community of Brampton spent $1.8 billion on energy and water in 2016, and at least $1.4 billion of those energy dollars left the community in payment for energy services to companies located outside of the city.
- Thirty percent of energy paid for by Brampton users is lost during energy conversion and transmission.
- Brampton's population and the workforce are expected to increase by 51% and 73%, respectively, by 2041.
- If we continue with business as usual, by 2041 Brampton's emissions will increase by 13% and remain twice that of global best practice, energy use will increase by almost 30%, and energy costs will increase by over 200%.
- A full glossary of terms is available at the beginning of this report. Some of the key terms used in this chapter include: Latest Energy Transition, and Deep Decarbonization.

4.0 How Brampton Uses Energy

Brampton's largest users of energy are transportation and residential buildings, with the transportation sector representing 35% and the residential sector representing 26% of source energy use. In Brampton, 65% of dwellings are considered low density, and the remainder medium density.

In Brampton, 80% of trips are done using single occupant vehicles, and according to the 2016 Census data, over 50% of Brampton's employed labor force commute more than 30 minutes to work. This is a result of Brampton's low activity rate and its built form being dominated by low density and separated uses. Together, these issues cause more residents to commute to jobs outside Brampton and drive for daily errands, which increases traffic congestion and the city's GHG emissions.

Brampton's activity rate, or the ratio of residents to jobs within the city, is 34%. That is, there are only enough jobs in Brampton to employ 34% of its residents. This is a low activity when compared to neighbouring municipalities (Mississauga - 60%, Vaughan - 50%, and Caledon - 50%).

Furthermore, compared to older city forms, where walking was the primary mode of transportation, Brampton occupies a vast area. For example, Copenhagen, which has the same population as Brampton, takes up only 30% of the land area (88 km^2) of Brampton's 266 km^2.

4.01 Residential

People need buildings to live, learn, work, and play in, and these buildings use energy. Houses and buildings account for 44% of Brampton's energy use and 28% of its GHG emissions.

According to Statistics Canada, the majority of people in Brampton live in single-detached homes. Just over 51% of private dwellings in Brampton are single detached homes, while 21.9% are apartments, 13.7% are semi-detached and 12.3% are row houses.

As such, increasing residential energy efficiency is critical to achieving CEERP goals and addressing the climate emergency. While new construction methods result in better energy efficiency than previous methods, the majority (52%) of Brampton's neighbourhoods were

ENERGY, EMISSIONS, AND BRAMPTON

9th LARGEST CITY IN CANADA

2nd FASTEST GROWING CITY IN CANADA

650,000 RESIDENTS

~14,000 NEW RESIDENTS EACH YEAR

HOUSING STOCK

65% LOW DENSITY
52% SINGLE DETACHED
13% SEMI DETACHED

35% HIGH DENSITY
22% APARTMENTS
13% ROW HOUSES

ACTIVITY RATE

34%

THAT MEANS THERE ARE ONLY ENOUGH JOBS IN BRAMPTON FOR 34% OF ITS POPULATION

METHOD OF TRANSPORTATION

65% PRIVATE AUTOMOBILE

8% PUBLIC TRANSIT

18% CARPOOLING

2.5% WALKING AND CYCLING

54.6% OF PEOPLE IN BRAMPTON HAVE A COMMUTE OF HALF AN HOUR OR LONGER

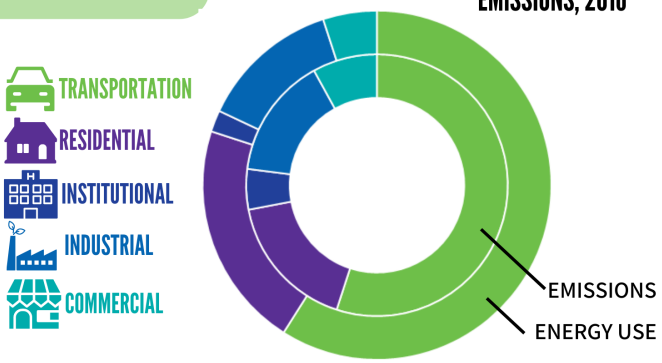
HOW DOES ALL OF THIS EFFECT BRAMPTON'S GREENHOUSE GAS EMISSIONS AND ENERGY USE?

OUR COMMUNITY SPENDS
$1.8 BILLION
ON ENERGY EACH YEAR

$1.4 BILLION
OF THOSE ENERGY DOLLARS LEAVE THE COMMUNITY

27% OF THE ENERGY WE BUY DOES NOT REACH US DUE TO SYSTEM LOSSES

BRAMPTON'S ENERGY USE AND EMISSIONS, 2016

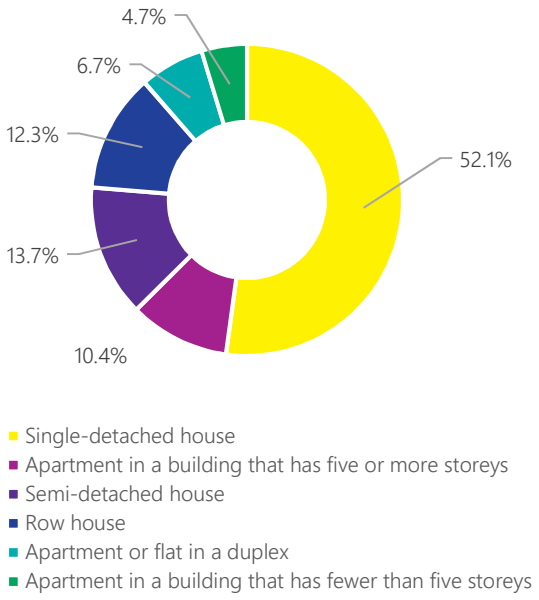


registered prior to 1989. Older homes use more energy and produce more emissions than newer homes, as older Ontario Building Codes did not consider energy efficiency. At the most basic level, these homes are likely lacking proper insulation and/or experiencing air leakage around windows and doors.

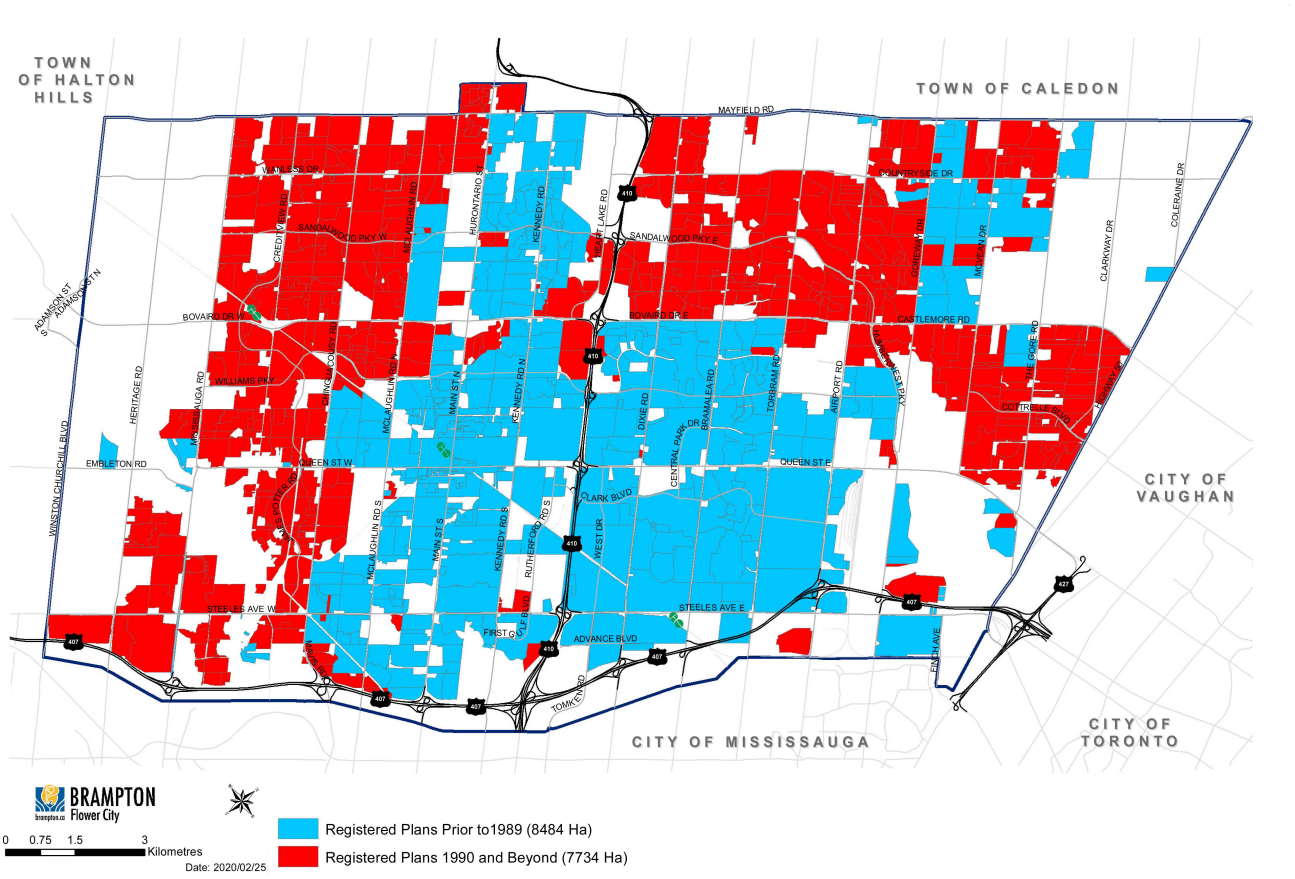
4.0.2 Transportation

Brampton is largely car-dependent and transportation accounts for almost 60% of community-wide GHG emissions and 50% of the total dollars spent on energy. For the most part, Brampton's growth has occurred as a typical automobile-oriented suburban form, characterized by separated land uses, low-density residential communities, large format retail, abundant parking, and a transportation network made up of wide arterial roads. This urban form that separates land uses does not encourage walking and cycling, making access to employment and commercial areas by active modes challenging.

Dwelling Types in Brampton, 2016



Registered Plans of Subdivision in Brampton



This urban form is, in part, a result of Brampton's main employment types. Approximately one in every four jobs in Brampton is in either part of the goods movement, warehousing, or the manufacturing sectors. These industries require large plots of land across vast spaces and a road network that can accommodate trucking.

In addition to these challenges, Brampton has other physical features, including two 400-series highways, two rail corridors, and a number of watercourses and utility corridors. These features can act as major barriers for active transportation users unless specific connectivity along and across them can be accommodated.

4.1 Brampton's Energy Use: Baseline and Base Case

In order to understand where we can be more energy efficient and cut emissions, we need to know how much energy we are using and where we are using it. The following section provides the details of Brampton's energy use, including:

- where Brampton was starting from in 2016 (Baseline); and
- where Brampton would be in 2041[1] without any coordinated climate change mitigation or energy efficiency actions (i.e. business as usual, Base Case).

The following is a summary of the main findings for Brampton's:

1. energy use,
2. water use,
3. energy-related emissions, and
4. energy and water costs.

4.1.1 Energy Use

In 2016, Brampton's total source and site energy use were 92 million gigajoules and 67 million gigajoules, respectively. Site energy use in Brampton was 109 gigajoules per capita. The transportation sector represented 35% of source energy use, the residential sector represented 26%, and the industrial, commercial, and institutional sectors combined represented 39%.

System losses accounted for approximately 30% of source energy use. System losses occur when one form of energy is converted to another (e.g. natural gas used to generate electricity) or when energy is moved from one location to another (transmission). This highlights the importance of considering efficiency solutions that will also address system losses.

By 2041, Brampton's population and workforce are expected to increase by 51% and 73%, respectively, which is estimated to increase source energy use by 28% and site energy use by 26%, during this time.

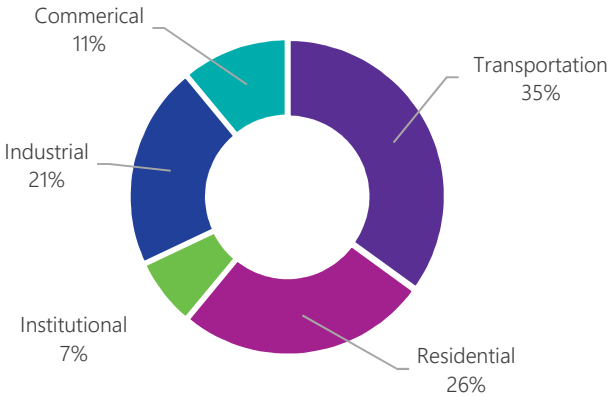
How Much is a Gigajoule?

1 Gigajoule (GJ) = 1,000,000,000 Joules (J)
That's enough energy to....

Make 1000 pots of coffee (that's 4286 medium cups of coffee)

Keep a 60-watt light bulb running continuously for six months

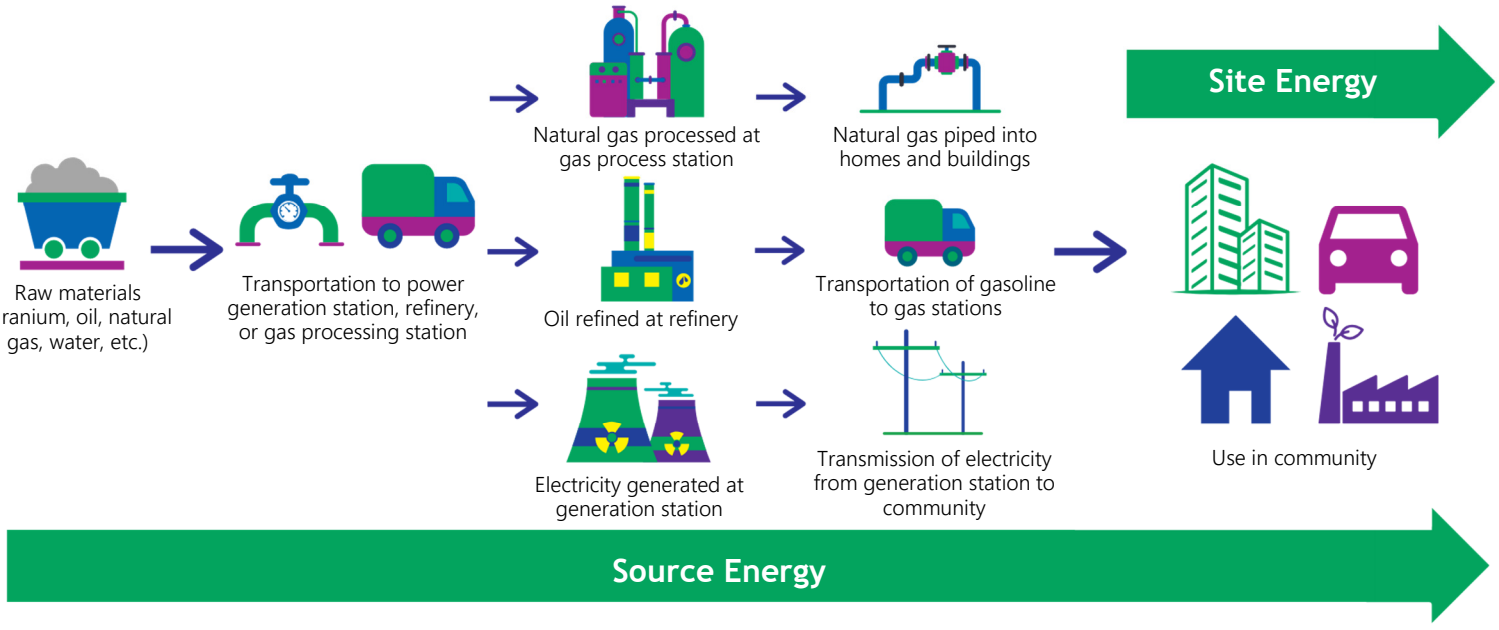
Brampton Source Energy Use by Sector, 2016



What is the Difference between Source and Site Energy and Why Does it Matter?

Site energy refers to the energy purchased by consumers at the utility meter or gas pump. Source energy not only considers the energy purchased at the utility meter or gas pump but all the energy required in production and distribution to consumers.

As consumers, we tend to think that the emissions and costs associated with the energy we consume is limited to what we purchase at the utility meter or gas pump. However, there are considerable upstream emissions and costs associated with our sources of energy, and community energy planning can identify local opportunities to reduce them. Therefore, it is important to consider source energy demand when making energy planning decisions that focus on reducing GHG emissions.

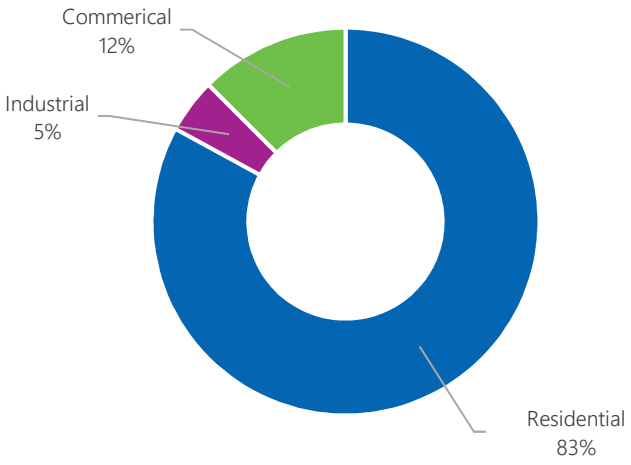


4.1.3. Brampton's Water Use

The residential sector accounts for almost three quarters (73%) of the water consumption in Brampton. The industrial sector represents 4%, and the commercial sector 23% of water use in the community. In 2041, water consumption will increase based on anticipated population and employment growth. The Base Case assumes water use in existing homes and buildings is constant, while new homes and buildings are projected to be 20% more efficient with current and future enhancements to the Ontario Building Code.

The relationship between water and energy production is extremely close and co-dependent. It takes a massive amount of water to generate energy, and it takes a huge quantity of energy to process water so that it can be utilized by humans for drinking and other purposes.[2] Therefore, it is important that water and energy policies are not developed in isolation from each other.

Water Use in Brampton by Sector, 2016



"Without enough water, you can't have power; without enough power, you can't have water."

- Sunpower (solar energy company and innovator)

4.2 Brampton's Energy-Related Emissions

4.2.1 Brampton Emissions by Sector

In 2016, Brampton's GHG emissions were 3.5 million tonnes, or 5.6 tonnes for every Brampton resident. Transportation accounted for almost 60% of emissions, while the residential sector accounted for 21%. The industrial, commercial, and institutional sectors accounted for the remaining 19% of the emissions.

4.2.2 Brampton Emissions by Utility Type

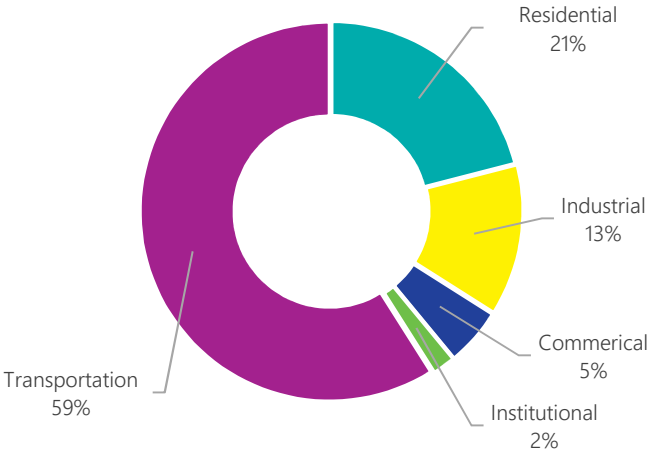
In 2016, the use of natural gas contributed 38% of Brampton's GHG emissions, while the use of gasoline and diesel contributed 59%. Only 3% of emissions arise from the community's use of electricity.

This data underscores the need to build compact communities that will support transit and active transportation, as well as the need to address heating, which is the primary use of natural gas in buildings.

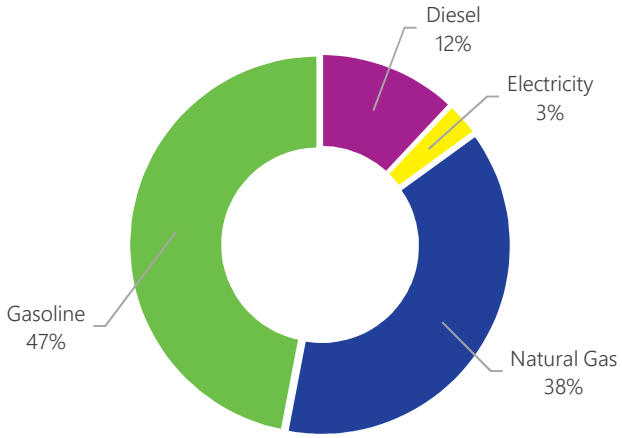
Despite population and employment growth, increases in GHG emissions are expected to be relatively moderate, at approximately a 13% increase by 2041. This is reflected in the Brampton Base Case scenario that projects improvements in average vehicle efficiency, more efficient new construction, and reduction in the carbon intensity of the natural gas grid.[3] However, Brampton's Base Case emissions remain approximately twice the global best practice and ten times the Government of Canada's target for 2050 based on the Paris Climate Agreement.

The effects of a warming climate will also impact the energy use and energy reliability profile of the community. Obvious examples include increased demand for air conditioning and less demand for space heating, with collateral impacts on energy supply and distribution demands. These are not factored into the Base Case outlook.

Brampton Emissions by Sector, 2016



Brampton Emissions by Utility, 2016



4.3 Brampton's Energy and Water Costs

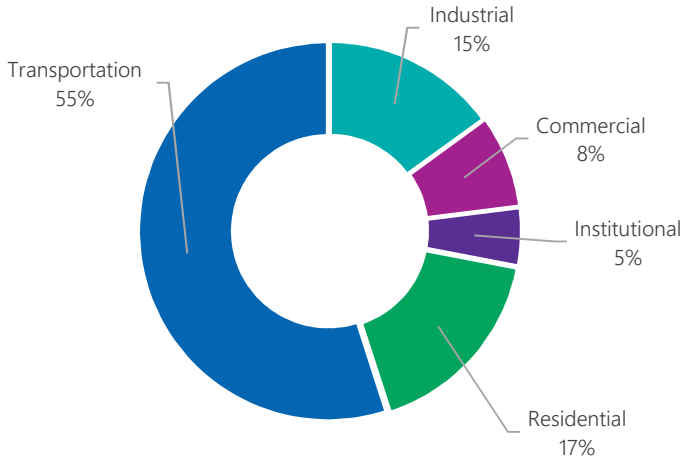
The community of Brampton spent $1.8 billion on energy and water in 2016. At least $1.4 billion of those energy dollars left the community in payment for energy services located in other jurisdictions.

4.3.1 Brampton Energy and Water Costs by Sector

In 2016, gasoline and diesel (transportation fuel) accounted for 55% of energy costs, while electricity accounted for 31%. Natural gas use only represented 13% of total energy costs, which presents a key obstacle to meaningful action on reducing GHG emissions associated with residential heating.

Approximately 30% of the energy that the community of Brampton pays for does not reach the end-user. This energy is primarily lost as heat when one form of energy is converted to another and through transmission and distribution. Electricity accounts for most of this loss.

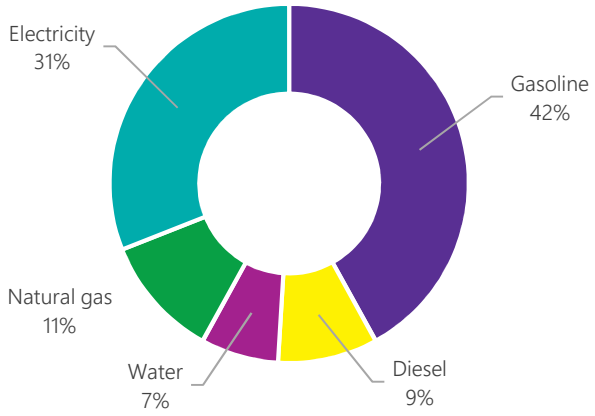
Brampton Energy and Water Costs by Sector, 2016



4.3.2 Brampton Energy Costs by Utility Type

Energy costs are projected to increase by a range of 200% to 410% by 2041 (see the CEERP Analytical Report[4] for more details). These increases reflect both higher prices, as well as population and employment growth. If energy prices are held at 2016 levels, the overall increase would be 68%.

Brampton Energy Costs by Utility, 2016



4.4 Benchmarking: How Do We Compare Globally and Locally?

One of the principles approved by the Community Task Force for developing the CEERP is to work toward global best practices.

On average, buildings in Brampton are approximately half as efficient as global benchmarks - a likely outcome of cheap oil and gas and less action on climate change.

Energy use per Brampton home is 2% less than the provincial average, but 40% higher than the Danish average.[5] Denmark is widely recognized as having one of the most efficient housing stocks due to the early adoption of efficient new construction and retrofit standards with regular updates.

Energy use in Brampton's residential sector per square metre is 37% lower than the Canadian average, due to Brampton having a higher percentage of smaller, newer homes relative to Ontario and the rest of Canada.[6] However, Brampton's residential sector per square metre is more than twice that of a German A-rated home. German A-rated homes are above local code and represent a significant portion of the new construction market in Germany.[7]

Local, Provincial, National, and Global Comparison of Energy Use and GHG Emissions[8]

Indicator	Brampton Baseline	Canada Average	Ontario Average	Comparable Best Practice
Energy use/household (Gigajoule - GJ)	99	106	107	68
Residential sector energy use per metre^2 (GJ)	0.6	0.79	N/A	0.29
Non-residential sector energy use per meter^2 (GJ)	1.4	1.65	N/A	0.72
Emission per capita (tonnes carbon dioxide equivalent - CO_2e)	5.6	9.7	6.2	3.5

Energy use in Brampton's commercial and institutional buildings per square metre is 37% higher than the Canadian average.[9] They are also more than twice the German average.[10] However, generalized comparisons in this sector are always challenging due to the mix of uses, property type, data quality, and climate.

GHG emissions per capita in Brampton is 40% less than the national average and 25% less than the provincial average.[11] However, this is approximately twice that of the City of Copenhagen, widely recognized as a global benchmark.[12] Brampton's current level is about ten times the Government of Canada's target for 2050 based on the Paris Climate Agreement. Water use per home is about 5% above the Ontario average and 7% above the national average when adjusted for household size.[13]

Comparing Apple to Oranges: Benchmarking to Neighbouring Cities

Benchmarking GHG emissions and energy use to other local cities, towns, or regions can be a challenge due to the wide variety of calculation methods used and the diversity in built form and land uses seen between cities. Total GHG emissions and energy use or per capita outputs do not reflect the differences between cities, and as such may not be ideal for comparisons. For example, the presence of heavy manufacturing, cement plants, airports, or other high emitters in a city that also services multiple surrounding cities, may heavily skew the host municipality's GHG emissions, while unduly, reflect positively on the surrounding cities that rely on it.

4.5 Summary of Findings

The following is a summary of the main Base Case findings for source energy, site energy, emissions, and energy costs for Brampton in 2041.[14] The table that follows provides a summary of modelled changes between 2016 and 2041. These findings demonstrate the opportunity for the CEERP to have positive economic, social, and environmental impacts in Brampton.

Energy Consumption

By 2041, population and employment growth are estimated to increase site energy use by 26% and source energy use by 28%. Both the population and the workforce are expected to increase by 51% and 73%, respectively, during this time.

GHG Emissions

Despite high population and employment growth, increases in GHG emissions are expected to be relatively moderate (approximately a 13% increase) by 2041. This is due to a projected increase in vehicle efficiency and reduction in the carbon intensity of the natural gas grid (note: this does not include pipeline leaks). However, emissions in Brampton, remain approximately twice the global best practice and ten times the Government of Canada target for 2050 based on the Paris Climate Agreement.

Energy Costs

Energy costs are estimated to increase by a range of 200% to 410% by 2041. These increases reflect both higher prices as well as population and employment growth. If energy prices are held at 2016 levels, the overall increase would be 68%.

Summary of Projected Changes in Brampton Energy Use, Energy Costs, and GHG Emissions

2016 Baseline	2041 Base Case
Brampton used 92 million gigajoules of energy.	Growth in population and employment increase energy use by about 30%.
The transportation sector represented 35% of source energy use. The residential sector represented 26% of source energy use, and the industrial, commercial, and institutional sectors represented 39% of source energy use.	No material change.
On average, homes and buildings in Brampton are approximately half as efficient as global benchmarks.	Gap widens against global best practice.
Systemic and end-user inefficiencies represent approximately half of the total energy use in Brampton.	No material change.
The City of Brampton's corporate source energy use for facilities, transit, and municipal fleet represents 1.88% of the community's source energy use.	No material change.
On average, Brampton residents release 5.6 tonnes of GHG emissions per capita each year.	Reduces to 4.4 tonnes per capita due to a projected increase in vehicle efficiency, a reduction of carbon intensity of the natural gas grid, and higher efficiency of new homes and buildings.
Emissions are twice global best practice and 10 times what is needed to meet the Paris Climate Agreement's goals.	No material change.
$1.8 billion spent on electricity, natural gas, gasoline, and diesel within the community.	Spending is estimated to increase to $5.4 billion (low risk) to $9.4 billion (high risk).
Less than 22% of the money spent on energy remained in the Brampton economy.	No material change.

Notes

[1] While much of the literature around energy and emissions planning uses a time horizon of 2050, the City's Official Plan and other master plans are aligned with the Provincial Growth Plan for the Greater Golden Horseshoe Area, which assigns regional population growth targets to 2041.

[2] Sunpower. (February 17, 2017). "Understanding the essential relationship between water and energy production". https://businessfeed.sunpower.com/articles/understanding-the-essential-relationship-between-water-and-energy-production

[3] Exclusive of pipeline leaks.

[4] Community Energy and Emissions Plan Analytical Report. (2020). City of Brampton

[5] Determined from data retrieved from the Danish Energy Agency and Statistics Canada.

[6] Determined from data retrieved from Statistics Canada plus the average home estimates.

[7] KfW Effienzhaus 70 ("Efficiency House") using typical average of 75kW.

[8] Benchmarks attributed to Brampton in this table are sourced from Canada and Ontario inventories made available through the United Nations Framework Convention on Climate Change (UNFCCC). Factors included in the Canadian/Ontario UNFCC inventories that are NOT included in the community inventory are: Petroleum Refining Industries, Mining and Upstream Oil and Gas Production, Agriculture and Forestry, Domestic Aviation, Off-Road Agriculture and Forestry Transportation, Off-Road Mining and Construction Transportation and Pipeline Transportation. Factors included in the Canadian/Ontario UNFCC inventories that are PARTIALLY included in the community inventory are: Manufacturing Industries, HDV Gasoline Trucks, HDV Diesel Trucks and Railways. In order to allow for comparison, all benchmarks provided (national, provincial, municipal) reflect these adjusted criteria; therefore, the resulting benchmarks provided in the table will, by definition, be less than those provided by the UN.

[9] Determined from data retrieved from Natural Resource Canada 2014 Building Surveys, https://www.nrcan.gc.ca/energy-efficiency/energy-star-benchmarking-commercial-and-institutional-buildings/energy-benchmarking-technical-information/building-energy-use-surveys/19454

[10] Determined from data retrieved from the Federal Statistical Office of Germany (Destasis) and the Working Group Energy Balances (AGEB) an energy market research group set up by several major German energy industry associations and economic research institutes.

[11] Determined from data retrieved from Canada's UNFCCC national and provincial inventories adjusted for municipal equivalent.

[12] City of Copenhagen. (2016). Copenhagen Climate Projects - 2016 Annual Report. https://international.kk.dk/artikel/carbon-neutral-capital

[13] Determined from data retrieved from the Environment Canada and Statistics Canada.