2018

Community Energy Use & Greenhouse Gas Emissions Inventory

EXECUTIVE SUMMARY

The purpose of this document is to provide an overview on energy consumption in London and associated greenhouse gas emissions during the period from 1990 to 2018. The details in the document provide a useful source of information to strengthen existing projects/programs, or to help identify new business and academic opportunities for energy efficient products and technologies, energy conservation and demand management products and services, biofuels, and renewable energy generation.

There are many factors that influence how much energy a modern city uses to function and thrive:

- Land use and development
- Urban design
- Transportation
- Buildings
- Personal choices and actions
- Local climate & economy

Community Energy Use Inventory

The three most common benchmark dates being used for reporting on overall progress are:

Burning fuels, like gasoline and natural gas, are our largest local contribution to climate change.

1990 the baseline year used for London's greenhouse gas (GHG) reduction targets

2007 the year energy use and greenhouse gas emissions reached their peak in London

2010 the first year for which total energy cost data has been determined in London

2018 – "A Spike Year" Colder Winter and Hotter Summer Increased Energy Use

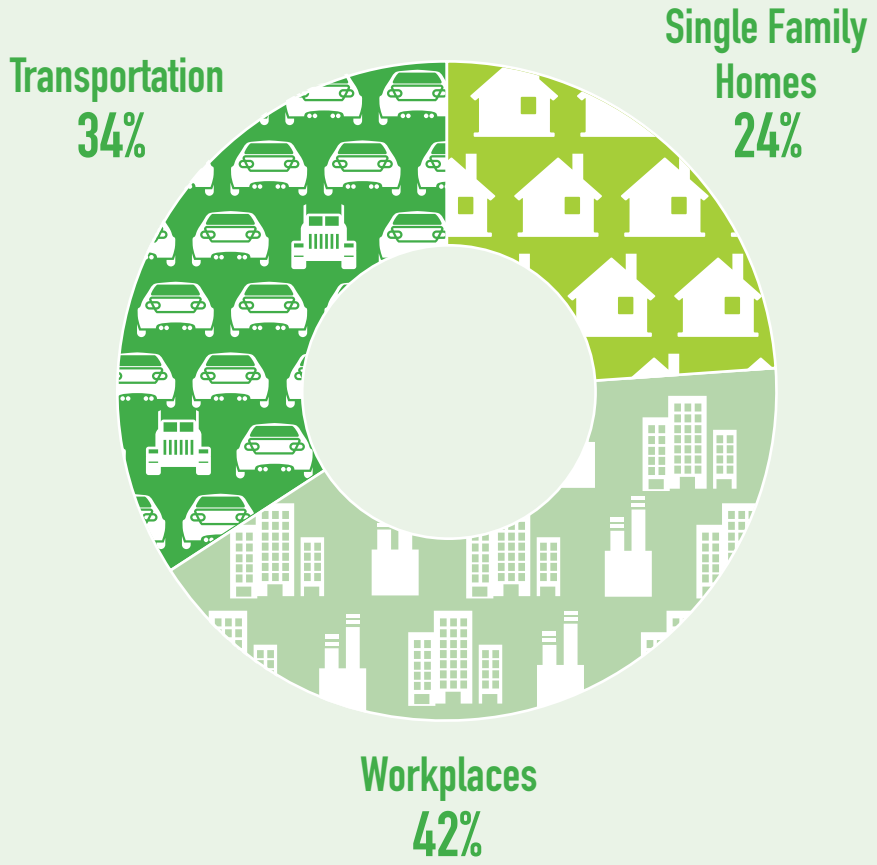
Weather has a big impact on energy use, especially in Southwestern Ontario where we need energy to heat our buildings in winter and to cool our buildings in summer. When we have colder winters or hotter summers, our building energy use goes up. In 2018, we had both, which led to a "spike year" for energy use. We have had spike years in the past, most recently in 2014.

Total community energy use in London in 2018 was 61,800 terajoules, 20 percent above 1990 levels, and four percent above 2007 levels.

Colder weather in the winter and spring seasons of 2018, compared to 2017, resulted in an increased demand for natural gas for space heating, with natural gas use in residential, commercial, and institutional buildings increasing by 15 percent in 2018 compared to 2017. The use of natural gas for local industrial customers increased by 25 percent.

The colder weather noted above, combined with hotter summer temperatures in 2018 compared to 2017, also resulted in increased demand for electricity for heating, ventilation, and air conditioning. Residential electricity use increased by nine percent. Electricity use for local industrial, commercial, and institutional customers only increased by two percent.

Energy Use by Sector in 2018



Reduction In Energy Use Per Person Since 1990

Homes

13%↓

Workplaces

3%↓

Transportation

10%↓

Energy Efficiency Trends

In 2018, energy use per person in London was eight percent below 1990 levels even with the impacts of the colder winter and hotter summer temperatures seen in 2018.

The biggest improvements seen since 1990 have been in residential energy use per person, which was 13 percent lower than 1990. This may be attributed to improvements in the energy efficiency of consumer appliances, space heating and cooling systems, home retrofits, and new home construction.

Energy use per person related to the local economy in 2018 was three percent lower than 1990. However, London's energy productivity – dollars of real gross domestic product generated per unit energy used by London's employment sector – improved by 35 percent between 1990 and 2018.

The latter value is very important because this means we are making more money for every unit of energy we use.

Energy productivity, measured in terms of dollars of local Gross Domestic Product (GDP – adjusted for inflation)

1990
$470

of value /gigajoule of energy used

2018
$640

of value /gigajoule of energy used

= 35%

More value for every gigajoule used!

Transportation Fuel Use Is Decreasing Even As Vehicle Ownership Increases

The one sector that had been lagging behind a couple of years ago was transportation. The volume of fuel sold in London had been increasing year-over-year between 2011 and 2016, but this trend stopped in 2017 and continued on in to 2018. Transportation fuel use per person decreased by four percent between 2017 and 2018, with transportation energy use per person in 2018 now 10 percent lower than 1990.

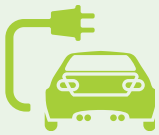
Vehicle ownership in London has grown by 36 percent since 2011, or almost five percent per year on average. As of December 2018, there were over 286,000 light-duty vehicles registered in London – an increase of about 75,000 since 2011. When compared to Census data on Londoners between the age of 20 and 84, vehicle registration increased from 0.77 per person in 2011 to 0.94 per person in 2018.

However, on a positive note, the average annual fuel use per registered vehicle in London was 19 percent lower in 2018 compared to 2011.

75,000 vehicles added since 2011

2,600 hybrids

▲250% since 2011



700 electric vehicles

0.94 vehicles per adult Londoner

fuel use per vehicle from 2011

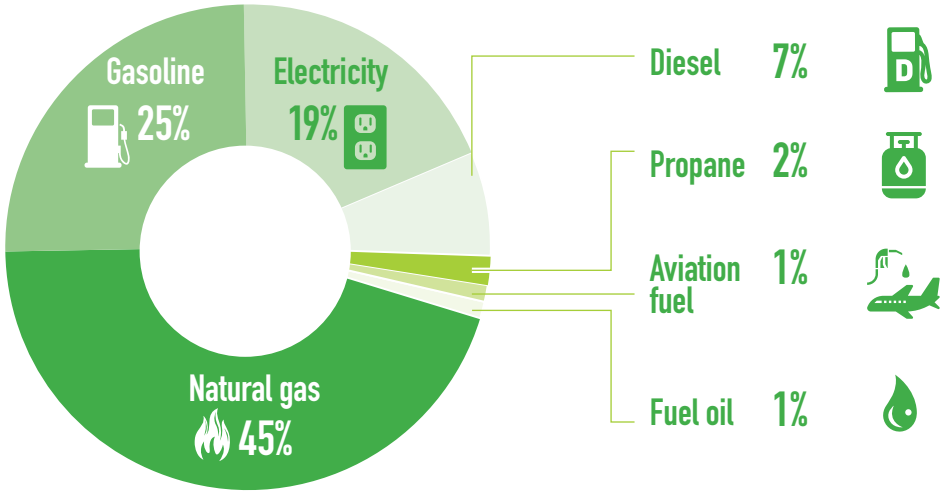
▼19% since 2011

Sources Of Energy Used In London

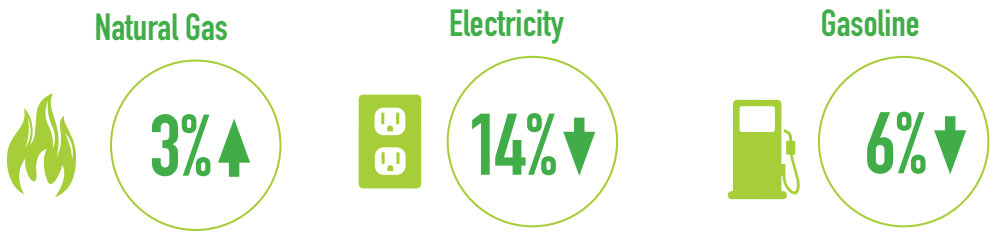
In terms of sources of energy, natural gas is the largest source of energy used in London, accounting for 45 percent of all energy used in London in 2018. Natural gas is used primarily for heating buildings, heating water, and providing heat for industrial processes.

Gasoline was the second largest source of energy, accounting for 25 percent of London's energy use.

Electricity accounted for 19 percent of all of the energy used in London.



Change in commodity use per person since 1990



Electricity Generation In London

London has almost 68 megawatts (MW) of local electricity generation capacity installed to date, an increase of 4.0 megawatts (MW) from 2017. Most of this local capacity is associated with combined heat and power cogeneration plants at London District Energy, Ingredion, London Health Sciences Centre, and Labatt Brewery. An additional 1.66 megawatts of combined heat and power was added in 2018.

By the end of 2018, there was 16.1 megawatts of solar photovoltaic (PV), 2.85 megawatts of biogas, and 0.675 megawatts of hydro-electric power generation in operation in London.

Some of this electricity generated is used "behind the meter", but between 2008 and 2018, embedded electricity generation purchases (i.e., locally produced electricity sold to the grid) have increased from 0.2 percent to 1.3 percent of London's electricity needs. This is below the 2.0 percent level reached in 2015. For London District Energy, generating power for the grid is dependent upon the Hourly Ontario Energy Price, which itself is driven by province-wide electricity demand.

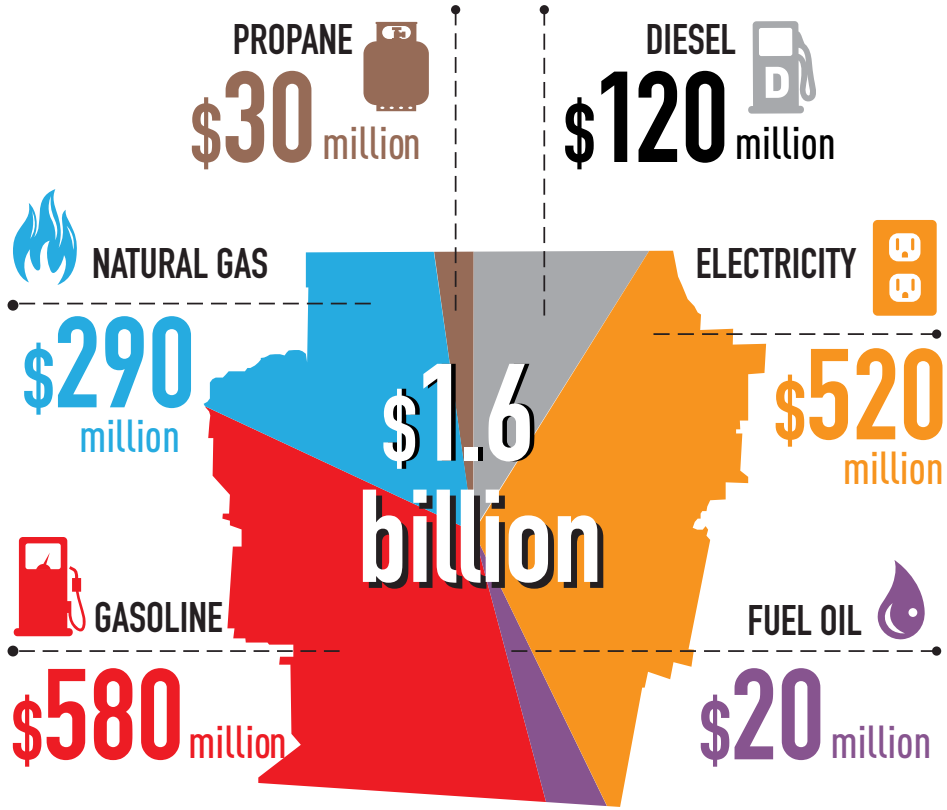
Translating Energy Use Into Economic And Business Development Opportunities

Gasoline is now the largest energy expenditure in London, accounting for **37 percent** of city-wide energy costs. Gasoline costs increased by nine percent, due primarily to crude oil price increases.

Electricity accounts for 33 percent of energy costs. Electricity costs increased by two percent, due to higher electricity consumption.

Natural gas use accounts for only 18 percent of energy costs, even though it is the largest source of energy we use. Natural gas costs increased by seven percent overall, where decreases in natural gas prices were offset by increases in natural gas consumption.

Every percentage that Londoners reduce their energy use results in around $13 million staying in London.



In 2018, the improvements in energy efficiency are estimated to have saved London $160 million in avoided energy costs. Added up year-over-year, London has avoided over $730 million in energy costs due to improved efficiency since 2010.

Translating Energy Use To Greenhouse Gas Impact

The total energy-based greenhouse gas (GHG) emissions in London for 2018 were almost 3.0 million tonnes, expressed in terms of equivalent carbon dioxide (CO_2e). This represents 94 percent of the total human activity based GHG emissions from London (over 3.1 million tonnes) in 2018.

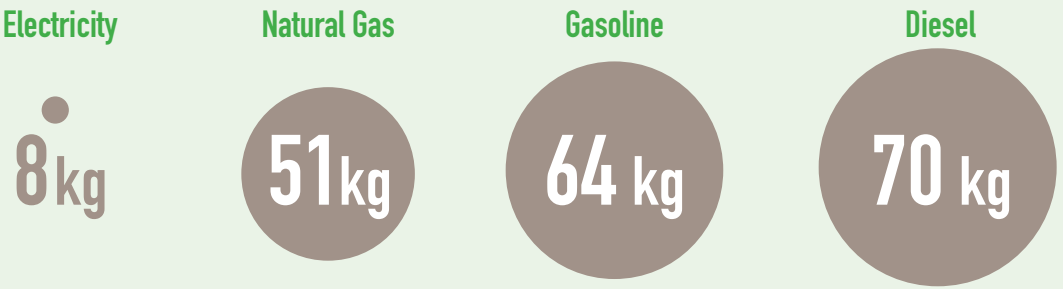
Greenhouse gases, primarily carbon dioxide, are created by burning fossil fuels such as natural gas, gasoline, and diesel. Although GHG emissions associated with electricity were significantly lower in 2018 (about 90 percent lower) than in 2003, its use still contributes to GHG emissions when natural gas power plants are in operation. In summary, energy-related GHG emissions are:

- 48 percent from natural gas
- 33 percent from gasoline
- 10 percent from diesel
- 3 percent from electricity
- 6 percent from other fuels

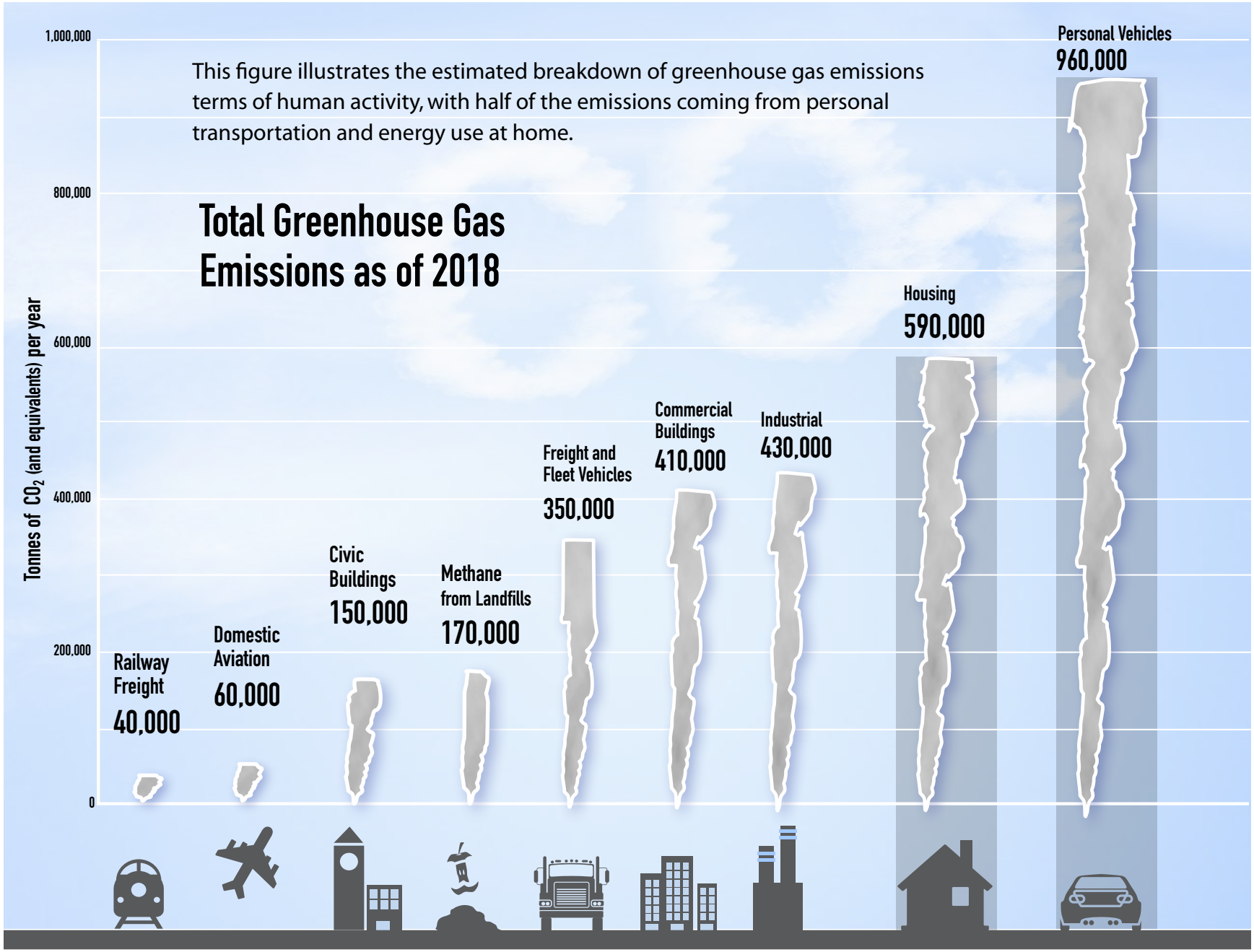
The remaining six percent of GHG emissions are methane emissions from the anaerobic decomposition of organic materials in the active and closed landfills located in London as well as commercial sector waste disposed in landfills outside London, and nitrous oxide emissions from sewage sludge incineration.

As a result of the Province of Ontario replacing coal-fired power plants with clean and green power generation, electricity is now 10 times cleaner than it was 10 year ago!

GHG emissions from fossil fuel energy sources

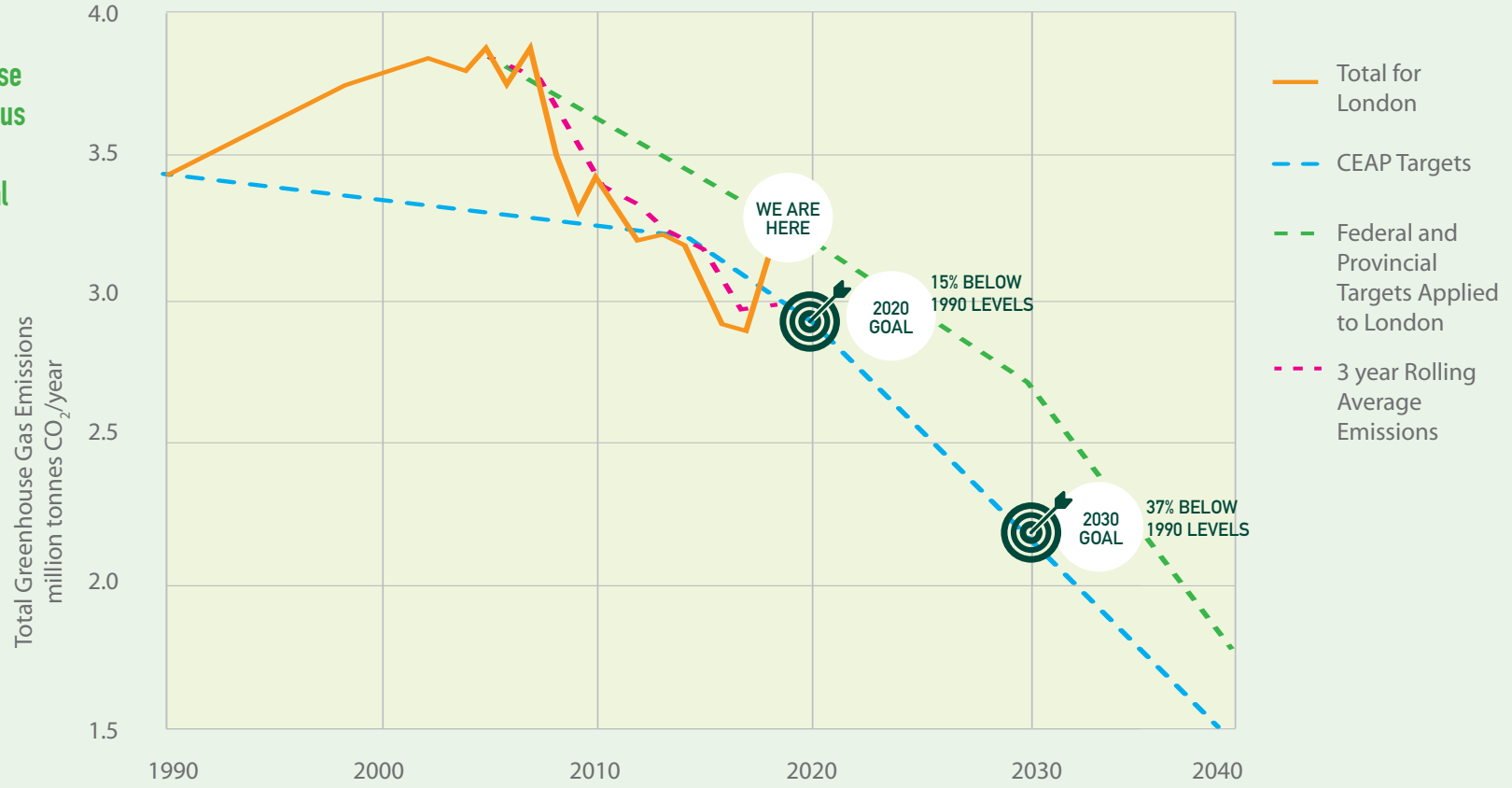


Measured in kilograms (kg) of equivalent carbon dioxide CO_2e per unit of energy gigajoule



These emission estimates do not include the lifecycle emissions from consumed products and services, such as the upstream impact of food production, which is particularly important for issues such as food waste.

London's Greenhouse Gas Emissions versus CEAP Targets and Federal & Provincial Reduction Targets



London's Community Energy Action Plan (CEAP) has the following GHG emission reduction goals:

- 15 percent reduction from 1990 levels by 2020
- 37 percent reduction by 2030, and
- 80 percent reduction by 2050.

Total GHG emissions in 2018 were nine percent lower than the 1990 level, which is above the trend line for meeting the 2020 goal. As noted earlier, colder weather in 2018 resulted in higher natural gas use.

Using a three-year rolling average smooths out the impact of annual variations in weather in order to determine trend directions. One year spikes in GHG emissions have occurred in previous years in London. Although total GHG emissions for 2018 were above the trend line for meeting the 2020 target, the three-year rolling average total GHG emissions for the 2016-2018 period (13 percent below 1990 levels) was still below the trend line for meeting the 2020 target.

Considering that London has grown a lot since 1990, looking at GHG emissions on a per-person level gives a better representation of the improvements made since then.

Greenhouse gas emissons per person in London are significantly lower than they were back in 1990.

Reduction in GHG Emissions per person since 1990

Whether emissions continue to decrease depends upon the impact of energy and fuel conservation efforts locally, provincial and federal climate change policies, climate trends, economic growth, and consumer choices.

Household Energy Use And Greenhouse Gas Emissions

It is estimated that the average household in London, living in a single-family home, spent over $450 every month on energy in 2018. Over half of this, about $260, was spent on gasoline. Electricity accounted for about $100 per month, while natural gas was under $80 per month.

In terms of household GHG emissions, the average household emitted almost 11 tonnes per year. As with cost, almost half (49%) of this comes from burning gasoline. Natural gas used for space heating and water heating accounts for 40 percent of emissions. Organic waste in the landfill accounts for about eight percent. Given Ontario's clean electricity grid, electricity use in the home only accounts for under two percent of household GHG emissions.

Where do your greenhouse gas emissions come from?

The average home in London emits

10.8 tonnes
PER YEAR

Vehicle
GASOLINE
51%

Methane
FROM FOOD & ORGANIC WASTE IN GARBAGE
8%

Propane
BBQs etc.
1%

Electricity
LIGHTING
<1%

Electricity
FURNACE & AIR CONDITIONER
1%

Natural gas
HOME HEATING
32%

Natural gas
WATER HEATING
9%

Electricity
APPLIANCES & ELECTRONICS
1%

* Based on 2018's average energy use for residential customers of London Hydro and Enbridge (formerly Union Gas), combined with retail sales of gasoline data.

Glossary – What Do These Mean?

Gigajoule – (or, one billion joules) is a metric unit for measuring energy, and is approximately equivalent to energy provided by burning 26 litres of gasoline (roughly half a tank of gas in a car)

Terajoule – (or, one trillion joules) is equal to 1,000 gigjoules, or approximately 26,000 litres of gasoline (roughly the amount of gasoline in 500 cars)

Megawatt – (or, one million watts) is a metric unit for measuring power output, usually for electricity, and is approximately the amount of power needed to light 200,000 LED light bulbs (at 5 watts each)

Greenhouse gas - a gas that contributes to the greenhouse effect in our atmosphere by absorbing infrared radiation, similar to the glass in a greenhouse that traps heat. Carbon dioxide is the most common greenhouse gas produced by human activity, but methane from decomposing garbage and nitrous oxides from incinerating sewage sludge are also potent greenhouse gases. Emissions of greenhouse gases are reported in terms of "equivalent carbon dioxide"

Tonne – is the metric unit of mass used to represent 1,000 kilograms. Emissions of greenhouse gas emissions are reported in terms of "tonnes of equivalent carbon dioxide". Given that carbon dioxide is an invisible gas, the best way to picture what a tonne of carbon dioxide like is to imagine this as a balloon about ten metres wide.

For more information on London's actions
to reduce energy use and greenhouse gas emissions, please check out
London's Community Energy Action Plan at

london.ca/ceap