Agenda

Environmental and Ecological Planning Advisory Committee

The 6th Meeting of the Environmental and Ecological Planning Advisory Committee
September 23, 2021, 5:00 PM
2021 Meeting - Virtual Meeting during the COVID-19 Emergency
Please check the City website for current details of COVID-19 service impacts.
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Environmental and Ecological Planning Advisory Committee Report

6th Meeting of the Environmental and Ecological Planning Advisory Committee
August 19, 2021
Advisory Committee Virtual Meeting - during the COVID-19 Emergency

Attendance

PRESENT: S. Levin (Chair), L. Banks, A. Bilson Darko, A. Boyer, S. Esan, P. Ferguson, S. Hall, S. Heuchan, B. Krichker, B. Samuels, S. Sivakumar, R. Trudeau and I. Whiteside and H. Lysynski (Committee Clerk)

ABSENT: I. Arturo, L. Grieves, J. Khan, I. Mohamed, K. Moser and M. Wallace

ALSO PRESENT: C. Creighton, J. MacKay, B. Page, M. Pease and M. Schulthess

The meeting was called to order at 5:00 PM

1. Call to Order

1.1 Disclosures of Pecuniary Interest

That it BE NOTED that no pecuniary interests were disclosed.

2. Scheduled Items

2.1 Homeowner Information Brochure

That a Working Group BE ESTABLISHED consisting of S. Hall, S. Heuchan, S. Levin (lead), B. Samuels and R. Trudeau, with respect to the homeowner brochure for property owners living near natural areas; it being noted that the Environmental and Ecological Planning Advisory Committee reviewed and received the attached presentation from B. House and J. Irving, students, with respect to this matter.

3. Consent

3.1 5th Report of the Environmental and Ecological Planning Advisory Committee

That it BE NOTED that the 5th Report of the Environmental and Ecological Planning Advisory Committee, from its meeting held on June 17, 2021, was received.

4. Sub-Committees and Working Groups

4.1 Climate Emergency Action Plan

That the following Climate Emergency Action Plan Working Group recommendations BE FORWARDED to the Civic Administration for consideration:

a) a special advisory committee should be created to actively participate in the Climate Emergency Action Plan development and implementation. The committee should consist of representation from the City's Climate Emergency Action Plan team, representatives from advisory committees including EEPAC, First Nations and politicians. The committee structure will facilitate continuous, long-term consultation with key stakeholders and involvement of expertise available to the City through its advisory committees;

b) the impacts of climate change to the Natural Heritage System should be prioritized and considered holistically, not as an add-on to anthropocentric objectives; plans to protect and enhance the Natural Heritage System under climate change conditions should be explicitly included in the Climate Emergency Action Plan;

c) the Natural Heritage System should be fully harnessed as part of the City's approach to climate change mitigation, such as the sequestration of carbon by existing green spaces including wetlands, prairies, meadows, forests and mature woodlots, etc. (not only via tree plantings), management of stormwater under extreme weather events and vegetative cover to provide evapotranspiration, reduced temperatures and reductions in runoff and flooding;

d) to recognize the potential utility of the Natural Heritage System for climate change mitigation, we must better understand current baseline conditions. To begin, EEPAC recommends that the City assemble and present existing baseline data to EEPAC to support the quantification of carbon sequestration by the Natural Heritage System, as well as inventory of the amounts and quality of wetlands, woodlots and other natural lands currently remaining within the City of London. Only with baseline data can an effective and successful Climate Emergency Action Plan with specific targets and accountability be achieved. Using this baseline data, the impacts of climate change on the Natural Heritage System should be modeled under various warming scenarios (e.g., using Global Circulation Models). Further, models could be used to predict the extent to which local climate change effects can be mitigated by Natural Heritage features (e.g., quantifying carbon sequestration and stormwater absorption by green spaces);

e) a framework should be developed to systematically monitor the impacts of climate change on the Natural Heritage System over time, with checkpoints to assess whether the City is on track to meet its climate targets and determine if further measures are warranted; and

f) the role of EEPAC in the further development and implementation of the Climate Emergency Action Plan should be clarified. EEPAC wishes to remain involved in consulting with and supporting the City on the implications of the Climate Emergency.

5. Items for Discussion

5.1 Light Pollution Relating to Bird Friendly Skies

That a Working Group consisting of P. Ferguson, L. Grieves and B. Samuels BE ESTABLISHED to light pollution as it relates to London's Bird Friendly Skies program; it being noted that the Environmental and Ecological Planning Advisory Committee reviewed and received a communication dated August 13, 2021, from B. Samuels, with respect to this matter.

5.2 2331 Kilally Road and 1588 Clarke Road

That it BE NOTED that the Notice of Planning Application to revise the application for Draft Plan of Subdivision, Official Plan and Zoning By-law Amendments relating to the properties located at 2331 Kilally Road and 1588 Clarke Road, dated July 6, 2021, from L. Mottram, Senior Planner, was received.

5.3 (ADDED) Western Road and Sarnia Road / Philip Aziz Improvements MCEA - Project Restart

That it BE NOTED that the Notice of Study Restart dated August 16, 2021, relating to the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class Environmental Assessment, was received.

6. Adjournment

The meeting adjourned at 6:30 PM.

The next meeting of the Environmental and Ecological Planning Advisory Committee will be held on September 23, 2021

LIVING ADJACENT TO NATURAL FEATURES

EEPAC Presentation

August 19th, 2021

OUR CHALLENGE

Reach out to Conservation Authorities, Municipalities, and Developers to understand what is provided to Homeowners Living Adjacent to Natural Heritage Features

WHAT OTHERS ARE DOING

Different priorities for different areas

- Southern Ontario: more emphasis on wetland protection, rarity because of development
- Northern Ontario: still need for protection but more common

Toronto

- concerns with bird collision deterrence
- *An Enduring Wilderness: Toronto's Natural Parklands* coffee table book
    - Neighbourhood association presentations of book and city Natural Heritage regulations
- Ravine and Natural Heritage Regulations

Guelph

- General Environmental policies

Ottawa

- Focus on species at risk native to the area

WHERE LONDON STANDS

Good protection policies, adaptable

New environmental management policies for developers based on new standards: calling for greater buffering/setbacks

Unique priority of targeting homeowners living near Natural Heritage Features

AREAS FOR IMPROVEMENT

When protecting Natural Heritage Areas, often encroachment has already occurred following development, policies are acquired too late

Although homeowners are given brochures with information, research has not been done to measure their effectiveness

No guarantee that original homeowners will pass on information received to next owner

With COVID-19, it is no longer just those living nearby encroaching Natural Heritage Areas

Maintaining the "City's side of the fence", homeowners only able to maintain their side of the fence

SUGGESTIONS FOR THE PUBLIC

Recognizing and targeting groups of concern

- Ex. Teens, best channels to provide information (ex. School, extracurricular organizations, Youth programs)
- Dog and Cat Owners
- Cyclists

Enforcement

- Auditing those who live nearby and abuse ESA

Guided Walks: "you can't appreciate natural areas if you can't go in"

- In-person with guide
- Social media through video
- QR Codes?

Pop-up Events and Booths at Local Events

Interpretive Signage, showing features of ESA rather than simple 'Don't do this' signs

SUGGESTIONS FOR DEVELOPERS

Reinforcement of Guidelines and Monitoring

- Are recommendations made through EISs being followed through?

Restrictions for adjacent properties should be outlined in a purchase agreement and buyers should be informed before purchase

Educating building and real estate community

P.O. Box 5035
300 Dufferin Avenue
London, ON
N6A 4L9

July 7, 2021

Chair and Members, Governance Working Group

I hereby certify that the Municipal Council, at its meeting held on July 6, 2021 resolved:

That, the following actions be taken with respect to the 5th Report of the Environmental and Ecological Planning Advisory Committee, from its meeting held on June 17, 2021:

a) the following recommendations of the Environmental and Ecological Planning Advisory Committee, with respect to the Advisory Committee Review and draft Terms of Reference Report dated May 17, 2021, BE PROVIDED to the Governance Working Group for consideration:

i) the reduction in membership to 19 is supported;
ii) quorum as a requirement for committee business be maintained;
iii) the existing Terms of Reference be maintained with one alteration highlighted below:

Add to the existing mandate:

"to provide advice on any global (e.g climate change), regional or local issue related to the long-term sustainability of the Natural Heritage System.";

iv) the existing name be maintained;
v) as the technical expertise needed is sometimes hard to obtain, term limits may not be suitable; this could be addressed by one or more of the following:

A) no term limits;
B) three council cycles (12 year limit); and,
C) current limit be continued but extensions be permitted on the advice of the Chair;

vi) given the specialized knowledge required for membership:

A) the City be asked to circulate application information to the relevant Department Chairs at Western University and Course Coordinators at Fanshawe. The Chair and Vice Chair can provide assistance in identifying the appropriate contacts; and,
B) the information circulated include a contact name from EEPAC so that potential applicants can ask questions about membership prior to applying;

vii) in the selection process, consideration be given to asking the current Chair and Vice Chair for assistance;

b) the Arva Pumping Station Working Group comments, appended to the Environmental and Ecological Planning Advisory Committee Agenda, BE FORWARDED to the Civic Administration for consideration; and,

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c) a Working Group BE ESTABLISHED consisting of A. Boyer, S. Hall, B. Krichker, K. Moser, B. Samuels and I. Whiteside, with respect to the Climate Emergency Action Plan; it being noted that the Environmental and Ecological Planning Advisory Committee reviewed and received the Discussion Primer for the Climate Emergency Action Plan - 2020; and,

d) clauses 1.1, 2.1 BE RECEIVED for information. (5.1/10/PEC)

C. Saunders
City Clerk
/pm

cc: S. Romano, Environmental Services Engineer
Chair and Members, Environmental and Ecological Planning Advisory Committee

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London
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September 15, 2021

J. Stanford
Director, Climate Change, Environment, and Waste Management
Environment and Infrastructure

M. Fabro
Manager, Climate Change Planning
Environment and Infrastructure

I hereby certify that the Municipal Council, at its meeting held on September 14, 2021, resolved:

That the following actions be taken with respect to the 6th Report of the Environmental and Ecological Planning Advisory Committee (EEPAC), from its meeting held on August 19, 2021:

a) the following Climate Emergency Action Plan Working Group recommendations BE FORWARDED to the Civic Administration to report back at a future Strategic Priorities and Policy Committee meeting:

i) a special advisory committee should be created to actively participate in the Climate Emergency Action Plan development and implementation. The committee should consist of representation from the City's Climate Emergency Action Plan team, representatives from advisory committees including EEPAC, First Nations and politicians.
The committee structure will facilitate continuous, long-term consultation with key stakeholders and involvement of expertise available to the City through its advisory committees;

ii) the impacts of climate change to the Natural Heritage System should be prioritized and considered holistically, not as an add-on to anthropocentric objectives; plans to protect and enhance the Natural Heritage System under climate change conditions should be explicitly included in the Climate Emergency Action Plan;

iii) the Natural Heritage System should be fully harnessed as part of the City's approach to climate change mitigation, such as the sequestration of carbon by existing green spaces including wetlands, prairies, meadows, forests and mature woodlots, etc. (not only via tree plantings), management of stormwater under extreme weather events and vegetative cover to provide evapotranspiration, reduced temperatures and reductions in runoff and flooding;

iv) to recognize the potential utility of the Natural Heritage System for climate change mitigation, we must better understand current baseline conditions. To begin, EEPAC recommends that the City assemble and present existing baseline data to EEPAC to support the quantification of carbon sequestration by the Natural Heritage System, as well as inventory of the amounts and quality of wetlands, woodlots and other natural lands currently remaining within the City of London. Only with baseline data can an effective and successful Climate Emergency Action Plan with specific targets and accountability be achieved. Using this baseline data, the impacts of climate change on the Natural Heritage

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System should be modeled under various warming scenarios (e.g., using Global Circulation Models). Further, models could be used to predict the extent to which local climate change effects can be mitigated by Natural Heritage features (e.g., quantifying carbon sequestration and stormwater absorption by green spaces);

v) a framework should be developed to systematically monitor the impacts of climate change on the Natural Heritage System over time, with checkpoints to assess whether the City is on track to meet its climate targets and determine if further measures are warranted; and,

vi) the role of EEPAC in the further development and implementation of the Climate Emergency Action Plan should be clarified. EEPAC wishes to remain involved in consulting with and supporting the City on the implications of the Climate Emergency;

b) clauses 1.1, 2.1, 3.1, 5.1 to 5.3, inclusive, BE RECEIVED for information;
it being noted that the Planning and Environment Committee heard a verbal delegation from S. Levin, Chair, EEPAC, relating to these matters. (3.1/12/PEC)

C. Saunders
City Clerk
/pm

cc: Chair and Members, Environmental and Ecological Planning Advisory Committee
H. Woolsey, Strategic Priorities and Policy Committee Deferred List

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From: Brendon Samuels
Sent: Monday, September 13, 2021 2:21 PM
To: Lysynski, Heather <hlysynsk@London.ca>
Cc: s.levin s.levin
Subject: [EXTERNAL] Item for EEPAC meeting agenda

Hi Heather,

I'm writing to request that an item be added to the EEPAC meeting agenda for September. I have attached a PDF to support this agenda item.

At our last meeting, EEPAC struck a working group to explore how public education about visiting Environmentally Significant Areas could be improved. The working group is developing plans to consult various community partners that monitor and perform stewardship activities in ESAs. One approach that we are considering is to collect information about specific locations where issues are observed in ESAs.

We have created a template using Google maps that members of community groups (or the public) can use to report issues in ESAs that they observe. This map is part of the working group's community consultation process, but it might also serve as inspiration for a mapping tool that could be incorporated on the City's webpage for ESAs. I have attached instructions for how the map can be used to this email.

At the next EEPAC meeting, we would like to discuss the feasibility of the City using an online mapping tool to collect reports of issues in ESAs.

Thank you,

Brendon Samuels
Member, EEPAC

Instructions for reporting issues in ESA using Google Maps

The following instructions are written for reporting locations of issues within London's ESAs using Google Maps. Please note that these instructions are applicable only to internet browsers on a computer, and may not be the same if using a tablet or phone.

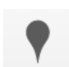
We recommend bookmarking the link to these instructions and/or the map hyperlinked in Step 1 so that you may add observations of conflicts in ESAs in the future.

Step 1: Visit the Google map for reporting ESA issues

Step 2: If you have not already, sign in to your Google account.

Step 3: At the top left, click the Edit button

Step 4: If starting reports for a new ESA not already listed, click the Add layer button. A new layer will appear called "Untitled layer". Click the three vertical dots beside it and rename the layer to match the name of the ESA. Note that the first layer shows examples in the Medway Forest ESA.

Step 5: With your new layer selected, visit the ESA on the map. To add markers, press the Add marker button  under the search bar at the top. Then click on the map where you want to place the marker. You can drag the marker around to reposition it if needed.

Step 6: Title the marker with a brief description of the issue being reported. You may add further details in the description. If available, you may upload photos of the issue by pressing the camera icon 

Step 7: Once you are finished adding a marker, press the Save button.

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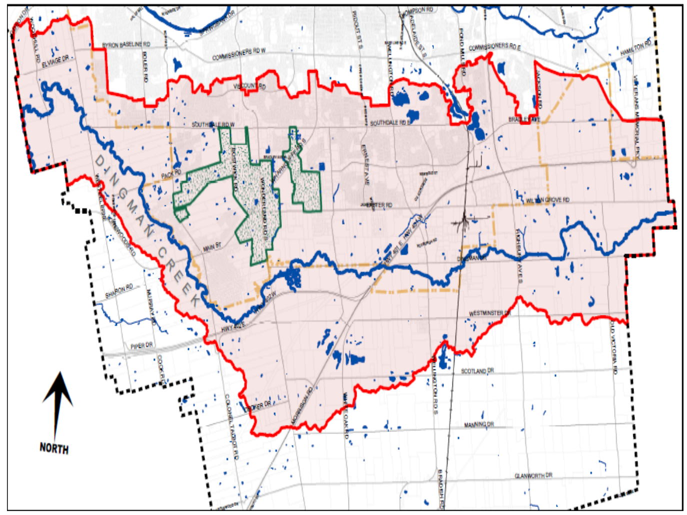
City of London
Notice of Study Initiation

Dingman Creek Subwatershed Stage 2 Lands Municipal Class Environmental Assessment

PUBLIC NOTICE **SEPTEMBER 2, 2021**

Purpose of Study



The purpose of the Dingman Creek Subwatershed Stage 2 Lands Municipal Class Environmental Assessment (EA) is to update the regulatory floodplain for Dingman Creek and assess potential flood mitigation and stormwater servicing alternatives to address imminent and future flooding and erosion risk within the subwatershed.

Through the EA, a range of flood mitigation and stormwater management strategies will be developed. The recommended approach will guide future development, identify mitigative and adaptive flood control works and align with the City's vision for the creek corridor to integrate natural heritage, stormwater management and recreational uses.

Process

The EA study will be undertaken in accordance with the *Ontario Environmental Assessment Act* and will cover all necessary phases of the Schedule 'C' EA Process. This process includes definition of the problem/opportunity, identification and evaluation of alternative solutions, and selection of a preferred one. There will be opportunity throughout the process for public input, including future Public Information Centres. As the study progresses, information and notices will be posted on the City's "Get Involved" website: https://getinvolved.london.ca/dingmancreek

Your feedback is important to us

To provide comments, request additional information, or receive future correspondence related to the project, please contact a member of the project team below:

Adrienne Sones, P.Eng.
Environmental Services Engineer
City of London
(519) 661-2489 ext.5593
asones@london.ca

Fuad Curi, P.Eng.
Project Manager
KGS Group Inc.
(905) 848-7884 ext.516
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Under the *Freedom of Information and Protection of Privacy Act* and the *Environmental Assessment Act*, unless otherwise stated in the submission, any personal information such as name, address, telephone number and property location included in a submission will become part of the public record files for this matter and may be released, if requested, to any person.

Report to Civic Works Committee

To: **Chair and Members**
Civic Works Committee
From: **Kelly Scherr, P.Eng., MBA, FEC**
Deputy City Manager, Environment & Infrastructure
Subject: **2020 Community Energy Use and Greenhouse Gas Emissions Inventory**
Date: **August 31, 2021**

Recommendation

That, on the recommendation of the Deputy City Manager, Environment & Infrastructure and City Engineer, the following actions **BE TAKEN:**

a) this report on the 2020 Community Energy Use and Greenhouse Gas Emissions Inventory **BE RECEIVED** for information; and,

b) this report **BE CIRCULATED** to the Advisory Committee on the Environment (ACE), Transportation Advisory Committee (TAC), Cycling Advisory Committee (CAC), Trees and Forestry Advisory Committee (TFAC), Agricultural Advisory Committee (AAG) and Environmental & Ecological Planning Advisory Committee (EEPAC) for their information.

Executive Summary

The 2020 Community Energy Use and Greenhouse Gas Emissions Inventory provides an overview of the energy used in the London community. This report covers all significant energy sources used in London: natural gas, gasoline, electricity, diesel, fuel oil, and propane. Energy-using sectors covered by the inventory include transportation, residential, industrial, commercial, and institutional. It also includes an estimate of the total cost associated with these energy needs and the greenhouse gas emissions associated with these energy sources. The COVID pandemic has had a major influence of energy use and greenhouse gas emissions.

2020 Community Energy Use

The impact of the COVID pandemic on transportation energy use was significant, which was 20 percent lower than 2019 overall. In particular:

- the amount of gasoline and diesel sold at London's gas stations dropped by 21%;
- Londoners used the opportunity provided by quieter roads to ride their bikes, with the estimated total distance of trips taken by bike increasing by 20% in 2020; and,
- The number of vehicles registered in London in 2020 decreased by 6%.

Energy used in London's single-family homes was down by four percent overall. Electricity use in homes did increase due in part to shifting to work from home as well as warmer summer temperatures increasing the demand for air conditioning. However, natural gas use decreased due to warmer winter and autumn weather reducing the demand for interior heating.

Energy used by London's industrial, commercial, and institutional sector remained relatively unchanged in 2020.

It is estimated that Londoners spent about $1.35 billion on energy in 2020, a decrease of 11 percent from 2019. The improvements in energy efficiency seen since 2010, combined with the COVID-19 pandemic, are estimated to have saved Londoners $380 million in avoided energy costs in 2020. Added up year-over-year, London has avoided over $1.3 billion in energy costs due to improved efficiency since 2010. On average, every percentage that Londoners reduce their energy use results in around $13 million staying in London.

2020 Greenhouse Gas Emissions

London's current greenhouse gas emission reduction targets are:

- 15% reduction from 1990 levels by 2020;
- 37% reduction from 1990 levels by 2030; and,
- Net-zero emissions by 2050.

In April 2021, the federal government revised its 2030 target to aim for a 40 to 45 percent reduction in greenhouse gas emissions from 2005 levels as well as net-zero emissions by 2050. To date, the provincial government has not revised its 2030 target for a 30 percent reduction from 2005 levels and has not established an emission reduction target beyond 2030.

Total greenhouse gas emissions in 2020 were over 2.7 million tonnes of equivalent carbon dioxide, or 22 percent lower than the 1990 level. This is well below the 15 percent reduction target set for 2020. However, it is important to note the extraordinary impact of the COVID-19 pandemic on emissions.

The COVID-19 pandemic has shown the impact that transportation demand management activities such as working-from-home can have on reducing emissions. This highlights the importance of new City-led measures to be developed in the upcoming Mobility Master Plan. There is also the potential role that building energy retrofits can play as part of the London Community Recovery Network.

Annual reporting on community energy use and resulting greenhouse gas emissions has been underway since 2012 These details are part of the foundation for the development of the Climate Emergency Action Plan, a response to the climate emergency declaration. Complete details are found in Appendix A: 2020 Community Energy Use and Greenhouse Gas Emissions Inventory – Executive Summary and Appendix B: 2020 Community Energy Use and Greenhouse Gas Emissions Inventory – Report.

Linkage to the Corporate Strategic Plan

Municipal Council continues to recognize the importance of climate change mitigation, sustainable energy use, related environmental issues, and the need for a more sustainable and resilient city in its 2019-2023 - Strategic Plan for the City of London. Specifically, London's efforts in climate change mitigation address four of the five Areas of Focus, at one level or another:

- Strengthening Our Community
- Building a Sustainable City
- Growing our Economy
- Leading in Public Service

Analysis

1.0 Background Information

1.1 Previous Reports Related to this Matter

- Report to the October 22, 2019 Civic Works Committee (CWC) Meeting, 2018 Community Energy and Greenhouse Gas Inventory (Agenda Item #2.9)

1.2 Context

Addressing the Need for Action on Climate Change
On April 23, 2019, the following was approved by Municipal Council with respect to climate change:

> *Therefore, a climate emergency be declared by the City of London for the purposes of naming, framing, and deepening our commitment to protecting our economy, our eco systems, and our community from climate change.*

The 2020 Community Energy Use and Greenhouse Gas Emissions Inventory report is the measurement tool to highlight London's progress towards meeting its community energy reduction and greenhouse gas reduction targets along with other targets and directions.

Background
The City of London does not have direct control over how much energy is used in London, but it does have influence. The control over energy use in London rests primarily with citizens, visitors, employers, and employees. Individual and collective action with respect to sustainable energy use, energy management, and energy conservation is critical for our future.

Continuing from London's previous 2014-2018 Community Energy Action Plan, the upcoming Climate Emergency Action Plan will continue to place a priority on providing Londoners with annual information on community energy use and greenhouse gas emissions. London's current greenhouse gas emission reduction targets are:

- 15% reduction from 1990 levels by 2020;
- 37% reduction from 1990 levels by 2030; and,
- Net-zero emissions by 2050.

In April 2021, the federal government revised its 2030 target to aim for a 40 to 45 percent reduction in greenhouse gas emissions from 2005 levels as well as net-zero emissions by 2050. To date, the provincial government has not revised its 2030 target for a 30 percent reduction from 2005 levels and has not established an emission reduction target beyond 2030.

The three most common benchmark dates used by City staff to report on overall progress are:

- 1990 – The first year that for which London's community-wide greenhouse gas emissions and energy use were determined, as well as Province of Ontario's previous baseline year;
- 2005 – the baseline year used for the Government of Canada's and the new Province of Ontario's greenhouse gas reduction targets; and,
- 2010 – the first year for which total energy cost data was determined in London.

The 2020 Community Energy Use and Greenhouse Gas Emissions Inventory provides an overview of the energy used in the London community. This report covers all significant energy sources used in London: natural gas, gasoline, electricity, diesel, fuel oil, and propane. Energy-using sectors covered by the inventory include transportation, residential, industrial, commercial, and institutional. It also includes an estimate of the total cost associated with these energy needs and the greenhouse gas emissions associated with these energy sources. In addition, this report also includes the greenhouse gas emissions associated with the City of London's W12A Landfill and closed landfill sites, as well as sewage sludge incineration at the Greenway Wastewater Treatment Plant.

The City of London also reports this information on an annual basis to CDP Cities and the Global Covenant of Mayors for Climate & Energy.

2.0 Discussion and Considerations

The 2020 Community Energy Use and Greenhouse Gas Emissions Inventory report can be found on the Get Involved London Climate Emergency Action Plan website. Highlights from the 2020 report are below in two categories:

1. Community energy use by product and sector including cost spent on energy
2. Greenhouse gas emissions and progress towards current targets

Energy use accounted for 95 percent of community greenhouse gas emissions. Not only does burning fossil fuels such as gasoline, diesel, and natural gas produce carbon dioxide – the most common greenhouse gas associated with human activity – but the use of electricity also contributes to greenhouse gas emissions. The remaining five percent of greenhouse gas emissions are methane emissions from landfills and nitrous oxide emissions from sewage sludge incineration.

2.1 2020 Community Energy Use

Energy use by sector in London was as follows:

- 44% from industrial, commercial, and institutional buildings and facilities;
- 31% from transportation, primarily cars and trucks on London's roads; and,
- 25% from single-family residential homes.

There are four major energy commodities used in London – natural gas, gasoline, electricity, and diesel. The following table summarizes the impact of these energy commodities in terms of total energy use, total cost, and greenhouse gas emissions.

Energy Commodity	Share of Total Energy Used (in terajoules)*	Share of Total Energy Costs	Share of Energy-related GHG Emissions
Natural gas	47%	21%	51%
Gasoline	20%	27%	29%
Electricity	21%	42%	4%
Diesel	8%	7%	11%
Other	4%	3%	5%

Table Note: * a terajoule (or, one trillion joules) is a metric unit for measuring energy and is approximately equivalent to the energy provided by burning 26,000 litres of gasoline (roughly the amount of gasoline in 500 cars).

The impact of the COVID-19 pandemic on transportation energy use was significant, which was 20 percent lower than 2019 overall. In particular:

- the amount of gasoline and diesel sold at London's gas stations dropped by 21% because of many London workplaces shifting to work-from-home as well as reduced non-work automobile trips associated with stay-at-home orders and similar restrictions;

- Londoners used the opportunity provided by quieter roads to ride their bikes, with Google's Environmental Insights Explorer estimating the total distance of trips taken by bike increasing by 20% in 2020; and,

- The number of vehicles registered in London in 2020 decreased by 6%.

Other highlights of recent community energy use progress and longer-term trends, include:

- **The total amount of energy used in London in 2020 was 55,100 terajoules.** This is an 8% decrease from 2019.

- **Londoners are using energy more efficiently** – on a per person basis, Londoners and London businesses used 21% less energy overall in 2020 than used in 1990.

- **London is producing more goods and services for every unit of energy used** – on a dollar gross domestic product (GDP adjusted for inflation) per unit energy basis, London's industrial, commercial, and institutional sector improved the value of goods and services produced per unit of energy used by 37% between 1990 and 2020.

- **$1.35 billion was spent by Londoners and London businesses on energy in 2020**. This is a decrease of 11% from 2019. As noted earlier, the response to the COVID Pandemic reduced the demand for gasoline, which also reduced the price for gasoline in 2020. In total, Londoners spent about $170 million less on gasoline in 2020 than they did in 2019. Almost 90% of the $1.35 billion leaves London. On average, every 1% reduction in energy use keeps about $13 million from leaving the local economy.

- **London is spending less money on energy** – The improvements in energy efficiency seen since 2010, combined with COVID, are estimated to have saved London $380 million in avoided energy costs in 2020. Added up year-over-year, London has avoided over $1.3 billion in energy costs due to improved efficiency since 2010.

In addition, since 1990, on an energy used per person basis:

- Transportation fuel use has decreased by 31%;
- Energy use to heat and power single-family residential homes has decreased by 21%; and,
- Energy use to heat and power industrial, commercial, and institutional buildings decreased by 12%.

Prior to COVID, vehicle ownership in London had grown by over four percent every year on average between 2010 and 2019, much faster than London's overall population growth. As of December 2020, the number of light-duty vehicles registered in London dropped by six percent to just over 273,000 vehicles. This works out to about 0.86 vehicles per person aged 20 to 84.

In terms of low-emission vehicles, the number of hybrid and/or electric vehicles in London is almost six times higher in 2020 compared to 2010. There are also now over 1,000 electric vehicles registered in London. Almost one percent of new 2020 model year vehicles registered were electric vehicles and four percent were hybrid vehicles.

On the negative side, high gas-consuming sport utility vehicles and large pick-ups continue to gain in popularity as the relative number of minivans and mid-sized sedans decline.

Figure 1 illustrates the trend in energy use for major energy-using sectors on a per person basis since 1990. Figure 2 illustrates the trend for energy costs by commodity since 2010.

Figure 1 – Change in Energy Use in London, Per Person, by Sector Since 1990

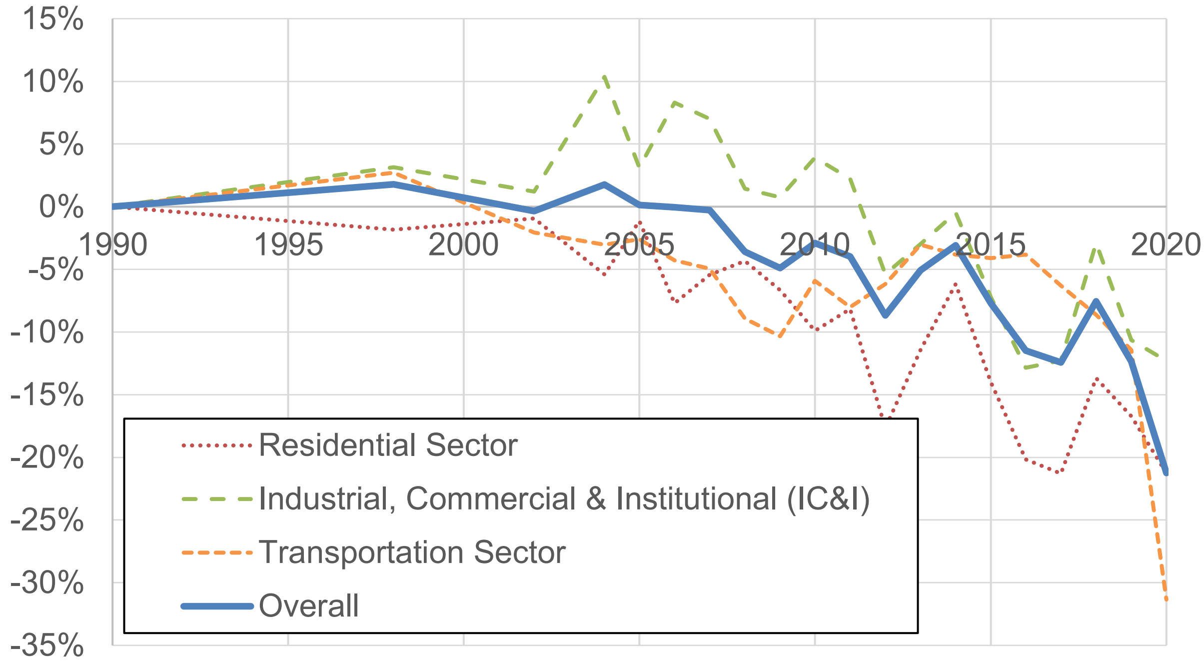
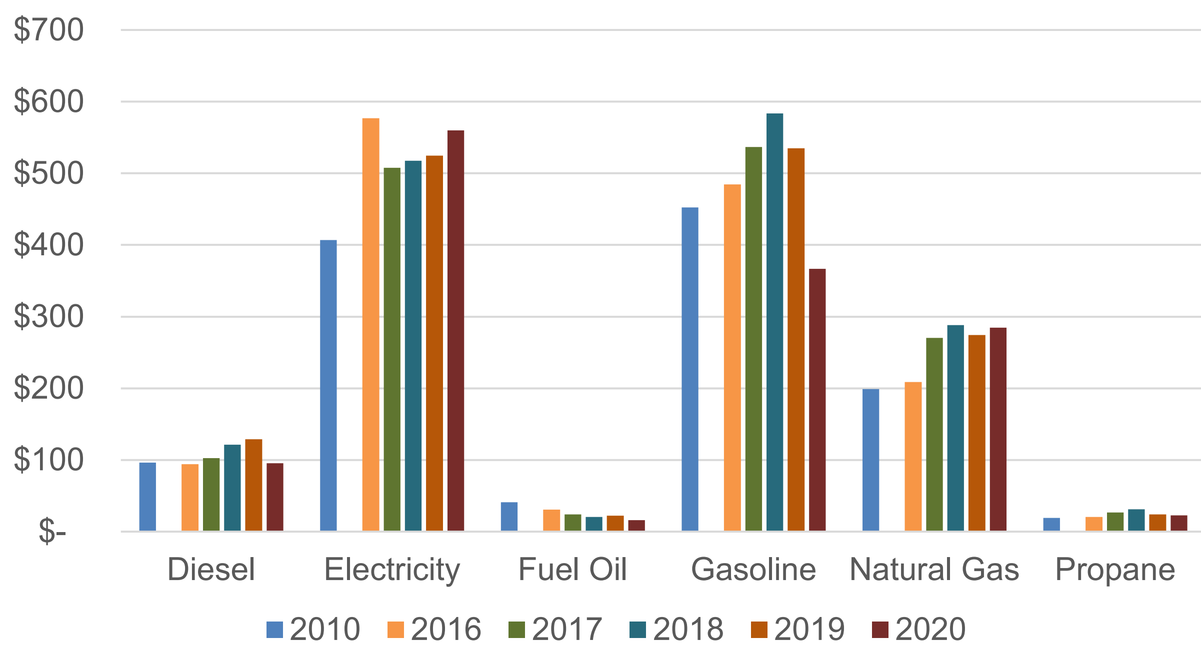


Figure 2 – Trends in Energy Costs ($ Millions) by Energy Commodity



2.2 2020 Greenhouse Gas Emissions and Progress Towards Targets

Total greenhouse gas emissions in 2020 were over 2.7 million tonnes of equivalent carbon dioxide. This is 22 percent lower than the 1990 level. This is well below the 15 percent reduction target set for 2020.

Compared to 2005, the baseline year used by the federal and provincial governments, total greenhouse gas emissions from London in 2020 have decreased by 30 percent.

As noted earlier, the COVID-19 pandemic had a significant impact on transportation fuel use, with an associated 20 percent drop in transportation greenhouse gas emissions between 2019 and 2020. Warmer weather in the winter and autumn also reduced the demand for natural gas used for heating, with an associated seven percent drop in residential greenhouse gas emissions between 2019 and 2020.

Over 90 percent of Ontario's electricity was generated from emissions-free sources in 2020, such as nuclear and hydro-electric generating stations as well as renewable sources (wind and solar). However, Ontario still relies on fossil fuels such as natural gas to generate almost seven percent of its electricity.

In summary:

- **Total greenhouse gas emissions in 2020 were over 2.7 million tonnes of equivalent carbon dioxide** – the top three sources in 2020 were personal vehicles (27%), single-family homes (20%), and commercial buildings (17%).

- **Londoners' per-person greenhouse gas emissions are significantly lower** – on a per person basis, Londoners and London businesses released 30% fewer greenhouse gas emissions in 2020 than they did in 1990.

Figure 3 illustrates the trends to date for greenhouse gas emissions compared to London's greenhouse gas emission reduction targets as well as targets set by senior levels of government.

Figure 3 – London's Greenhouse Gas Emissions Trend versus Reduction Targets

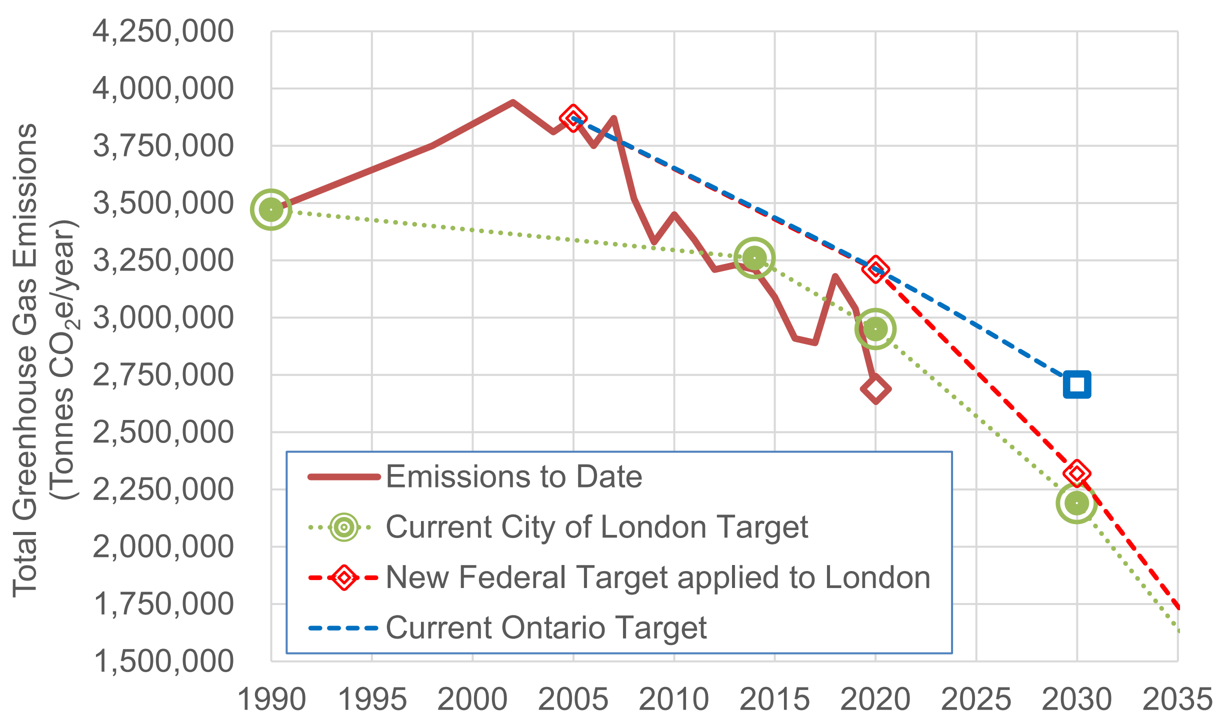


Chart Note:

- London's targets are for a 15% reduction from 1990 levels by 2020, 37% reduction from 1990 levels by 2030, and net-zero emissions by 2050.
- Federal targets are for a 40% to 45% reduction from 2005 levels as well as net-zero emissions by 2050. The 40% target is shown here.
- Provincial target is for a 30% reduction from 2005 levels by 2030. The province does not currently have any long-term targets.

Whether emissions continue to decrease depends upon the impact of energy and fuel conservation efforts, provincial and federal climate change policies, climate trends, economic growth, and consumer choices. It is also important to note that these actions also contribute to reductions in air pollution emissions (e.g., nitrogen oxides, volatile organic compounds) from fossil fuel use.

Household-Level Energy Use and Greenhouse Gas Emissions

It is estimated that the average household in London, living in a single-family home, spent over $380 every month on energy in 2020. Almost half of this, about $170 a month, was spent on gasoline. Note that this was $70 a month lower than 2019. Electricity accounted for around $120 per month, while natural gas was around $70 per month.

In terms of household greenhouse gas emissions, the average household emitted over nine tonnes per year. As with cost, almost half of this came from burning gasoline. Natural gas used for interior heating and water heating accounted for 42 percent of emissions. Organic waste in the landfill accounts for about seven percent. Given Ontario's clean electricity grid, using electricity in the home only accounts for under two percent of household GHG emissions.

It is important to recognize the fact that the production and transportation of the consumer goods purchased also have an environmental impact and that some types of goods (e.g., meat and dairy products) do have a larger impact than others. At this point in time, there is no easy-to-use methodology to estimate this at the community-wide scale. Therefore, municipalities across Canada currently do not include the energy use and greenhouse gas emissions from these activities in inventory reporting. These are often considered Scope 3 emissions (generated outside of the community). Establishing a consistent and acceptable measurement and reporting methodology will be important in the near future.

However, the Environmental Commissioner of Ontario report, *Climate Pollution: Reducing My Footprint (2019)*, provides estimates of consumption related GHG for Ontario residents. This report estimated that the average household's consumption related GHG emissions are about 18 tonnes per year. This is larger than the emissions from the direct use of energy and from waste. This highlights the climate change mitigation of several environmental initiatives such as:

- Food waste reduction;
- Buying durable products;
- Buying local products and local "staycations";
- Recycling and the circular economy; and,
- Repurposing and renovating existing buildings.

2.3 Development of the Climate Emergency Action Plan

The development of a Climate Emergency Action Plan is a fundamental and required response to the City of London's climate emergency declaration. The goals are to improve London's resilience to climate change impacts, reduce London's greenhouse gas emissions by at least 37% below 1990 levels by 2030 and reach net-zero emissions by 2050.

A recent report to Council's Strategic Priorities and Policy Committee on April 27, 2021 provided an update on the plan's engagement and development to date. City staff are currently reviewing the ideas and feedback collected from residents and businesses submitted between October 2020 and April 2021 as part of the development of the plan. Opportunities for input continue and can found at https://getinvolved.london.ca/climate

The 2020 Community Energy Use and Greenhouse Gas Emissions Inventory Report Annual reporting on community energy use and resulting greenhouse gas emissions has been underway since 2012 These details are part of the foundation for the development of the Climate Emergency Action Plan (CEAP). The CEAP is currently scheduled to be submitted to the Strategic Priorities and Policy Committee (SPPC) in late fall 2021.

Conclusion

The results as demonstrated in the 2020 Community Energy Use and Greenhouse Gas Emissions Inventory Report continue to tell a positive story for London. Ontario's actions to replace coal-fired power plants with cleaner power generation have played a significant role in this reduction. Londoners have also taken action by reducing the amount of energy they use at home and at work.

Transportation fuel use remains an area where progress is needed. The COVID-19 pandemic has shown the impact that transportation demand management activities such as working-from-home can have on reducing emissions. This highlights the importance of City-led measures to be developed in the upcoming Mobility Master Plan.

Prepared by:	**James Skimming, P.Eng.** **Manager, Energy & Climate Change**
Prepared and Submitted by:	**Jay Stanford MA, MPA** **Director, Climate Change, Environment & Waste Management**
Recommended by:	**Kelly Scherr, P.Eng., MBA, FEC, Deputy City Manager, Environment & Infrastructure**

Appendix A 2020 Community Energy Use and Greenhouse Gas Emissions Inventory – Executive Summary

Appendix B 2020 Community Energy Use and Greenhouse Gas Emissions Inventory – Report

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Community Energy Use & Greenhouse Gas Emissions Inventory

Executive Summary

2020

London
CANADA

Introduction

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 2020. 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

Previous annual reports for 2012 through to 2018, as well as 2006 to 2008, 1998, and 1990 are available upon request.

Contents

Community energy use inventory

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

1990

The first year that for which London's community-wide GHG emissions and energy use were determined, as well as Ontario's previous baseline year.

2005

the baseline year used for the Government of Canada's and the Province of Ontario's greenhouse gas (GHG) reduction targets

2010

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

Previous annual reports for 2012 through to 2019, as well as 2006 to 2008, 1998, and 1990 are available upon request.

COVID's big impact on transportation in 2020

The impact of the COVID-19 pandemic on transportation energy use was significant, which was 20 percent lower than 2019 overall. In particular:

↓21% Gasoline and diesel sold

↑20% Distance travelled by bike

↓6% Vehicles registered

It is anticipated that the shift to working-from-home will remain in place at London's workplaces after the COVID-19 pandemic is over, although this is not likely to be a full-time shift for everybody. It is also anticipated that the interest in cycling for transportation will continue to grow.

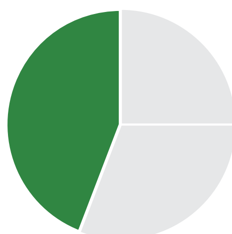
Energy used in London's single-family homes was down by four percent overall. Electricity use in homes did increase due in part to shifting to work from home as well as warmer summer temperatures increasing the demand for air conditioning. However, natural gas use decreased due to warmer winter and autumn weather reducing the demand for space heating.

Energy used by London's industrial, commercial, and institutional sector remained relatively unchanged in 2020.

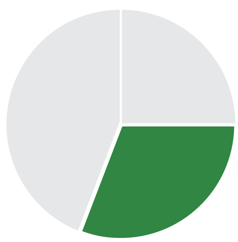
Total energy use in London in 2020 was 55,100 terajoules, an eight percent decrease from the previous year (2019).

Energy Use by Sector in 2020

25% Homes



31% Transportation



44% Workplaces

Energy efficiency trends

In 2020, energy use per person in London was 21 percent below 1990 levels.

As noted earlier, COVID-19's impact on transportation in 2020 was dramatic. However, it is too early to consider this a long-term trend.

The biggest long-term trend seen since 1990 is in residential energy use per person, which was 21 percent lower in 2020 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.

Reduction In Energy Use Per Person Since 1990

↓21% Homes

↓31% Transportation

↓12% Workplaces

Energy use per person in 2020 related to workplaces was 12 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 – looks even more impressive with a 37 percent improvement between 1990 and 2020, even when adjusting for inflation.

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

1990 $524

2020 $717

of value /gigajoule of energy used

= 37%

more value for every gigajoule used!

Transportation fuel use is decreasing even as vehicle ownership increases

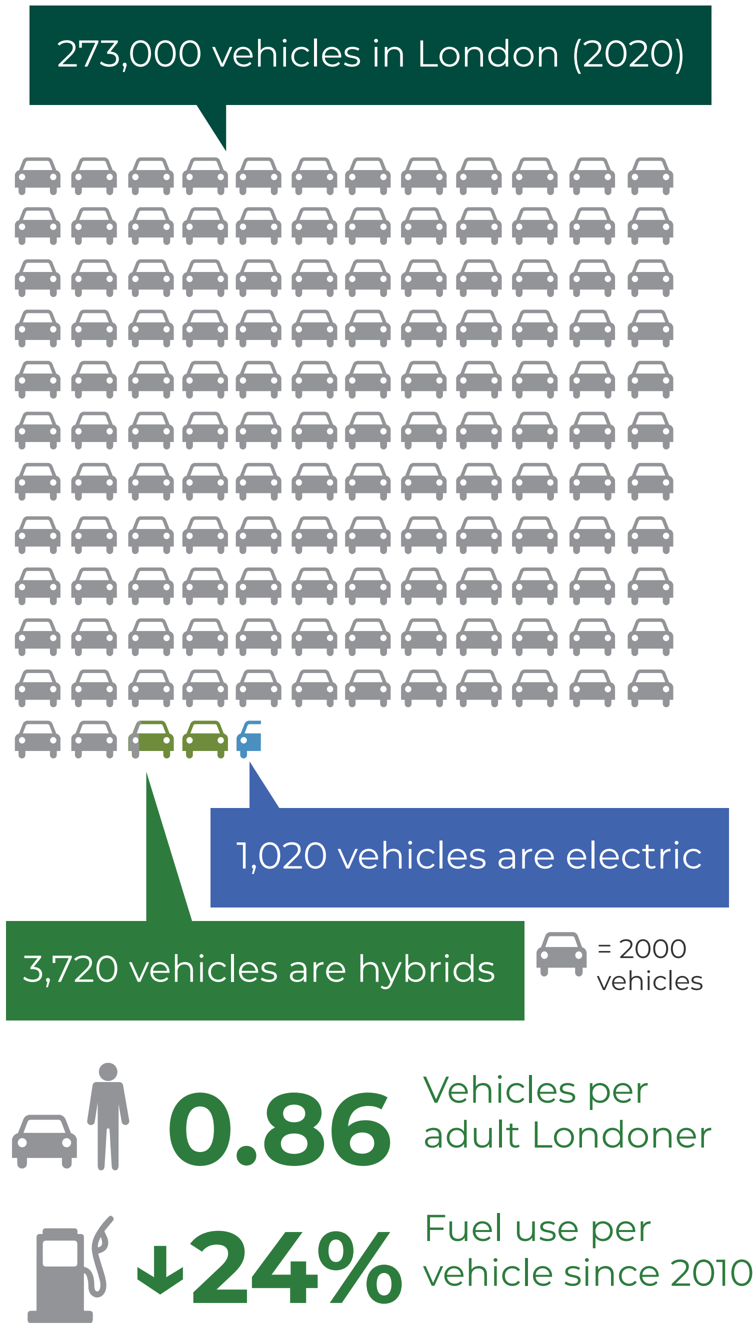
Prior to COVID-19, vehicle ownership in London had grown by over four percent every year on average between 2010 and 2019, much faster than London's overall population growth. As of December 2019, there were almost 292,000 light-duty vehicles registered in London – an increase of almost 89,000 since 2010. When compared to Census data on Londoners between the age of 20 and 84, vehicle registration increased from 0.75 per person in 2010 to an estimated 0.94 per person in 2019.

However, as of December 2020, the number of light-duty vehicles registered in London dropped by six percent down to just over 273,000 vehicles. This works out to about 0.86 vehicles per person aged 20 to 84.

The number of hybrid and/or electric vehicles in London are almost six times higher in 2020 compared to 2010. There are also now over 1,000 electric vehicles registered in London.

Almost one percent of new 2020 Model Year vehicles registered were electric vehicles and four percent were hybrid vehicles.

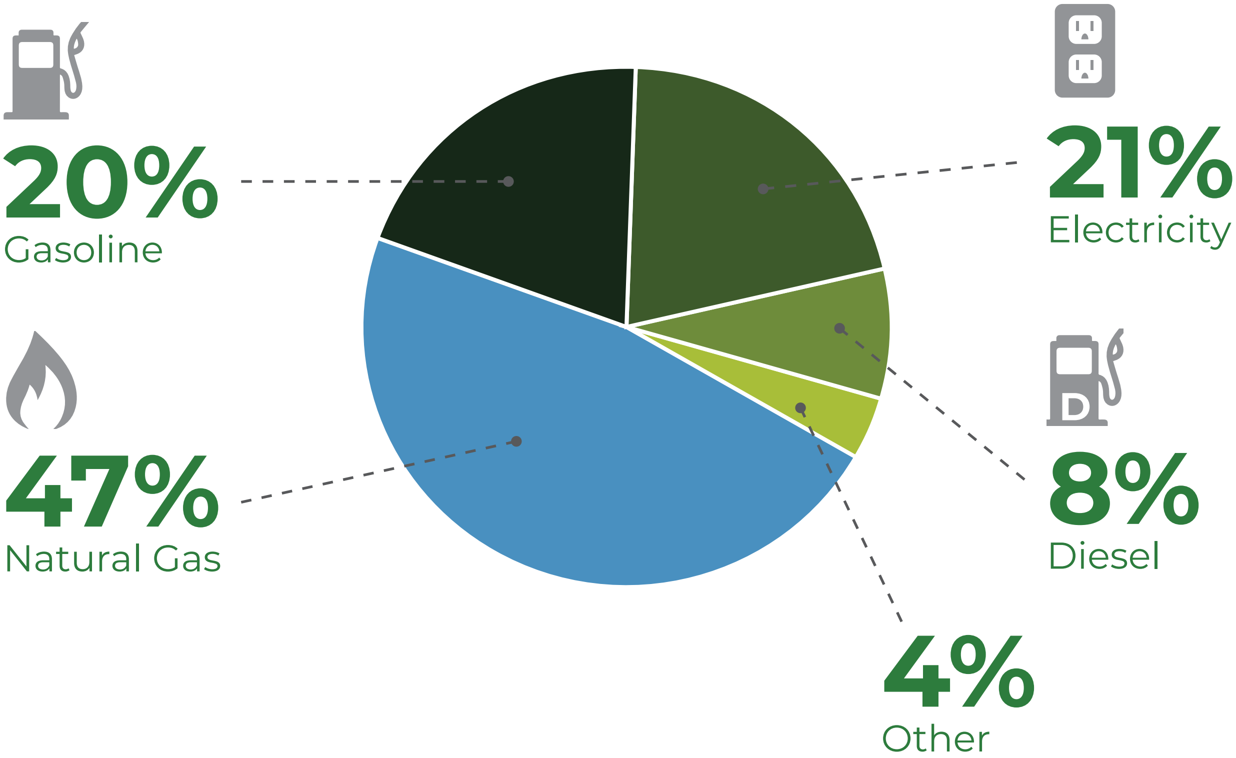
On the negative side, high gas consumption sport utility vehicles and large pick-ups continue to gain in popularity as the relative number of minivans and mid-sized sedans decline.



Sources of energy used in London

Sources of energy used in London

What sources of energy were used in London?



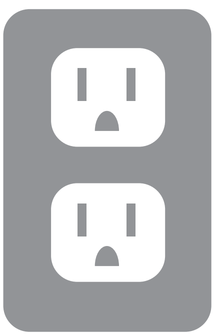
In terms of sources of energy, natural gas is the largest source of energy used in London, accounting for 47 percent of all energy used in 2020. Natural gas is used primarily for heating buildings, heating water, and providing heat for industrial processes.

Electricity was the second largest source of energy, accounting for 21 percent of London's energy use.

Gasoline accounted for 20 percent of all the energy used in London.

Electricity generation in London

London has almost 90 megawatts (MW) of local electricity generation capacity installed to date, an increase of about one megawatt from 2019. As of April 2021, there was 68.3 megawatts of gas-fired co-generation, 17.9 megawatts of solar photovoltaic (PV), 2.85 megawatts of biogas, and 0.675 megawatts of hydro-electric power generation in operation in London.



Most of London's local generating capacity is associated with natural gas combined heat and power cogeneration plants, used in four different applications:

- **District energy** - London District Energy (38.7 MW) provides power to the grid plus steam and chilled water to downtown buildings from its Colborne Street facility.
- **Industrial** - Ingredion (14.1 MW) and Labatt Brewery (4.2 MW) generate steam as well as electricity "behind-the-meter" for use in their operations.
- **Campus** – the London Health Sciences Centre (9.6 MW) Victoria Hospital campus generates both steam and electricity for hospital buildings.
- **Micro-scale** – small scale systems (under 100 kilowatts) are in use at the Canada Games Aquatic Centre and H.B. Beal Secondary School for pool heating as well as electricity "behind-the-meter" for use in their operations.

London CANADA

Translating energy use into economic and business development opportunities

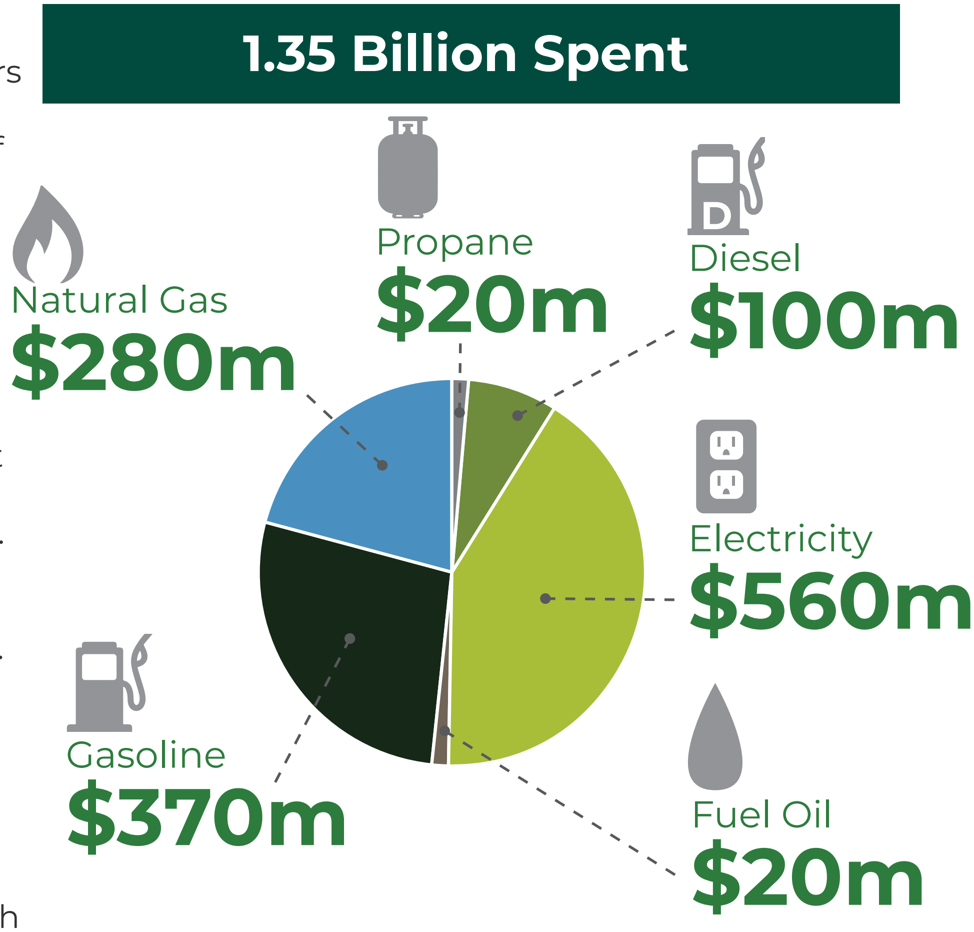
It is estimated that Londoners spent about $1.35 billion on energy in 2020, a decrease of 11 percent from 2019.

As noted earlier, COVID-19 reduced the demand for gasoline. As a result, the price for gasoline in 2020 decreased by 13 percent. In total, Londoners spent about $170 million less on gasoline in 2020 than they did in 2019.

Electricity accounts for 42 percent of total energy costs.

Natural gas use accounts for only 21 percent of energy costs, even though it is the largest source of energy we use. This is due to the low price of natural gas, even with the $30 per tonne carbon price in place during 2020.

On average, every percentage that Londoners reduce their energy use results in around $13 million staying in London.



The improvements in energy efficiency seen since 2010, combined with COVID-19, are estimated to have saved London $380 million in avoided energy costs in 2020. Added up year-over-year, London has avoided over $1.3 billion in energy costs due to improved efficiency since 2010.

Please note: due to rounding of numbers, individual numbers illustrated above may not add up to the rounded total.

Translating energy use to greenhouse gas impact

Total greenhouse gas emissions in 2020 were about 2.7 million tonnes of equivalent carbon dioxide, or 22 percent lower than the 1990 level. This is well below the 15 percent reduction target set for 2020. However, it is important to note the extraordinary impact of the COVID-19 pandemic on emissions.

Energy use is responsible for 95 percent of all GHG emissions from human activity in London. Not only does burning fossil fuels such as gasoline, diesel, and natural gas produce carbon dioxide – the most common GHG associated with human activity – but the use of electricity also contributes to GHG emissions.

Over 90 percent of Ontario's electricity was generated from emissions-free sources in 2020, such as nuclear and hydro-electric generating stations as well as renewable sources (wind and solar).

However, Ontario still relies on fossil fuels such as natural gas to generate almost seven percent of the electricity we use.

In summary, energy related GHG emissions are:

- 51 percent from natural gas
- 29 percent from gasoline
- 11 percent from diesel
- 4 percent from electricity
- 5 percent from other fuels

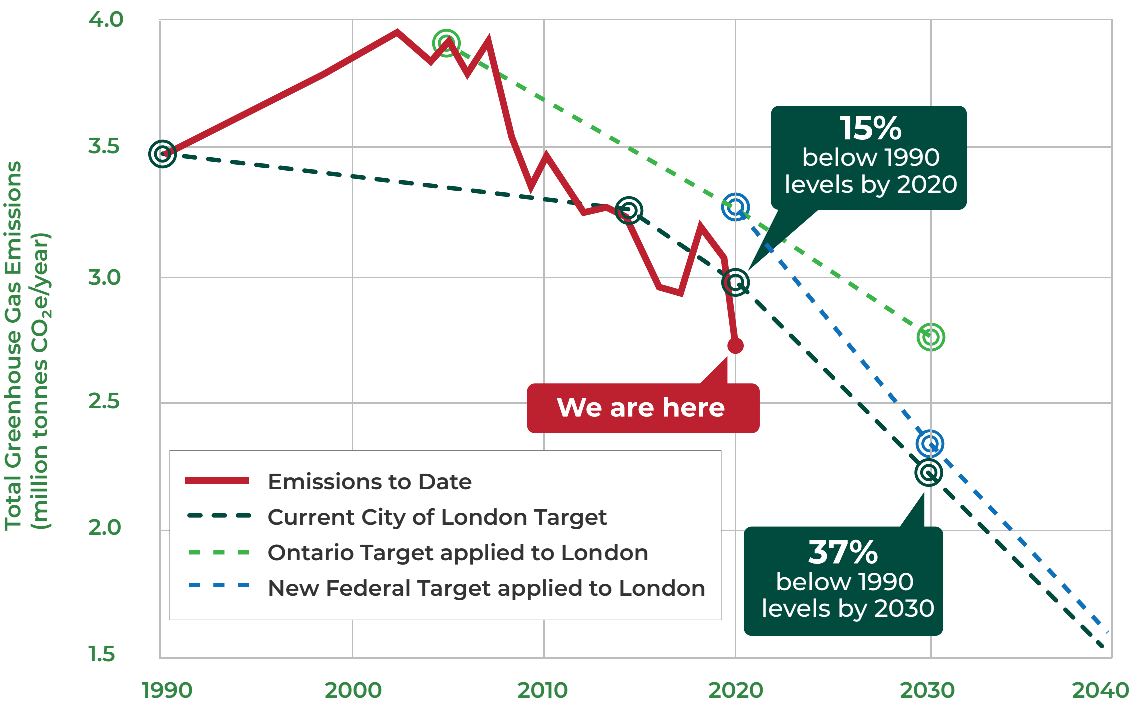
The remaining five percent of GHG emissions are methane emissions from the anaerobic decomposition of organic materials in the active and closed landfills located in London as well as commercial sector waste disposed in landfills outside London, and nitrous oxide emissions from sewage sludge incineration.

GHG emissions from energy sources

Electricity	Natural Gas	Gasoline	Diesel
8kg	**51kg**	**64kg**	**70kg**

Measured in kilograms (kg) of equivalent carbon dioxide CO_2E per unit of energy gigajoule

London's greenhouse gas emissions versus CEAP targets and Federal & Provincial reduction targets



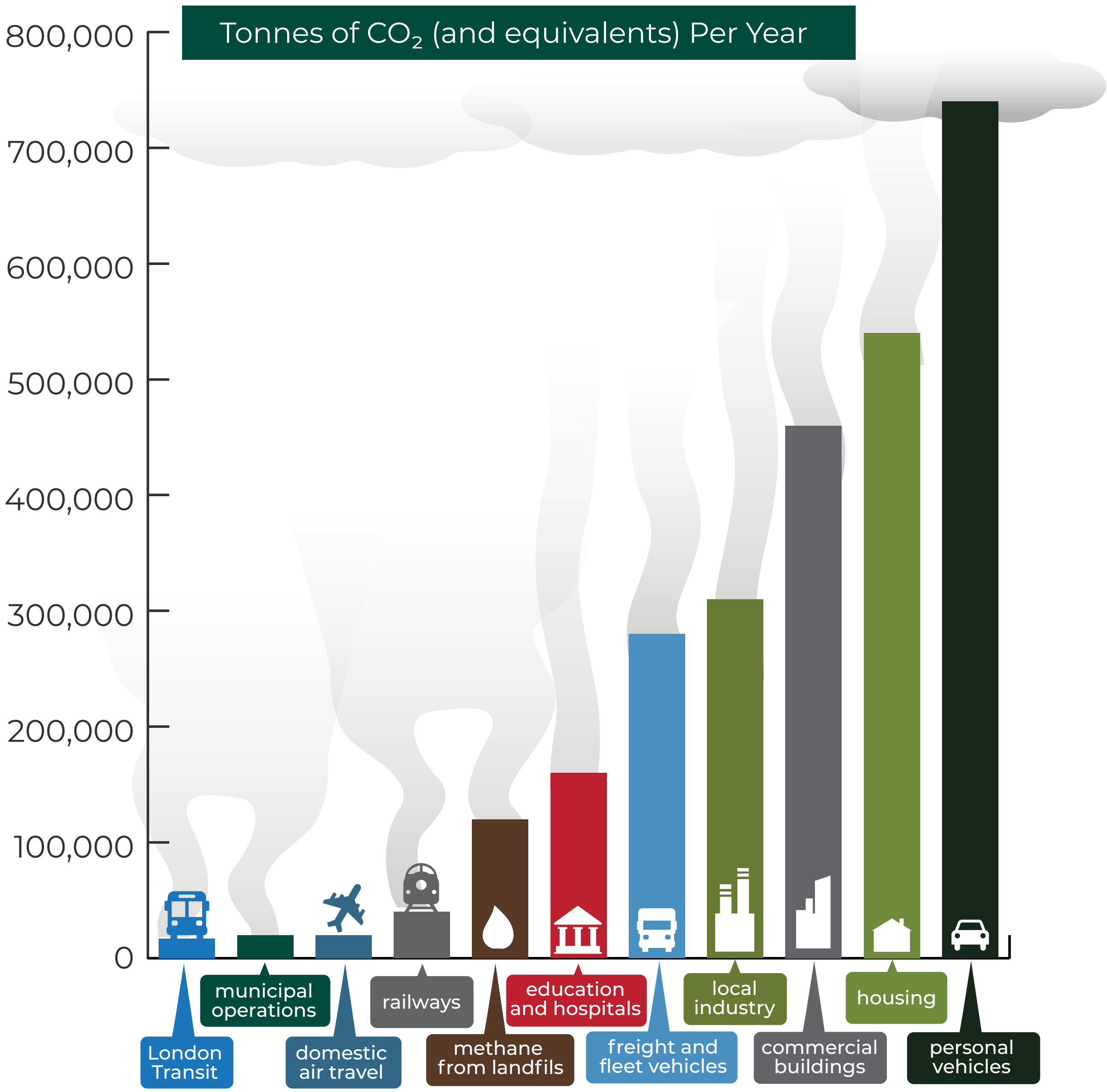
London's Climate Emergency Action Plan (CEAP) currently has the following greenhouse gas emission reduction goals:

- 15 percent reduction from 1990 levels by 2020
- 37 percent reduction by 2030, and
- Net-zero emissions by 2050.

In April 2021, the federal government revised its 2030 target to aim for a minimum 40 percent reduction in GHG emissions from 2005 levels as well as net-zero emissions by 2050. To date, the provincial government has not revised its 2030 target for a 30 percent reduction from 2005 levels and has not established an emission reduction target beyond 2030.

Compared to 2005, total greenhouse gas emissions from London in 2020 have decreased by 30 percent.

The following figure illustrates the estimated breakdown of greenhouse gas emissions in terms of human activity, with half of the emissions coming from personal transportation and energy use at home.



As mentioned earlier, the COVID-19 pandemic had a significant impact on transportation fuel use, with an associated 20 percent drop in transportation GHG emissions between 2019 and 2020. Warmer weather in the winter and autumn also reduced the demand for natural gas used for heating, with an associated seven percent drop in residential GHG emissions between 2019 and 2020.

Seasonal weather variations can affect energy use and associated emissions significantly on a year-by-year basis. However, over the last ten years, winter average temperatures and most summer average temperatures have been warmer than normal.

> Since 2005 there has been a downward trend in community-wide emissions driven by a combination of cleaner electricity generation in Ontario and improved energy efficiency.

Reduction in GHG emissions per person since 1990

↓47%	↓37%	↓39%
Homes	Transportation	Workplaces

Whether emissions continue to decrease depends upon the impact of City-led actions as well as energy and fuel conservation efforts from Londoners, 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 $380 every month on energy in 2020. Almost half of this, about $170 a month, was spent on gasoline. Note that this was $70 a month lower than 2019.

Electricity accounted for around $120 per month, while natural gas was around $70 per month.

In terms of household greenhouse gas emissions, the average household emitted over nine tonnes per year. As with cost, almost half of this came from burning gasoline. Natural gas used for space heating and water heating accounted for 42 percent of emissions. Organic waste in the landfill accounts for about seven percent. Given Ontario's clean electricity grid, using electricity in the home only accounts for under two percent of household GHG emissions.

It is important to recognize the fact that the production and transportation of the consumer goods purchased do have an environmental impact, and that some types of goods (e.g., meat and dairy products) do have a larger impact than others. At this point in time, there is no easy-to-use methodology to estimate this at the community-wide scale.

However, the Environmental Commissioner of Ontario report, *Climate Pollution: Reducing My Footprint*, provides estimates of consumption related GHG for Ontario residents. Using the information in this report, it is estimated that the average household's consumption related GHG emissions are about 18 tonnes per year. This is larger than the emissions from the direct use of energy and from waste.

This highlights the climate change mitigation of several environmental initiatives such as:

- Food waste reduction
- Buying durable products
- Buying local products and local "staycations"
- Recycling and the circular economy
- Repurposing and renovating existing buildings

Where do your greenhouse gas emissions come from?

Vehicle Gasoline

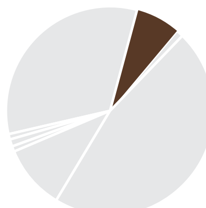
47%

Natural Gas
Home Heating

33%

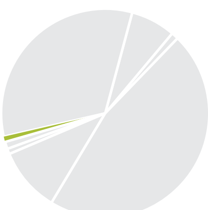
Natural Gas
Water Heating

10%



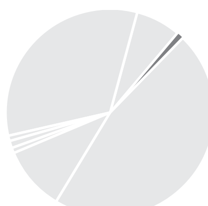
Methane From Food & Organic Waste in Garbage

7%



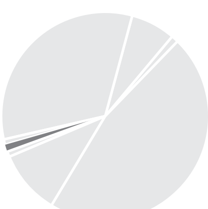
Propane BBQs etc.

1%



Electricity
Furnace & Air Conditioner

1%



Electricity
Appliances & Electronics

1%

Electricity Lighting

<1%

The average home in London emits

9.3

tonnes per year.

Based on 2020 average energy use for residential customers of London Hydro and Enbridge (formerly Union Gas), combined with retail sales of gasoline data.

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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 alternate metric unit of mass used to represent one megagram (one million grams or 1,000 kilograms), which is roughly the same (about 10% different) as a “ton” in the old Imperial system of measurement. 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.

London
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2020 Community Energy Use & Greenhouse Gas Emissions Inventory

August 2021

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TABLE OF CONTENTS

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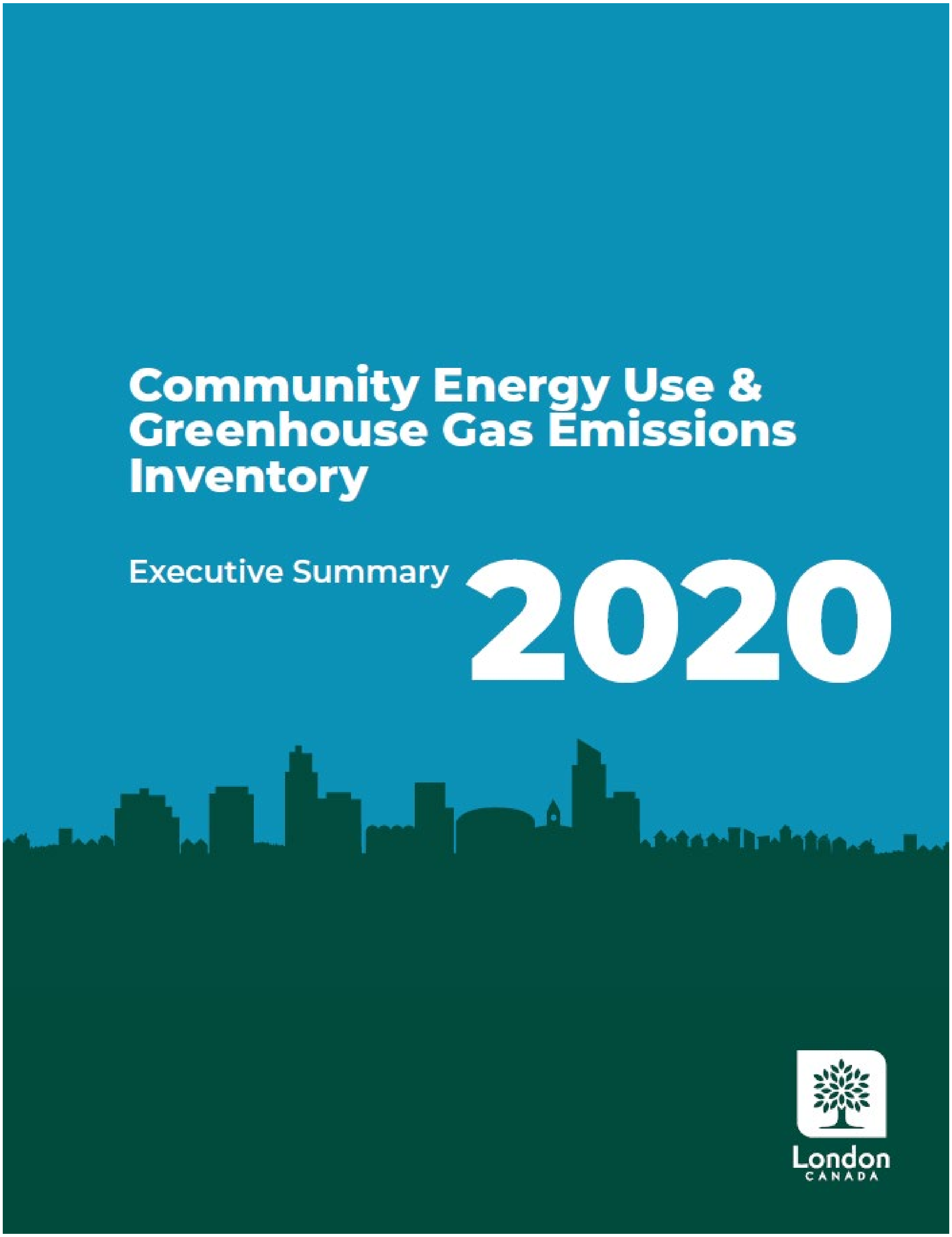
EXECUTIVE SUMMARY

The Executive Summary for the 2020 Community Energy Use & Greenhouse Gas Emissions Inventory is now a stand-alone document.



1 PURPOSE OF THIS DOCUMENT

The purpose of this document is to provide an overview of:

- energy consumption in London (a high-level inventory of energy use) during the period 1990 to 2020;
- associated greenhouse gas (GHG) emissions; and
- energy expenditures in London.

On April 23, 2019, the following was approved by Municipal Council with respect to climate change:

> *Therefore, a climate emergency be declared by the City of London for the purposes of naming, framing, and deepening our commitment to protecting our economy, our eco systems, and our community from climate change.*

This document is the measurement tool to highlight London's progress towards meeting its community energy reduction and GHG emission reduction targets along with other targets and directions.

Energy efficiency and conservation provides important opportunities to reduce costs. Most of the money spent on energy leaves London, but money spent on energy efficiency and conservation stays in London. It supports local businesses offering these products and services, while the resulting money saved from energy efficiency and conservation can then be used for more productive uses.

Many people benefit from the use of energy efficiency, renewable energy, and energy conservation products and services:

- Households can help the environment and typically save more money in the long run.
- Business owners and managers can reduce operating costs, become role models for corporate social responsibility, and position themselves with a competitive advantage.
- Students and teachers can benefit from learning about our current, unsustainable demand for energy and how energy conservation, energy efficiency and renewable energy technologies can help our environment and replace fossil fuels that are being depleted.
- Innovators can create new energy-efficient and renewable energy products and services, and become architects of change.

Many of these inventory reports have a similar look and feel by design. The data may change annually, but the rationale and dialogue remain similar. A complete listing of reports is found in Section 3.

The City of London also reports this information on an annual basis to CDP Cities and the Global Covenant of Mayors for Climate & Energy.

2 BACKGROUND

The City of London does not have direct control over how much energy is used in London, but it does have influence. The control over energy use in London rests primarily with citizens, visitors, employers, and employees. Individual and collective action with respect to sustainable energy use, energy management, and energy conservation is critical for our future.

London's 2014-2018 Community Energy Action Plan (CEAP) was approved by Council in July 2014. Within the 2014-2018 CEAP, listed under the subsection titled Reporting and Education about the Economic and Environmental Considerations of Energy Use, the highest priority actions for the City of London were to:

1. Provide Londoners with annual information on community energy use and GHG emissions.

2. Develop and report new energy-related performance indicators that highlight the total cost of energy and total money saved/generated from community energy actions.

3. Develop new tools to raise awareness on progress being made in London.

With the development of the new Climate Emergency Action Plan underway, the necessity to provide up-to-date information on London's progress towards its GHG emission reduction targets remains in place.

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

Land use and urban development – planning city growth sets the framework for how much energy is needed for a city to function. Mixed density balances the energy-efficiency of higher-density and social demand for living space. Mixed land use reduces the distance people and goods need to travel.

Urban design – urban design can either negate or enhance the energy efficiency benefits of good functional planning (mixed land use and mixed density). This includes design factors such as connectivity between city blocks, streetscape design, and street orientation.

Transportation – transportation planning accounts for the movement of people and goods. In an ideal world, you would minimize the interactions between the two. However, the reality is that a city's transportation network often must serve both needs at the same time. An energy-efficient transportation system is one that provides several competitive choices for the movement of people and goods.

Buildings – The design, construction, and maintenance of all building types (homes, office buildings, industrial buildings) has a significant impact on the energy consumed by that building. New buildings can be designed that approach net-zero energy use, but most London's buildings are old, inefficient designs that often have unseen problems with their insulation and draft-proofing. Building type can also affect energy use and associated emissions. Building energy modelling done for the London Energy Efficiency Partnership (LEEP) Project indicates the following:

- Single-family residential buildings (detached, semi-detached and row housing) require more energy for winter space (interior) heating than for summer space (interior) cooling;

- Conversely, commercial office buildings require more energy for summer space cooling than for winter space heating; and

- Multi-unit residential buildings generally have a balance between annual space heating and space cooling energy demand.

Personal choices and actions – Design and technology has its limits. For example, a programmable thermostat has no energy conservation benefit if its user does not program it. Social norms are a powerful influence on people's behaviour.

Local economy – the nature of the economic base will influence how much energy it will use. For some businesses, energy use is a minor cost. For others, energy bills can make the difference between profit and loss. For many local employers, there are opportunities for energy conservation, energy-efficiency, and renewable energy generation waiting to be developed.

Leadership – the words spoken, commitments made, and actions taken by leaders in the business, institutional, government and non-government sectors with respect to energy conservation, sustainable energy, reducing the use of fossil fuels, reducing GHG emissions and adapting to climate change.

Seasonal weather variations can affect energy use and associated emissions. London's climate is one that is dominated by the heating demand during cold weather months. On average, the heating season starts in late September and ends in May. With climate change, the energy demand for heating are expected to fall.

The energy demand for space cooling (i.e., air conditioning) in London is relatively small compared to space heating. However, on a hot summer day, a typical household's electricity demand will be three times greater than a cool summer day. This short term "peak demand" places strain on Ontario's electricity generation and supply system. With climate change, the energy demand for air conditioning is expected to increase.

3 PREVIOUS INVENTORY REPORTS

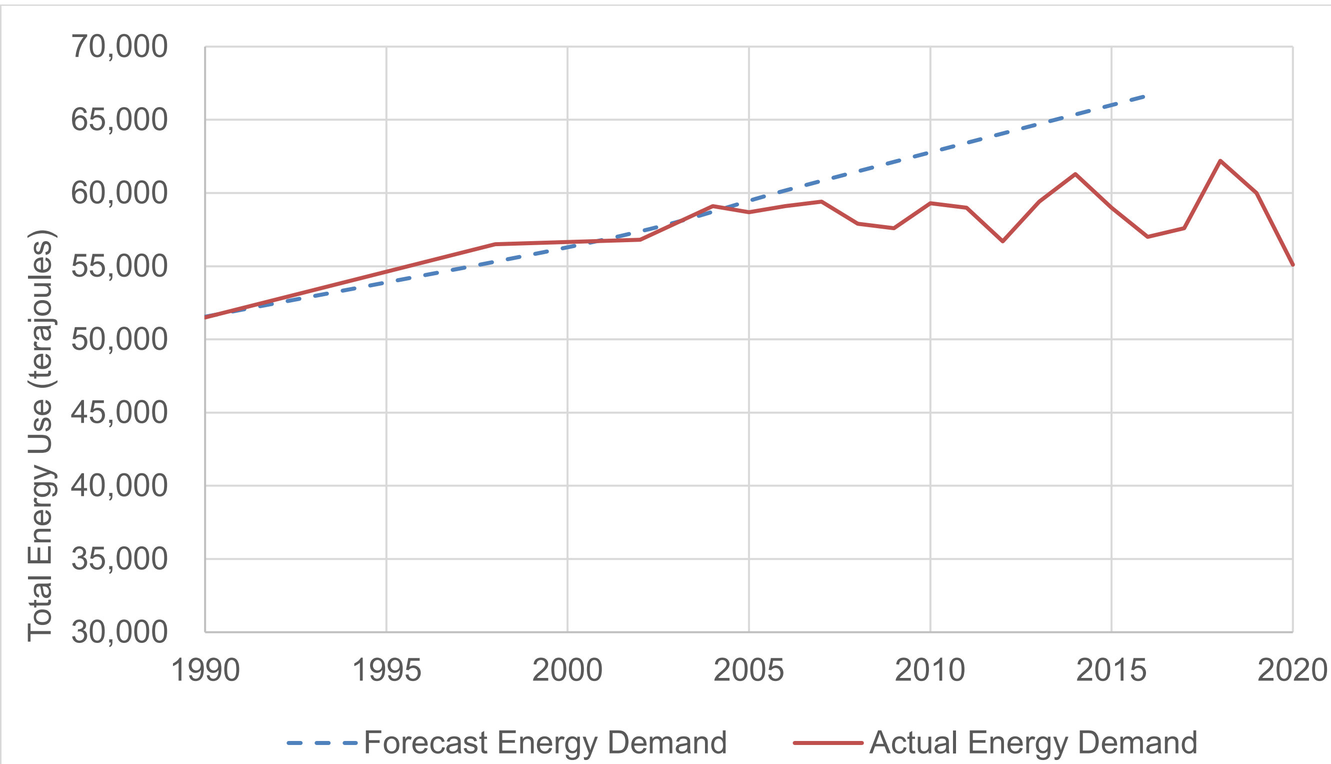
The following is a list of the previous energy inventory reports that have been prepared for London:

- *2019 Community Energy & Greenhouse Gas Inventory,* published on the City of London's Get Involved London website in December 2020.
- *2018 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in October 2019.
- *2017 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in August 2018.
- *2016 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in August 2017.
- *2015 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in June 2016.
- *2014 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in May 2015.
- *2013 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in July 2014.
- *2012 Community Energy & Greenhouse Gas Inventory: Challenges & Opportunities,* prepared by the City of London for the Civic Works Committee in October 2013.
- 2011 data was highlighted in the *Environmental Programs Update,* prepared for the Civic Works Committee meeting in May 2012.
- *2008 Energy Use Inventory Report,* prepared by the City of London for the Environment and Transportation Committee in July 2010.
- *2007 Energy Use Inventory Report,* prepared by the City of London for the Environment and Transportation Committee in May 2008.
- *2006 Energy Use Inventory Report,* prepared by the City of London for the Mayor's Sustainable Energy Council in November 2007.
- *1998 Air Emissions and Energy Use in the City of London*, prepared for the London Energy/Air Emissions Reduction Strategy Task Force in March 2000.
- *1990 City of London Air Emissions Study*, prepared by SENES Consultants in association with Proctor and Redfern Limited and Torrie Smith Associates for Vision '96 in September 1995.

4 COMMUNITY ENERGY USE INVENTORY

Total energy use in London in 2020 was 55,100 terajoules[1], seven per cent above 1990 levels, and six per cent below 2005 levels. As seen from Figure 1, since the mid 2000s, London's total energy use has dropped below the forecasted "business as usual" track forecasted in the 1990s. This illustrates the impact that energy conservation activities over the last 15 years have had decoupling energy use from growth.

Figure 1 - Comparison of Forecast vs. Actual Energy Demand for London



The COVID-19 pandemic had an impact on energy used in London, with overall total energy use in 2020 being eight per cent lower than 2019, as shown in Figure 1 above and Table 1 below.

The main impact was seen in transportation energy use, which was 20 per cent lower than 2019 overall. In particular, the local retail sales of gasoline and diesel at gas stations dropped by 21 per cent because of many London workplaces shifting to work from home as well as reduced discretionary trips associated with stay-at-home orders and similar restrictions.

Energy used by London's industrial, commercial, and institutional sector remained relatively unchanged in 2020. A six per cent decrease in electricity use was offset by a 14 increase in natural gas used in the industrial sector.

[1] a terajoule (or, one trillion joules) is a metric unit for measuring energy, and is approximately equivalent to the energy provided by burning 26,000 litres of gasoline (roughly the amount of gasoline in 500 cars)

Energy used in London’s single-family homes was down by four per cent overall. Electricity use in homes did increase by six per cent, due in part to shifting to work from home as well as warmer summer temperatures increasing the demand for air conditioning. However, natural gas use decreased by eight per cent due to warmer winter and autumn weather reducing the demand for space heating.

Table 1 – 1990-2020 Total Community Energy Use by Sector (Terajoules per Year)

Sector	1990	2005	2019	2020
Transportation	18,200	20,200	21,200	17,000
Residential	13,100	14,800	14,600	14,000
Industrial, Commercial & Institutional (IC&I)	20,200	23,800	24,200	24,100
Total	**51,500**	**58,700**	**60,000**	**55,100**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

London’s industrial, commercial, and institutional buildings and facilities accounted for 44 per cent of all energy used in London (Table 2). London Hydro and Enbridge include multi-unit residential buildings (apartment buildings and condominiums) under the category of commercial buildings. Transportation accounted for 31 per cent of all energy used in London, most of which is associated with personal vehicle use. Single family residential homes accounted for 25 per cent of all the energy used in London.

Table 2 – 1990-2019 Share of Community Energy Use by Sector

Sector	1990	2005	2019	2020
Transportation	35%	34%	35%	31%
Residential	25%	25%	24%	25%
Industrial, Commercial & Institutional (IC&I)	40%	40%	40%	44%

The community energy model developed by the Canadian Urban Institute for the Integrated Energy Mapping for Ontario Communities project, combined with latest provincial Broader Public Sector (BPS) energy data (2018 data), was used to estimate a more-detailed breakdown of energy use by building type, as shown in Table 3.

Table 3 – 2020 Estimated Breakdown of Energy Use by Subsector (Terajoules per Year)

Sector	Sub-sector	Energy Use
Transportation	Fuel sold at gas stations	11,900
Transportation	Road freight transport	3,100
Transportation	Corporate fleets	1,000
Transportation	London Transit	200
Transportation	Railway freight transport	500
Transportation	Domestic aviation	300
Residential	Low-density homes	11,700
Residential	Medium-density townhomes	2,400
Industrial, Commercial & Institutional	High-density residential buildings	1,600
Industrial, Commercial & Institutional	Commercial – office buildings	3,700
Industrial, Commercial & Institutional	Commercial – retail (e.g., malls)	6,300
Industrial, Commercial & Institutional	Industrial	8,000
Industrial, Commercial & Institutional	Institutional - schools	700
Industrial, Commercial & Institutional	Institutional - hospitals	1,200
Industrial, Commercial & Institutional	Institutional - colleges & universities	2,100
Industrial, Commercial & Institutional	Institutional - municipal	400
Industrial, Commercial & Institutional	Other	200

Over the 1990-2020 period, London's population has increased by 36 per cent. Energy use per person in London was 132 gigajoules (GJ) per year in 2020, down 21 per cent from 2007 and the 1990 baseline level as well (Table 4).

Table 4 – 1990-2020 per Person Energy Use by Sector (Gigajoules per person)

Sector	1990 (Pop. 307,000)	2005 (Pop. 349,000)	2020 (Pop. 417,000)	Change from 1990
Transportation	59	58	41	-31%
Residential	43	42	34	-21%
Industrial, Commercial & Institutional (IC&I)	66	68	58	-12%
Total	**168**	**168**	**132**	**-21%**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

Figure 2 – Change in Energy Use in London, Per Person by Sector Since 1990

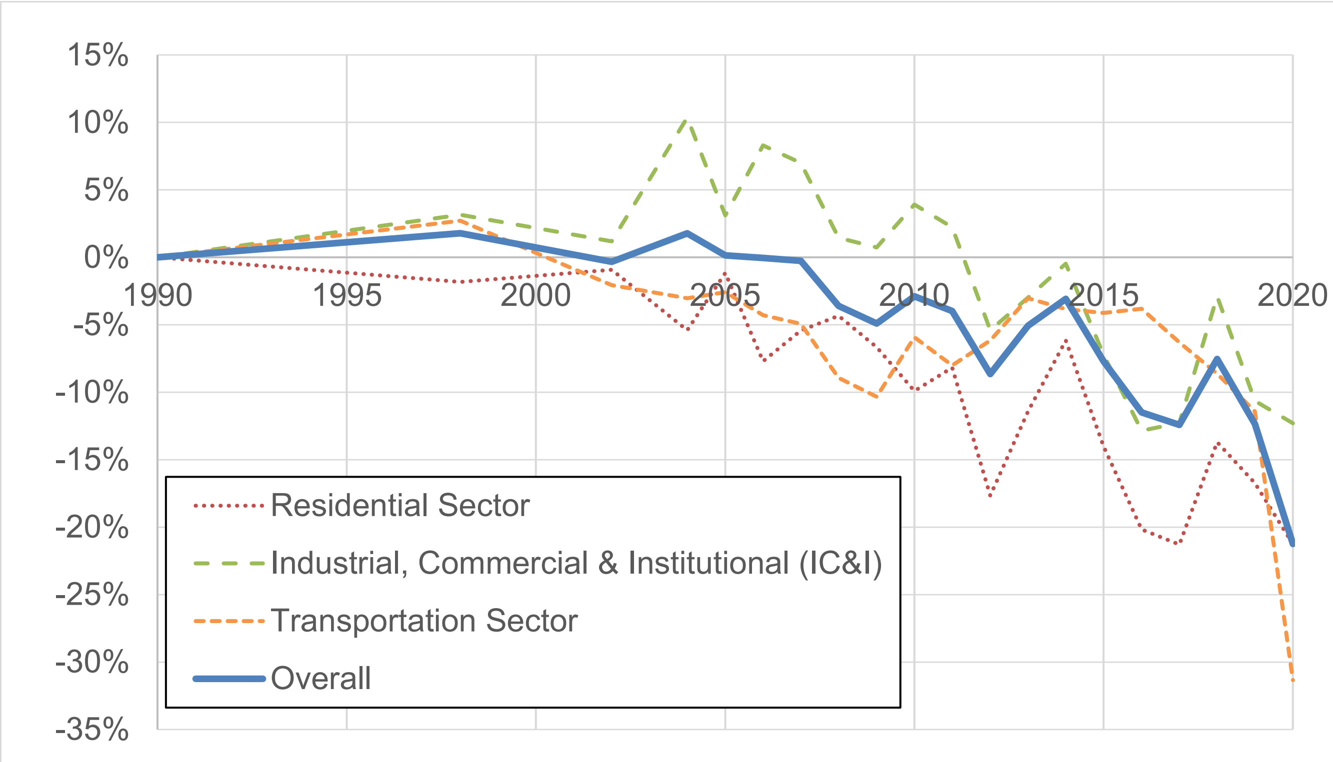


Figure 2 illustrates the change in energy consumption in London by sector on a per person basis, using 1990 as the baseline year. Overall, since the mid 2000s, the trend has been downwards, with the weather-related impacts of the “Winter that Wasn’t” of 2012 (very warm winter), the “Polar Vortex” of 2014 (very cold winter), and the combination of a colder winter and warmer summer in 2018 being clearly visible, especially for the residential sector. The major impact of the COVID-19 pandemic on transportation energy use in 2020 is also very apparent.

4.1 Transportation Energy Use

In the early 2010s, transportation energy use was increasing, with the volume of fuel sold in London increasing year-over-year between 2011 and 2016. However, this trend reversed in 2017 and the volume of fuel sold continued to drop through to 2019. This recent trend may not be driven by fuel prices since the average fuel prices at the pumps actually decreased by about 10 cents per litre between 2018 and 2019. Therefore, this could be due to a combination of fewer trips by car and improving vehicle fuel economy.

Registered Vehicles in London

The City started to track local vehicle registration data beginning with 2010 data to try and gain additional insight into transportation energy use.

Prior to COVID-19, vehicle ownership in London has grown by over four per cent every year on average between 2010 and 2019, much faster than London’s overall population growth. As of December 2019, there were almost 292,000 light-duty vehicles registered in London – an increase of almost 89,000 since 2010. When compared to Census data on Londoners between the age of 20 and 84, vehicle registration increased from 0.75 per person in 2010 to an estimated 0.94 per person in 2019.

However, as of December 2020, the number of light-duty vehicles registered in London dropped by six per cent down to just over 273,000 vehicles. This works out to about 0.86 vehicles per person aged 20 to 84.

The vehicle registration data is showing a mix of positive and negative trends.

On the positive side:

- fuel-efficient compact cars remain the most-popular vehicle segment in London.
- the number of hybrid and/or electric vehicles in London are almost six times higher in 2020 compared to 2010.
- There are now over 1,000 electric vehicles registered in London.
- 0.8% of new 2020 Model Year vehicles registered were electric vehicles and 3.9% were mild hybrid vehicles

On the negative side, high gas consumption sport utility vehicles and large pick-ups continue to gain in popularity as the relative number of minivans and mid-sized sedans decline.

Additional detail is provided in Table 5 below.

Table 5 – Vehicle Ownership Statistics for London

	2010	2020	Change
Total registered vehicles	202,800	273,300	35%
No. of adults 20-84 years old	271,000 (estimate)	317,000 (estimate)	17%
Vehicles per adult	0.75	0.86	15%
Hybrid gas-electric vehicles (excluding plug-in hybrids)	840	3,720	+ 2,880
Plug-in electric vehicles	0	1,020	+ 1,020
Fuel use per vehicle (GJ/year)	71	54	-24%
Average vehicle age	n/a	7 years (2014 models)	
Top five vehicle segments (share of vehicle registrations)	Compact car (22%) Mid-sized car (14%) Minivan (10%) Compact SUV 10%) Full-sized car (7%)	Compact car (23%) Compact SUV (22%) Mid-sized car (11%) Large pickup (9%) Intermediate SUV (8%)	

Transportation Data from Google's Environmental Insights Explorer

The City of London was amongst the first cohort of Canadian cities to participate in Google's Environmental Insights Explorer project. This project makes use of Google Maps data such as building shapes and mobility data (from tracking the movement of smart phones equipped with GPS) to estimate greenhouse gas emissions from cities.

There are some limitations to this data, in that not everyone travels with a smart phone on hand or with location services enabled on their phone. However, their transportation data has provided some useful insights, namely that trips to/from London have a large impact on emissions even through they are far fewer in number of trips.

The Environmental Insights Explorer tool has also provided data on 2020, which confirms the impact that COVID-19 has had on transportation. Table 6 summarizes the 2019 and 2020 transportation trip information for London from the Environmental Insights Explorer.

Table 6 – Total Trip Distance Travelled by Mode and Destination for 2019 and 2020

Travel Mode	Destination	2019 Total Trip Distance (km)	2020 Total Trip Distance (km)	Change
Automobile	Inbound	1,581,600,000	1,170,900,000	-26%
Automobile	Outbound	1,590,100,000	1,165,300,000	-27%
Automobile	In-Boundary	1,402,100,000	999,100,000	-29%
Cycling	In-Boundary	12,000,000	14,500,000	21%
Walking	In-Boundary	53,700,000	42,100,000	-22%
Transit	In-Boundary	56,200,000	39,100,000	-30%
VIA Rail	Inbound	30,600,000	n/a	n/a
VIA Rail	Outbound	32,100,000	n/a	n/a

Note that cycling was the only travel mode that saw an increase in distance travelled in 2020, with a 21 per cent increase in 2020. Increases in cycling was also seen in other Ontario cities with Environmental Insights Explorer data. This has been noted in cities world-wide, with the reduction of vehicle traffic on roads encouraging more people to use bicycles for transportation. Many North American reports and articles highlighted the increase in bicycle sales in 2020 including London, Ontario.

Trips made by walking were also down in 2020, which can be attributed primarily to the closure of schools, post-secondary education campuses, and workplaces during the COVID-19 pandemic.

This highlights the importance of City-led transportation initiatives such as rapid transit and the Cycling Master Plan. According to London's *Smart Moves 2030 Transportation Master Plan*, around 84 per cent of all personal trips made in London during the weekday afternoon peak period are made in personal vehicles, and most of these only have one occupant – the driver.

4.2 Energy Use and the Local Economy

Energy use per person related to the industrial, commercial, and institutional sector in 2020 was 12 per cent lower than 1990 and 18 per cent lower than 2007. London Hydro and Enbridge have also been increasing efforts to promote energy conservation and demand management with their business client base.

Another way to measure improvements in energy efficiency of the local economy is to compare it to Gross Domestic Product (GDP). According to the Conference Board of Canada, the COVID-19 pandemic reduced the greater London area's GDP by six per cent. However, most of this reduction is expected to be reversed once the COVID-19 pandemic has ended.

However, since 1990, London's GDP has grown significantly. Using statistics from the London Economic Development Corporation (LEDC) and the Conference Board of Canada, London's GDP (in constant 2012 dollars – i.e., excluding inflation) has grown by 63 per cent between 1990 and 2020.

Using these GDP estimates for 1990, London's energy productivity - GDP generated per unit energy used in London's employment sector - has improved by 37 per cent. Table 7 illustrates this in more detail. This means that local businesses are producing products and services more efficiently and/or moving towards producing products and services of higher value for the same amount of energy used.

Table 7 – 1990-2020 Energy Productivity of London's Employment (IC&I) Sector

	1990	1998	2007	2020
Gross Domestic Product ($ millions GDP[1])	$10,600[2]	$12,800[2]	$16,900	$17,300
Energy Used by IC&I Sector (Terajoules - TJ)	20,200	22,500	25,100	24,100
Energy Productivity ($GDP per Gigajoules - GJ)[3]	$524	$569	$675	$717
Improvement in Productivity Since 1990		9%	29%	37%
Average Annual Productivity Improvement		1.0%	2.0%	0.6%

A number of London's major employers have taken a leadership position on energy management, but there are still many opportunities to reduce energy use in the employment

1 – GDP data based on the London Census Metropolitan Area (includes St. Thomas & Strathroy), prorated by 77% based on population of London, and adjusted to constant 2012 dollars based on the Consumers Price Index (CPI) for Ontario
2 – Extrapolated from 2007 GDP data for London CMA based on changes to Ontario's real GDP for 1990 and 1998
3 – London's GDP divided by energy used in IC&I sector

sector, particularly amongst small-to-medium sized enterprises who may not have the human, financial, and/or technical resources to manage their energy use effectively.

4.3 Energy Commodities Used in London

The breakdown of energy use and GHG emissions by commodity is outlined in Table 8.

Natural gas was the largest source of energy used in London in 2020, accounting for 47 per cent of all energy used. Natural gas use decreased by one per cent from 2019. Gasoline was the second largest source of energy, accounting for 21 per cent of London's energy use. Total gasoline use decreased by 18 per cent from 2019. For transportation fuels, at least 90 per cent of all the gasoline sold in gas stations in London was ethanol blended gasoline (10% ethanol) according to Kent Marketing. Electricity accounted for 21 per cent of all the energy used in London. Electricity use decreased by two per cent from 2019.

Compared to 2019, the weather in 2020 had an overall warmer winter, cooler spring, warmer summer, and warmer autumn. Warmer summer weather increases the demand for electricity used for air conditioning, while warmer winter and autumn weather decreases the demand for natural gas used for heating.

For electricity, it is important to note that over 90 per cent of the electricity generated in Ontario comes from emissions-free sources. In 2020, as reported by the Independent Electricity System Operator (IESO), 60 per cent of Ontario's grid electricity was supplied by nuclear generating stations, while hydroelectric generating stations supplied 25 per cent and other renewable sources of electricity (wind, biomass, solar) provided nine per cent of our electricity needs. Natural gas-fired generating stations provided almost seven per cent of Ontario's supply.

Table 8 – 2020 Community Energy Use by Energy Commodity

Energy Commodity	Total Used	Energy (Terajoules)	Energy (%)
Natural Gas	697,000,000 m^3	25,900	47%
Gasoline[1]	328,900,000 L	11,400	20%
Electricity	3,162,000 MWh	11,400	21%
Diesel[1,2]	108,700,000 L	4,200	8%
Aviation fuel[2]	6,900,000 L	300	< 1%
Propane[1]	27,400,000 L	700	> 1%
Ethanol (blended into gasoline)	30,000,000 L	600	> 1%
Fuel Oil[1]	15,000,000 L	600	> 1%
	Total	**55,100**	

NOTE: due to rounding of numbers, individual numbers may not add up to the total

1 – includes some data prorated from Ontario consumption data provided by Statistics Canada; 2019 data

2 – aviation and freight fuel data prorated from Canada consumption data provided by Statistics Canada; 2020 data

However, one important concept that needs to be understood is thermal efficiency. Whenever any fuel is burned in an engine to create mechanical energy or used to make steam to spin a turbine to generate electricity, only a small portion of thermal energy ends up being converted to mechanical or electrical energy. The rest of the energy often ends up being lost as "waste heat". For example, the amount of thermal energy converted into power by steam-driven turbines in electricity generating stations is usually about 33 per cent, or in other words you need to use three units of heat energy to make one unit of electrical energy. The conversion rate is higher for combined cycle gas-fired power plants, which can reach about 50 per cent conversion of heat energy into electricity.

This is the same for internal combustion engines used in vehicles, which are about 35 per cent efficient when running in highway driving, and about 20 per cent efficient overall when you take into account the fuel wasted in city driving associated with waiting at stop lights and other situations where the engine idles. Replacing internal combustion vehicles with battery-powered electric vehicles is more efficient overall, even more so when sources like hydroelectricity are used.

When the thermal efficiency of converting heat into power in electricity generating stations is considered, a different picture of energy needs emerges, as seen in Table 9.

Table 9 – 2020 Energy Use in Electricity Generation Accounting for Thermal Efficiency

Source of Energy[1]	Energy (Terajoules)	Energy (%)
Uranium[2]	20,500	79%
Hydroelectric	2,900	11%
Natural Gas[3]	1,500	6%
Wind	910	4%
Solar[4]	60	0.2%
Biofuels[2]	90	0.4%
Total	**25,900**	

NOTE: due to rounding of numbers, individual numbers may not add up to the total

1 – Based on IESO 2019 annual electricity generation data from transmission-connected sources

2 – Assumed 33% thermal efficiency for generating electricity

3 – Assumed 50% thermal efficiency for generating electricity

4 – IESO data for solar only includes large transmission-connected solar farms. The Ontario Energy Board estimates that solar PV accounts for over 2% of power generation when smaller, local embedded generation is included

Table 9 helps illustrate the fact that electricity is not an energy resource, but the conversion of one form of energy (e.g., thermal energy in the case of nuclear and natural gas, gravitational potential energy in the case of hydroelectricity, kinetic energy in the case of wind) into electrical energy. In most cases, the remaining heat from large electricity generation plants is wasted. For London's electricity needs, 26,700 terajoules of energy resources were consumed to provide London with 11,600 terajoules of electricity – the remaining 15,100 terajoules of energy was waste heat that was not utilized. However, this table helps to illustrate that greater use of cogeneration (or combined heat and power) and non-fuel renewables (hydro, wind, solar) will help to reduce this waste. Note that there are other "losses" that occur in energy distribution, such as line losses from power transmission, which have not been quantified.

Table 10 outlines the trend in per person energy commodity use since 1990.

Table 10 – 1990-2020 per Person Energy Use by Energy Commodity (GJ per Person)

Energy Commodity	1990	2005	2020	Change from 1990
Natural Gas	67	69	62	-7%
Gasoline (including ethanol-blended gasoline)	41	40	29	-30%
Electricity	34	37	27	-21%
Diesel	13	13	10	-22%
Fuel Oil	7	4	1	-81%
Aviation fuel	3	2	1	-80%
Propane	2	2	2	-31%
Total	**168**	**168**	**132**	**-21%**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

5 ENERGY EXPENDITURES AND ENERGY GENERATION

5.1 ENERGY EXPENDITURES IN LONDON

Using information on utility billing rates and fuel price data from Kent Marketing, the total cost of energy use can be estimated. Note that these costs also include costs for the distribution and delivery of the energy commodity, as well as taxes on these commodities. A full description of the methodology is outlined in Appendix A (Section A.3).

Energy use and associated expenditures on energy are a significant operating cost for many businesses. In addition, for many Londoners, the rising costs of gasoline and electricity have put pressure on day-to-day household expenses, often requiring households to cut back on discretionary purchasing.

Understanding how much is collectively spent on energy, and the opportunities arising from energy conservation, is important for London. Table 11 outlines the total estimated costs associated with the energy commodities used in London.

Table 11 – Total Estimated Cost by Energy Commodity in 2020

Energy Commodity[1]	Cost ($ million)	Share (%)	Energy (terajoules)	Price per gigajoule
Gasoline (including ethanol-blends)	$367	27 %	12,000	$31
Electricity	$560	42 %	11,400	$49
Natural Gas	$285	21 %	25,900	$11
Diesel[1]	$97	7 %	4,200	$27
Propane	$24	2 %	700	$32
Fuel Oil	$16	1 %	600	$27
Total	**$ 1,346**		**54,500[1]**	**$24**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

1 – excludes diesel for railway freight transportation and aviation fuels

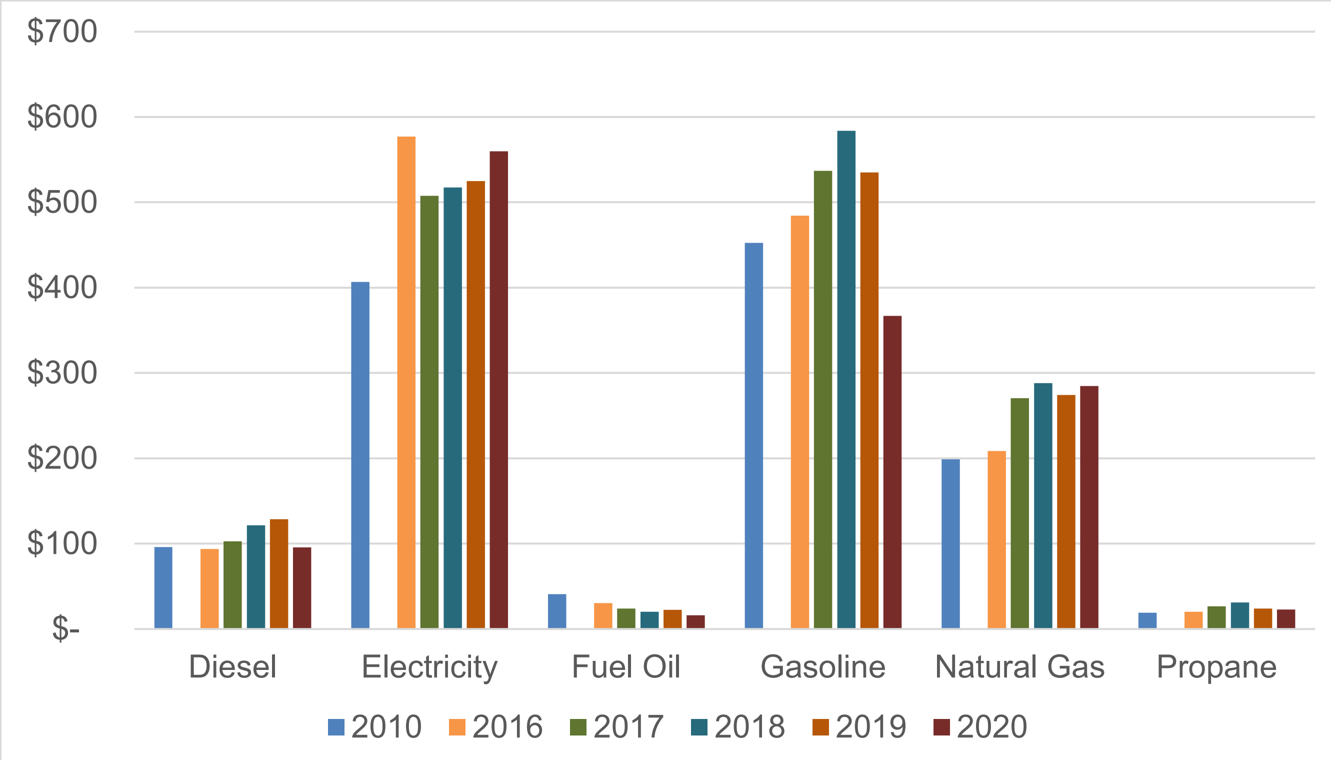
It is estimated that Londoners spent about $1.35 billion on energy in 2020, a decrease of 11 per cent from 2019.

As noted earlier, the work-from-home and stay-at-home orders due to COVID-19 reduced the demand for gasoline. As a result, the price for gasoline in 2020 decreased by 13 per cent. In total, Londoners spent about $170 million less on gasoline in 2020 than they did in 2019.

Electricity accounts for 42 per cent of total energy costs, due to electricity being the most expensive energy commodity used by Londoners.

Natural gas use accounts for only 21 per cent of energy costs, even though it is the largest source of energy we use, because of the low price of natural gas even with the $30 per tonne carbon price in place during 2020.

Figure 3 – Trend for Total Energy Commodity Costs (Millions) by Commodity in London



It is important to note that costs could have been higher. If 2010 is used as a baseline year in terms of energy use per capita, as noted in Figure 4, recent improvements in energy efficiency have created ongoing savings. In 2020, it is estimated that $380 million in energy costs were avoided through energy efficiency as well as the unique COVID-19-related reductions in transportation fuel use. Added up year-over-year, London has avoided over $1.3 billion in energy costs due to improved efficiency since 2010.

In recent years, every percentage that Londoners reduce their energy use results in around $13 million staying in London.

Information from utility billing rates and fuel price data can also be used to provide a reasonable estimate where the money is spent by Londoners on energy, as illustrated in Table 11. Out of the $1.35 billion spent on energy in 2020, it is estimated that 18 per cent of this money stayed in London, most of which goes towards London Hydro's and Enbridge's local operations. This is higher than previous years due to the impact of the COVID-19 pandemic. The rest leaves London. On average, from 2010 to 2019, between 85 per cent and 88 per cent of the annual expenditure on energy has left London's local economy.

With the drop in global oil commodity prices due to the COVID-19 pandemic related reductions in transportation fuel use, Western Canada's share of our energy dollars has dropped significantly. In 2014, Londoners and London businesses sent about $440 million of their energy dollars to Western Canada compared to about $180 million in 2020.

About $420 million of our energy dollars also goes to electricity generators in Ontario like Bruce Power and Ontario Power Generation, as well as Ontario's electricity transmitter, Hydro One.

Figure 4 – Trend for Total Energy Costs Compared to 2010 Energy Efficiency Baseline

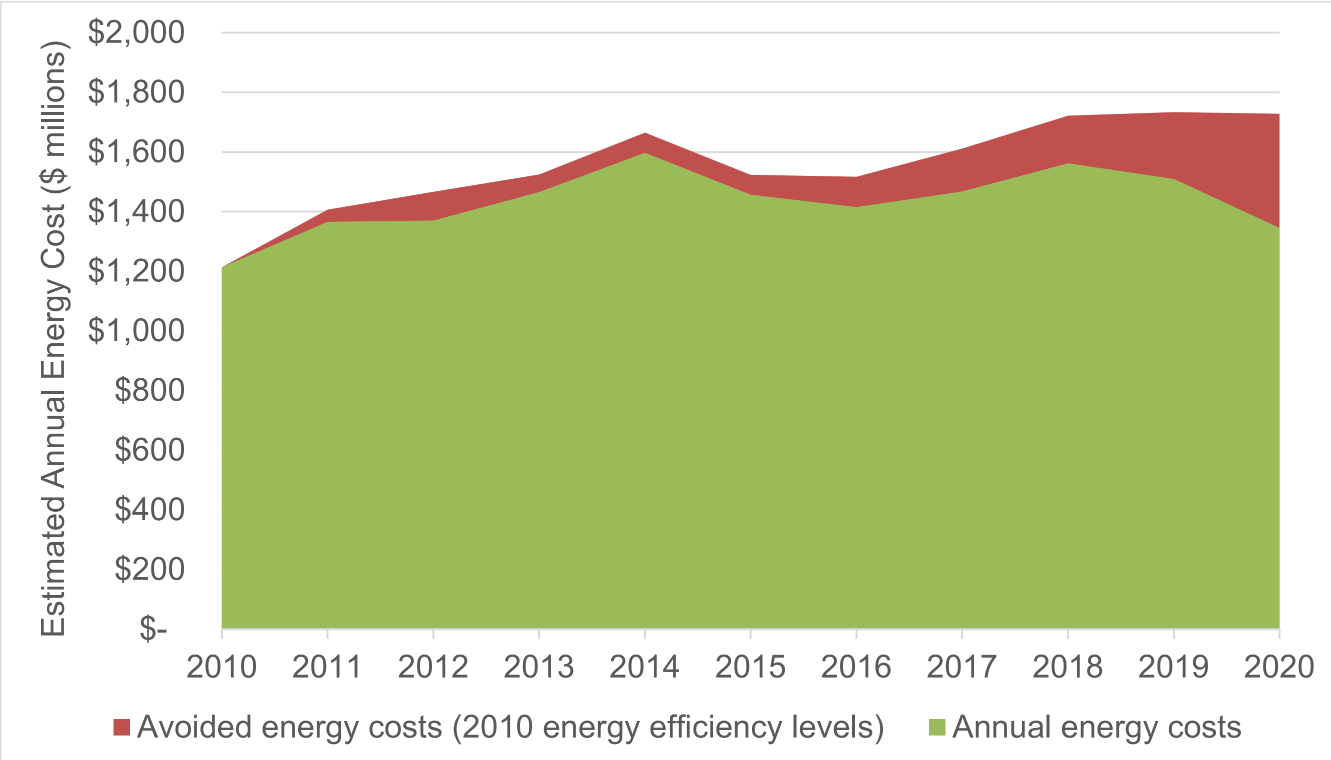


Table 11 – Estimated Share of Energy Revenue (2020)

Commodity	London Region	Ontario - Business	Ontario - Government	Western Canada	Canada - Government	United States
Diesel	>1%	2%	2%	2%	1%	-
Electricity	5%	31%	4%	-	1%	-
Fuel Oil	<1%	<1%	<1%	<1%	<1%	-
Gasoline	4%	6%	6%	8%	4%	-
Natural Gas	6%	3%	4%	3%	1%	4%
Propane	1%	1%	<1%	-	<1%	-
Total	**18%**	**43%**	**16%**	**13%**	**7%**	**4%**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

A portion of the money collected from federal and provincial taxes and other utility bill fees does help pay for other government services in London. For example, the City of London gets a portion of the gasoline tax to help pay for improvements to local transportation, other infrastructure, and environmental projects. Also, energy conservation incentives offered by utility companies are also funded through utility bills, as it is usually more economical to invest in conserving energy rather than it is to build new power plants.

The federal government also applies their carbon pollution pricing backstop in Ontario given that Ontario no longer has a carbon pricing system in place. Most of the funds collected by the backstop are used for the Climate Action Incentive provided when filing personal income tax returns, with the remaining used for funding federal climate action programs such as the Incentives for Zero-Emission Vehicles program. City staff estimate that about $65 million was collected through the carbon pricing backstop in 2020.

5.2 Energy Generation in London

London has almost 90 megawatts (MW) of local electricity generation capacity installed to date, an increase of about 1 megawatt from 2019. Currently, there is 68.3 megawatts of gas-fired co-generation, 17.9 megawatts of solar photovoltaic (PV), 2.85 megawatts of biogas, and 0.675 megawatts of hydro-electric power generation in operation in London.

Most of London's local generating capacity is associated with natural gas combined heat and power cogeneration plants, used in four different applications:

- **District energy** - London District Energy (38.7 MW) is a "merchant plant" that sells the power to the Independent Electricity System Operator and the thermal energy (steam for heating, chilled water for cooling) to buildings in central London. London District Energy has recently doubled its capacity to deliver combined heat and power at its Colborne Street facility.

- **Industrial** - Ingredion (14.1 MW) and Labatt Brewery (4.2 MW) generate steam as well as electricity "behind-the-meter" for use in their operations.

- **Hospital campus** – the London Health Sciences Centre (9.6 MW) Victoria Hospital campus generates both steam and electricity for hospital buildings, including the ability to keep the heat and power in the event of an emergency.

- **Micro-scale** – small scale combined heat and power systems (under 100 kilowatts) are in use at the Canada Games Aquatic Centre and H.B. Beal Secondary School for pool heating as well as electricity "behind-the-meter" for use in their operations.

6 TRANSLATING ENERGY USE INTO GREENHOUSE GAS IMPACT

6.1 GREENHOUSE GAS EMISSIONS FOR 2020

Energy use in London was responsible for almost 2.6 million tonnes of greenhouse gas (GHG) emissions (expressed in terms of equivalent carbon dioxide, or CO_2e) in 2020. Table 12 provides additional information on GHG emissions associated with the various sources of energy used in London.

Table 12 – 2020 GHG Emissions by Energy Commodity

Energy Commodity	Energy (Terajoules - TJ)	GHG Emissions (kilotonnes CO_2e)	GHG (%)	GHG Intensity (tonnes/TJ)
Natural Gas	25,900	1,320	51%	51
Gasoline (including ethanol)	12,000	760	29%	63
Diesel	4,200	300	11%	70
Electricity	11,400	100	4%	8
Aviation Fuel	300	20	1%	68
Propane	700	40	2%	60
Fuel Oil	600	40	2%	70
Total	**55,100**	**2,570**		

NOTE: due to rounding of numbers, individual numbers may not add up to the total

Energy use is responsible for 95 per cent of all GHG emissions from human activity in London. Not only does burning fossil fuels such as gasoline, diesel, and natural gas produce carbon dioxide – the most common GHG associated with human activity – but the use of electricity also contributes to GHG emissions.

Over 90 per cent of Ontario's electricity was generated from emissions-free sources in 2020, such as nuclear and hydro-electric generating stations as well as renewable sources (wind and solar). However, as reported by the Independent Electricity System Operator, Ontario still relies on fossil fuels such as natural gas to generate almost seven per cent of the electricity we use. In 2020, it is estimated that every 1,000 kilowatt-hours of electricity generated in Ontario produced about 30 kilograms of carbon dioxide emissions. This is ten times better than it was 16 years ago (2003), when electricity generated in Ontario produced around 300 kilograms of carbon dioxide emissions.

The remaining five per cent 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.

The City of London currently has the following GHG reduction targets:

- a 15% reduction from 1990 levels by 2020,
- a 37% reduction from 1990 levels by 2030, and
- net-zero emissions 2050.

In April 2021, the federal government revised its 2030 target to aim for a 40 to 45 per cent reduction in GHG emissions from 2005 levels as well as net-zero emissions by 2050. To date, the provincial government has not revised its 2030 target for a 30 per cent reduction from 2005 levels and has not established an emission reduction target beyond 2030.

In 2020, total GHG emissions were estimated to be 2.72 million tonnes of equivalent carbon dioxide, or 22 per cent lower than the 1990 level. This is well below the 15 per cent reduction target set for 2020. However, it is important to note the extraordinary impact of the COVID-19 pandemic on emissions.

As mentioned earlier, the COVID-19 pandemic had a significant impact on transportation fuel use, with an associated 20 per cent drop in transportation GHG emissions between 2019 and 2020. Warmer weather in the winter and autumn also reduced the demand for natural gas used for heating, with an associated seven per cent drop in residential GHG emissions between 2019 and 2020.

Seasonal weather variations can affect energy use and associated emissions significantly. However, over the last ten years, winter average temperatures and most summer average temperatures have been warmer than normal (as defined by Environment Canada's 1971-2000 climate data for London - see Appendix B).

Figure 5 illustrates the total GHG emission trend since 1990 in comparison to the targets used for London, for Ontario, and for Canada (with the minimum 40 per cent reduction target shown in the chart). The increase in GHG emissions began to stabilize around 2002 after a continued climb from 1990. Since 2005 there has been a downward trend driven by a combination of cleaner electricity generation and improved energy efficiency.

Figure 5 - Targets vs. Actual GHG Emissions from London

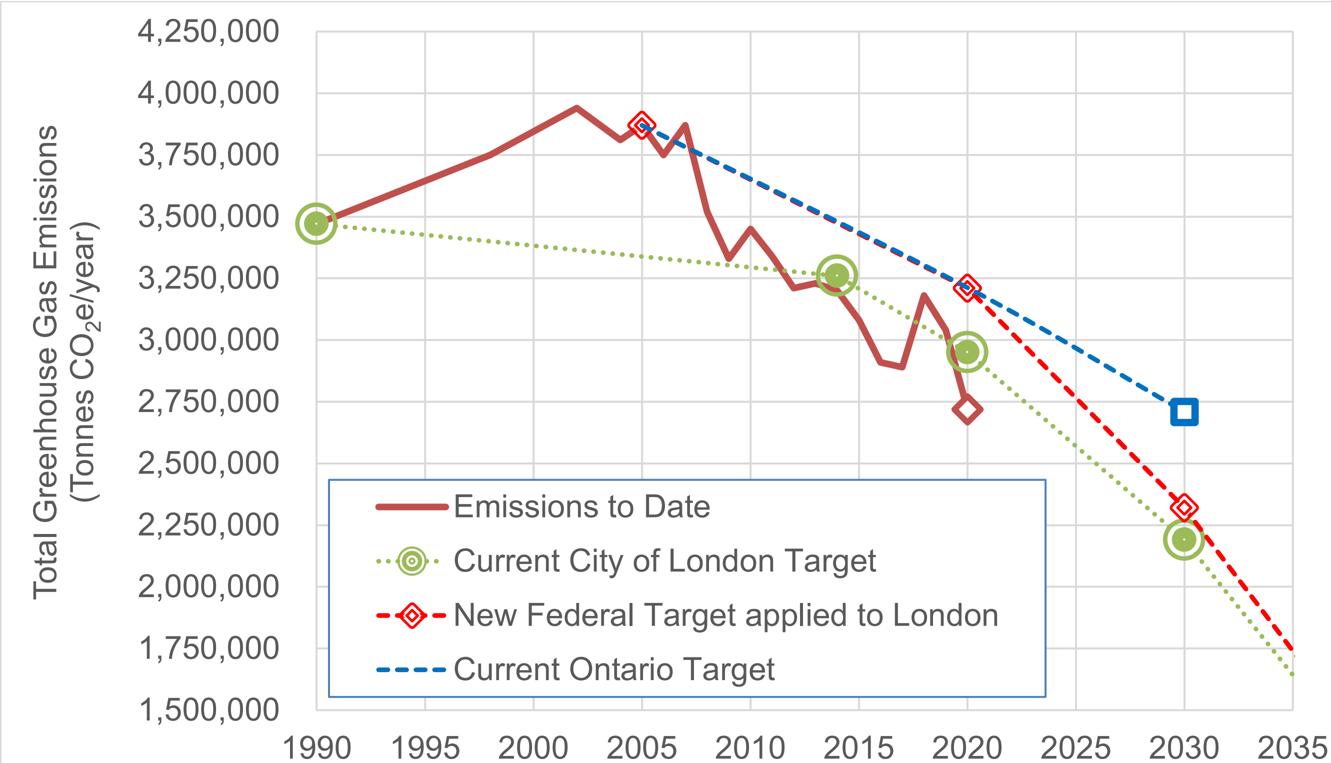


Table 13 illustrates the GHG emission trends by sector, including landfill gas emissions. As seen in Table 13, transportation and the industrial, commercial, and institutional sectors have the greatest contribution.

Table 13 – 1990-2020 Community GHG Inventory in London (kilotonnes CO_2e per year)

Sector	1990	2005	2020
Transportation	1,290	1,400	1,100
Residential	730	850	540
Industrial, Commercial & Institutional	1,120	1,380	940
Landfill Gas Emissions & Sewage Incineration	300	240	150
Total	**3,440**	**3,870**	**2,720**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

The community energy model developed by the Canadian Urban Institute for the Integrated Energy Mapping for Ontario Communities project, combined with provincial Broader Public Sector (BPS) energy data, was used to estimate a more-detailed breakdown of GHG emissions by building type, as shown in Table 14.

Table 14 – 2020 Breakdown of GHG Emissions by Subsector

Sector	Sub-sector	GHG Emissions (kilotonnes/year)
Transportation	Fuel sold at gas stations	740
Transportation	Road freight transport	220
Transportation	Corporate fleets	60
Transportation	London Transit	20
Transportation	Railway freight transport	40
Transportation	Domestic aviation	20
Residential	Low-density homes	460
Residential	Medium-density townhomes	80
Industrial, Commercial & Institutional	High-density residential buildings	50
Industrial, Commercial & Institutional	Commercial – office buildings	160
Industrial, Commercial & Institutional	Commercial – retail & warehouses	250
Industrial, Commercial & Institutional	Industrial	310
Industrial, Commercial & Institutional	Institutional - schools	20
Industrial, Commercial & Institutional	Institutional - hospitals	50
Industrial, Commercial & Institutional	Institutional - colleges & universities	80
Industrial, Commercial & Institutional	Institutional - municipal energy use	10
Waste Management	W12A Landfill	90
Waste Management	Closed landfills	30
Waste Management	IC&I waste disposed outside London	20
Wastewater Treatment	Sewage sludge incineration	10

In terms of per person emissions, as illustrated in Table 15 and Figure 6, emissions today are 42 per cent lower than they were back in 1990 (11.3 tonnes per person in 1990 versus 6.5 tonnes per person in 2020).

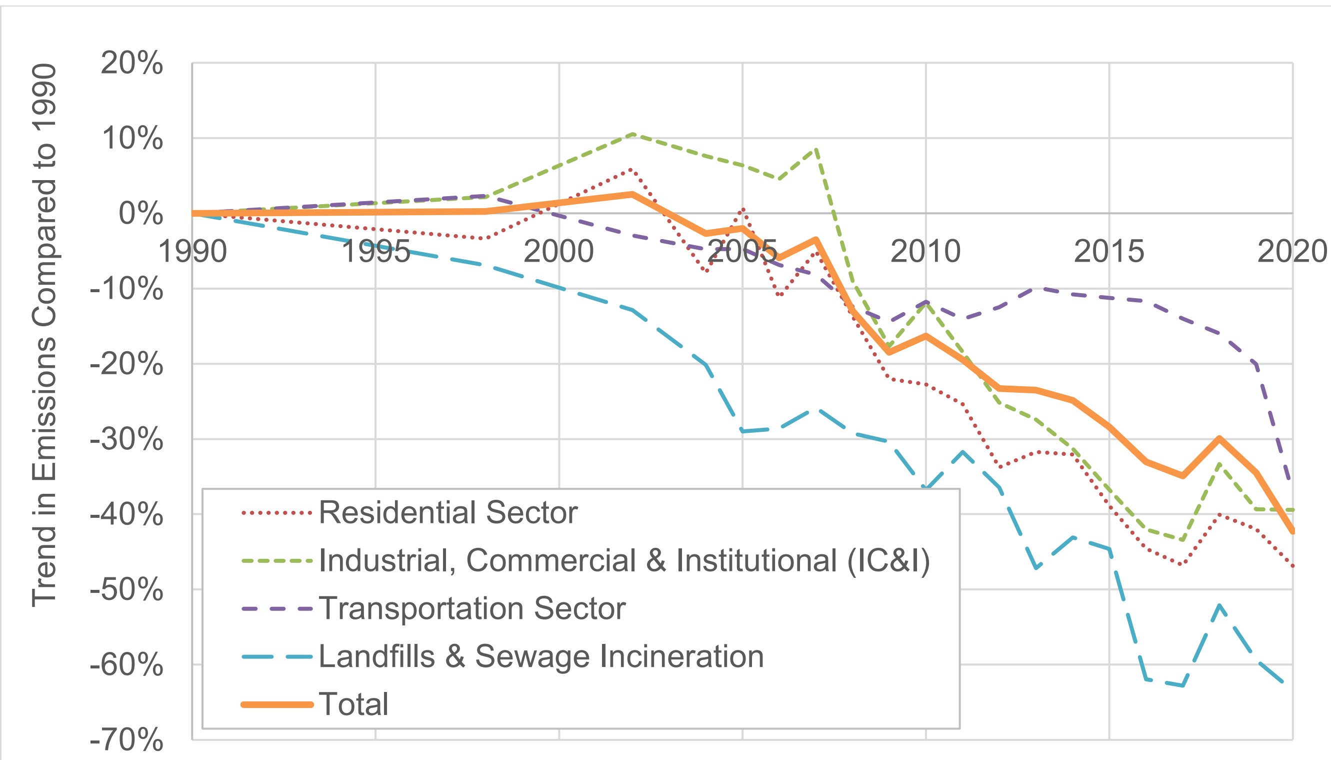
This reduction in GHG emissions has been created by a reduced GHG intensity for Ontario’s electricity grid, improved home energy efficiency, reduced energy use in the business sector, and the City of London landfill gas collection and flaring system at the W12A Landfill. Transportation emissions are also lower due to improved fuel efficiency, the use of ethanol-blended gasoline (10% ethanol by volume) as well as vehicle tailpipe emission controls that have reduced emissions of nitrous oxide.

Table 15 – 1990-2020 per Person GHG Inventory in London (tonnes per person)

Sector	1990 (Pop. 307,000)	2005 (Pop. 349,000)	2020 (Pop. 417,000)	Change from 1990
Transportation	4.2	4.0	2.6	-37%
Residential	2.4	2.4	1.3	-47%
Industrial, Commercial & Institutional	3.6	3.9	2.2	-39%
Landfill Gas Emissions & Sewage Incineration	1.0	0.7	0.4	-63%
Total	**11.2**	**11.1**	**6.5**	**-42%**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

Figure 6 – Change in GHG Emissions in London, Per Person by Sector, Since 1990



It is important to note these GHG emission estimates do not include emissions (indirect emissions) associated with the extraction, production, and transportation of materials, fuels, food, and consumer products (e.g., emissions from produce grown and transported from California, consumer products made and transported from China.) This is consistent with the approach taken by other Canadian cities reporting GHG emissions through the Partners for Climate Protection program. However, it is important to recognize the fact that the production and transportation of the consumer goods purchased do have an environmental impact, and that some types of goods (e.g., meat and dairy products) do have a larger impact than others. Additional information on consumption-related household GHG emissions are provided in Section 7 – Household Energy Use and Emissions.

6.2 Publicly Reported Local Emitters

In 2019, the provincial government required facilities that emit more than 10,000 tonnes of greenhouse gases to report their emissions on an annual basis. In London, there are eight facilities that have reported their emissions, including Fanshawe College who report voluntarily, as shown in Table 16. Note that these are direct emissions only, and do not include emissions associated with electricity use or vehicle fuel use.

The district heating steam plant at Western University provides heat for buildings on the Western University campus as well as the neighbouring London Health Sciences Centre University Hospital. In the case of London District Energy, these emissions are associated with providing steam heating and chilled water to buildings, as well as generating electricity. Many building owners served by London District Energy, including the City of London and St. Joseph's Health Care, include their share of these emissions within their energy and GHG reporting.

It is important to note that these "large emitters" only accounted for 15 per cent of London's total GHG emissions.

Table 16 – Annual GHG Emissions from Reporting Facilities (tonnes CO_2e per year)

Reporting Facility	2010	2013	2019
Fanshawe College of Applied Arts and Technology	3,143	2,924	3,007
3M Canada	N/A	N/A	10,316
Ingredion Canada Incorporated	124,320	115,988	126,752
Labatt Breweries of Canada LP	26,594	27,503	29,335
London Health Sciences Centre (Victoria Campus)	37,108	41,707	51,874
Western University (steam plant)	51,364	47,322	54,163
London District Energy	39,844	44,622	34,476
Great Lakes Copper	N/A	N/A	12,581
Kaiser Aluminum	N/A	N/A	16,566
W12A Landfill – Corporation of the City of London	160,430	106,349	102,025
Greenway Pollution Control Centre – Corporation of the City of London	N/A	N/A	12,653
Total	**442,803**	**386,415**	**453,748**
Percentage of total emissions from London	**13%**	**12%**	**15%**

The institutional sector – municipal government, colleges and universities, schools, hospitals – is also required to report its energy use and associated GHG emissions to the Province of Ontario through Ontario Regulation 397/11. These emissions will be for the organization as a whole, not just one specific facility or building. Table 17 summarizes the data reported for 2018, the most recent information available from the provincial government. Note that this information will include emissions from electricity use but does not include emissions from vehicle fuels. Also, in the case of the City of London, the province's reporting requirements do not require electricity use for street lighting and sports field lighting to be reported.

Table 17 – Ontario Regulation 397/11 Reporting Organizations in London

Reporting Organization (based on building electricity and fuel use)	Annual GHG Emissions 2018 (tonnes CO_2e)
University of Western Ontario	56,095
London Health Sciences Centre	49,876
Thames Valley District School Board	14,283
St. Joseph's Health Care London	14,210
City of London	10,548
Fanshawe College	5,144
London District Catholic School Board	9,005
Conseil scolaire de district des écoles catholiques du Sud-Ouest	447
County of Middlesex (buildings in London)	564
Conseil scolaire de district du Viamonde	273
Municipality of Thames Centre (building in London)	5
Boreal College	4
total	**160,456**
Percentage of industrial, commercial, and institutional emissions	**16%**
Percentage of total emissions from London	**5%**

7 HOUSEHOLD ENERGY USE AND EMISSIONS

Providing estimates of energy use and greenhouse gas emissions for an average household in London provides a clearer understanding the current situation (i.e., what to focus efforts on) and identify opportunities for improvements. These estimates can be made using the following assumptions:

- For electricity and natural gas, divide the total residential customer energy use by the number of customers
- For gasoline, divide the total retail sales of gasoline by the number of households in London
- For propane, divide the estimated total residential use of propane by the number of households in London

Electricity and natural gas use can be broken down further based on provincial data on typical energy use breakdown in Ontario homes.

Greenhouse gas emissions from organic waste in curbside waste can be estimated by dividing the annual GHG emissions from the W12A Landfill by the number of households in London.

Note that these estimates best reflect those Londoners who live in single-family homes.

Table 18 – Estimated Average Household Energy Use and Emissions in London for 2020

Household Activity	Average Monthly Use over the Year	Average Monthly Cost over the Year	Average Annual Cost	Average Annual GHG Emissions (tonnes CO_2e)
Gasoline use (vehicles)	169 litres	\$173	\$2,070	4.3
Natural gas use	172 m^3	\$71	\$850	3.9
Home heating		*\$55*	*\$660*	*3.0*
Hot water heating		*\$16*	*\$190*	*0.9*
Electricity use	680 kWh	\$122	\$1,470	0.25
Air conditioning		*\$16*	*\$190*	*0.03*
Appliance & plug load		*\$39*	*\$470*	*0.08*
Lighting		*\$12*	*\$140*	*0.02*
HVAC fan motor		*\$55*	*\$660*	*0.11*
Propane use	6 litres	\$11	\$120	0.1
Food waste in garbage		n/a	n/a	0.7
Total		**\$377**	**\$4,520**	**9.3**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

7.1 Consumption (Scope 3) Greenhouse Gas Emissions

As noted earlier, it is important to recognize the fact that the production and transportation of the consumer goods we purchase do have an environmental impact, and that some types of goods (e.g., meat and dairy products) do have a larger impact than others. At this point in time, there is no easy-to-use methodology to estimate this at the community-wide scale.

However, with the information contained within the Environmental Commissioner of Ontario report, *Climate Pollution: Reducing My Footprint*, that report's estimates of consumption-related GHG emissions per person for Ontario residents can be compared to the GHG emissions from the direct use of energy and from waste shown in Table 18.

Table 19 – Estimated Average Household Consumption-Relation GHG Emissions in London

Household activity or purchases	Average Annual Lifecycle GHG Emissions (tonnes CO_2e per household)
Air travel – domestic	0.4
Air travel – international	2.7
Food – beef (e.g., enteric fermentation, processing, transportation)	1.1
Food – other (e.g., fertilizer, farm fuel use, processing, transportation)	2.0
Home – raw material extraction & processing, home construction	0.7
Home – natural gas extraction & processing, pipeline transportation	1.2
Other purchased goods & services (e.g., clothing, electronics, internet)	7.0
Vehicle – raw material extraction & processing, parts manufacturing & assembly	1.6
Vehicle fuel – oil extraction, fuel refining, pipeline transportation	1.0
Total Consumption (Scope 3) Emissions	**17.7**

As can be seen from Table 18 and Table 19, greenhouse gas emissions associated with the manufacturing and delivery of the goods purchased by the average household is larger than the emissions from the direct use of energy and from waste. This highlights the importance climate change mitigation of several environmental initiatives such as:

- Food waste reduction
- Buying durable products
- Buying local products
- Recycling and the circular economy (end-of-product-life material recovery and reuse)
- Repurposing and renovating existing buildings

8 SUMMARY AND CONCLUSIONS

8.1 ENERGY USE

The impact of the COVID-19 pandemic on transportation energy use was significant, which was 20 per cent lower 2019 overall. In particular:

- the local retail sales of gasoline and diesel at gas stations dropped by 21% because of many London workplaces shifting to work from home as well as reduced discretionary trips associated with stay-at-home orders and similar restrictions.

- Londoners took the opportunity provided by quieter roads to use their bikes for trips, with the estimated total distance of trips taken by bike in London increasing by 20% in 2020.

- The number vehicles registered in London in 2020 decreased by 6%.

It is anticipated that the shift to working-from-home will remain in place at London's workplaces after the COVID-19 pandemic is over, although this is not likely to be a full-time shift for everybody. It is also anticipated that the interest in cycling for transportation will continue to grow.

Residential (single-family home) energy efficiency has seen improvement, driven by energy conservation programs such as the former federal and provincial home energy audit and retrofit programs, along with utility conservation and demand management programs. New home construction in London has seen energy efficiency improvements driven by voluntary participation in efficiency programs such as Energy Star New Homes, as well as the 2012 Ontario Building Code.

Over the last ten years, energy efficiency for London's industrial, commercial, and institutional sector has been improving. London has many examples of local employers who have acted on energy efficiency and conservation.

In summary, specific highlights of recent community energy use progress and longer-term trends, include:

- The total amount of energy used in London in 2020 was 55,100 terajoules. This is an 8% decrease from the previous year (2019).

- Londoners are using energy more efficiently – on a per person basis, Londoners and London businesses used 21% less energy overall in 2020 than used in 1990.

- London is producing more goods and services for every unit of energy used – on a dollar gross domestic product (GDP adjusted for inflation) per unit energy basis, London's industrial, commercial, and institutional sector improved the value of goods and services produced per unit of energy used by 37% between 1990 and 2020.

- About $1.35 billion was spent by Londoners and London businesses on energy in 2020. Over 80% of this money left London.

- London is spending less money on energy – improvements in energy efficiency compared to 2010 levels of efficiency (on a per person basis and applied to activity in 2019) avoided about $380 million in energy costs had there been no improvements.

Vehicle ownership in London has grown by 35 per cent since 2010, or over double the pace that London's population has grown. The number of "green" vehicles in London (i.e., hybrids and electric vehicles) is over five times higher than it was in 2010. There are now over 1,000 electric vehicles registered in London. However, the number of "gas guzzling" SUVs and pick-up trucks in London has also increased.

8.2 Opportunities for London

Out of the $1.35 billion spent on energy in 2020, it is estimated that about 18 per cent of this money stayed in London. London would benefit from keeping more of its money in London. Every percentage that Londoners reduce their energy use results in approximately $13 million staying in London.

For example, the average household in London, living in a single-family home, spent about $380 every month on energy in 2020. This is about $70 a month lower than 2019, most of this due to reduced vehicle use associated with working from home as well as stay-at-home orders.

Money saved through energy efficiency and conservation can be used for other purposes, whether that's paying down debts faster or purchasing other goods and services (or a combination of both). Also, investing in energy saving retrofits, local sustainable energy projects and local energy production creates local jobs.

8.3 Greenhouse Gas Emissions

From a GHG reduction perspective, credit should be given to the previous Government of Ontario for following through in its plans to replace coal-fired power generation plants with cleaner sources, such as nuclear, hydroelectric, natural gas, and renewables, as well as encouraging electricity conservation. GHG emissions from the province's electricity grid are now 90 per cent lower than they were ten years ago.

The reductions in energy use noted above are also a contributor to London's significant reductions in GHG emissions. Federal vehicle emission standards and provincial ethanol in gasoline requirements have also helped to reduce transportation GHG emissions. Finally, the City of London's landfill gas collection and flaring system represents the largest source of GHG emissions reduction directly under municipal government control.

In summary: the use of energy in London has had the following GHG impacts:

- Total GHG emissions in 2020 were about 2.7 million tonnes of equivalent carbon dioxide – the top three sources in 2020 were personal vehicles (27%), single-family homes (20%), and commercial buildings (17%).

- London's total GHG emissions in 2020 were 22% below 1990 levels – an 11% decrease from the previous year due to the impact of COVID-19 in transportation energy use as well as a warmer winter and autumn.

- London met and exceeded its 2020 goal to reach 15% reduction from 1990 levels.

- Londoners' per-person GHG emissions are significantly lower – on a per person basis, Londoners and London businesses released 42% fewer GHG emissions in 2020 than they did in 1990.

In terms of household GHG emissions, the average household emitted 9.3 tonnes per year. As with cost, about half (47%) of this came from burning gasoline. Natural gas used for space heating and water heating accounted for 42 per cent of emissions. Organic waste in the landfill accounted for about seven per cent. Given Ontario's clean electricity grid, using electricity in the home only accounts for two per cent of household GHG emissions.

Whether emissions continue to decrease depends upon the impact of energy and fuel conservation efforts, provincial and federal climate change policies, climate trends, economic growth, and consumer choices. It is also important to note that these actions also contribute to reductions in air pollution emissions (e.g., nitrogen oxides, volatile organic compounds) from fossil fuel use.

The quantification of GHG emissions from the consumption of goods and services used by Londoners and London's employers is a growing area of interest for the City of London. Almost all these GHG emissions occur outside London. For consumer goods, most of these emissions occur outside of Canada. However, Londoners and London's employers can influence these emissions by the choices made regarding the goods and services they use.

APPENDIX A - METHODOLOGY

This document builds upon two foundational energy use and GHG emissions inventories that have been developed for London and related data, specifically:

- The 1995 *City of London Air Emissions Study*, prepared by SENES Consultants in association with Proctor & Redfern Limited and Torrie Smith Associates. It provided the baseline inventory for the community (1990) and municipal operations (1992).

- The London Energy/Air Emissions Reduction Strategy Task Force report in March 2000 titled *Air Emissions and Energy Use in the City of London.* This report revised the baseline 1990 community inventory and provided an update to the community inventory using 1998 data. It also provided an emissions and energy use business-as-usual forecast for 2001, 2006, 2012, and 2016.

Since 2003, City of London (Environmental Programs) staff has maintained and updated the community energy use and GHG emissions inventory on an annual basis.

The methodology employed is consistent with the GHG emission inventory protocol provided by ICLEI Canada for participants in the Federation of Canadian Municipalities' Partners for Climate Protection (PCP) program. The *2012 Community Energy & Greenhouse Gas Inventory: Challenges & Opportunities* report was reviewed by ICLEI and FCM staff as part of the City of London's Milestone 5 recognition for the PCP program.

The GHG inventory includes Scope 1 and Scope 2 emission sources, plus those Scope 3 emission sources required by the Global Covenant of Mayors:

- Scope 1 - GHG emissions from fuel use and landfills within the boundary of the city

- Scope 2 - Indirect GHG emissions that occur outside of the city boundary because of electricity consumption within the city

- Scope 3 - Other indirect emissions that occur outside of the city boundary because of activity within the city:
    - solid waste disposal (IC&I waste disposed in landfills outside London)
    - domestic aviation
    - railways

The remaining Scope 3 emissions, other indirect emissions and embodied emissions that occur outside of the city boundary because of activities of the city, are not included in the inventory, such as:

- marine transportation of goods
- embodied emissions upstream of power plants
- embodied emissions in fuels
- embodied emissions in imported construction materials
- embodied emissions in imported goods
- embodied emissions in imported food

A.1. COMMUNITY INVENTORY DATA COLLECTION

Data for the community inventory is available for 1990, 1998, 2002, and 2004-2020 unless otherwise noted below. The inventory information used for the residential sector is based on the following:

- Annual electricity use data was provided by London Hydro. Note that this excludes multi-unit residential buildings, which are considered to be commercial accounts by London Hydro.
- Annual natural gas use data was provided by Union Gas. Note that this excludes multi-unit residential buildings, which are considered to be commercial accounts by Union Gas.
- Other home heating fuel data (e.g., propane, fuel oil) was obtained from Statistics Canada end-use energy data for Ontario prorated by population to estimate use within London. Note that the latest information is from 2019.

The inventory information used for the business and institutional sector is based on the following:

- Annual electricity use was provided by London Hydro. Note that this includes General Service < 50 kW , General Service > 50 kW , Large Users > 5000 kW, Users with Embedded Services (e.g., co-generation plants), sentinel lights, and street lighting.
- Annual natural gas use was provided by Union Gas. Note that this includes industrial, commercial, and institutional accounts.
- Other fuel data (e.g., fuel oil, kerosene) developed from Statistics Canada end-use data for Ontario prorated by population to estimate use within London. Note that the latest information is from 2019.

The inventory information used for the transportation sector is based on the following:

- Annual retail transportation fuel sales data for gasoline, ethanol-blended gasoline (E10) and diesel was provided by Kent Group. Given that London is a self-contained urban area, it is assumed that all transportation fuel used by London residents and businesses are purchased within London. This information has the benefit of being current (2020 data).
- Diesel use for public transit was provided by London Transit.
- Diesel use for road freight transportation was estimated using national-level 2020 data from Statistics Canada, prorated by population, to provide estimates that reflected the impact of the COVID-19 pandemic on road freight transportation.
- Diesel used for railways was developed from Statistics Canada energy end-use data for Ontario prorated by population to estimate use within London. Note that the latest information is from 2019.
- Community non-retail (i.e., commercial and other institutional) transportation fuel data developed from Statistics Canada end-use energy data for Ontario prorated by

population to estimate use within London. Propane identified as being used in the commercial and industrial sector is assumed to be used as transportation fuel only. Note that the latest information is from 2019.

- Aviation fuel use was estimated using national-level 2020 data from Statistics Canada, prorated by population, to provide estimates that reflected the impact of the COVID-19 pandemic on air travel.

The inventory information used for landfills is based on the following:

- Annual waste quantities placed within the landfills for each calendar year.
- For the W12A landfill, the emission reductions associated with the landfill gas collection and flaring system are based on continuously measured landfill gas flow rate and methane concentration at the landfill flare.
- The global warming potential of methane of 25, as per the Intergovernmental Panel on Climate Change's *Fourth Assessment Report* and used by the federal government in its GHG emissions reporting.

The inventory information used for waste generated in London and disposed outside of London is based on the following:

- GHG emissions were estimated by taking the reported GHG emissions from the Twin Creek Landfill and Ridge Landfill for 2016 and dividing it by London's share of the annual fill rate at these landfills. City of London Solid Waste Management staff estimated the volume of London's industrial, commercial, and institutional (IC&I) sector solid waste disposed outside of London to be around 83,000 tonnes – 45,000 tonnes to the Twin Creek Landfill and 8,000 tonnes to landfills in Michigan.
- For the 1990 to 2016 period, the amount of IC&I waste per capita was assumed to be the same as reported last year, namely 0.31 tonnes per person. GHG emissions were estimated based on the Ontario Waste Management Association' Cap & Trade Research spreadsheet model for Ontario waste sector; based on the model's estimated 0.75 tonnes CO_2e emitted per tonne waste disposed at large landfills. It was assumed 50% landfill gas capture from 2002 to 2019, only 25% landfill gas capture for 1998, and no landfill gas capture for 1990.

As a result of London having joined the Global Covenant of Mayors in 2015, it is recommended that nitrous oxide emissions from sewage treatment be included within London's energy and GHG emissions inventory as per the Global Protocol for Community-Scale GHG Emission Inventories (GPC). Nitrous oxide is a combustion by-product from the incineration of sewage sludge and its formation is influenced by incinerator operating conditions (i.e., combustion temperature).

Since 2008, annual stack testing at the Greenway Wastewater Treatment Plant sludge incinerator has included the measurement to nitrous oxide alongside other air pollutants. Table A-1 summarizes the nitrous oxide stack test results.

Table A-1: Summary of 2008 – 2020 Stack Test Results for Nitrous Oxide (N_2O) Emissions from the Greenway WWTP Sewage Sludge Incinerator

Year	Measured average emissions g/s	Measured average emissions kg/h	Estimated annual emissions tonnes/y	Estimated annual CO_2e tonnes/y
2008	0.1	0.4	3	1,000
2009	1.1	3.9	28	8,800
2010	1.1	3.9	28	8,700
2011	1.2	4.4	32	9,900
2012	1.0	3.5	26	7,900
2013	0.2	0.6	4	1,400
2014	1.1	4.1	29	9,100
2015	1.0	3.7	26	8,200
2016	0.3	1.1	7	2,300
2017	2.4	8.6	65	20,000
2018	1.7	6.0	43	13,000
2019	1.5	5.5	33	10,200
2020	0.8	3.0	18	5,500

As can be seen from the table above, measured emissions of nitrous oxides can vary from year to year.

A.3. Greenhouse Gas Emission Factors for Energy Commodities

Greenhouse gas emissions associated with energy use were calculated based on the emission factors provided by *Canada's National Inventory Report 1990-2019*, except for the 2020 grid-average emission factors for Ontario, which have been estimated based on the 2020 electricity supply mix for Ontario reported by the IESO, combined with the data from *Canada's National Inventory Report 1990-2019*. A summary of emission factors has been provided in Table A-2.

All GHG emissions are expressed in terms of equivalent carbon dioxide (CO_2e), based on the global warming potentials (GWP) of the various GHG emissions provided by *Canada's National Inventory Report 1990-2019.*

Table A-2 – Greenhouse Gas Emission Factors and Energy Conversions

Source of Emission	Emission Factor (CO_2e)	Information Source
Electricity - Ontario 2020	0.03 kg/kWh	Estimated based on IESO information for 2020
Electricity - Ontario 2019	0.03 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2018	0.03 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2017	0.02 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2016	0.04 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2015	0.04 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2014	0.04 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2013	0.08 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2012	0.11 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2011	0.11 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2010	0.14 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2009	0.12 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2008	0.17 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2007	0.24 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2006	0.21 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2005	0.25 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 2002	0.29 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 1998	0.23 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
Electricity - Ontario 1990	0.22 kg/kWh	National Inventory Report, 1990-2019 - ANNEX 11
natural gas	1.90 kg/m^3	National Inventory Report, 1990-2019 - ANNEX 6
fuel oil	2.73 kg/L	National Inventory Report, 1990-2019 - ANNEX 6
propane	1.54 kg/L	National Inventory Report, 1990-2019 - ANNEX 6
gasoline	2.31 kg/L	National Inventory Report, 1990-2019 - ANNEX 6
diesel	2.71 kg/L	National Inventory Report, 1990-2019 - ANNEX 6
gasoline (E-10)	2.08 kg/L	National Inventory Report, 1990-2019 - ANNEX 6

A.4. Cost Estimates for Community Energy Use

Information on the cost of using petroleum products is based on information available from Kent Marketing Services, specifically:

- Annual retail prices (including tax) and wholesale prices for regular-grade gasoline, mid-grade gasoline, premium-grade gasoline, diesel, and furnace oil;
- Crude oil price component associated with retail fuels, allocated to Western Canada (Alberta and Saskatchewan) which is the source of oil for refineries in Sarnia;
- The refiners operating margin, which is the difference between annual crude oil prices and wholesale prices, allocated to Ontario (refineries in Sarnia);
- The Harmonized (Federal and Provincial) Sales Tax and Federal Fuel Excise Tax; and
- The marketing operating margin, which is the difference between annual retail prices the wholesale prices and federal and provincial taxes, allocated to London (gas stations).

This allocation method was reviewed and accepted as being reasonable in 2013 by Kent Marketing.

Information on the cost of using electricity is based on customer rate structure information available on London Hydro's website, specifically:

- The Rate Component ($/kWh), the Loss Adjustment Factor, and (where applicable) the Global Adjustment, which is allocated to Ontario reflect the cost to generate electricity in Ontario;
- Delivery-related costs (Distribution Variable Charge, Network Charge, Connection Charge, Rate Rider for Tax Change, and Rate Rider for Variance Account), which is allocated to London to reflect London Hydro's operations;
- Transmission-related costs, which is allocated to Ontario to reflect Hydro One's operations; and
- Regulatory-related and Government-related charges (e.g., Ontario Hydro Debt Retirement, HST).

This allocation method was reviewed and accepted as being reasonable in 2013 by Wattsworth Analysis, the City of London's energy procurement advisor.

Information on the cost of using natural gas is based on customer rate structure information available on Union Gas's website, specifically:

- The Gas Commodity Rate, the Gas Price Adjustment, and Transportation, which is allocated to a mix of Western Canada (conventional gas wells) and United States (shale gas) to reflect the sources of natural gas supply and transporting this gas to Ontario ;
- Storage-related costs, which is allocated to Ontario to reflect Union Gas's regional and Ontario-wide storage and distribution operations;

- Delivery-related costs, which is allocated to London to reflect Union gas's local operations to supply natural gas to customers in London; and
- The HST.

This allocation method was reviewed and accepted as being reasonable by Wattsworth Analysis.

APPENDIX B - 2003-2019 HEATING & COOLING DEGREE DAYS FOR LONDON

Heating degree day (HDD) is a measurement tool used to estimate energy demand needed to heat a home or business. A similar measurement, cooling degree day (CDD), reflects the amount of energy used to cool a home or business.

It is based on the average outdoor air temperature over an entire day. The heating needs for a home or a building are generally directly proportional to the number of HDD at that location. Heating degree days are defined relative to a base temperature; the outside temperature above which a building needs no heating. For homes, a daily average temperature of 18 °C is used as this base. Therefore, if the average temperature for a day was 8 °C, then the HDD would be 10 for that day. Similarly, if the average temperature for a day was -2 °C, then the HDD would be 20 for that day. A typical winter month would have about 700 HDDs in London.

Environment Canada produces Climate Normal data ranges over a historic 30-year period. Over the last 10 years, most winters and summers have been warmer than they were over the 1971-2000 period.

Table B-1 – Annual Residential Heating and Cooling Degree-Days for London

Year	Heating Degree-Days	Cooling Degree-Days	Heating - Difference from 30 Year Average	Cooling - Difference from 30 Year Average
2010	3,664	369	-7%	44%
2011	3,766	330	-4%	29%
2012	3,297	381	-16%	49%
2013	3,951	276	0%	8%
2014	4,309	201	9%	-21%
2015	3,971	254	1%	-1%
2016	3,615	343	-8%	34%
2017	3,597	271	-9%	6%
2018	3,836	392	-3%	53%
2019	3,937	277	0%	8%
2020	3,562	347	-10%	36%
Average for 2010-2020 period	**3,773**	**313**	**-4%**	**22%**
30-year average (1971-2000)	**4,058**	**236**		

Notes: 1. Climate Normal data based on the 1971-2000 period
2. Heating and cooling degree-days based on the daily average difference from 18°C

Using this data, it can be assumed that, over the last 10 years, building heating needs were about four per cent lower than they would have been back in the 1971-2000 period, and that air conditioning needs were 22 per cent higher.

Figure B-1 – Annual Residential Heating and Cooling Degree-Days for London