city of Columbia
Office of Sustainability

2024

City of Columbia, Missouri

Greenhouse Gas Inventory Report

Community and Municipal Inventories for Calendar Year 2024

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2024 Greenhouse Gas Inventory Report

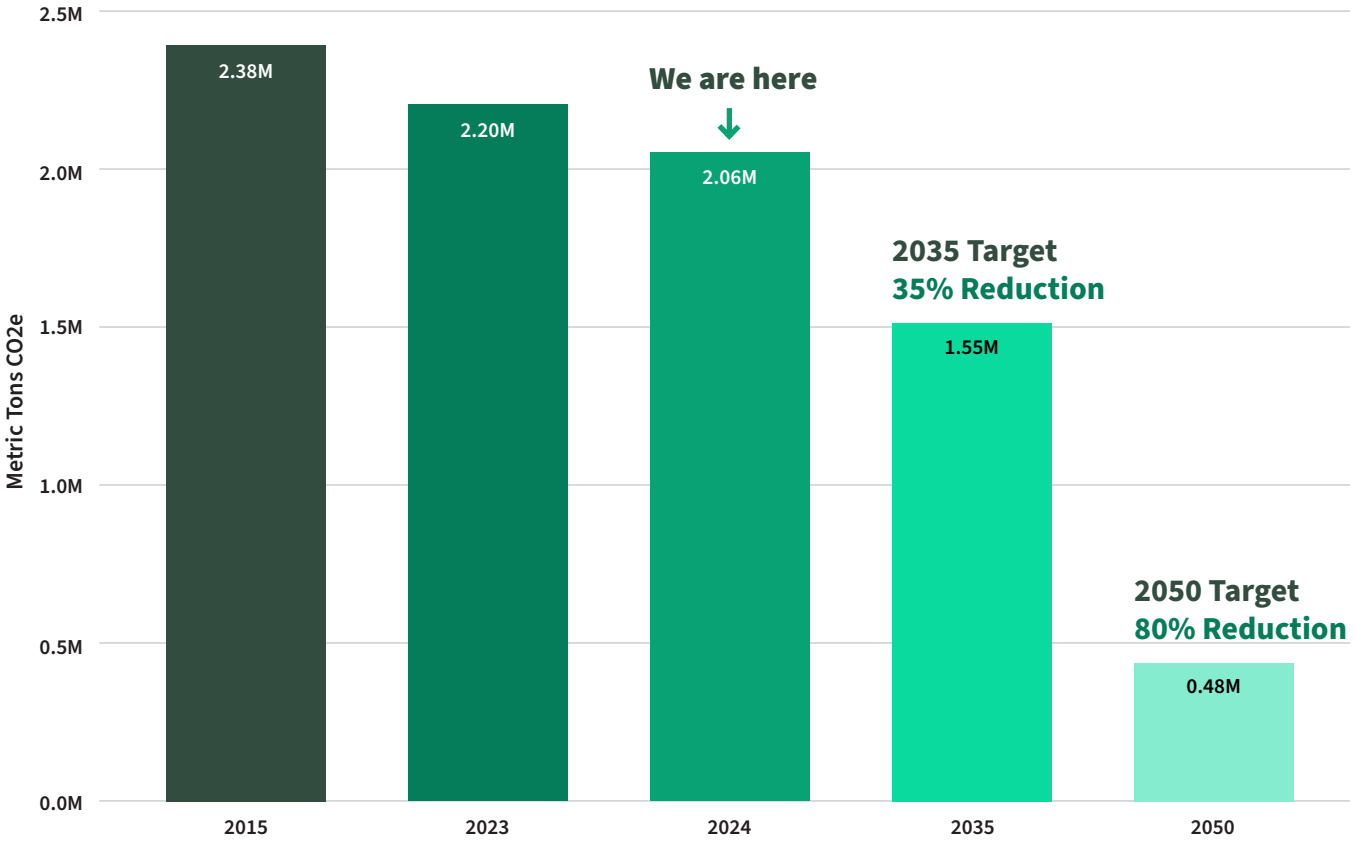
Explore the Sustainability Data Dashboard:

The Office of Sustainability's webpage (**CoMo.Gov/sustainability**) hosts a dashboard with 2015-2022 greenhouse gas emissions inventory data. There are now downloadable and screen reader-friendly CSV tables of the data in the dashboard.

Introduction

The 2024 Greenhouse Gas Inventory Report highlights how Columbia's energy use, transportation and waste patterns shape our city's emissions story. A key goal of (CAAP) is to reduce community-wide greenhouse gas (gHG) emissions through targeted municipal, residential, industrial and commercial activities. This year's report focuses on community-wide emissions along with municipal operation emissions, providing us a clearer picture of where we stand—and where we need to go.

We use nationally recognized GHG reporting protocols to track emissions across key sectors. This year, we introduced two important changes: transportation emissions were estimated using a regression model due to the absence of local vehicle miles traveled (VMT) data; and the inventory's scope was expanded to include Scope 3 aviation emissions, reflecting how people travel to and from Columbia. These updates help provide a more complete and transparent picture of our community's emissions profile.



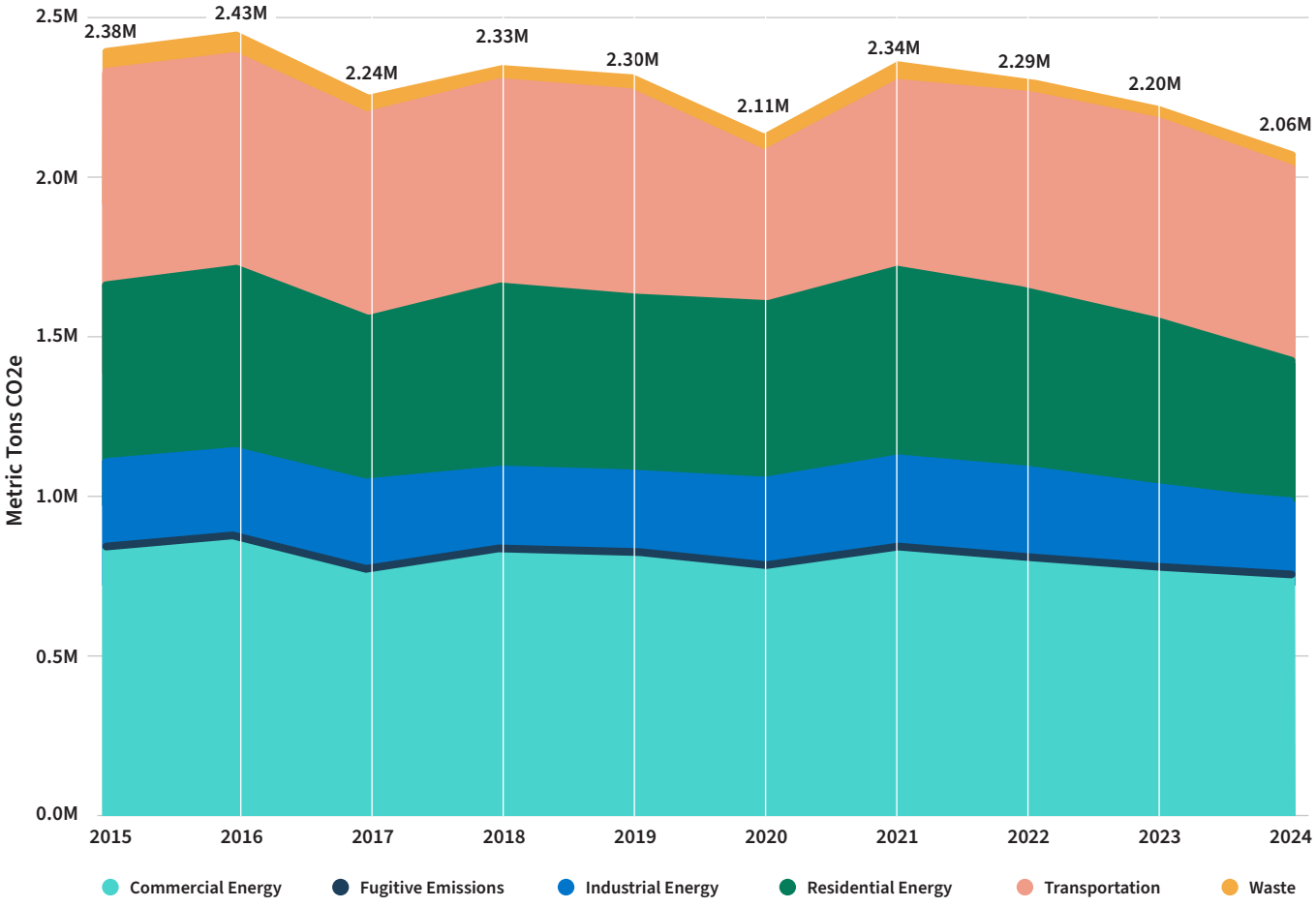
*Part of the 2024 Transportation emissions were estimated due to lack of timely data

Scope of Emissions

Understanding the scope of emissions helps us differentiate between direct and indirect sources of greenhouse gas emissions and where we have the most control. This inventory includes Scope 1 and 2 emissions that occur within or result directly from activities in Columbia, such as natural gas use, electricity consumption, and transportation. For the first time, we've also included Scope 3 emissions from air travel, capturing the impact of residents flying in and out of Columbia Regional Airport.

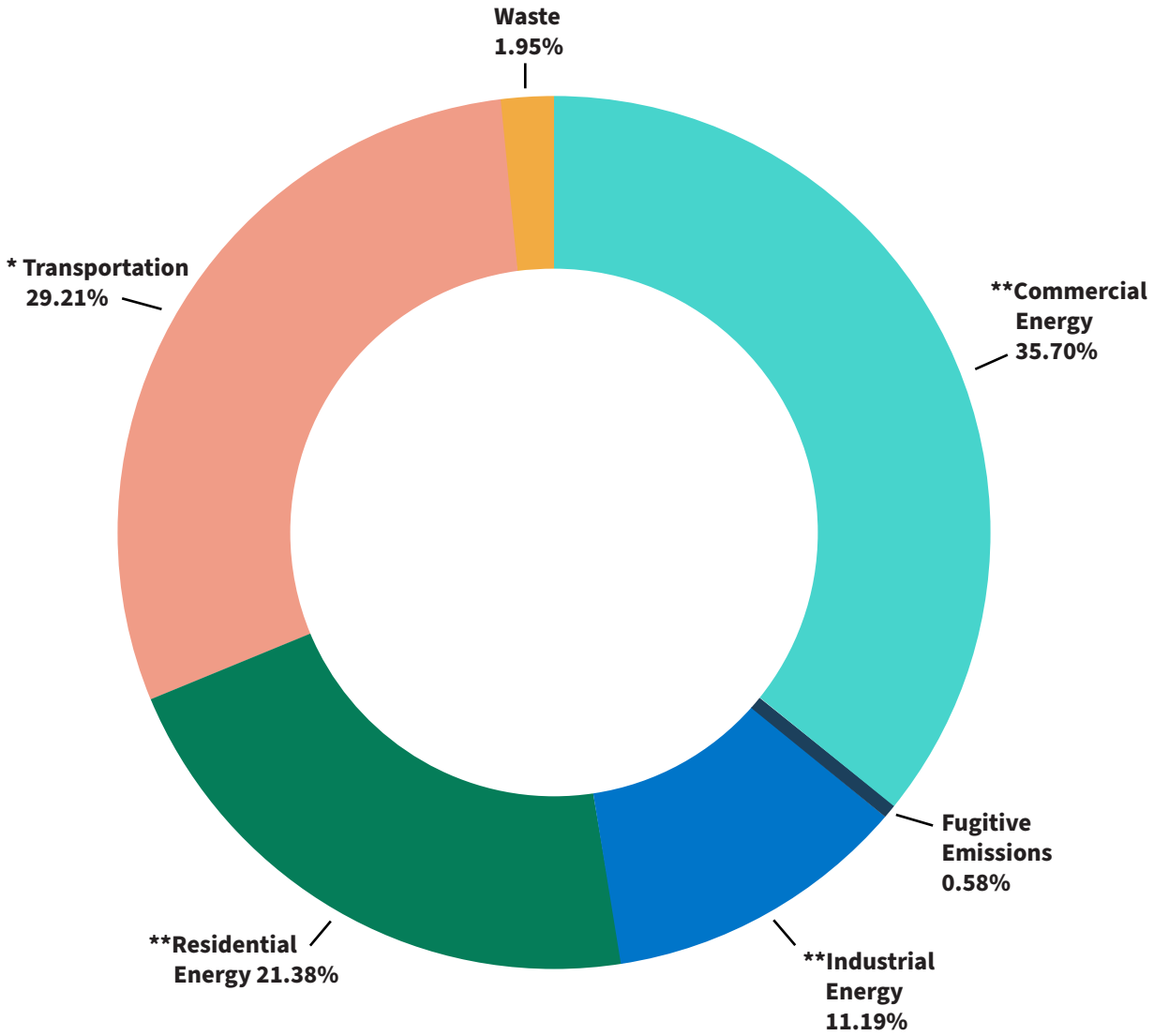
Community Greenhouse Gas Emissions

Total GHG Emissions by Sector and Year



In 2024, community-wide greenhouse gas (GHG) emissions totaled 2.06 million metric tons of CO_2e ($MTCO_2e$)—a 14% reduction from 2015 baseline levels and a 6.5% decrease from 2023. This marks the largest year-over-year decrease (excluding 2020) and the greatest overall drop from the baseline recorded to date in Columbia. The chart above shows this trend across sectors over time.

Which sectors contribute most to our emissions?



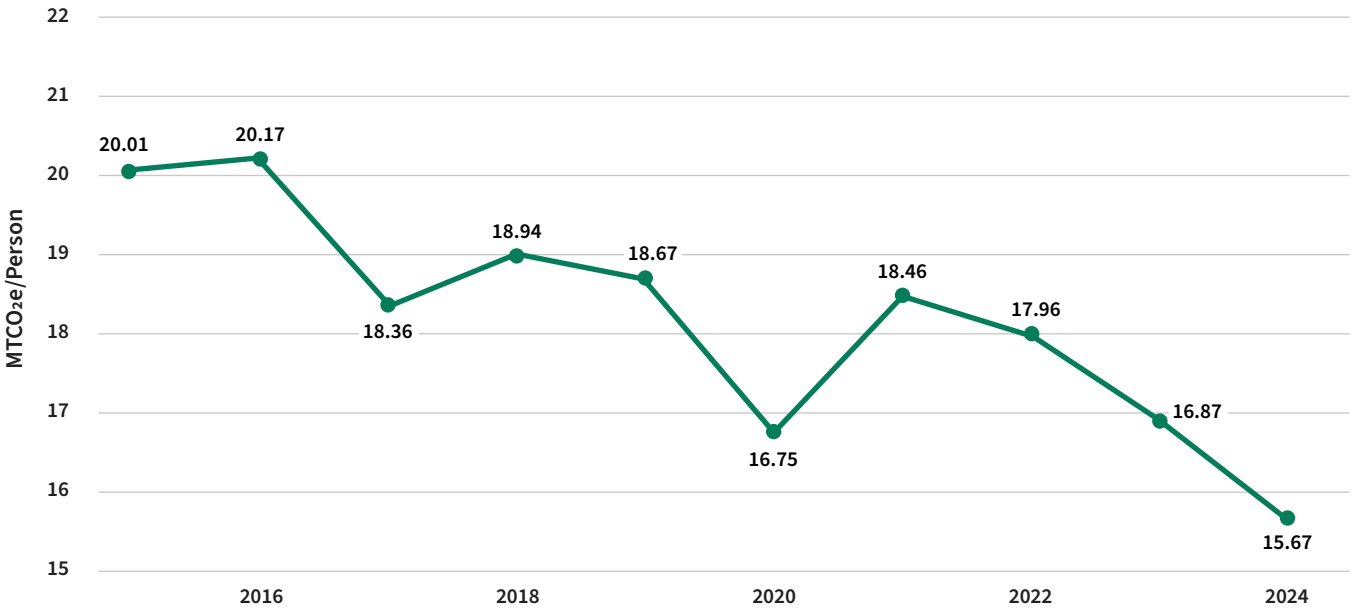
*** Transportation emissions were estimated for 2024**
**** Three energy sectors. Total 68.27%**

The energy sector, made up of commercial, residential, and industrial electricity and gas use, remains the largest contributor to Columbia's greenhouse gas emissions. In 2024, it accounted for 68.3% of total community emissions. Transportation followed at 29.2%, while waste and other sources combined made up less than 3% of the total inventory.

Although the energy sector is the most significant portion of our emissions, the share of emissions from transportation is gradually increasing, reflecting rising demand as Columbia grows as a community. To make the most impact, efforts to reduce emissions should focus on both cleaning our energy supply and transforming how we move through the city.

As Columbia grows, are emissions decreasing?

Per Capita Emissions (2015–2024)



Columbia continues to expand, and with that growth comes increased demand for energy, mobility and services. Tracking per capita emissions, helps us understand whether we're making progress as our population expands.

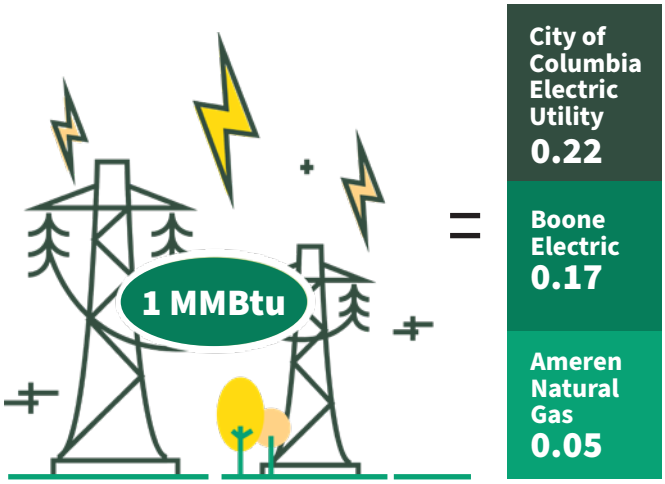
In 2024, per capita emissions dropped to 15.67 $MTCO_2e$, down from 20.01 in 2015—a 21.7% decrease since 2015. This is decrease is a promising sign. However, to reach our 2035 and 2050 climate targets, emissions will need to decline even faster than the population grows. Continued investments in renewable energy, energy efficiency, and low-carbon transportation will be key to driving emissions reductions.

Not all energy is Equal: Understanding Emissions Factors

Every unit of energy we consume has a different climate impact, and that's where emissions factors come in. An emissions factor tells us how much greenhouse gas is released for every unit of energy used. It's the difference between powering a home with solar energy and powering it with coal.

In 2024, Columbia's grid got a little cleaner: the share of renewable electricity increased from 22.0% to 23.0%, and the city used less energy from high-emission sources like coal and natural gas. As a result, our overall electricity emissions factor dropped, meaning that even though energy consumption increased, the emissions from that energy went down. The more we shift toward renewables, the lower our emissions factors go and the closer we get to our climate goals.

Emissions Factor by Utility(MTCO2e/MMBtu)



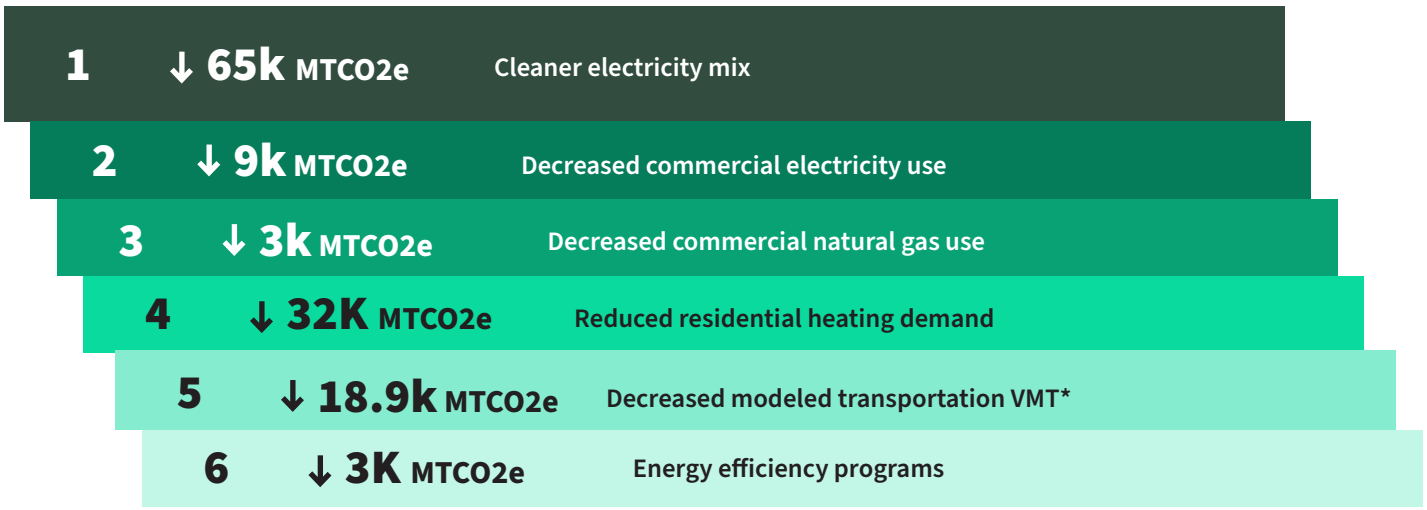
Exploring Changes in Emissions: The Community Contribution Analysis

Understanding what's behind our emissions trends is just as important as tracking the numbers. The Contribution Analysis helps uncover the "why," explaining which factors had the biggest impact on reducing or increasing emissions from one year to the next.

In 2024, community emissions saw the largest percentage drop from the baseline to date. So what changed?

Factors such as weather, population, economic metrics and activity data (like energy consumption and vehicle miles traveled) are analyzed to identify the top drivers of emissions decreases between 2023 and 2024:

Top drivers:



*Please note transportation emissions were estimated for this year

This year, one of the biggest drivers was a cleaner electricity mix—thanks to incremental increases in renewables and lower-emission grid sources. This alone accounted for about 65,000 $MTCO_2e$ of the overall drop.

Energy use in buildings also declined. Commercial electricity and natural gas usage fell slightly, and a milder winter led to a reduction in residential heating demand. Combined, these changes contributed over 40,000 $MTCO_2e$ in avoided emissions.

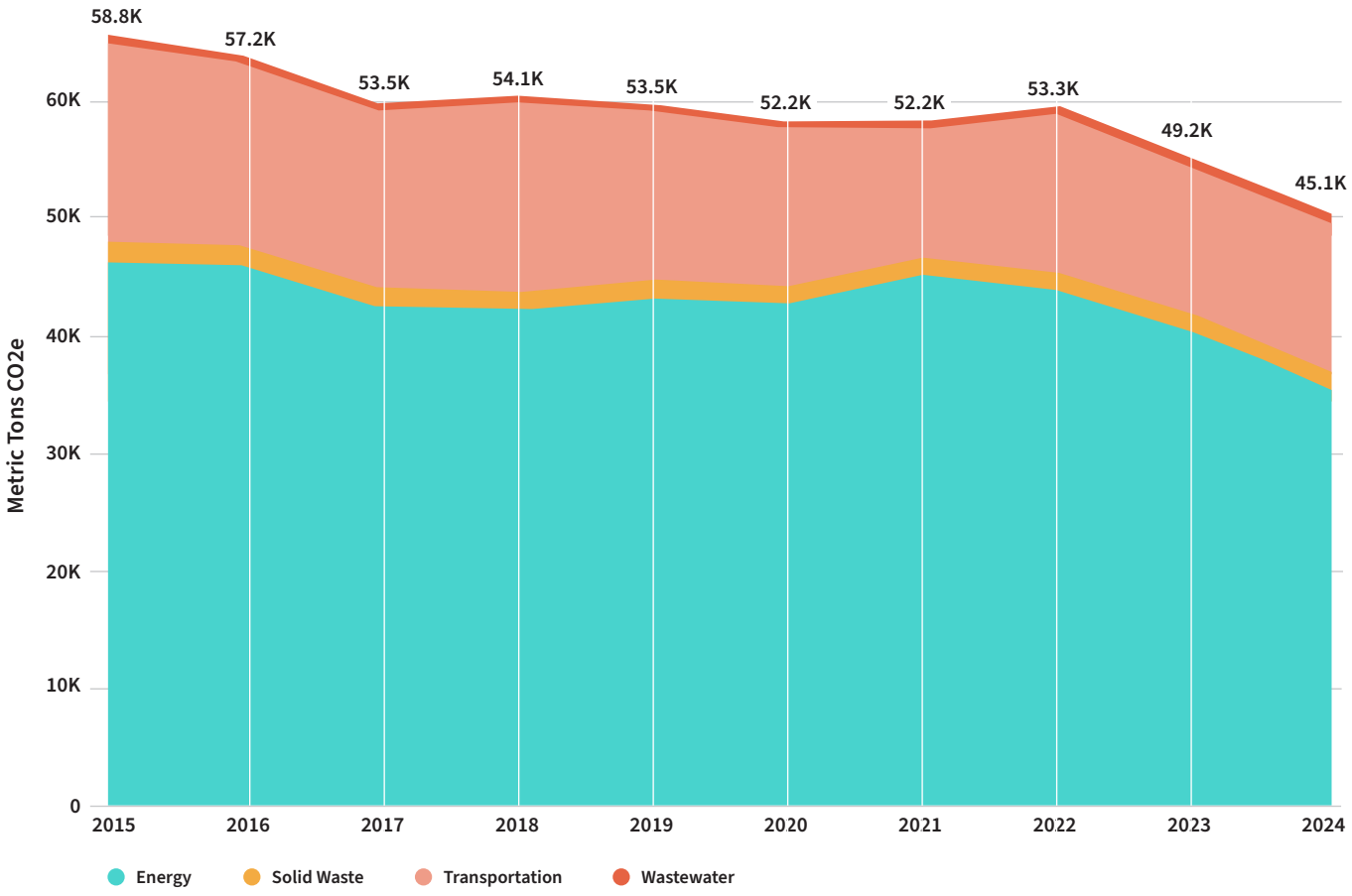
Transportation emissions were estimated using a linear regression model applied to post-pandemic VMT trends. While trips have generally increased, total distance traveled has remained steady or decreased slightly which is a reflection of changing mobility patterns. This method provides a data-driven estimate in the absence of timely VMT data, and offers a transparent baseline for future refinements. With that being said, transportation also played a role. Decreased vehicle miles traveled, modeled using updated activity data, led to nearly 19,000 $MTCO_2e$ in reductions.

These shifts brought us significantly closer to our climate goals, demonstrating that cleaner energy and individual choices both matter in reducing our emissions.

Municipal Operations Emissions

The City of Columbia's municipal operations emissions have decreased by 23.3% since the 2015 baseline.

The City of Columbia's municipal operations, everything from powering public buildings to fueling our buses generated approximately [45,117 $MTCO_2e$] in 2024, accounting for about 2.2% of the City's total community-wide emissions. While municipal operations represent a smaller share of overall emissions, the City has adopted ambitious climate goals: a 50% reduction in municipal emissions by 2035 and net-zero by 2050, guided by strategies outlined in the Climate Action and Adaptation Plan (CAAP). These activities lay the foundation for reducing community emissions as well. To learn more about CAAP programs and progress, find the plan and the 2024 Annual CAAP Report at CoMo.gov/sustainability/reports-documents.

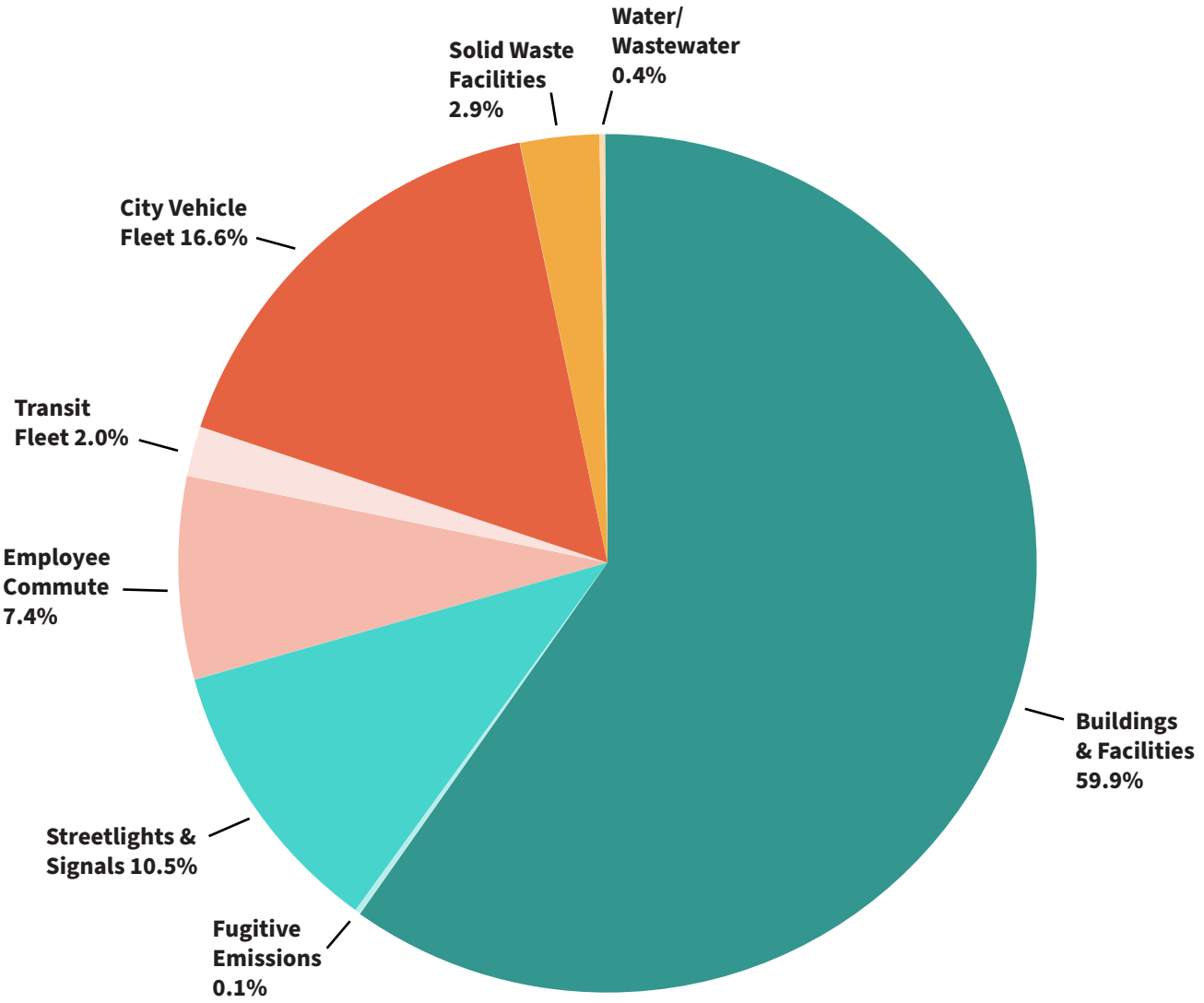


Where Municipal Emissions Come From

The City tracks greenhouse gas emissions from ten municipal sources, grouped into three major sectors: Energy, Transportation and Waste. The pie chart illustrates the proportional breakdown of 2024 emissions by source.

Facility electricity use remains the largest contributor to municipal energy emissions. This includes electricity consumed by buildings, water and wastewater treatment facilities, and other core infrastructure.

Since 2015, several new municipal buildings have been added, while many existing facilities have undergone energy efficiency upgrades. It's important to note that data may fluctuate slightly from year to year as accounts close, new facilities are added, and data tracking systems improve, leading to a more accurate and refined inventory over time.



Learn more at **CoMo.gov/sustainability**

What changed in 2024?

The municipal emissions distribution continues to mirror the broader community inventory, with energy as the largest sector, followed by transportation and waste.

Below are the key changes in emissions from previous years:

- ↓ **18% decrease in streetlight emissions since 2023**
- ↓ **17% decrease in transit fleet emissions since 2023**
- ↑ **4% increase in vehicle fleet emissions since 2023**
- ↓ **11% decrease in buildings & facilities emissions since 2023**
- ↓ **24% decrease in transportation emissions since 2015**
- ↑ **68% increase in fugitive emissions since 2023**

Where are we seeing progress?

Energy continues to be the largest contributor to municipal emissions, particularly from electricity used in buildings and streetlighting. However, the City has made meaningful progress in reducing emissions from these sources. Buildings and facilities emissions dropped by 11% in 2024, and streetlight emissions fell by 18%, reflecting the impact of energy efficiency improvements and reduced electricity consumption respectively.

Facilities have been retrofitted with energy-efficient systems, while new municipal buildings are being benchmarked for performance. In upcoming years, the City is planning major upgrades for older facilities, which account for the majority of emissions from the buildings and facilities category.

Columbia's transit fleet emissions fell by 17%, a substantial year-over-year reduction. This drop highlights the success of optimized fixed-route service and maximizing our use of electric buses, making it one of the most notable progress areas in 2024.

While vehicle fleet emissions increased by 4% compared to 2023, since 2015, transportation emissions have declined by 24%, showing a steady long-term reduction.

Fleet electrification planning is already underway,laying the groundwork for long-term reductions in this area.

Tools like fleet electrification dashboards and building energy benchmarking are helping City departments prioritize next steps and accelerate action.

Appendix

A. Community Wide GHG Emissions Changes 2023 to 2024

The table summarizes year over year changes in greenhouse vegas (GHG) emissions by sector and category. The changes reflect shafts in energy use, travel behavior and other key trends.

Sector	Category	% Change in GHG Emissions	Explanation
Energy	Commercial Energy	-3.6%	Cleaner grid mix and slight decrease in total electricity consumption.
Energy	Industrial Energy	-6.7%	Consumption actually rose in 2024, but overall emission reduction reflects a cleaner electricity mix, where each unit of electricity carried fewer emissions due to a modest increase in renewables and a reduced share of coal and gas generation
Energy	Residential Energy	-15.2%	Warmer winter and increased grid renewables lowered heating-related emissions. Slight decrease in consumption.
Energy	Fugitive Emissions	-6.0%	Warmer winter led to decreased natural gas leakage
Transportation	Total Transportation	-3.1%	Modeled reduction in total vehicle kilometers traveled (VMT).* This is an estimate
Waste	Solid Waste	0.0%	
Wastewater	Wastewater Facilities	-7.7%	BOD_5 load and population served in 2024 increased but total wastewater emissions decreased due to improved treatment efficiency where 92% of BOD_5 was removed in primary treatment in 2024, compared to 91% in 2023. An update in methodology from the IPCC Fifth to the Sixth Assessment Report, which revised global warming potentials and wastewater emissions factors, also affected the decrease.

Appendix

B. Municipal Operations GHG emissions changes 2023 to 2024

This table shows the change in greenhouse gas emissions across municipal operations between 2023 and 2024, including the absolute and percentage change in emissions ($MTCO_2e$) along with brief explanations of key contributing factors.

Sector	Category	Change in GHG Emissions ($MTCO_2e$)	% Change in Emissions	Explanation
Energy	Buildings & Facilities	–3,281	–10.8%	Warmer winter and increased building energy efficiency along with increase in W&L renewable energy.
Energy	Street Lights & Traffic Signals	–1,048	–18.1%	Reduced consumption in electricity.
Energy	Fugitive Emissions	+21	+67.7%	Increase in natural gas usage and more accurate tracking of data.
Transportation	Vehicle Fleet	+289	+4.0%	Increase in gas and diesel consumption, reflects increased vehicle usage for operational needs.
Transportation	Employee Commute	+154	+4.8%	Increased number of employees commuting to the office.
Transportation	Transit Fleet	–187	–17.0%	Maximizing use of electric buses and route optimization.
Solid Waste	Solid Waste Facilities	–38	–2.8%	
Wastewater	Water & Wastewater Treatment Facilities	+6	+3.2%	This is an estimate. There was an increase in the estimate from past years due to change in GWP with the newest IPCC Sixth Assessment values.

Appendix

C. 2024 Transportation Sector Estimate Model Notes

To estimate 2024 transportation emissions, the City of Columbia applied a modeling approach based on historically available data. In the absence of timely local vehicle miles traveled (VMT) data, a linear regression model was used to estimate emissions based on historical trends in total distance traveled and trip counts from 2015 through 2023. The year 2020 was excluded due to anomalous travel behavior during the COVID-19 pandemic.

The model incorporated the following variables:

- Total annual distance traveled (km) by automobiles across all travel bounds (in-boundary, inbound, and outbound),
- Annual trip counts, and
- Population growth.

A best-fit line was generated from the 2018–2023 data to project 2024 transportation activity. While the number of trips in 2024 was expected to increase in line with population growth, total distance traveled appeared to stabilize. This suggests greater trip density or shorter average travel distances.

This modeling approach produced a modest decrease in estimated transportation emissions for 2024 compared to 2023. Although suitable for high-level community-scale estimation, the approach introduces uncertainty due to its reliance on proxy indicators rather than measured VMT.

Emissions figures will be revised as updated 2024 transportation data becomes available. The relevant data dashboard will be updated accordingly to reflect finalized values.

Definitions

Carbon Dioxide Equivalent (CO_2e)
A standard unit for measuring greenhouse gases. It expresses the impact of different gases in terms of the amount of CO_2 that would create the same warming effect.

Community Contribution Analysis
A comparison tool used by Office of Sustainability staff to identify the key drivers of emissions increases or decreases between inventory years.

Community Emissions
Scope 1 and 2 greenhouse gas emissions from activities within Columbia, including commercial, residential, and industrial energy use, transportation, waste and wastewater.

Emissions Factors
The amount of greenhouse gases emitted per unit of energy consumed. These vary by fuel type and energy source.

Emissions Inventory
A quantified record of greenhouse gas emissions over a specific period. Inventories track emissions by sector and inform emission reduction strategies.

Fugitive Emissions
Greenhouse gas emissions that escape from systems, such as leaks from natural gas pipelines and distribution systems.

GHG Inventory
A snapshot of emissions by sector for a given year, typically categorized by scopes.

Greenhouse Gas (GHG) Emissions
Gases released into the atmosphere when fossil fuels are burned for electricity, transportation, heating or during waste decomposition.

Global Warming Potential (GWP)
A measure of how much a greenhouse gas (GHG) warms the Earth, compared to a CO2 molecule over a specific time horizon. The GWP can change with better scientific understanding.

IPCC 6th Assessment Definition (AR6)
The Sixth Assessment Report of the United Nations Intergovernmental Panel on Climate Change is the sixth in a series of reports which assess the available scientific information on climate change.

MMBtu
One million British Thermal Units—a common unit for measuring energy from electricity and natural gas. One BTU is the energy needed to raise the temperature of one pound of water by one degree Fahrenheit.

Municipal Emissions
Emissions from the daily operations of the City of Columbia as an organization, including energy use in facilities, vehicle fuel consumption and waste from City services.

Per Capita Emissions
The total community emissions divided by population, showing the average emissions responsibility per person.

Scope 1 Emissions
Direct emissions from sources within city limits (e.g., on-site fuel use, city fleet).

Scope 2 Emissions
Indirect emissions from purchased electricity used within the city.

Scope 3 Emissions
Other indirect emissions, such as emissions from air travel, supply chains and commuting.

VMT (Vehicle Miles Traveled)
A measure of total miles driven by all vehicles in a region—used to estimate transportation-related emissions.

Explore the City's Sustainability Data Dashboard at **CoMo.gov/sustainability** for interactive tools and open data.

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