



City of Columbia, Missouri

Greenhouse Gas Inventory Report

Community and Municipal Inventories for Calendar Year 2021



GHG Report

Definitions

Community Contribution Analysis:

A greenhouse gas emissions inventory comparison tool used by Office of Sustainability staff to determine drivers of emissions increases and decreases between individual inventory years.

Community Emissions:

Emissions associated with activity within Columbia. Sources of GHG emissions from the Columbia community include commercial, residential, industrial energy use, transportation, wastewater and waste.

Emissions Factors:

Represent the amount of greenhouse gases emitted (MT CO₂e) per unit of energy provided.

Emissions Inventory:

Lists, by source, the amount of GHGs discharged into the atmosphere during a specific period of time. Inventories will allow city staff to determine prominent sources of air pollutants and target regulatory actions.

Fugitive Emissions:

Greenhouse gas emissions from natural gas distribution/system leakage.

Greenhouse Gas (GHG) Emissions:

Atmospheric gases released when burning fossil fuels to produce electricity and heat, to power vehicles, and in the decomposition of waste.

Carbon Dioxide Equivalent (CO₂e):

Signifies the amount of CO₂ which would have the same global warming impact for any gas. CO₂e reports the global warming impact of multiple gases with just one metric.

Municipal Emissions:

Emissions produced by the day-to-day operations of the City as an organization. Includes building and facility energy use, waste produced, and fuel use by vehicles and equipment.

MMBtu:

One million metric British thermal units; a common energy unit used to measure energy from both electricity and natural gas. One British thermal unit is equal to the amount of energy needed to raise the temperature of one pound of water by one degree Fahrenheit.

Introduction:

Columbia City Council reaffirmed Columbia's commitment to take action to reduce climate pollution (Resolution 89-19A) on June 17th, 2019, by adopting the Climate Action and Adaptation Plan (CAAP). One of the main purposes of the CAAP is to reduce GHG emissions community-wide through targeted municipal, residential, industrial, and commercial activities. The CAAP outlines goals for reducing community greenhouse gas emissions by 35% by 2035, by 80% by 2050, and by 100% by 2060. The CAAP goals for reducing municipal operations emissions are 50% by 2035 and 100% by 2050. Each year, the Office of Sustainability staff conducts greenhouse gas inventories to measure both community and municipal operations GHG emissions. This report has two sections; the Community Greenhouse Gas Inventory Report and the Municipal Greenhouse Gas Inventory report.

This document reports on scope 1 and scope 2 emissions. This inventory does not include scope 3 emissions, which refer to all other indirect greenhouse gas emissions that occur outside of the city as a result of activities that take place within city limits that are not covered by scope 2 emissions. An example of this is emissions from the production of goods consumed by Columbia residents.

The methodology used for our GHG inventories is the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions. This protocol was developed through ICLEI-Local Governments for Sustainability USA (a US nonprofit corporation organization) and is widely used by municipalities in over seventy countries. GHG emissions are organized in the following sectors: residential energy, commercial energy, industrial energy, transportation, solid waste, water and wastewater, and process and fugitive.



What are the Scopes of Carbon Emissions?

Scope 1

Emissions produced within the city limits and released into the community atmosphere. This includes combustion of all fossil fuels, and methane produced from landfill waste and wastewater treatment.



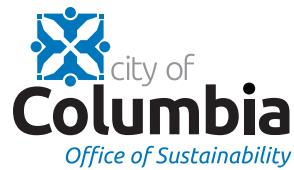
Scope 2

All greenhouse gases that are emitted outside of Columbia as a direct result of activities within Columbia (e.g. grid-supplied electricity).

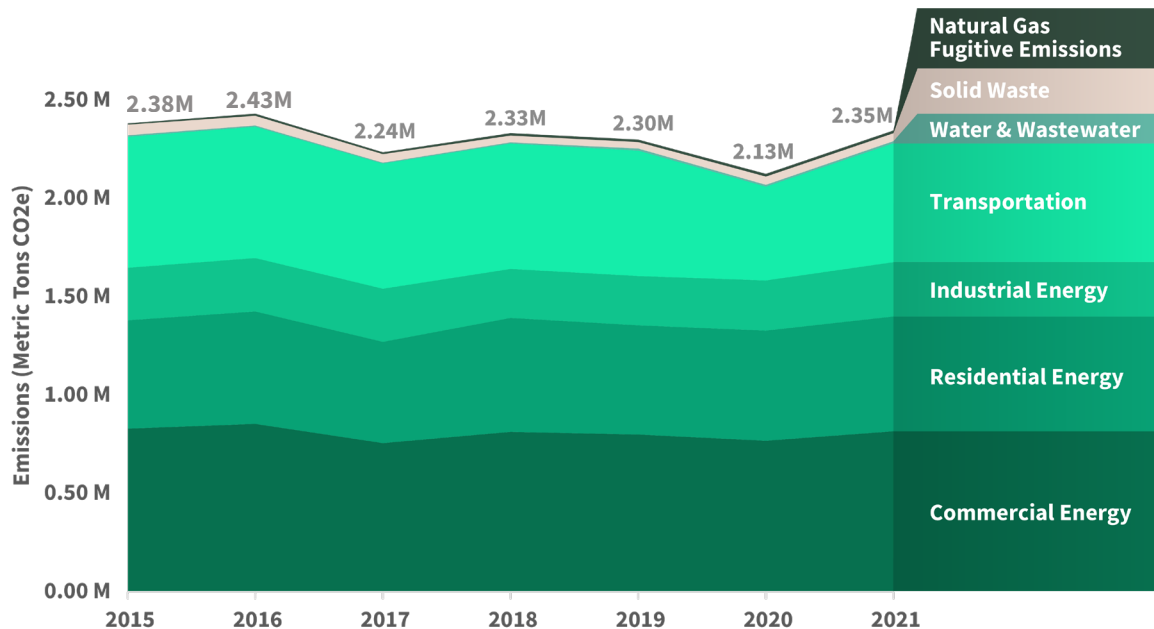


City of Columbia, Missouri

Community Greenhouse Gas Inventory Report - 2021

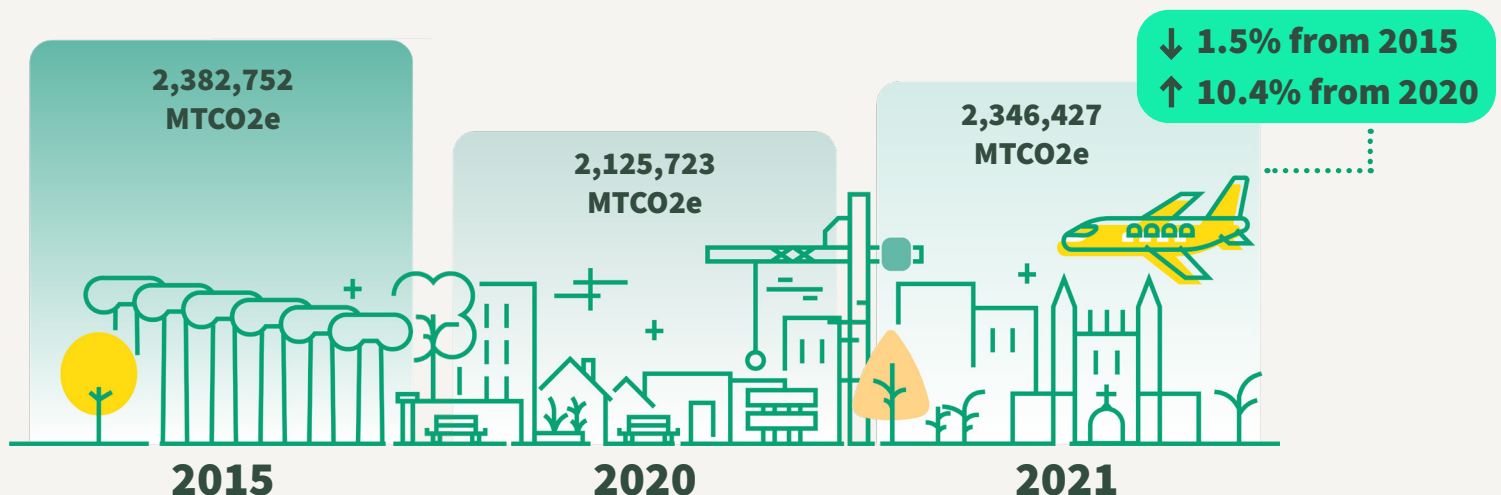


Community Greenhouse Gas Emissions



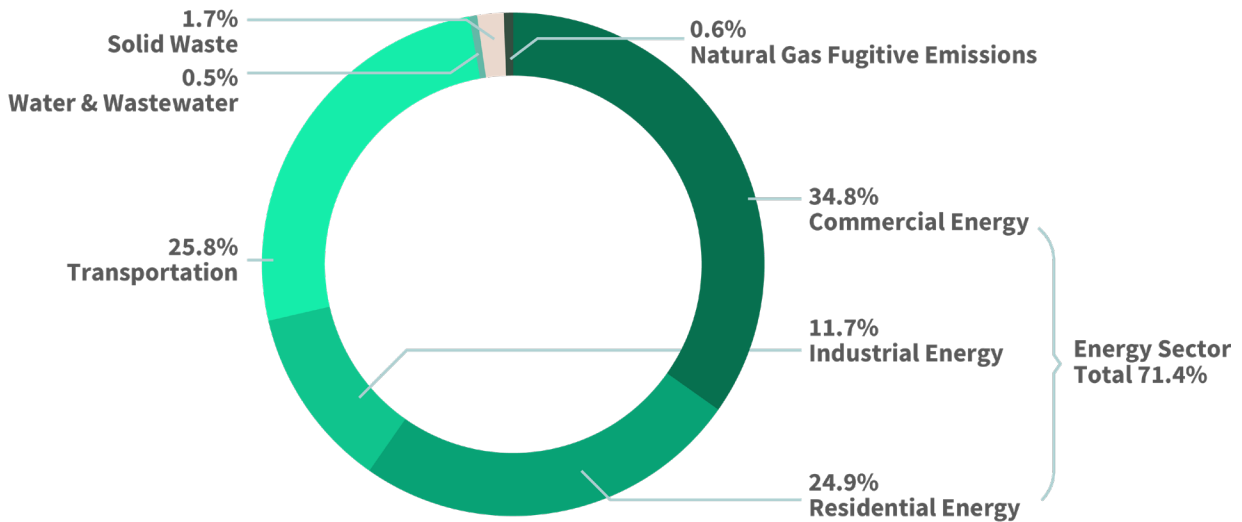
The total for 2021 community greenhouse gas (GHG) emissions was 2.35 million metric tons of carbon dioxide equivalent (MTCO₂e).

How Have Emissions Changed Since the 2015 Baseline?



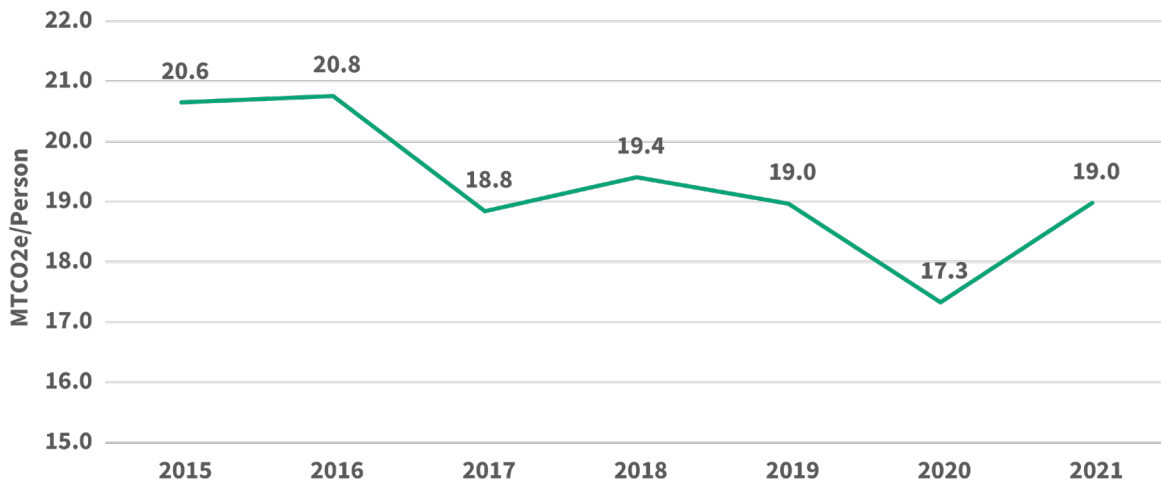
- Emissions decreased by 1.5% between the 2015 baseline and 2021 inventories.
- Emissions increased by 10.4% between 2020 and 2021. The majority of this change took place due to the transportation sector returning to almost pre-pandemic levels.
- In comparison to the 2015 baseline inventory, 2021 emissions are higher in the industrial energy, residential energy, and natural gas fugitive emissions sectors, while emissions in all other sectors have decreased.

2021 GHG Emissions by Sector



The energy sector, made up of commercial, residential, and industrial energy, is the largest contributor to community greenhouse gas emissions. In 2021, the energy sector accounted for 71.4% of community emissions. Transportation made up a quarter of total emissions, and solid waste and other emissions accounted for less than 3% of the inventory.

Per Capita Emissions

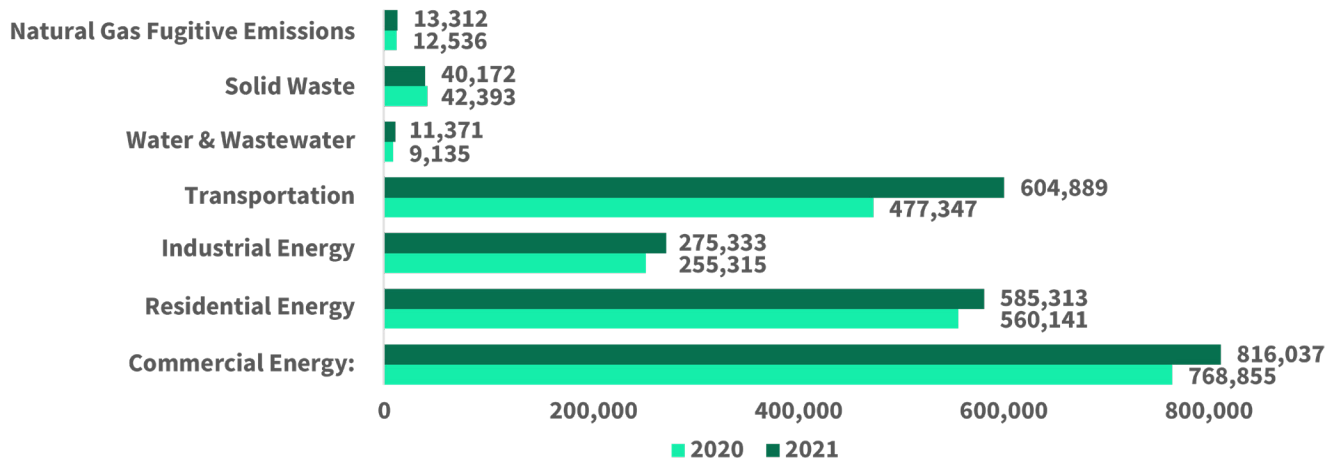


Community GHG emissions are related to community size. As Columbia continues to grow, more energy, vehicles, and jobs will be needed. Per capita emissions help us understand how our community GHG emissions are changing in relation to changes in population.

The City of Columbia's per capita emissions have decreased by 8.1% between 2015 and 2021. To reach our goals, Columbia's emissions will need to decrease faster than population increases. Systemic changes, such as increasing the supply of renewable electricity, have a large impact in reducing per capita emissions. Individual actions can also help reduce emissions.

GHG Emissions by Sector

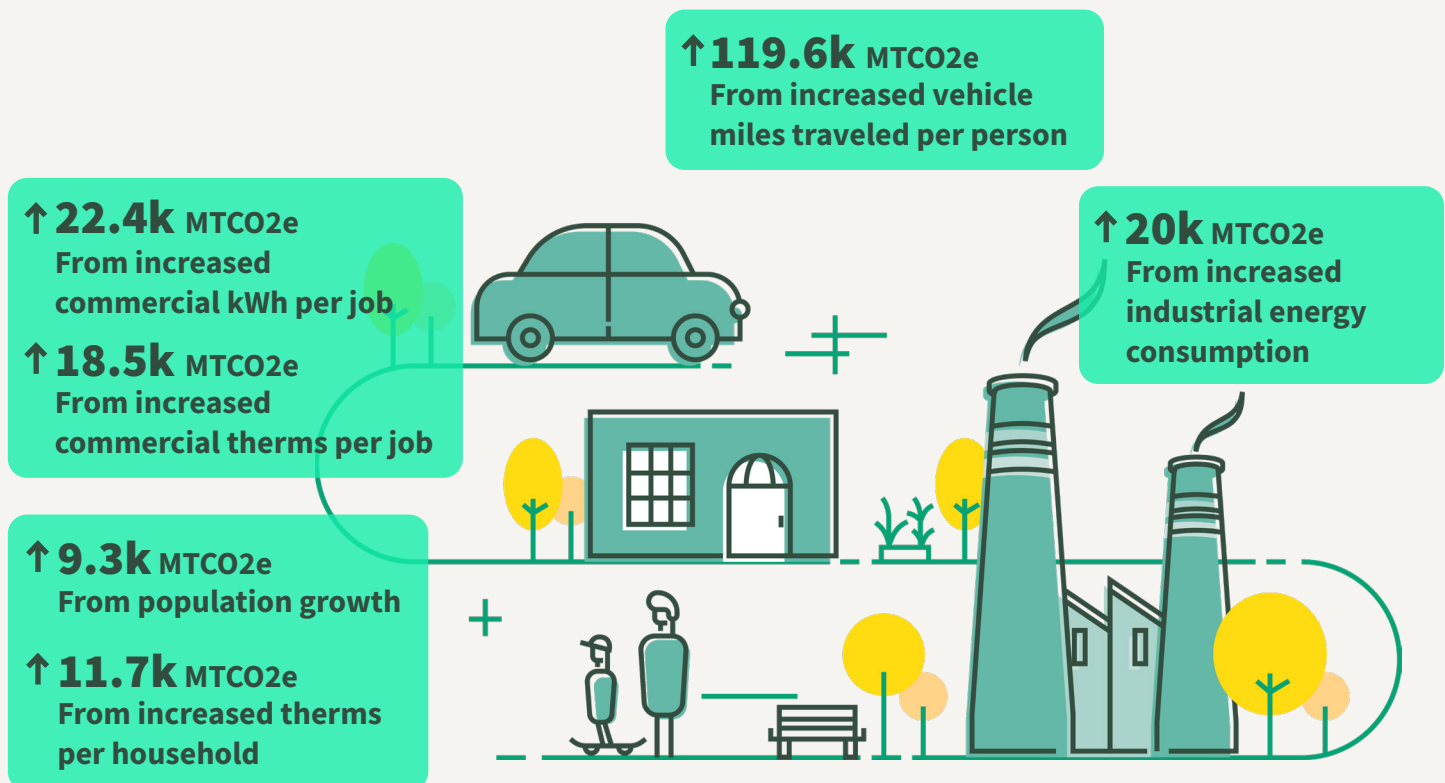
2020 vs. 2021



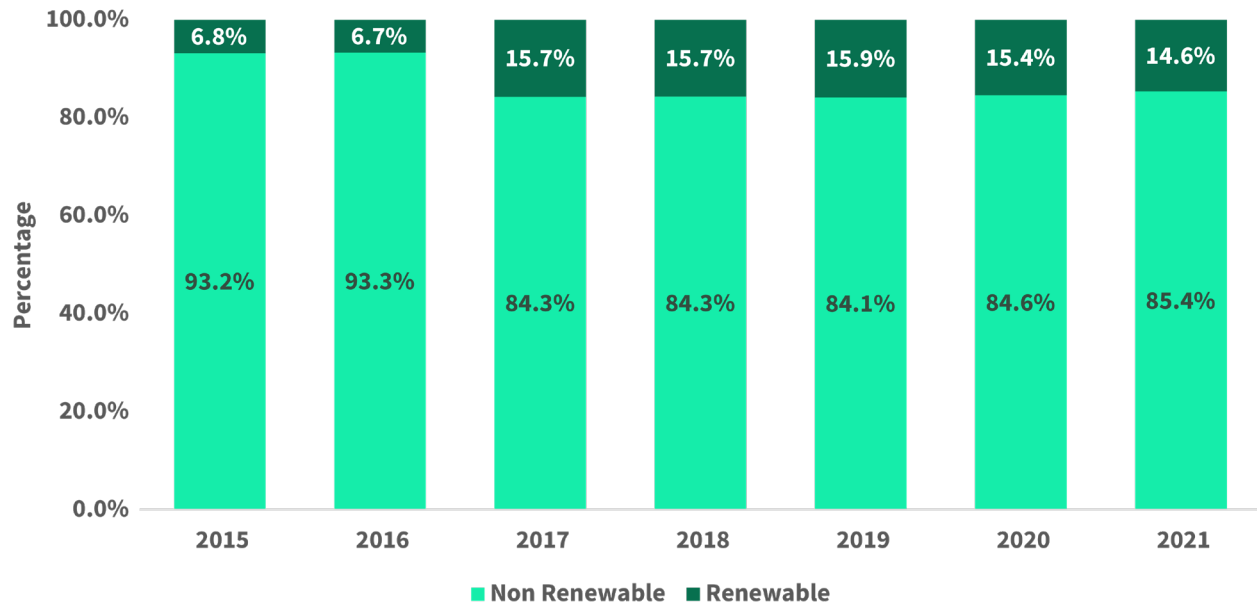
Between 2020 and 2021, emissions increased in each sector other than solid waste. The largest single increase between the two years took place in the transportation sector as vehicle miles traveled in 2021 returned to nearly pre-pandemic levels.

What Explains the Increase in Emissions from 2020 to 2021?

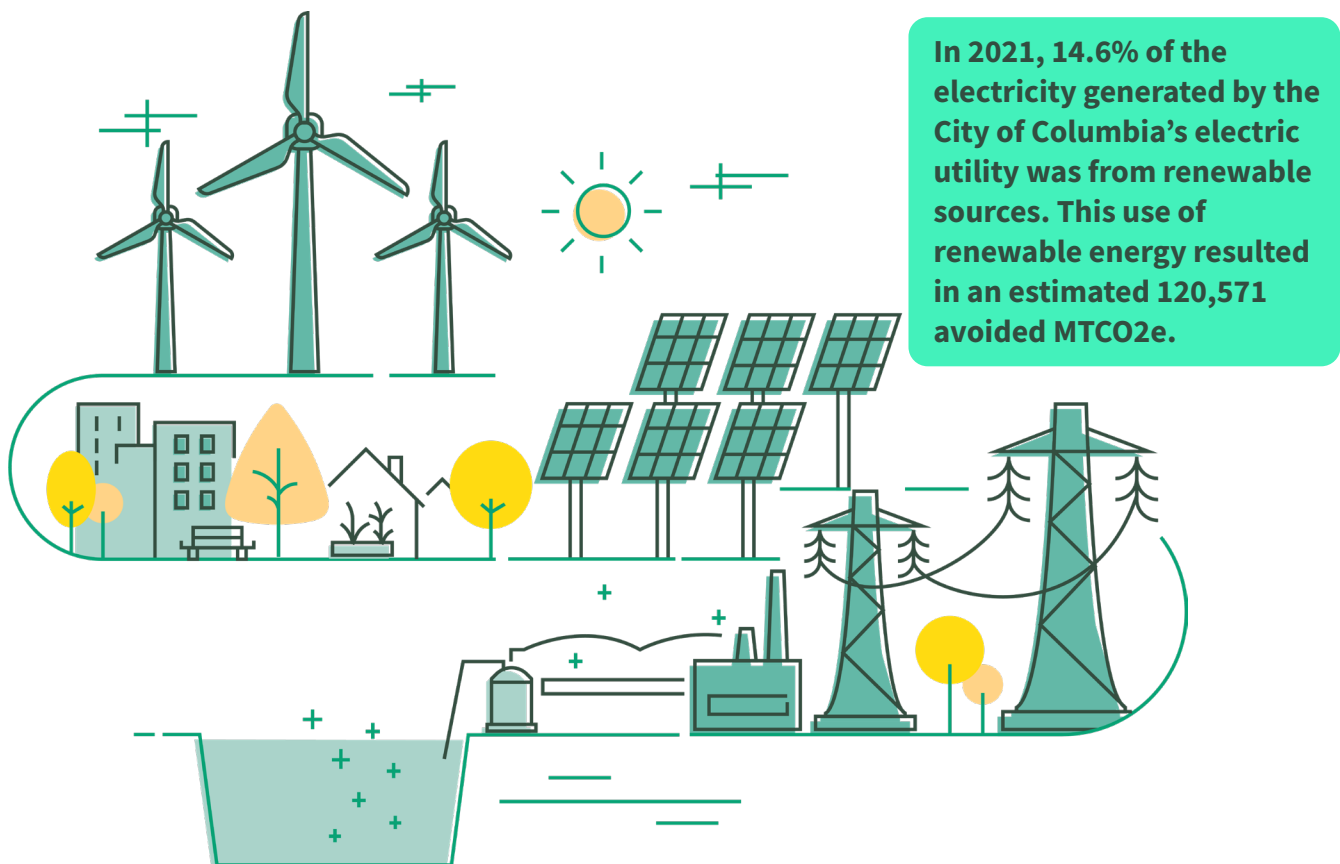
The Community Contribution Analysis identified the following major drivers of changes in community emissions:



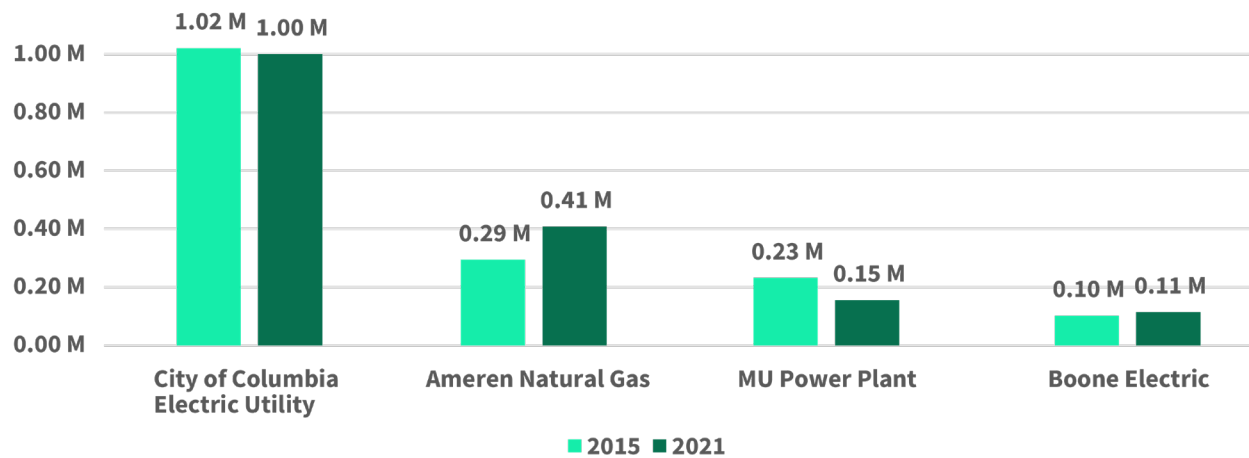
City of Columbia Electric Utility Renewable Energy



The City of Columbia's electric utility is the largest provider of electricity in Columbia, making the use of renewable energy by the utility vital for reducing energy sector emissions.



Energy Emissions by Utility



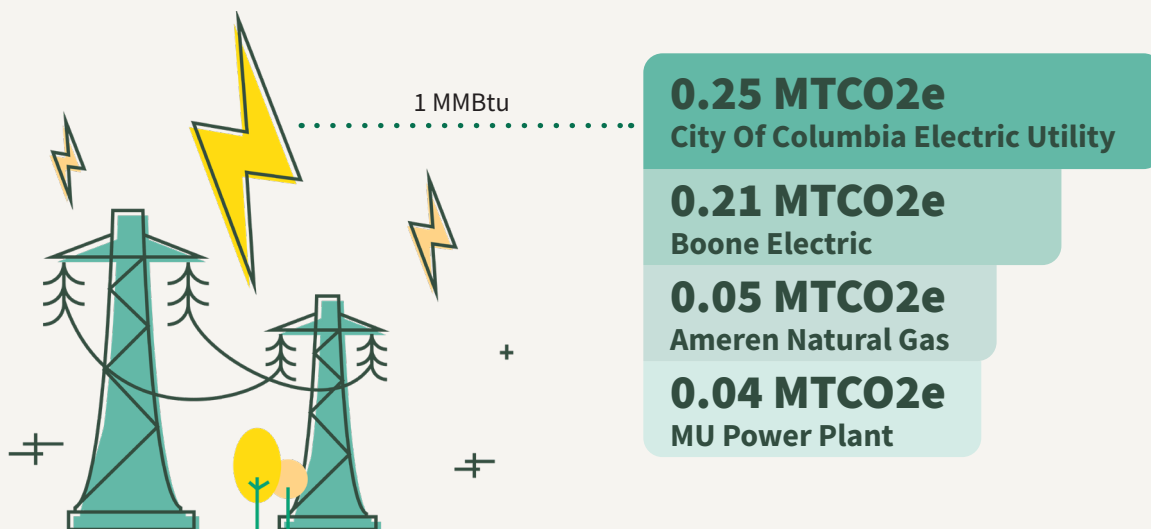
The City of Columbia's electric utility has remained the largest provider of electricity and the largest single source of GHG emissions since the 2015 baseline year. Emissions from the City of Columbia's electric utility have decreased slightly since 2015. MU Power Plant emissions have decreased by 77k metric tons of CO₂e (MTCO₂e), and Ameren Natural Gas emissions have increased by 109k MTCO₂e since the 2015 baseline. In total, energy emissions were 1.7%, or 28k MTCO₂e higher in 2021 than in 2015.

Emissions factors (EFs) represent the amount of greenhouse gases emitted per unit of energy provided. Emissions are expressed in units of MTCO₂e, and energy is expressed in units of MMBtu. The City of Columbia electric utility consistently has the highest EF of the four utilities. Sourcing from an increasing percentage of renewable energy is fundamental to reducing EFs and achieving community emissions reduction goals.

How do We Measure a Unit of Energy?

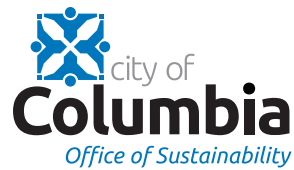
We use a British thermal unit (Btu) to measure both electricity and gas energy. One Btu is the amount of energy needed to increase the temperature of one pound of water by 1°F.

How Much CO₂e is Emitted for Every One Million Btu?

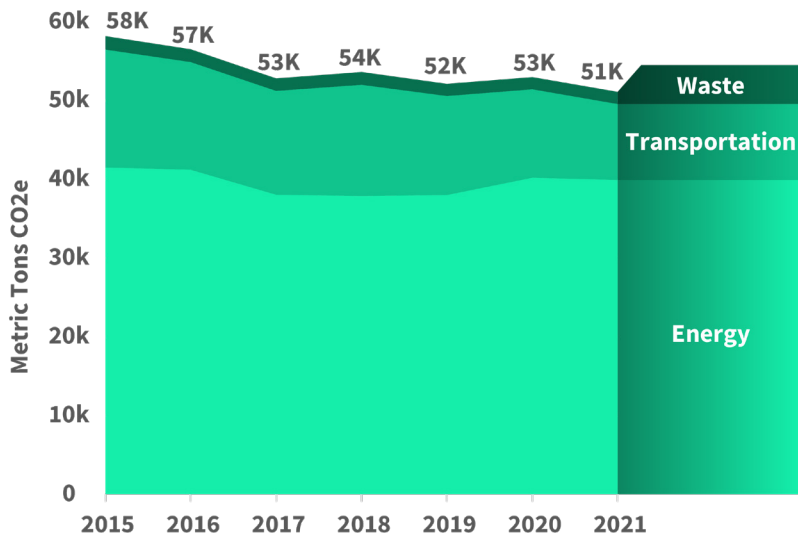


City of Columbia, Missouri

Municipal Greenhouse Gas Inventory Report - 2021



2021 City of Columbia Municipal Emissions

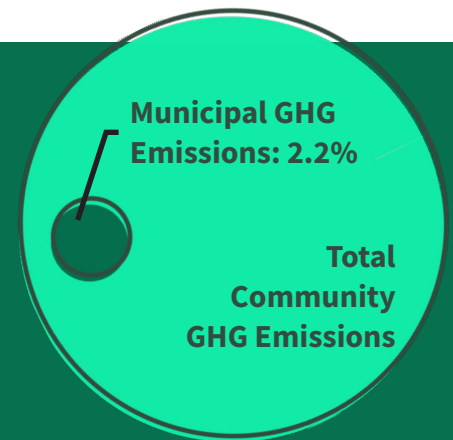


The City of Columbia's municipal emissions have trended downward since the 2015 baseline, with an overall 12.2% reduction in emissions.

The City of Columbia plans to continue reducing its municipal emissions through activities outlined in the Climate Action and Adaptation Plan (CAAP). These activities will lay the foundation for reducing community emissions as well. To learn more about CAAP programs and progress, find the plan and the 2021 Annual CAAP Report at CoMo.gov/sustainability/areas-of-focus/climate-action/.

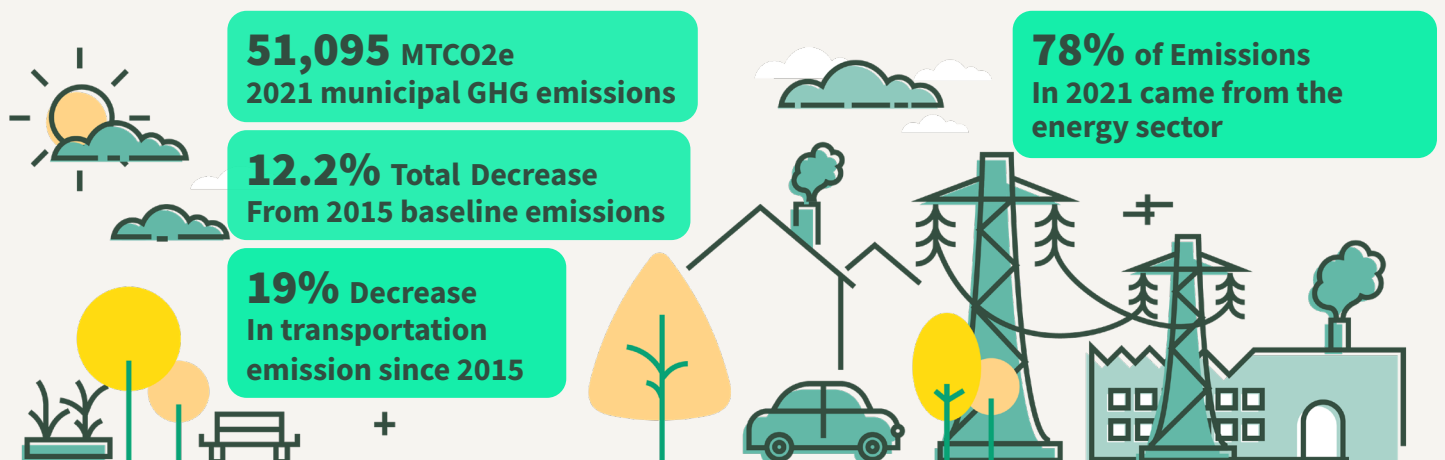
How do Municipal Emissions Relate to Community Emissions?

In 2021, municipal emissions made up 2.2% of the total community emissions. The municipal distribution across sectors resembles the community's inventory, with energy being the largest sector, followed by transportation and waste.



2021 Municipal Inventory Highlights

The emissions reported here represent the impact of City of Columbia operations as an organization. This report includes greenhouse gas (GHG) emissions associated with energy use, transportation, and waste produced by municipal operations only.



Emissions by Sector & Sources

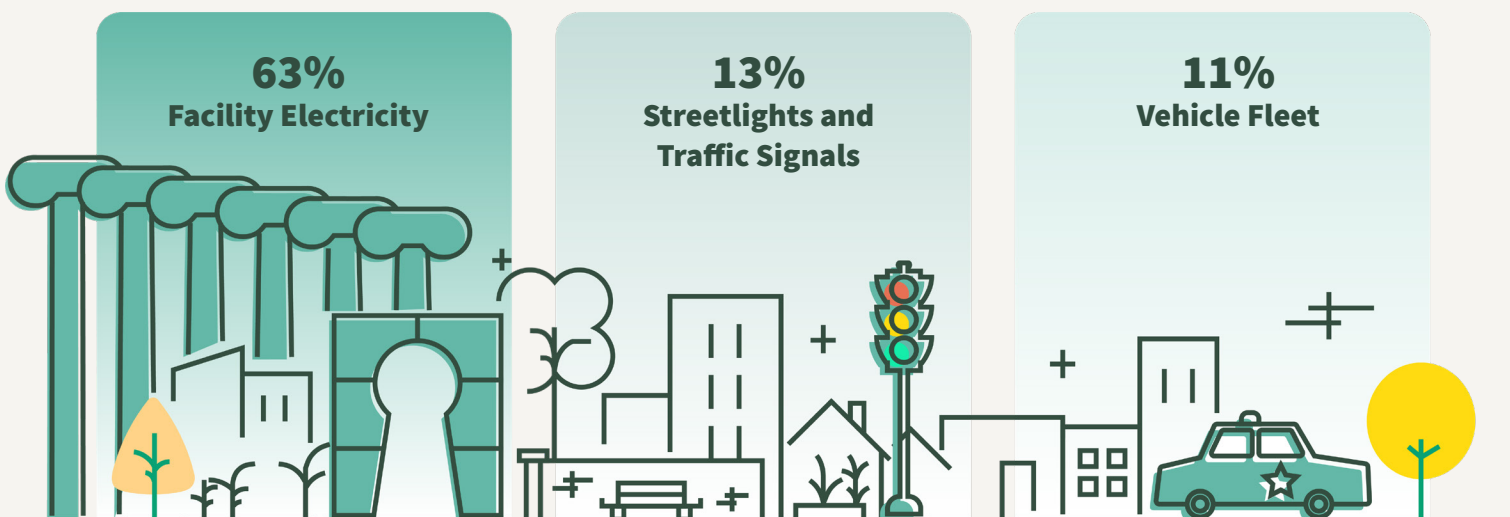
Ten sources of emissions are categorized into three sectors to calculate annual GHG emissions from City of Columbia municipal operations. This table displays the total MTCO₂e and the percentage of total emissions for each source and sector in calendar year 2021.

Facility electricity is the largest source of energy emissions and is comprised of electricity used by municipal buildings and water and wastewater treatment facilities. Several new municipal facilities have been added since 2015, while many existing facilities have undergone energy improvement projects. With these two factors at play, facility electricity emissions have remained relatively consistent throughout inventory years.

Sector	% of Total	MTCO ₂ e
Energy	78.1%	39,912
Facility Electricity	62.8%	32,065
Streetlights & Traffic Signals	12.8%	6,535
Facility Natural Gas	2.5%	1,261
Airport Fuel Oil	0.1%	51
Transportation	18.9%	9,651
Vehicle Fleet	11.3%	5,760
Employee Commute	5.3%	2,701
Transit Fleet	2.2%	1,103
Airport Equipment	0.2%	87
Waste	3.0%	1,532
Facility Solid Waste	2.6%	1,344
Facility Wastewater	0.4%	188
Total of Three Sectors		51,095

What Were the Largest Sources of Municipal Emissions in 2021?

City of Columbia staff is developing new tools to provide insight into municipal GHG emissions and guide progress towards reduction goals. Benchmarking municipal building energy is one tool that is being used to prioritize energy efficiency projects and renovations. The first municipal benchmarking report can be found at CoMo.gov/sustainability/internal-sustainability/. Tools for gaining insight into vehicle and transit fleet are also being developed.



[This page is intentionally left blank]



701 E. Broadway, P.O. Box 6015
Columbia, MO 65205-6015