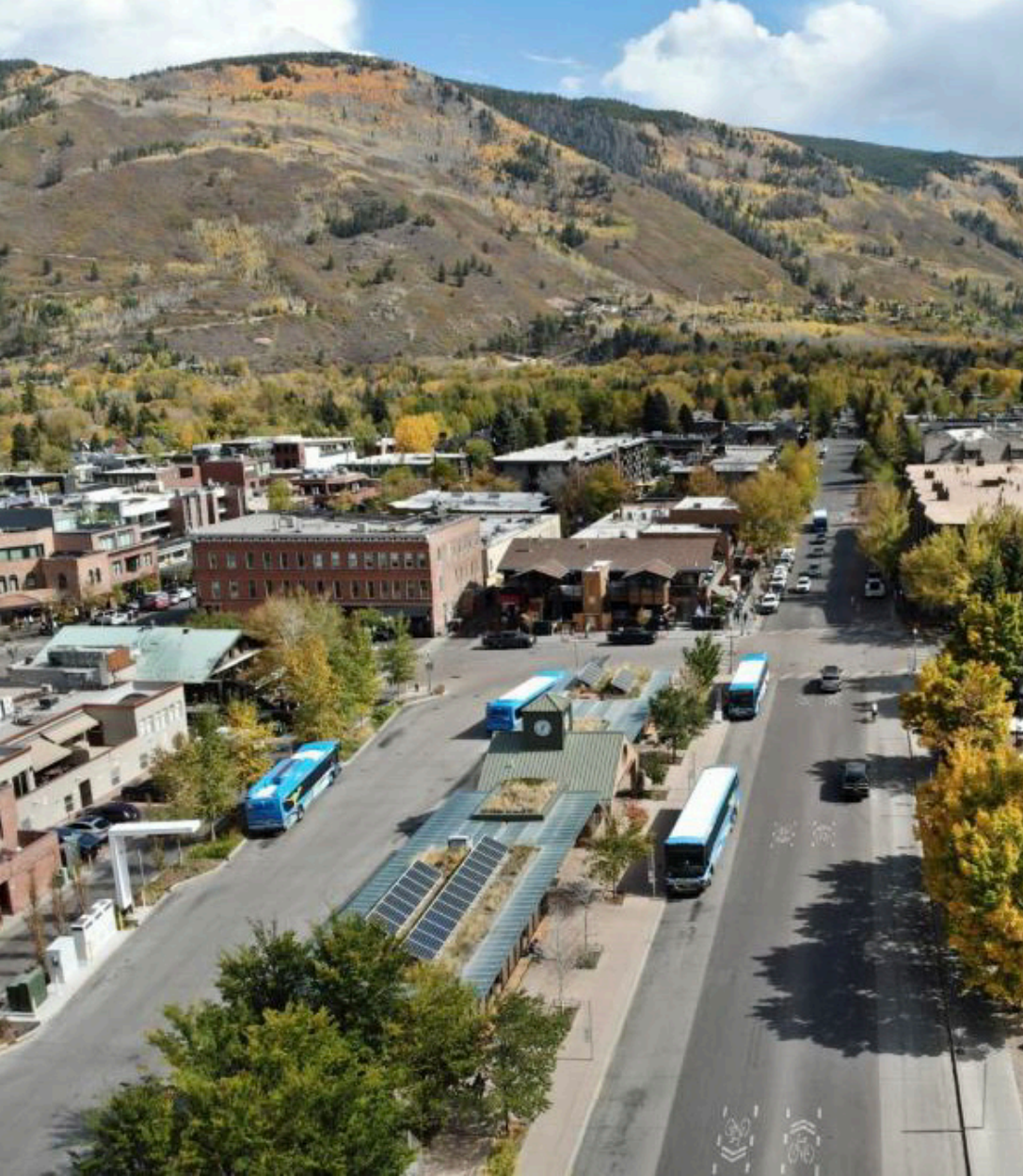


2023



CITY OF ASPEN

MUNICIPAL GREENHOUSE GAS INVENTORY



The City of Aspen completes both community-wide and municipal (city organizational operations) greenhouse gas (GHG) emissions inventories every three years. GHG reporting at the City of Aspen dates back to 2004. This report details the GHG emissions from city (municipal) operations, which are the result of city owned building energy use, fleet vehicle and equipment fuel use, waste created at city-owned buildings, employee business travel, and employee commuting.

In 2023, the City of Aspen, in collaboration with neighboring communities Town of Basalt, and Town of Snowmass Village, partnered with Pitkin County to complete a regional Pitkin County GHG inventory. Lotus Engineering and Sustainability, LLC (Lotus) was selected as the consultant team to complete both the community-wide and the City of Aspen municipal GHG emissions inventory as part of the regional Pitkin County GHG Inventory.

KEY FINDINGS

The City of Aspen's operational greenhouse gas emissions (GHG) in 2023 totaled 6,006 metric tons of Carbon Dioxide Equivalent (Co2e). Excluding employee commute emissions, operational GHGs in 2023 totaled 3,511 MTCO_{2e}. This represents a 5.5% decrease in emissions from the 2019 municipal GHG inventory (which is considered a more representative year for emissions than the 2020 municipal GHG inventory). Excluding employee commuting, emissions trended slightly down from previous inventories. Gas use in buildings is the most significant source of emissions followed by gasoline/diesel use in the city fleet.

EMPLOYEE COMMUTING

Employee commuting is a newly included source of operational emissions and makes up the largest portion of emissions at 42% of the total.

What the city can do:

The city can investigate ways to reduce employee commuting emissions through policy and programs and establish ongoing trends by surveying employees in future inventories.

BUILDINGS

Electricity use in City buildings increases from the last inventory due to the occupation of the new City Hall building but electricity emissions overall decrease.

Gas use is significantly up from the 2019/2020 inventory due to better data collection and analysis performed in 2023.

What the city can do:

Decreasing gas use in city buildings represents one of the most impactful ways the city can reduce its overall emissions footprint. By tracking city-owned building energy and water use over time through a process called benchmarking, staff can plan for eventual gas equipment replacements. The city should continue internal collaboration to reduce barriers to greater building electrification.

FLEET

City of Aspen fleet fuel usage overall saw a slight decrease from the 2019 inventory largely due to successes with the introduction of electric vehicles and equipment to the fleet.

What the city can do:

The city should continue to transition fleet vehicles and equipment as they reach the end of their useful life to electric and zero emission alternatives.

WASTE

Emissions from waste produced from city operations are difficult to measure, but data the city has collected shows waste emissions have trended downwards since the 2019 inventory was performed.

What the city can do:

The city should continue to collaborate on employee education to reduce solid waste totals through compost and recycling. The city should also look to purchase goods and supplies that have less packaging and are from local sources.

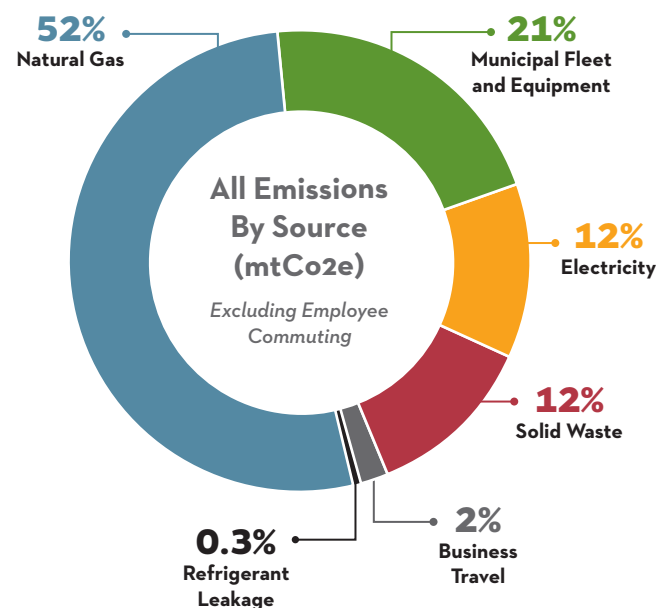
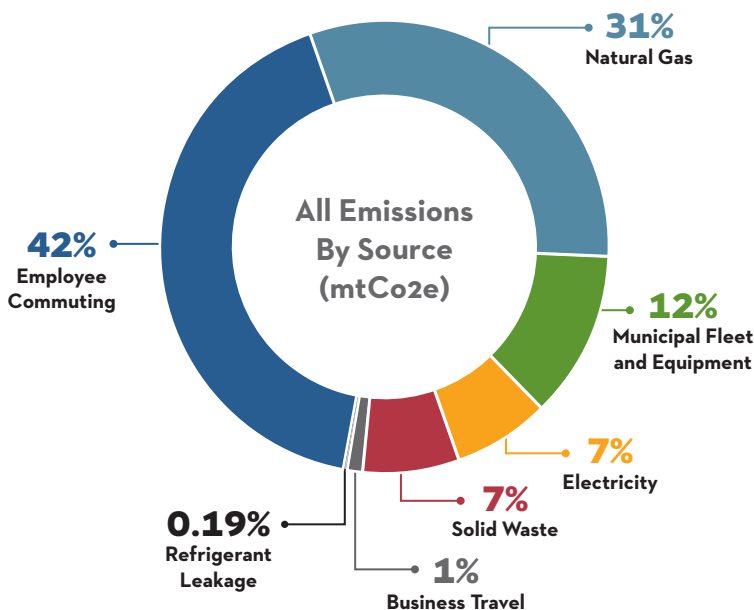
REFRIGERANTS

Buildings consider the impacts of refrigerants for the first time in this inventory which make up less than 1% of total emissions. Including refrigerants is a best practice for recording emissions and air quality in buildings.

What the city can do:

The city should continue to improve data collection/accuracy to understand the impacts of cooling systems in use in city buildings in future years.

The graphs below display the City of Aspen operational emissions with and without employee commuting:





GHG REDUCTION TARGET

In 2022, the City of Aspen adopted science-based targets that represent the Aspen community's fair share of emissions reduction needed to limit global warming to 1.5 degrees Celsius above pre-industrial levels (as outlined in the Paris Agreement). Aspen's science-based targets are as follows:

63.4% REDUCTION

based on 2017 emissions levels.

100% REDUCTION

based on 2017 emissions levels.

In addition, the city adopted targets to reduce waste emissions:

25% REDUCTION

in organic material buried in the landfill by 2025
and 100% reduction by 2050

70% REDUCTION

in all waste going to the landfill by 2050

The City of Aspen's operational GHG reduction goals follow the science-based targets outlined above.

DIRECT AND INDIRECT EMISSIONS SOURCES

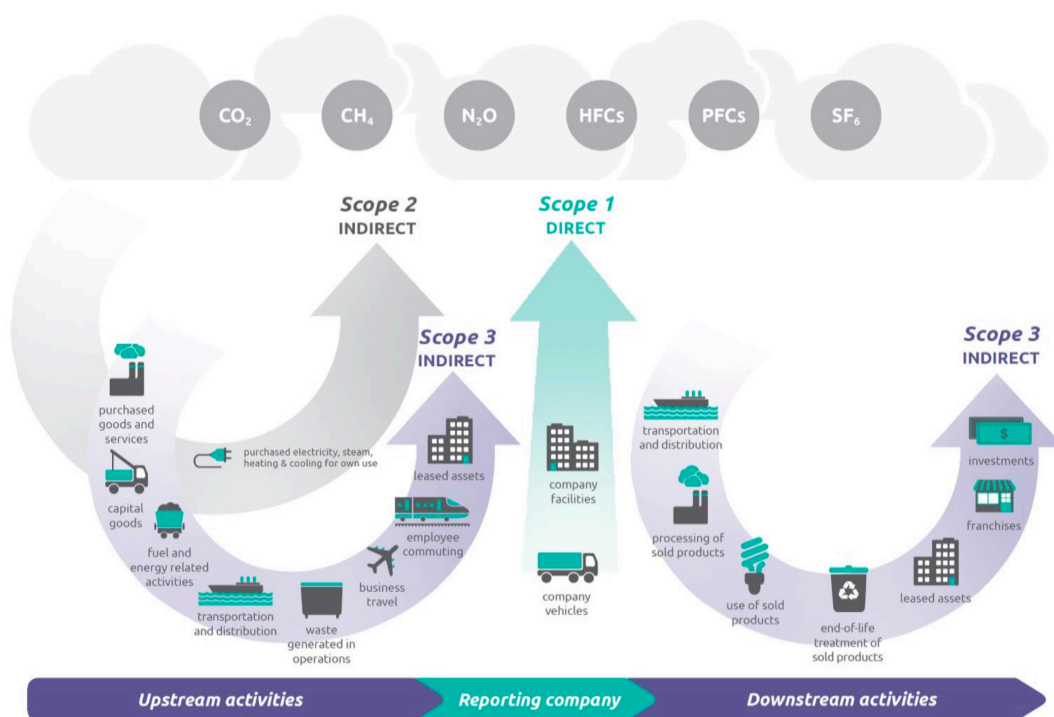
The Global Protocol for Community-Scale Greenhouse Gas (GPC) is the universally accepted standard for tracking progress towards climate goals. The GPC categorizes where emissions originate through a scope framework:

SCOPE 1: Direct emissions from sources owned or controlled by the city

SCOPE 2: Indirect emissions from the purchase and use of energy, such as electricity, steam, heating, and cooling

SCOPE 3: All other indirect emissions that occur in the city's value chain, such as when the city buys, uses, and disposes of products from suppliers

The image below explains the relationship between scope 1, scope 2, and scope 3 emissions.



Employee commuting emissions are a good example of scope 3 emissions. Employee commuting represents the estimated emissions from employees travelling to and from work from their homes. Employee commuting emissions are considered to be an indirect emissions source for the city, meaning it's a consequence of city operations but not directly within the city's control.

HOW THIS REPORT IS ORGANIZED

As employee commuting is a new emissions source, the report alternates between including and excluding employee commuting totals to help make better year-over-year comparisons.



STATIONARY ENERGY

Stationary energy emissions come from gas combustion, electricity generation, and refrigerants used to operate city-owned buildings, traffic lights, and streetlights.

In 2023, stationary energy made up 2,268 MTCO₂e of emissions, which accounts for:

38% OF CITY EMISSIONS
(including employee commuting)

64% OF CITY EMISSIONS
(excluding employee commuting)

Importantly, the ways that the city measures building energy consumption data have greatly improved since the last inventory. The Building IQ Ordinance passed in 2022 initiated the collection of energy and water use data for larger commercial and multifamily buildings which includes municipal buildings. This process is called benchmarking and provided the 2023 Municipal Greenhouse Gas Inventory with high-quality stationary energy data.

City of Aspen buildings are served by three utilities: Aspen Electric, Holy Cross Energy, and Black Hills Energy.

QUICK FACTS

59 city buildings analyzed and 693,258 square feet

Many use types: including offices and recreation centers

Residential units are not included in the Municipal GHG inventory.



ELECTRICITY EMISSIONS

The city of Aspen Utilities achieved 100% renewable energy status back in 2015, therefore there are no emissions recorded in buildings served by Aspen Electric. At the time of this inventory, fossil fuel energy sources accounted for approximately half of Holy Cross Energy's electricity supply. Holy Cross Energy is making progress towards its goal to provide 100% renewable energy to customers by 2030. Electricity use in buildings increased since the last inventory however due to Holy Cross energy bringing on more renewables, the emissions from electricity consumption decreased. Electricity consumed in city facilities served by Holy Cross Energy is considered scope 2 and accounts for:

7% OF EMISSIONS

(including employee commuting)

12% OF EMISSIONS

(excluding employee commuting)

GAS EMISSIONS

Gas use in city buildings represents the largest portion of emissions after employee commuting. Gas accounts for:

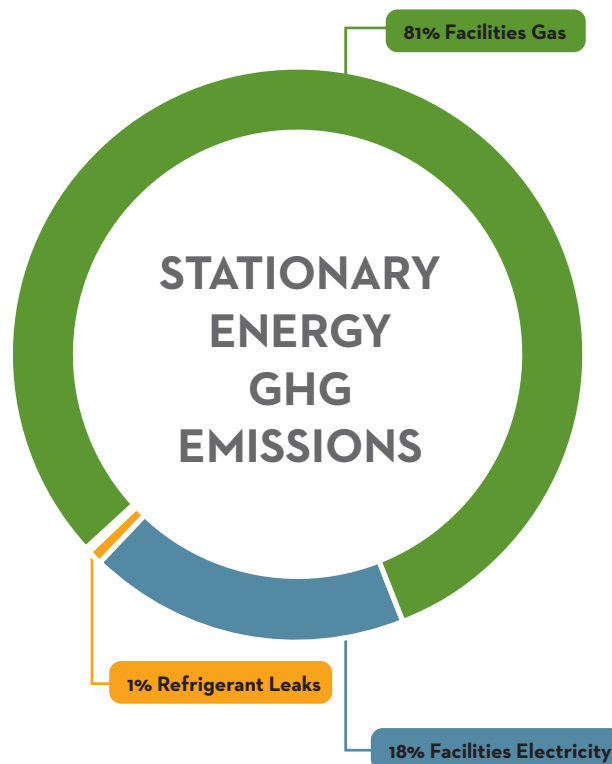
31% OF TOTAL EMISSIONS

(including employee commuting)

52% OF TOTAL EMISSIONS

(excluding employee commuting)

As the city has installed heating/cooling equipment that relies on gas as its primary energy source, these emissions are considered scope 1. Emissions from gas consumption increased by 1.4% since 2017. If accounting for stationary energy emissions separately from the combined total, gas accounts for 81% of all emissions due to the high carbon intensity of gas compared to other energy sources. Reducing gas consumption in buildings is a high impact opportunity to reduce emissions from the built environment. The city is addressing these emissions by starting work on projects such as the Municipal Facilities Decarbonization Roadmap in 2025.



REFRIGERANTS

Refrigerant data accounts for 11 metric tons of Co₂ equivalent (MTCO₂e), or about 1% of city emissions. These are scope 1 emissions because they originate from refrigerant loss in city equipment. The city inventoried emissions from cooling systems for the first time in 2023. Including "refrigerants" such as R-22, R-410A, and R-134a, often referred to by their chemical names or brand names like "Freon" is an emerging best practice.

Refrigerant data was collected through interviews with facilities managers who provided estimates of air-conditioned floor area and the type of cooling system in use. Emissions estimates were calculated by Lotus Engineering using an average expected leakage of 5% and the total cooled area. Interviews were conducted in conjunction with the Building IQ benchmarking program to benefit from cross-program synergies.



FLEET FUEL USE

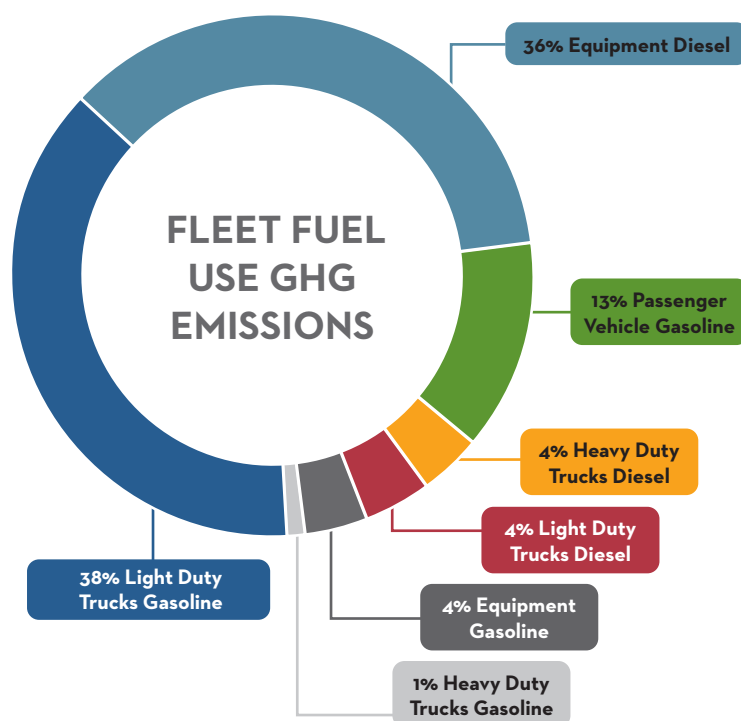
Fleet fuel emissions are created by fuel combustion and grid-supplied energy in municipal-owned fleet vehicles and equipment. The emissions factors include gasoline, diesel, ethanol, and electricity. The inventory includes both fleet vehicles (which could include passenger cars, pick-up trucks and heavy trucks) and fleet equipment (which includes lawn mowers, tractors and skid steers).

In 2023, municipal fleet emissions i.e. tailpipe pollution from gasoline/diesel fleet vehicles and equipment accounted for 740 MTCO₂e, or:

12% OF CITY EMISSIONS
(including employee commuting)

21% OF CITY EMISSIONS
(excluding employee commuting)

Emissions from gasoline, diesel, and ethanol are considered scope 1. Emissions from charging electric vehicles on a non-renewable grid are considered scope 2. Fleet fuel emissions from gasoline decreased by about 3% in 2023 compared to 2019. The emissions from diesel decreased by about 25% in 2023 compared to 2019. The gallons of diesel and gasoline significantly decreased in 2020; however, due to the pandemic, this activity data was excluded from this analysis.



In 2022, the city of Aspen signed on to become a GoEV City, which is a commitment to transition its fleet to 100% electric and zero emission alternatives by 2050. Electric vehicles represent the best opportunity to reduce fleet fuel emissions when powered on Aspen's Utilities 100% renewable energy electric grid and Holy Cross Energy's increasingly renewable grid. The Fleet Zero Emissions Roadmap outlines the steps necessary to replace gas-powered vehicles with zero emission vehicles and equipment.

QUICK FACTS

236 fleet assets were included in the analysis (140 vehicles and 103 pieces of equipment).

10 electric vehicles were included.

WASTE



Waste emissions are the result of waste generated from city operations that are sent to the landfill, as well as the emissions avoided from recycling. Waste produced by city operations accounts for 428 MTCO₂e and are considered scope 3.

Waste emissions represent:

7% OF CITY EMISSIONS

(including employee commuting)

12% OF CITY EMISSIONS

(excluding employee commuting)

Waste emissions for municipal operations are notoriously difficult to track, as staff would need to track the number of dumpsters leaving all city facilities, their weight, and what their contents were. In 2023, waste hauler reports (waste total estimates collected from drivers) were incorporated in the calculations used to estimate the city's emissions from the waste it produces. This was a slight improvement on previous inventories but still provides a very rough estimate of the true total.

BUSINESS TRAVEL



Business travel emissions include emissions from business air travel, business travel in ground transportation vehicles (such as rental cars, taxis, and fuel purchases at public facilities, etc.), and reimbursed mileage for business travel in employee-owned vehicles. Business travel is considered scope 3 and the data used in the inventory is collected from expense reports submitted by city employees in the financial software platform, Oracle.

Business travel accounts for just 76 MTCO₂e, or:

<1% OF TOTAL EMISSIONS

(including employee commuting);

2% OF TOTAL EMISSIONS

(excluding employee commuting).



EMPLOYEE COMMUTING

Employee commuting emissions are the result of mobile fuel consumption (the technical term for fuel used from travelling to and from a location) from employee commuting. The emissions come from gasoline, ethanol, diesel, and electricity. Including employee commuting emissions in municipal GHG inventories is an emerging best practice used by many municipalities to understand the indirect impacts of their employee's commute. Employee commuting represents 2,495 MTCO₂e of emissions or 42% of city operational emissions.

2023 EMPLOYEE COMMUTE SURVEY

The city widely shared a survey in both English and Spanish that asked 455 employees several questions about their commute to work including the total distance, how many times a week, and by what mode of transportation. 91 employees responded resulting in a 20% response rate to the survey, which is considered in the acceptable range to make the calculations necessary for the inventory.

Details of the survey sample size are included below:

Full-time employees	331
Part-time employees	194
Assumed % Worked by Part Time Employees	50%
Temporary employees	16
Assumed % of the Year Worked by Temporary Employees	25%
Seasonal employees	91
Assumed % Year Worked by Seasonal Employees	25%
Total number of City employees Full-Time Equivalent	455

Employee commuting represents the largest portion of emissions in the 2023 City of Aspen Municipal GHG Inventory. Compared to other municipalities that Lotus consultants have worked with, the total emissions recorded for employees commuting to the city of Aspen is considered high. There are multiple reasons for employee commuting emissions being so high, ranging from high cost of living and lack of housing causing staff to commute from further distances to issues with public transportation in areas where employees commute from.

YEAR OVER YEAR EMISSIONS TRENDS

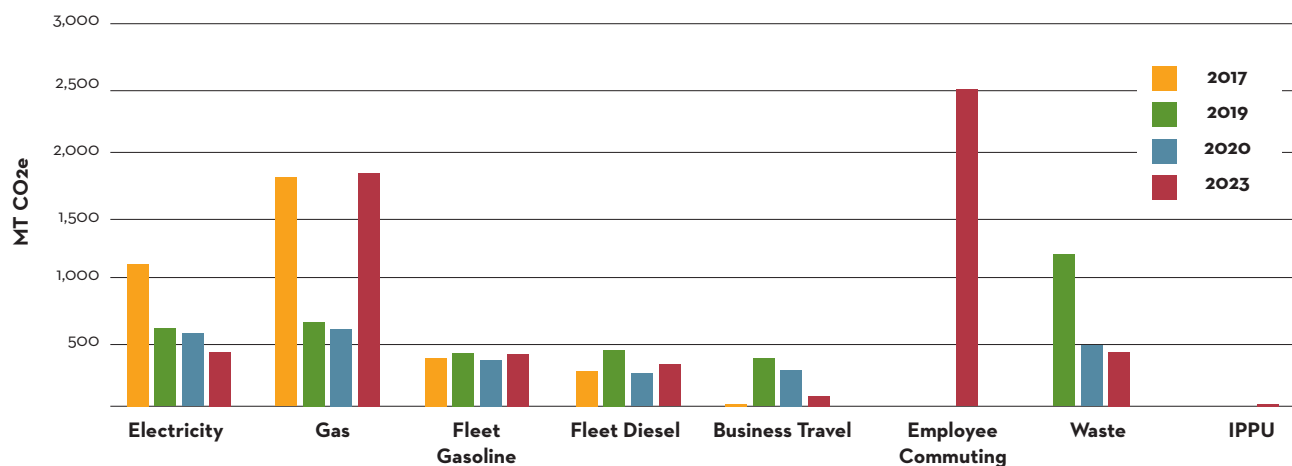
The table below shows emissions trends over the past several GHG inventory cycles (2017, 2019/2020, and 2023). Reduced emissions from electricity are due to the greening of Holy Cross Energy's power supply. Due to issues validating city-owned building data in 2020, there are discrepancies in 2019/2020 gas totals that have been corrected in the 2023 inventory. 2017 is considered a better year for year over year emissions comparisons. Employee commuting was calculated for the first time in 2023.

EMISSIONS BY SECTOR

	2017-2018	2019	2020	2023
Electricity	1,121	605	566	424
Natural Gas	1,808	669	615	1,833
Fleet Gasoline	378	426	353	415
Fleet Diesel	273	438	261	325
Business Travel	11	374	272	75
Employee Commuting	-	-	-	2,495
Waste	-	1,200	480	428
IPPU	-	-	-	11
TOTAL (including employee commute)	3,616	3,712	2,547	6,006
% Change since 2017-2018		3%	-30%	66%
TOTAL (excluding employee commute)	3,616	3,712	2,547	3,511
% Change since 2017-2018		3%	-30%	-3%

The graph below further highlights City of Aspen operational GHG emission trends:

EMISSIONS BY SECTOR FROM CITY OPERATIONS





CONCLUSION

In 2023, City of Aspen Municipal GHGs totaled 6,006 metric tons of Co₂e or 3,511 metric tons of Co₂e when excluding employee commuting. Employee commuting emissions are the largest portion of the inventory total by far, followed closely by stationary energy emissions, fleet and equipment fuel emissions, and then solid waste emissions. The 2023 Municipal GHG inventory benefited from improved data and analysis associated with building consumption data and fleet fuel use. The city should continue to investigate ways to improve data collection to make the reporting cycle easier. As the city continues to implement strategies to address emissions, focusing on reducing employee commuting emissions, replacing gas equipment, replacing gasoline/diesel/ethanol vehicles and equipment, and mitigating waste should be prioritized.

