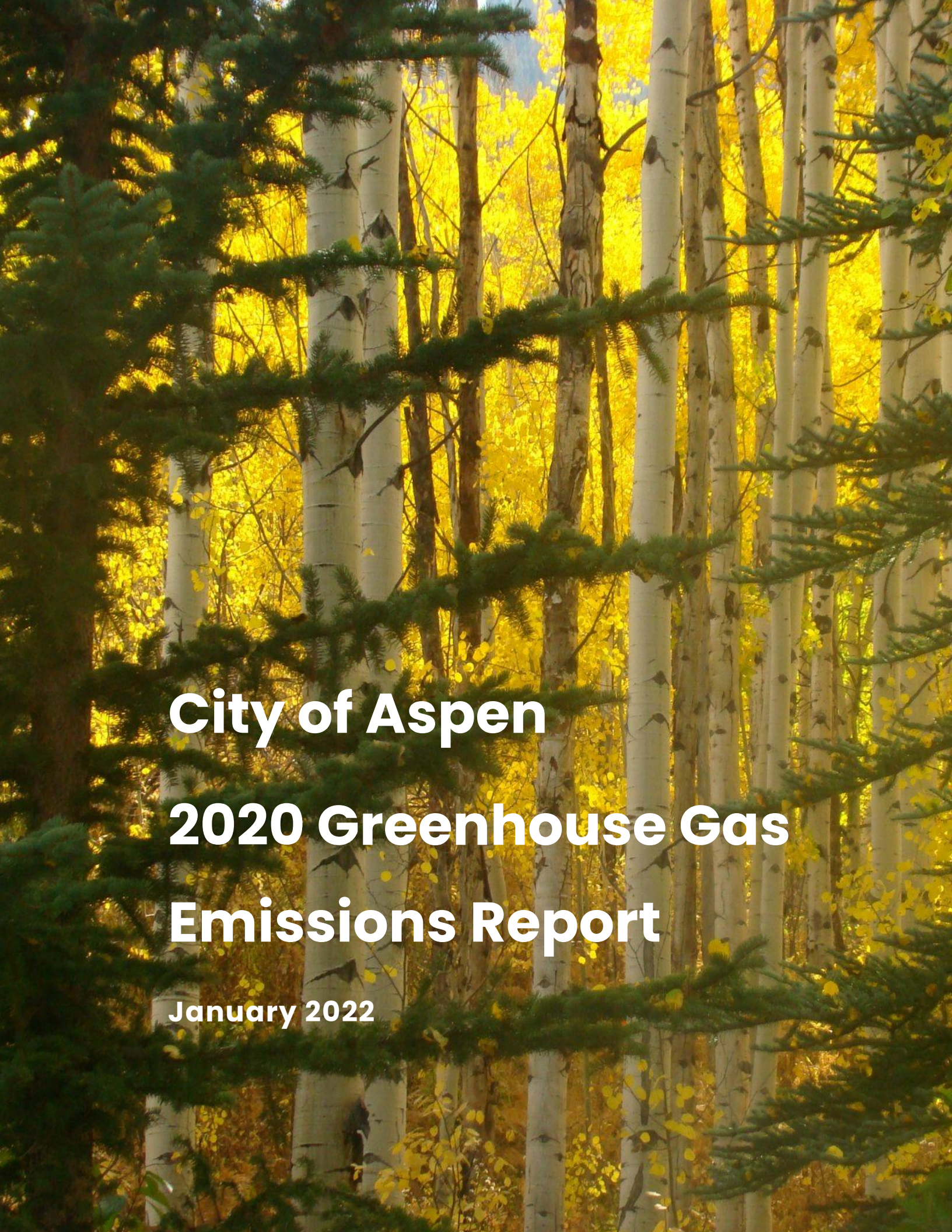

City of Aspen

2020 Greenhouse Gas Emissions Report

January 2022

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Executive Summary

Protecting the environment is a salient value within the City of Aspen (Aspen) community. The city is committed to fighting climate change and preserving the natural beauty that characterizes the region. Since 2004, Aspen has tracked their (greenhouse gas) GHG emissions and implemented rigorous emission mitigation policies, establishing itself as a leading city in the fight against climate change.

In line with ICLEI's Race to Zero Pledge[1], Aspen recently revised its climate goals to strive for a 63% reduction in emissions by 2030 and a 100% reduction in emissions (i.e., achieving zero carbon) by 2050 (over a 2017 baseline).

Aspen and surrounding communities conducted 2019 and 2020 GHG emissions inventories to understand current emissions sources and to inform future climate action planning. Due to the COVID-19 pandemic, 2020 was not a representative year of typical GHG emissions. Therefore, both a 2019 and 2020 inventory were conducted to understand the impact of COVID-19 and broader trends.

Aspen's Emissions Reduction Goals

63% reduction of GHG emissions by 2030 over 2017 baseline.

100% reduction of GHG emissions (net-zero) by 2050 over 2017 baseline.

Summary of 2020 Inventory Results

- Aspen's emission total in 2020 was 179,086 metric tons of carbon dioxide equivalents ($mtCO_2e$). Since 2017, Aspen has reduced emissions by 23%.
- In line with national trends, the buildings sector produced the greatest amount of Aspen's GHG emissions, comprising 57% of the total. Between 2017 and 2020,

[1] See https://icleiusa.org/race-to-zero/.

residential emissions decreased 30% and commercial emissions decreased 18%. Natural gas generated the most emissions at 32% of the community's total, followed by electricity at 26%.

- Since 2017, residential and commercial energy emissions have decreased significantly. This can largely be credited with the adoption of renewable energy policies and programs by the city's electric utility providers: Aspen Electric has transitioned to 100% renewable energy and Holy Cross has been actively greening its fuel mix over the past several years.
- Transportation emissions were the second greatest contributor to the total, where 15% of Aspen's total emissions come from the aviation sector and on-road transportation makes up 11% of Aspen's total emissions. On-road emissions are more easily influenced by local policy and programs than aviation. While emissions from the aviation sector have increased since 2017, on-road transportation emissions have decreased significantly.

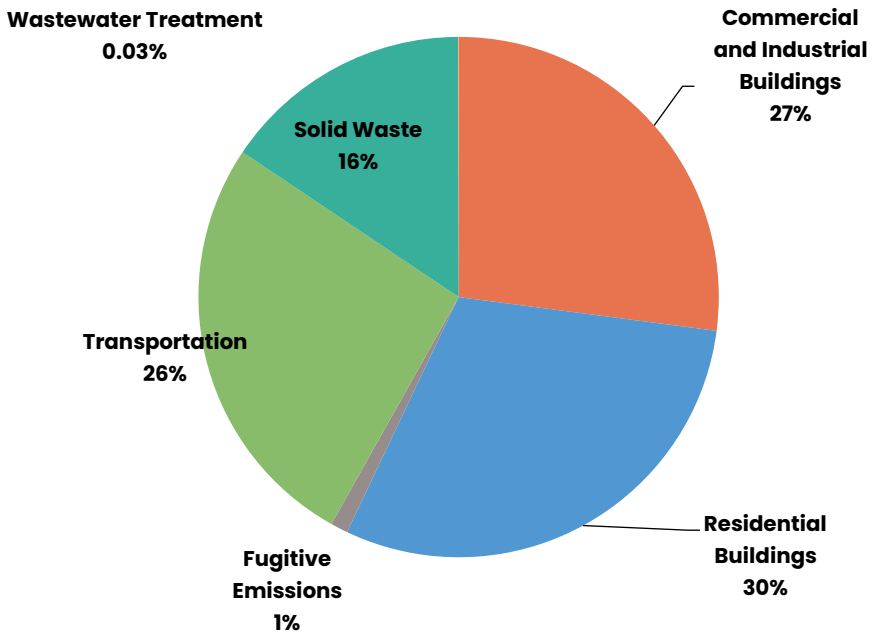

Figure ES 1: Aspen's 2020 emissions by sector.

- Aspen residents generated almost 26 tons of emissions per capita in 2020; while this is higher than the national average of approximately 20 tons per person,[2] the influx of population that Aspen experiences during the summer and winter tourism months is not reflected in the per capita total.
- Aspen's emissions decrease by 9% between 2019 and 2020. Much of the decrease in emissions during this time can be attributed to pandemic factors; specifically, the steep drop in transportation and commercial energy emissions.
- While Aspen is making good progress towards its goals by achieving a 23% reduction in emissions between 2017 and 2020, the emissions forecasts indicates that the community is unlikely to meet its emissions reduction targets without further action.

Key Findings for 2020

In 2020, the City of Aspen reduced overall emissions by 23% from the 2017 baseline.

The buildings sector contributed the largest share of emissions at 57%.

Residential buildings generated slightly more emissions than commercial buildings, and natural gas generated more emissions than electricity use.

Transportation activities, including those at the Aspen-Pitkin County Regional Airport, comprised 26% of emissions.

Waste emissions made up 16% of Aspen's 2020 inventory.

There was a 9% decrease in emissions from 2019 to 2020. This decrease in emissions can largely be attributed to the pandemic.

While Aspen is making good progress towards its goals, the community needs to take aggressive action to meet its emissions reduction targets.

[2] See https://www.epa.gov/sites/default/files/2021-04/documents/us-ghg-inventory-2021-chapter-executive-summary.pdf?VersionId=zIDuKzdiqjVlVgYiiK_CGXhk36JU02zr.

Progress Towards Emissions Goals

Emissions have decreased 23% since the 2017 inventory (assumptions used were consistent from 2017 to 2020 inventories). This significant decrease is due in large part to the reduced carbon intensity of purchased electricity in Aspen as well as Aspen's effective climate mitigation programs. The COVID-19 pandemic also played a role in reducing emissions, particularly in the transportation and commercial energy sectors.

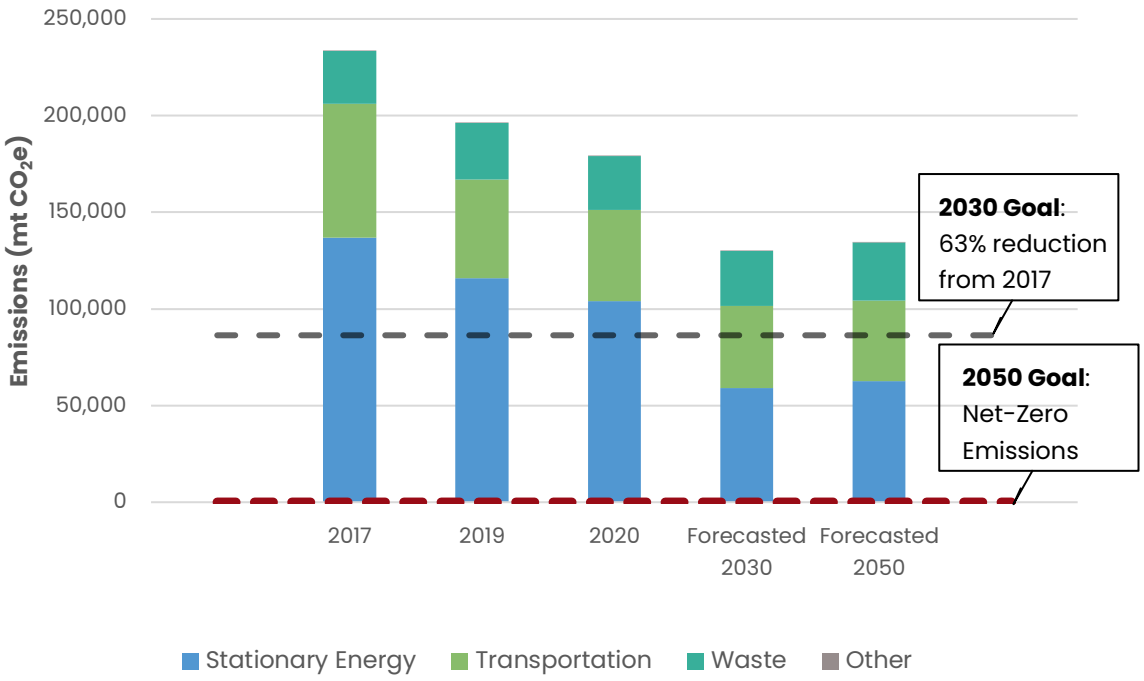

Figure ES 2: Aspen's business-as-usual forecasted emissions and reduction goals.

Aspen is making progress towards its goal of a 63% reduction in emissions by 2030, but based on a business-as-usual forecast, a concentrated effort will be needed to reach both the 2030 goal and the ambitious goal of reducing all emissions (net-zero) by 2050. Increasing the rate of implementation and intensity of emissions reductions strategies and policies, particularly those outlined in Aspen's CAP, will be necessary for Aspen to achieve its goals.

Introduction

The 2020 Intergovernmental Panel on Climate Change (IPCC) report issued a "code red for humanity," warning that human activities are changing the climate at an unprecedented rate. The report states that, "unless rapid and deep reductions in CO2 and other greenhouse gas (GHG) emissions occur," global warming will exceed 1.5 degrees Celsius in the coming decades.[i]

The climate crisis could have long-term impacts on the local economy, environment, and human health in Aspen. The region could see temperature increases between 2.5-6.5 degrees Fahrenheit; hotter and drier summers; and greater amounts of winter precipitation falling in the form of rain rather than snow.[ii] Observed changes in regional conditions, such as the fact that Aspen is experiencing 31 more frost-free days per year than it was between 1980-1989, provide evidence that climate change is already manifesting itself locally.[iii] As is the case globally, the degree to which Aspen will be affected by climate change over the medium and long term is directly tied to current and future emissions trajectories.

While tackling climate change requires global-scale emissions reductions, communities like Aspen have the power to lead in emissions reductions and inspire action by example. Through the implementation of ambitious local climate policies and dramatic GHG emission reductions, Aspen has the power to inspire regional, national, and international planning efforts.

About the GHG Inventory

The Community Office for Resource Efficiency (CORE), the City of Aspen (Aspen), and Pitkin County contracted Lotus Engineering and Sustainability, LLC (Lotus) to create 2019 and 2020 greenhouse (GHG) emissions inventories for Aspen and surrounding communities. The purpose of these inventories is to understand current GHG emission sources and guide future climate action planning. The inventories include all BASIC sources and sectors per the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC protocol) methodology,[3] plus additional sources of emissions from aviation activities at the Aspen-Pitkin County Regional Airport. More information about the methodology of the inventory can be found in Appendix B.

GHG emissions are a product of emission factors and activity data and are reported in metric tons of carbon dioxide equivalent (mt CO_2e). Emission factors represent the carbon intensity of the fuel or materials used in a specific activity, while activity data refers to the data measured related to community activities, such as fuel consumed, electricity consumed, tons of waste generated, and vehicle miles traveled

GHG Emissions:

Scope 1, 2, and 3

Scope 1: GHG emissions from sources located within the community's boundary, including:

- Energy and transportation fuel combustion.
- Fugitive emissions (i.e., leakage of natural gas).
- Wastewater treated within the boundary.

Scope 2: Emissions occurring outside of the boundary because of the use of grid-supplied electricity, heat, steam, and/or cooling within the boundary.

Scope 3: GHG emissions that occur outside the boundary because of activities taking place within the boundary:

- Solid waste (including compost) treated outside the boundary.
- Transportation activities for which fuel combustion occurs outside the boundary.

[3]For more information regarding GPC see: http://c40-production-images.s3.amazonaws.com/other_uploads/images/143_GHGP_GPC_1.0.original.pdf?1426866613.

Aspen's Emissions Inventory Boundary

Aspen's GHG inventories prior to 2019 used an emissions inventory boundary (EIB) that included the City of Aspen and parts of unincorporated Pitkin County around the city, including ski areas, residential neighborhoods, and the Aspen/Pitkin County Airport. This boundary was used previously because it was assumed to capture emissions from the geographic area that represents the total of Aspen's core functionality and economy. Aviation activities are attributed to Aspen due to the prevalence of tourism-driven activities in the community

The 2019 and 2020 inventories use Aspen's legal boundaries to fully align with the GPC protocol and the methods used for other surrounding communities—in this way, using the City boundary avoids double-counting with inventories created for unincorporated Pitkin County. Due to the smaller geographic boundary in the 2019 and 2020 inventories compared to prior years, emissions from previous Aspen inventories were originally calculated to be significantly higher. The 2017 Aspen inventory has been adjusted to reflect the new geographic boundary so accurate comparisons can be made between the 2017 baseline year and subsequent inventories.

COVID-19 Impact on Emissions

The COVID-19 pandemic brought unprecedented changes to communities across the world. Thus, 2020 was not a year that represents typical emissions behaviors. National GHG emissions declined 10% from 2019-2020, marking a record-breaking decrease in the United States. The national drop in emissions is largely attributed to the pandemic. To understand typical emissions behavior as well as the impact of COVID-19, Aspen and surrounding communities conducted an inventory for both 2019 and 2020.

Analyzing the changes from 2019 to 2020 provides insight into how the pandemic may have influenced emissions behavior.

In the City of Aspen, emissions decreased 9% from 2019-2020, closely mirroring the national trend. Commercial activity and transportation were the greatest sectors impacted by COVID-19 policy. There were notable reductions in each of these sectors. Commercial and industrial building energy decreased 14% from 2019-2020. The transportation sector saw an 8% decline in vehicle miles and a related reduction in on-road transportation emissions (decrease of 9%). Aviation emissions also decreased 8% between 2019-2020. The reduction in commercial and transportation emissions from 2019-2020 can largely be attributed to the pandemic, rather than drastic policy changes or program success.

Aspen's GHG Emissions Inventory Trends

Overall Emissions Trends

In general, GHG emissions are driven by activity occurring within the community, and significant changes to community size, economy, and character will impact how emissions change over time. From 2017 to 2020, Aspen's population grew by nearly 2%, with an 8% increase occurring from 2017 to 2019, and then a 6% drop from 2019 to 2020. It should be noted, however, that population data does not account for the influx of visitors to the community in the summer and winter tourism months. In addition, census data was harder to collect in 2020, due to the COVID-19 pandemic. Population values, particularly those from 2020, may not be an accurate representation of the actual number of people living in Aspen over the year.

Table 1: Aspen population and housing trends.

Population and Housing Data				
Indicator	**2017**	**2019**	**2020**	**2017 to 2020 difference**
Population	6,879	7,431	7,004	1.8%
Number of housing units	5,907	6,483	6,213	5.2%

*2017 values reflect activity only within the City of Aspen boundaries, not the original totals for the EIB.

Aspen's emission total in 2020 was 179,086 metric tons of carbon dioxide equivalents ($mtCO_2e$). Since 2017, the Aspen community has reduced total CO_2e emissions by 23%. This decrease in emissions in 2020 is a significant accomplishment considering the growth in population and housing over the same time frame. The greatest reduction in emissions between 2017 and 2020 came from the transportation sector, in which emissions decreased by 32%. Stationary energy emissions decreased by 24% from 2017 to 2020.

In 2020, the building and the transportation sectors were the greatest emitters. Residential and commercial buildings contributed to over half of total emissions (57%), and transportation contributed about 26% of total emissions. By source, natural gas makes up the greatest percentage of total emissions (32%) followed by building electricity (26%). The relative contribution of each source and sector remained relatively stable from 2019-2020.

Emissions Overview for 2020 and 2019

In accordance with the GPC protocol, emissions are classified by sector (residential and commercial energy, on-road transportation, and waste). These sectors are further categorized by the source of emissions (electricity, natural gas, mobile gasoline, diesel etc.).

In 2020, the residential building sector accounted for 30% of total emissions, while energy from commercial and industrial buildings made up 27% of total emissions. Altogether, emissions from building energy use contributed to over half of all emissions. The transportation sector was also a significant emitter, making up 26% of total emissions. This is followed by solid waste which contributed 16% to the total.

Table 2: Aspen's 2019 and 2020 emissions by sector and percent change.

Sector	2019 Emissions	2020 Emissions	2019 to 2020 Change
Commercial and Industrial Buildings	56,167	48,484	-14%
Residential Buildings	57,295	53,700	-6%
Fugitive Emissions	2,293	1,920	-16%
Transportation	51,179	47,044	-8%
Solid Waste	29,171	27,878	-4%
Wastewater	65	60	-8%
Total	**196,169**	**179,086**	**-9%**

The breakdown of emissions by sector in Aspen's 2019 inventory was nearly identical to the 2020 results, see Figure 1 and Figure 2. Total emissions in 2019 were 196,169 $mtCO_2e$; between 2019 and 2020 emissions decreased by 9%.

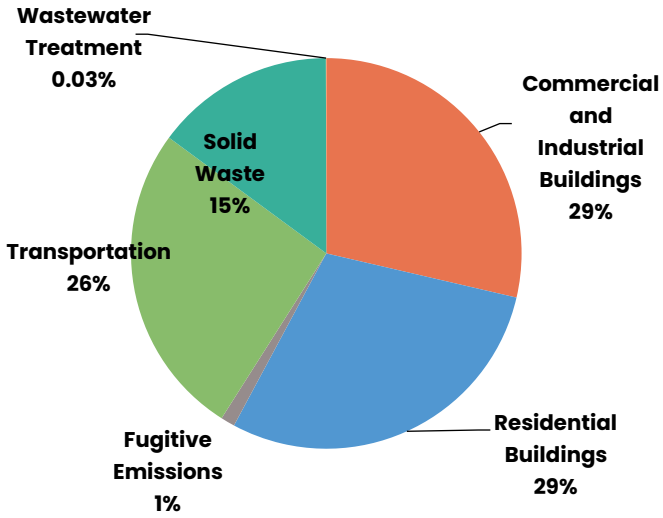

Figure 1: Aspen's 2019 Emissions by Sector

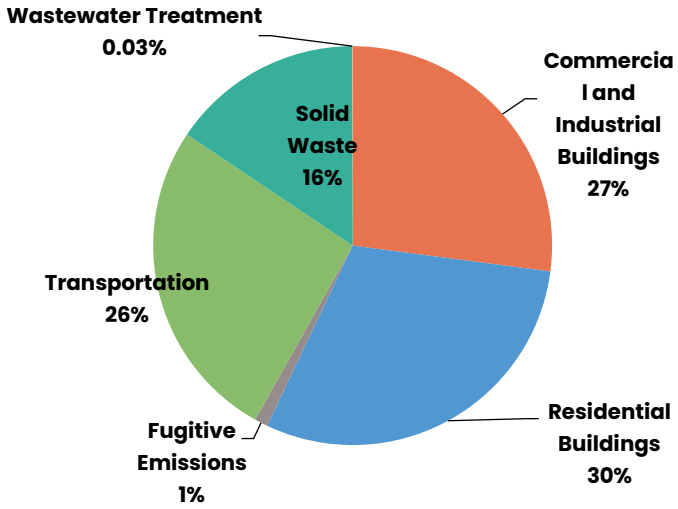

Figure 2: Aspen's 2020 Emissions by Source

Table 3: Aspen's 2019 and 2020 Emissions by Sector and Source

Sector	Source	2019 Emissions	2020 Emissions	2019 to 2020 Change
Energy	Electricity	47,053	46,309	-2%
	Natural Gas (including fugitive emissions)	68,134	57,067	-16%
	Propane	567	728	28%
Transportation	On-Road Gas and Diesel Vehicles	21,814	19,855	-9%
	On-Road EVs and EV Buses	131	129	-9%
	Aviation	29,234	27,060	-2%
Waste	Solid Waste (landfill and compost)	29,171	27,878	-4%
	Wastewater	65	60	-8%
Total		**196,169**	**179,086**	**-9%**

Emissions without the contribution from aviation are 166,935 $mtCO_2e$ in 2019 and 152,025 $mtCO_2e$ in 2020. See Figures 3 and 4.

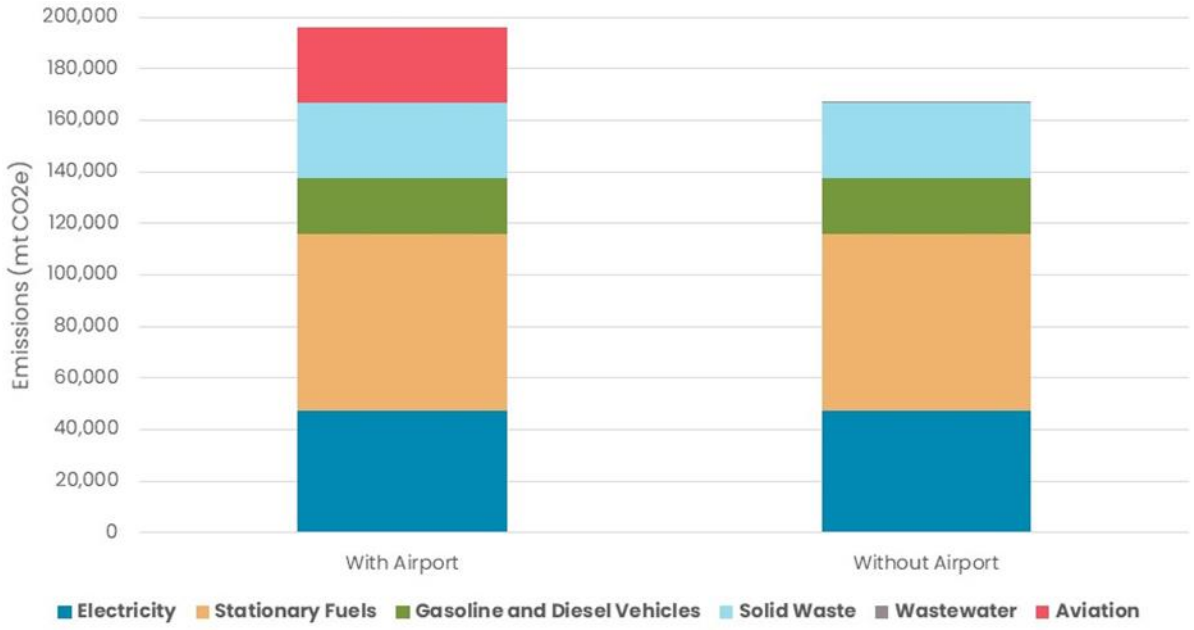

Figure 3: Aspen's 2019 Emissions by Source With and Without Aviation Contributions

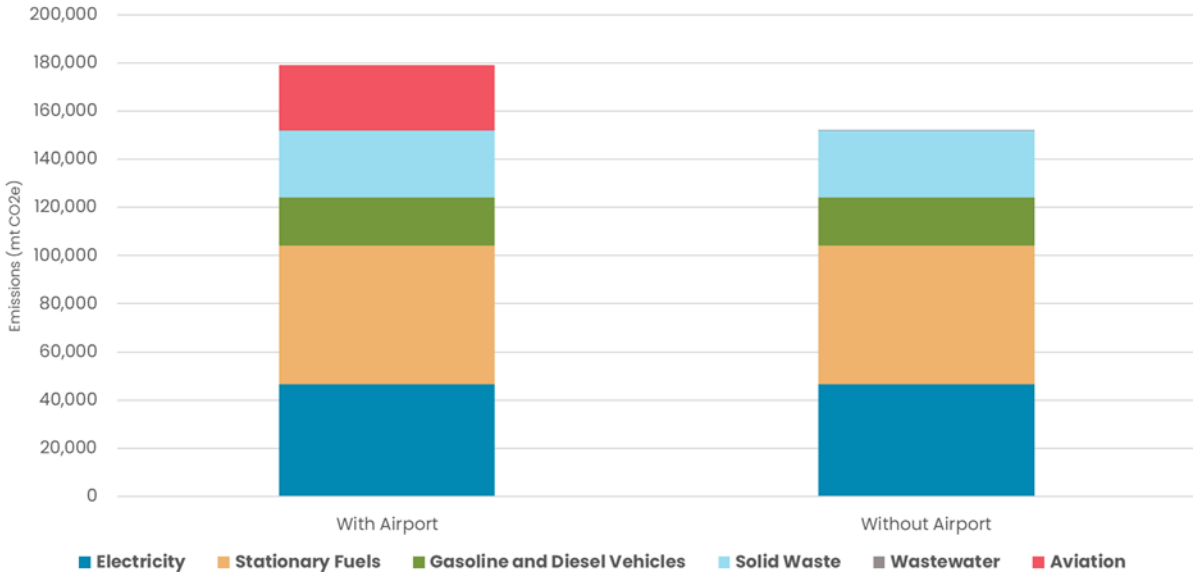

Figure 4: Aspen's 2020 Emissions by Source With and Without Aviation Contributions

Natural gas makes up the greatest percentage of emissions at 32%, followed by building electricity at 26%. Solid waste and aviation are also significant contributors to overall emissions, comprising 16% and 15%, respectively. See Figures 5 and 6.

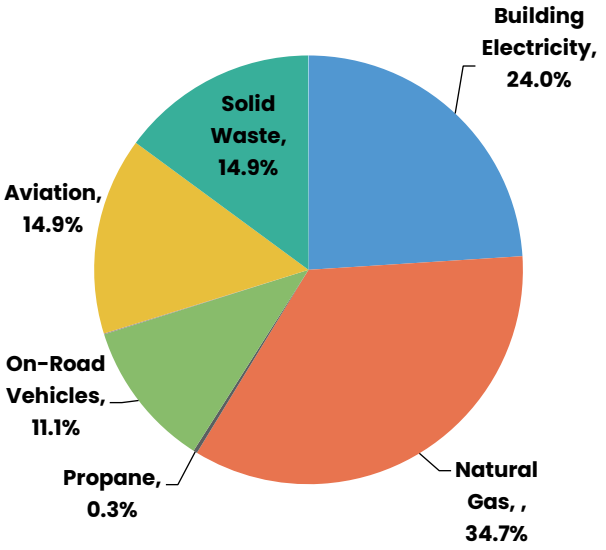

Figure 5: Aspen's 2019 Emissions by Source

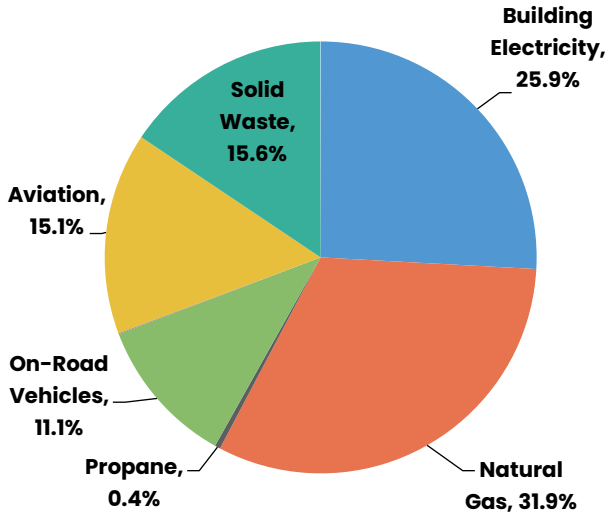

Figure 6: Aspen's 2020 Emissions by Source

Once again, the relative contribution of emissions sources was consistent from 2019 and 2020. In 2019, natural gas was the greatest contributor to overall emissions at 35%, and electricity made up 24% of total emissions. Solid waste and aviation both contributed 15%.

Aspen's GHG Emissions Details

Building Sector Emissions

Because emissions from residential and commercial buildings account for over half of all Aspen's emissions (57%), this presents significant opportunity for climate action efforts.

In 2020, residential electricity comprised 27% of building sector emissions, and residential natural gas accounted for 25% of total emissions. This is fairly comparable to the 2019 inventory in which residential electricity contributed 23% and residential natural gas made up 26% of total building emissions. See Figures 7 and 8.

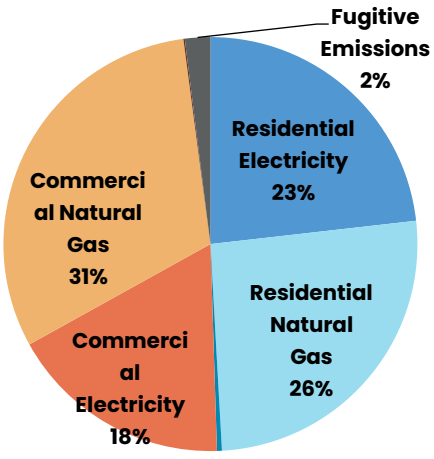

Figure 7: Aspen's 2019 Stationary Energy Emissions Details

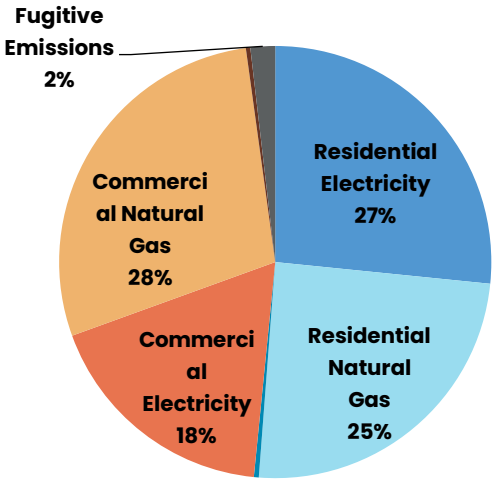

Figure 8: Aspen's 2020 Stationary Energy Emissions Details

Commercial and industrial energy uses, which includes multifamily housing, make up the other major proportion of emissions. In 2020, commercial electricity accounted for 18% of building emissions and commercial natural gas accounted for 28%. Once again, these emissions are fairly comparable to the 2019 inventory where commercial

electricity made up 17% of building emissions and commercial natural gas made up 31%. Residential and commercial building emissions decreased by 10% from 2019 to 2020, with more reductions seen in commercial buildings than residential buildings. This indicates that the slowdown in the commercial sector and tourism activities in 2020, due to the COVID-19 pandemic, were significant contributors to emissions reductions from this sector.

Since 2017, residential and commercial energy emissions have decreased significantly. Residential energy emissions have decreased 30% and commercial energy has been reduced by 18%. This can largely be credited with the adoption of renewable energy policies and programs by the city's electric utility providers. Aspen is served by two electrical utilities: Aspen Electric, the City-owned municipal utility which provides electricity for approximately 19% of Aspen customers, and Holy Cross Energy, which provides the remainder of electricity in Aspen. Aspen Electric has transitioned to 100% renewable energy. The emissions coming from electricity use in homes served by Aspen Electric are negligible. Holy Cross has also been actively greening its fuel mix over the past several years, and in 2020 the utility's resource mix was reported to be 44% sourced from renewable energy (an increase from 26% renewably sourced in 2017).

Emissions from the building sector accounted for 57% of total emissions in 2020 and 58% in 2019. Emissions from the building energy sector have significantly decreased since 2017 (30% for residential buildings and 18% for commercial buildings). Much of this decrease can be attributed to the adoption of renewable energy sources by Aspen's main electrical utility. Emissions from stationary energy decreased 10% between 2019 and 2020, with more savings coming from commercial buildings than residential buildings, indicating that the slowdown in commercial activity during the COVID-19 pandemic was likely the primary driver of emissions reductions during this time period.

A small share (1% in both 2019 and 2020) of stationary energy emissions are due to fugitive emissions that occur from the leakage of natural gas through the distribution system to homes and buildings.

COVID-19 Impact

Emissions from the stationary energy sector decreased 10% between 2019 and 2020, with more savings from commercial buildings than residential buildings. The decrease in commercial activity during the COVID-19 pandemic was likely the primary driver of commercial building emissions reductions during this time period.

Transportation Sector Emissions

The relative contribution of the transportation sector stayed consistent from 2019-2020 (making up 26% of Aspen's total emissions in both years). However, the metric tons of transportation emissions were reduced by over 4,000 mtCO2e from 2019-2020.

Within the transportation sector, aviation is the greatest emitter, accounting for 58% of transportation emissions in 2020 (and 57% in 2019). Since 2017, aviation emissions have increased by nearly 63%. Between 2019 and 2020, however, emissions from the aviation sector decreased by 7%. This is likely a result of pandemic travel restrictions.

In both 2019 and 2020, on-road transportation in gasoline and diesel personal and freight vehicles made up about 41% of the emissions from the transportation sector. A very small proportion of transportation emissions are generated from transit activities through the Roaring Fork Transit Authority's (RFTA) service in the City (2% in 2019 and 1% in 2020). Less than a quarter of one percent of transportation emissions come from the use of electric vehicles. See Figures 9 and 10.

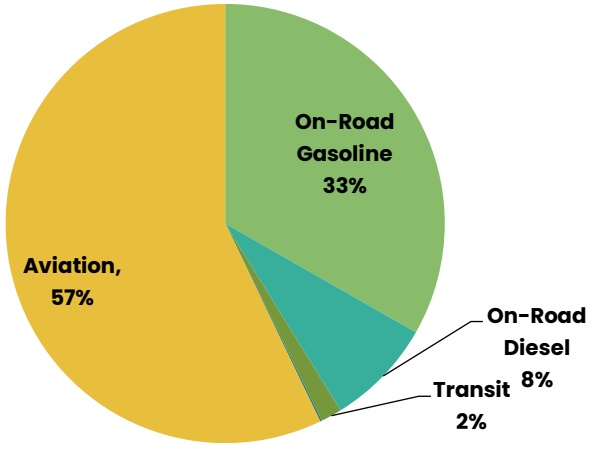

Figure 9: Aspen's 2019 Transportation Emissions Details

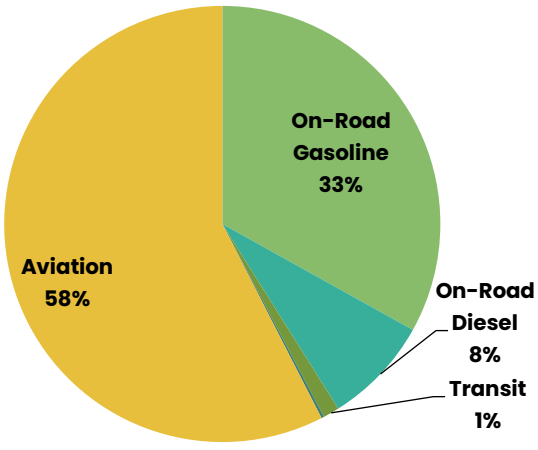

Figure 10: Aspen's 2020 Transportation Emissions Details

Total emissions from on-road activity in Aspen have decreased by 61% since 2017. This is primarily a result of a new methodology used to calculate vehicle miles traveled (VMT). The new methodology more accurately attributes regional trips to the City of Aspen and therefore reduces the amount of VMT accounted for in Aspen's inventory. Additionally, active efforts on the part of the City of Aspen and RFTA to improve public transit access and service in the community have aimed to decrease congestion. Aspen's CAP outlines several strategies that have likely contributed to reduced emissions in the on-road sector, including (but not limited to) expanding transit networks and incentives, expanding safe multi-modal (i.e., biking, walking, and transit) options in the community, and increasing the ratio of electric vehicles (EVs) in fleets throughout the community.

Transportation emissions made up 26% of all of the City of Aspen's emissions in 2020. The majority of these emissions come from on-road passenger and freight vehicles (41%) and in-boundary aviation (58%). Since 2017, on-road transportation emissions have decreased significantly (62%). This is due in large part to an updated methodology to calculate VMT study. It can also be attributed, in part, to the success of the City's effort to improve multimodal and EV options.

COVID-19 IMPACT

Aspen's total VMT decreased 8% from 2019 to 2020. Correspondingly, from 2019-2020, on-road transportation emissions were reduced by 9%. Aviation emissions also experienced an 8% decrease in emissions from 2019-2020. Up until 2019, aviation emissions were increasing dramatically each year. The 2019-2020 drop in transportation emissions reductions can largely be attributed to the pandemic.

Waste Sector Emissions

The waste sector accounted for 16% of Aspen's total emissions in 2020 and 15% in 2019. Within the waste sector, almost the entirety of emissions came from landfilled waste (99%), while only 1% came from compost and 0.2% came from wastewater. Refer to Figure 11.

The vast majority of waste emissions in Aspen come from solid waste that is landfilled (99%); 1% of waste emissions come from composting food and other organic waste. Waste emissions have decreased by 2% from 2017 to 2020.

Total emissions from community-generated solid waste have increased slightly (2%) since 2017. Waste emissions are historically some of the most difficult to measure due to difficulties in accurately tracking and attributing waste to communities. Waste deposited at the Pitkin County Solid Waste Center (PCSW) is attributed to Aspen based on population; construction and demolition (C&D) waste, which makes up a significant portion (58%) of the waste tonnage in Aspen, is determined based on the total amount of C&D waste disposed of at PCSW and Aspen's proportion of building permits relative to surrounding communities.

In general, per-capita waste generation is extremely high in Aspen. On average, 17.3 pounds of waste is produced per capita each day in Aspen. This is nearly four times the US average of 4.5 pounds per capita per day. However, this per capita value only reflects Aspen's full-time resident population, and doesn't consider the fact that Aspen is a tourist-based economy. Therefore, all waste produced by out-of-town visitors is attributed to residents.

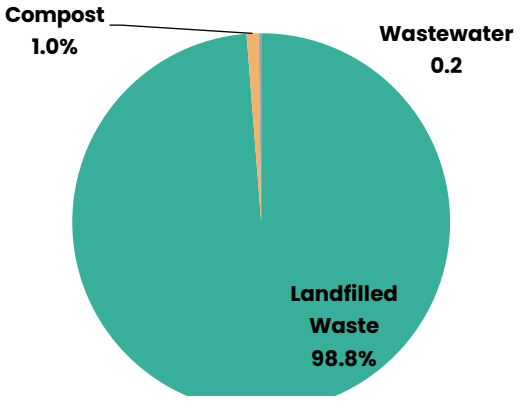

Figure 11: Aspen's 2020 Waste Emissions Details

COVID-19 Impact

In general, there are a couple COVID-19 factors that could influence waste. On the one hand, the pandemic led to an increase in take-out packaging, disposable products, and masks that ended up in landfills. On the other hand, the pandemic led to a

decrease in tourism. This is particularly relevant for communities, like Aspen, that experience a large influx of visitors. The reduction in tourism may have reduced the city's waste and emissions in 2020.

Overall, waste emissions decreased 4% (1,293 mtCO2e) from 2019-2020 in the City of Aspen. This is a relatively small decrease, and it is difficult to determine the degree to which the pandemic influenced this reduction.

Contributors to Aspen's Emissions Trends

To better understand the major drivers of emissions trends between 2017 and 2020, the ICLEI-Local Governments for Sustainability Contribution Analysis tool[4] was completed for Aspen. This tool normalizes changes in emissions with external factors such as population change and weather patterns to determine the primary drivers in emissions changes between the two years.

Based on this analysis, the known drivers that increased emissions produced in Aspen between 2017 and 2020:

- Increased commercial energy use per job.
- Population growth.
- Colder winter.

The primary drivers that led to a 23% reduction in emissions between 2017 and 2020 were:

- Decrease in energy use per household.
- Decrease in VMT per person.
- Decrease in jobs in the area.
- Electricity and heating fuels mix.

The graph below shows the factors that drove up emissions (red) as well as the greatest contributors to the decrease in emissions (blue) from 2017-2020. According to the graph, increased commercial energy use per job and population growth were significant factors in driving up emissions. Conversely, lower energy use per household

[4] See https://icleiusa.org/ghg-contribution-analysis/.

and decreased VMT per person were the primary contributors to reducing emissions between 2017 and 2020. Refer to Figure 12.

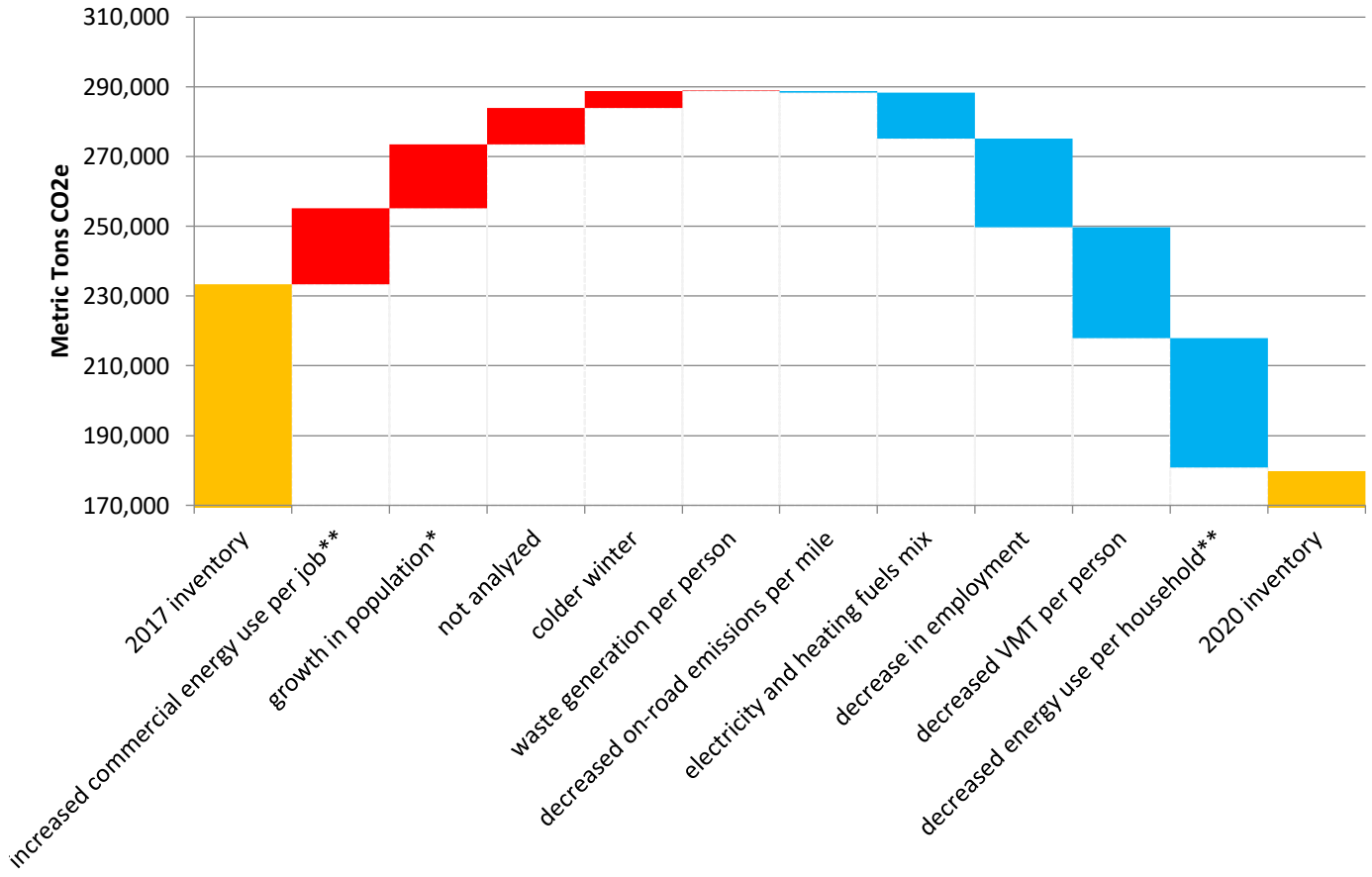

Figure 12: Aspen's 2017-2020 Contribution Analysis

Forecasted Emissions and Progress Towards Aspen's Goals

Aspen has established aggressive emission reduction goals to align with science-based targets—the City is striving for a 63% reduction in emissions from the 2017 baseline by 2030, and to be net-zero emissions by 2050.

While Aspen is making good progress towards its goals by achieving a 23% reduction in emissions between 2017 and 2020, the community is unlikely to meet its emissions reduction targets without further action. Figure 13 shows the business-as-usual

emissions forecast (i.e., the most likely emissions trajectory if no further action is taken) compared to Aspen's 2030 and 2050 goals.

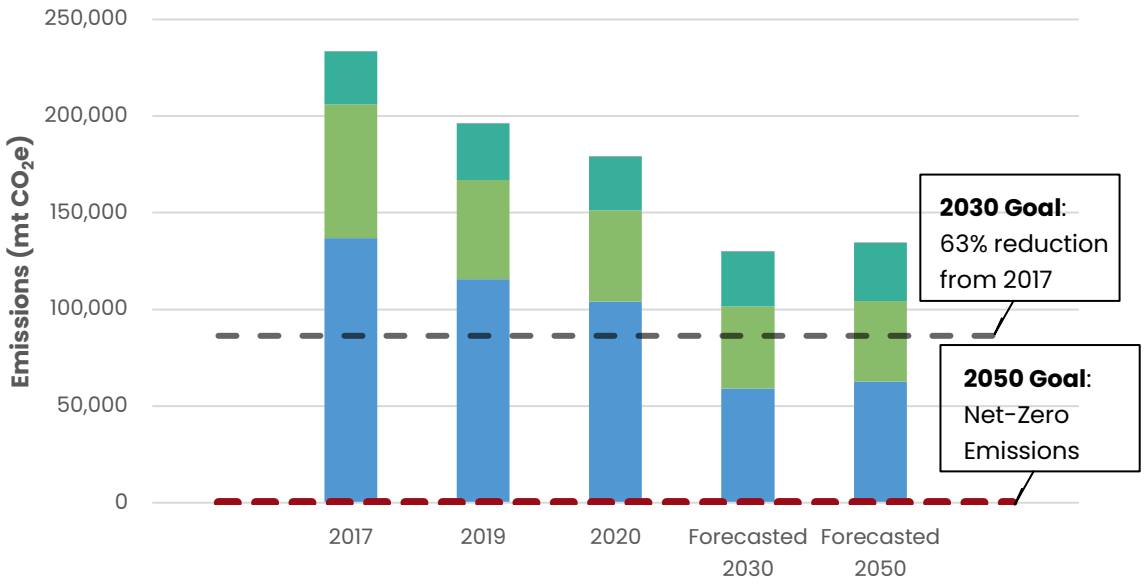

Figure 13: Aspen's business-as-usual forecasted emissions and reduction goals

Aspen's emissions are anticipated to grow between 2030 and 2050 in line with expected community population growth. In order for Aspen to reach its goals, additional policies, programs, and community engagement will be needed. Areas of opportunity may include reducing emissions from building energy use through energy reduction programs and policies and building electrification policies. Additional progress may come from supporting greater adoption of EVs and decreasing the use of single occupancy vehicles in the community.

Conclusion

The Aspen community has reduced its overall GHG emissions by 23% from the 2017 baseline. This impressive reduction in emissions demonstrates Aspen's leadership and commitment to mitigating the impacts of climate change. Aspen's innovative approach to emissions reductions, including moving the municipal-owned electric utility to 100% renewable energy, investing in projects to increase community-wide building energy efficiency, and improving public transit systems, have in large part driven these emissions reductions. In addition, Aspen has implemented successful

waste diversion programs, which have reduced emissions from the waste sector, a small amount, although there is more room for progress here.

Aspen continues to establish itself as a leading community. In the coming decades, climate mitigation efforts must continue and intensify to reach the City's goal of net-zero emissions by 2050. Through a continued effort to improve and accelerate the data-driven strategies, projects, programs, and policies outlined in Aspen's climate action plan, the City can ensure that Aspen remains at the forefront of climate action.

Appendix A: Table of All Emissions by Source and Sector

Emissions Inventory by Scope Summary				
Scope	**2019 Emissions**	**2019 % of Total**	**2020 Emissions**	**2020 % of Total**
Scope 1	90,515	46%	77,649	43%
Scope 2	47,184	24%	46,438	26%
Scope 3	58,469	30%	54,998	31%
Total	**196,169**		**179,086**	

Emissions by Sector Summary					
Sector	**2019 Emissions**	**Percent of 2019 Total**	**2020 Emissions**	**Percent of 2020 Total**	**2019 to 2020 Change**
Commercial and Industrial Buildings	56,167	29%	48,484	27%	-14%
Residential Buildings	57,295	29%	53,700	30%	-6%
Fugitive Emissions	2,293	1%	1,920	1%	-16%
Transportation	51,179	26%	47,044	26%	-8%
Solid Waste	29,171	15%	27,878	16%	-4%
Wastewater	65	0.03%	60	0.03%	-8%
Total	**196,169**		**179,086**		**-9%**

	All Emissions by Source				
Sector	**Source**	**2019 Emissions**	**2019 % of Total**	**2020 Emissions**	**2020 % of Total**
Energy	Electricity	47,053	24%	46,309	26%
	Natural Gas	68,134	35%	57,067	32%
	Propane	567	0.3%	728	0.4%
Transportation	On-Road Gas and Diesel Vehicles	21,814	11%	19,855	11%
	On-Road EVs and EV Buses	131	0.07%	129	0.07%
	Aviation	29,234	15%	27,060	15%
Waste	Solid Waste (landfill and compost)	29,171	15%	27,878	16%
	Wastewater	65	0.03%	60	0.03%
Total		**196,169**		**179,086**	

Appendix B: Inventory Methodology

Lotus Engineering and Sustainability, LLC (Lotus) was contracted by the Community Office for Resource Efficiency (CORE), the City of Aspen, and Pitkin County to create 2019 and 2020 community-wide greenhouse gas (GHG) emissions inventories for the City of Aspen. The purpose of these GHG emissions inventories is to create a clear picture of current GHG emission sources in Aspen and provide an updated inventory that will guide climate action planning.

Inventory Methodology

The 2019 and 2020 GHG inventories use the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC protocol) methodology.[5] The GPC provides a transparent and consistent GHG accounting methodology for reporting community GHG emissions. There are two reporting levels for the community framework:

- BASIC: The BASIC level includes stationary energy, in-boundary transportation, and community-generated waste.
- BASIC+: The BASIC+ level includes BASIC emissions sources, as well as more comprehensive coverage of emissions sources such as transboundary transportation; electricity transmission and distribution losses; industrial processes and product use; and agriculture, forestry, and other land uses.

The 2019 and 2020 community GHG inventories were developed in compliance with the GPC BASIC reporting level. Emissions from transboundary aviation, which is a BASIC+ source, were additionally included in these inventories because they represent emissions occurring primarily as a direct result of the community's tourism-based economy.

[5]For more information regarding GPC see: http://c40-production-images.s3.amazonaws.com/other_uploads/images/143_GHGP_GPC_1.0.original.pdf?1426866613.

Calculating Emissions

GHG emissions are a product of emission factors and activity data. Emission factors represent the carbon intensity of the fuel or materials used in a specific activity. Activity data refers to the data measured for the community GHG emission inventory calculations, such as fuel consumed, electricity consumed, tons of waste generated, and vehicle miles traveled. Activity data is influenced by community indicators (e.g., population, economic growth, etc.), energy consumption, and other consumption-related behaviors (e.g., mode of transportation, etc.). Changes in emissions result from the interplay of activity data and emission factors.

GHG Emissions:

Scope 1, 2, and 3

Scope 1: GHG emissions from sources located within the c community's boundary, including:

- Energy and transportation fuel combustion.
- Fugitive emissions (i.e., leakage of natural gas).
- Wastewater treated within the boundary.

Scope 2: Emissions occurring outside of the boundary because of the use of grid-supplied electricity, heat, steam, and/or cooling within the boundary.

Scope 3: GHG emissions that occur outside the boundary because of activities taking place within the boundary:

- Solid waste (including compost) treated outside the boundary.
- Transportation activities for which fuel combustion occurs outside the boundary.

Emissions Inventory Boundary

Aspen's GHG inventories prior to 2019 used an emissions inventory boundary (EIB) to calculate emissions; this EIB included the City of Aspen and parts of unincorporated Pitkin County around the city, including ski areas, residential neighborhoods, and the Aspen/Pitkin County Airport. This boundary was used previously because it was assumed to capture emissions from the geographic area that represents the total of Aspen's core functionality and economy. The 2019 and 2020 inventories do not use the EIB, but instead, use the City of Aspen's legal boundaries to fully align with the GPC protocol and the methods used for other surrounding communities. The emissions outside Aspen's city limit are now accounted for in the unincorporated Pitkin County inventories. Due to the larger geographic boundary in the 2019/2020

inventory, emissions from previous Aspen inventories are significantly higher. The 2017 Aspen inventory has been adjusted to reflect the new geographic boundary so accurate comparisons can be made to the 2017 baseline year.

Emissions Scope, Sectors, and Sources

The inventory analyzes emissions by scope and further breaks down emissions into applicable sectors (e.g., residential building energy use, on-road transportation, etc.) and source (e.g., electricity, natural gas, mobile gasoline, etc.). The 2020 inventory quantifies emissions from the scopes, sources, and sectors in the text box to the right.

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