Attachment 2

2014 PITKIN COUNTY GREENHOUSE GAS EMISSIONS INVENTORY

A REPORT BY THE COMMUNITY OFFICE FOR RESOURCE EFFICIENCY (CORE)
PREPARED FOR PITKIN COUNTY, 2017

CORE
Community Office for Resource Efficiency

Pitkin County

ACKNOWLEDGEMENTS

The Community Office for Resource Efficiency (CORE) performed this inventory on behalf of Pitkin County, Colorado. CORE is a nonprofit organization that works cooperatively with businesses, individuals, utilities, and government entities to create measurable improvements in energy and water efficiency in order to benefit the environment and develop a more sustainable economy. The organization has also completed GHG inventories on behalf of regional partners (the Town of Snowmass Village and the Town of Basalt).

The *2014 Pitkin County Greenhouse Gas Emissions Inventory* was made possible by the assistance and support of Ashley Perl (Climate Action Manager, City of Aspen), Chris Menges (Data Research and Project Planner, City of Aspen), Mona Newton (Executive Director, CORE), Lara Whitley (Community Engagement and Marketing Manager, CORE). A special thanks to Emily Artale and Hillary Dobos (Lotus Sustainability) for providing insight and expertise.

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EXECUTIVE SUMMARY

Pitkin County has long been committed to climate action. For more than a decade, the County has made greenhouse gas (GHG) emission reduction a priority, and has invested in energy efficiency, renewable energy, alternative transportation and waste minimization, among other efforts. These measures undoubtedly translated into a reduction of GHG emissions, however without tracking the amount of emissions in Pitkin County, it was impossible to know to exactly what extent. With this report, the *2014 Pitkin County Greenhouse Gas Emissions Inventory*, Pitkin County now has a snapshot of overall emissions and a baseline against which emissions reduction trends can be assessed.

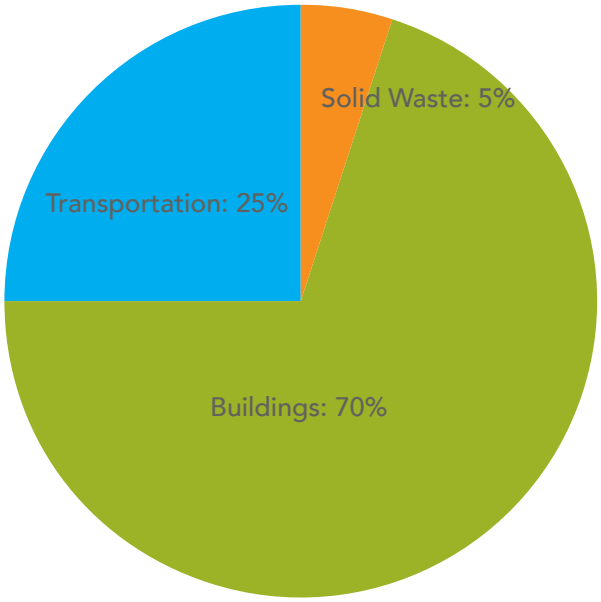
In 2014, Pitkin County emitted an estimated 551,900 metric tons of greenhouse gas emissions, measured in carbon dioxide equivalent (CO_2e).

The results are divided into the following categories:

- **BUILDINGS:** emissions from the energy (electricity, natural gas, and propane) used to heat and power homes and businesses
- **TRANSPORTATION:** emissions from the fuel used to operate personal vehicles, trucks, public transit buses, and aircrafts
- **SOLID WASTE:** emissions from the decomposition of solid waste at the Pitkin County Landfill and fuel used for on-site vehicles
- **WASTEWATER:** emissions that naturally occur during wastewater treatment

Consistent with national and regional trends, the Buildings sector was responsible for the vast majority of emissions (70%). The Transportation sector contributed about 25% of overall emissions, primarily due to the fuel used in passenger vehicles. Other emissions originated from the decay of solid waste at the landfill (5%) and during wastewater treatment (0.1%).

FIGURE 1: GHG EMISSIONS BY SECTOR



Note: The Wastewater sector is not included in Figure 1 as emissions generated from wastewater-related activities account for less than 1% of overall emissions.

The inventory results set the stage for a more sustainable and resilient Pitkin County. These results may be used to inform policy development and direct climate action planning strategies. To assess the effectiveness of climate action, emissions should continue to be monitored, with a comprehensive inventory analysis performed regularly.

INTRODUCTION

> "We are the first generation to feel the effect of climate change and the last generation who can do something about it."
>
> -- GOVERNOR JAY INSLEE, WASHINGTON STATE

As the urgency of climate change increases, it is crucial that action is taken at all levels. In particular, local government has an essential role to play in making meaningful reductions in greenhouse gas (GHG) emissions.

Pitkin County has long recognized how local action can play a significant role in influencing global emissions trends. Now, to acknowledge the magnitude of the climate challenge, Pitkin County is taking deliberate steps to strategically reduce its contribution of GHGs through the preparation of an emissions inventory.

The first of its kind for Pitkin County, this emissions inventory provides a baseline against which progress towards reducing emissions can be measured. The overall quantity of emissions generated is detailed and the dominant emissions sources are profiled. The four identified emissions sources are: buildings energy, transportation, waste, and wastewater treatment. The inventory excludes emissions from certain other sources (including cement production, refrigerant and fire suppressant leakage) as these are outside of the scope of analysis.

The *2014 Pitkin County Greenhouse Gas Emissions Inventory* captures emissions from activities across the county. This snapshot of emissions illuminates that activities that are the greatest contributors to GHG emissions, and therefore also the greatest opportunities for emissions reductions. Results may be used to assess emissions reduction trends, inform strategic policy development, and direct climate action planning.

CLIMATE BACKGROUND

Leading scientists agree that carbon emissions from human activities have increased the concentration of GHGs in the atmosphere and have destabilized the Earth's climate. The consequences of this destabilization are felt around the world: 2016 was the hottest year in recorded history, following a series of record-breaking years (2015, 2014).[1]

Locally, the effects of a changing climate is no longer theoretical: in Pitkin County there are now 23 fewer days of winter as compared to the 1980s.[2] This dramatic decrease of winter (almost a month less) impacts the timing of the winter season, and spring runoff patterns. These, and other climate change impacts, have the potential to influence the Pitkin County community in complex and profound ways. By modifying Earth's natural systems, the economic prosperity, public health, and quality of life for residents and visitors alike is threatened. The severity of climate change and the magnitude of these impacts are dependent on the current and the future GHG trends.

It is clear that the burning of fossil fuels is adding too much carbon to the atmosphere. As such, communities around the world are developing ambitious strategies to reduce emissions (referred to as "climate action planning"), as well as strategies to prepare for the impacts climate change will have on natural and human systems (referred to as "resiliency planning").

SCOPE

GHGs can be generated from variety of sources, but the man-made emissions from everyday activities (including the use of fossil fuels for generating electricity, heating homes, and driving around town) are the focus of this analysis.

Broadly, inventories are categorized as a local government operations approach or a community-wide approach. The local government operation approach is solely focused on emissions from government facilities and operations. A community-wide approach is an examination of the emissions generated by the entire community. The *2014 Pitkin County Greenhouse Gas Emissions Inventory* is a community-wide analysis, examining the collective carbon footprint across Pitkin County (in both unincorporated and incorporated territory).

This inventory quantifies the most prevalent GHGs that contribute to climate change: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). For all data presented in this inventory, results are reflected in metric tons of carbon dioxide equivalent ($MTCO_2e$). This unit represents each GHG's relative potency (atmospheric lifetime and heat-trapping ability) in an equivalent volume of carbon dioxide. To measure relative potency, calculations use the latest values as defined in the Intergovernmental Panel on Climate Change's (IPCC) 5th Assessment Report 100-year potentials.

This report was prepared in 2017 using data that was collected in 2016. At the time of data collection, the calendar year 2014 represented the most readily available, accurate, and complete data set. Additionally, the calendar year 2014 aligns Pitkin County's inventory with those of regional partners.

BOUNDARIES

Prior to the preparation of the *2014 Pitkin County Greenhouse Gas Emissions Inventory*, Aspen, Snowmass Village and Basalt had already completed community-wide inventories for 2014. Despite this availability of data, it was determined that compiling and summing these inventory results would be problematic. Instead, the research team instead decided to perform a stand-alone inventory for Pitkin County using county-specific data. The chosen approach and provides an aggregated total for each sector at the county-level, and does not isolate emissions for specific territories within Pitkin County for a more accurate and complete snapshot of emissions.

An additive approach in which the results of the existing inventories were compiled and summed was considered. Due to differences in scope, and due to the potential to double count emissions, an additive approach would have resulted in the double counting of emissions sources.

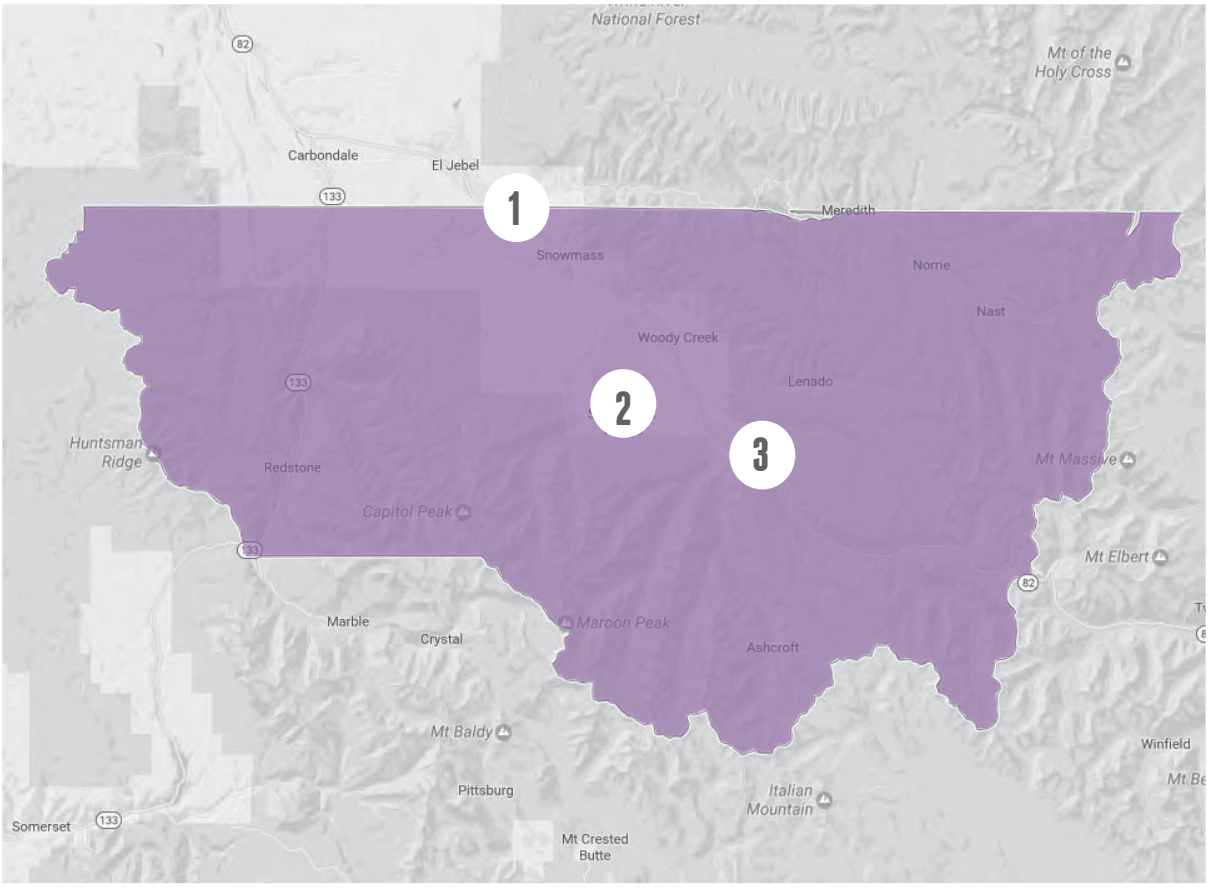
Pitkin County, Aspen, Snowmass Village and Basalt may all claim responsibility for a portion, or the entirety, of emissions for a particular sector. For instance, all community inventories account for emissions that result from the fuel used by public transit as the Roaring Fork Transit Authority's fleet spans multiple jurisdictions. Each community has incorporated this emissions source as a component of their carbon footprint. This is also the case with the airport. Therefore, a direct summation of inventory results would result in the double counting of emissions and skew the regional perspective.

SCOPE CONTINUED

Additionally, while each inventory applies the same basic methodology (ICLEI's US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions), there are important differences that should be noted. These differences are accentuated by the availability of local data, which defines the granularity of results and the defined scope. For instance, the *2014 Aspen Community-wide GHG Inventory* includes portions of unincorporated Pitkin County as it covers the Aspen Urban Growth Boundary.

The figure below illustrates the relationship between the four stand-alone emissions inventories. The *2014 Pitkin County Emissions Inventory* includes the emissions from across Pitkin County, the entirety of the purple shaded region. This includes the emissions generated within both incorporated and unincorporated territory. Aspen, Basalt, and Snowmass Village also monitor emissions within their territory. The result is that Pitkin County, Aspen, Basalt, and Snowmass Village all have an emissions inventory that reflects their unique community profile.

FIGURE 2: EMISSIONS INVENTORY OVERLAP



1: BASALT | 2: SNOWMASS VILLAGE | 3: ASPEN

METHODOLOGY

This inventory was conducted using an industry-accepted methodology and data-reporting tool developed by the Local Governments for Sustainability (ICLEI). ICLEI's standardized US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions informs the methodology, and their ClearPath software supports the quantification and reporting of emissions. This approach is widely accepted as best practice and is used by governments across the world, including regional partners Eagle County and the City of Aspen.

This section is an overview of the methodology and that data that were used to calculate emissions for each sector. Broadly speaking, emissions are determined by the amount of energy (electricity, natural gas, gasoline, diesel) consumed, as well as the GHG emission factor for that fuel. The GHG emission factor (also referred to as the "emission coefficient") identifies the amount of gases released per unit of fuel (kWh, therm, gallon, etc.) consumed.

BUILDINGS

The utility providers and fuel suppliers provided energy usage data. Holy Cross Energy and Aspen Electric provided emission factors to account for carbon dioxide emissions based on electricity generation. The methane and nitrous oxide emissions for electricity were based on regional averages. The natural gas and propane emissions factors were based on national averages.

DATA CONSIDERATIONS

It is likely that the emissions from propane consumption are dramatically underreported. The research team was unable to obtain data from two of the three vendors that served Pitkin County in 2014. Propane data is notoriously challenging to obtain; as an unregulated fuel, propane suppliers are not required to report sales data. It is also worth nothing that annual sales data from propane suppliers may not directly equate to annual usage as some residences or businesses may not refill their propane tanks annually.

The GHG emissions that result from electric transmission and distribution (T&D) losses are not included in this inventory. While it is safe to assume the electricity transmission system is not 100% efficient, quantifying these emissions is outside the scope of this analysis.

TRANSPORTATION

The Transportation sector is an estimate of the emissions that result from energy used for transportation within Pitkin County. Transportation is composed of three subsectors: emissions from passenger vehicles, public transit, and airport-related activities.

VEHICLES

The preferred tool for calculating a community's transportation-related emissions is a travel demand model. While expensive, a travel demand model represents a robust approach to quantifying emissions. Lacking a travel demand model, and lacking robust studies on local vehicle travel habits (frequency, purpose, and length of personal and commute trips), an alternative methodology to determine vehicle miles travelled (VMT) was prepared.

Rick Heede, an expert in emissions inventories and the principal at Climate Mitigation Services developed the applied VMT approach. The methodology relied on CDOT traffic statistics for the portions of State Highway 82 and State

METHODOLOGY CONTINUED

Highway 133 within Pitkin County, along with local vehicle fuel efficiency data. This approach likely underestimates GHG emissions due to the notable data limitations. The CDOT data does not account for traffic on local, county, or city streets. Experts suggest that traffic on the local, county, and city streets represents a large portion of vehicle traffic in Pitkin County.

It should be noted that electric vehicles (EVs) are not represented in this analysis. In 2014, EVs represented a very small portion of vehicles on Pitkin County roads: in Aspen, estimates revealed that EVs represent about 0.03% of the overall share of vehicles.[3]

PUBLIC TRANSIT

Roaring Fork Transit Authority (RFTA) and the Snowmass Village Shuttle provided data. Route mileage, vehicle fleet type and fuel type were used to estimate the amount of fuel used and emissions generated. Emissions from RFTA buses, which travel from outside of the county are counted.

AIRPORT

To quantify airport-related emissions, the findings of ASE's internal inventory were applied. The Airport's inventory followed best practices established by the Transportation Research Board to calculate emissions for both private and commercial activities.

WASTE

The Waste sector quantifies emissions from all waste at the Pitkin County Landfill. Waste emissions were calculated using the mass of waste entering the landfill and the composition of the waste stream. The composition of the waste stream (portion of waste categorized as organic, paper, plastic, glass, metal, etc.) was determined based on the waste characterization study conducted for the *Roaring Fork Comprehensive Waste Diversion Plan*. This sector examines the estimated future methane emissions that result from the anaerobic breakdown of biodegradable materials.

DATA CONSIDERATIONS

Following the standard ICLEI protocol, this analysis considers only the emissions associated with the decay of biodegradable waste. The emissions from the production of goods and services are not included in this inventory, as the County has very limited authority or opportunity to influence these emissions. Nevertheless, studies show that the vast majority of a product's lifecycle emissions are created before the waste is disposed of, during the mining of virgin materials, manufacturing, packaging, distribution and use.

Recycling and composting are acknowledged as diversion programs that lower the total mass of waste disposed of at the landfill. Composting operations were outside the scope of this inventory.

WASTEWATER TREATMENT

Wastewater emissions were informed by the amount of water treated and the nitrogen content of the treated wastewater. In accordance with ICLEI protocol, the energy used during wastewater treatment at the centralized facilities within Pitkin County is included in the Buildings sector rather than the Wastewater sector.

BACKGROUND

This emissions inventory is the latest in a series of actions Pitkin County has taken to advance climate protection and sustainability, starting almost a decade ago. Building on the previously established emissions reduction targets and the 2012 *Endorsing Climate Protection Resolution*, Pitkin County has now completed an emissions inventory.

An emissions inventory is a key piece of climate action planning, see the best practice framework in Figure 3. Climate action planning is an ongoing, iterative process designed to provide a roadmap to motivate action and to track progress. The emissions inventory is often the first step, providing the background information to drive emissions reduction efforts. Following this standard framework, Pitkin County should use the inventory results to develop strategies to accelerate emissions reduction, and to implement new programs.

FIGURE 3: CLIMATE ACTION PLANNING FRAMEWORK

PITKIN COUNTY CLIMATE CHANGE COMMITMENTS

It is important to recognize past and ongoing emissions-reduction activities, while acknowledging that the threat of climate change calls for more aggressive efforts. By virtue of these past and on-going programs, the community's emissions are assumed to be less than they otherwise would be. Of note are the 2006, 2008 and 2012 climate commitments.

In 2006, the Pitkin County Board of County Commissioners passed a resolution committing to the *U.S. Mayors Climate Protection Agreement*. Under the agreement, Pitkin County pledged to reduce global warming pollution levels to seven percent below 1990 levels by 2012.

BACKGROUND CONTINUED

To reach this goal, the Pitkin County Board of County Commissioners adopted *Energy Action Plan*, see Appendix B. The *Energy Action Plan* identified four main goals:

1. Establish Pitkin County as a local leader in sustainability practices.
2. Commit to goals and deadlines to improve efficiency, promote resource conservation to reduce local greenhouse gas emissions, improve air quality, and enhance community livability.
3. Adopt programs and policies that promote both environmental and fiscal sustainability.
4. Improve the quality and productivity of Pitkin County work environments.

Then, the 2012 *Endorsing Climate Protection Resolution* builds on the 2008 Plan commitments. The resolution calls for implementation of the actions outlined and recognizes additional areas in which the County can reduce emissions within the community and its own operations, see Appendix C.

FIGURE 4: TIMELINE OF CLIMATE MILESTONES

2000: **Adopted the Renewable Energy Mitigation Program (REMP), setting an energy budget for homes and seeding renewable energy projects**

2006: **Committed to an emissions reduction goal through the *U.S. Mayors Climate Protection Agreement***

2008: **Adopted the *Energy Action Plan* and launched associated programs**

2011: **Launched the Energy Smart Colorado program to stimulate energy efficiency in homes and buildings**

2012: **Emissions reduction goals expired**

2012: **Reinvigorated climate efforts through the *Endorsing Climate Protection Resolution***

2015: **Approval of robust energy building codes**

2016: **Joined the Colorado Communities for Climate Action coalition**

2016/7: **Development of Caucus Master Plans incorporating sustainability**

2017: **Performed a baseline GHG emissions inventory for 2014**

Note: This is a partial list of Pitkin County's climate action achievements.

BACKGROUND CONTINUED

LOCAL CLIMATE CHANGE COMMITMENTS

Local jurisdictions are already engaging in significant climate action work and have been essential partners in achieving regional climate successes. Pitkin County's efforts can support, and be supported by, these local commitments for GHG reductions. A summary of key commitments is listed below.

ASPEN:

- Emissions Inventories: completed for 2004, and updated for 2007, 2011, and 2014
- Emissions Reduction Targets: 30% reduction by 2020; 80% reduction by 2050 (measured against a 2004 baseline)
- Climate Action Plan: the *2017 Climate Action Plan* is an update of the *2007 Climate Action Plan*. The Action Plan covers 2017 through 2050 as a living document.

BASALT:

- Emissions Inventory: completed for 2014
- Emissions Reduction Targets: 25% by 2025; 80% by 2050 (measured against a 2014 baseline)
- Climate Action Plan: adopted the *Climate Action Plan for the Eagle County Community*, along with the *Basalt Climate Action Plan* in 2017.

It should be noted that only a portion of Basalt is within Pitkin County; the bulk of it is within Eagle County.

SNOWMASS VILLAGE:

- Emissions Inventories: completed for 2009 and updated for 2014
- Emissions Reduction Target: 20% by 2020 (measured against a 2009 baseline)
- Climate Action Plan: the *2015 Resiliency and Sustainability Plan* is an update of the 2009 *Sustainability Plan*

UNINCORPORATED PITKIN COUNTY:

Pitkin County recognizes nine distinct caucuses, which are responsible for making recommendations to the county on issues affecting the caucus areas. The majority of the Master Plans acknowledge environmental protection as a core value.

In particular, the *Crystal River Valley Master Plan* calls for climate change mitigation efforts through renewable energy and energy efficiency, citing the objective to "meet or exceed the goal of reducing energy from non-renewable sources by at least 20% throughout the County by 2020."

INVENTORY RESULTS

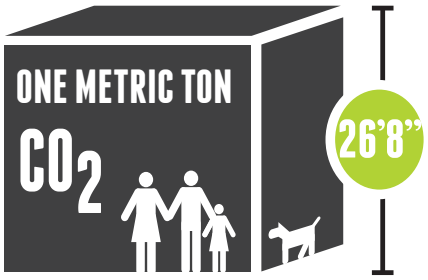
In 2014, Pitkin County (including the municipalities within Pitkin County) emitted an estimated 551,900 metric tons of GHGs, measured in carbon dioxide equivalent (CO_2e).

To better facilitate understanding inventory results, the emissions results are broken down into the main emission-generating sectors and emission-generating sources (see Figure 6 and Figure 7).

- The emission sector considers where the emissions are generated. Examples include the energy used in buildings and the fuel used in transportation.
- The emission source considers how the emissions are generated. Examples include fuels such as natural gas and electricity.

The following sections contain a discussion of results by sector.

FIGURE 5: ONE $MTCO_2$ VISUALIZED



GHG emissions are not tangible; the emissions generated from vehicle tailpipes or household energy use cannot be seen. To contextualize the inventory results, visualization can be a useful tool. In Figure 5, one metric ton of carbon dioxide is shown as a cube almost 27 feet high.[4] For the Pitkin County community, a year of emissions can be visualized as 552,000 hot air balloons taking off.[5]

INVENTORY RESULTS CONTINUED

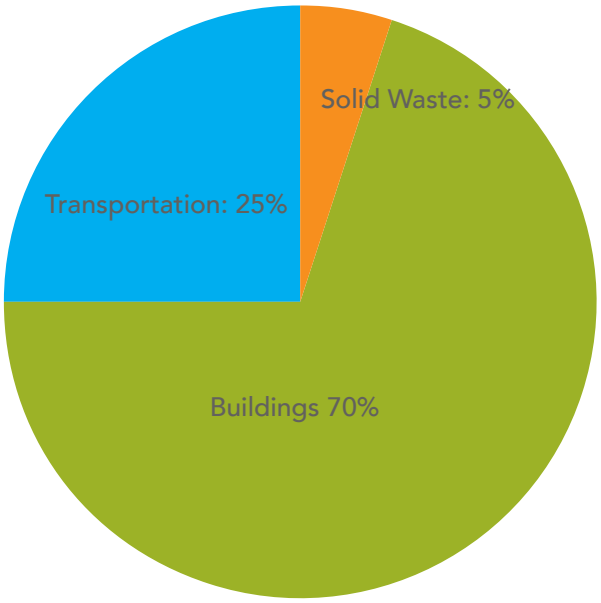
GHG EMISSIONS BY SECTOR

The dominant emissions-generating sectors are categorized as follows:

- **BUILDINGS:** emissions from the energy used to heat and power buildings (electricity, natural gas, and propane)
- **TRANSPORTATION:** emissions from the fuel used to operate personal vehicles, trucks, public transit buses, and aircrafts
- **SOLID WASTE:** emissions from the decomposition of solid waste at the Pitkin County Landfill and fuel used for on-site vehicles
- **WASTEWATER:** emissions that naturally occur during wastewater treatment

Consistent with regional and national trends, the vast majority of emissions were generated from the energy used in buildings (70% or 386,898 $MTCO_2e$). The emissions from the fuel used in transportation contributed 25% of overall emissions. The emissions generated during the decay of solid waste at the landfill contributed 5% of overall emissions, with the emissions generated during wastewater treatment at 0.1% of overall emissions.

FIGURE 6: GHG EMISSIONS BY SECTOR

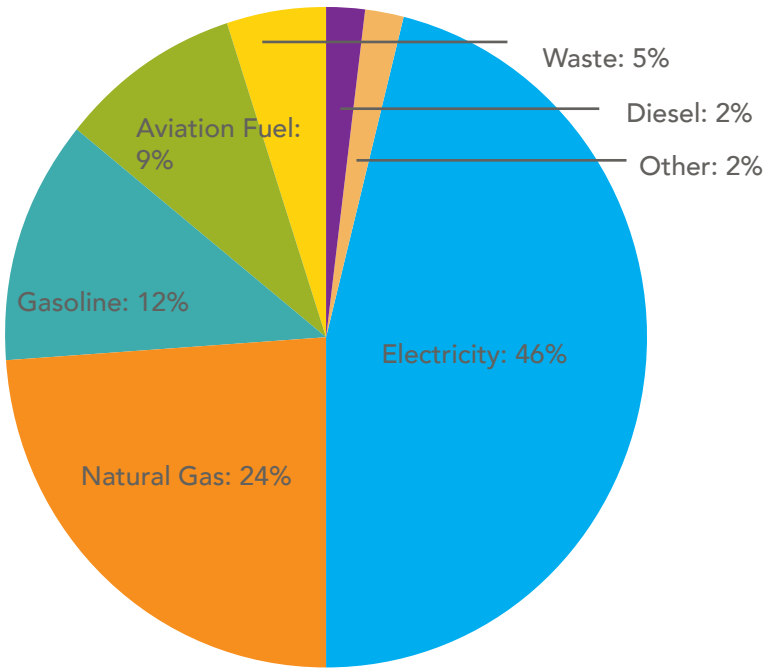


Note: the Wastewater sector is not included in Figure 6 as emissions generated from wastewater-related activities account for less than 1% of overall emissions.

GHG EMISSIONS BY SOURCE

To reveal additional emissions trends, Figure 7 shows the breakdown of emissions by fuel source to reveal additional trends. Electricity is the greatest contributor of fuel-sourced emissions, responsible for almost half of the community's overall emissions (at 46%). The natural gas used in buildings and the gasoline used in vehicles also contributed a significant amount of emissions (at 24% and 12%, respectively). A lesser amount of emissions result from aviation fuel, landfilled waste, and alternative fuels (such as compressed natural gas and biodiesel).

FIGURE 7: GHG EMISSIONS BY SOURCE



BUILDINGS SECTOR

Seventy percent of overall emissions were generated from the use of energy (electricity, natural gas, and propane) to heat and power buildings.

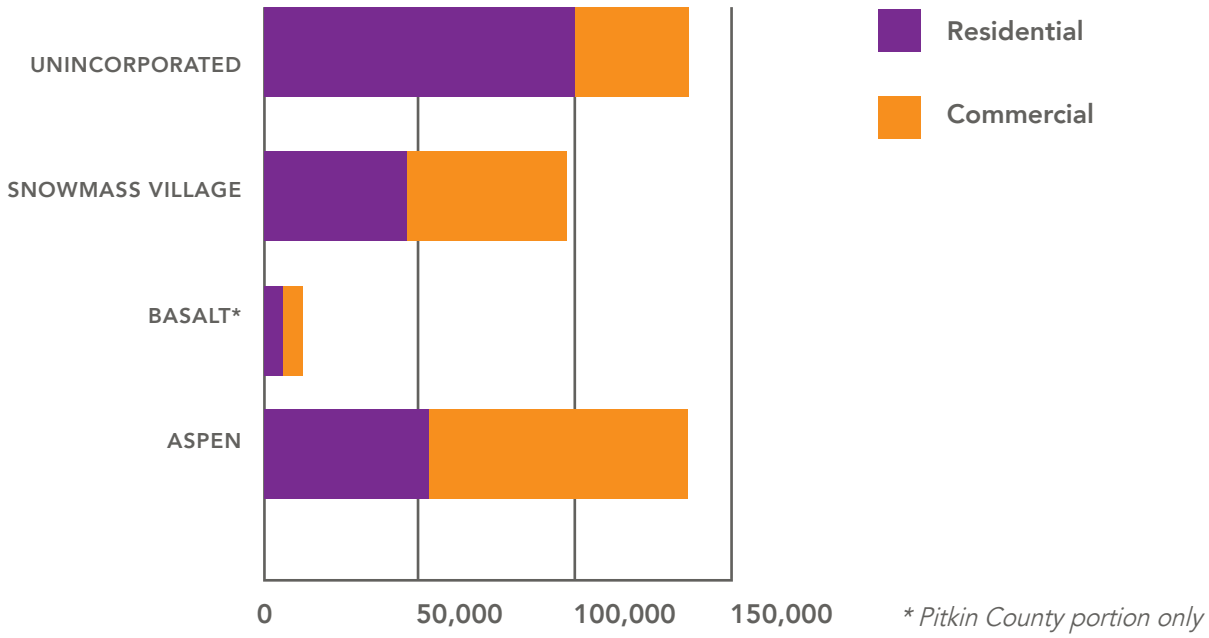
BUILDINGS AT A GLANCE:

- **Seventy percent of all Pitkin County emissions are a result of the electricity, natural gas, and propane used in buildings. This is five times larger than any other sector.**
- **The greatest contributors to Buildings sector emissions were the homes and businesses in Aspen and in unincorporated Pitkin County.**
- **The electricity serving Pitkin County was largely generated by the burning of fossil fuels: over 60% of Holy Cross Energy's electricity is generated by coal-fired power plants.**

EMISSIONS FROM ENERGY USE BY JURISDICTION

The greatest share of energy-related emissions in Pitkin County was from buildings in Aspen, closely followed by buildings in unincorporated Pitkin County, at 139,636 $MTCO_2e$ and 138,987 $MTCO_2e$, respectively (or 72% of the total). Snowmass Village was the third greatest source of emissions at 98,048 $MTCO_2e$ (or 25% of the total). Buildings in the Pitkin County-portion of Basalt generated the remaining amount at 11,233 $MTCO_2e$ (or 3% of emissions).

FIGURE 8: GHG EMISSIONS BY CITY ($MTCO_2E$)



It should be noted that the number of buildings within each jurisdiction largely influences the above results. While one electric utility account does not necessarily equate to one building, comparing the number of electric utility accounts provides context to the results shown above. Aspen has the highest number of accounts (6,586), followed by unincorporated Pitkin County (5,008), Snowmass Village (3,396), and Basalt (699).

BUILDINGS SECTOR CONTINUED

HOMES & BUSINESSES

An examination of overall emissions in Pitkin County revealed that the energy used in buildings was greater in the residential sector than the commercial sector (at 56% and 44%, respectively). This is primarily a result of the large share of emissions from the residential sector of unincorporated Pitkin County.

An analysis of emissions across Aspen, Basalt and Snowmass Village, shows that the opposite is true: energy use in the commercial sector, rather than the residential sector, represented a greater overall portion of emissions. These unique community profiles are shown in Figure 8. In these municipalities, a larger percentage of GHG emissions are concentrated in a relatively small number of commercial buildings (as determined by the number of utility accounts).

For this analysis, the utility provider or fuel supplier's account classifications were maintained. Therefore, the commercial accounts may include some multi-family apartment buildings. Public facilities are also largely included in the commercial category.

PUBLIC FACILITIES

Emissions from Pitkin County-owned buildings contributed a small percentage of overall Buildings sector emissions (less than 1%). Nevertheless, this segment is very important: as Pitkin County has more direct control over its own operations, it can act as a community leader by implementing energy-reduction measures in its facilities. It is important to note that reducing energy consumption not only means fewer GHG emissions, but also fewer dollars dedicated to utility bills. Therefore, energy-efficiency projects can free up funds that could be used for other services.

RENEWABLE ENERGY

Renewable energy generation facilities in Pitkin County included rooftop solar photovoltaic systems, solar thermal systems, and hydropower systems. The inventory analysis is focused on the amount of energy supplied from utilities and consumed across Pitkin County, but the amount of energy generated by renewable energy systems is embedded in this data. Overall utility-supplied energy use, and therefore overall emissions, is reduced when buildings rely on renewable energy systems for heat and power. Additionally, the energy produced from renewable generation sources in Pitkin County help to reduce the amount of utility energy consumed and may contribute to the carbon intensity of the grid.

BUILDINGS SECTOR CONTINUED

ENERGY USAGE & ENERGY GENERATION

The two fundamental drivers of buildings-related emissions are:

- The amount of energy consumed, and
- The carbon intensity of the energy supply (the carbon emissions generated per unit of energy used).

ENERGY CONSUMPTION

More than half of the energy consumed in Pitkin County was natural gas (57%) however, a greater percentage of emissions were from the consumption of electricity (see Figure 10). Roughly 66% of the Buildings sector emissions were generated by electricity use with 34% generated by the combustion of natural gas use.

Holy Cross Energy and Aspen Electric are the two electricity providers powering Pitkin County homes and businesses. Holy Cross Energy is a member-owned electrical cooperative serving over 55,000 consumers in Western Colorado, including the majority of Pitkin County. Aspen Electric is Aspen's municipal utility, which delivers electricity to 2/3 of Aspen.[6]

ELECTRICITY GENERATION

The electricity supplied by each provider has dramatically different carbon intensities due to the fuel mix (or "fuel portfolio") used to generate electricity.

In 2014 Aspen Electric was primarily supplied by renewable energy with 74% clean and renewable sources. These include wind, hydroelectric, and solar.[7]

In 2014 the majority of Holy Cross Energy's electricity was generated by fossil fuels, with 62% of the electricity generated by coal-fired power plants. An estimated 20% of energy was supplied by renewable sources.[8]

It should be recognized that both utilities have made great strides to increase the amount of renewable energy supplying their grids, essentially tripling their energy from renewable sources. In 2004, Aspen Electric was approximately 35% renewable, with Holy Cross at approximately 6% renewable.[9]

FIGURE 9: GHG EMISSIONS BY ENERGY FUEL TYPE

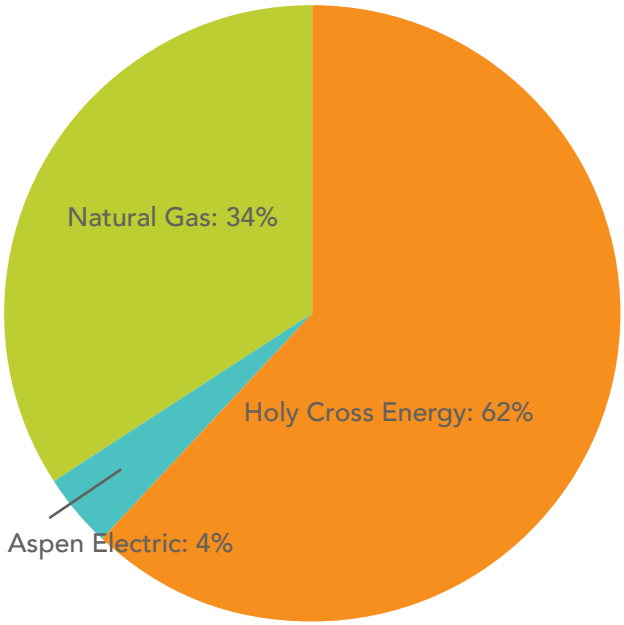
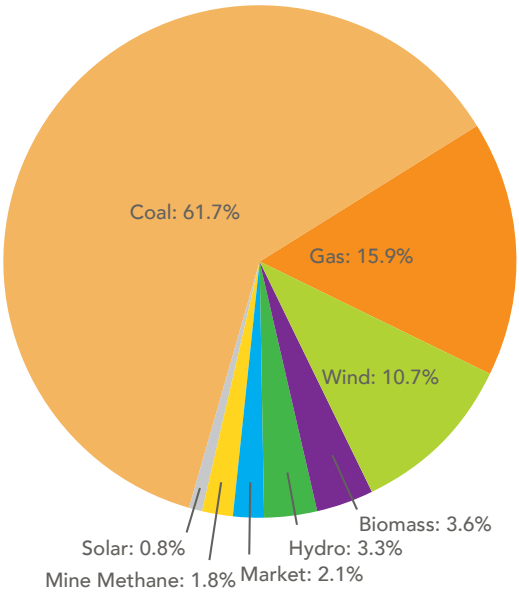


FIGURE 10:
WHERE DOES HOLY CROSS GET ITS ENERGY?



Source: Holy Cross Energy

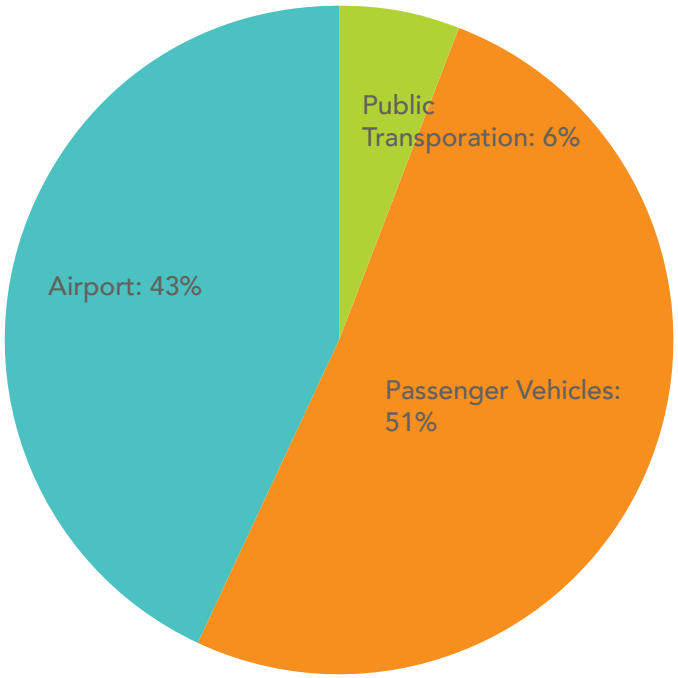
TRANSPORTATION SECTOR

Twenty five percent of overall emissions were generated by the fuel used to power cars, trucks, motorcycles, transit buses, and aircrafts.

TRANSPORTATION AT A GLANCE:

- As with many other cities, transportation is one of the primary sources of a community's emissions.
- The fuel used to power cars, trucks and motorcycles is responsible for just over half of the sector's emissions, at 51% and nearly 13% of overall emissions. Nearly all of the fuel used by passenger vehicles is fossil fuel-based (either gasoline and diesel).
- The fuel loaded into aircrafts and the fuel used to power ground support equipment at the Aspen Pitkin County Airport (ASE) is responsible for 43% of the Transportation sector's emissions.
- Public transit has a relatively small impact on overall emissions. As buses have the ability to carry more passengers, they can be a more effective use of fuel per person per mile. Both the Roaring Fork Transit Authority (RFTA) and the Snowmass Village Shuttle strive to use efficient vehicles and fuels.

FIGURE 11: TRANSPORTATION GHG EMISSIONS (MTCO2E)

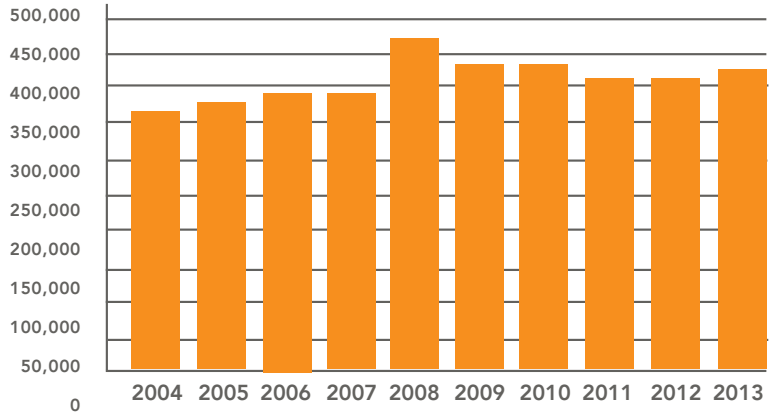


PASSENGER VEHICLES

Tailpipe emissions from passenger vehicles (cars and trucks) contributed the greatest amount of emissions to the Transportation sector. In particular, gasoline vehicles are the most significant contributor of GHG emissions and represent the most common vehicles on the road.

According to CDOT traffic count data, traffic volumes in Pitkin County have grown slightly as compared to 2004. Vehicle miles of travel (VMT) have increased 15%, primarily due to traffic in the summer months.[10]

FIGURE 12: AVERAGE DAILY STATE HIGHWAY VMT



TRANSPORTATION SECTOR CONTINUED

PUBLIC TRANSIT

The Pitkin County community benefits from being a member of Roaring Fork Transit Authority (RFTA), one of the largest rural public transit systems in the state. All RFTA buses rely on some form of alternative fuels: VelociRFTA Bus Rapid Transit buses run on compressed natural gas (CNG); other buses run on B5 (a 5% biodiesel/95% petroleum diesel blend). These cleaner fuels emit fewer GHG pollutants as compared to conventional transportation fuels.

To better understand the climate impact of public transit, it is helpful to compare not only the fuel efficiency of the vehicle (miles per gallon, or "mpg"), but also the passenger miles per gallon (or "pmpg"). Often buses have a greater quantity of tailpipe emissions than cars, but buses have the ability to carry more passengers. This makes the case for how buses can be a more effective use of fuel per person per mile.

TRANSPORTATION SECTOR CONTINUED

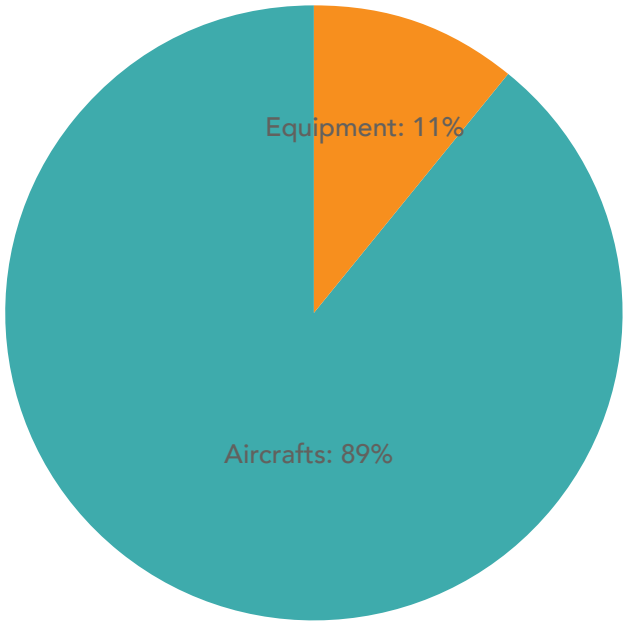
AIRPORT

ASE has been a leader in tracking and reporting emissions. ASE was one of the first airports in the U.S. to generate an airport-wide emissions inventory, and has continued to prepare inventories to address emission reduction opportunities.

Emission sources at the airport include the terminal, ground support equipment, ground access vehicles, aircrafts, runway lighting, and more. Following the ICLEI emissions accounting standards, this sector quantifies the emissions from equipment (ground support and ground access vehicles) and aircrafts. The energy (natural gas and electricity) is captured in the Energy sector. Additionally, it should be noted that the quantification of emissions does not include fuel loaded elsewhere on incoming aircrafts, only the fuel loaded at ASE.

Consistent with national trends, the fuel loaded into aircrafts (both private and commercial) represents the greatest share of airport-related emissions. Emissions from aircrafts can increase and decrease depending on a variety of factors, including the fuel type, number of passengers being served, distances of flights into and out of ASE, and the number of takeoffs and landings.

FIGURE 13: AIRPORT GHG EMISSIONS ($MTCO_2E$)



There are limited opportunities for Pitkin County to influence airport-related emissions. The County owned and controlled sources are limited to airport fleet vehicles, and energy use in facilities. The Federal Aviation Administration and the airlines largely control the flights into and out of the airport, as well as the amount and type of fuel used.

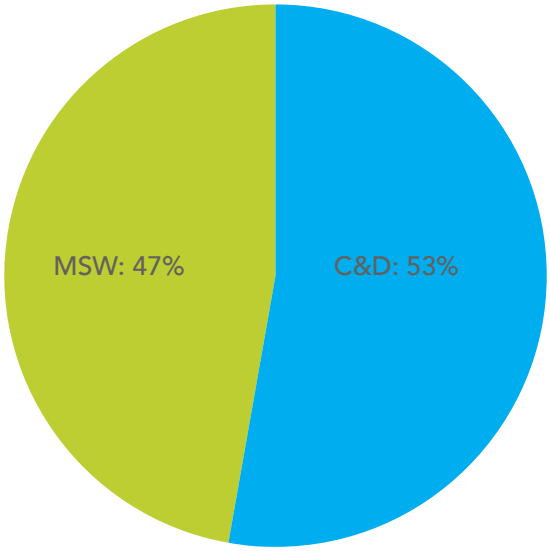
SOLID WASTE SECTOR

Five percent of overall emissions were generated by the decay of solid waste at the Pitkin County Landfill, and from the equipment used on-site.

SOLID WASTE AT A GLANCE:

- **Emissions from the Solid Waste sector were fairly evenly split between municipal solid waste (the trash generated by homes and businesses) and construction and demolition waste (the building material debris from new construction, renovations, and demolition projects).**
- **More than 50% of the waste that entered the landfill could have been diverted through recycling and composting programs.**
- **Per capita waste generation in Pitkin County is 11.8 pounds of waste per day, which is greater than the US average of 4.5 pounds of waste per day.**

FIGURE 14: WASTE GHG EMISSIONS ($MTCO_2E$)



Note: the fuel used to operate on-site landfill equipment is not visualized in Figure 11, as total emissions are less than 1% of Solid Waste sector emissions.

CONSTRUCTION & DEMOLITION WASTE (C&D)

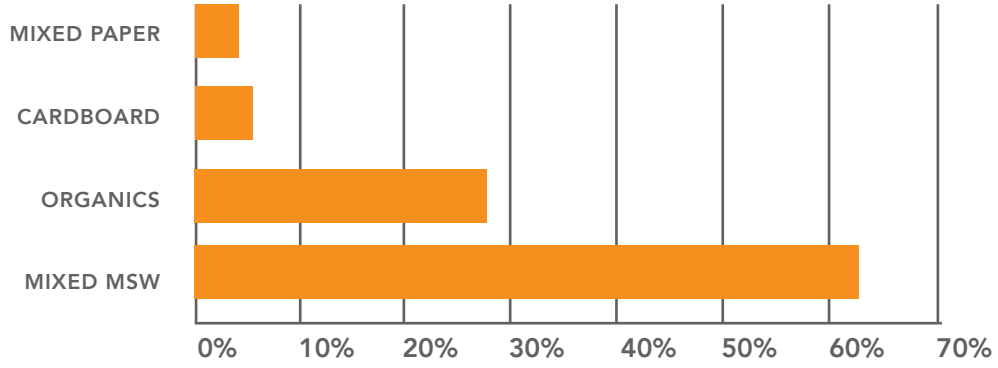
The decay of biodegradable C&D waste (such as wood) represents 53% of Solid Waste sector emissions. It should be noted that the mass of C&D and characterization of C&D materials could fluctuate year-to-year, as the waste is largely dependent on the local economy and demolition projects. That being said, the mass of C&D waste delivered to the landfill in 2014 was not an outlier; it represented a fairly typical year.

SOLID WASTE SECTOR CONTINUED

MUNICIPAL SOLID WASTE (MSW)

The mass of biodegradable materials and recyclable items in household and commercial trash contributes nearly half of the Solid Waste sector emissions. A 2015 waste audit revealed that Pitkin County's waste stream is just over 25% organic material: with 16.6% as food scraps and 10.5% as yard trimmings.[11] Organic waste buried in a landfill generates methane, a GHG that is more potent than carbon dioxide. However, the same food scraps and yard trimmings generate carbon dioxide when decomposing in a compost pile.

FIGURE 15: MSW COMPOSITION

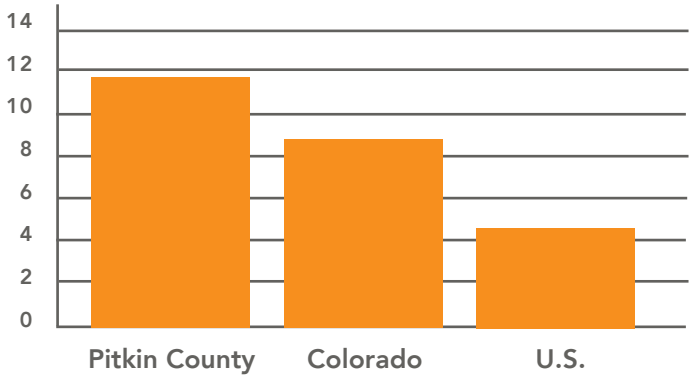


Source: Roaring Fork Valley Comprehensive Waste Diversion Plan

PER CAPITA WASTE

Per person, the volume of trash generated in Pitkin County is significantly greater than statewide and national averages. The average Pitkin County resident is responsible for 11.8 pounds of trash per day.[12] Lacking precise data on waste generation by tourist and transient populations, all waste generated across Pitkin County is allocated to the full time residents.

FIGURE 16: PER CAPITA WASTE



WASTEWATER SECTOR

Less than half of 1% of overall emissions are generated by wastewater treatment.

WASTEWATER AT A GLANCE

A limited amount of GHG emissions were released as unintended or indirect consequences of wastewater treatment.

FUGITIVE EMISSIONS

The wastewater treatment process filters bacteria and pathogens from wastewater before it is returned to the environment. As a by-product of this treatment (both in centralized wastewater treatment plants and septic systems), GHGs are released into the atmosphere.

At wastewater treatment plants, two key stages spur naturally occurring chemical processes. First, emissions are generated when pollutants (such as nitrates) are removed from the wastewater. Then, emissions are generated when the treated wastewater (referred to as "effluent") is discharged into the river. Similarly, in septic systems, the anaerobic digestion of the organic materials in waste releases methane, which escapes into the atmosphere.

NEXT STEPS

The inventory is a snapshot of the emissions in Pitkin County in 2014. The County may choose to use this information to help inform and direct the good work that is already occurring, and build on it with more ambitious commitments.

USING THIS BACKGROUND INFORMATION, THE COUNTY MAY CHOOSE TO:

- ENGAGE THE COMMUNITY: share inventory findings to increase public awareness of and participation in sustainability efforts
- UPDATE THE EMISSIONS REDUCTION TARGET: an emissions reduction target identifies a goal, helps to track progress, and motivates action. The best practice approach is to adopt an interim and long-term goal. An emissions reduction target can be made for the community, as well as for internal operations.
- COMPLETE A COUNTY OPERATIONS GHG EMISSIONS INVENTORY: an inventory of county operations identifies the emissions generated by county activities, including fleet activity, waste management, and facility energy use. Currently these emission sources are bundled into the community-wide results.
- PERFORM FORECASTING AND MODELING: forecasting can help to better understand the community's future emission reduction potential. The effects of federal, state, and local measures as well as projected demographic, economic, and operational changes are modeled. The results of forecasting and modeling help to contextualize the scale of the response that is required.
- UPDATE THE 2008 ENERGY ACTION PLAN: the *2008 Energy Action Plan* and the *2012 Energy Resolution* could be updated to reflect current priorities and to propose new emissions reduction strategies.
- IDENTIFY, DEVELOP, AND IMPLEMENT EMISSION REDUCTION PROGRAMS: enact programs and policies to meet GHG reduction goal(s).
- CONTINUE TO TRACK EMISSIONS: best practice is to monitor emissions regularly, and update the emissions inventory every three to five years.
- CONTINUE TO ENGAGE IN BROADER ADVOCACY EFFORTS: encourage policies at the regional, state, and national level that create green jobs and reduce emissions.

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APPENDIX A -- INVENTORY SUMMARY CHARTS

SECTOR SUMMARY

	Physical Units		CO2e Equivalent		Percent of Total
	kWh, therms, gallons		metric tons CO2e		percent
Building Energy: Residential					
Electricity	224,211,670	kWh	150,072	mt CO2e	27.2%
Natural Gas	12,463,337	therms	66,288	mt CO2e	12.0%
Propane	78,812	gallons	445	mt CO2e	0.1%
Total Residential			216,805	mt CO2e	39.3%
Building Energy: Commercial					
Electricity	173,696,479	kWh	103,568	mt CO2e	18.8%
Natural Gas	12,439,447	therms	66,161	mt CO2e	12.0%
Propane	62,422	gallons	364	mt CO2e	0.1%
Total Commercial			170,093	mt CO2e	30.8%
Total Building Energy			**386,898**	**mt CO2e**	**70%**
Transportation: Passenger Vehicles					
Gasoline	135,352,225	VMT	59,684.20	mt CO2e	10.8%
Diesel	11,032,850	VMT	10,040.37	mt CO2e	1.8%
Total Passenger Vehicles	**146,385,075**	**VMT**	**69,725**	**mt CO2e**	**12.6%**
Airport					
Aircraft fuel	n/a	n/a	51,974	mt CO2e	9.4%
Ground support equipment & facility energy use	n/a	n/a	6,551	mt CO2e	1.2%
Total Airport			**58,525**	**mt CO2e**	**10.6%**
Transportation: Public Transit					
Roaring Fork Transit Authority (CNG & Biodiesel)	4,844,114	VMT	6,991	mt CO2e	1.3%
Snowmass Village Shuttle (Gasoline & Diesel)	390,588	VMT	726	mt CO2e	0.1%
Total Public Transit	**5,234,702**	**VMT**	**7,717**	**mt CO2e**	**1.4%**
Total Transportation			**135,966**	**mt CO2e**	**25%**
Solid Waste					
Mixed solid waste (MSW)	18,774	tons	13,285	mt CO2e	2.4%
Construction & demolition debris (C&D)	33,254	tons	15,126	mt CO2e	2.7%
On-site equipment	n/a	n/a	48	mt CO2e	0.0%
Total Waste			**28,459**	**mt CO2e**	**5%**
Wastewater Treatment					
Denitrification	n/a	n/a	39	mt CO2e	0.0%
Effluent discharge	n/a	n/a	52	mt CO2e	0.0%
Septic systems	n/a	n/a	486	mt CO2e	0.1%
Total Wastewater Treamtent			**577**	**mt CO2e**	**0%**
Total			**551,900**	**mt CO2e**	**100%**

APPENDIX B -- INVENTORY SUMMARY CHARTS

SOURCE SUMMARY

	Physical Units		CO2e Equivalent		Percent of Total
	kWh, therms, gallons		metric tons CO2e		percent
Electricity					
Residential Electricity	224,211,670	kWh	150,072	mt CO2e	59.2%
Commercial Electricity	173,696,479	kWh	103,568	mt CO2e	40.8%
Total Electricity	397,908,149	kWh	253,640	mt CO2e	46.0%
Natural Gas					
Residential Natural Gas	12,463,337	therms	66,288	mt CO2e	50.0%
Commercial Natural Gas	12,439,447	therms	66,161	mt CO2e	50.0%
Total Natural Gas	24,902,784	therms	132,449	mt CO2e	24.0%
Gasoline					
Transportation Sector		gallons	59,882	mt CO2e	90.1%
Waste Sector	1,011	gallons	9	mt CO2e	0.0%
Airport Sector		gallons	6,551	mt CO2e	9.9%
Total Gasoline	1,011	gallons	66,442	mt CO2e	12.0%
Avaition Fuel					
Airport Sector		gallons	51,974	mt CO2e	100.0%
Total Aviation Fuel	0	gallons	51,974	mt CO2e	9.4%
Waste					
MSW	18,774	tons	13,285	mt CO2e	46.8%
C&D	33,254	tons	15,126	mt CO2e	53.2%
Total Waste	52,028	gallons	28,411	mt CO2e	5.1%
Diesel					
Transportation Sector		gallons	10,568	mt CO2e	99.6%
Waste Sector	3,817	gallons	39	mt CO2e	0.4%
Total Diesel	3,817	gallons	10,607	mt CO2e	1.9%
Deminimis Fuels					
Propane	141,234	gallons	809	mt CO2e	0.1%
Biodiesel	699,819	gallons	6,793	mt CO2e	81.1%
Wastewater Treatment	n/a	n/a	577	mt CO2e	0.1%
CNG	308,900	gallons	198	mt CO2e	2.4%
Total Alternative Fuels	1,149,953	gallons	8,377	mt CO2e	1.5%
Total			551,900	mt CO2e	100%