



2018 GREENHOUSE GAS INVENTORY
AND FORECASTED EMISSIONS REPORT
Routt County • City of Steamboat Springs



STEERING COMMITTEE

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Acronyms

AFOLU	Agriculture, Forestry, and Other Land Use
C&I	Commercial and Industrial
CO ₂	Carbon Dioxide
CH ₄	Methane
eGRID	Emissions & Generation Resource Integrated Database
EIA	Energy Information Administration
EPA	U.S. Environmental Protection Agency
EV	Electric Vehicles
FLIGHT	Facility Level Information for Greenhouse Gas Tool
GHG	Greenhouse Gas Emissions
GPC	Global Protocol for Community-Scale Greenhouse Gas Emission Inventories
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
kWh	Kilowatt Hour
MSW	Municipal Solid Waste
MWh	Megawatt Hour
N ₂ O	Nitrous Oxide
SIT	State Inventory Tool
USDA	U.S. Department of Agriculture
YVEA	Yampa Valley Electric Association

EXECUTIVE SUMMARY



ROUTT COUNTY EMISSIONS

37%

Emissions from Steamboat Springs

63%

Emissions from Hayden, Oak Creek, Yampa and unincorporated Routt County

According to a recent report released by the Intergovernmental Panel on Climate Change (IPCC), limiting global warming to 1.5 degrees Celsius would result in a more sustainable and equitable society.¹ To achieve this, accelerated action is needed to reduce the amount of greenhouse gases (GHG) released into our atmosphere. To quantify GHG emissions within Routt County and the City of Steamboat Springs, Lotus Engineering and Sustainability, LLC (Lotus) was contracted to create a 2005 and 2018 GHG inventory for both Steamboat Springs and Routt County. The purpose of these GHG emissions inventories is to create a clear picture of past and current GHG emission sources, understand trends, and establish a baseline for future emissions inventories that will guide climate action planning.

There is momentum for Routt County and Steamboat Springs to build upon current sustainability initiatives related to waste reduction and diversion, transportation, energy efficiency, and green building. As outlined in both communities' Strategic Plans and the upcoming Climate Action Plan, Routt County and Steamboat Springs are committed to addressing climate change at the local level by reducing GHG emissions. These inventories will help inform future local, regional, and state initiatives to secure the best path forward for a healthy and vibrant future for citizens, visitors, and the natural environment.

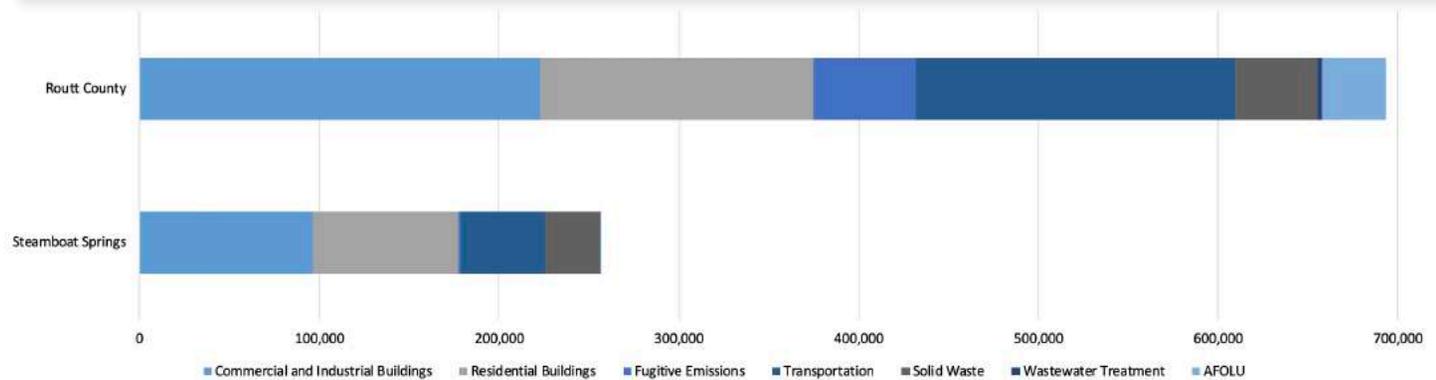
Routt County is made up of five distinct communities: Steamboat Springs, Hayden, Oak Creek, Yampa, and Unincorporated Routt County. Lotus completed two inventories: one for all of Routt County that includes each of the aforementioned communities and one for just the City of Steamboat Springs. The difference between the amount of emissions within Routt County and City of Steamboat Springs includes emissions from Hayden, Oak Creek, Yampa, and unincorporated Routt County.

2018 Emissions by Sector and Source

The 2018 GHG Emissions Inventory showed Routt County emissions, including the City of Steamboat Springs, totaling 693,367 mt CO₂e. Thirty-seven percent (256,120 mt CO₂e) of the 693,367 mt CO₂e were from Steamboat Springs. The remaining 63 percent came from Hayden, Oak Creek, Yampa and unincorporated Routt County. Stationary energy sector emissions from commercial and residential buildings comprise the largest source of GHG emissions within Routt County (431,898 mt CO₂e) and Steamboat Springs (178,881 mt CO₂e) followed by transportation (177,605 mt CO₂e in Routt County and 46,970 mt CO₂e in Steamboat Springs). Emissions for all sectors are shown in Figure ES-1 on Page ES 2.



Figure ES-1. Emissions by Sector for Routt County and Steamboat Springs (mt CO₂e).



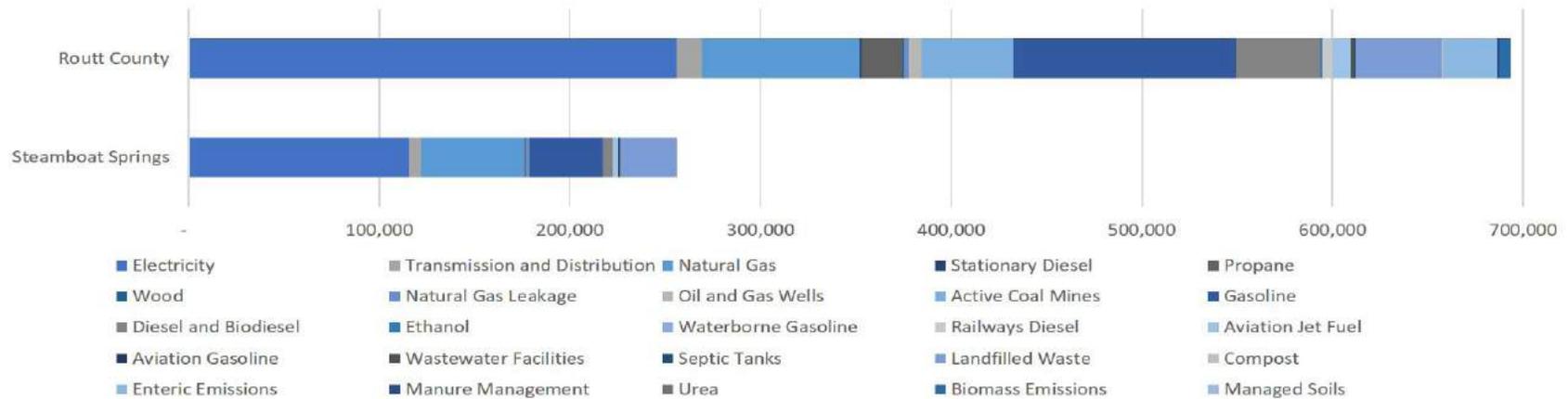
For both Routt County and Steamboat Springs emissions from electricity use and production comprised the highest proportion of emissions by source (37 percent for Routt County and 45 percent for Steamboat Springs). Emissions from natural gas, stationary diesel, propane, and wood used for heating in buildings made up 15 percent for Routt County and 22 percent for Steamboat Springs.

Various sources of emissions within the agriculture, forestry, and other land use (AFOLU) sector comprised seven percent of overall emissions for Routt County, but accounted for no emissions for Steamboat Springs. Within the AFOLU sector, the largest sources of emissions are attributed to enteric methane emissions from livestock and biomass (wildfires).

Emissions from the transportation sector accounted for 26 percent of Routt County's total in 2018, while accounting for 18 percent of Steamboat Springs emissions in 2018. Within the transportation sector, the largest source of emissions in both Routt County and Steamboat Springs was gasoline-powered vehicles, followed by emissions from diesel vehicles, aviation, and railways.

The remaining emissions were attributed to activities and processes surrounding Twentymile Mine, waste, and wastewater. The largest sources of emissions in Routt County and Steamboat Springs and their respective totals are shown in Figure ES- 2.

Figure ES-2. Emission Totals by Source in 2018 for Routt County and Steamboat Springs (mt CO₂e).



Trends Between 2005 and 2018

Both Routt County and Steamboat Springs have seen significant growth in population, number of total housing units (includes second homes), and the number of occupied housing units.

Between 2005 and 2018, Routt County’s population and number of housing units increased by 20 percent and 22 percent, respectively. Steamboat Springs followed a similar growth pattern with both the population and number of housing units increasing by 19 and 22 percent respectively (see Table ES-1 on Page ES-4).

This rate of growth has increased the use of electricity, natural gas, and propane in buildings and an increase in emissions in the transportation sector specifically from on-road vehicles. Note that the difference between the number of housing units and occupied housing units includes vacant homes, rental properties, and vacation homes utilized by tourists.

Between 2005 and 2018, emissions in Routt County and the City of Steamboat Springs have increased by slightly more than one percent. This increase in emissions has been driven by an increase in transportation emissions, fugitive emissions (includes leakage of natural gas, oil and gas wells, and active coal mines) and AFOLU sector. By contrast, emissions in Steamboat Springs over the same time period have decreased by more than nine percent. This decrease in emissions can be attributed primarily to an increase in renewable energy in the electricity provided by the Yampa Valley Electric Association (YVEA). YVEA provides 98 percent of the electricity to the County with the remaining 2 percent provided by Oak Creek electric.

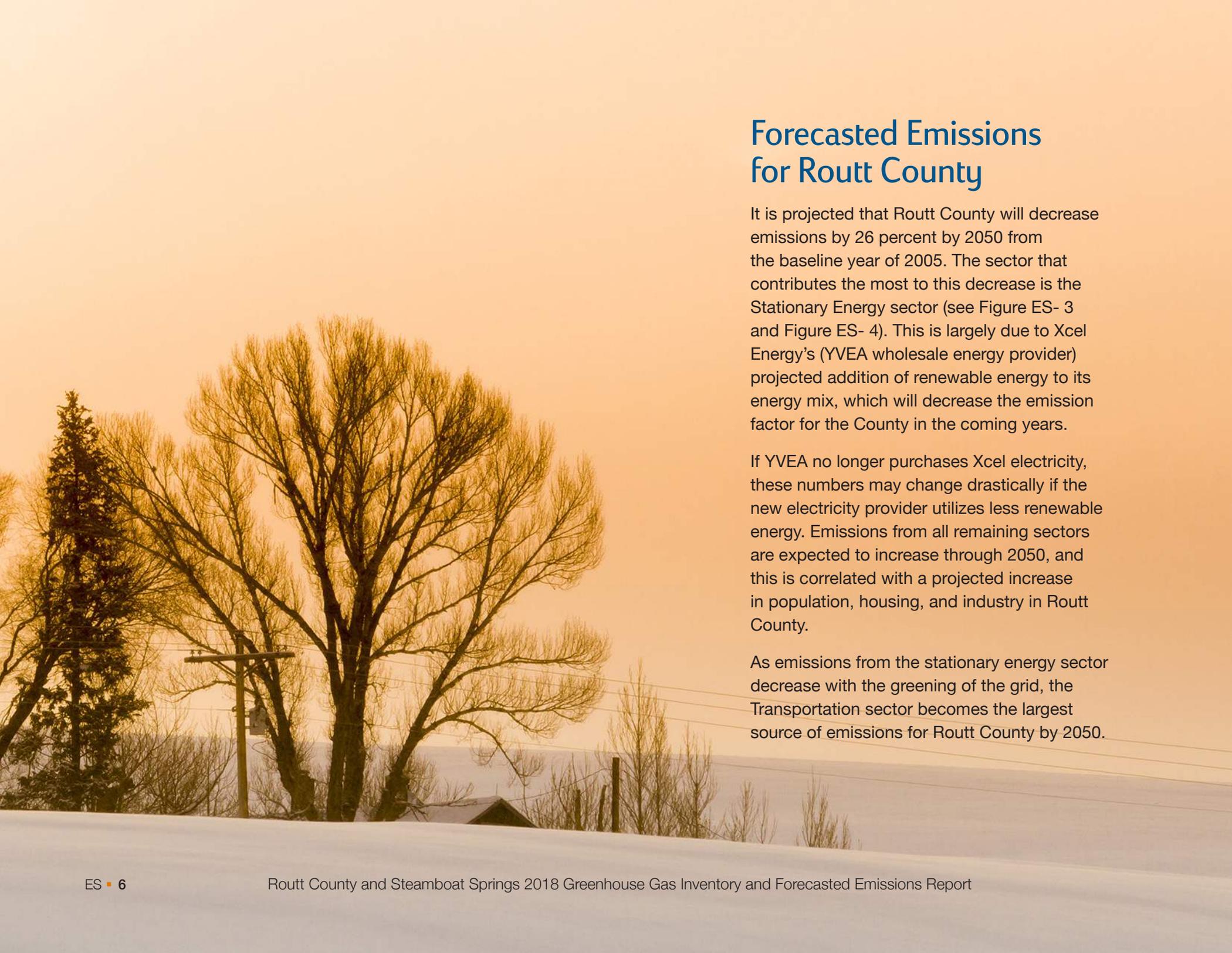
In both Steamboat Springs and Routt County, emissions per capita have decreased by 18 percent and 31 percent, respectively. For Routt County, the sector with the largest decrease in emissions (by percentage) was waste followed by stationary energy, while the sector with the largest increase in emissions was the transportation sector followed by AFOLU. Steamboat Springs emissions decreased by nine percent due to a reduction in stationary energy and waste emissions. The largest increase in emissions was the transportation sector. Further discussion of these trends will be found in the rest of this report. See Table ES-2 on Page ES 5 for more detail.

Table ES-1. Community Indicator Changes Between 2005 and 2018.			
	2005	2018	% Change Between 2018 and 2005
Population - Routt County	21,453	25,680	20%
Number of Housing Units - Routt County	13,856	16,942	22%
Number of Vacant Housing Units - Routt County	5,025	6,117	22%
Number of Occupied Housing Units - Routt County	8,831	10,825	23%
Population - Steamboat Springs	11,107	13,198	19%
Number of Housing Units - Steamboat Springs	8,475	10,362	22%
Number of Vacant Housing Units - Steamboat Springs	3,681	4,666	27%
Number of Occupied Housing Units - Steamboat Springs	4,794	5,696	19%



Table ES-2. Changes in Emissions Between 2005 and 2018.

Sector	Change in mt CO ₂ e between 2005 and 2018		
	Steamboat Springs	Routt County (not including Steamboat Springs)	Routt County
Residential energy	-5,732	-7,854	-13,586
C&I Energy	-16,405	-22,202	-38,607
Fugitive Emissions	502	27,039	27,541
Total Stationary Energy	-21,635	-3,017	-24,652
Transportation (on-road)	5,083	36,127	41,210
Transportation (off-road)	0	0.4	0.4
Waterborne	0	-0.001	-0.001
Railways	0	-0.2	-0.2
Air Travel	-1,693	-3,860	-5,553
Total Transportation	3,389	32,267	35,657
Waste Disposal (Landfill)	-7,215	-3,885	-11,100
WWTP Process	248	70	319
Total Waste	-6,967	-3,815	-10,781
Total AFOLU (Agriculture)	0	6,922	6,922
Total Emissions	-25,212	32,358	7,146
Percent change in emissions per Capita	-18%	-10%	-31%
Percent change in emissions per household	-21%	-12%	-34%
Percent change in emissions per occupied household	-21%	-15%	-31%



Forecasted Emissions for Routt County

It is projected that Routt County will decrease emissions by 26 percent by 2050 from the baseline year of 2005. The sector that contributes the most to this decrease is the Stationary Energy sector (see Figure ES- 3 and Figure ES- 4). This is largely due to Xcel Energy's (YVEA wholesale energy provider) projected addition of renewable energy to its energy mix, which will decrease the emission factor for the County in the coming years.

If YVEA no longer purchases Xcel electricity, these numbers may change drastically if the new electricity provider utilizes less renewable energy. Emissions from all remaining sectors are expected to increase through 2050, and this is correlated with a projected increase in population, housing, and industry in Routt County.

As emissions from the stationary energy sector decrease with the greening of the grid, the Transportation sector becomes the largest source of emissions for Routt County by 2050.

Figure ES-3. Emissions Trends and Projections by Sector for Routt County (mt CO₂e).

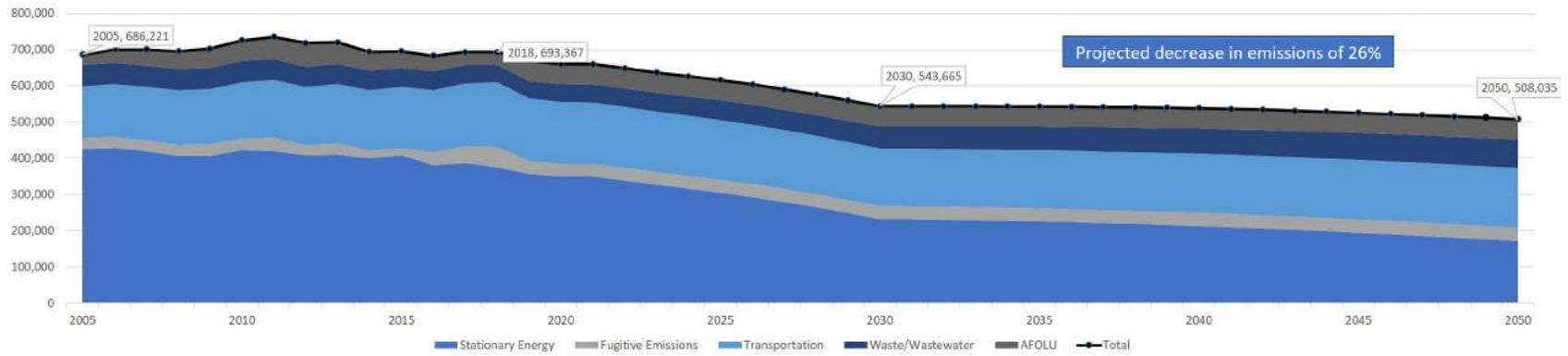
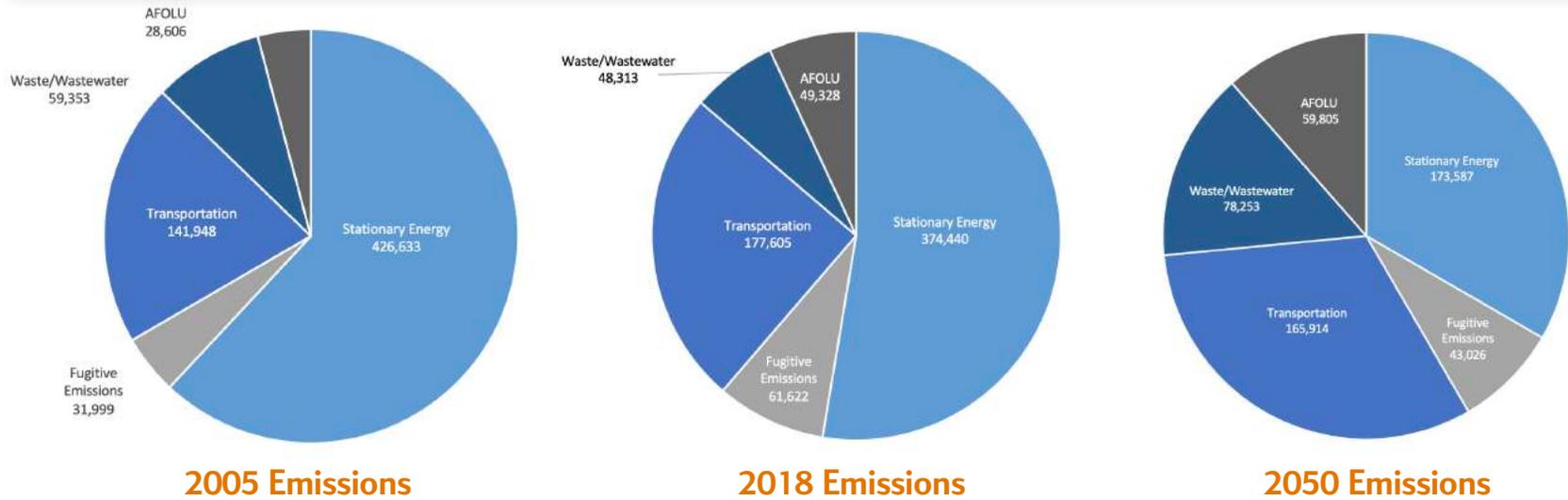


Figure ES-4. Emissions Over Time and Projected for Routt County (mt CO₂e).



Forecasted Emissions for Steamboat Springs

It is projected that Steamboat Springs' emissions will decrease by 35 percent by 2050 from the baseline year of 2005. As with Routt County's forecast, the sector that contributes the most to this decrease is the Stationary Energy sector (see Figure ES-5 and Figure ES-6 on Page ES-8), while all the remaining sectors are expected to increase through 2050.

STATIONARY ENERGY SOURCES: Routt County and Steamboat Springs



Fugitive Emissions
(coal mining, oil and gas)



Stationary Diesel
(emergency generators)



Transmission / Distribution



Wood burning



Electricity



Natural Gas



Propane

Figure ES-5. Emission Trends and Projections for Steamboat Springs (mt CO₂e).

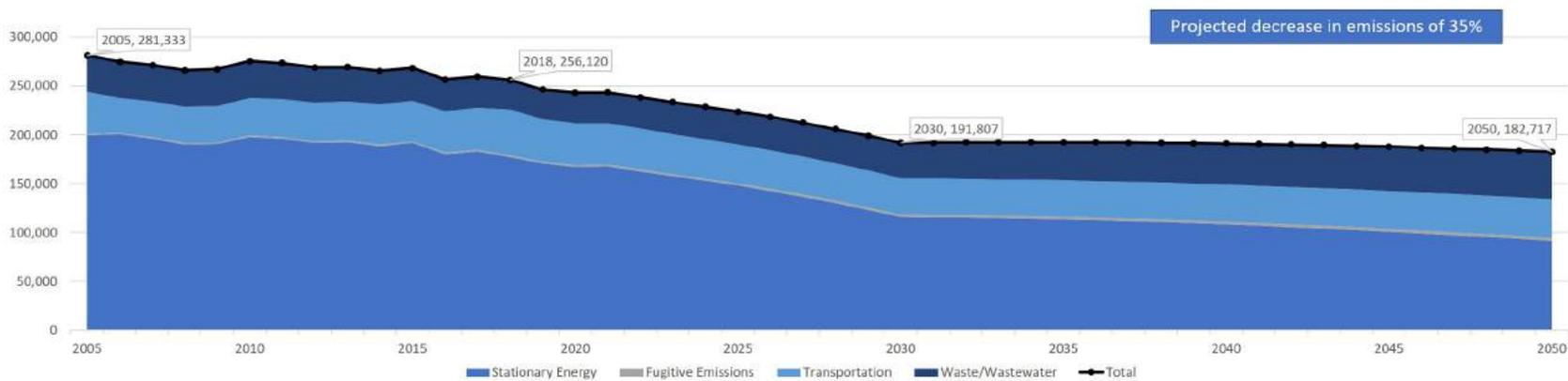
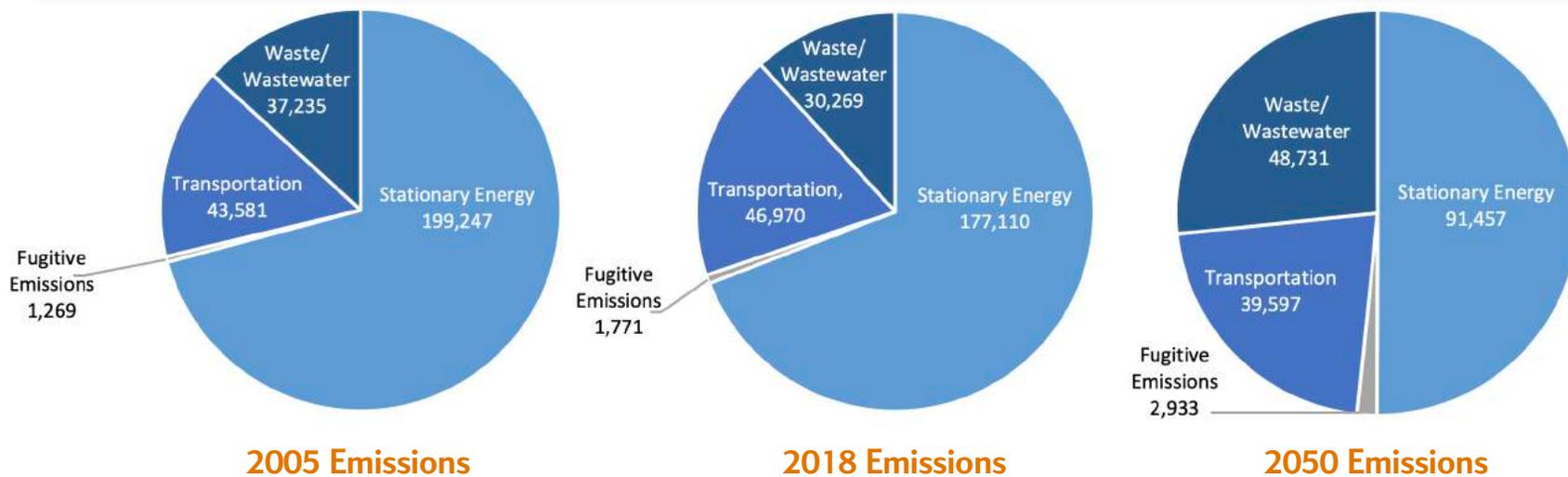


Figure ES-6. Emissions Over Time and Projected for Steamboat Springs (mt CO₂e).





INTRODUCTION



Routt County and the City of Steamboat Springs recognize that impacts from climate change threaten the viability of the natural resources, economic stability, and the services and infrastructure within Routt County that roughly 25,000 residents call home and hundreds of thousands of visitors visit annually.

Routt County's mission includes providing a safe and healthy place to live for current and future generations and the City of Steamboat Springs vision is to preserve our past while assuring an economically, culturally, and environmentally sustainable future.

Both Routt County and the City of Steamboat Springs together are committed not only to recognizing what can be done to mitigate the impacts of climate change, but also to striving to increase resiliency for its citizens. This commitment is evident by the many long-standing community programs and initiatives including green building, energy efficiency, waste reduction, and more.

The biggest contributor to the changing climate is the use of fossil fuels for electricity in buildings and for transportation. Burning fossil fuels releases greenhouse gases (GHG) including carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) which trap heat in our atmosphere.

Here in Colorado, House Bill 19-1261 addresses statewide GHG emission reduction goals and calls for a Climate Action Plan to Reduce Pollution. Senate Bill 19-096 requires public statewide reporting of GHG emissions every two years and the adoption of rules requiring public reporting of GHG emissions in support of state goals.

Locally, climate change is expected to have widespread impacts. These include increasing temperatures, precipitation falling more as rain than snow, and more extreme weather events. The change in precipitation from snow to rain will have impacts on water quantity, snow depth, and the timing of snow runoff. In return, this may have negative impacts on the region's economy and subsequently the tourism industry.

Lastly, climate change is expected to result in negative impacts to public health as well as air and water quality. Understanding where the region's greenhouse gas emissions come from will allow the region to effectively plan to mitigate these impacts.

1877

Routt County was established

1900

Steamboat Springs was established



How the 2005 and 2018 Inventories were Developed

Routt County and the City of Steamboat Springs contracted with Lotus Engineering and Sustainability LLC (Lotus) to complete a 2018 GHG emissions inventory. The goal of the GHG inventory was to better understand the City and County's 2018 emissions profiles and to give insight to policies and programs that could help reduce GHG emissions.

The 2005 and 2018 inventories were completed following the framework provided by the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC protocol), which is a global standard for GHG emission accounting and reporting. The GPC protocol was developed and launched in 2014 and provides a template from which communities can create comparable and standard emission inventories.

The first GHG emissions inventory for Routt County was completed for the year 2005 by the University of Colorado Denver in 2010. However, this inventory was not created using the same protocol as the 2018 inventory. As such, Lotus was asked to update the 2005 inventory to ensure that trends could be accurately identified. Using the information from the 2005 and 2018 GHG emission inventories allows for a solid foundation and understanding of the emissions profile on a community-wide basis.

Methodology

The GPC protocol is the official protocol specified by the Global Covenant. It defines what emissions must be reported and how. There are two reporting levels for the community framework:

- **BASIC:** The BASIC methodology covers stationary energy, in-boundary transportation, and community-generated waste.
- **BASIC+:** The BASIC+ level includes BASIC emission sources, as well as a more comprehensive coverage of emissions sources such as trans-boundary transportation; energy transmission and distribution losses; industrial processes and product use (IPPU); and agriculture, forestry and other land uses (AFOLU).

This inventory was completed at the BASIC level, with some BASIC+ level items such as livestock emissions within the AFOLU sector. Where appropriate (as was the case for part of the agricultural sector), the U.S. Environmental Protection Agency (EPA) State Inventory and Projection Tool (SIT) was used to calculate emissions. The SIT has state-specific values that make it a useful tool for GHG

inventories. Default emission factors from the Intergovernmental Panel on Climate Change (IPCC) and The Climate Registry were used and noted throughout the GHG emission inventory workbook. The inventory is based on the use of activity data from a consumer standpoint, thereby providing a snapshot of “controllable” emissions. For example, electricity emissions are typically based on the number of kilowatt-hours used in a community; therefore, if the quantity of kilowatt-hours (kWh) is reduced, then the GHG emissions are reduced.

Process

The process of developing the 2018 GHG emissions inventory began with a kick-off meeting with Routt County, Steamboat Springs, and the Steering Committee to identify sources, contacts, and areas of interest. Data collection was completed in collaboration with the inventory team. Throughout this process, monthly inventory team meetings were held to ensure timely progress toward the development of the 2018 GHG emissions inventory.

Lotus synthesized the collected data, completed emission calculations, and created a customized inventory management workbook to keep a record of data, emission factors, contacts, and assumptions. Lotus also developed an accompanying Inventory Management Plan for the inventory that provides guidance for future inventories. Lastly, Lotus also compared current activity data to data from 2005 and looked at forecasted emissions out to 2050. This overarching analysis allowed for a snapshot of trends, opportunities, and challenges for Routt County and Steamboat Springs, which are discussed in this report.





Overview of 2018 Emissions



EMISSION SOURCES

CO₂

Carbon dioxide

CH₄

Methane

N₂O

Nitrous oxide

The 2018 GHG emissions inventory revealed all GHG emission sources within Routt County and Steamboat Springs. The specific GHGs accounted for in the inventory include CO₂, CH₄, and N₂O. Emissions are calculated in the inventory workbook by GHG and by metric ton carbon dioxide equivalents (mt CO₂e). In rare cases, such as emissions from Twentymile Mine, data from the EPA was used, which were only reported in mt CO₂e. Collectively, the GHG inventory workbook and the Inventory Management Plan capture all data assumptions, provide explanations as to the reasoning behind what data was used, and any caveats. This 2018 emission inventory resulted in Routt County emissions totaling 693,367 mt CO₂e. Thirty-seven percent (256,120 mt CO₂e) of the 693,367 mt CO₂e were from Steamboat Springs. The remaining 63 percent came from Hayden, Oak Creek, Yampa and unincorporated Routt County Throughout this report, Steamboat Springs emissions are included in Routt County emission totals. Steamboat Springs emissions are also called out separately for reference.

Emission Scopes, Sectors, and Sources

The 2018 GHG emissions inventory categorizes emissions by scopes, sectors, and sources. Scopes are defined by globally recognized protocols and provide a high-level view of emissions with combined sectors and sources within. Per the GPC protocol, the following definitions apply to emission scopes:

- **SCOPE 1:** GHG emissions from sources within the boundary.
- **SCOPE 2:** GHG emissions occurring as a result of the use of grid-supplied electricity, heat, steam and/or cooling within the boundary.
- **SCOPE 3:** All other GHG emissions that occur outside the boundary as a result of activities taking place within the boundary.

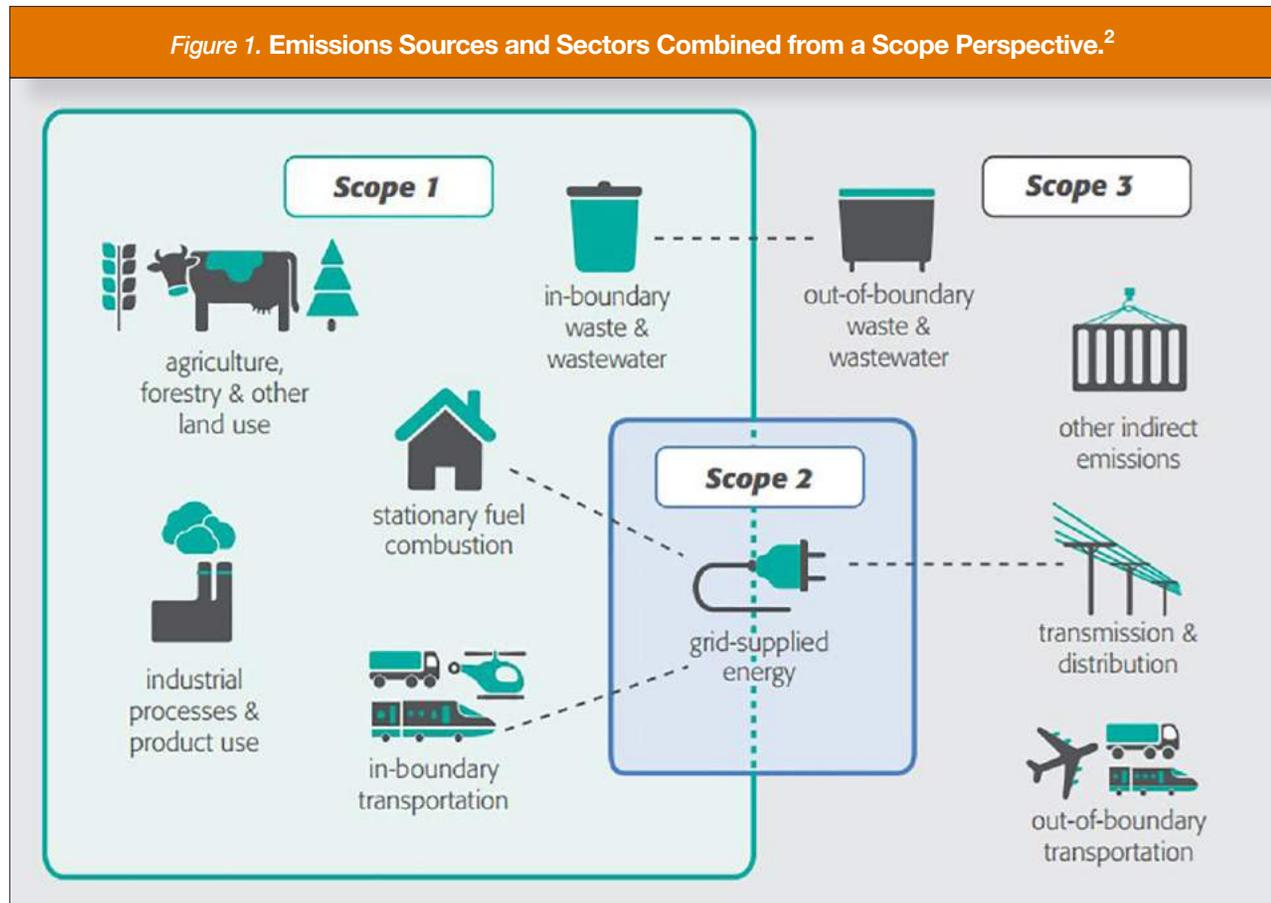
Per Figure 1 (Page 6), the main sectors are stationary energy, transportation, waste, wastewater, industrial processes and product use, and agriculture. Within each sector, specific emission sources were identified (e.g. gasoline use or amount of electricity used). The GPC protocol does not recognize emissions avoided through renewable energy use or recycling. However, to understand these activities' potential impact, the inventory includes these emissions as information-only items, which are discussed later in this report. Table 1 (Page 7) summarizes the sector, source, and scopes applied to Routt County and Steamboat Springs.

Scope emissions for Routt County and Steamboat Springs are provided in Figure 2 (Page 8).

Scope emissions are important to understand as they demonstrate what emissions sources are “owned;” for example with direct emissions associated with Scope 1 versus indirect emissions associated with Scope 2 (e.g. grid-supplied electricity) and Scope 3 (e.g. out-of-boundary transportation).

Stationary energy sector emissions from commercial and residential buildings comprise the largest source of GHG emissions within Routt County (431,898

Figure 1. Emissions Sources and Sectors Combined from a Scope Perspective.²



mt CO₂e) and Steamboat Springs (178,881 mt CO₂e) followed by transportation (177,605 mt CO₂e in Routt County and 46,970 mt CO₂e in Steamboat Springs). Emissions for all sectors are shown in Figure 3 (Page 9).

For both Routt County and Steamboat Springs emissions from electricity use and production comprised the highest proportion of emissions by source (37 percent for Routt County and 45 percent for Steamboat Springs).

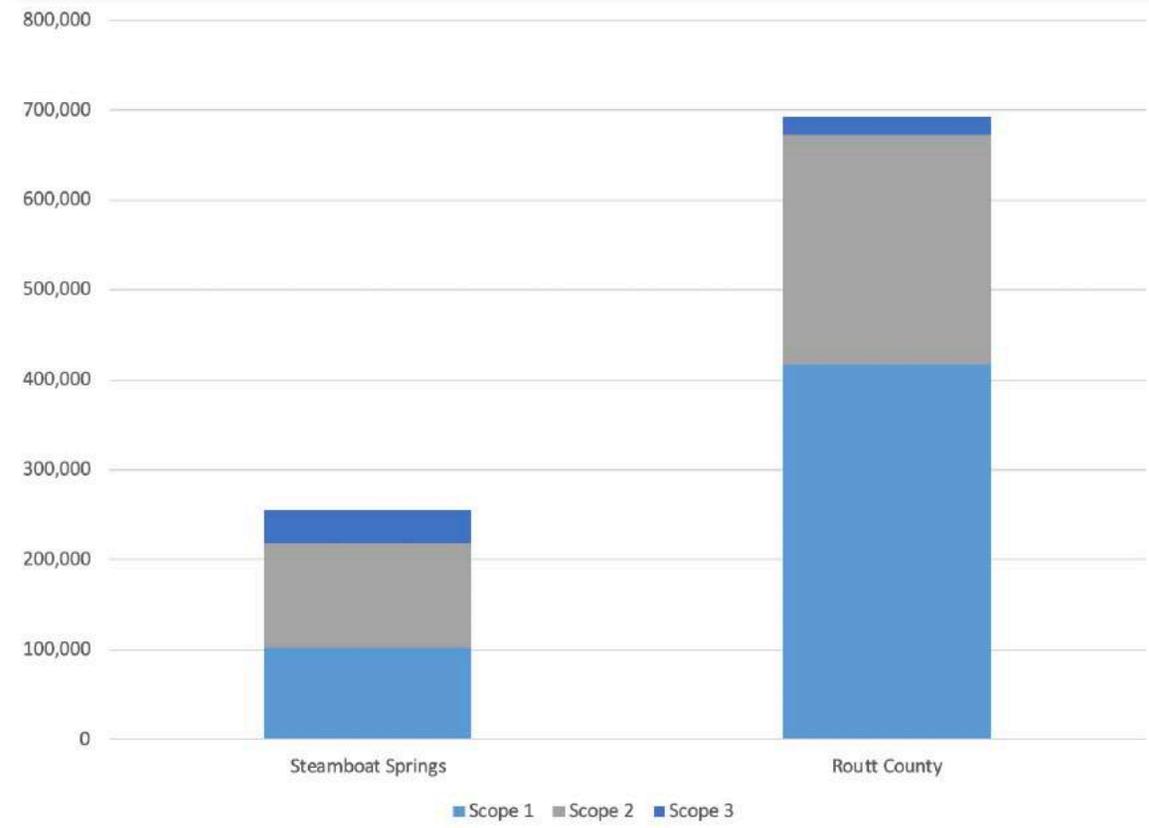
Emissions from natural gas, stationary diesel, propane, and wood used for heating in buildings made up 15 percent for Routt County and 22 percent for Steamboat Springs.

Table 1. Sectors, Sources and Scopes for Routt County and Steamboat Springs

Sector	Source	Scope(s)
Stationary Energy	Fuel Combustion - Buildings and Facilities	1
	Electricity Use – Buildings and Facilities	2
	Transmission and Distribution Losses	3
	Fugitive Emissions (Oil and Gas, Coal Mining, Natural Gas Leakage)	1
Transportation	Fuel Use	1
	Electricity Use in Vehicles	2
	Waterborne Navigation	1
	Railways	1
	Aviation (Itinerant and Transboundary)[1]	1, 3
Waste	Landfilled Waste	1, 3
	Composting	1, 3
Wastewater	Wastewater treated in the County/City	1
	Wastewater treated outside the County/City	3
Industrial Processes and Products Use (IPPU)	Industrial Facilities and Refrigerants[2]	N/A
Agriculture, Forestry, and Other Land Use (AFOLU)	Livestock Enteric Emissions	1
	Livestock Manure Management	1
	Urea Use	1
	Biomass (Wildfires)	1



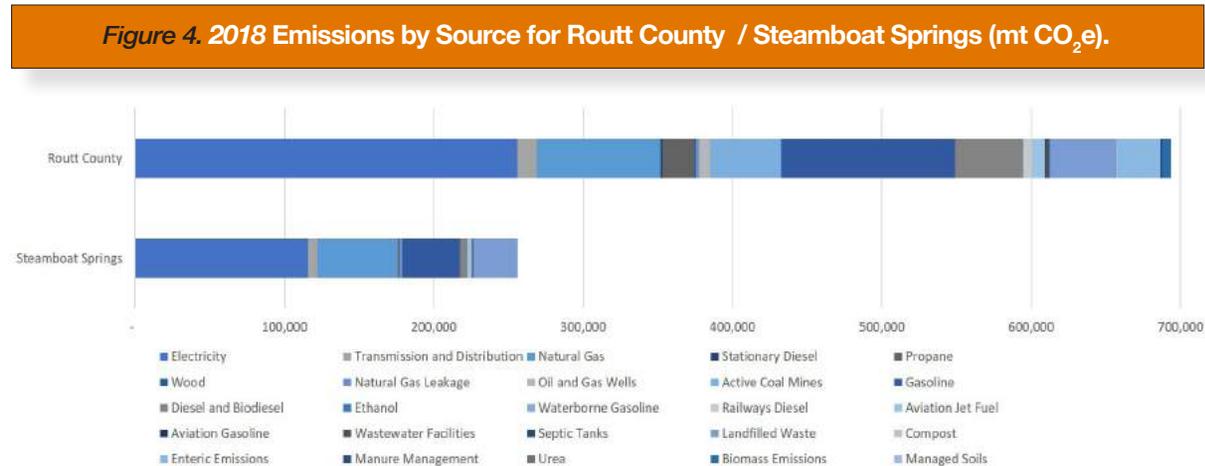
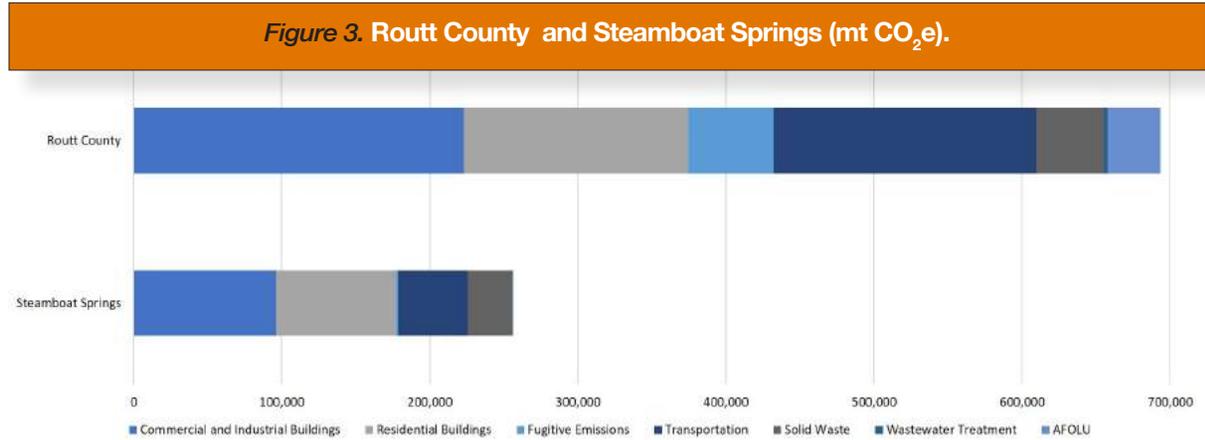
Figure 2. Total 2018 Emissions by Scope for Routt County / Steamboat Springs (mt CO₂e).



Various sources of emissions within the AFOLU sector comprised seven percent of overall emissions for Routt County, but accounted for no emissions for Steamboat Springs. Within the AFOLU sector, the largest sources of emissions are attributed to enteric methane emissions from livestock and biomass (wildfires). Emissions from the transportation sector accounted for 26 percent of Routt County’s total in 2018, while accounting for 18 percent of Steamboat Springs emissions in 2018. Within the transportation sector, the largest source

of emissions in both Routt County and Steamboat Springs was gasoline-powered vehicles, followed by emissions from diesel vehicles, and aviation. The remaining emissions were attributed to activities and processes surrounding Twentymile Mine, waste, and wastewater. The largest sources of emissions in Routt County and Steamboat Springs and their respective totals are shown in Figure 4. Routt County's forests have the potential to significantly sequester (that is, capture and store) GHG emissions.

This inventory does not take into account this potential, however in future years Routt County hopes to include the ability for forestry to sequester carbon in their inventories. They will also include emissions from development of buildings, roads, or recreational areas that result in a permanent loss of forest area.





Greenhouse Gas Trends 2005 and 2018



EMISSION TRENDS

1%

Increase in emissions for Routt County (as a whole) between 2005 and 2050

9%

Decrease in Steamboat Springs emissions between 2005 and 2050

In May 2019, Governor Jared Polis signed House Bill 1261, which sets statewide targets to reduce statewide greenhouse gas emissions by 90 percent in 2050 from pollution levels in 2005. Routt County, as a whole, has increased its emissions by one percent since the baseline year of 2005. It is projected that by 2050 emissions will only reduce by 26 percent below baseline based on business-as-usual estimates.

Steamboat Springs emissions have reduced by 9 percent since 2005 and are expected to decrease by 35 percent by 2050 (with a 2005 baseline). To meet the statewide 2050 target, Routt County and Steamboat Springs must significantly reduce their greenhouse gas emissions within all sectors throughout the county. Figures 5 and 6 show how far emissions will need to be reduced to meet goals set by Governor Polis earlier this year.

Factors Influencing Emissions

Routt County and Steamboat Springs can influence positive changes in emissions through various programs, policies, and outreach and education efforts. A review of emission changes and the factors that influence those changes inform how well Routt County and Steamboat Springs'

Figure 5. Routt County Forecasted Emission Reductions (mt CO₂e).



Figure 6. Steamboat Springs Forecasted Emission Reductions (mt CO₂e).



climate change initiatives are working and may inform where the City and County should focus future efforts. The following is an overview of drivers that affected GHG emissions throughout the years.

Emission Factor Trends

Colorado’s Renewable Energy Standard⁵ and the state’s Clean Air Clean Jobs Act⁶ require Xcel Energy to increase the efficiency of its operations and procure increasing amounts of energy from low-to zero-carbon sources (i.e., renewable energy, recycled energy, etc.). As a result, the mix of energy sources supplying Xcel Energy’s electric grid changes every year and the resulting electricity emission factor decreases every year. Based on Xcel Energy data, electricity emission factors for CO₂ decreased by 34 percent from 2005 to 2018.⁷ This emissions decrease offsets the increased commercial and industrial (C&I) electricity consumption is shown in the Energy Trends subsection. Emission factors for other emission sources are not expected to change significantly year to year.

Community Indicator Trends

Between 2005 and 2018, Routt County experienced growth across all community indicators (Table 2). Note that vacant housing units refer to second homes.

Weather

Weather can impact emissions. The region experienced an increase in both heating degree days and cooling degree days. A heating degree day and cooling degree day are roughly proportional to the energy used for heating and cooling a building. An increase in heating degree days means that there was an increase in days were

Table 2. Community Indicator Changes Between 2005 and 2018.

	2005	2018	% Change Between 2018 and 2005
Population - Routt County	21,453	25,680	20%
Number of Housing Units - Routt County	13,856	16,942	22%
Number of Vacant Housing Units - Routt County	5,025	6,117	22%
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Number of Vacant Housing Units - Steamboat Springs	3,681	4,666	27%
Number of Occupied Housing Units - Steamboat Springs	4,794	5,696	19%

Routt residents needed to heat their houses using wood, propane, natural gas, and/or electricity. An increase in cooling degree days means there was an increase in days were residents needed to cool houses during the summer.

Tourism

Routt County is a tourist destination gaining in popularity. As Figure 7 shows (Page 13), since 2004 tourism-based spending has increased by 89 percent leading to an increase in energy demand.⁹

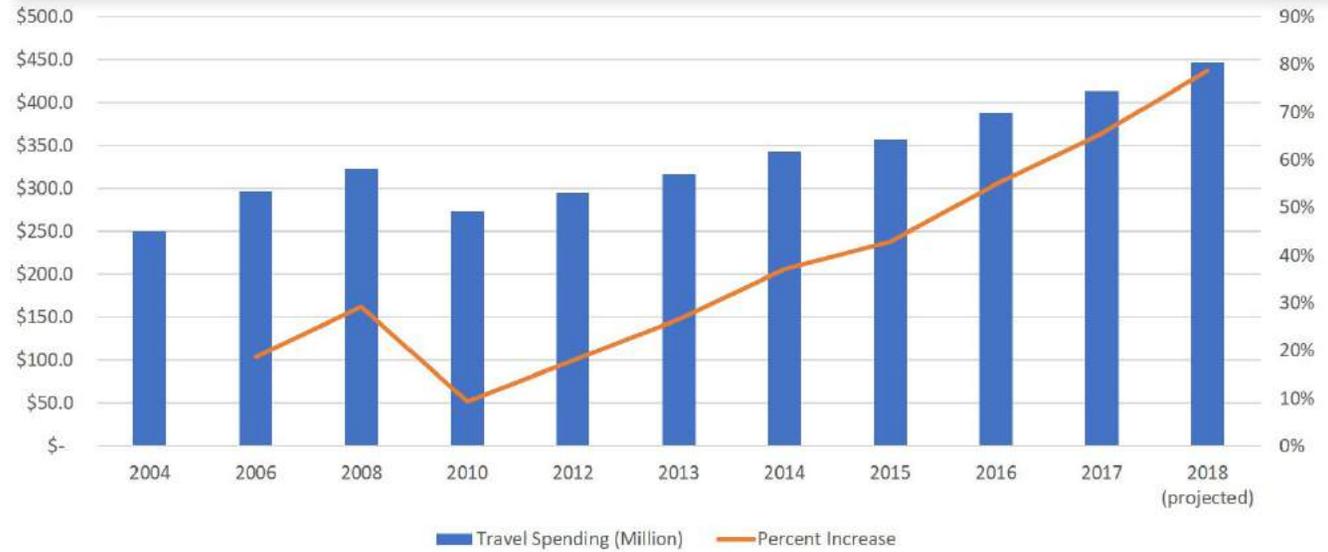


**ROUTT COUNTY
TOURISM**

89%

Increase in tourism based-spending since 2004, leading to an increase in energy demand

Figure 7. Travel Spending in Routt County (millions).





Stationary Energy



Current Emissions

The stationary energy sector typically presents one of the largest contributors of emissions as it includes all the electricity, natural gas, diesel, propane, and other heating fuel use. The stationary energy sector also includes fugitive emissions associated with coal mines, oil and gas wells, and leakage from natural gas systems (within the inventory workbook, fugitive emissions are calculated on a separate tab).

Stationary energy emissions related to electricity are largely dependent on the utility providers and their emission factors. For electricity providers, their fuel resource mix is especially important. As more renewable energy is used the emission factor decreases, which in turn, decreases overall GHG emissions. For natural gas, diesel, and propane providers the emission factors remain somewhat constant; however, data availability and consistency can vary.

Of the total 693,367 mt CO₂e emissions for the County in 2018, stationary energy use in Routt County consisted of 431,898 mt CO₂e (62 percent). For Steamboat Springs, stationary energy emissions comprised 178,881 mt CO₂e out of 256,120 mt CO₂e (70 percent).

62%

**Routt County
emissions from
stationary energy**

70%

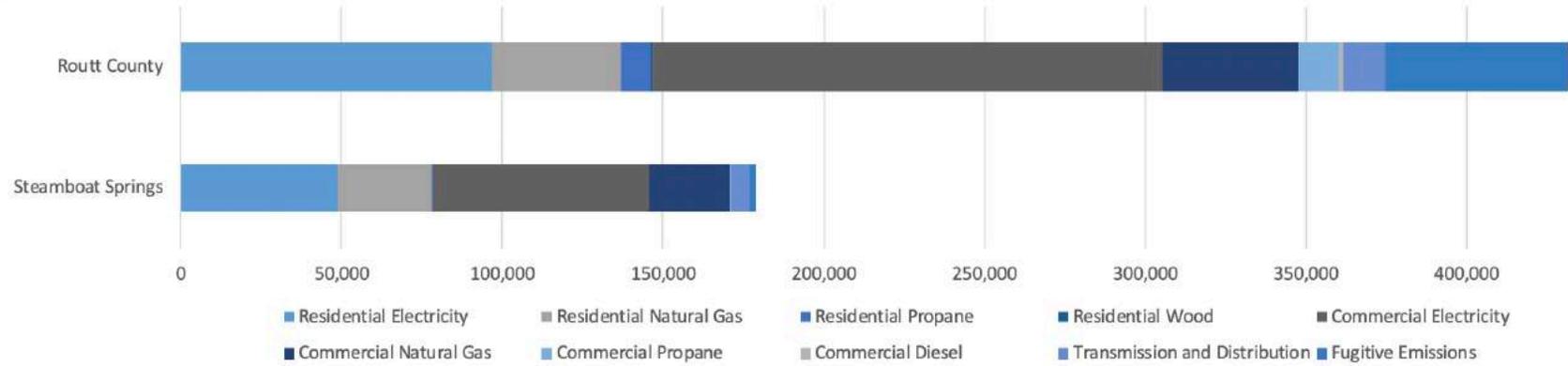
**Steamboat Springs
emissions from
stationary energy**

Stationary Energy Emission Sources

Stationary energy sources for Routt County include the following:

- electricity use;
- natural gas use;
- propane use;
- wood use;
- stationary diesel use (this is mostly from emergency generators);
- transmission and distribution losses;
- fugitive emissions (unintended releases of GHGs from coal mining, oil and gas wells, and leakage from natural gas systems)

Figure 8. Routt County and Steamboat Springs Stationary Energy Sector 2018 Emissions (mt CO₂e).



In Routt County, commercial buildings represent the largest source of stationary energy use emissions at 52 percent and residential as the second highest at 35 percent (including Steamboat Springs). Similarly, emissions for Steamboat Springs reveal that commercial and industrial buildings lead the way at 54 percent, with residential buildings close behind at 45 percent of overall emissions (Figure 8). Commercial buildings also include emissions associated with snow-making.

Past Trends and Forecasted Emissions

Stationary energy emissions have decreased in Routt County (including Steamboat Springs) since the baseline year of 2005. This can be linked to YVEA, and its electricity supplier Xcel Energy, increasing the amount of carbon-free energy and phasing out emissions-heavy energy sources in their grid mix. This trend will likely continue, and therefore the emissions from the stationary energy sector are expected to decrease in Routt County (and Steamboat Springs) through 2050. This assumes that YVEA will continue to purchase electricity from Xcel Energy through 2050.

If YVEA ceases to purchase electricity from Xcel, these totals may change. In 2005, the largest sources of emissions in the stationary energy sector were residential and commercial electricity. In 2018, those were still the largest sources of emissions, but emissions from commercial and residential natural gas increased. As the electricity supply emissions reduce to zero, emissions from residential and commercial natural gas become the predominant sources of stationary emissions in Routt County and Steamboat Springs, as shown in Figures 9 and 10 (Page 17).

Figure 9. Stationary Energy Sector Emissions for Routt County in 2050 (mt CO₂e).

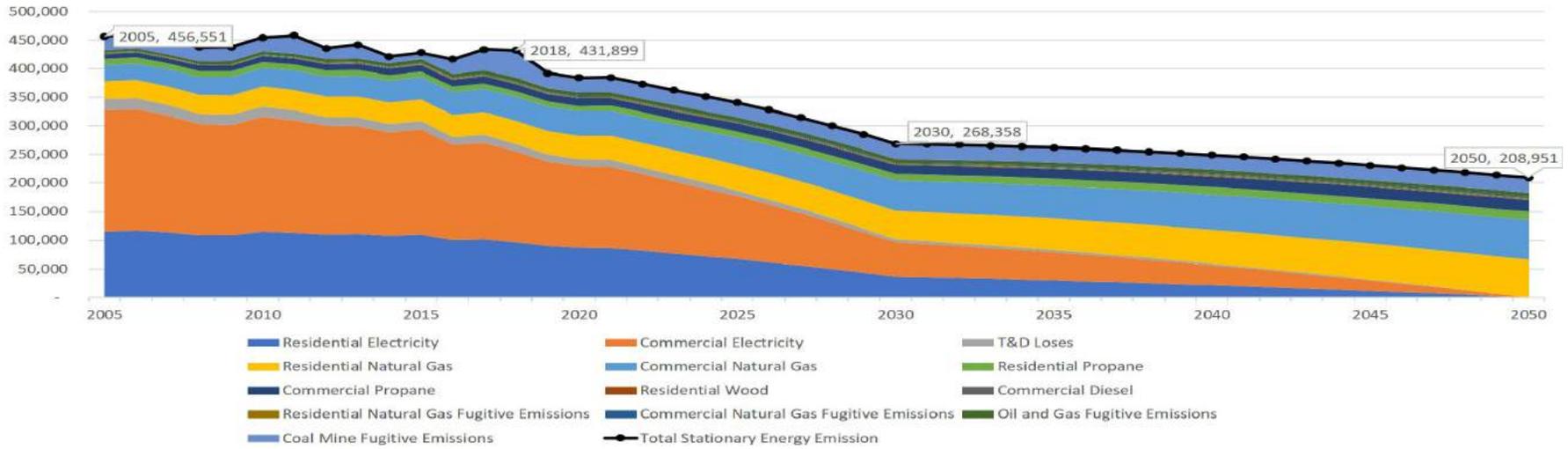
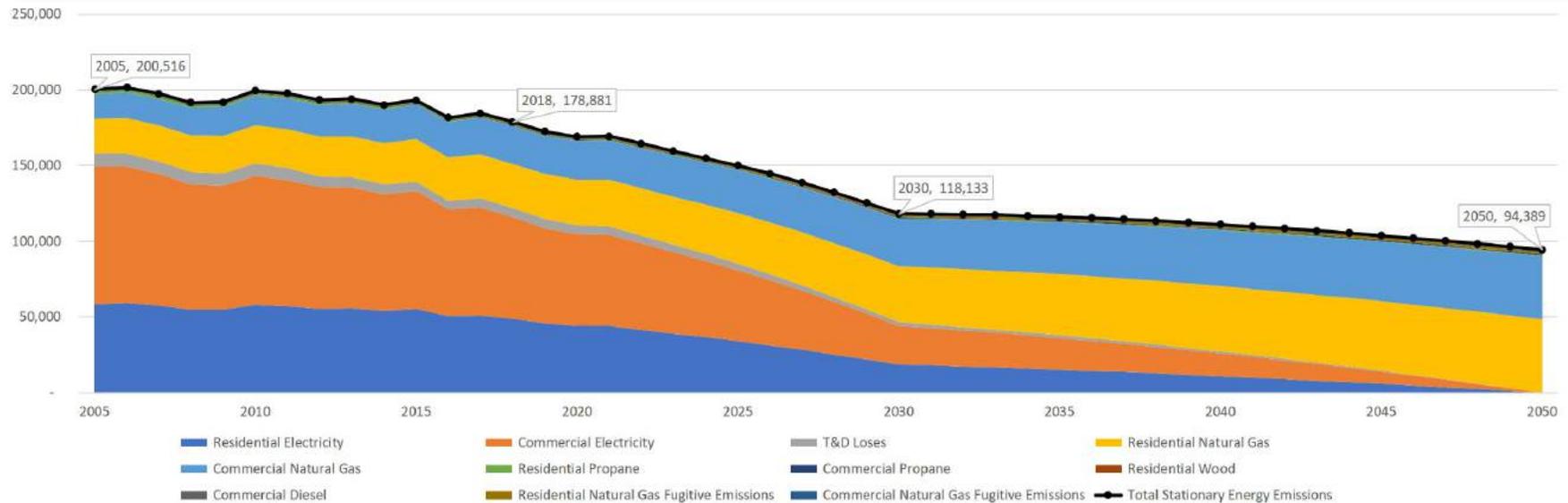


Figure 10. Stationary Energy Sector Emissions for Steamboat Springs in 2050 (mt CO₂e).



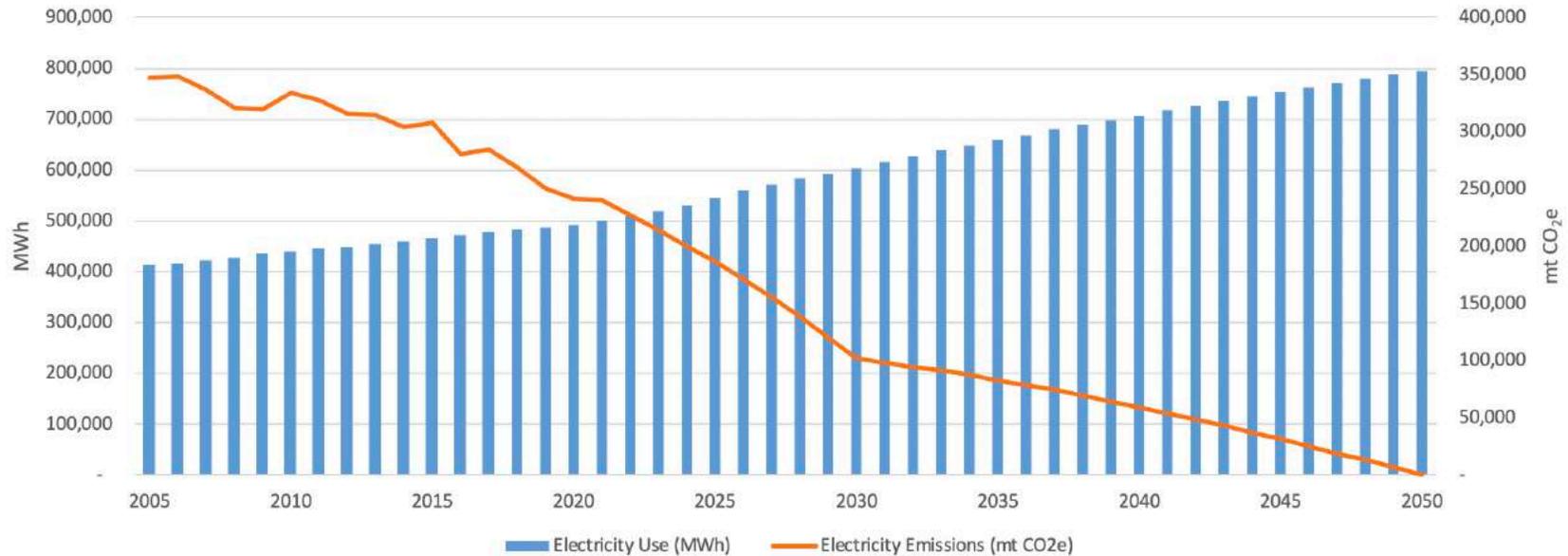


Key Takeaways

The following trends and key takeaways were observed for the stationary energy sector:

- Electricity emissions (including T&D losses) accounted for 62 percent of stationary energy emissions for Routt County, followed by natural gas (including leakage) at 20 percent. Between 2005 and 2018 stationary emissions decreased by five percent. Stationary energy emissions are expected to decrease by 54 percent between 2005 and 2050.
- Steamboat Springs electricity emissions accounted for 68 percent of the City's stationary energy emissions, followed by natural gas at 31 percent. Between 2005 and 2018, stationary emissions decreased by 11 percent. Stationary energy emissions are expected to decrease by 53 percent between 2005 and 2050.
- Electricity usage is expected to increase at the same rate as population, however, electricity emissions are expected to decrease by 62 percent between 2018 and 2050. See Figure 11 on Page 19 for more information on the connection between electricity usage and emission factors.
- Based on the number of housing units in Routt County, 43 percent use natural gas for heat, 30 percent of households have electric heat, and 16 percent have propane tanks. The remaining ten percent of households use either wood, coal or coke, or solar energy for heat. By 2050, residential natural gas use is forecasted to increase to 81 percent from 2018. The wood used in homes for fuel is expected to remain constant, and related emissions are low.

Figure 11. Commercial Electricity Usage Compared to Emissions in Routt County (2005-2050).



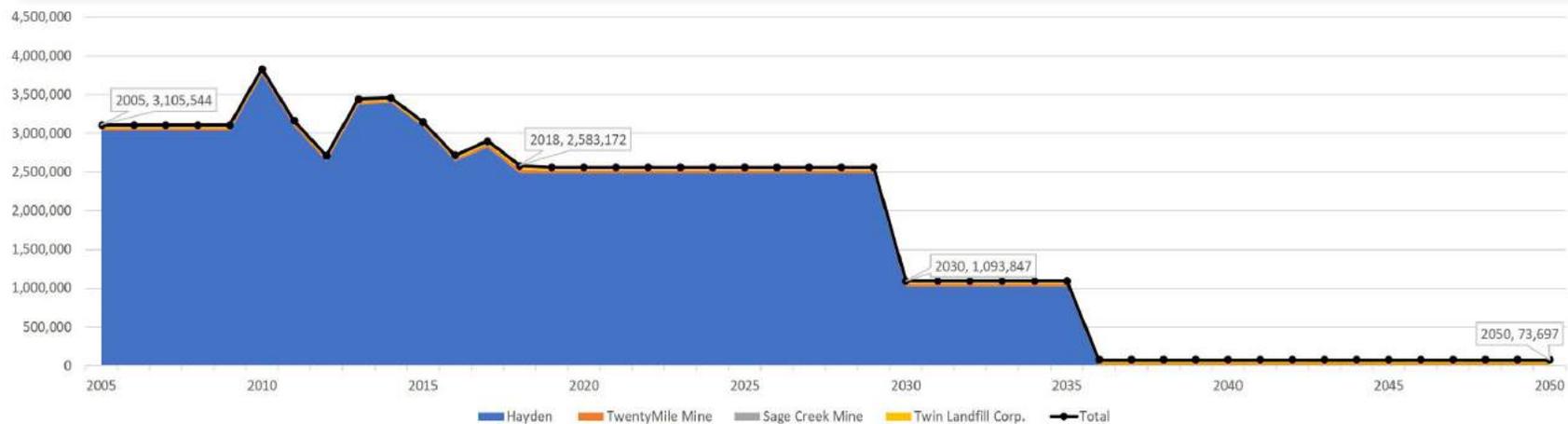
- Fugitive emissions from Twentymile mine constitute 83 percent of all fugitive emissions (47,923 mt CO₂e of the total 57,459 mt CO₂e), followed by oil and gas at 12 percent and fugitive emissions from natural gas at five percent. In 2050 the bulk of emissions will still be from Twentymile - 26,038 out of 36,638 mt CO₂e.
- Although it is highly likely that oil and gas wells were in place in Routt County prior to 2013, data on the number of oil and gas wells specific to Routt County was only available starting in October 2013. Prior to that time, data was only available on a state-wide basis. Therefore, estimates are made. In terms of forecasting, activity associated with oil and gas (i.e. wells) is largely tied to the market price per barrel. The forecast anticipates the number of wells remaining constant; however, the number of wells could vary based on market fluctuations (therefore, emissions from oil and gas would fluctuate accordingly).

HAYDEN POWER PLANT

Xcel Energy's Hayden Power Plant first went online in 1965. Emissions from the plant have fluctuated a great deal since 2005 where emissions totaled 3,032,109 mt CO₂e and in 2018 emissions totaled 2,488,170 mt CO₂e. Peak emissions were realized in 2010 with a total of 3,757,251 mt CO₂e (Figure 12).

According to Xcel Energy's 2016 Electric Resources Plan, the Hayden plant is anticipated to close its two coal-fired units, Unit 1 and Unit 2, by 2030 and 2036, respectively.¹¹ Emissions from the actual generation of electricity at the plant are not accounted for in the 2018 Routt County GHG emissions inventory. The reason for this is because the electricity that is produced at the Hayden Power Plant is used in areas beyond the boundary of Routt County. Therefore the emissions from the usage of the electricity produced would be counted where the electricity is consumed. However, emissions associated with the operation of the plant (e.g. lights, generators, etc.) are included in the inventory. Figure 12 shows the fluctuation of emissions from 2005 to 2050.

Figure 12. Industrial Emissions in Routt County (2005-2050).



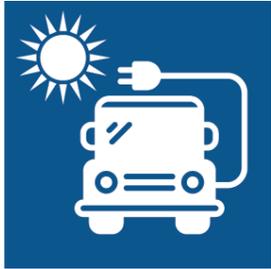
Twentymile Mine

Twentymile Mine is operated by Peabody Energy and is the second largest coal producing mine in Colorado.¹² Twentymile Mine's largest contract for coal is the Hayden Power Plant.¹³ With the closure of the power plant in 2036, it is assumed the mine will be impacted. However, the mine's fate will depend on the market. As such, emissions are expected to be consistent moving forward.





Transportation



270

Electric vehicles in
Routt County in 2018

25,435

Flights in and out of
Routt County in 2018

Current Emissions

Transportation emissions typically account for a large portion of the overall emissions. Emissions related to transportation include all fuel used in vehicles – gasoline, diesel, ethanol, biodiesel, and electricity. A reduction in the amount of fuel used in vehicles ultimately impacts GHG emissions. In Routt County the transportation sector accounted for 26 percent of all 2018 GHG emissions. For Steamboat Springs, transportation accounted for 18 percent of emissions.

Transportation Emission Sources

The following sources are included in the transportation sector:

- on-road vehicles use of gasoline, electricity, diesel, and ethanol;
- off-road vehicles use of gasoline, diesel, and ethanol;
- waterborne navigation (i.e. gasoline used in boats at the marinas);
- railways (i.e. diesel); and;
- aviation fuel

Currently, the largest source of transportation emissions in Routt County is on- and off-road gasoline-powered vehicles, contributing 66 percent of the transportation sector's emissions. This is also the case in Steamboat Springs, where gasoline-powered vehicles make up 82 percent of transportation emissions (Figure 13, Page 25). Other significant sources of emissions for both Routt County and Steamboat Springs were diesel-powered vehicles and aviation.





Past Trends and Forecasted Emissions

Since 2005, transportation emissions have increased by 25 percent in Routt County and eight percent in Steamboat Springs, and emissions from on- and off-road vehicles in Routt County and Steamboat Springs have increased substantially (34 percent and 13 percent respectively). This is likely due to the increase in population and tourism for both the County and the City. However, in Routt County it is projected that emissions from the transportation sector will decrease seven percent by 2050, largely due to drivers switching to driving electric vehicles and having the electricity come from greener sources (Figure 13 on Page 25), along with more efficient vehicles.

Other sources of transportation sector emissions in Routt County, such as waterborne, railways and aviation, have remained constant or decreased since 2005. However, emissions from these sources combined are expected to increase by nearly three percent by 2050. This will largely come from aviation, as it is projected that population and visitation will increase in the County (Figures 14 and 15 on Page 25). Emissions from railways are likely to decrease though, as the current railroad in Routt County is mainly used to transport coal to the Hayden Power Plant and the Hayden Power Plant is scheduled to close by 2036.

Trends and Key Takeaways

The following trends and key takeaways were observed for the transportation sector:

- In 2018, Public Transportation carried 1,093,637 passengers. Expanding and electrifying public transportation will lead to a reduction in GHG emissions in Routt County.
- Currently, 270 electric vehicles are registered in Routt County. Electric vehicle use is supported in Steamboat Springs with four public charging stations and three with limited access.¹⁴ In January 2019, Governor Polis signed Executive Order B 2019-002 Supporting a Transition to Zero Emission Vehicles.¹⁵ An increase in electric vehicle registrations and use is expected.
- Railways within Routt County also run through the boundary of Steamboat Springs. As such, emissions in the inventory are captured as both Routt County and the estimated portion of railways within Steamboat Springs. Railway emissions remain constant (primarily based on the closure of Hayden Power Plant), emissions from aviation are expected to increase based on population growth.
- Emissions from gasoline use at both marinas (Steamboat Lake and Stagecoach) is expected to remain constant and are relatively minor in terms of the overall transportation sector.

Figure 13. Transportation Sector Emissions Sources in 2018 (mt CO₂e).

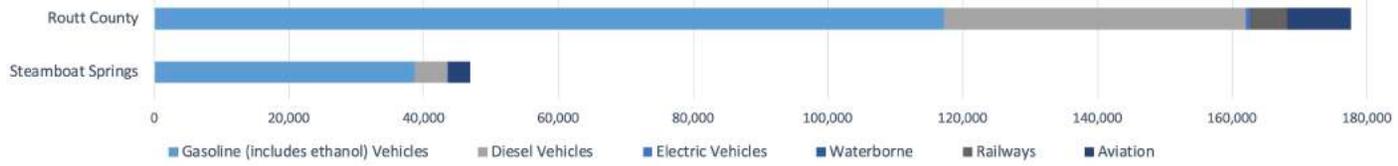


Figure 14. Transportation Emissions Trends in Routt County 2005-2050 (mt CO₂e).

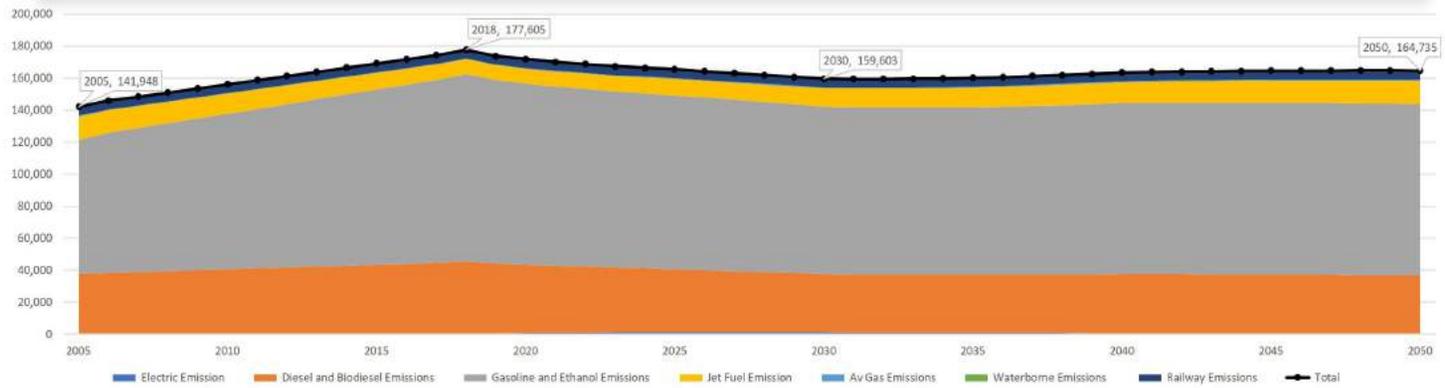
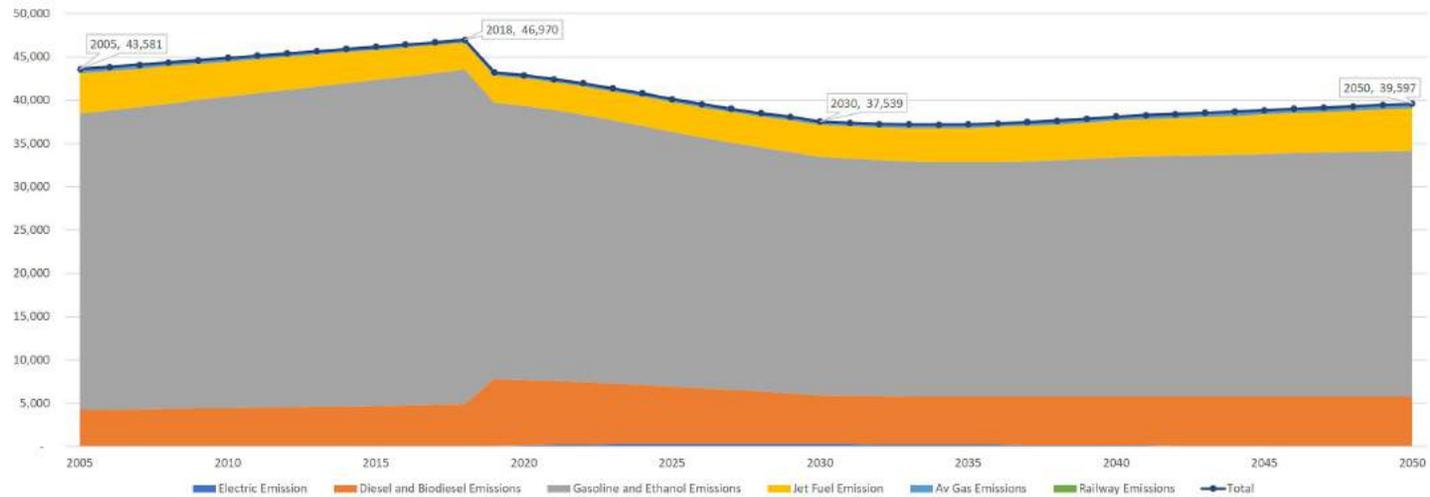


Figure 15. Transportation Emissions Trends in Steamboat Springs 2005-2050 (mt CO₂e).





Waste and Wastewater



Current Emissions

Emissions from waste result as the waste decomposes and releases methane. Nationwide, landfill emissions present a major source of methane emissions (16 percent).¹⁶ As a result, there is strong encouragement on local, county, and nationwide fronts to reduce the amount of waste going to the landfill. Colorado established a statewide goal in 2017 to increase waste diversion to 45 percent by 2036.¹⁷ In response, Routt County developed a 2019 Waste Diversion Strategic Plan that specifically calls out the importance that waste diversion plays in reducing GHG emissions.

The 2018 GHG emissions inventory indicates that six percent of overall emissions are contributed to solid waste disposal in Milner Landfill. In 2018, a total of 17,230 mt CO₂e were avoided through recycling (13,952 mt CO₂e for Steamboat Springs).

Composting in the County currently consists of biosolids from wastewater treatment and no program is in effect for residential or commercial composting (i.e. food composting) and emissions equaled 403 mt CO₂e (261 mt CO₂e for Steamboat Springs).

Emissions (CH₄ and N₂O) from the wastewater sector are attributed to wastewater treatment. This inventory included 11 wastewater treatment plants (WWTP), each with varying treatment operations. Because details for each facility varied, Lotus used a population-based approach to calculate emissions from each facility that were aggregated for an overall sector total. Emissions from the wastewater sector are minimal, comprising less than one percent of the totals for Routt County and Steamboat Springs.

9.5%

Waste recycled in
Routt County in 2018

14%

Waste composted in
Routt County in 2018





32%

**Waste emissions
increase by 2050**

Past Trends and Forecasted Emissions

Waste and Wastewater Emission Sources

The following sources are included:

- solid waste disposed of in landfills;
- biological treatment of waste (compost);
- septic tanks; and
- wastewater treatment plants.

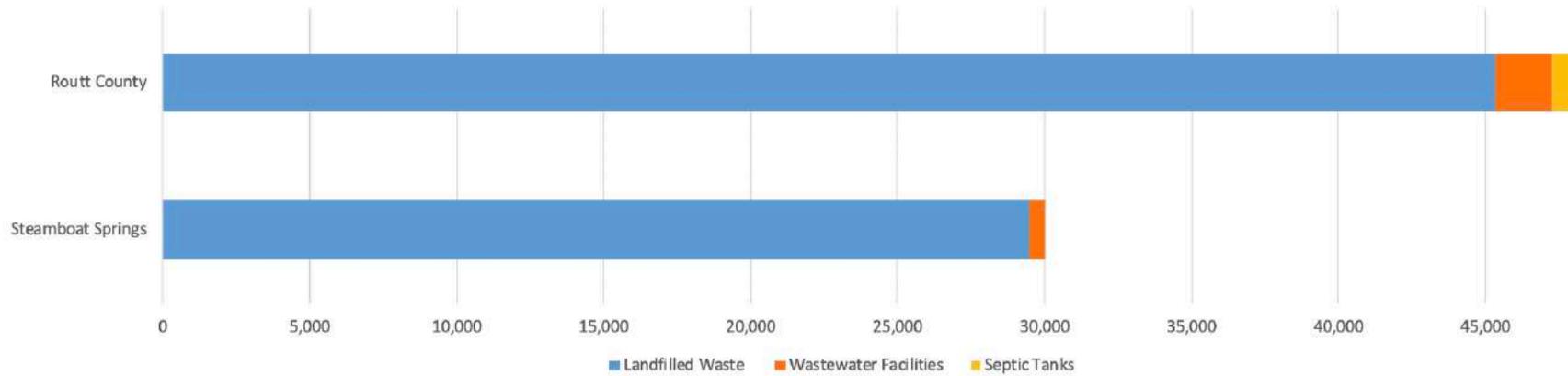
In Routt County approximately 29,500 tons of waste is disposed of at Milner Landfill, which represents the majority of emissions (Figure 16 on Page 30). Waste sector emissions have decreased by nearly 20 percent since 2005.

The emissions from this sector are projected to increase through 2050 by as much as 32 percent from baseline levels (Figure 17 on Page 31). This is largely associated with an increase in population and construction in the County. These emissions can be mitigated by working to divert more waste from the landfill and instituting County-wide recycling and composting programs.

Emissions from wastewater treatment in Routt County have increased slightly more than 12 percent since the baseline year of 2005. It is projected that this trend will continue through 2050, with a total increase in emissions of 35 percent since baseline (Figure 18 on Page 31). This increase is linked to an increase in population in Routt County.



Figure 16. Waste and Wastewater Emissions in 2018 (mt CO₂e).



Trends and Key Takeaways

The following trends and key takeaways were observed for the waste sector:

- Routt County 2018 GHG emissions from decomposition of the approximately 29,500 tons of solid waste sent to Milner Landfill and composting resulted in emissions of 45,750 mt CO₂e. Total emissions for Steamboat Springs were 29,738 mt CO₂e.
- Landfill emissions comprised 99 percent of the waste emissions for both Routt County and Steamboat Springs. Emissions from wastewater treatment in Routt County totaled 2,585 mt CO₂e and 531 mt CO₂e for Steamboat Springs.
- Emissions from the waste and wastewater sector are expected to increase with population.

Figure 17. Routt County Waste and Wastewater Sector Emissions 2005-2050 (mt CO₂e).

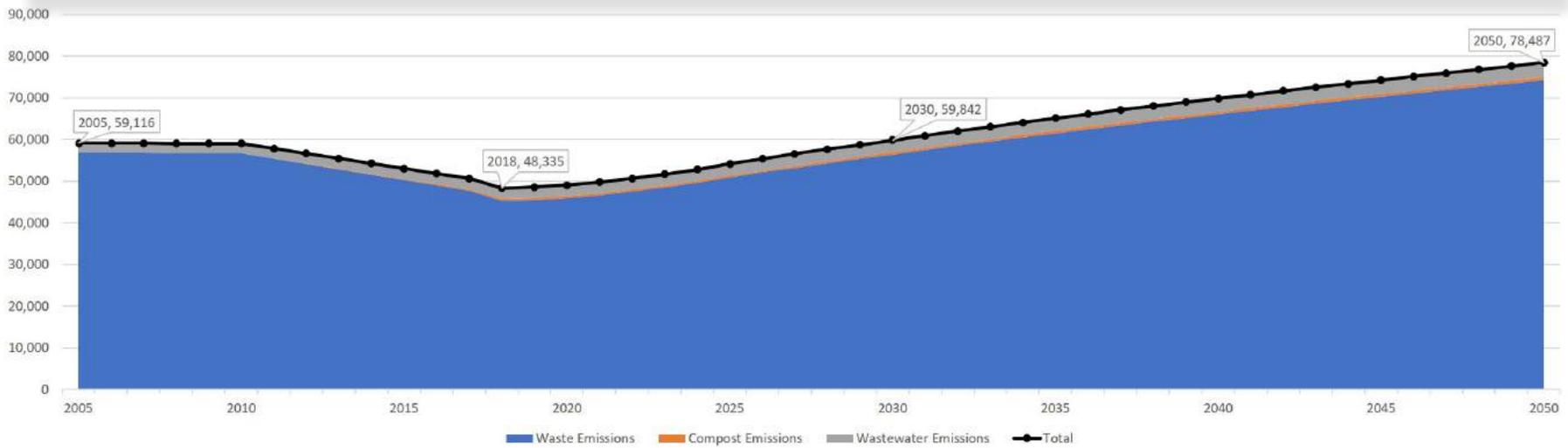
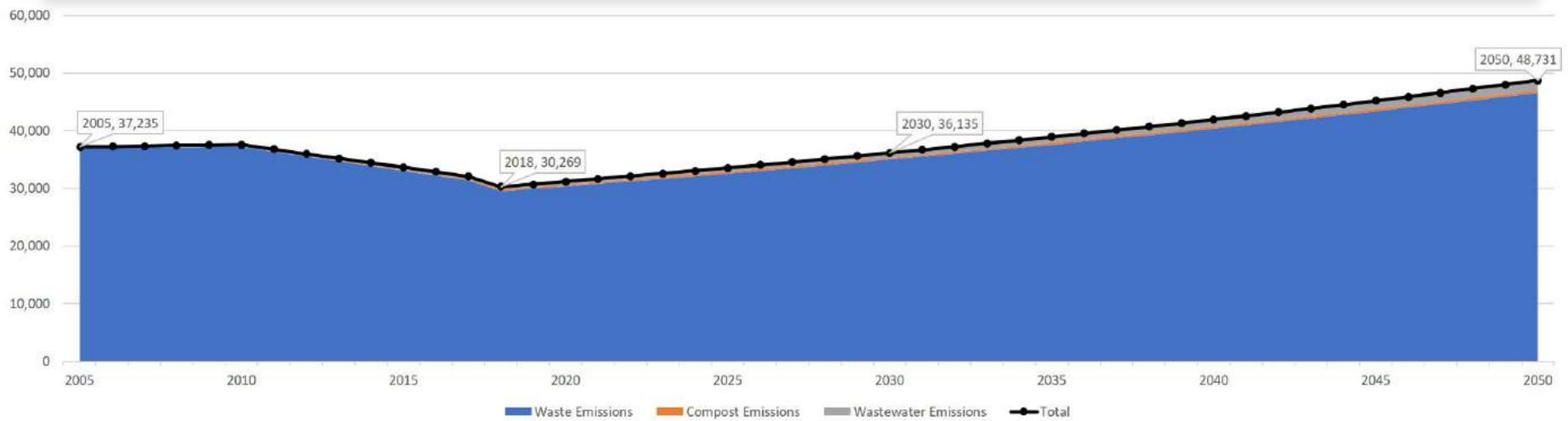
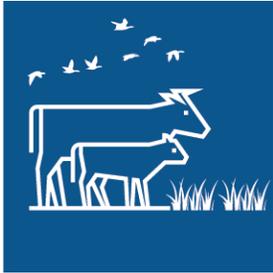


Figure 18. Steamboat Springs Waste and Wastewater Sector Emissions 2005-2050 (mt CO₂e).





Agriculture, Forestry and Other Land Uses



Current Emissions

Per the GPC protocol, emissions from the agriculture, forestry and other land uses (AFOLU) sector are produced in several ways including livestock (enteric fermentation and manure management) and aggregate sources and non-CO₂ emission sources on land (fertilizer use).¹⁸

This sector also includes emissions as a result of wildfires. For the 2018 inventory, it was assumed that all agricultural operations occur outside the boundary of Steamboat Springs.

1871

First herd of year-round cattle brought into the area

Figure 19. AFOLU Sector Emissions for Routt County in 2018 (mt CO₂e).



AFOLU Emission Sources

The following sources are included:

- Livestock (enteric emissions and manure management)
- Direct and Indirect N₂O emissions
- Biomass (wildfires)





Past Trends and Forecasted Emissions

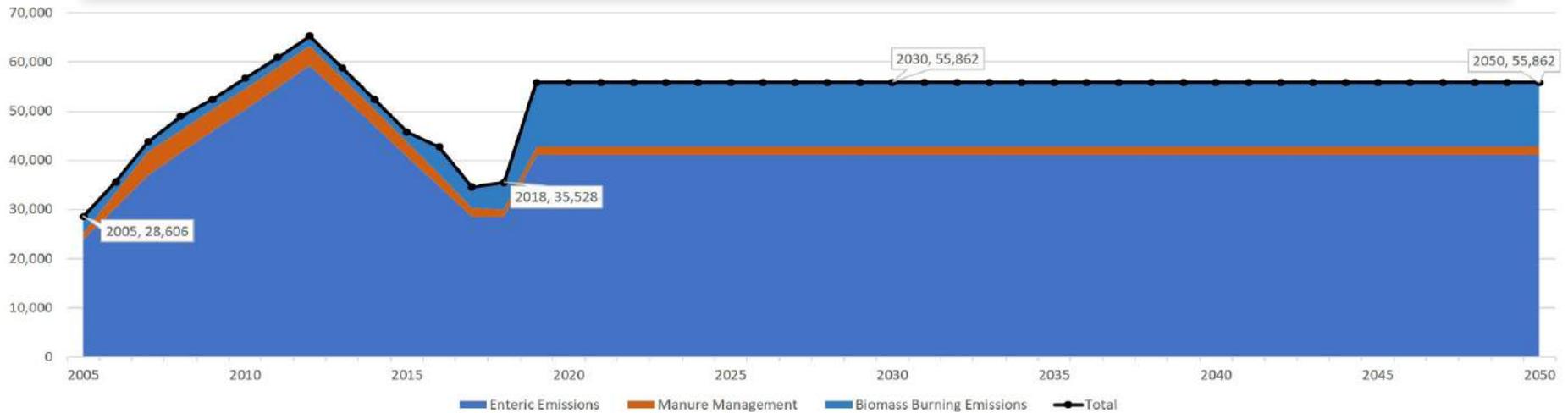
Emissions from the AFOLU sector have increased by 24 percent since the baseline year of 2005. The largest source of these emissions is enteric emissions from livestock, accounting for 80 percent of all AFOLU emissions in 2018.

Routt County has experienced significant growth to the agricultural sector and has seen a notable increase in the number of livestock within the County since 2005 (Table 3). This increase in the number of livestock within the County contributes greatly to the amount of emissions for the County and is expected to increase slightly or stay constant through 2050 depending on land use changes that occur in the coming years (Figure 20 on Page 35).

Table 3. Livestock Totals and Percentage Change for Routt County (2005-2018).

Type of Livestock	2005 (Baseline)	2018	% Change Between 2018 and Baseline
Dairy Cattle	7	23	228.6%
Beef Cattle	14,807	15,831	6.9%
Sheep	713	14,163	1886.4%
Goat	37	243	556.8%
Buffalo	0	250	N/A
Swine	92	24	-73.9%
Horse	3,501	2,736	-21.9%
Poultry	452	1,469	225.0%

Figure 20. Projected Emissions for the AFOLU Sector in Routt County 2005-2050 (mt CO₂e).



Trends and Key Takeaways

The following trends and key takeaways were observed for the AFOLU sector:

- Emissions associated with the AFOLU sector totaled 35,528 mt CO₂e. Of this total, enteric emissions from livestock were the highest at 28,547 mt CO₂e or 80 percent of total AFOLU emissions. Biomass emissions were the second highest in the AFOLU sector with 5,601 mt CO₂e, or 16 percent.
- The number of livestock in Routt County increased from 19,609 (2005) to 34,739 (2018).
- It is anticipated that emissions from this sector will remain constant but may decrease slightly over time as land use changes occur.
- It is anticipated that wildfires will impose an increased risk for Routt County.



Information Only



502

Kilowatts installed in
Routt County

The GPC protocol does not recognize emissions avoided through renewable energy use or recycling. However, to understand the potential impact of these activities, the inventory included these emissions as information-only items.

- Renewable energy use in Routt County and Steamboat Springs consists of solar, through renewable energy credits and installed solar. Emissions avoided from renewable energy credits totaled 1,041 mt CO₂e (386 mt CO₂e for Steamboat Springs), while installed solar totaled 397 mt CO₂e (147 mt CO₂e for Steamboat Springs).
- It is anticipated that renewable energy use will increase over time. Incentives and policies surrounding business and residential renewable energy use may increase use at an accelerated rate.
- Avoided emissions from recycling equaled 17,230 mt CO₂e (13,952 mt CO₂e for Steamboat Springs).
- Routt County has a waste diversion strategic plan in place that details the opportunities and challenges that are present. Waste diversion is one way Routt County and Steamboat Springs can reduce GHG emissions, and also help the state achieve the goal of 45 percent recovery by 2036.



CONCLUSION



GHG PROJECTIONS

35%

Emission reductions projected by 2050 in a Steamboat Springs business-as-usual scenario

26%

Emission reductions projected by 2050 in a Routt County business-as-usual scenario

The 2018 GHG emissions profile for Routt County and Steamboat Springs is not unlike other mountain areas. Typically, electricity and natural gas use in buildings and transportation comprise the largest portion of emissions. In Routt County, because of the large presence of agriculture, emissions are also high from the AFOLU sector. Overall, emissions are projected to reduce by 26 percent by 2050 as shown in Table 4 below. Additionally, GHG emissions per capita decreased 63 percent by 2050 from 32 mt CO₂e in 2005 to 12 mt CO₂e in 2050. All of this has occurred while the region has experienced an 18 percent increase in second homes and an 89 percent increase in tourism over the past 13 years.

In Steamboat Springs, it is projected that emissions will decrease consistently over time. The drop is due to the large decrease in the stationary energy sector emissions, while all other sectors' emissions are expected to increase (see Table 5).

The biggest reduction in emissions is expected in the stationary energy sector. This will likely be attributed to YVEA transitioning away from fossil fuel electricity sources and adding more carbon-free

Table 4. Emissions Trends for Routt County 2005-2050 (mt CO₂e).

	2005	2018	2030	2050
Stationary Energy	426,633	374,440	232,782	172,313
Fugitive Emissions	29,917	57,459	35,575	36,638
Transportation	141,948	177,605	159,603	164,735
Waste/Wastewater	59,116	48,335	59,842	78,487
AFOLU	28,606	35,528	55,862	55,862
Routt County Total	686,221	693,367	543,665	508,035
Percent Change Since 2005		1%	-21%	-26%

Table 5. Emissions Trends for Steamboat Springs 2005-2050 (mt CO₂e).

	2005	2018	2030	2050
Stationary Energy	199,247	177,110	115,906	91,457
Fugitive Emissions	1,269	1,771	2,227	2,933
Transportation	43,581	46,970	37,539	39,597
Waste/Wastewater	37,235	30,269	36,135	48,731
Steamboat Springs Total	686,221	693,367	543,665	508,035
Percent Change Since 2005	-	-9%	-32%	-35%



sources to its grid mix. If YVEA can achieve 100 percent carbon-free energy generation by 2050, residential and commercial natural gas use will take over as the largest emission sources in the stationary energy sector. Transportation, waste, wastewater, and the AFOLU sectors are anticipated to see an increase in emissions, as the Routt County population increases. In the case of transportation, this could be mitigated by an increased adoption of electric vehicles by residents, as well as expanding and electrifying public transportation. Similarly, expanding recycling and composting in the County can help mitigate emissions in the waste sector. By understanding which GHG emissions sources are big or small, a path forward can be established. This path may include a Climate Action Plan, where strategies toward achieving emissions reductions are identified and stakeholders are engaged in discussions surrounding where the biggest impact and reductions can occur.

Action-Based Strategies to Reduce Emissions

The idea of sustainability and reducing GHG emissions is not new in Routt County or Steamboat Springs and the need to reduce GHG emissions is a priority. Many programs and initiatives are already in place that keep sustainability at the forefront of the community. In addition, there are several existing plans and reports in place including the Vision 2030, Waste Diversion 2019 Strategic Plan for Routt County, and 2016 sustainability goals adopted by City Council, with each offering a unique lens on how emissions can be reduced over time. A reduction in emissions will be directly tied to action-based strategies in line with existing initiatives including, but not limited to, the following:

- Increase the recycling of waste materials from demolition projects and achieve zero waste by 2030 from construction and demolition.¹⁹
- Increase biking, carsharing, and transit options.²⁰
- Establish a composting program for food scraps, which would divert organics from the landfill and reduce overall solid waste emissions.
- Increase green infrastructure by two percent annually and increase cooling via tree canopy cover, green roofs, and green walls.
- Reduce energy use and water use by 15 percent (each) over the next five years.

This GHG emissions inventory can help inform the process of identifying the next steps Routt County and Steamboat Springs take in the fight against climate change.

ENDNOTES

1. See <https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/>
2. See https://ghgprotocol.org/sites/default/files/standards_supporting/GPC_Executive_Summary_1.pdf
3. Itinerant aviation operations include those performed by an aircraft that lands at an airport, arrives from outside the airport area, or departs and leaves the airport area.
4. Four IPPU facilities were identified for Routt County: Hayden Power Plant, Sage Creek Mine, Twentymile Mine, and Twin Landfill Corporation. No IPPU emissions were reported because emissions were either not reported or are captured in other sectors.
5. For more information, see: <https://www.xcelenergy.com/staticfiles/xcel/Corporate/CRR2013/environment/renewable-energy.html>.
6. For more information, see: https://www.xcelenergy.com/environment/system_improvements/colorado_clean_air_clean_jobs.
7. Xcel Energy does not report emission factors for methane and nitrous oxide. These values are sourced from U.S. Environmental Protection Agency's (EPA) eGRID and are not expected to change annually.
8. A heating degree day (HDD) and cooling degree day (CDD) are roughly proportional to the energy used for heating and cooling a building. They are calculated by taking the difference between the average daily temperature and the balance point temperature. The balance point temperature is the average daily outside temperature at which a building maintains a comfortable indoor temperature without heating or cooling. When the average daily temperature is above the balance point temperature, the result is cooling degree days (i.e., a building must be cooled to maintain the balance point temperature). When the average daily temperature is below the balance point temperature the result is heating degree days (i.e., the building must be heated to maintain the balance point temperature). HDD and CDD were taken from: <http://www.weatherdatadepot.com/> using at 65-degree Fahrenheit balance point.
9. See Dean Runyan Associates Colorado Travel Impacts Report http://www.deanrunyan.com/doc_library/COImp.pdf
10. See <https://www.steamboatpilot.com/news/as-the-hayden-power-plant-inches-closer-to-retirement-the-yampa-valley-looks-toward-a-future-without-its-smokestacks/>
11. Source: <https://www.xcelenergy.com/staticfiles/xcel/PDF/Attachment%20AKJ-2.pdf>
12. Source: https://www.gjsentinel.com/news/western_colorado/coal-titans-plan-joint-venture/article_5af3319a-9321-11e9-ae4-20677ce85d90.html
13. Source: <https://www.craigdailypress.com/news/production-down-at-twentymile-mine-in-2018/>
14. Source: <http://www.yvsc.org/evridendrive/>
15. Source: <https://www.colorado.gov/pacific/cdphe/zero-emission-vehicle-mandate-proposal>
16. Source: <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>
17. See <http://www.yvsc.org/wastediversionstrategicplan/>
18. Data on livestock was collected from the USDA's most recent Agricultural Census (2017). The Agricultural Census is completed on a five-year cycle, thus giving a snapshot of the agricultural makeup at the time of survey.
19. Source: <http://report.routtcountyvision2030.org/>
20. Source: <http://report.routtcountyvision2030.org/>

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- Figure ES-3** Emissions Trends and Projections by Sector for Routt County • **ES-7**
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