

FY21

# Greenhouse Gas Inventory Technical Report

Colorado College  
Office of  
Sustainability

Greenhouse Gas Inventory  
Team



Office of  
Sustainability

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# Introduction

The purpose of this report is to offer an overview of Colorado College's (CC) carbon footprint. In 2008, CC began measuring carbon emissions and set a carbon-neutral target year of 2020. As of January 1st, 2020, that goal has been achieved. This report summarizes emissions statistics for Fiscal Year '21 (FY21), from July 1st, 2020, to June 30th, 2021. It includes Colorado College's gross and net emissions data, as well as carbon offsets and carbon sinks data (carbon sequestration by compost). Colorado College measures its carbon footprint by submitting annual reports to AASHE STARS® and Second Nature, two organizations committed to supporting higher education institutions with sustainability initiatives.

This report begins with a snapshot of CC's gross and net emissions for FY21. We give information on greenhouse gases as well as the three "scopes" that CC uses to discern sources of carbon emissions. In addition, we discuss carbon neutrality, carbon offsets, and Renewable Energy Certificates (RECs). The report then summarizes the data obtained throughout the FY21 greenhouse gas inventory process, starting with methodology and concluding with graphics from SIMAP®, the inventory's online platform. Finally, we present an update on previous suggestions to reduce our carbon emissions, as well as new recommendations to do so.





# Terms and Definitions

1. Greenhouse Gas Emissions (GHGs): gases such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) that collect in the atmosphere and absorb radiant heat, preventing it from escaping back into space. Emissions from human activities increase the GHGs in the atmosphere, which trap more and more heat under the atmosphere and increase global warming.

2. Global Warming Potential (GWP): the amount of heat absorbed by a gas in the atmosphere; the higher GWP a gas has, the more it will exacerbate global warming. Methane is 28 times as potent as carbon dioxide and nitrous oxide is 2665 times more potent than carbon dioxide (IPCC).

3. Metric Tonnes of Carbon Dioxide Equivalent (MTCO<sub>2</sub>E): the unit of measure for GHG emissions; methane and nitrous oxide emissions are scaled to their carbon dioxide-equivalent emissions.

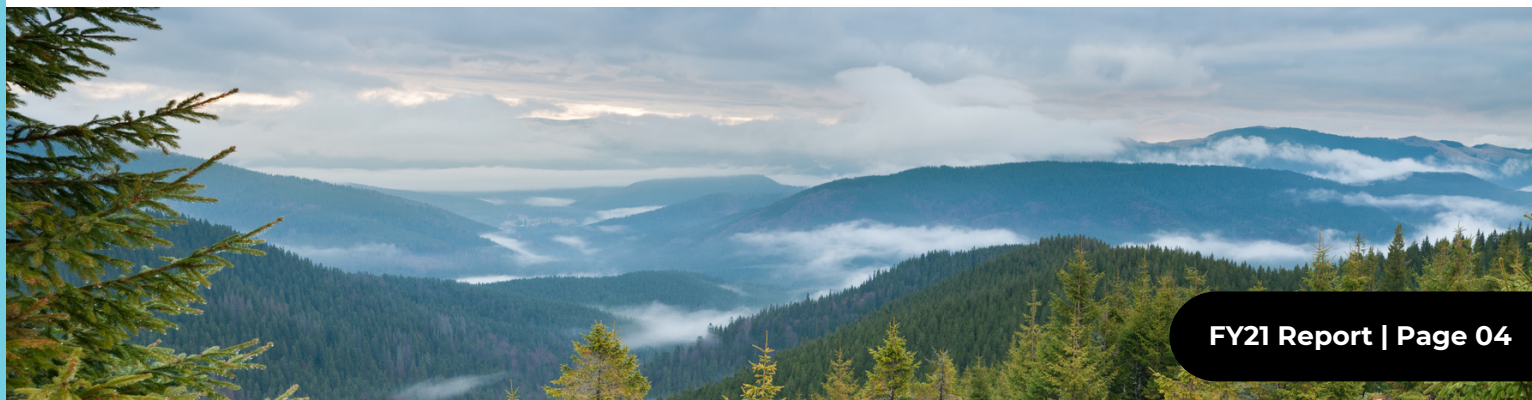
4. Carbon Neutrality: the balancing out of carbon emissions with carbon sequestration or avoidance; gross emissions still exist but are balanced out through different tactics that remove or avoid carbon emissions in the atmosphere. This creates a net-zero scenario where overall, no extra carbon emissions are entering the atmosphere.

5. Carbon Offsets: one carbon offset represents the sequestration or avoidance of one metric ton of carbon dioxide equivalent. There are two types of offsets: 1) sequestration, or capturing and storing carbon in trees, forests, soil, and other natural materials; and 2) avoidance, or avoiding the emissions in the first place by changing business as usual.

6. Renewable Energy Certificate (REC): using RECs to purchase electricity is a way to ensure that the purchased energy is coming directly from renewable energy sources, such as wind or solar power, as opposed to fossil fuels.

7. Emissions Scopes: three categories of GHG emissions

- a. Scope 1 - Direct Institutional: Scope 1 emissions measure direct emissions from sources that are owned and/or operated by Colorado College. This includes natural gas for heating, gasoline and diesel for CC's vehicle fleet, and fertilizers and refrigerants.
- b. Scope 2 - Indirect Institutional: Scope 2 emissions measure indirect emissions from the generation of purchased electricity.
- c. Scope 3 - Indirect Behavioral: Scope 3 emissions are related to behavioral choices. CC has chosen to measure emissions from study abroad, faculty and staff commuting, student travel to- and from home, business travel paid for by Colorado College, solid waste and wastewater, and paper usage. These choices reflect CC's commitment to address and change the behavioral patterns that drive indirect emissions.





# FY21 Emissions Snapshot

2008 (FY08) is CC's baseline year for measuring carbon emissions.

## Total Emissions

Gross Emissions  
+ 16,940.39  
MTCO2E

Offsets  
- 16,858.0  
MTCO2E

Compost  
- 82.47  
MTCO2E

Net Emissions  
= 0  
MTCO2E

## Emissions by Scope

11,270.05

Gross Scope 1 Emissions (MTCO2E)

0

Gross Scope 2 Emissions (MTCO2E)

5,670.35

Gross Scope 3 Emissions (MTCO2E)

## Percent Change from FY08 to FY21

+7%

Scope 1 Emissions

-100%

Scope 2 Emissions

-50%

Scope 3 Emissions

# Data Collection and Methodology

The Office of Sustainability created the Greenhouse Gas Inventory (GHG) Team to keep track of the college's carbon emissions. Every year, the members of the GHG team complete an inventory of these emissions. The team contacts faculty and staff to gather emissions data, and also runs surveys for student travel and faculty/staff commuting data. After compiling and organizing the data, it is entered into the Sustainability Indicator Management and Analysis Platform (SIMAP®).

SIMAP uses emissions factors to convert our emissions data into metric tonnes of carbon dioxide equivalent (MTCO<sub>2</sub>E), which is how we quantify our overall emissions. The algorithms used by SIMAP are based on the latest science from the United Nations' Intergovernmental Panel on Climate Change's most recent Assessment Report and are updated frequently. From the emission factor conversions, the annual greenhouse gas inventory is created. Our team verifies the data and compares it to the previous year's data for consistency and reliability. Due to limited availability of data as a result of the Covid-19 pandemic, data from FY19 were used for landfill waste and compost in this year's (FY21) report.



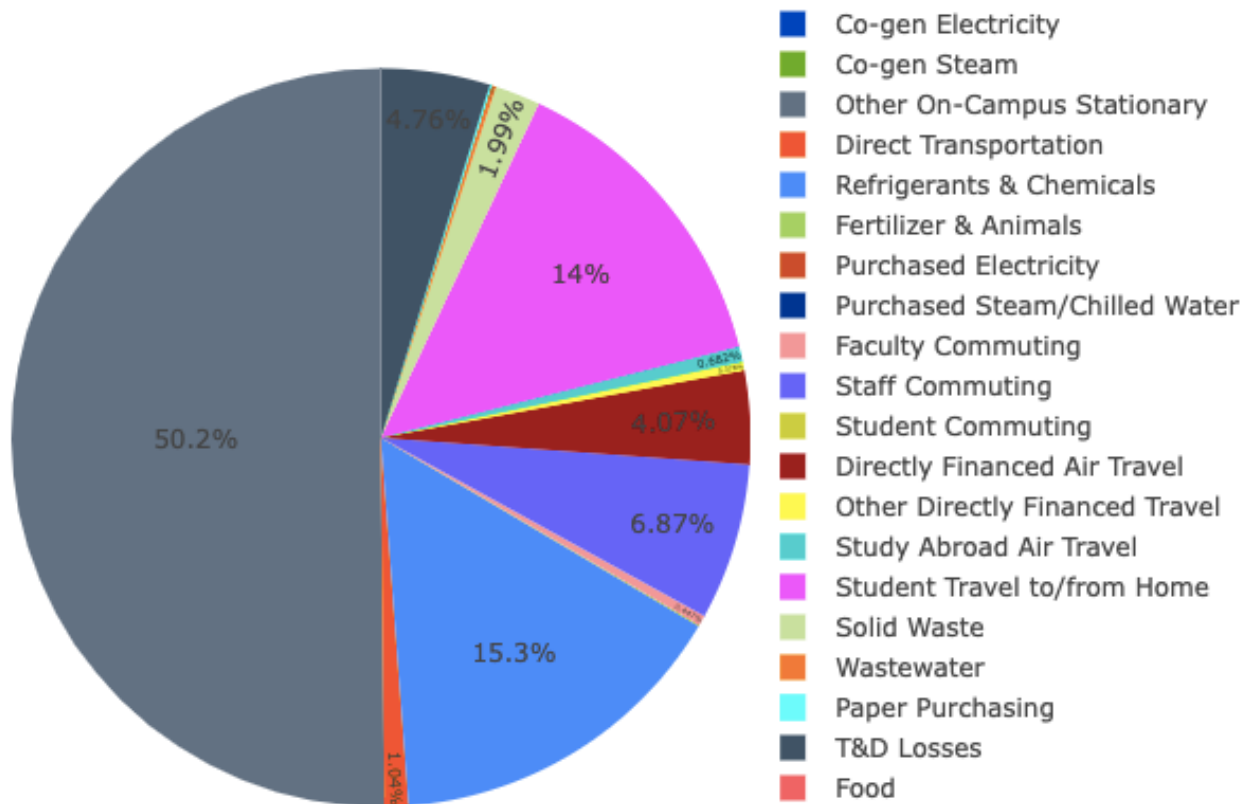
## Offsets and RECs at CC

Colorado College reached carbon neutrality through investments in carbon offsets and renewable energy certificates (RECs). Colorado College invests in an emissions avoidance project at Larimer County Landfill in Fort Collins, Colorado. This project, called the Larimer County Landfill Gas Destruction Project, breaks down methane in landfill waste and uses it to generate electricity. It converts previous sources of emissions into something much less potent, while also generating electricity. CC's investment in this project was instrumental in helping with the project's verification. CC has since used offsets from the project to reach carbon neutrality.

To offset Scope 2 emissions from purchased electricity, Colorado College uses Renewable Energy Certificates (RECs). RECs allow the tracking of where purchased electricity is coming from to ensure that the electricity sources are renewable. Investing in RECs is important because it supports the development of renewable energy and prioritizes renewable energy generation.

# Data Summary

Carbon: 2021



Data from SIMAP

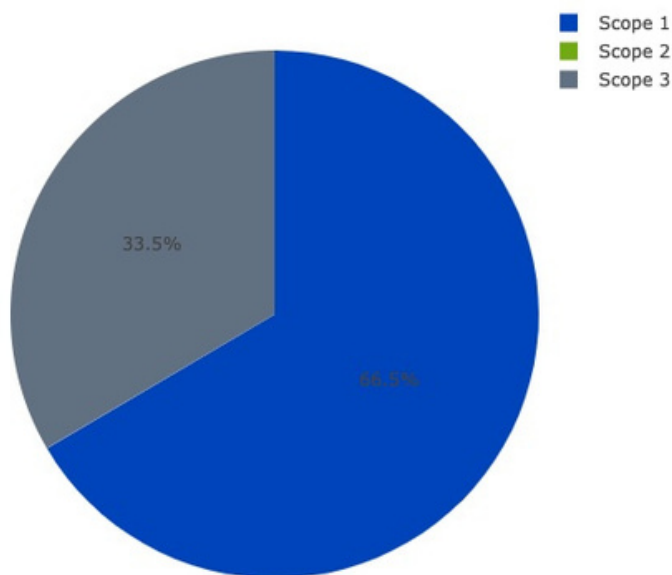
This graph depicts each source of carbon emissions included in the college's greenhouse gas inventory. Other on-campus stationary sources (Scope 1 direct, including distillate oil and natural gas) account for 35.1% of CC's gross carbon emissions in FY21; it is the largest category of gross emissions. Wastewater (Scope 3 indirect) and refrigerants and chemicals (Scope 1 direct) are the second and third largest categories, respectively. These categories can be targeted for further emission reductions in the future.

One crucial point to notice is that, while emissions from other on-campus stationary sources were relatively constant from FY20, emissions from refrigerants and chemicals increased significantly. These emissions increased by 8.01 percent for refrigerants and chemicals (2.69% to 10.7%).



# Data Summary cont.

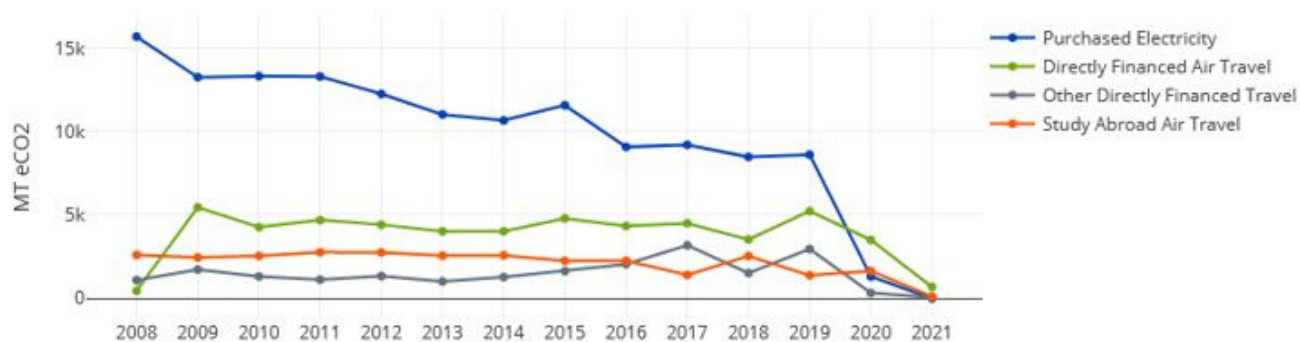
Carbon: 2021



Of the college's gross carbon emissions from FY21, 66.5% are from Scope 1 emissions and 33.5% are from Scope 3 emissions. As of this reporting period, the college has no emissions from Scope 2 sources because all purchased electricity now comes from guaranteed renewable energy sources generated in the local service area.

Data from SIMAP

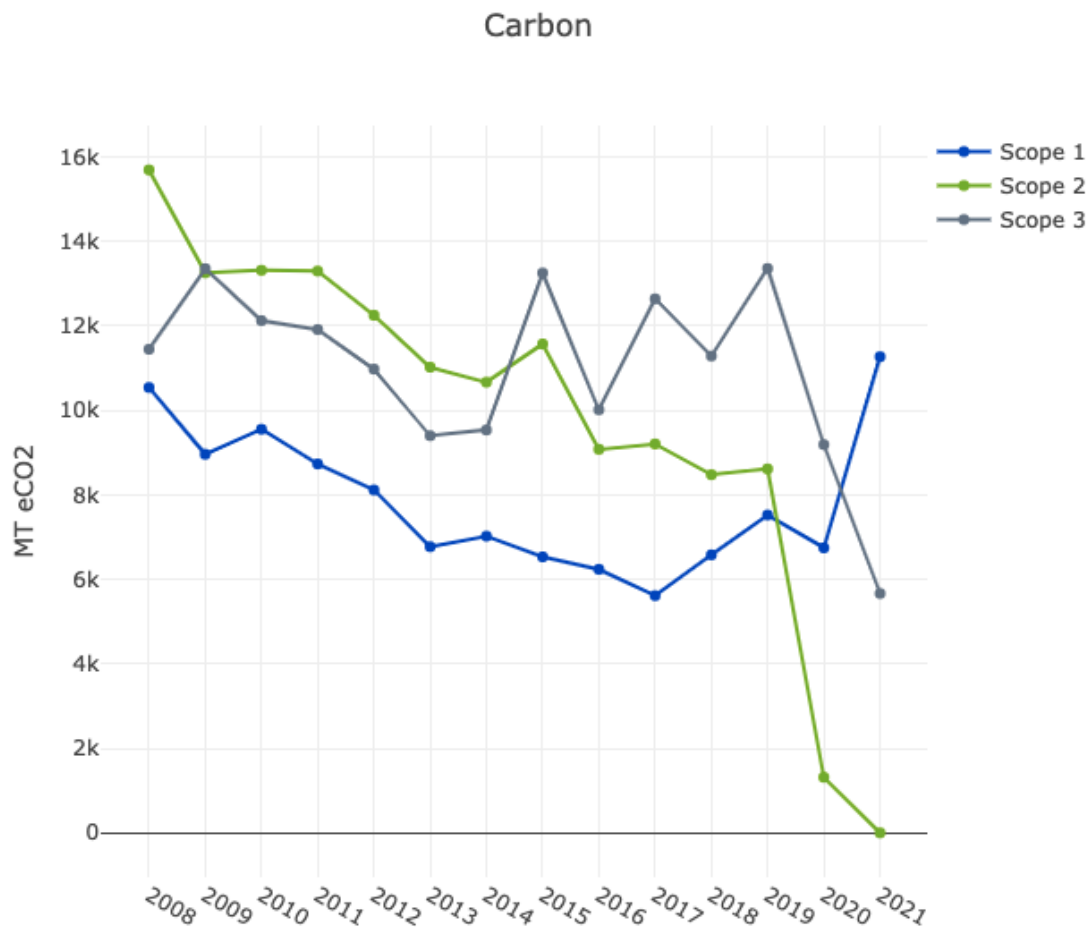
Carbon



Data from SIMAP

This graph shows the sources of carbon that have demonstrated the greatest declines in emissions over the past three years. Notably, some of the biggest changes occurred in sectors severely affected by the ramifications of the COVID-19 pandemic.

# Data Summary cont.

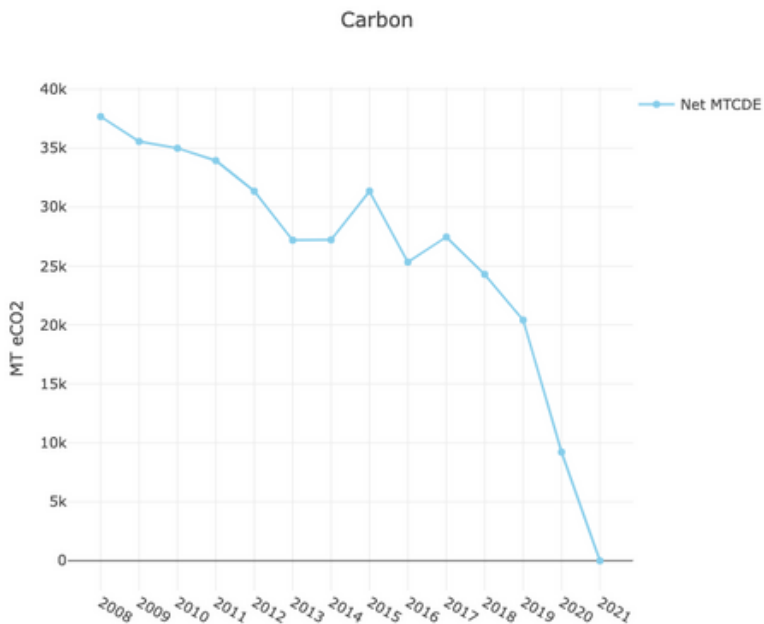


Data from SIMAP

This graph portrays the college's Scope 1, Scope 2, and Scope 3 emissions from our baseline year to our most recent inventory period. Most notable is the decrease of our Scope 2 emissions to zero MTCO<sub>2</sub>E; all of the college's purchased electricity now comes from guaranteed renewable energy sources generated in the local service area. Overall, Scope 3 emissions are on the decline, but part of the reason for the large decrease in Scope 3 is due to the pandemic. Student study abroad is usually the largest category in Scope 3; however, hardly any students studied abroad in FY21.

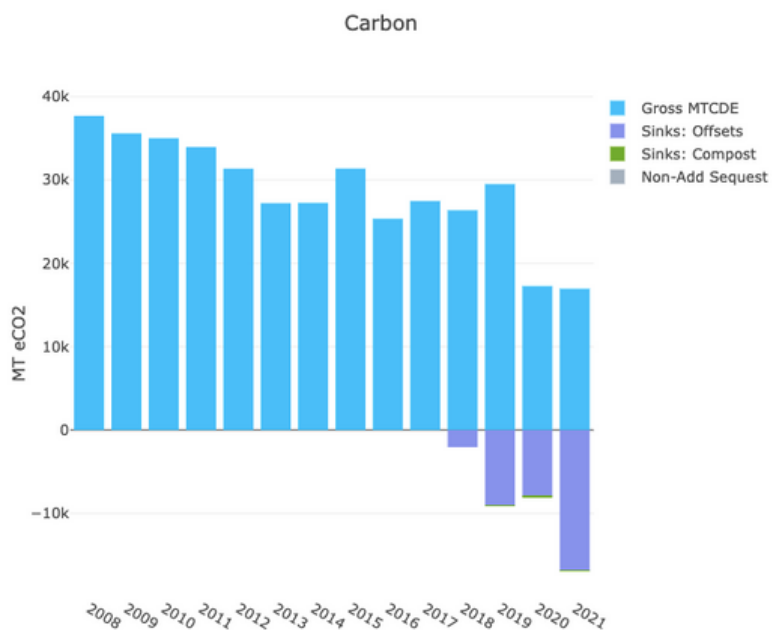
There is also a spike in Scope 1 emissions for FY21. Part of the reason for this spike is due to two large refrigerant leaks that occurred at the Worner refrigerant rack, as well as a couple of other small leaks. The refrigerant used in Worner has a high global warming potential—a measure of the potency of gases and how strongly they could affect atmospheric warming. This heavily impacted our carbon emissions for Scope 1; however, this was an isolated event. Building ventilation has also increased significantly due to the pandemic, which increases our energy usage in Scope 1 because the air is conditioned much more frequently. This is not an isolated event, but it will likely become a new normal for CC.

# Data Summary cont.



This graph illustrates Colorado College's net carbon emissions footprint (gross emissions minus sinks) from FY08 to FY21. Despite a few increases, the net carbon footprint of CC has now decreased to zero. Although CC reached carbon neutrality in January 2020, the misalignment between fiscal year and calendar year still left positive net emissions for FY20 (see FY20 GHG report). This year's report (FY21) is the first report to fully encompass CC having met carbon neutrality, i.e. zero net emissions.

Data from SIMAP



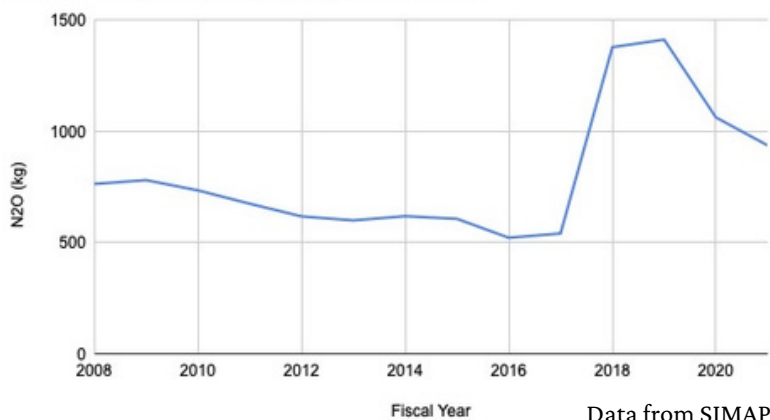
This graph shows Colorado College's gross carbon emissions from 2008 to 2021. Carbon offsets were introduced in 2018 and began to offset the college's gross emissions. Starting in January 2020, the college reached carbon neutrality and all gross emissions will now be entirely offset. The college is continuing to work towards lowering remaining annual gross emissions. This year's reporting period is the first in which all gross emissions accounted for in our inventory process are counterbalanced with carbon offsets.

Data from SIMAP



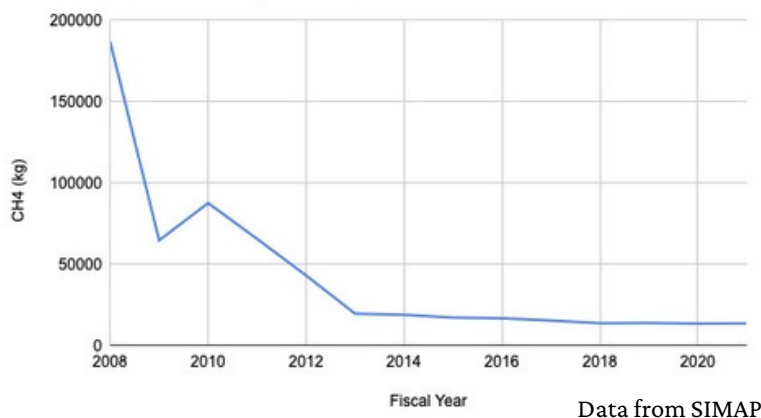
# Data Summary cont.

Nitrous Oxide Emissions by Fiscal Year



Above is a graph displaying the gross nitrous oxide emissions at CC for every year since data collection started, with the year 2008 corresponding to the FY08. The values for nitrous oxide emissions are in kilograms. With the exceptions of the FY18 and FY19, there appears to be a negative, linear trend in the nitrous oxide emissions as overall carbon emissions also decrease. According to the Environmental Protection Agency, “Nitrous oxide is emitted during agricultural, land use, industrial activities, combustion of fossil fuels and solid waste, as well as during treatment of wastewater” (EPA).

Methane Emissions by Fiscal Year



Here we can see CC’s gross methane (CH<sub>4</sub>) emissions for each fiscal year since 2008, also measured in kilograms. Methane emissions appear to experience a general reduction from FY08 to FY13, with a period of roughly constant methane emissions from FY13 to the most recent reporting period. When considering the college’s methane emissions, it is important to consider that “Methane’s lifetime in the atmosphere is much shorter than carbon dioxide (CO<sub>2</sub>), but CH<sub>4</sub> is more efficient at trapping radiation than CO<sub>2</sub>. Pound for pound, the comparative impact of CH<sub>4</sub> is 25 times greater than CO<sub>2</sub> over a 100-year period” (EPA). Given the ability of methane to contribute to global warming, the decreasing trend seen in the above graph is encouraging, but it is crucial to keep reducing emissions of this harmful gas.

# Goals and Future Recommendations

The Colorado College Office of Sustainability has outlined a number of goals and recommendations specifically related to reducing our greenhouse gas emissions. The first goal involves reducing Scope 1 emissions, or the direct emissions from CC facilities, by an additional 25% from the baseline year of 2008 by the year 2030. In order to achieve this goal, implementing an internal carbon tax on emissions could be instrumental. Additionally, the Office recommends transitioning Colorado College's vehicle fleet from gas-powered to electric-powered to reduce Scope 1 emissions. Finally, upgrading HVAC, plumbing, and other means of energy usage to more energy-efficient methods across campus to decrease emissions is also important in reaching this goal.

Another main goal the Office of Sustainability has identified is the reduction of Scope 3 emissions by an additional 25% from 2008 levels by the year 2027. A carbon tax could also be implemented here in order to drive the college to treat greenhouse gas emissions as a direct economic cost. This would help to disincentivize both emissions produced directly by college facilities and emissions generated by behavioral choices of Colorado College faculty, staff, and students. Since Scope 3 emissions involve choices made by students, faculty, and staff, reducing emissions in this scope would involve changing how community members think about carbon emissions. This could include providing resources and opportunities for carbon offset programs and creating a larger change in the culture at CC away from gas-powered vehicles and flights whenever possible.

Finally, it is important to recognize that in the past few years, the Colorado College campus has added a significant number of new buildings which increase the number of emissions sources. Thus, comparing emissions from more recent years with years closer to 2008 can be somewhat misleading, since it will not demonstrate the full reduction in emissions taking into account the additional buildings. One recommendation would be to consider 2020 as the new baseline fiscal year against which we can compare more recent emissions data, since the campus has greatly expanded and changed since 2008.

# Appendix

	Category	MTCO2E
<b>Scope 1</b>	Other On-Campus Stationary	8,495.80
	Direct Transportation	176.96
	Refrigerants and Chemicals	2,588.83
	Fertilizer	8.46
<b>Scope 2</b>	Purchased Electricity	0
<b>Scope 3</b>	Faculty Commuting	75.75
	Staff Commuting	1,164.21
	Directly-Financed Air Travel	689.7
	Other Directly-Financed Travel	63.65
	Study Abroad Air Travel	115.54
	Student Travel to/from Home	2,370.65
	Solid Waste*	337.28
	Wastewater	31.94
	Paper Purchasing	15.4
	T&D Losses	806.22
<b>Sinks</b>	Offsets	-16,858.00
	Compost*	-82.47
<b>Totals</b>	Total Scope 1	11,270.05
	Total Scope 2	0
	Combines Scopes 1 and 2	11,270.05
	Total Scope 3	5,670.35
	Total Gross Emissions	16,940.39
	Total Net Emissions	0
	*FY19 data used due to Covid-19	



# Acknowledgments

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