



# **GREENHOUSE GAS INVENTORY SUMMARY**

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# INTRODUCTION

The American College and University Presidents' Climate Commitment (ACUPCC) requires biennial updates to university greenhouse gas (GHG) inventories from its Carbon Commitment Charter signatories. University of Montana has been a charter signatory since 2007. The data in this report includes scopes 1, 2, and 3 (partial) emissions from Missoula College (both campuses), Bandy Ranch, UM Main Campus, Lubrecht Experimental Forest buildings, and the biological station at Flathead Lake, all of which have been included in previous inventories.

The first charts illustrate overall campus GHG emissions and trends. The report then examines FY 2018 - 2020 consumption of electricity, gas/diesel, propane, and other fossil fuels that impact our emissions footprint. The summary concludes with a look at future campus projects and expected impacts on GHG emissions.

## GHG INVENTORY COMPONENTS

### Scope 1



**Scope 1 includes direct emissions from sources that are owned and/or controlled by the University of Montana.**

This includes:

- All on-campus fuel combustion (co-gen facility, heating oil, propane)
- Direct Transportation Sources (all fleet vehicles, gasoline & diesel use)
- Agriculture (fertilizer application and methane from livestock)

### Scope 2



**Scope 2 includes indirect emissions** from sources that are neither owned nor operated by University of Montana, but whose products are directly linked to on campus energy consumption.

- **All purchased energy:** typically electricity, steam, and chilled water.
- However, University of Montana does not purchase steam or chilled water.
- For UM Scope 2 only includes purchased electricity.

### Scope 3



**Scope 3 encompasses other emissions attributed to the university that are deemed 'optional' to include in corporate inventories.**

- Emissions from regular commuting by faculty, staff, and students.
- Directly financed transportation: staff and athletic team air and bus travel.
- UM does not currently include emissions from purchased goods in our scope 3 emissions.

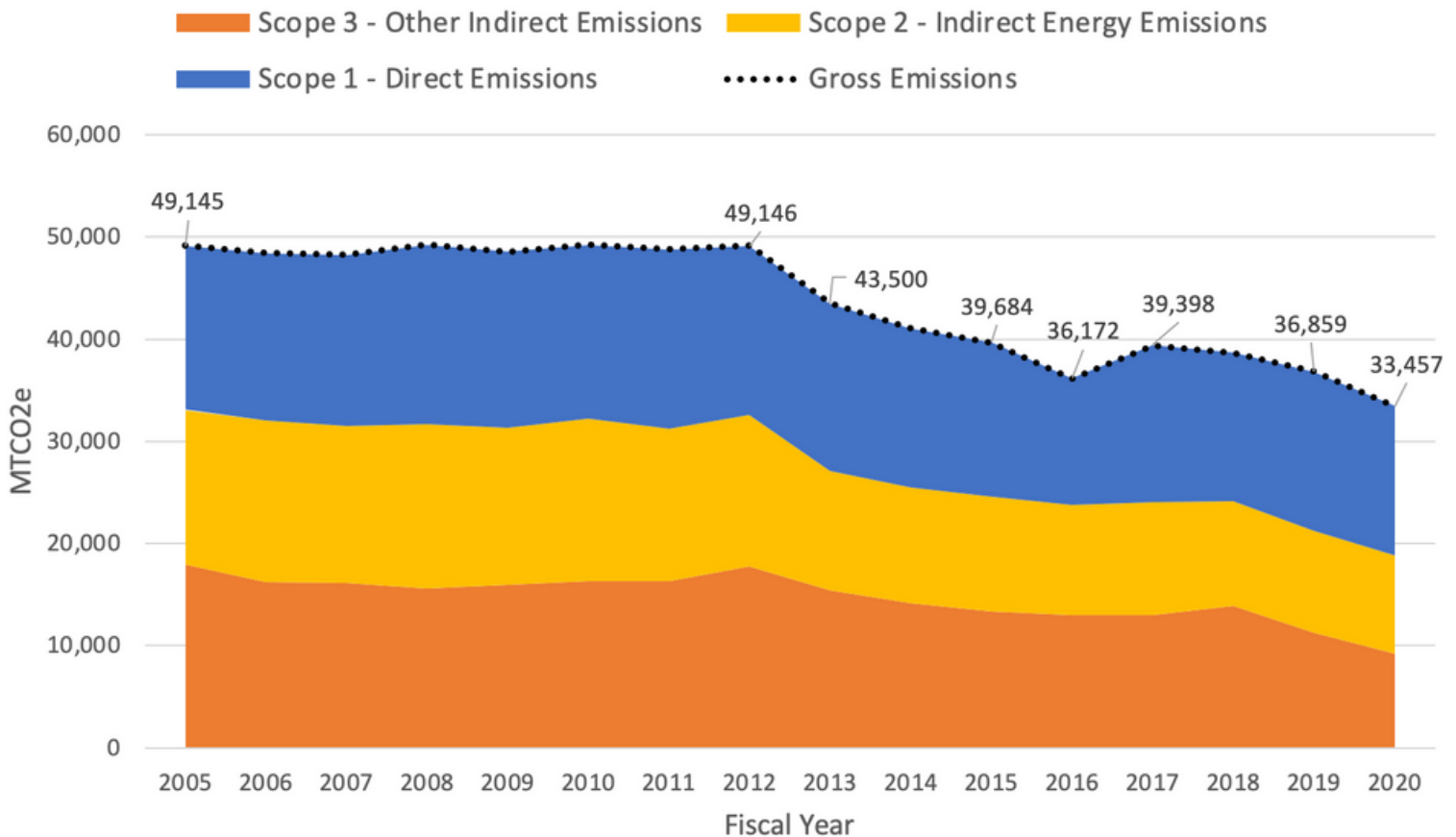
## CAMPUS EMISSIONS TRENDS

UM’s most recent inventory was completed in December 2020 and indicated a trend of decreasing net emissions since FY 2018.

In 2017, the university’s emissions totaled 39,398 MTeCO<sub>2</sub>. By the end of FY 2020, UM’s footprint had shrunk to 33,457 MTeCO<sub>2</sub>. Our analysis tells us this decrease is likely due to energy efficiency improvements in our campus buildings and the COVID-19 pandemic resulting in significantly less air and bus travel and less commuting.

UM’s previous inventory updates also indicated a slight decrease in overall emissions, illustrating an 18.5% reduction in overall emissions from 2014 to 2020. The trend in overall emissions is illustrated in the graph below.

**Campus Carbon Footprint (FY 2005 - 2020)**

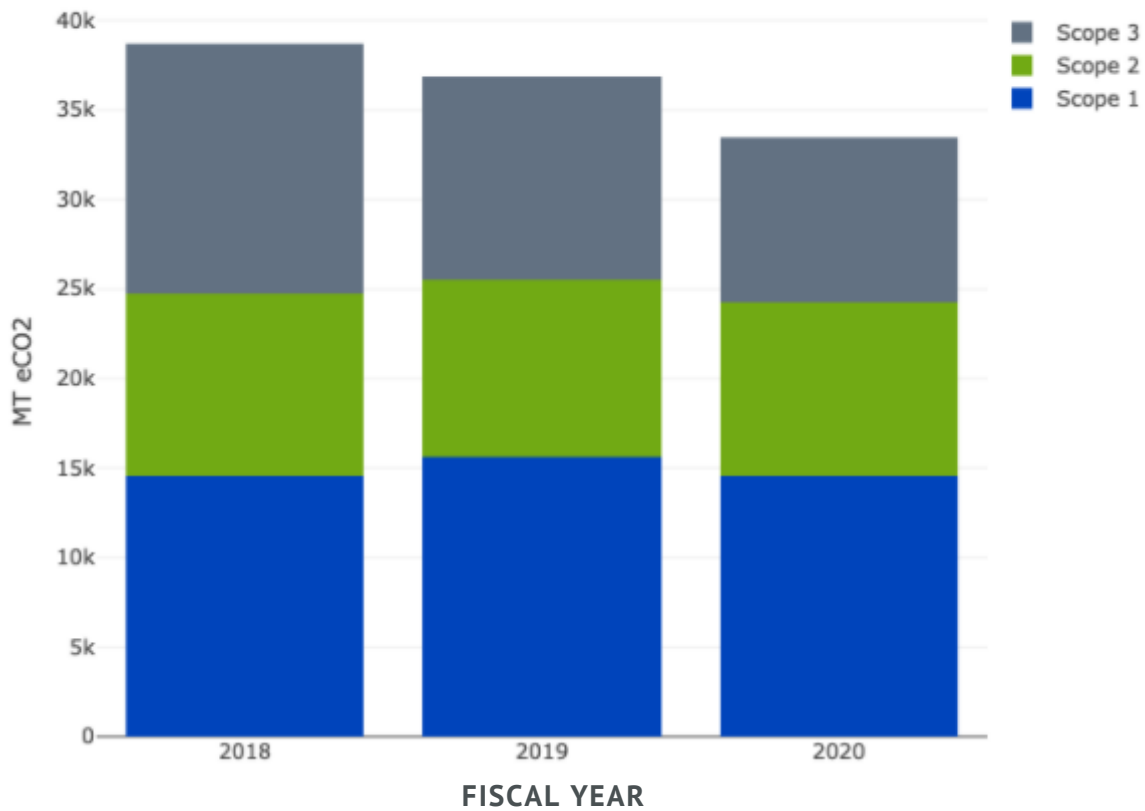


# FISCAL YEARS 2018 TO 2020

## *Overall campus carbon footprint by scope*

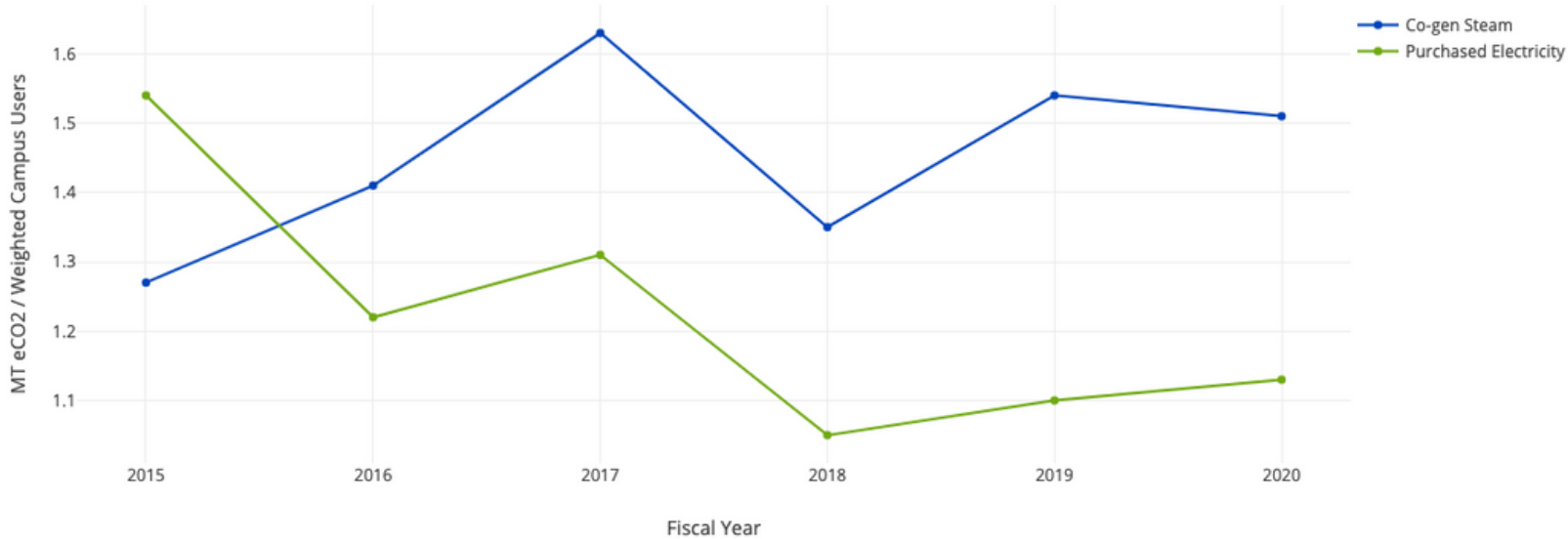
The graph below further illustrates the impact of the COVID-19 pandemic. In 2020, we saw emissions from Scope 3, which encapsulates financed staff and athletic team travel, shrink significantly compared to Scopes 1 and 2. This represents the major decrease in travel that occurred as the novel coronavirus spread.

**TOTAL CAMPUS CARBON EMISSIONS, BY SCOPE**



# SCOPE 1

## ANNUAL CARBON EQUIVALENT PER WEIGHTED CAMPUS USER



The graph above compares on-campus Co-gen Steam (Scope 1) with Purchased Electricity (Scope 2). We compare these two metrics after normalizing for weighted campus users. Weighted campus user is a measurement of an institution's population adjusted to account for energy use intensity by type of student residence. For example, a university with a higher proportion of on campus residents would see an increase in emissions compared to universities with more off campus students because their energy, water use and waste generation would be included in inventory totals. The above graph demonstrates the annual carbon emissions attributed to each weighted campus user.

The analysis suggests that the energy used to power our campus is fairly inelastic: not greatly affected by the number of students inhabiting our buildings. Noticeable too is a sharp rise in co-gen steam in FY17. This is a factor of weather patterns and the number of Heating Degree Days attributed to that fiscal year. *Heating Degree Days* are defined as the average degrees below 65 over the course of a full day (a day that was consistently 60 degrees for 24 hours would require 5 HDD of energy). In fact, when we normalize for weather, we do not see this sharp rise and fall in Scope 1. We expect to see a significant decrease in scope 2 emissions as CHP comes online in early 2023.

# SCOPE 2

## PURCHASED ELECTRICITY (kWh)



UM's scope 2 emissions represent purchased electricity. From Fiscal Years 2017 to 2020, campus saw an 8.2% decline in Scope 2 emissions. The decrease in electricity use is likely due to improvements in building operations and efficiency, resulting in energy savings.

Electricity use has steadily declined since FY17 despite additional buildings being added to the campus footprint. In FY17, UM's total footprint was 3,541,992 square feet compared to 3,680,415 square feet at the end of FY20, an increase of 138,423 sq. ft. over a 3 year period.

A new Combined Heat and Power (CHP) plant on main campus, expected online by early 2023, will reduce UM's need for purchased electricity even further.

**TAKEAWAY**

Source EUI has declined since FY17 despite an increase in our total built footprint.

**This is one indicator of efficient energy use!**

$$\frac{\text{Natural Gas (kBtu)} + \text{Purchased Electricity (kBtu)}}{\text{UM Main Campus + Missoula College Total Built Footprint (sq. ft)}}$$

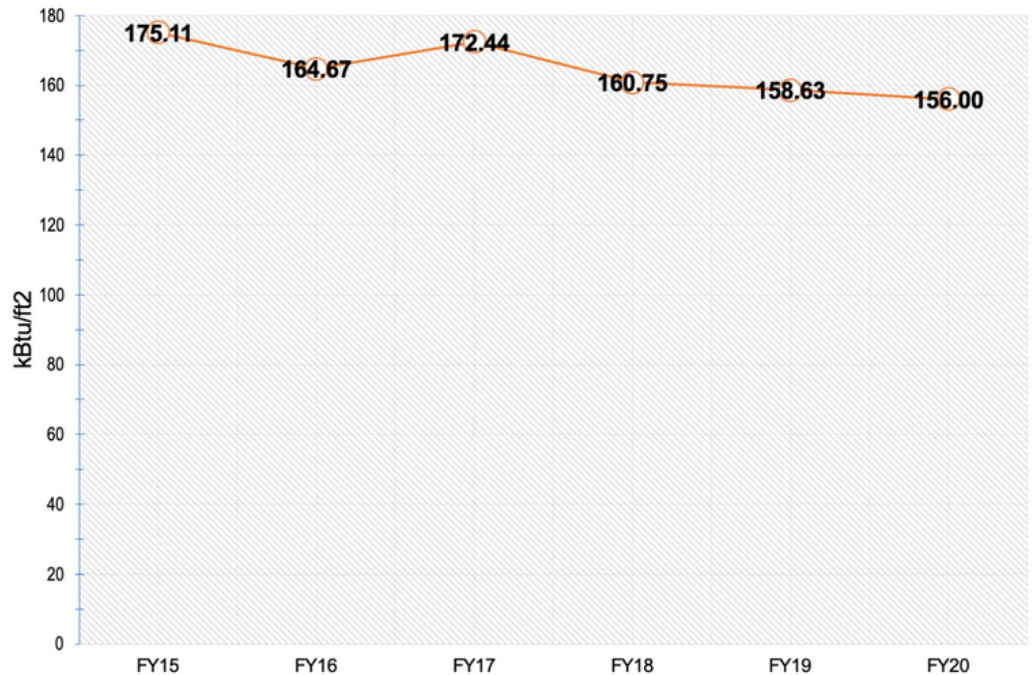
↓  
Site Energy Use Intensity (EUI)

↓  
Estimated 5.1% Loss in Grid Energy Efficiency

↓  
Source Energy Use Intensity (EUI)

**SCOPES 1 AND 2**

Source Energy Use Intensity (EUI)



Energy Use Intensity (EUI) is a metric used by the EPA to evaluate building energy efficiency. Generally, a lower EUI demonstrates higher efficiency. We calculated our campus EUI by converting annual energy use (natural gas and purchased electricity) to kilo-British thermal units (kBtu) and dividing it by our campus built footprint.

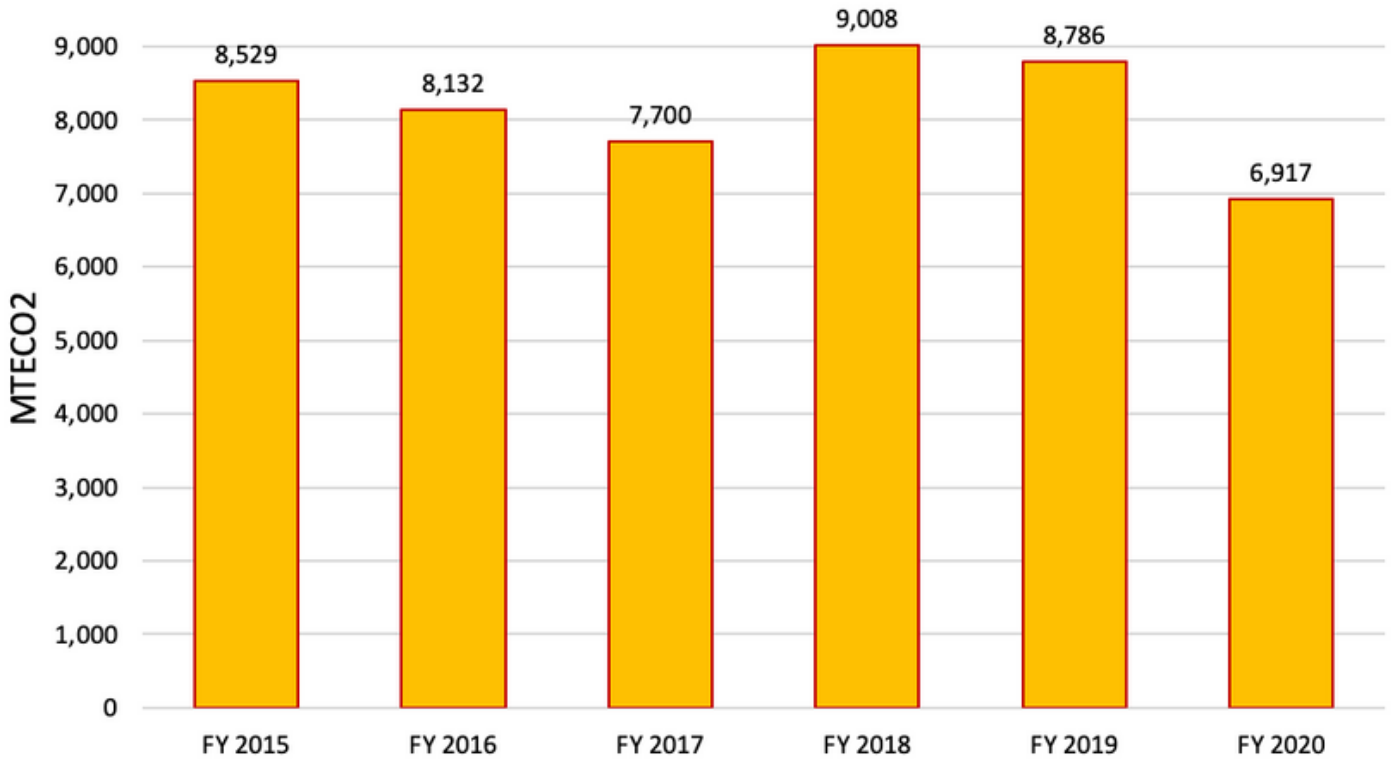
Source EUI, compared to Site EUI, takes into account efficiency of the electric generating, transmission and distribution process, thereby providing a more complete assessment of our purchased electricity use. To calculate our Source EUI, we allowed for an estimated 5.1% electricity grid loss, the standard for our geographic region.

Except for FY17, in which natural gas use spiked due to colder than average winter, the data points reveal a consistent downward trend, despite an increase in our built footprint. This appears to validate our campus energy efficiency and conservation measures. A future inventory could include a building-by-building EUI to identify possible areas of disproportionate energy use on campus.



# SCOPE 3

## UNIVERSITY SPONSORED AIR TRAVEL FOOTPRINT



Scope 3 emissions include those generated by student, faculty, and staff commuting as well as university-financed air and bus travel for research and/or athletic events. While emissions climbed in 2018 and 2019, the pandemic reduced air and bus travel considerably in 2020, resulting in a smaller travel-related footprint than we've seen in over 5 years. It is unclear if this trend will continue in 2022 and beyond. It is likely impacts from coronavirus will be long-lasting and could alter the frequency of professional and athletic travel in years to come.

# CONCLUSION



*RENDERING OF COMBINED HEAT & POWER PLANT*

- With Combined Heat and Power (CHP) coming online in early 2023, we will see a 30% reduction in the sum of scopes 1 and 2 emissions from our 2018 baseline levels.
- We expect to see an increase in Scope 3 when athletic and professional travel returns to pre-pandemic levels. We are still experiencing the effects of the Covid-19 pandemic and will be for years to come. It is unclear what total impact this will have on our travel-related emissions.
- Given our findings that energy use on campus is fairly inelastic as it relates to campus users, the University should commit to no net new building space going forward. This means a commitment that we do not increase our total built footprint, even when buildings are updated or campus undergoes construction projects.
- Conducting an ongoing Source EUI for each campus building would help the University more fully track building efficiency over time.