2023 Greenhouse Gas Inventory

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List of Nomenclature

AASHE	Association for the Advancement of Sustainability in Higher Education
CCC	Campus Carbon Calculator
CFC	Chlorofluorocarbons
CH_4	Methane
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
BDT	Bone dry ton
eGRID	Emissions and Generation Resource Integrated Database
EPA	United States Environmental Protection Agency
FERA	Fuel- and energy-related activities
FY2023	Fiscal Year 2023
GHG	Greenhouse gas(es)
GWP	Global warming potential
HFC	Hydrofluorocarbons
IRIC	Integrated Research and Innovation Center
Kg	Kilogram
kWh	Kilowatt-hour
N_2O	Nitrous oxide
NWPP	Northwest Power Pool subregion
OOS	Office of Sustainability
PCLC	Presidents' Climate Leadership Commitments
PFC	Perfluorocarbons
REC	Renewable energy certificate
Scope 1	Direct emissions
Scope 2	Indirect emissions
Scope 3	Other emissions
SF_6	Sulfur hexafluoride
SIMAP	Sustainability Indicator Management and Analysis Platform
STARS	Sustainability Tracking, Assessment, and Rating System
T&D	Transmission and distribution
U of I	University of Idaho
WRI	World Resources Institute

Highlights

Total Emissions

(metric tons CO_2e)

FY2023 Net Emissions:

34,732.31

Scope 1:

11,985.10

Scope 2:

12,722.13

Scope 3:

10,025.08

Emissions per student:

3.79 tons

Emissions per sq. ft:

7.67 tons

Change in Emissions:

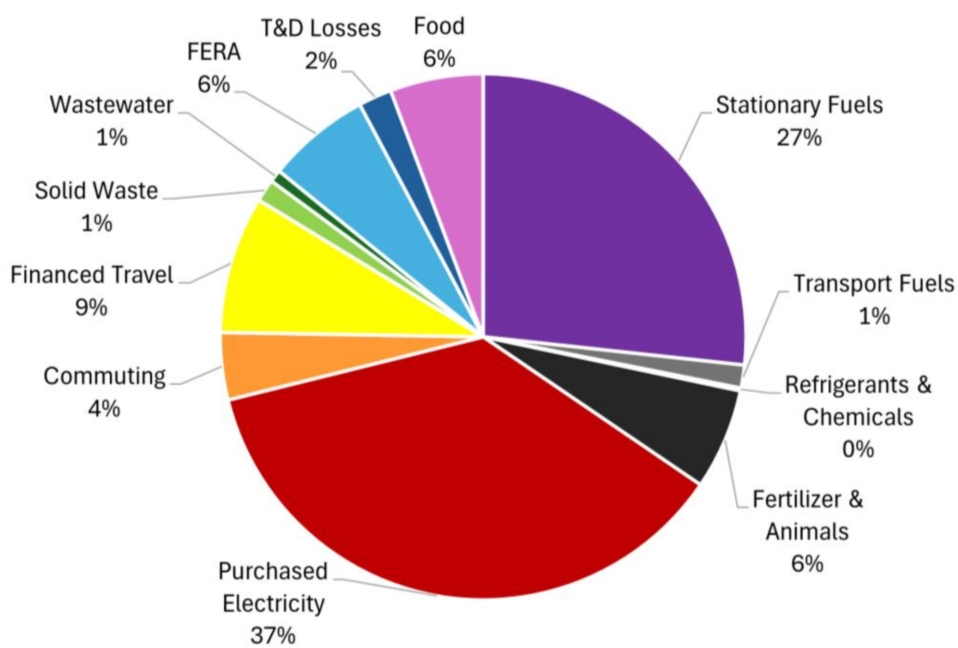
-18.45%*

from FY2019

*Change in comparable emissions

Executive Summary

Total greenhouse gas emissions for the University of Idaho in FY2023 were 34,732.31 metric tons of carbon dioxide equivalent (CO_2e). The largest sources of campus emissions were purchased electricity consumption (37%), stationary fuel use (e.g. natural gas and wood chips) (27%) and directly financed travel (9%). This inventory encompasses the main Moscow campus, neighboring farms, and other locations in Moscow, Idaho.



Improvements can be made across all categories. To achieve the 2030 carbon neutrality goal, the University of Idaho must continue to reduce energy consumption through increases in building efficiencies and further investment in renewable energy sources, like photovoltaic solar arrays. Modifying behaviors of the campus community, such as those related to commuting, utility use, and fuel consumption, can also result in significant emissions reductions.

Introduction

Purpose of this Report

The University of Idaho (U of I) is committed to institutional sustainability. Recent initiatives, like the university's Presidential Sustainability White Paper and the Gold sustainability rating awarded by the Association for the Advancement of Sustainability in Higher Education's (AASHE) Sustainability Tracking and Reporting System (STARS), reflect this commitment. U of I acknowledges the serious impact of climate change on the environmental, economic, and social wellbeing of communities both locally and globally. In Idaho, climate change affects many of the state's major industries, including agriculture, energy, forestry, rangeland, healthcare, and tourism [1]. As a signatory of two climate commitments, the Talloires Declaration and the Presidents' Climate Leadership Commitments (PCLC), the university set a goal to achieve carbon neutrality by 2030, outlined in its Climate Action Plan. This report aims to quantify the university's recent greenhouse gas (GHG) emissions as a necessary step towards achieving this goal.

Organizational Boundaries

For this GHG inventory, the organizational boundary encompasses the Moscow, Idaho campus and adjacent facilities under U of I's jurisdiction. These additional facilities include West Farm, North Farm, and the Parker Farm. Excluded from this report are certain Moscow facilities, like university-owned family housing and the Greek system, which are on their own utility meters. Facilities elsewhere in the state are also excluded from this GHG inventory with the exception of Rinker Rock Creek Ranch, which is included for informational purposes in the non-additional carbon sequestration category. Appendix A provides a list of the campus buildings that lie within the boundaries of this report.

Methodology

Units

The carbon footprint of an institution is a measure of the GHGs it emits through its various activities and operations. The Kyoto Protocol specifies six specific GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulfur hexafluoride (SF_6) [2]. The standard unit for measuring and reporting these GHG emissions is in metric tons of carbon dioxide equivalent (CO_2e), which is calculated using the global warming potentials (GWP) of the GHGs (see Table 1). Each gas has a different ability to absorb energy and trap heat. GWPs compare the amount of energy that the emissions of one ton of a specific gas will absorb over a set period of time, typically a 100-year average [3]. Using CO_2e to quantify emissions allows for comparisons of impact between gases.

For consistency, CO_2e is used in this report for measuring all GHG emissions. Other measured data, such as solid waste generation, are measured in U.S. customary units, like the short ton (2,000 lb.).

The bone dry ton (BDT) is only used for reporting wood chip weight. The BDT equates to 2,000 pounds of wood with zero moisture content and is the conventional unit of measurement when quantifying wood chips.

Unless stated otherwise, other references to tons in this report always refer to metric tons.

Gas Name	Chemical Formula	Global Warming Potential (CO_2e)
Methane	CH_4	28
Nitrous Oxide	N_2O	273
HCFC-22	$CHClF_2$	1,760
R404-a	CHF_2CF_3, CH_3CF_3, and CH_2FCF_3	3,943

***Table 1**: SIMAP GWP values for GHGs measured in this report.*

U of I Reporting Methods

GHG reporting methods have changed over the years as data collection and modeling techniques improve. The Greenhouse Gas Protocol (GHG Protocol), developed by the World Resources Institute (WRI), provides standards, guidance, and a selection of tools to measure GHG emissions [4]. GHG Protocol standards are the most accepted worldwide and nearly all emissions calculators available are based on them.

Early U of I GHG inventories used the Campus Carbon Calculator (CCC) tool, which was developed at the University of New Hampshire and based on the GHG Protocol standards. The CCC was a calculation tool designed specifically for institutions of higher education that enabled them to quantify their GHG emissions. The CCC program was discontinued in January 2018 and replaced by the Sustainability Indicator Management and Analysis Platform (SIMAP). In SIMAP, the user enters raw data (e.g. wastewater volumes or natural gas consumption) into the online tool, which calculates emissions from usage data and each source's relevant emissions factor.

An emissions factor is a coefficient which allows for the conversion of activity data (e.g. the burning of one gallon of gasoline) into GHG emission weights (e.g. 8.49898762 kg CO_2, 0.00046334 kg CH_4, and 0.000301 kg N_2O) which can subsequently be cumulatively converted into CO_2e with GWP values. Previous U of I GHG reports used emissions factors directly sourced from the United States Environmental Protection Agency. This report takes all data from SIMAP. While the EPA provides the raw data for SIMAP, the software provides calculations to convert the emission factors into useable data. Sometimes this is simply a unit conversion, such as changing the EPA eGRID electricity values from lb/MWh to kg/kWh, but it can be a longer calculation, such as calculating the CO_2 emission factors for stationary fuels from the carbon content and heating values of those fuel sources. Therefore, using SIMAP's emissions factors to calculate total emissions yields more accurate results than manually calculating emissions from the EPA and standardizes methodology.

Previous Reports and Baseline Year

This report inventories U of I's GHG emissions for fiscal year 2023 (FY2023), which took place between July 1, 2022, to June 30, 2023. GHG emission inventory reports have previously been completed for the university in fiscal years 2008, 2011, 2013, 2019, and 2020. In 2023, U of I's first Office of Sustainability was created, with dedicated staff working towards large sustainability goals at the university.

Previous U of I GHG emissions reports and AASHE STARS reports used emissions data from 2005 as the baseline year for benchmarking progress. Due to significant changes in methodology, inconsistencies in reporting, and unfillable gaps in historic data (especially Scope 3 emissions), the Office of Sustainability has determined that it is impossible to make accurate comparisons between 2005 and FY2023 emissions. Therefore, we have established FY2023 as our university's new baseline year for internal GHG emission accounting and comparisons. Establishing FY2023 as the new baseline ensures that future GHG inventories can accurately quantify and report progress in reducing the university's emissions footprint. This decision was made in consultation with the developers of SIMAP at the University of New Hampshire.

Nonetheless, there is still value in using historical data to understand how U of I has fared in emissions reductions, even if historical datasets are incomplete. Therefore, updated historical data from FY2019 is provided in Appendix B for comparison purposes. FY2019 was chosen for comparison because it is the most recent dataset available that was unaffected by the operational changes from the COVID-19 pandemic. FY2019 data was originally calculated partly with EPA emissions factors. For the purposes of this report, this FY2019 data has been recalculated in SIMAP. Consequently, data here differs from what was published in the original 2019 report. This change in methodology allows for more accurate comparisons between the FY2019 and FY2023 data sets. Raw data for both years is available in Appendix C.

Both GHG emissions accounting and the university's record-keeping have improved over time. First-time additions to the GHG inventory are listed below in Table 2.

Category	Previous Reports	FY2023
Scope 1		
Wood Chips	No	Yes
Biodiesel	No	Yes
Fertilizer	No	Yes
Scope 3		
FERA: Natural Gas	No	Yes
FERA: Solar-Electric	No	Yes

***Table 2**: New categories reported in FY2023.*

2005 will still be used as the benchmark year for AASHE STARS reporting because AASHE only requires data from Scopes 1 and 2 emissions, and the 2005 data for Scope 1 and 2 emissions sources meets the organization's reporting requirements.

Results and Discussion

Scopes (Operational Boundaries)

Operational boundaries define which emissions can be realistically measured and are grouped together in "Scopes." The three measured scopes are defined by the level of responsibility an institution holds for the produced emissions. Scope 1 emissions are direct emissions, which come from owned or controlled operations such as on-campus natural gas consumption or transportation fuels used by U of I's fleet. Scope 2 emissions are indirect emissions, which come from the generation of purchased or acquired energy, like electricity produced off-site and consumed by U of I. Scope 3 emissions are often the most difficult to track, as they account for all other indirect emissions associated with an institution, such as commuting, waste generation, or food purchasing.

Scope 1: Direct Emissions

Stationary Fuels

Emissions for this category come from the combustion of natural gas and wood chips for the purpose of heating and cooling buildings.

Wood Chips

U of I has a cogeneration plant on campus that produces heat and steam. This District Energy Plant was built in 1926 to use coal and converted in the 1980s to burn natural gas and wood chip waste from regional timber operations. Three boilers use these fuels to produce steam for heat for 62 campus buildings.

Wood chips are the primary fuel source for U of I's cogeneration plant. The chips are sourced from the local timber industry. Wood chips are considered a carbon-dioxide-neutral fuel source, since the CO_2 that was originally removed from the atmosphere by trees through photosynthesis would eventually cycle back into the atmosphere through the natural decomposition processes [5]. These neutral emissions from burning wood chips are called biogenic emissions. Biogenic carbon emissions do not contribute to U of I's net carbon footprint. However, burning wood chips also results in CH_4 and N_2O emissions, which are potent greenhouses gases that are not offset through the growth process of the trees. Therefore, CH_4 and N_2O emissions, quantified in units of CO_2e, are included in Scope 1 emissions and count toward U of I's net GHG footprint.

In FY2023, the University of Idaho used 21,870 BDT of wood chips to fuel the District Energy Plant. This resulted in a total of 35,856 tons of biogenic CO_2e. Although these biogenic emissions do not add to U of I's net footprint, biogenic emissions from wood chips are provided here for reporting transparency.

In FY2023, the use of wood chips as a fuel source also resulted in 3,816 tons CO_2e in CH_4 and N_2O emissions. The emissions generated by the burning of wood chips are indicated in Table 3 below. Wood chip volume data was provided by McKinstry.

Source	**Quantity**
Tons of Wood Chips Burned	21,870 BDT
Biogenic CO_2 emissions	35,856 tons CO_2e*
CH_4 and N_2O emissions (Cogeneration)	3,816 tons CO_2e

***Table 3**: Tons of wood chips used and resulting emissions in FY2023.*

***Biogenic CO_2 emissions are carbon neutral and are not counted towards U of I's net GHG footprint.*

Natural Gas

There are three main sources for natural gas consumption on campus: the District Energy Plant, campus buildings, and auxiliary buildings. The District Energy Plant uses natural gas as a supplementary fuel for wood chips. The District Energy Plant also produces steam for heating purposes that is then distributed to 62 buildings on campus. However, there are 70 other buildings on campus that are not connected to the steam network; these buildings must use natural gas that is directly sourced from Avista for heating. Most of these 70 campus buildings are on one main natural gas feed. However, seven of them are fueled and billed independently and are therefore considered auxiliary buildings. These auxiliary buildings include the Teaching and Learning Commons, McConnell Hall, Kibbie Stadium, Housing Storage, Theophilus Hall, Shoup Hall and Building 7 in the Living and Learning Community residential mall. The District Energy Plan, other campus buildings, and auxiliary buildings are all accounted for in this GHG inventory. Appendix A lists the buildings on U of I's campus that are connected to the steam network and those heated with natural gas.

Natural gas consumption for U of I in FY2023 is listed in Table 4. Data was gathered directly from Avista billing statements and McKinstry. In FY2023, the plant consumed 557,249 therms of natural gas, making it the single largest user on campus. Total natural gas consumption on campus was 1,028,982 therms.

Source	**Unit**	**FY2023**
Energy Plant (Cogeneration)	therm	557,249
Campus Buildings	therm	308,473
Auxiliary Buildings	therm	163,260
Total Gas Consumption	**therm**	**1,028,982**

Table 4: *Natural gas consumption.*

The EPA estimates that 1 therm of natural gas releases 5.306 kg CO_2e after consumption [6]. Figure 1 shows emissions released from natural gas consumption at U of I. In FY2023, 5,462.47 metric tons of CO_2e were released. Natural gas consumption has increased from previous reporting years. For instance, natural gas consumption in FY2023 increased by 30.4% from FY2019. This significant increase may be partly due to differences in outside temperatures (see temperature comparisons in the Conclusions section). Additionally, aging infrastructure that has increased dependence on natural gas. When the wood-fueled boilers shut down for repairs, more of the campus is heated with natural gas.

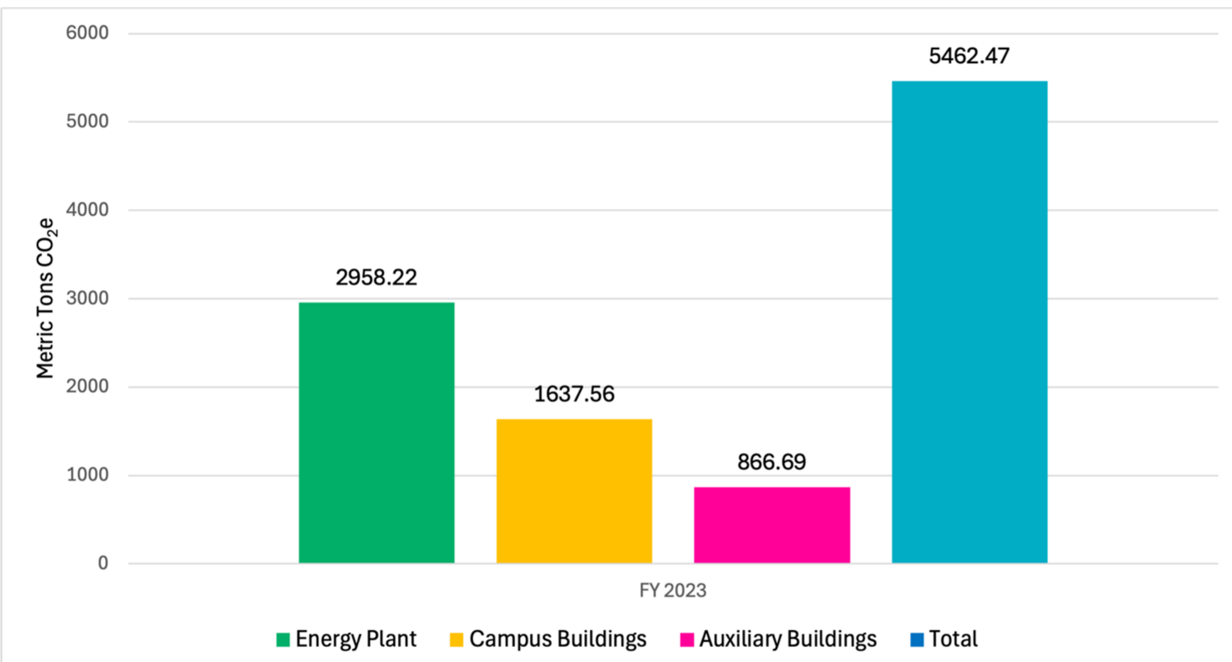


Figure 1*: Emissions from natural gas consumption.*

Total Stationary Fuels Emissions

Table 5 provides the total consumption and resulting emissions for each campus fuel source. Total emissions from stationary fuels are 9,278.78 tons of CO_2e.

Source	Consumption	Emissions
Cogeneration: Natural Gas	557,249 therms	2,958.22 tons CO_2e
Non-Cogeneration: Natural Gas	471,733 therms	2,504.25 tons CO_2e
Cogeneration: Wood Chips	21,869.71 BDT	3,816.31 tons CO_2e

Table 5*: Scope 1 stationary fuels consumption and emissions.*

Transport Fuels

Another source of U of I's direct emissions is from liquid fuels used in vehicles, generators, and other machinery. Fuel for university vehicles and equipment is purchased from Coleman Oil. Data was provided through billing statements. Table 6 provides a breakdown of fuel consumption of university vehicles and other equipment.

Fuel Type	Units	FY2023
Gasoline	US gallons	32,740
Diesel	US gallons	20,529
Biodiesel	US gallons	26

Table 6*: University fleet fuel consumption.*

Emissions from transport fuels consist mostly of CO_2, CH_4, and N_2O. Calculating precise CO_2e emissions from CH_4 and N_2O can be complex and is dependent on the specific vehicle or equipment and the technology, operation, and weather conditions [7]. The U of I fleet is diverse in age and utilization frequency, which further complicates estimating emissions. The SIMAP CO_2e calculation was used to estimate all fleet fuel emissions in order to standardize slight variations related to equipment age and use. Figure 2 displays the emissions from each of the three transport fuels used in FY2023. Total emissions from all three transport fuels for FY2023 are 490.43 tons of CO_2e.

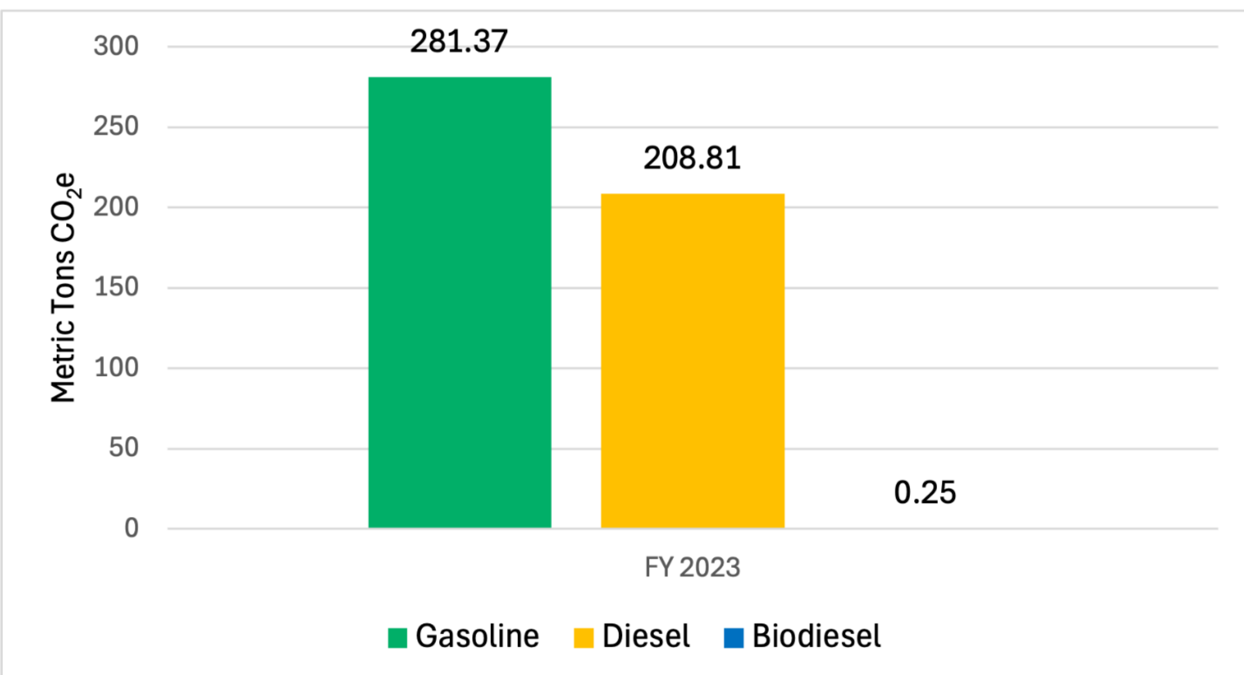


Figure 2*: Emissions from transport fuels.*

Animals and Fertilizer

Agricultural activities contribute to the emission of GHGs, mostly in the form of CH_4 and N_2O (see Table 1). Emissions primarily result through fertilizer application, enteric fermentation (digestive microbe processes) and manure management and storage [8]. Count and usage data was sourced from Landscape Services, the College of Agriculture and Life Sciences, and Auxiliaries Services. Table 7 presents SIMAP emissions factors and quantities from each source, while Figure 3 illustrates the CO_2e by emission source.

Source	Emissions Factor (kg CO_2e/unit)	Unit	Count	FY2023 Emissions (metric tons CO_2e)
Beef cows	2215.10	Head	88	194.61
Dairy cows	6319.33	Head	290	1,829.88
Horses	581.38	Head	3	1.74
Sheep	285.19	Head	440	125.79
Fertilizer (synthetic)	2.50	Pounds	1658	4.28
Total Emissions		**Metric tons CO_2e**		**2,156.30**

***Table 7**: Emissions by agricultural source.*

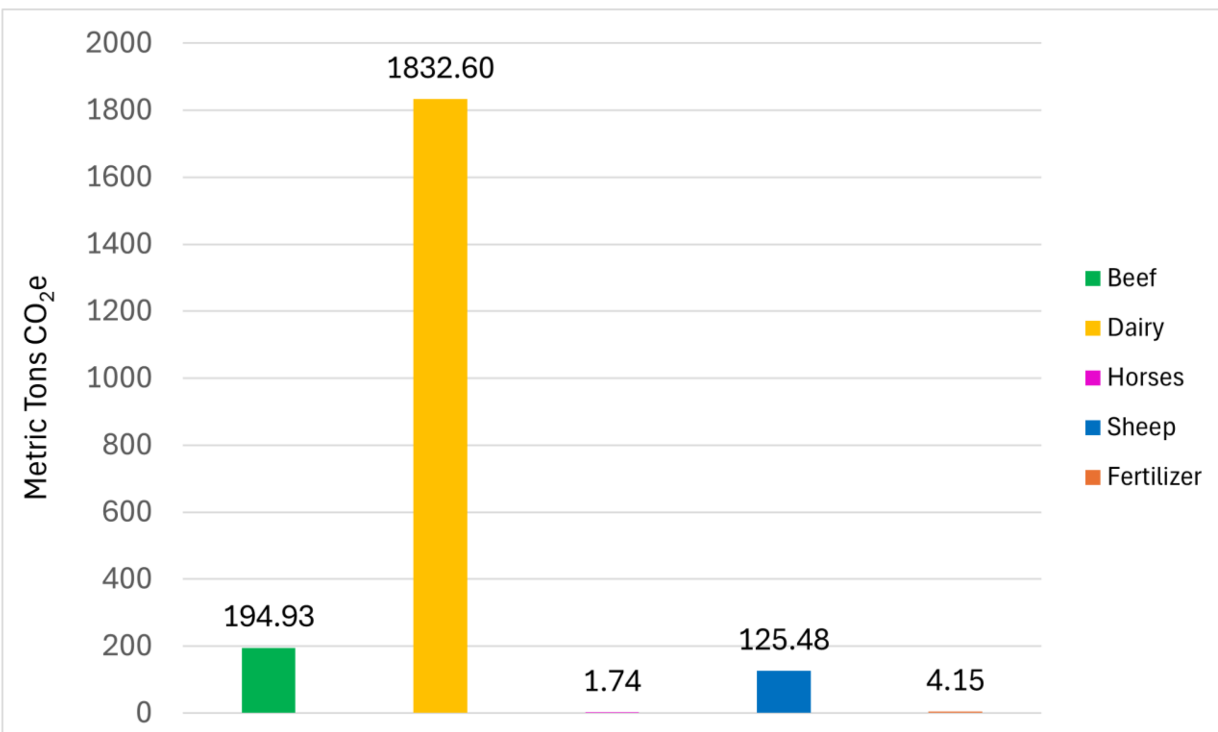


***Figure 3**: Metric tons of CO_2e produced by animal and fertilizer activities.*

Refrigerants and Chemicals

Refrigerants can release unintentional gases, known as fugitive emissions, through leakage, service, and disposal methods. The gases released from refrigerants have extremely high GWP values (see Table 1) compared to other GHGs. Two types of refrigerants, HCFC-22 and R404a, were employed on campus in FY2023, detailed in Table 8. These two refrigerants are used each year, while previous years have also reported the use of R-12, R-124, R134A, R-152A, R401A, and R-410A. All of these refrigerants are recommended for replacement for most applications through the EPA's Significant New Alternatives Policy that focuses on phasing out refrigerants with high GWPs and ozone depletion potential [9]. Multiplying the amount of leaked refrigerant by its 100-year GWP provides the annual CO_2e emissions. It is assumed that leaks from air conditioning units and refrigeration systems on campus match the amount recharged into these systems. This data was sourced from the Facilities HVAC/Refrigeration team.

Source	Unit	GWP	Usage	FY2023 Emissions (metric tons CO_2e)
HCFC-22	kilogram	1,760	8.79	17.23
R404-a	kilogram	3,943	8.96	42.36
Total Emissions	**Metric tons CO_2e**			**59.59**

***Table 8**: Refrigerant usage and emissions.*

Cumulative Scope 1 Emissions

Figure 4 displays the total Scope 1 emissions for FY2023. Total Scope 1 emissions are 11,985.10 tons of CO_2e. Stationary fuels (e.g. natural gas and wood chips) are the largest sources of emissions on campus. Beef and dairy herds also result in significant emissions. Transport fuels and refrigerants are low in comparison.

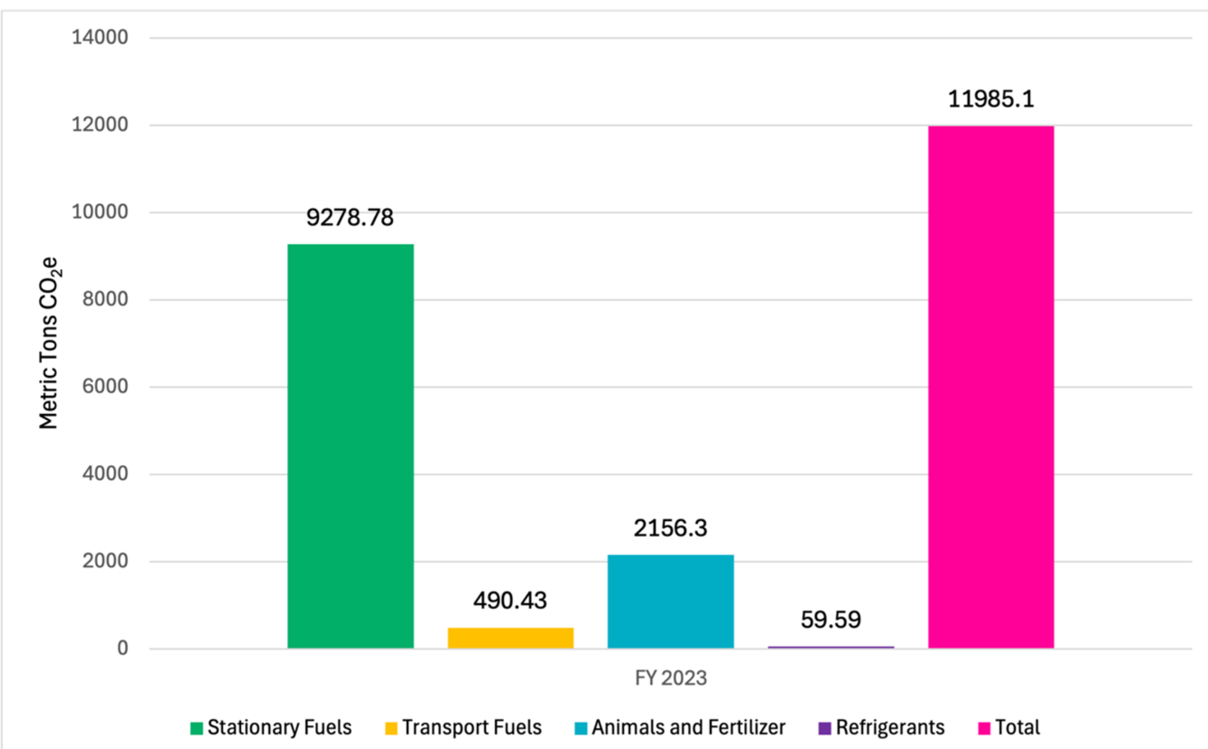


***Figure 4**: Cumulative Scope 1 emissions.*

Scope 2: Indirect Emissions

Indirect emissions are from sources that are neither owned nor operated by U of I, but whose products are directly linked to campus energy consumption. This encompasses purchased energy from a utility provider. U of I purchases electricity from Avista Utilities. Although U of I did not produce the electricity, the university still consumed it to power campus, making U of I indirectly responsible for these emissions.

Purchased Electricity

Electricity is delivered to the main campus through two points, referred to as the East and West feeds. As with natural gas, there are some buildings on campus that are excluded from the East and West feeds and are billed separately in secondary accounts; these are also referred to as auxiliary buildings. Auxiliary buildings for purchased electricity include the university golf course, the Pitkin Nursery, the University House, the WWAMI Medical Education Building, Art and Architecture East, the CLASS Annex, and Human Resources. Auxiliary buildings are included in our consumption data. Farm buildings at Parker Farm and North Farm (dairy and sheep farms) are also included in our electricity consumption data. Data for electricity consumption was sourced from monthly billing statements for the two main feeds and the accounts for the auxiliary buildings and farms. Table 9 includes electricity consumption for the East and West feeds, auxiliary buildings, farms, and total amount consumed for FY2023.

Source	Unit	FY2023
East/West Feeds	kWh	43,041,961
Auxiliary Buildings	kWh	665,697
Farm Buildings	kWh	1,525,915
Total	**kWh**	**45,233,573**

***Table 9**: Electricity consumption.*

GHG Protocol guidelines require institutions to use either location or market-based methods for Scope 2 reporting [10]. Scope 2 emissions for U of I are calculated through SIMAP using the market-based method, which calculates emissions using the residual emissions factor from the EPA's Emissions and Generation Resource Integrated Database (eGRID) subregions [11]. A residual emissions factor is a multiplier used to calculate GHG emissions from purchased electricity, while excluding electricity generation from all voluntary renewable energy transactions, such as the purchase of Renewable Energy Certificates (RECs) [12]. Although U of I does not currently have any renewable energy transactions, the university may potentially pursue market transactions in the future, making the market-based method the most appropriate to maintain consistent methodology for prospective reporting.

U of I is in the Northwest Power Pool (NWPP) eGRID subregion, shown below in Figure 5. The primary source of energy in the NWPP is hydropower, followed by natural gas and coal. The most recent energy mix for 2022 is shown in Figure 6. Thanks to the extensive use of renewable energy sources (i.e., hydro and wind), the NWPP has a lower emissions rate than the national average, which means that our Scope 2 emissions are lower than a similarly consumptive school located elsewhere in the country. The residual emissions factor for the NWPP is 0.281 kg CO_2e/kWh, which is the factor used to calculate U of I's Scope 2 emissions per the market-based method.

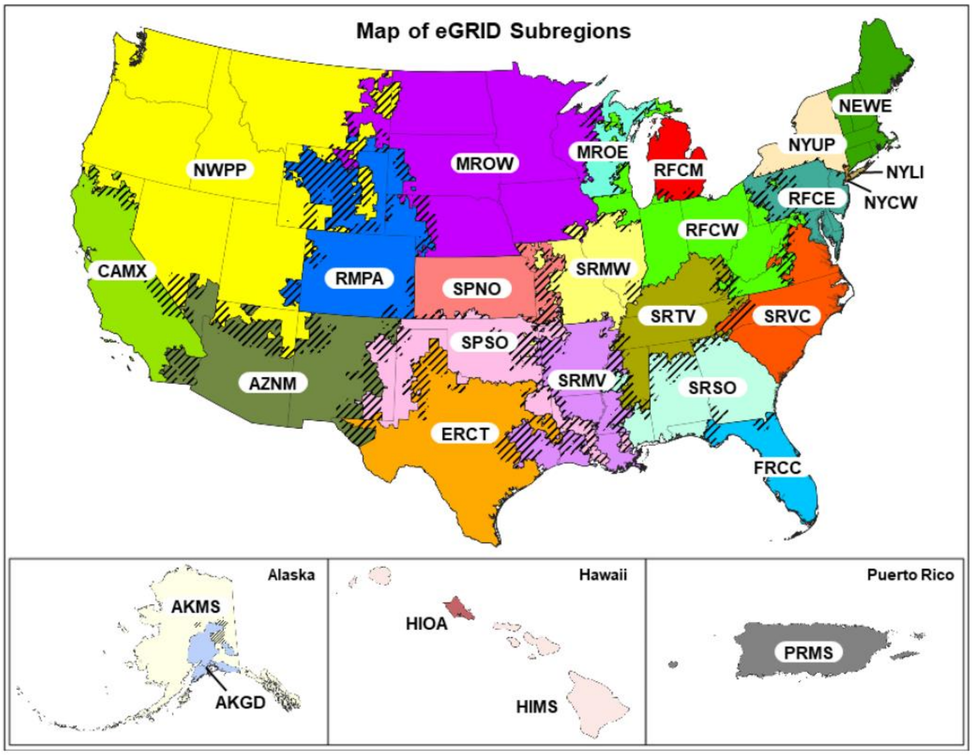


Figure 5*: Map of EPA eGRID subregions [11]. Crosshatching indicates that an area falls within overlapping eGRID subregions. U of I is in the NWPP subregion.*

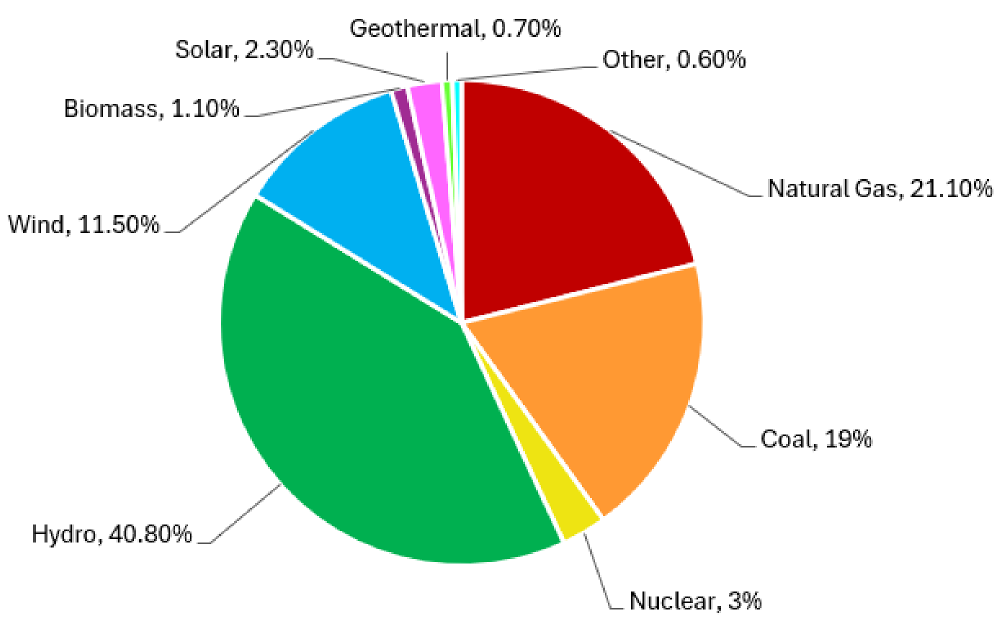


Figure 6*: NWPP eGRID subregion 2022 energy mix [13].*

	Unit	FY2023
Total electricity purchased	kWh	45,233,573
Residual emissions factor	kg CO_2e/kWh	0.281254
Total emissions	**Metric Tons CO_2e**	**12,722.13**

***Table 10**: Scope 2 emissions from purchased electricity.*

Total FY2023 Scope 2 emissions are 12,722.13 metric tons CO_2e. Table 10 shows total purchased electricity and the residual emissions factor provided by SIMAP [12] used to calculate total emissions.

Scope 3: Other Emissions

Scope 3 emissions include all other emissions that are attributed to U of I. This encompasses emissions from sources that are neither owned nor operated by U of I but are directly financed or linked to campus operations. Scope 3 emissions are considered "upstream" from the university, as the university did not directly produce them, but influenced or encouraged them, such as the emissions from employees and students commuting to campus or emissions from employee air travel to work events for which the university paid. Scope 3 emissions for which the U of I has data come from the following sources: commuting to and from campus, business travel, electrical transmission and distribution losses, food consumption, solid waste, and wastewater. All emissions were calculated in SIMAP, in accordance with the GHG Protocol guidelines for Scope 3 emissions [14].

Commuting

Commuting to and from campus can result in GHG emissions, depending on the mode of transportation utilized. The Office of Sustainability's 2023 Sustainability Cultural Assessment was administered online through the survey software Qualtrics to the entire U of I population (i.e., all students, staff, and faculty). Along with data on the sustainability values, attitudes, and behaviors of the campus population, the survey collected data on commuter behaviors. Participation in the survey was voluntary but was incentivized by the chance to win a gift card to a local store. Seven percent of the campus responded to the survey, which was statistically recognized as a representative sample. The commuter data was then averaged over each campus population group. Despite the rigor of the survey methodology used and the achievement of a representative sample, the survey data may not fully portray the true commuting habits of U of I since it is difficult to generalize behaviors to an entire population from a small sample of people. The data below can be considered a snapshot of commuter emissions for FY2023. Future commuter data collection should be improved to provide more accurate estimates of commuting emissions.

Moscow is a small town, encompassing less than 7 square miles. The typical commuting distance for the entire population of faculty, staff, and students is somewhere between 1 and 5 miles. Many students live less than 1 mile away from campus or live on campus, which greatly reduces their commuting emissions. Table 11 provides a breakdown of commuting behaviors for each campus group.

Campus Group	Number of Commuters	Automobile	Bike	Carpool	Electric Vehicle	Public Bus	Walk
Students	9,493	29%	28%	9%	1%	3%	30%
Faculty	583	58%	15%	8%	2%	3%	14%
Staff	1,108	58%	15%	8%	2%	3%	14%

***Table 11**: Number of commuters and percentage of mode of transport for students, faculty, and staff.*

GHG emissions from commuting were calculated using SIMAP. Total emissions from commuting for FY2023 are 1,435.05 tons of CO_2e. Figure 7 provides a breakdown of emissions for each campus group. Staff and faculty account for most of the commuting emissions. Students are more likely to opt for lower-emission commuting modes, such as biking, walking, or carpooling. This may be due to proximity to campus, affordability, or convenience. On average, faculty and staff mostly drive vehicles to campus alone, commute throughout the year, and live further from campus.

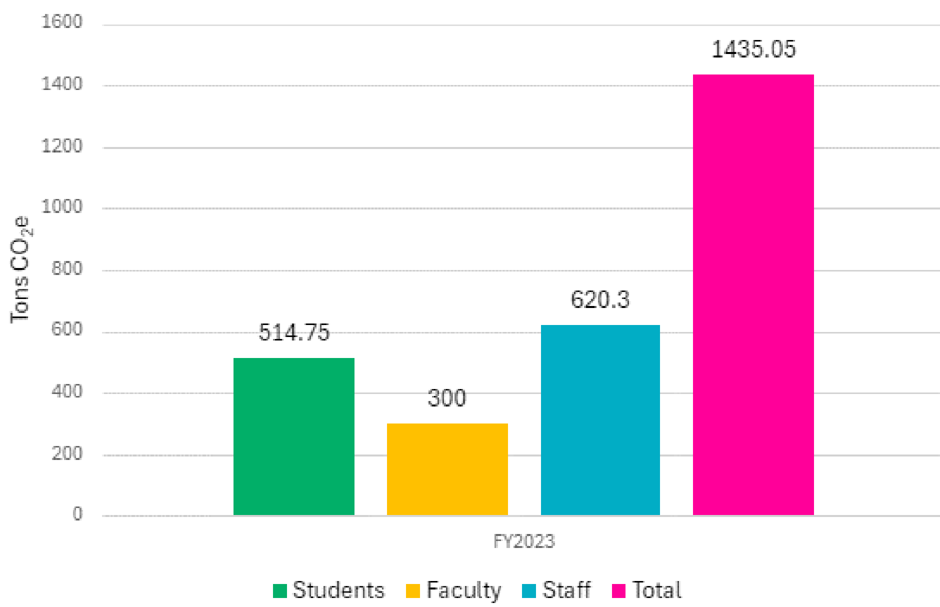


***Figure 7**: Emissions from commuting.*

U of I Financed Transportation

Directly financed transportation includes business trips on commercial aircraft and reimbursed personal mileage for faculty and staff, exclusive of university owned vehicles. Faculty and staff travel frequently for business, conferences, and other events, making air and passenger vehicle travel a significant part of university operations. Data on directly financed transportation was provided by the University Controller's Office. Transportation data only includes the distance between origins and destinations of trips, without accounting for any layovers or circuitous routes. Therefore, emissions estimates are lower than actuality. Regardless, this method for calculating GHG emissions related to business travel is standard practice in GHG reporting.

Emissions from airline and vehicle travel can differ based on modality, distance, equipment efficiency, and the number of breaks during travel. The EPA provides CO_2 emissions factors for passenger vehicles and short, medium, and long-haul airline travel [6]. We provide the EPA emissions factors to highlight that according to the 2023 EPA emissions factors, medium-haul air travel (between 300 and 2,300 miles) has the lowest CO_2 emissions factor, passenger vehicle travel has the highest, as seen in Table 12. These factors have all been decreasing over time as airlines and car manufacturers increase operating efficiency.

Travel Type	Distance Travelled (Miles)	Emissions Factor (kg CO_2/mile)
Air – Short Haul	< 300	0.207
Air – Medium haul	>300, < 2,300	0.129
Air – Long Haul	> 2,300	0.163
Passenger Vehicle	any	0.306

Table 12*: 2023 EPA emissions factors for business travel and commuting.*

Miles traveled by air and passenger vehicle and their associated emissions are in Table 13 below. Emissions were calculated using SIMAP's business travel emissions calculator, which provides a more accurate estimate by using both EPA emissions factors and the radiative forcing factor for air travel [15]. The radiative forcing factor is a multiplier used in travel emissions calculations to account for the higher GWP of emissions released at higher altitudes [16]. SIMAP's emissions factor for air travel is 0.16 kg CO_2e per mile, which is an averaged factor for short, medium, and long haul trips [17]. SIMAP's private automobile emissions factor is 0.33 kg CO_2e per mile [17]. Total emissions for directly financed travel from FY2023 were 2,930.83 tons of CO_2e, resulting from 7,035,725 miles traveled via air and vehicle.

Category	Travel Type	Unit	FY2023
Air Travel	Short Haul	Miles	175,968
	Medium Haul	Miles	2,674,107
	Long Haul	Miles	2,999,944
	Subtotal Miles	Miles	5,850,019
	Subtotal Emissions	Tons CO_2e	2,540.08
Private Automotive	Personal Reimbursement	Miles	1,185,706
	Subtotal Emissions	Tons CO_2e	390.75
Combined Air & Private Automotive	Total Miles	Miles	7,035,725
	Total Emissions	**Metric Tons CO_2e**	**2,930.83**

Table 13*: Directly financed transportation miles and emissions.*

Transmission and Distribution Losses from Purchased Electricity

Emissions from transmission and distribution (T&D) inefficiencies estimate the energy lost when supplying customers with electricity. Losses come from energy dissipated in transformers, conductors, and other equipment used to transmit, transform, and distribute electrical power. Although typically difficult to measure, SIMAP provides a loss estimate that is an adjusted percentage based on the regional fuel mix of the Moscow campus location and the fuel mix of the NWPP subregion from the EPA eGRID subregion [13]. SIMAP's estimate is a 5.3% loss. Using the 5.3% value, emissions from T&D losses can be calculated using the same emissions factors used for Scope 2 emissions from purchased electricity, shown below in Table 14. Total emissions from T&D losses in FY2023 were 712.01 metric tons CO_2e.

Source	Unit	FY2023
T&D Losses	kWh	2,397,379
Total Emissions	Kg CO_2	707,707
Total Emissions	**Metric Tons CO_2e**	**712.01**

Table 14: *T&D losses from purchased electricity.*

Food

Emissions from food production account for fertilizer application, cattle enteric fermentation, manure management, soil respiration, deforestation, and transportation [18]. For an accurate estimation, data on the total weight, type, sustainability practices, and growth/production location of all food was collected. Data was provided by Idaho Eats, U of I's food vendor (managed by Chartwells) for all food purchases for FY2023. The food data includes all campus market and dining locations managed by Idaho Eats. Food purchases for independent food contractors (e.g. Einstein Bros Bagels, Qdoba, Chick-fil-A, Ace Sushi, and Firehouse Subs) are not included.

Total food weight was 485.86 metric tons. Figure 8 shows the weight of each food category consumed. Consumption by weight is largest for liquids, milk, grains, and vegetables. Figure 9 shows the emissions from each food category. Total carbon emissions from food consumption were 1,989 metric tons of CO_2e. Beef accounts for 50% of total food emissions but only 5% by weight, followed by pork (9% of emissions, 4% by weight), cheese (8% of emissions, 4% by weight), and chicken and milk (both 6% of emissions, 5% and 11% by weight respectively). Grains and vegetables accounted for 5% of emissions and 21% by weight.

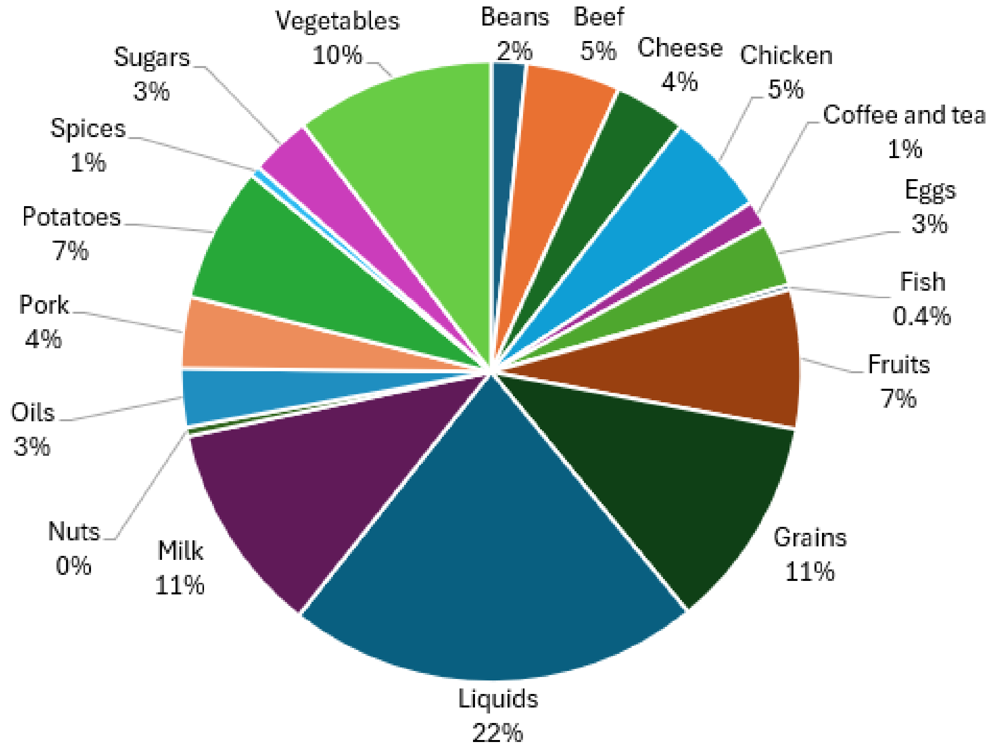


Figure 8: *Food consumption by weight of food category.*

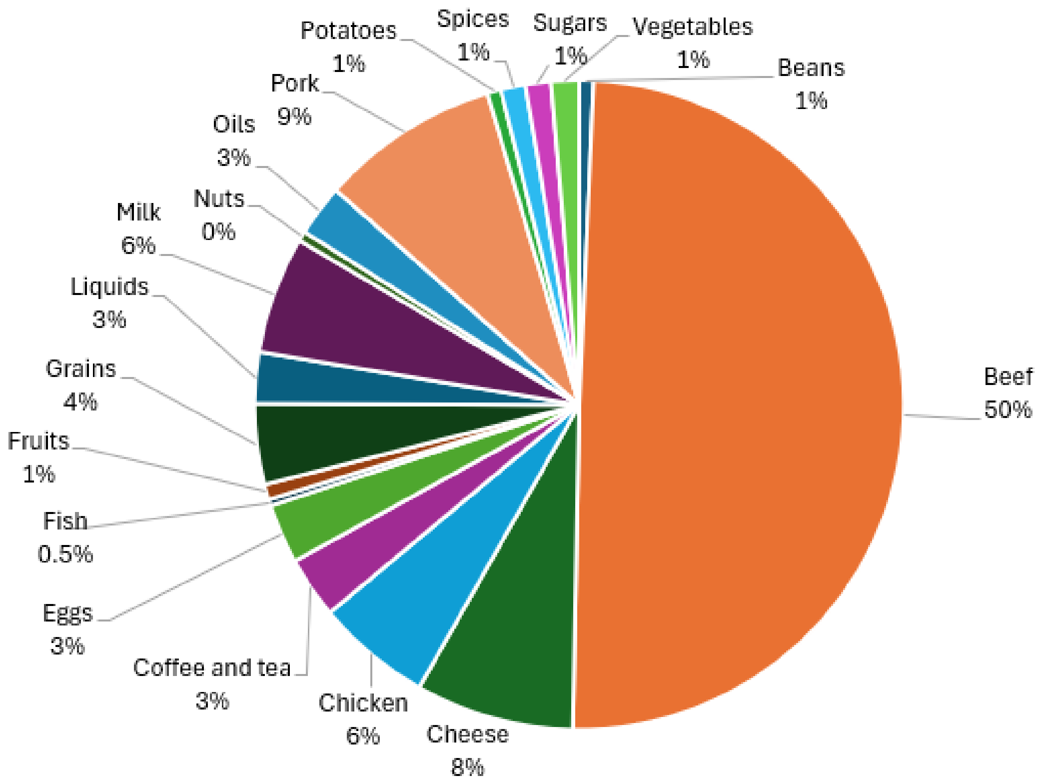


Figure 9: *Emissions from food consumption by food category.*

Solid Waste

Waste generation and disposal practices at the university produce GHG emissions. A significant portion of campus waste ends up in landfills. The new single-stream recycling program launched in April of 2023, allowing for three months of data within the reporting period. The average diversion rate during this time period was 27%, though this includes a backstock of electronic waste and recyclable that were in storage.

Solid waste is generally measured in short tons, with weight estimates based on the tipping fees from Latah Sanitation (LSI). LSI collects unrecyclable municipal solid waste (MSW) and transports it 234 miles (one-way) to the Columbia Ridge Recycling and Landfill site south of Arlington, Oregon. At this landfill, organic waste decomposes anaerobically into CH_4, which is captured by the landfill's CH_4 recovery system to produce electrical power [19].

The recycling program was restructured and relaunched in FY2023 as a single-stream indoor collection program to reduce previous contamination levels. Recycling on campus is collected separately to minimize resource extraction and reduce the volume of landfill waste. LSI also handles single stream recycling collection, transporting it 295 miles (one-way) to the Republic Services Materials Recovery Facility (MRF) in Seattle, Washington [20]. There, it is sorted, processed, and sold to mills for new production. Scrap metal is mostly sent to Pacific Steel and Recycling in Lewiston, Idaho, about 31 miles away. Recycling avoids GHG emissions by keeping materials out of the landfill, but it is not considered an offset. This is because recycling does not result in a direct net loss of carbon to the atmosphere. Instead, the impact of recycling is reflected in reduced emissions from solid waste disposal, since recycling leads to less waste being sent to the landfill.

Emissions from solid waste generation are summarized in Table 15. Data was provided by the Recycling, Surplus, and Solid Waste (RSSW) division of Landscape and Exterior Services.

Source	Unit	Amount
Landfilled Solid Waste	Short ton	937
CH_4 Emissions*	kilogram	17,240
Total Emissions	**Metric tons CO_2e**	**480.99**

***Table 15**: Emissions from landfilled solid waste.*

**CH_4 has a GWP of 28.*

Wastewater

Wastewater treatment emissions vary depending on the treatment process used. The Moscow Wastewater Treatment Plant employs an anaerobic digestion process, which results in the release of CH_4 and N_2O. According to U of I's utility manager, McKinstry, U of I operations produced 129,815,262 gallons of wastewater in FY2023**.** This number is equivalent to the number of gallons of water drawn from the main wells on campus; McKinstry does not record actual wastewater volumes. Based on the emissions factor for anaerobic digestion, 129,815,262 gallons of wastewater produced 264.45 metric tons of CO_2e. Table 16 provides details on U of I's wastewater emissions.

Source	Unit	Emissions Factor (kg CO_2e/unit)	Amount
Wastewater	gallon	2.04×10^{-3}	129,815,262
Total Emissions	**Metric tons CO_2e**		**264.45**

Table 16*: Emissions from wastewater generated in FY2023.*

Fuel- and Energy-Related Activities

The fuel- and energy-related activities (FERA) category accounts for the emissions that occur upstream from the direct combustion of a fuel or generation of energy and are not accounted for in Scope 1 calculations [21]. Upstream emissions can come from the extraction, production, and transportation of fuels or the materials used to make solar panels. SIMAP automatically calculates FERA emissions from Scope 1 stationary fuels of natural gas and solar production. FERA estimates are not yet available for Scope 1 stationary fuel of wood chips in SIMAP. FERA estimates for wood chips will likely be included in future reports.

Table 17 displays the FERA emissions that occurred upstream from U of I's stationary fuel use of natural gas and solar. Total FERA emissions for FY2023 are 2,212.71 tons of CO_2e.

Source	FY2023
FERA: Natural Gas	2,206.20 tons CO_2e
FERA: Solar – Electric	6.51 tons CO_2e
Total FERA Emissions	**2212.71 tons CO_2e**

Table 17*: FERA emissions.*

Scope 3 Categories Not Addressed

There are some Scope 3 categories in SIMAP that we are unable to address due to a lack of data. Table 18 provides these categories. These categories account for the upstream emissions resulting from the extraction, production, and transportation of the following: goods and services purchased by the university; university owned or managed assets; and goods and services sold by the university. At this time, U of I does not have a purchasing system that can provide the data needed to calculate emissions for these categories. We hope to include these categories in future reports as data collection strategies improve.

Relevant Scope 3 categories not addressed	**Emissions Source**	**Data explanation**
Purchased goods and services	Emissions that occur upstream of the institution's purchases (i.e. extraction, production, and transportation of purchased goods and services)	Limited production data for paper or other office supplies
Capital goods	Emissions that occur upstream of purchased products (including processing of raw materials and manufacturing)	No production data for most capital goods (construction, equipment, machinery, etc.)
Upstream transportation and distribution	Emissions from the final delivery of products from the institution's direct suppliers	No data on the transportation or distribution of purchased products
Upstream leased assets	Emissions from the operation of assets that are leased by the institution (offices or vehicles)	No data on the operation of assets leased by the institution
Downstream transportation and distribution	Emissions from the transportation and distribution of products sold by the institution in vehicles and facilities not owned or controlled by the institution	No data on the transportation or distribution of products sold
Downstream leased assets	Emissions from the operation of assets that are owned by the institution and leased to other entities (offices or vehicles)	No data on the operation of assets owned by the institution and leased to other entities
Franchises	Emissions from the operation of franchises (any entity licensed to sell the institution's goods or services), including franchised campus dining locations (e.g., Einstein Bros Bagels and Qdoba)	No data from on-campus franchises of the goods or services sold
Investments	Emissions from the operation of institutional investments	No data on the operation of investments (e.g. equity and debt investments or project finance)

***Table 18**: Scope 3 categories that are not addressed in this report.*

Cumulative Scope 3 Emissions

Figure 10 displays the total emissions for Scope 3. Total Scope 3 emissions for FY2023 are 10,025.08 tons of CO_2e. Emissions from directly financed travel are the largest source of emissions for Scope 3, followed closely by FERA emissions. Food consumption and commuting are also significant sources of emissions. T&D losses, solid waste, and wastewater are smaller sources of emissions in comparison.

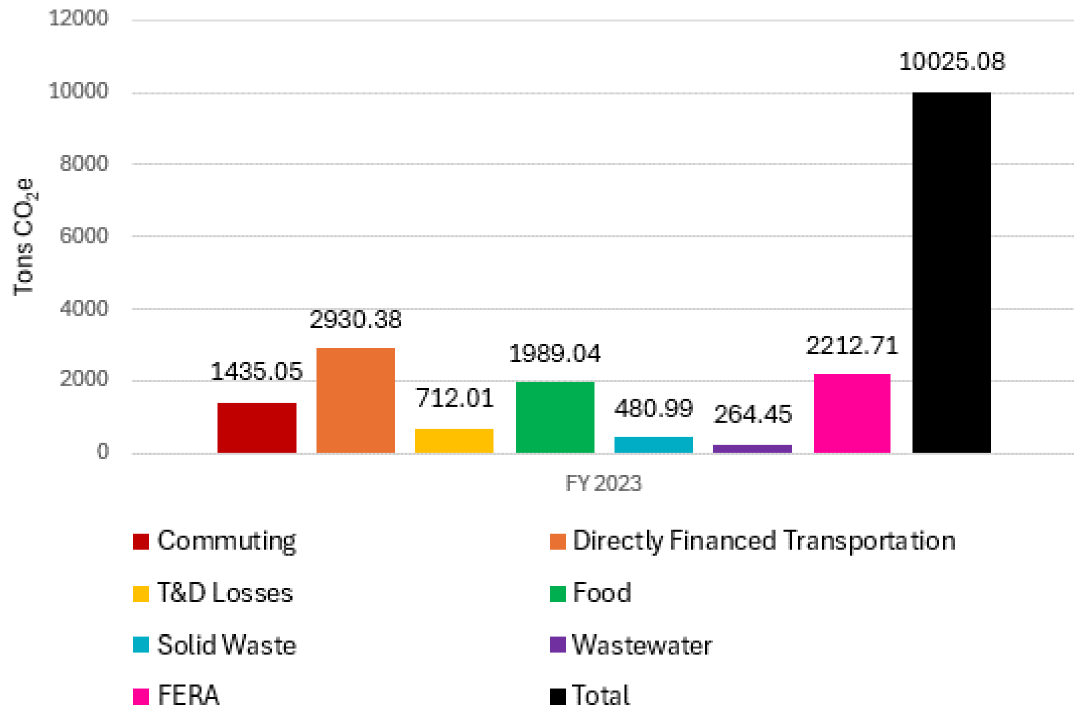


Figure 10: *Cumulative Scope 3 emissions.*

Total University Emissions Profile

Combining emissions from all three scopes provides the total university carbon footprint. Due to reporting inconsistencies in previous GHG inventory reports, FY2023 is the new emissions baseline and will be used for comparison in future reports. Total campus emissions in FY2023 are 34,732.31 tons of CO_2e. Table 19 and Figure 11 both provide a breakdown of the total emissions by scope. Scope 1, 2, and 3 emissions account for 34%, 37%, and 29% of the total emissions profile, respectively.

Scope	Unit	FY2023
Scope 1	Tons CO_2e	11,985.10
Scope 2	Tons CO_2e	12,722.13
Scope 3	Tons CO_2e	10,025.08
Total emissions	**Tons CO_2e**	**34,732.31**

Table 19: *Total university emissions by scope.*

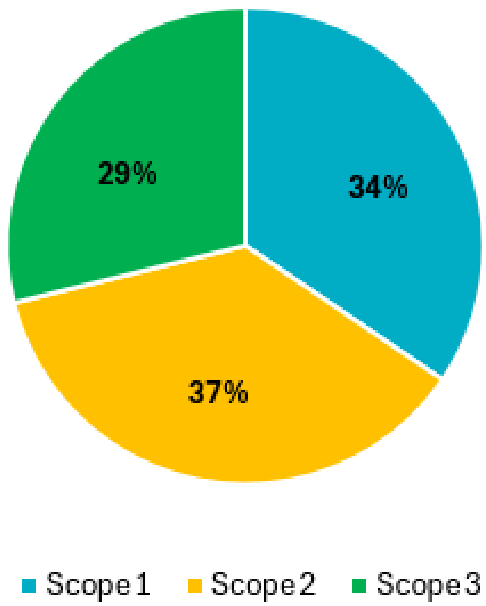


Figure 11*: Total university emissions by scope.*

The breakdown of the total GHG emissions in FY2023 are shown below in Figure 12. The largest sources of campus emissions are electricity consumption (37%) and stationary fuel use of both natural gas and wood chips (27%).

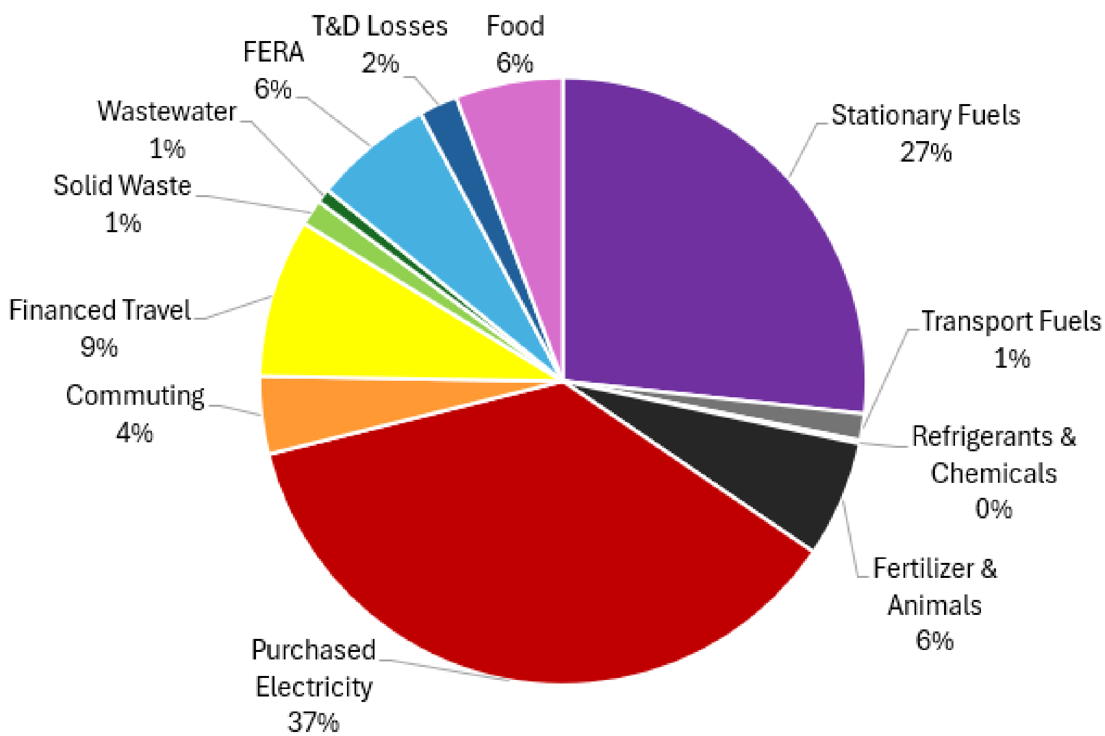


Figure 12*: FY2023 emissions profile.*

Normalization

Carbon footprint is more often an indicator of campus size than performance, complicating the ability to make footprint comparisons between institutions. To account for these discrepancies and facilitate more meaningful benchmarking, results can be normalized per gross square footage and per full-time equivalent student population.

Emissions per square foot

As of FY2023, estimated occupied space of the Moscow campus is 4,529,287 square feet, which includes all farms and other Moscow locations. Total emissions for FY2023 are 7.67 kg CO_2e per square foot.

Emissions per full-time equivalent student

As of FY2023, the population of full-time equivalent students is 9,175 students. Total emissions for FY2023 are 3.79 tons of CO_2e per full-time equivalent student.

Alternative Energy on Campus

U of I has two alternative energy sources on campus that help the university avoid emitting GHG emissions associated with electricity production: the steam turbines at the District Energy Plant and the Integrated Research and Innovation Center (IRIC) solar array.

In 2022, the university added three electricity-producing steam turbines to the District Energy Plant as part of a major renewable energy initiative to improve on-site energy production. As wood and natural gas are burned in the boilers of the energy plant to heat campus, steam is produced. Instead of simply being released into the atmosphere, the steam is then captured and used to turn the blades of the turbines and generate electricity for campus. The District Energy Plant produces about 250 million pounds of steam annually, which is now converted to energy through the steam turbines. This cogeneration process capitalizes on the byproducts of the existing heat generation process and helps avoid the release of additional GHG emissions associated with producing electricity [22].

In FY2023, the District Energy Plant's three turbines produced 3,966,842 kWh of electricity for the university, offsetting 8.01% of the university's total energy demand. Cogeneration data was provided by McKinstry. The turbines are not currently running at full speed to ensure that steam pressure remains consistent. Regardless, the turbines exceed the facility's electrical needs, making the District Energy Plant the first carbon-negative building on campus.

Along with the steam turbines, the IRIC solar array produces electricity for our campus and helps U of I avoid emitting additional GHG emissions. Solar panels are a renewable energy source, as they convert sunlight into electrical energy and do not release GHG emissions while creating energy. The IRIC photovoltaic solar array is the university's first, installed in 2019 to further reduce U of I's GHG emissions from electricity consumption. This array, consisting of 368 panels funded by 120 donors including ASUI and the Office of the President, has the potential to generate up to 132.2 kW per hour. This accounts for up to 15% of the IRIC's high energy demand during peak usage. After completing all the necessary power purchasing agreements, the solar array was turned on in February of 2022.

In FY2023, the IRIC solar array produced 293,161 kWh of electricity, making up 0.59% of the university's total electricity consumption. By producing 293,161 kWh of electricity, the IRIC solar array avoided emitting 205 tons of CO_2e. This production is far lower than expected, and it is likely that the solar array is not yet functioning correctly. Future efforts should be directed at repairing and maintaining the IRIC solar array to ensure U of I is taking advantage of its zero-emissions electricity production. Solar array data was obtained from McKinstry.

Carbon Sinks: Non-Additional Sequestration

A carbon sink is something that absorbs and stores carbon dioxide from the atmosphere. Natural carbon sinks, such as forests, oceans, and wetlands, absorb more carbon than they release through processes like photosynthesis or oceanic carbon absorption. Rinker Rock Creek Ranch, Taylor Wilderness Research Station, and the U of I Experimental Forest are university research stations and are considered natural carbon sinks. For reasons explained below, none of these sinks decreases U of I's carbon footprint. This report only discusses Rinker Rock Creek Ranch for illustrative purposes.

Rinker Rock Creek Ranch (Rinker Rock) is made up of over 10,000 acres of high-quality rangeland in the Wood River Valley of central Idaho. Although Rinker Rock is a carbon sink, accounting for its carbon absorption neither adds nor subtracts to U of I's GHG footprint for FY2023. This is because Rinker Rock's carbon sequestration does not result in a net increase in carbon storage beyond what would have occurred naturally – it is not reducing emissions but only keeping additional carbon from being released into the atmosphere. For the purposes of GHG accounting, this is known as non-additional sequestration. Despite it having no impact on the total GHG footprint, there is still value in quantifying carbon sequestration at Rinker Rock to highlight the additional amount of carbon that would be released into the atmosphere if the land were managed differently.

Carbon sequestration was calculated using the USDA COMET Planner, which can provide accurate estimates of GHG emissions reductions for common conservation agricultural practices and other land-use strategies [23] based on area location. Figure 13 displays the GHG sequestration and release from Rinker Rock Creek Ranch for FY2023.

In FY2023, Rinker Rock land-use strategies of range planting and seeding forages to improve rangeland condition for ten acres of land sequestered three tons of CO_2e. A riparian restoration project that repaired 21 acres of disturbed and degraded areas by planting woody plants sequestered an additional 21 tons of CO_2e.

For prescribed grazing and grazing management to improve rangeland conditions, nitrogen was also sequestered from the atmosphere, which is reported in CO_2e units for reporting consistency. Prescribed grazing on rangeland can enhance nitrogen sequestration from the atmosphere by promoting healthy plant and root growth, increasing organic matter in soil from manure, minimizing soil disturbance from traditional farming practices, and encouraging more diverse plant communities [24]. Due to grazing management strategies for 10,370 acres, 276 tons of CO_2e (nitrogen) were sequestered.

Rinker Rock land practices can also release carbon into the atmosphere. Emissions from grazing can occur when land is overgrazed, resulting in soil disturbance and erosion, a reduction in plant cover, and increased decomposition rates of organic material in soil, all of which can release CO_2 and hamper the land's ability to sequester CO_2 from the atmosphere [25]. Furthermore, livestock digestion produces CH_4, a potent GHG [25]. In FY2023, grazing 10,370 acres of rangelands released 167 tons of CO_2e into the atmosphere. Accounting for both the GHG sequestered and released, Rinker Rock Creek Ranch absorbed an estimated 133 tons of CO_2e in FY2023 cumulatively.

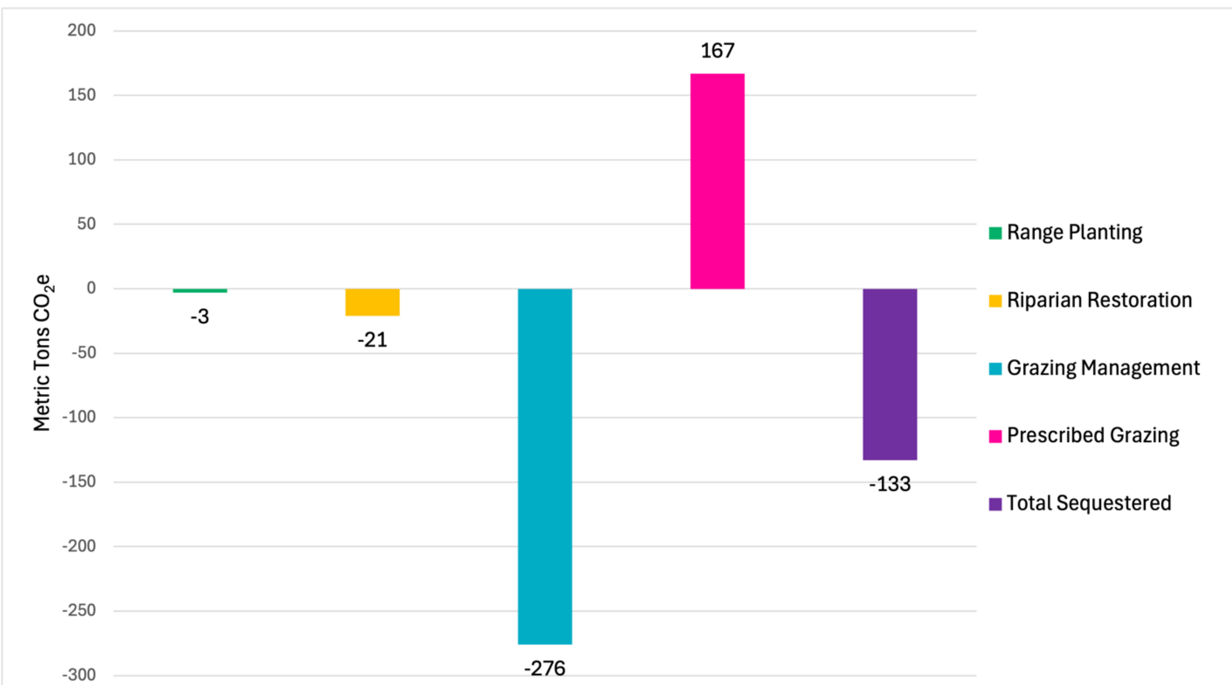


Figure 13: *Amount of CO_2e sequestered and released due to land-use strategies at Rinker Rock Creek Ranch.*

Conclusions and Recommendations

Climate Change & Weather in Idaho

According to the National Aeronautics and Space Administration (NASA), the earth is warming at an unprecedented rate, a phenomenon known as climate change. Since recordkeeping began in 1880, the ten most recent years have been the warmest years on record, with 2023 being the warmest ever recorded [26]. Overall, the earth was about 2.45 degrees Fahrenheit warmer in 2023 than in the late 19th century [27]. Although our planet has experienced climate fluctuations throughout its history, the current global warming trend is occurring at an alarmingly fast rate, directly resulting from human activities [28]. Namely, the burning of fossil fuels and other industrial activities that fuel our modern lifestyles emit GHGs into the atmosphere, like carbon dioxide, methane, nitrous oxide, chlorofluorocarbons (CFCs), and water vapor. These GHGs trap heat around our planet and slow heat loss to space, creating a greenhouse effect around the earth and increasing average temperatures across its surface.

The effects of climate change are already occurring and will worsen in the future if we continue to emit GHGs at our current rate. Effects include sea ice loss, accelerated sea level rise, and more frequent, destructive weather phenomena, such as hurricanes, heat waves, tsunamis, tornadoes, droughts, wildfires, etc. [29]. Climate change is also unevenly impacting precipitation patterns, with some regions experiencing increased precipitation while others experience drought. In the United States, the Northwest region will experience significant changes in the timing of peak flows in rivers and streams, which will reduce fresh water supplies and worsen competing demands for water. Increased incidences and severity of wildfires, heat waves, erosion, flooding, insect outbreaks, and tree diseases are also being driven by climate change and causing widespread forest die-off [30].

In Idaho specifically, the annual average temperature has risen nearly 2 degrees Fahrenheit since 1900, which has spurred an array of dramatic changes in the state's overall climate [31]. Summer precipitation has significantly decreased, while winter and spring have increased [31]. However, winter precipitation is now more likely to fall as rain instead of snow due to warmer temperatures [31]. This has led to large reductions in annual snowpack and earlier spring snowmelt. Drought and extreme weather events (e.g., floods, heat waves, cold snaps, high winds, and extreme precipitation) in Idaho are growing issues and are projected to worsen in the future [32]. Additionally, climate-induced weather changes have heightened the risk of larger and more severe wildfires in Idaho, as well as lengthening the overall fire season [32]. Climate projections suggest that the average annual temperatures in Idaho can increase by 4.7 to 10 degrees Fahrenheit by the end of the century [31]. These changes will impact nearly every facet of our lives – from our agriculture, our drinking water availability, and even the way we recreate in the summers and winters.

Recommendations

This report documents the U of I's GHG emissions from FY 2023 and quantifies our contribution to climate change. Given the climatic impacts our region is already experiencing, it is critical that we identify strategies to reduce our overall GHG footprint. There are many opportunities for the university to reduce its GHG emissions. We provide some examples below.

To mitigate emissions, aging equipment using refrigerants with high GWPs should be replaced proactively before failure occurs. Upgrading to newer, more efficient equipment not only reduces emissions but also lowers energy consumption. Phasing out older refrigerants with high GWPs and replacing them with alternatives that have lower GWPs, lower ozone depletion levels, lower toxicity and less flammability is expected to further decrease emissions and overall environmental impact over time [9]. Seeking out opportunities for natural refrigerant utilization will improve the environmental performance of refrigeration systems.

Scope 2 emissions are our largest source. Avista provides options for homeowners to purchase electricity solely from renewable sources. That program is called My Clean Energy. If the university chose to purchase the same electricity, our emissions would be reduced by roughly one third. Likewise, expanding our on-campus electricity generation sources would limit our dependence on power generated by third parties. We recommend additional investment in solar arrays.

Encouraging more low- or zero-emissions commuting and travel behaviors can significantly decrease U of I's GHG footprint. In FY2023, 29% of students and 58% of employees drove themselves to and from campus in single-occupancy vehicles for their daily commute. Driving a passenger vehicle alone emits more GHG emissions than any other form of commute. Future efforts should be directed at encouraging more low-emissions or zero-emissions commuting behaviors like biking, walking, carpooling, or taking the bus, especially amongst faculty and staff. U of I financed travel emissions were also high. In FY2023, U of I financed over 7 million miles of travel, emitting 2,930.83 tons of CO_2e. Travel is inevitable, so employees traveling alone should opt for air travel as much as possible, even for short distances, as air travel emits fewer kilograms of CO_2e per mile than passenger vehicles. In vehicles with three or more people, driving is the better option.

In FY2023, U of I consumed over 1 million therms of natural gas. Natural gas emits 5.306 kg of CO_2e for every therm used, making it a significant contributor to U of I's total GHG footprint. One way to reduce natural gas consumption would be to increase the operating capacity of the District Energy Plant's steam network. Currently, only 62 out of 132 suitable buildings on campus are connected to the steam network, which provides steam for heating purposes from the energy plant. Furthermore, aging equipment at the District Energy Plant should be repaired or replaced to increase operating efficiency.

Choosing low-emissions food can also help U of I reduce its GHG footprint. Total carbon emissions from food consumption in FY2023 were 1,989 metric tons of CO_2e. Unlike other sources of emissions, food emissions are better addressed by placing emphasis on the types of food served instead of reducing overall consumption volume. It is suggested that local or regional (i.e., sourced from within 250 miles of campus) food be purchased when possible and consumption of foods with higher associated emissions be reduced.

Most importantly, U of I should update its Climate Action Plan. U of I published its first and only Climate Action Plan in 2010, with ambitious goals to achieve carbon neutrality by 2030. This GHG report has shown, however, that as an institution, we have a long way to go before reaching carbon neutrality. Updating the Climate Action Plan can help U of I set realistic goals and outline specific plans for reducing GHG emissions in priority areas.

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University of Idaho Fuel Distributor

College of Agricultural & Life Sciences
University of Idaho

Controller's Office
University of Idaho

HVAC/Refrigeration Shop
University of Idaho Facilities

Idaho Eats
Chartwells Higher Education

Landscape Division
University of Idaho Facilities

McKinstry
University of Idaho Utility Partner

SIMAP Program
University of New Hampshire Sustainability Institute

Waste Management Division
University of Idaho Facilities

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Appendix A: U of I Buildings & Heat Sources

U of I buildings that have electricity and lie within the operational boundary of this report are listed below. Connectivity to the District Energy Plant's steam network is indicated by yes or no, and the billing designation between campus buildings and auxiliary buildings are provided.

Building	Steam	Billing Designation
ADMINISTRATION BUILDING	YES	Campus
AGRICULTURAL BIOTECHNOLOGY	YES	Campus
AGRICULTURAL EDUCATION	NO	Campus
ANIMAL PAVILION & MEATS LAB	NO	Campus
AQUACULTURE INSTITUTE	NO	Campus
AQUACULTURE RESEARCH INSTITUTE	NO	Campus
AQUACULTURE RESEARCH INSTITUTE	NO	Campus
AQUACULTURE WET LAB	NO	Campus
AQUACULTURE WET LAB	NO	Campus
ARCHIE PHINNEY HALL	YES	Campus
ART & ARCH INTERIOR DESIGN	YES	Campus
ART & ARCHITECTURE BUILDING	YES	Campus
ART & ARCHITECTURE EAST	NO	Campus
ART & ARCHITECTURE NORTH	YES	Campus
ART & ARCHITECTURE SOUTH	YES	Campus
ASUI KIBBIE ACTIVITY CTR / VAC	NO	Campus
AVS RESEARCH HAY BARN	NO	Campus
BEEF WORKING FACILITY	NO	Campus
BLAKE HOUSE	YES	Campus
BOOKSTORE/US POST OFFICE	NO	Campus
BRUCE M. PITMAN CENTER	YES	Campus
BUCHANAN ENGINEERING LAB	YES	Campus
CAMPUS STORAGE #1	NO	Campus
CAROL RYRIE BRINK HALL (FOCE)	YES	Campus
CHEMICAL STORAGE	NO	Campus
CHIP FACILITY SCALE HOUSE	NO	Campus
CHIP STORAGE/DRYING FACILITY	NO	Campus
CLASS ANNEX	NO	Campus
COLLEGE OF EDUCATION BUILDING	YES	Campus
COLLEGE OF NATURAL RESOURCES	YES	Campus
EARLY CHILDHOOD LRNG CENTER	NO	Campus
ENGINEERING ANNEX	NO	Campus
ENGINEERING/PHYSICS BLDG	YES	Campus
ENVIRONMENTAL HEALTH & SAFETY	NO	Campus
FACILITIES EQUIPMENT STORAGE	NO	Campus
FACILITIES GARAGE	NO	Campus

FACILITIES LATHHOUSE/GRNHOUSE	NO	Campus
FACILITIES SERVICES	NO	Campus
FACILITIES STORAGE	NO	Campus
FARM OPERATIONS SHOP	NO	Campus
FARM RESIDENCE - BEEF	NO	Campus
FARM STORAGE BUILDING #2	NO	Campus
FEED & STORAGE POULTRY 1	NO	Campus
FOOD RESEARCH CENTER	YES	Campus
GAUSS-JOHNSON ENGINEERING LAB	YES	Campus
GERTRUDE L. HAYS HALL (Alumni Center)	YES	Campus
GIBB HALL	YES	Campus
GOLF CART STORAGE SHED	NO	Campus
GOLF COURSE PUMPHOUSE	NO	Campus
GOLF COURSE STORAGE BLDG	NO	Campus
GRADUATE ART STUDIO	YES	Campus
HAMPTON MUSIC BUILDING	YES	Campus
HARTUNG THEATRE	NO	Campus
HAZARDOUS MATERIALS STORAGE	NO	Campus
HOLM CENTER	NO	Campus
HOUSING STORAGE	NO	Auxiliary
HUMAN RESOURCES	NO	Campus
I TANK	NO	Campus
IDAHO ARENA	YES	Campus
IDAHO COMMONS	YES	Campus
IDDINGS AG SCIENCE BUILDING	YES	Campus
INTEGRATED RESEACH INNOVATION CENTER	YES	Campus
INTERMODAL TRANSIT CENTER	NO	Campus
IRRIGATION SYSTEM PUMPHOUSE	NO	Campus
J. A. ALBERTSON	YES	Campus
J.W. MARTIN LAB	NO	Campus
JANSSEN ENGINEERING BLDG	YES	Campus
KIBBIE WEST TICKET BOOTH	NO	Auxiliary
LES SMALL ENGINE SHOP	NO	Campus
LIBRARY	YES	Campus
LIFE SCIENCES SOUTH	YES	Campus
LLC - CNR - BLDG 5	YES	Campus
LLC - ENGINEERING - BLDG 7	YES	Auxiliary
LLC - GAULT - BLDG 6	YES	Campus
LLC - GEM - BLDG 1	YES	Campus
LLC - SAGE - BLDG 3	YES	Campus
LLC - SCHOLARS - BLDG 8	YES	Campus
LLC - SYRINGA - BLDG 2	YES	Campus
LLC - UPHAM - BLDG 4	YES	Campus
LONGHOUSE	NO	Campus

MACHINE SHED	NO	Campus
MARY E. FORNEY HALL	YES	Campus
MCCLURE HALL	YES	Campus
MCCONNELL HALL	YES	Auxiliary
MEMORIAL GYM	YES	Campus
MENARD LAW BUILDING	YES	Campus
METABOLISM/SURGERY BUILDING	NO	Campus
MIKE RYAN TRACK & FIELD OFFICE	NO	Campus
MINES BUILDING	YES	Campus
MONSON WORKING FACILITY	NO	Campus
MORRILL HALL	YES	Campus
NATIVE AMERICAN/MIGRANT ED CTR	YES	Campus
NIATT CCVT STORAGE BUILDING	NO	Campus
NICCOLLS BUILDING	YES	Campus
PESTICIDE STORAGE	NO	Campus
PHYSICAL EDUCATION BLDG	YES	Campus
POULTRY HILL WAREHOUSE	NO	Campus
PREEC GREENHOUSES (4 UNITS)	YES	Campus
PUBLIC SAFETY & SECURITY	NO	Campus
PUMPHOUSE 5	NO	Campus
PUMPHOUSE 9	NO	Campus
RADIATION STORAGE BUILDING	NO	Campus
RADIO-TV CENTER	NO	Campus
RECLAIM WATER CHLORINATION BLD	NO	Campus
RECYCLING/SURPLUS	NO	Campus
RENFREW	YES	Campus
RIDENBAUGH HALL	YES	Campus
SEED POTATO	NO	Campus
SHOUP HALL	YES	Auxiliary
SOUTH CAMPUS CHILLER PLANT	NO	Campus
SOUTH HILL COMMUNITY CENTER	NO	Campus
STUDENT HEALTH CENTER	YES	Campus
STUDENT RECREATION CENTER	YES	Campus
TEACHING AND LEARNING CENTER	YES	Auxiliary
THEOPHILUS TOWER	YES	Campus
TRANSFORMER STORAGE	NO	Campus
UI SWIMMING CENTER	YES	Campus
UNIV EVENTS/BOOKSTORE STORAGE	NO	Campus
UNIVERSITY ADVANCEMENT ANNEX	NO	Campus
UNIVERSITY ENERGY PLANT	YES	Campus
UNIVERSITY HOUSE	NO	Campus
UNIVERSITY VEHICLE STORAGE	NO	Campus
USDA INCINERATOR	NO	Campus
USDA RESEARCH BARN	NO	Campus

VEHICLE RESEARCH LAB	YES	Campus
WALLACE RESIDENCE- BALLARD	YES	Campus
WALLACE RESIDENCE- COMMON	YES	Campus
WALLACE RESIDENCE- GOODING	YES	Campus
WALLACE RESIDENCE- STEVENSON	YES	Campus
WALLACE RESIDENCE- WILLEY	YES	Campus
WICKS FIELD STORAGE & RESTROOM	NO	Campus
WWAMI MEDICAL EDUCATION BLDG	NO	Campus
YARD CONTAINERS - LARGE	NO	Campus
YARD CONTAINERS - SMALL	NO	Campus

Appendix B: Historical Data

Context & Data Inclusion

Previous GHG inventory reports and AASHE STARS reports used 2005 as the baseline year for emissions accounting. 2005 will remain the baseline year for future AASHE STARS reporting efforts since the dataset from 2005 meets reporting requirements for that program. However, due to missing data and methodological inconsistencies in previous GHG reports, FY2023 was determined to be the new baseline for internal GHG reporting moving forward. Resetting the baseline year to FY2023 for GHG reports has methodological advantages, but it also excludes critical context from historical emissions data. This makes comparison and benchmarking difficult.

To illustrate the impacts of major energy projects and policy changes, data from FY2019 is compared to FY2023 in Table 20. FY2019 was chosen for comparison because FY2019 is the most recent dataset available that was unaffected by the operational changes from the COVID-19 pandemic and emissions could be re-calculated in SIMAP to ensure methodological consistency with 2023.

In Table 20, reductions in emissions are noted in green. Increases in emissions are noted in orange. Bold, italic values in FY2023 represent data that was collected for the first time in 2023 and cannot be compared to FY2019. This data is excluded from the *compared emissions calculation* to provide directly comparable values between FY2019 and FY2023. However, this data is still included in the *total emissions calculation* for reporting transparency.

Source	FY2019 Emissions (metric tons)	FY2023 Emissions (metric tons)	Absolute Change (metric tons)	Percent Change (+/-)
SCOPE 1	7280.42	8168.54	888.12	12.20
Stationary Fuels	4208.58	5462.47	1253.89	29.79
Energy Plant (cogeneration)	1656.00	2958.22	1302.22	78.64
Campus buildings	1429.00	1637.56	208.56	14.59
Auxiliary buildings	1122.00	866.69	-255.31	-22.75
Wood chips (cogeneration)	NOT REPORTED	***3816.31***	N/A	N/A
Transport Fuels	537.80	490.18	-47.62	-8.85
Gasoline	294.94	281.37	-13.57	-4.60
Diesel	242.86	208.81	-34.05	-14.02
Biodiesel	NOT REPORTED	***0.25***	N/A	N/A
Animals and Fertilizer	2476.50	2156.30	-320.20	-12.93
Beef cows	503.30	194.61	-308.69	-61.33
Dairy cows	1723.30	1829.88	106.58	6.18
Horses	2.31	1.74	-0.57	-24.68
Sheep	245.27	125.79	-119.48	-48.71
Fertilzer	2.32	4.28	1.96	N/A
Refrigerants and Chemicals ✶	57.54	59.59	2.05	3.56
HCFC-22	1.78	17.23	15.45	867.98
R-404A	55.76	42.36	-13.40	-24.03
SCOPE 2	16362.82	12722.13	-3640.69	-22.25
Purchased Electricity	16362.82	12722.13	-3640.69	-22.25
SCOPE 3	11554.42	7812.37	-3742.05	-32.39
Commuting ✶	1620.11	1435.05	-185.06	-11.42
Students	405.11	514.75	109.64	27.06
Faculty	361.82	300.00	-61.82	-17.09
Staff	853.18	620.30	-232.88	-27.30
Financed Travel ✶	5889.00	2930.83	-2958.17	-50.23
Air travel	5883.95	2540.08	-3343.87	-56.83
Private Automotive	5.05	390.75	385.70	7637.62
T&D Losses from Purchased Electricity	879.35	712.01	-167.34	-19.03
Food	2432.10	1989.04	-443.06	-18.22
Solid waste	431.85	480.99	49.14	11.38
Wastewater ✶	302.01	264.45	-37.56	-12.44
FERA	NOT REPORTED	***2212.71***	N/A	N/A
Natural gas	NOT REPORTED	***2206.20***	N/A	N/A
Solar-Electric	NOT REPORTED	***6.51***	N/A	N/A
Demographics				
Emissions per square foot	8.28	7.67	-0.61	-7.37
Emissions per student	3.85	3.79	-0.06	-1.56
TOTAL COMPARED EMISSIONS	**35197.66**	**28703.04**	**-6494.62**	**-18.45**
TOTAL REPORTED EMISSIONS	35197.66	34732.31	-465.35	-1.32

✶ Categories with low-confidence data due to data collection challenges and collection method differences over time

***Table 20**: FY2019 and FY2023 GHG comparison.*
**Reductions in emissions are green. Increases in emissions are orange. Bold, italic values mean that data was collected for the first time in FY2023 and cannot be compared to FY2019 data. Low confidence data is noted with a star.*

Changing Climate

It is also important to consider the changes in temperature when comparing FY2019 and FY2023 GHG footprints. Figures 14 and 15 show the average monthly temperatures for FY2019 and FY2023. The average annual temperature in FY2019 was 47.93 degrees Fahrenheit; 2023 was 48.37 degrees Fahrenheit [33]. The slight increase in average annual temperature from FY2019 to FY2023 may have also contributed to the increase in U of I's GHG footprint.

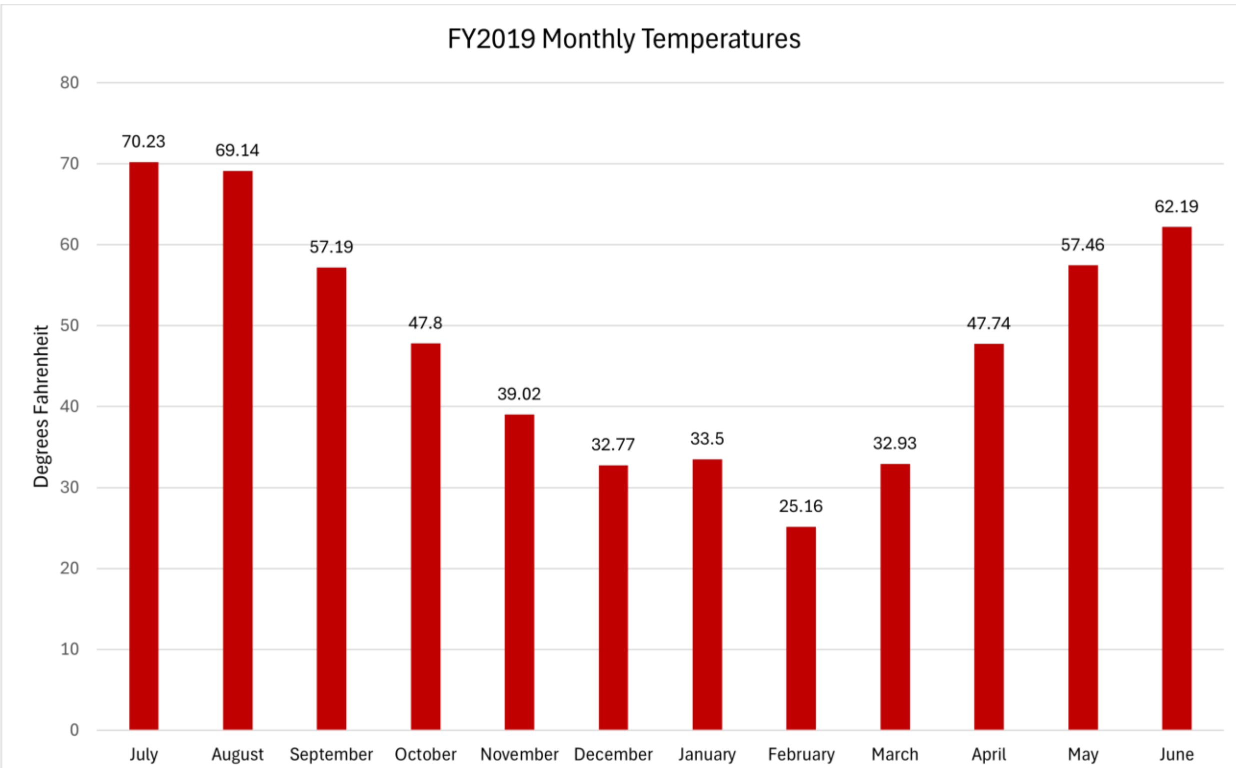

***Figure 14**: Average monthly temperatures for 2019. Data from Weather Underground – Pullman Moscow Regional Airport Station.*

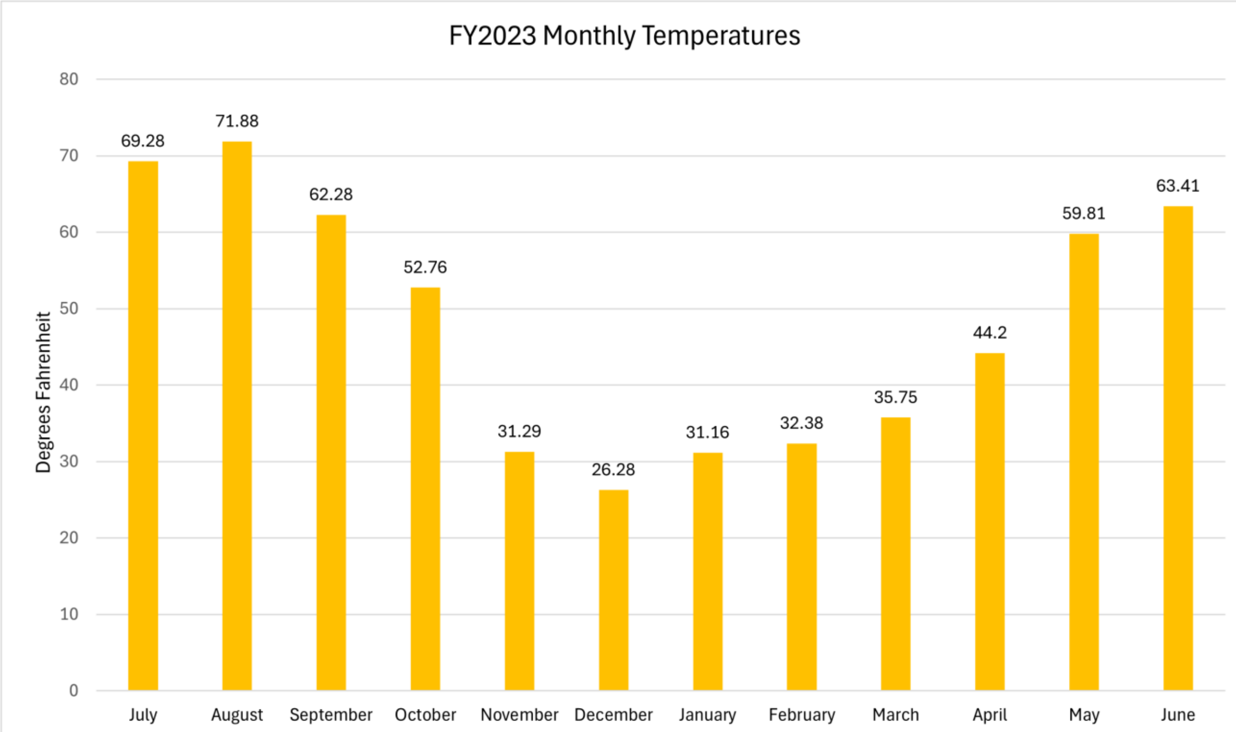

Figure 15*: Average monthly temperatures for 2023. Data from Weather Underground – Pullman Moscow Regional Airport Station.*

Appendix C: Raw Data for FY2019 and FY2023

FY2023

Scope	Source	Quantity	Unit	CO_2 (kg)	CO_2 (MTCDE)	Biogenic (MT CO_2)	CH4 (kg)	CH_4 (MTCDE)	N_2O (kg)	N_2O (MTCDE)	GHG MTCDE
N/A	Sinks: Non-Additional Sequestration: Carbon	-467	MT eCO2	0	0	0	0	0	0	0	0
1	Agriculture Sources: Animal Husbandry: Beef Cows	88	head	0	0	0	6,565	183.16	42	11.45	194.61
1	Agriculture Sources: Animal Husbandry: Dairy Cows	290	head	0	0	0	61,406	1,713.21	427	116.67	1,829.88
1	Agriculture Sources: Animal Husbandry: Horses	3	head	0	0	0	58	1.6	1	0.14	1.74
1	Agriculture Sources: Animal Husbandry: Sheep	440	head	0	0	0	3,681	102.69	85	23.1	125.79
1	Agriculture Sources: Fertilizer: Synthetic	1,658	pound N	0	0	0	0	0	16	4.28	4.28
1	Direct Transportation Sources: University Fleet: B5 Fleet	26	US gallon	252	0.25	0.01	0	0	0	0	0.25
1	Direct Transportation Sources: University Fleet: Diesel Fleet	20,529	US gallon	208,616	208.62	0	1	0.02	1	0.17	208.81
1	Direct Transportation Sources: University Fleet: Gasoline Fleet	32,740	US gallon	278,261	278.26	0	15	0.42	10	2.69	281.37
1	On-Campus Stationary Sources: Natural Gas	47,173	MMBtu	2,495,939	2,495.94	0	249	6.94	5	1.37	2,504.25
1	Cogeneration: Natural Gas	55,725	MMBtu	2,948,404	2,948.40	0	294	8.2	6	1.61	2,958.22
1	On-Campus Stationary Sources: Solar - Electric (RECs owned)	293,161	kWh	0	0	0	0	0	0	0	0
1	Cogeneration: Wood Chips	21,870	short ton	0	0	35,855.55	120,999	3,375.87	1,613	440.44	3,816.31
1	Refrigerants & Chemicals: HCFC-22	9	kilogram	0	0	0	0	0	0	0	17.23
1	Refrigerants & Chemicals: R-404a	9	kilogram	0	0	0	0	0	0	0	42.36
2	Electricity, Steam, and Chilled Water: Electricity	45,233,573	kWh	12,645,260	12,645.26	0	1,149	32.06	164	44.81	12,722.13
3	Commuting: Faculty Commuting: Automobile	840,061	vehicle mile	273,782	273.78	0	15	0.42	10	2.64	276.84
3	Commuting: Faculty Commuting: Bike	217,257	passenger mile	0	0	0	0	0	0	0	0
3	Commuting: Faculty Commuting: Carpool	115,871	passenger mile	18,882	18.88	0	1	0.03	1	0.18	19.09
3	Commuting: Faculty Commuting: Electric Vehicle	28,968	passenger mile	1,222	1.22	0	0	0	0	0	1.23
3	Commuting: Faculty Commuting: Public Bus	43,451	passenger mile	2,835	2.84	0	0	0	0	0	2.84
3	Commuting: Faculty Commuting: Walk	202,773	passenger mile	0	0	0	0	0	0	0	0
3	Commuting: Staff Commuting: Automobile	1,743,804	vehicle mile	568,318	568.32	0	31	0.87	20	5.49	574.67
3	Commuting: Staff Commuting: Bike	450,984	passenger mile	0	0	0	0	0	0	0	0
3	Commuting: Staff Commuting: Carpool	240,525	passenger mile	39,194	39.19	0	2	0.06	1	0.38	39.63
3	Commuting: Staff Commuting: Electric Vehicle	60,131	passenger mile	101	0.1	0	0	0	0	0	0.1
3	Commuting: Staff Commuting: Public Bus	90,197	passenger mile	5,885	5.88	0	0	0	0	0.01	5.89
3	Commuting: Staff Commuting: Walk	420,918	passenger mile	0	0	0	0	0	0	0	0
3	Commuting: Student Commuting: Automobile	1,328,473	vehicle mile	432,959	432.96	0	24	0.66	15	4.18	437.8
3	Commuting: Student Commuting: Bike	1,282,664	passenger mile	0	0	0	0	0	0	0	0
3	Commuting: Student Commuting: Carpool	412,285	passenger mile	67,183	67.18	0	4	0.1	2	0.65	67.93
3	Commuting: Student Commuting: Electric Vehicle	45,809	passenger mile	39	0.04	0	0	0	0	0	0.04

3	Commuting: Student Commuting: Public Bus	137,428	passenger mile	8,967	8.97	0	0	0	0	0.01	8.97
3	Commuting: Student Commuting: Walk	1,374,283	passenger mile	0	0	0	0	0	0	0	0
3	Directly Financed Outsourced Travel: Air: Faculty / Staff	5,850,019	passenger mile	2,532,074	2,532.07	0	0	0	29	8	2,540.08
3	Directly Financed Outsourced Travel: Ground: Personal Mileage Reimbursement	1,185,706	vehicle mile	386,430	386.43	0	21	0.59	14	3.73	390.75
3	Electricity, Steam, and Chilled Water: T&D Losses	45,233,573	kWh	707,707	707.71	0	64	1.79	9	2.51	712.01
3	Solid Waste: Landfilled Waste: CH4 Recovery and Flaring	937	short ton	0	0	0	17,240	480.99	0	0	480.99
3	Wastewater: Central Treatment System: Aerobic + Anaerobic Digestion	129,815,262	US gallon	0	0	0	2,479	69.18	715	195.27	264.45
3	FERA Mobile: University Fleet: B5 Fleet	26	US gallon	0	0	0	0	0	0	0	0
3	FERA Mobile: University Fleet: Diesel Fleet	20,529	US gallon	0	0	0	0	0	0	0	0
3	FERA Mobile: University Fleet: Gasoline Fleet	32,740	US gallon	0	0	0	0	0	0	0	0
3	FERA Stationary: Natural Gas	102,898	MMBtu	692,230	692.23	0	54,193	1,511.98	7	1.99	2,206.20
3	FERA Stationary: Solar - Electric	293,161	kWh	6,513	6.51	0	0	0	0	0	6.51
3	FERA Stationary: Wood Chips	21,870	short ton	0	0	0	0	0	0	0	0
3	Food	485,859	kg	1,989,035	1,989.04	0	0	0	0	0	1,989.04

FY2019

Scope	Source	Quantity	Unit	CO2 (kg)	CO2 (MTCDE)	CH4 (kg)	CH4 (MTCDE)	N2O (kg)	N2O (MTCDE)	GHG MTCDE
N/A	Sinks: Compost: Agricultural Waste	17	short ton	-4,944	-4.94	0	0	0	0	-4.94
N/A	Sinks: Compost: Dining Waste	7	short ton	-1,935	-1.93	0	0	0	0	-1.93
1	Agriculture Sources: Animal Husbandry: Beef Cows	228	head	0	0	16,984	473.84	108	29.46	503.3
1	Agriculture Sources: Animal Husbandry: Dairy Cows	279	head	0	0	57,778	1,612.01	408	111.28	1,723.30
1	Agriculture Sources: Animal Husbandry: Horses	4	head	0	0	77	2.14	1	0.17	2.31
1	Agriculture Sources: Animal Husbandry: Sheep	859	head	0	0	7,184	200.44	164	44.84	245.27
1	Agriculture Sources: Fertilizer: Synthetic	901	pound N	0	0	0	0	9	2.32	2.32
1	Direct Transportation Sources: University Fleet: Diesel Fleet	23,877	US gallon	242,643	242.64	1	0.02	1	0.2	242.86
1	Direct Transportation Sources: University Fleet: Gasoline Fleet	34,319	US gallon	291,676	291.68	16	0.44	10	2.82	294.94
1	On-Campus Stationary Sources: Natural Gas	79,278	MMBtu	4,194,620	4,194.62	418	11.67	8	2.29	4,208.58
1	Refrigerants & Chemicals: HCFC-22	1	kilogram	0	0	0	0	0	0	1.78
1	Refrigerants & Chemicals: R-404a	12	kilogram	0	0	0	0	0	0	55.76
2	Electricity, Steam, and Chilled Water: Electricity	48,850,992	kWh	16,260,291	16,260.29	1,507	42.04	222	60.49	16,362.82
3	Commuting: Faculty Commuting: Automobile	951,808	vehicle mile	323,956	323.96	18	0.49	11	3.13	327.58
3	Commuting: Faculty Commuting: Bike	133,848	passenger mile	0	0	0	0	0	0	0
3	Commuting: Faculty Commuting: Carpool	193,336	passenger mile	32,902	32.9	2	0.05	1	0.32	33.27
3	Commuting: Faculty Commuting: Public Bus	14,872	passenger mile	972	0.97	0	0	0	0	0.97
3	Commuting: Faculty Commuting: Walk	48,334	passenger mile	0	0	0	0	0	0	0
3	Commuting: Staff Commuting: Automobile	2,244,403	vehicle mile	763,901	763.9	42	1.16	27	7.38	772.44
3	Commuting: Staff Commuting: Bike	315,619	passenger mile	0	0	0	0	0	0	0
3	Commuting: Staff Commuting: Carpool	455,894	passenger mile	77,584	77.58	4	0.12	3	0.75	78.45
3	Commuting: Staff Commuting: Public Bus	35,069	passenger mile	2,291	2.29	0	0	0	0	2.29
3	Commuting: Staff Commuting: Walk	113,974	passenger mile	0	0	0	0	0	0	0
3	Commuting: Student Commuting: Automobile	1,026,605	vehicle mile	349,413	349.41	19	0.53	12	3.38	353.32
3	Commuting: Student Commuting: Bike	384,977	passenger mile	0	0	0	0	0	0	0
3	Commuting: Student Commuting: Carpool	288,733	passenger mile	49,136	49.14	3	0.07	2	0.47	49.69
3	Commuting: Student Commuting: Public Bus	32,081	passenger mile	2,096	2.1	0	0	0	0	2.1
3	Commuting: Student Commuting: Walk	1,475,744	passenger mile	0	0	0	0	0	0	0