

**GREENHOUSE GAS EMISSIONS INVENTORY
FOR
THE UNIVERSITY OF WYOMING
Fiscal Year 2015**

By
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For

**The Campus Sustainability Committee of the
University of Wyoming**

And

**The American College and University Presidents Climate
Commitment**

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Abstract

UW conducts a Greenhouse Gas (GHG) Inventory as part of its commitments as a signatory to the American College and University Presidents Climate Commitment (ACUPCC), which UW President Tom Buchanan signed in the fall of 2007.

This document is a narrative report based on the GHG Emissions Inventory of the University of Wyoming (UW) for the Fiscal Year (FY) 2015. The inventory data is included in Appendix A and includes all fiscal years up to the current year.

Version 8.0 of the Campus Carbon Calculator developed by Clean Air Cool Planet was used for this year's calculations.

UW emitted a net total of 101,512.4 metric tons of eCO₂ during FY 2015, an 18.8% decrease from FY 2014 (125,009.0 metric tons). Since a different version of the calculator was used this year, the total emission rates are slightly different from previous years. The small change in total eCO₂ may be due to updates made to the calculator.

Acknowledgements

Apart from my efforts, the success of this project depends largely on the encouragement and guidelines of many others. I take this opportunity to express my gratitude to the people who have been instrumental for the completion of this project. In particular, my greatest appreciation goes to my supervisors, Matt Peterson, Design Engineer at Facilities Engineering, and Nicole Korfanta, Director, Ruckelshaus Institute. I thank you for your tremendous support.

Introduction

American College and University Presidents Climate Commitment (ACUPCC)

The ACUPCC was organized in the fall of 2006 and is supported by the Association for the Advancement of Sustainability in Higher Education (AASHE), ecoAmerica and Second Nature. The purpose of this organization is to address global climate change by engaging institutions of higher education to commit to neutralizing their (GHG) emissions.

In September 2007, UW President Tom Buchanan signed onto this organization, joining 152 other presidents and chancellors representing higher education institutions across the United States. Signatories to the commitment pledge to complete a series of steps to eliminate their campuses' greenhouse gas emissions and increase sustainability over time.

These steps are to:

- Complete an annual emissions inventory
- Choose from a designated list of immediate or short-term actions to reduce GHG emissions
- Complete a Climate Action Plan within two years of signing to achieve carbon neutrality
- Integrate sustainability into the curriculum
- Make the Climate Action Plan, inventory and progress reports publicly available

Greenhouse Gas Emissions Inventories

A GHG Emissions Inventory is an accounting of the amount of GHGs emitted to or removed from the atmosphere over a specific period of time from a spatially and conceptually defined entity—in this case the University of Wyoming. Conducting a GHG Emissions Inventory provides a measurement by which an institution can monitor the effects of its efforts on GHG emissions.

There are numerous emissions inventory calculators used by governments, businesses, schools and others around the globe. However, the goal to provide a numerical value for an entity's role in contributing to global climate change is still the same. Almost all GHG emissions calculators convert emissions and energy use data into Carbon Dioxide equivalent units, or eCO₂. An eCO₂ is calculated based on its Global Warming Potential (GWP), which is the ratio of warming that would result from 1 kg of any GHG to x kg of CO₂ in a fixed period of time. The GWP ratio is the Radiative Forcing (RF) of a given substance being emitted in relation to the RF of CO₂ which, based on wavelength and lifetime, determines the degree to which the gas traps the sun's energy. For instance, the GWP of Methane (CH₄) is 25, so 1 molecule of CH₄ warms the planet to a similar extent as 25 molecules of CO₂ meaning that emitting 1 kg of CH₄ is equivalent to emitting 25 kg of CO₂. This methodology allows for a standardized unit of comparison between various gases and facilitates meaningful comparisons both within and among measuring entities (IPCC 2007).

“As a nationally recognized leader in sustainability, the University of New Hampshire draws on the Sustainability Institute to act as convener, cultivator and champion of sustainability on campus, in the state and region, and around the world. UNHSI began managing CarbonMAP in 2014, taking it over from the nonprofit Clean Air-Cool Planet (CA-CP). UNHSI had worked with CA-CP from 2000-2001 to create the pre-cursor to CarbonMAP, the Campus Carbon Calculator, when it undertook one of the first campus-wide GHG inventories to be ever completed and published” (About Us).

Physical and Temporal Boundaries

The physical boundaries of this inventory are extended beyond the main campus to include off-campus property owned by UW within the state of Wyoming. The ACUPCC requires participating institutions to calculate and report emissions in periods of one year, either calendar, fiscal, or academic. This inventory calculates and reports data according to the fiscal year (July 1, 2014 through June 30, 2015).

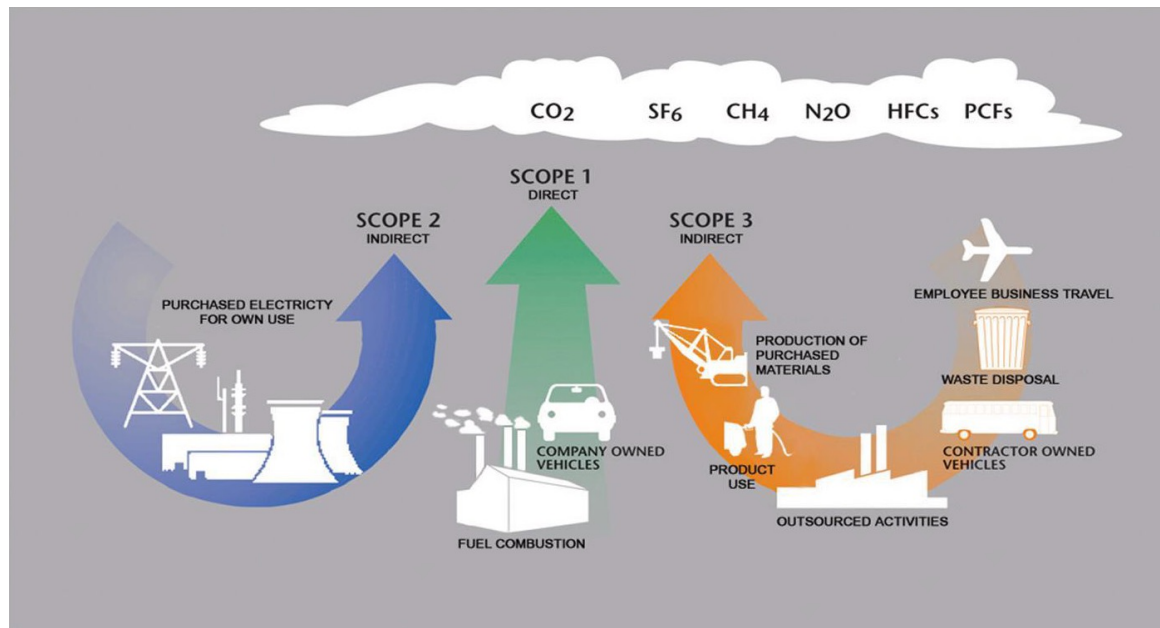
Methodology for Collection of Data

UW student Jay Quintanilla, with direction and oversight from the University’s Campus Sustainability Committee, conducted the FY 2015 GHG emissions inventory for UW. Data was collected from the main campus and off-campus properties and then entered into version 8.0 of the Clean-Air Cool-Planet Campus Carbon Calculator (CCC). In FY 2015, all prior year data was reentered into this version of the CCC and recalculated to ensure a consistent historical comparison.

When collecting data, the intern verified with campus sources whether or not the data included or excluded properties outside of the main campus to avoid missing information or double counting. In the event the data provided did not include UW property outside of the main campus, satellite properties were contacted for the remaining data, which was then aggregated, with the main campus data before being entered into the CCC spreadsheet for calculation. The resulting data sets include on campus and off campus sources. Appendix C shows each emission data category and the source from which each was obtained.

The ACUPCC identifies three scopes of emissions that the data categories of the CCC inventory calculator fall into:

- Scope 1 emissions are direct GHG emissions from sources either owned or controlled by the institution.
- Scope 2 emissions are indirect emissions that are generated in the production of electricity, steam, and chilled water.
- Scope 3 refers to all other indirect emissions that occur as a consequence of activities of the university from sources not owned or controlled by the university.



Scope 2: Emissions from utility production not at the institution

Scope 1: Emissions from the direct activities of the campus

Scope 3: Indirect emissions including transportation, waste disposal, etc.

Source: Clean Air Cool Planet at www.cleanair-coolplanet.org

Emission data and institutional data obtained for UW are explained below. Also, data requiring more in depth analysis is explained.

Budget

For this inventory, data concerning the University budget is divided into three categories: operational budget, research dollars, and energy budget. It is important to note that the data for these three categories were collected separately from different entities on campus. The operational budget includes the entire energy budget as well as some of the funds used for research; therefore, the energy budget must be subtracted from the operational budget to ensure that it is not counted twice, and this fact must be noted when interpreting data outcomes. Furthermore, the CA-CP calculator instructs users to include the combined costs of purchased electricity, chilled and steamed water, and any other purchases for the production of On-Campus Stationary sources of energy (i.e., heating, cooling, etc.). Therefore, UW's current energy budget includes purchased electricity, coal, propane, and natural gas. Water is not included because the water used and purchased by the university does not go towards energy production.

Research funds are separate monetary awards or grants to the University for Specific Research Projects. The research money included in the operational budget is a much lower amount that primarily covers personnel costs, which the additional research money does not cover, so there is no double-counting.

All three budget categories include data from UW's satellite locations and properties. The operational budget would include any costs that are associated with new building or facility upgrades, including satellite buildings financed by UW.

Building Space

Data regarding total building space was taken from the campus master building list. Square footage for total building research space was obtained from UW Real Estate Operations and excludes satellite building space with utilities not paid for by the University.

The demolition of old buildings and addition of new buildings each year effectively alters the building space numbers. Research space was included in total building space. This is not considered double counting because the two numbers are graphed separately and this inclusion follows the CA-CP calculator guide.

Other On-Campus Stationary Sources

UW does not co-generate, hence this data falls under the Other On-Campus Stationary sources category. When calculating and converting total emissions in Metric Tons (MT) of eCO₂ from original units, the CA-CP calculator automatically combines the components of on-campus stationary into one total figure of MT eCO₂.

Transportation

The University of Wyoming buys and provides gasoline and diesel for its own fleet.

Refrigeration

The refrigerants used for FY 2015f were HFC-134a, R-404a, and HCFC-22.

Electricity

UW purchased 98% of its electricity from Rocky Mountain Power and 2% from Carbon Power & Light. The college does not purchase any steam or chilled water.

Commercial Air Travel

Commercial air travel mileage data has been recorded from FY98 to the present (in the form of dollars paid) by Accounts Payable at the University of Wyoming. This information was tracked through departmental receipts kept on record. In order to estimate the total airline miles, Accounts Payable receipts under \$100 that had information designating them as a travel reimbursement for something other than airline travel were disregarded.

From the fiscal year 1998 to the fiscal year 2008 the following method was applied. To estimate total airline miles traveled, a random sample of 40 flight receipts was used. The average miles flown per ticket for the 40 flights was calculated and multiplied by the total number of flights

found through Accounts Payable. This yielded the estimated total amount of commercial airline miles flown.

For the fiscal year 2009 to the fiscal year 2014 the following method was applied. The cost per mile for commercial airline travel in FY15 was obtained from the Airlines for America Organization's website¹. The total cost for each FY was found out (extrapolation was used for some of the years) and then the miles travelled were estimated using the cost-per-mile graph. This method was chosen because it does not ignore any data, unlike previous years that relied on a sample of flight receipts.

For fiscal year 2015, the previous total cost/cost per mile method was updated by subtracting a fixed baggage fee (\$12.51) and reservation fee (\$10.57) for each account payable data entry. The fixed fee rate and cost per mile data was obtained from the Airlines for America Organization's website¹.

Private Air Travel

The University of Wyoming owns two private planes—the N2UW and the N200UW. The miles travelled for FY 2015 were obtained for both aircrafts.

Solid Waste

UW solid waste generated is taken to a landfill where there is no CH₄ recovery.

Results & Discussion

In FY 2015 the University of Wyoming emitted a gross total of 101,512.4 metric tons of eCO₂. This is an 18.8% decrease in emissions from FY 2014's net total of 125,009.0 metric tons of eCO₂.

The diagram shows the overall trend in UW's net emissions, by source, from 2003 to 2015.

¹ <http://airlines.org/data/annual-round-trip-fares-and-fees-domestic/>

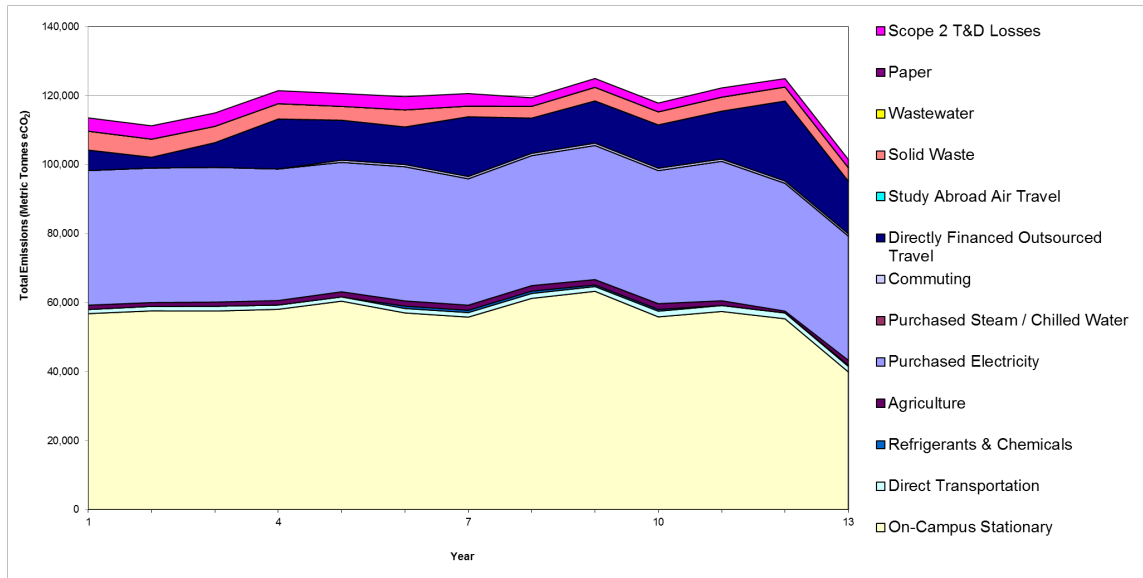


Figure 1: UW greenhouse gas emissions by source, 2003 – 2015, reported as metric tons of eCO₂.

The major sources of eCO₂ emission for UW are on-campus stationary sources, purchased electricity, and directly financed air travel (Figure 1).

The net decrease in GHG emission during FY15 was due to overall decreases in Scope 1, Scope 2, and Scope 3 sources. Emissions from purchased electricity also continue to decrease as a percentage of overall emissions due to implementation of energy efficiency projects that reduce building consumption on a per square foot basis. The most significant reduction in eCO₂ emissions for FY 15 is a direct result of switching from coal to natural gas for on-campus stationary sources (Figure 2). This switch resulted in an estimated decrease of 14274 MT eCO₂ from FY 15 levels (Figure 3).

Fiscal Year	Natural Gas	LPG (Propane)	Coal (Steam Coal)
	MMBtu	Gallons	Short Tons
2007	107,146	6,841	25,864
2008	113,269	8,867	24,510
2009	113,076	6,416	23,749
2010	120,815	5,418	27,137
2011	102,949	6,565	27,529
2012	89,637	6,712	25,269
2013	84,566	6,876	26,255
2014	119,494	8,117	24,282
2015	213,460	4,892	14,165

Figure 2. Fuel sources for on campus stationary sources FY14-FY15

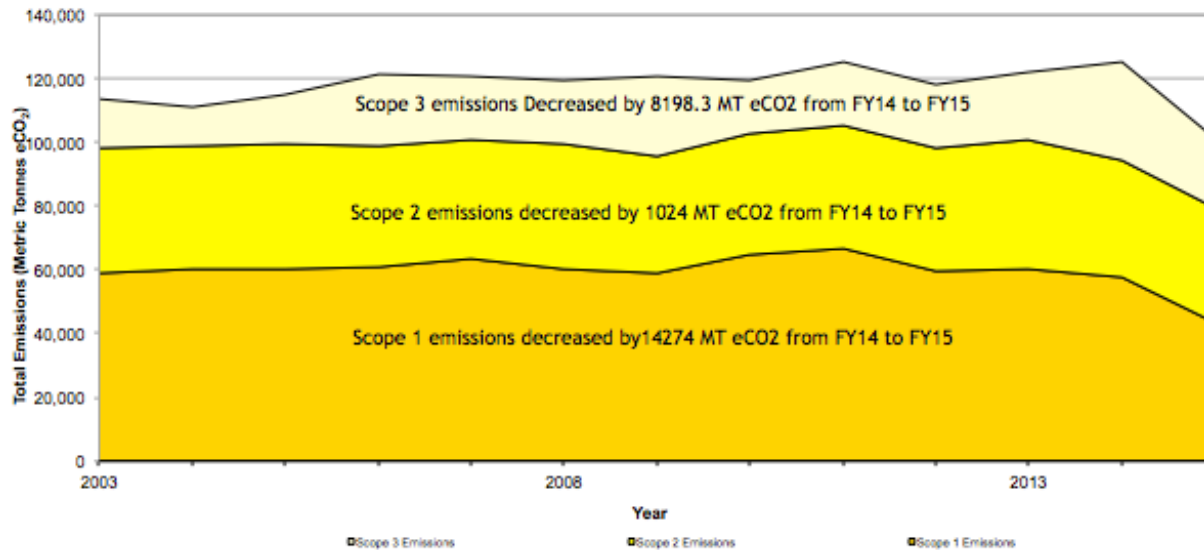


Figure 3. Total emissions for each Scope 1, 2, and 3.

Scope 2 T&D losses deal with the transmission and distribution losses associated with purchased utilities such as electricity, chilled water, steam etc. Since UW only purchases electricity, the emissions from this come only from the purchased electricity. If UW does decide to purchase other utilities then Scope 2 T&D losses would be much higher, while Scope 1 emissions would decline. This will be discussed later.

The highest GHG contributor for FY15 was Other On-Campus Stationary, with an overall contribution of 40.27%, followed by purchased electricity (36.34%), and directly financed air travel (14.71%) (Figure 2). Other sources contributed to less than 9% of the emissions for 2015.

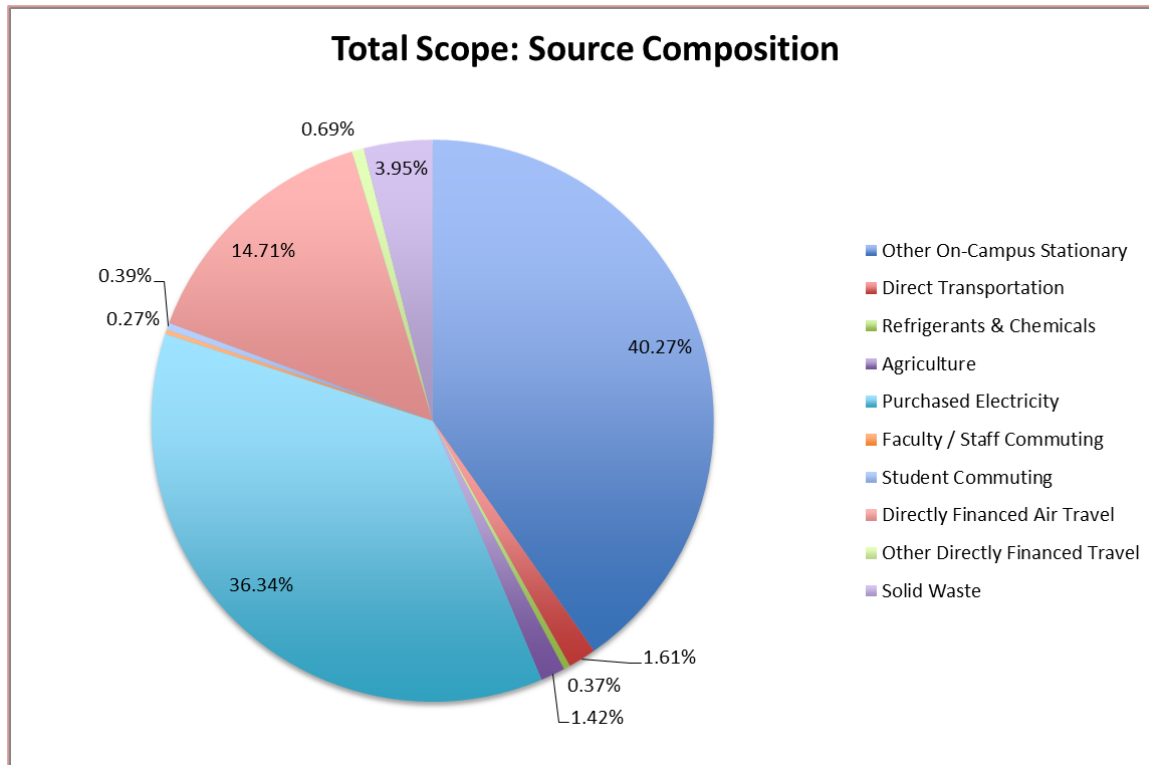


Figure 2: FY 2015 percentage contributions to UW's total GHG emissions by source

Some of the data that were input into the calculator do not affect the results of this report, including the budget, population, research space, and building space. Those are included primarily for explaining trends in emissions. For example, if the building space increased drastically during a fiscal year then it would make sense that emissions increased as more electricity and other utilities would be used. Hence it can be used for individual research purposes to see if there are any trends between particular statistics and increased emissions.

Recommendations

The University of Wyoming signed the ACUPCC to demonstrate its commitment to reducing GHG emissions in a way that is compatible with the economy of the state and the university. The Campus Sustainability Committee, through the Climate Action Plan, has devised ways to achieve that goal. Additional recommendations to reduce emissions include:

- Updating the accounts payable airfare reporting system to include actual miles traveled will greatly improve the accuracy of emission inventory.
- Continue efforts on the implementation of building automation systems. Examples include but are not limited to the installation of VFDs, lighting control systems, digital controls, scheduling, temperature set points and monitoring.
- Transition fuel usage at the Central Energy Plant from coal to natural gas, as long as economically feasible.

- Pursue satellite boiler and chiller plants, which would utilize efficient modular boilers and chillers.

There continue to be financial reasons why the University of Wyoming uses fossil fuels to generate On Campus Stationary energy. In such cases, there can be a balance between being environmentally friendly and financially viable. A very important sheet in the calculator is the one titled EF_eCO2. This gives a summary of the emission factor for every source and is very helpful if one wants to consider replacing a particular source or to increase the use of another.

Appendix A: Major Sources of Emission in Metric Tons eCO2

Fiscal Year	Agriculture	On-Campus Stationary	Purchased Electricity	Solid Waste	Directly Financed Airfare	Direct Transportation
	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2
2002	1653	53626	36513	6543	5306	1100
2003	1268	56832	39018	5473	5939	1191
2004	1089	57635	39011	5258	3113	1312
2005	1216	57584	39071	4737	7149	1375
2006	1312	58089	38127	4443	14490	1234
2007	1489	60445	37523	4014	11577	1231
2008	1515	57037	38891	4938	10902	1292
2009	1469	55819	36650	3095	17323	1313
2010	1597	61250	37678	3406	10217	1427
2011	1553	63308	38872	3944	12242	1375
2012	1672	55896	38587	3779	12566	1645
2013	1350	57453	40419	4064	13893	1726
2014	511	55340	37050	4064	23195	1669
2015	1404	39926	36026	3913	15266	1600

Works Cited

About Us. (2016). *Campuscarbon.com*. Retrieved 10 May 2016, from <http://campuscarbon.com/About.aspx>