GREENHOUSE GAS EMISSIONS INVENTORY FOR THE UNIVERSITY OF WYOMING: Fiscal Year 2014

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For

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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 the 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) 2014. The inventory data is included in Appendix A and includes all fiscal years up to the current year.

Version 6.9 of the Campus Carbon Calculator developed by Clean Air Cool Planet was used for this year's calculations.

UW emitted a net total of 127,478.0 metric tons of eCO_2 during FY 2014, a 5.38% increase from FY 2013 (120,975.9 metric tons). Since a different version used in this year, the corresponding numbers are different from previous years. This small overall eCO_2 increment is mainly due to the increase of directly financed air travel. Air travel mileages were calculated using the estimated travel costs, so the potential exists for a margin of error.

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 the supervisor Mr. Jim Scott and the Deputy Director of the Physical Plant Mr. Forrest 'Frosty' Selmer. 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 that represented higher education institutions across the United States. Signatories to the commitment are pledging 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 in use 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 eCO_2. An eCO_2 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 CO_2 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 CO_2 which, based on wavelength and lifetime, determines the degree to which the gas traps the sun's energy. For instance, the GWP of Methane (CH_4) is 25, so 1 molecule of CH_4 warms the planet to a similar extent as 25 molecules of CO_2 meaning that emitting 1 kg of CH_4 is equivalent to emitting 25 kg of CO_2. This methodology allows for a standardized unit of comparison between various gases and facilitates meaningful comparisons both within and among measuring entities (IPCC 2007).

The calculator recommended for and used by the vast majority of the ACUPCC signatories, including UW, is the **Campus Carbon Calculator (CCC),** which also uses eCO_2.[1] The CCC was developed by Clean-Air Cool Planet (CA-CP) through a project completed by the University of New Hampshire based on workbooks of the International Panel on Climate Change (IPCC). It is a Microsoft Excel-based spreadsheet tool customized to account for the main emission sources on college and university campuses, including on-campus energy production, purchased electricity, transportation, waste, agriculture, and refrigerants (CA-CP 2008).

Physical and Temporal Boundaries

The physical boundaries of this inventory were 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, 2012 through June 30, 2014).

Methodology for Collection of Data

The FY 2014 GHG emissions inventory for UW was conducted by UW student Divantha Ekanayake, with direction and oversight from the University's Campus Sustainability Committee. Data was collected from the main campus and off campus properties and then entered into version 6.9 of the Clean-Air Cool-Planet Campus Carbon Calculator (CCC). In FY 2014, 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 emissions 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.

Emissions data and institutional data obtained for UW is 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 does include the entire energy budget as well as some of the funds used for research.

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.

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 eCO_2 from original units, the CA-CP calculator automatically combines the components of on-campus stationary into one total figure of MT eCO_2.

Transportation

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

Refrigeration

The refrigerant used for FY 2014 was only HFC-134a.

Electricity

UW purchases most of its electricity from Rocky Mountain Power and some 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 money 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 were 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 2009 to the fiscal year 2014 the following method was applied. A graph containing the real cost per mile versus the year for commercial airline travel was obtained. The total cost for each FY was found out (extrapolation was used for some of the years) and then using the graph the miles travelled was calculated. This method was chosen as it did not ignore any data.

Private Air Travel

The University of Wyoming owns two private planes – namely the N2UW and the N200UW. The miles travelled for FY 2014 was obtained for both aircrafts.

Solid Waste

The solid waste generated is taken to a landfill where there is no CH_4 recovery.

Results & Discussion

In FY 2014 the University of Wyoming emitted a gross total of 127,478.0 metric tons of eCO_2. This is an increase in emissions from FY 2013's net total of 120,975.9 metric tons of eCO_2. The net difference of 6,503 metric tons is an increase equivalent 5.38%.

The diagram shows the overall trend in UW's net emissions, by source, from 2003 to 2020 projections.

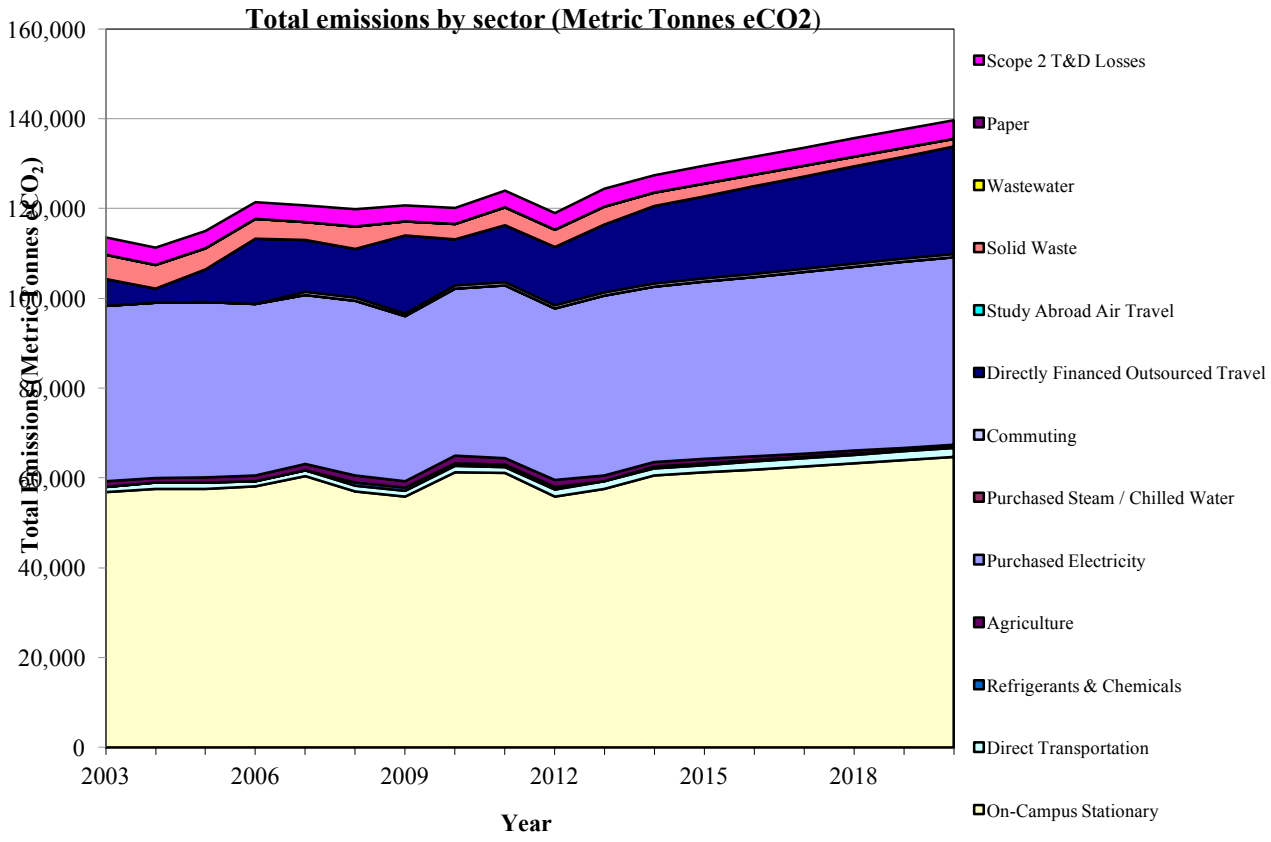


Figure 1: UW greenhouse gas emissions by source, 2003 – 2014, reported as metric tons of eCO_2.

As the above figure shows, the major sources of eCO_2 emission for UW are directly financed air travel, purchased electricity and other on-campus stationary sources.
Here is a look at how much the emissions from sources compared to the last fiscal year:

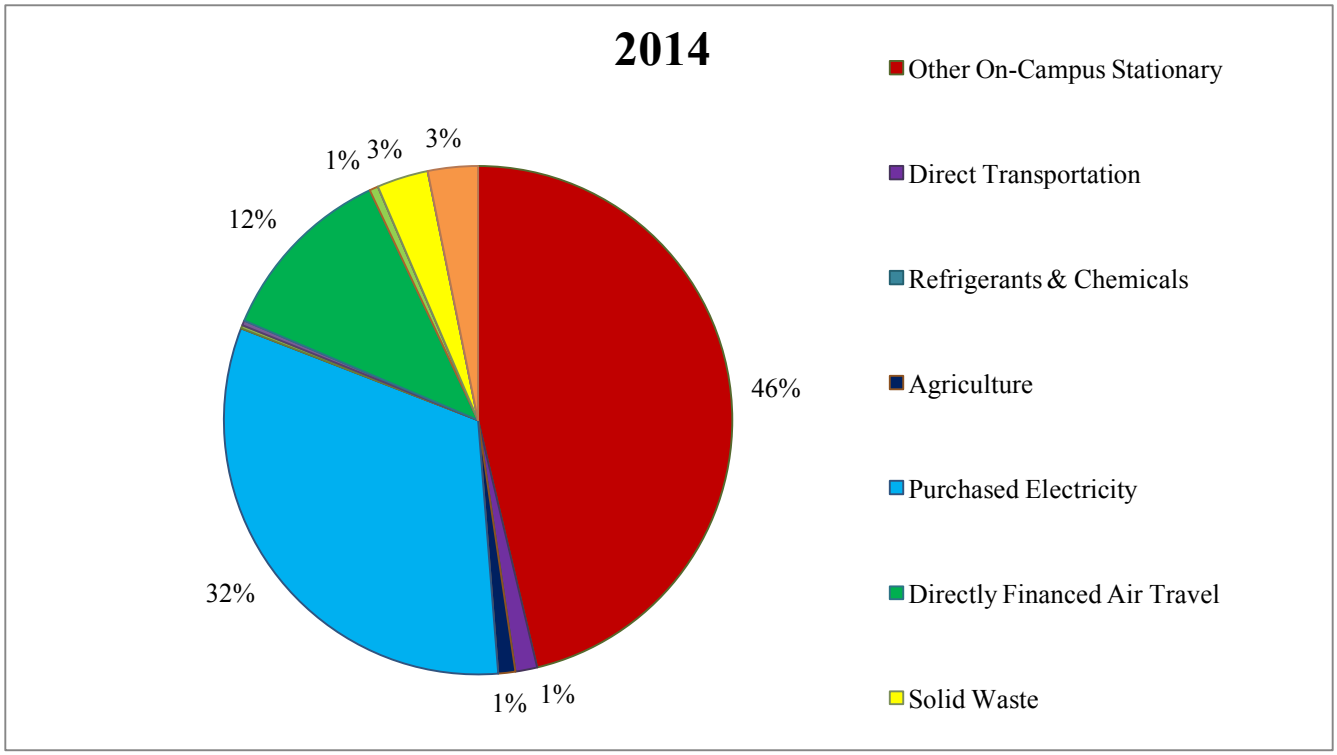
- Directly financed air travel stayed constant at 12%
- Purchased electricity stayed constant at 32%
- Other on-campus stationary sources decreased by 4%
- Solid Waste stayed constant at 3%
- Agriculture stayed constant at 1%
- Direct transportation decreased by 1%

Directly financed air travel has made a major impact in the overall emissions. On Campus Stationary also impacted the overall emissions increase. Conversely, emissions from Electricity 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 other sources did not have a major impact; however, since the other sources emitted less than 1000 metric tons of eCO_2 their effect would be negligible.

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 the former, the emissions from this come only from the purchased electricity. If UW does decide to purchase other utilities then obviously it would be much higher. But then, the emissions from scope 1 would go down. This will be discussed later.

The pie-chart below gives a visual on the contributions by each source for the emission of metric tons of eCO_2 for the fiscal year of 2014. The highest contributor for the year was the other on-campus stationary with an overall contribution of 46%, followed by the purchased electricity (32%) and directly financed air travel (12%). This means the other sources contributed to less than 10% of the emissions for 2014.

Figure 2: FY 2014 percentage contributions to UW's total GHG emissions by source



Some of the data that was input into the calculator do not affect the results of this report. This includes the budget, population, research space and building space. Those are included primarily for comparison purposes. 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

UW signed the ACUPCC to demonstrate its commitment to reducing GHG emissions, and to play a role in preserving the environment. The Campus Sustainability Committee, through the Climate Action Plan, has devised ways to achieve that goal. However, since we have been working on this report for a couple of months, here are a couple of recommendations that the university should consider to reduce its emissions:

- Carbon Power & Light (CP&L) has a coal content of 67.8% while for Rocky Mountain Power (RMP) it is 30.43%. Economically, RMP is cheaper as it charges 8.5c per hour[3] and CP&L has a charge of 10c per hour[4]. Where there is a choice, it would be a better option to use RMP instead of CP&L.
- Out of all the refrigerants used, R404a has the highest emissions factor per pound. Unfortunately, its use has increased over the last couple of years. Refrigerants such as RS-50 have been developed to replace R404a because of its high global warming potential and it is an option to be considered.[5]
- A system where methane recovery is present in the landfilled waste would reduce GHG emissions instead of the current system where it is buried underground.[6] Recovery of methane would mean it will not be in the land and later exerted into the air. In addition, the methane obtained could be used for energy purposes on campus.

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

	Directly financed air travel	Purchased electricity	Other on-campus stationary sources	Solid Waste	Agriculture	Direct transportation
2001	165.7	38822.28	60008.22		1,617.0	1086.19
2002	5,305.8	36524.01	53626.30	6543.46	1,652.8	1100.36
2003	5,939.3	39029.81	56832.38	5473.10	1,267.8	1191.29
2004	3,113.2	39022.33	57634.55	5258.38	1,089.2	1312.17
2005	7,148.9	39081.94	57584.43	4736.91	1,216.3	1374.74
2006	14,490.1	38138.48	58089.25	4443.18	1,311.9	1234.18
2007	11,577.5	37622.20	60444.54	4013.73	1,488.8	1230.82
2008	10,902.1	38993.91	57036.99	4938.30	1,514.6	1291.51
2009	17,323.2	36752.57	55818.94	3095.35	1,468.8	1312.74
2010	10,216.9	37290.58	61249.56	3406.28	1,596.9	1427.32
2011	11,983.0	38472.17	61098.20	3944.48	1,553.4	1374.96
2012	12,244.1	38190.24	55827.49	3779.49	1,672.1	1644.47
2013	14,411.5	37102.67	57549.03	3800.60	1,350.0	1725.93
2014	16,514.1	39032.50	60505.10	3077.30	1,006.0	1643.70