GREENHOUSE GAS EMISSIONS INVENTORY FOR THE UNIVERSITY OF WYOMING: Update, Fiscal Year 2010

by

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And

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Abstract

This document is a narrative report based on the Greenhouse Gas (GHG) Emissions Inventory of the University of Wyoming (UW) for the Fiscal Year (FY) 2010. The inventory data is included in Appendix A and includes all fiscal years up to the current year. UW emitted a net total of 121,707 metric tons of CO_{2e} during FY 2010, a 1% increase from FY 2009. Most of the calculated emissions haven't changed drastically from the previous year except for building space. The minimal increase/decrease in emissions for other sources throughout this period have resulted from changes in the university's population, new construction projects, and fluctuations in weather/temperature, which have led to fluctuations in energy used for heating and additions to data categories in the inventory.

Version 6.4 of the Campus Carbon Calculator developed by Clean Air Cool Planet was used for this year's calculations.

UW conducts a 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.

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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 not only to commit to neutralizing their Greenhouse Gas (GHG) emissions, but to realize their unique ability and responsibility in advancing research and education to their students and communities that will provide society with the tools it needs to address all dimensions of global climate change. 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 GHG 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, GHG Emissions 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 (e.g., UW). 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 CO_{2e}. A CO_{2e} 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 CO_{2e}. 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).

Global Climate Change

The ACUPCC and its required GHG Emissions Inventory is a mechanism to address global climate change through awareness of an institution's emissions. The amount of anthropogenically released GHGs, primarily CO_2, has dramatically increased since pre-industrial times. Current levels of 380 ppm of CO_2 in the atmosphere exceeds historical variations of 180-300 ppm, as does the rate of global temperature rise. GHGs trap solar radiation in the atmosphere, keeping the planet at a hospitable global average temperature. However, when the concentration of GHGs gets too high and too much solar radiation is trapped, the temperature can increase, resulting in changes to global climate patterns (Allali et al. 2007). Human activities have greatly increased the concentration of GHGs in the atmosphere by emitting GHGs through activities such as the burning of fossil fuels for electricity production and transportation.Mitigation actions by colleges and universities to decrease anthropogenic GHG emissions into the atmosphere can set an example for other public and private entities.

Greenhouse Gas Emissions Inventory

Methodology

The FY 2010 GHG emissions inventory for UW was conducted by UW students, Jeff Wenke and Chris Michael, with direction and oversight from the University's Campus Sustainability Committee. Data was collected from the main campus and off campus properties then entered into version 6.4 of the Clean-Air Cool-Planet Campus Carbon Calculator (CCC). In FY09, all prior year data was reentered into this version of the CCC and recalculated to ensure a consistent historical comparison. Several new emissions sources are included beginning with version 6.4, including transportation and distribution losses for steam, water and electricity.

When collecting data, interns 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 D 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. These sources include on-campus stationary fossil fuel combustion, fossil fuel combustion by institution-owned or controlled vehicles, and fugitive emissions. Fugitive emissions are either intentional or unintentional GHG emissions, including Hydrofluorocarbons from refrigeration and air conditioning equipment and CH_4 from institution owned livestock.

- Scope 2 emissions are indirect emissions that are generated in the production of electricity, which is consumed by the university.
- 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.

ACUPCC signatories must report on Scope 1 and 2 emissions, as well as some Scope 3 emissions, including commuting and air travel paid for by or through the university. Emissions data requiring more in depth explanation is detailed below.

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, but 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 dollars are not included in the operational budget. 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. Future interns should ensure this is still the case when collecting data on UW's budget.

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.

On-Campus Stationary

When calculating and converting total emissions in Metric Tons (MT) of CO_{2e} from original units, the CA-CP calculator automatically combines the components of on-campus stationary sources (currently including coal, natural gas and propane) into one total figure of MT CO_{2e}. In order to calculate and convert the individual components of on-campus stationary

sources into MT of CO_{2e}, a separate spreadsheet was used. The emissions factors are approximations showing the amount of MT of CO_{2e} per given unit of an individual emission source (e.g., MT of CO_{2e} per Short Ton of coal). These emissions factors from the calculator were multiplied by the amount of each on-campus stationary source in its own unit of measure to determine their individual contributions to UW's GHG emissions. The separate calculations, which are included in Appendix C, will provide valuable information to UW in evaluating progress toward energy reduction goals included in the University's Climate Action Plan.

Commercial Air Travel

Commercial airline miles were first calculated by finding the total number of flights paid for by the University. This information was either tracked through departmental receipts kept on record by Accounts Payable or on receipts from UW employee debit cards, called the Procurement Card, or P-Card. A new account code for flight purchases was implemented at the beginning of FY 2010 (July 1, 2009) by Accounts Payable, which began separating flight receipts from travel reimbursements. Although the new coding system has reduced some of the inaccuracies from previous year's inventories, results are thought to be still slightly equivocal.

In order to estimate the total airline miles, Accounts Payable and P-Card receipts under $100 that had information designating them as a travel reimbursement for something other than airline travel were disregarded. 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 and the P-Card. This yielded the estimated total amount of commercial airline miles flown for FY 2010. This method is consistent with the method used for calculating commercial air travel for previous fiscal years for the purposes of this inventory.

Due to the P-Card dataset not containing destinations within the information, the sample was only taken from the Accounts Payable flight receipts because the P-Card data does not include destinations so flight mileage could not be determined. Until flight records are tracked by mileage from both Accounts Payable and the P-Card, commercial air travel will remain a derived estimate.

Physical and Temporal Boundaries

The physical boundaries of this emissions inventory 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 through June 30).

UW Inventory

The American College and University Presidents Climate Commitment (ACUPCC) recommends that colleges and universities utilize the CCC to conduct their emissions inventory, although this recommendation is not a requirement since some signatories have already completed emissions inventories utilizing different calculators. Additionally, some institutions

are enrolled in programs such as the Chicago Climate Exchange or the California Climate Action Registry, that require emissions be calculated in a specific manner. In light of this, signatories are allowed to use any emissions inventory calculator that is "consistent with the standards of the Greenhouse Gas Protocol" (Dautremont-Smith 2007). The CCC is designed specifically for colleges and universities. It is the most common inventory tool for colleges and universities, facilitating comparability and consistency. For these reasons, the CCC v6.4 is the calculator used for the UW GHG emissions inventory.

The main input fields and data sources are listed in Appendix A. Some of the categories are entered solely for reporting and comparison purposes. For instance, the budget data includes input fields for the operating budget, research dollars, and energy budget. This information does not impact the emissions calculations, but is used to generate reports and graphs comparing the budget data to emissions. Likewise, population and physical size are not themselves used in the calculator to determine emissions. Rather, the information is used to generate reports such as per capita emissions.

Findings

During FY 2010, the University of Wyoming emitted a gross total of 121,716 metric tons of CO_{2e}. Subtracting 9 metric tons CO_{2e} of offsets gives a net total of 121,707 metric tons of CO_{2e}. This is an increase in emissions from FY 2009's net total of 120,238 metric tons of $CO_{2e.}$ The net difference of 1469 metric tons is an increase equivalent to 1%. More detail addressing differences in the distribution of the sources of these emissions will be explained later in this section. **Figure 1** shows the overall trend in UW's net emissions, by source, from 1997-2010.

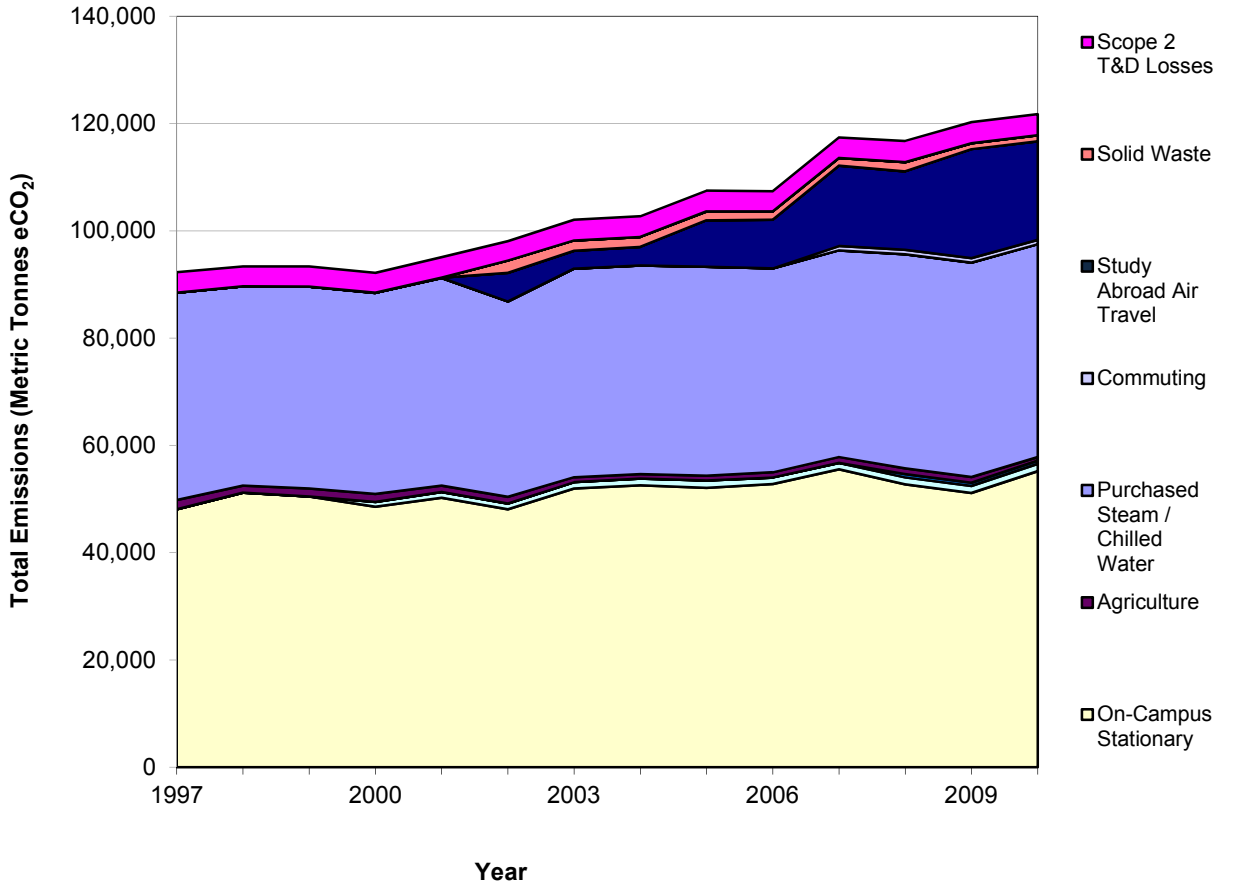

Figure 2. UW greenhouse gas emissions by source, 1997 – 2010, reported as metric tons of CO_{2e}.

The amount of purchased electricity decreased 0.8% from FY 2009 to FY 2010. On-campus stationary emissions increased approximately 7.9% from FY 2009 to FY 2010. The CA-CP calculator defines on-campus stationary sources as energy sources that generate emissions on campus for the production of heat, cooling, cooking and other campus uses. UW's current on-campus stationary sources include coal, natural gas and propane, with coal being the largest emitter and propane being the smallest. Please see Appendix A for the individual unit amounts before they were converted to CO_{2e} and combined into the total on-campus stationary value. The amount of on-campus stationary is up quite a bit from last year but this could be due to abnormally warm winter last year compared to the past few years.

Transportation decreased 8% from last year although student population is up from last year. Emissions of flights have decreased 10.5% from FY 2009 to FY 2010 This is likely due to better airline flight record keeping.

Agriculture has dropped substantially from last year, but this is due to smaller amount of livestock currently at the University. Solid waste is steady from last year. Both of these sources are rather insignificant relative to UW's total emissions. The same value for refrigerants was used from the previous year because of a lack of tracking information.

The percentage of emissions from each CA-CP category source is shown in **Figure 2** to provide a visual breakdown of UW's contributions to GHGs. The CA-CP combines components for some categories of UW's emissions sources. Both transportation and on-campus stationary

emissions consist of multiple components, as described previously for **Figure 1**. Electricity (33%), stationary (45%), and air travel (15%), are the major contributors to $C0_{2e}$ GHG emissions at UW. This distribution is consistent with other colleges and universities that have completed an emissions inventory.

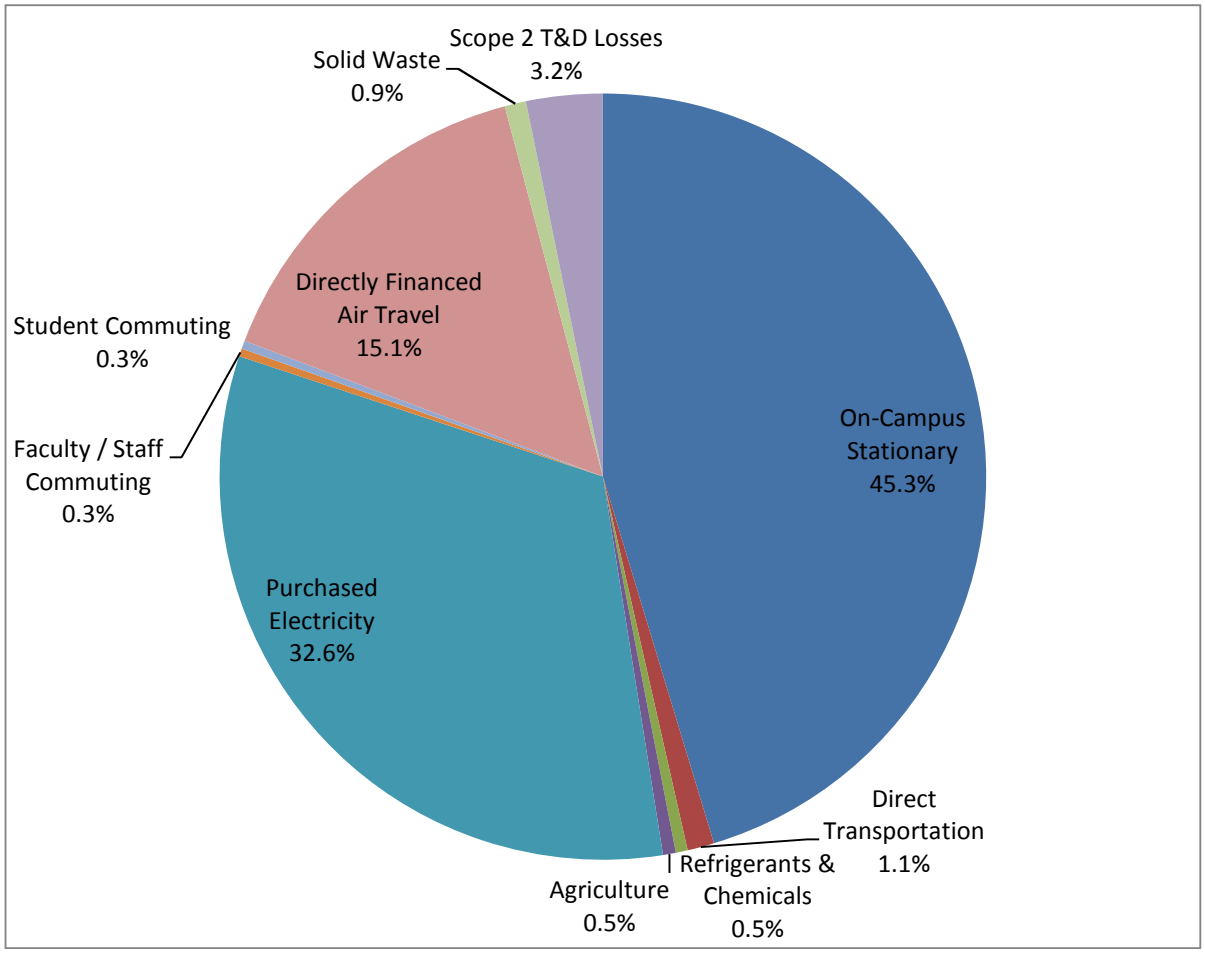

Figure 2. FY2010 percentage contributions to UW's total GHG emissions by source.

Figure 3 shows a percentage breakdown of the components for transportation emissions. As shown, air travel contributes 89% of the total transportation emissions.

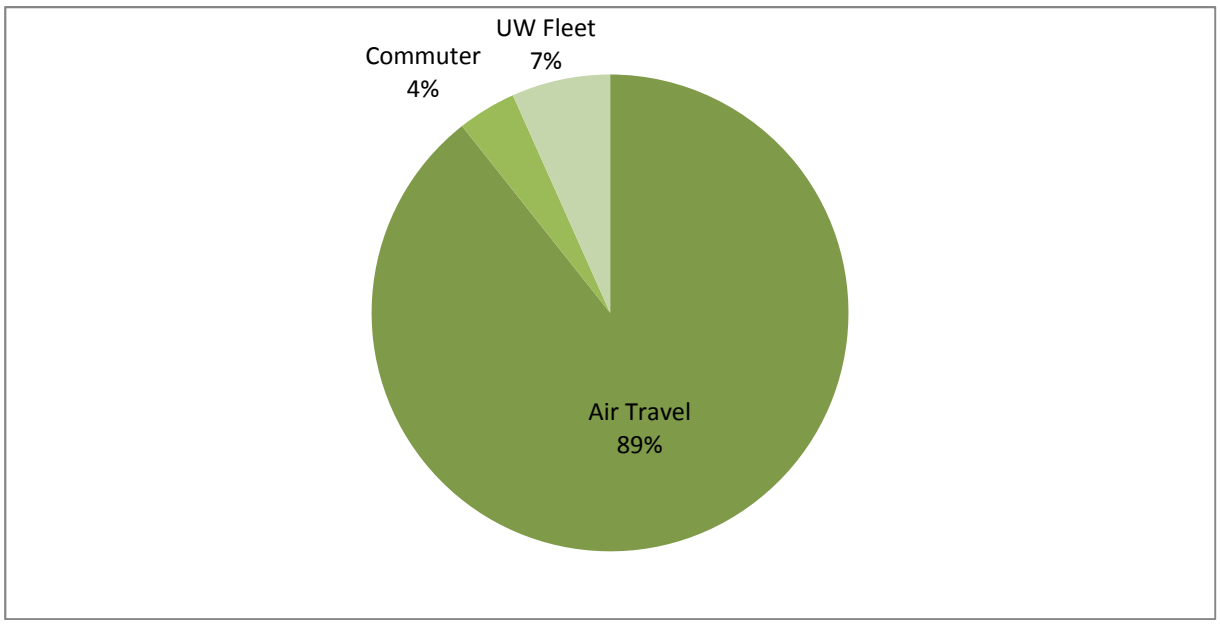

Figure 3. FY 2010 percentage contributions to UW's transportation emissions.

Recommendations

Upon completing the UW GHG inventory for FY 2010, the following recommendations suggest how the inventory may be expanded and/or improved in the future. These recommendations are aimed at improving accuracy of information and comprehensiveness of the report.

- Devising a methodology for including paper purchasing and wastewater treatment should be investigated to improve the accuracy for the net emissions total.
- Customization to conditions at UW should continue to be investigated so that the Custom Fuel Mix feature of the CCC can be used. It is recommended that the heat content value of coal specific to UW's Central Energy Plant be utilized.
- A commuter survey, designed to gather data required for the GHG inventory, should be conducted in FY12. Due to the current and ongoing expansion of the University shuttle system, as well as the fact that a commuter survey has not been conducted since 2007, we recommend another survey be conducted to update data and trends. The GHG Protocol tool CO_2 Emissions from Employee Commuting v. 2.0 (WRI 2006) contains an MS Excel-based survey. This employee survey could be modified for students, faculty, and staff at UW and dispersed electronically to the UW community.
- To produce a more accurate total airline mileage, it is suggested that the P-Card receipts also list departing location and destination. Including whether the flight was one-way or round-trip will also help to reduce inaccuracies within the survey.

References

Allali A, Bojariu R, Diaz S, Elgizouli I, Griggs D, Hawkins D, Hohmeyer O, Jallow BP, Kajfez-Bogata L, Leary N, Lee H, Wratt D, editors . 2007. Climate change 2007: synthesis report. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 52p.

Clean Air-Cool Planet (CA-AP). 2008. Campuses for climate action program. [cited in 2008 March 5]. Available from http://www.cleanair-coolplanet.org.

Appendix A: GHG Emissions Inventory CA-CP Calculator Data Sheets

(Note: FY 2007 was the first year UW conducted a GHG inventory and historical data was collected to provide a ten year analysis period. In some cases data was accessible for FYs prior to 1997, the earliest being 1990. Data is shown from the earliest year collected and recorded to provide for as much trend analysis as possible. Blanks indicate missing/unknown data, as opposed to 0, which indicates no (known) quantity exists for UW.

Fiscal Year	Institutional Data		
	Budget - Click here to enter data		
	Operating Budget	Research Budget	Energy Budget
	$ (2005)	$ (2005)	$ (2005)
1990	$ 289,436,453.73	$ 45,736,941.27	$ -
1991	$ 291,085,909.64	$ 43,708,913.63	$ -
1992	$ 290,181,923.52	$ 48,165,018.06	$ -
1993	$ 289,027,487.74	$ 47,488,988.77	$ -
1994	$ 278,022,127.79	$ 47,065,356.97	$ -
1995	$ 292,056,382.77	$ 48,086,686.20	$ -
1996	$ 290,334,318.50	$ 50,200,351.77	$ -
1997	$ 297,420,629.18	$ 52,119,267.94	$ -
1998	$ 284,950,396.53	$ 52,614,587.19	$ -
1999	$ 294,453,656.47	$ 52,371,002.73	$ -
2000	$ 279,010,407.58	$ 51,434,616.88	$ -
2001	$ 285,009,871.45	$ 54,284,187.96	$ 917,755.77
2002	$ 281,575,319.39	$ 55,119,266.45	$ 844,576.18
2003	$ 298,209,967.18	$ 57,355,268.22	$ 3,241,245.66
2004	$ 289,699,510.95	$ 62,194,621.67	$ 3,416,943.89
2005	$ 302,707,265.99	$ 63,369,136.61	$ 3,817,988.13
2006	$ 290,117,383.97	$ 65,182,135.63	$ 3,895,617.49
2007	$ 312,922,558.64	$ 64,219,403.70	$ 4,201,420.68
2008	$ 320,367,758.14	$ 65,555,944.79	$ 4,854,003.46
2009	$ 384,380,857.19	$ 73,609,890.33	$ 5,812,932.39
2010	$ 385,057,632.88	$ 90,602,343.23	$ 6,321,280

Fiscal Year	Institutional Data				
	Population				
	Full Time Students	Part-Time Students	Summer School Students	Faculty	Staff
	#	#	#	#	#
1990	8797	4723	3474	612	1920
1991	8682	4921	3877	613	1920
1992	8698	4761	3761	635	1920
1993	8584	4474	3466	600	1920
1994	8551	4076	3241	591	2073
1995	8564	3953	3106	635	2073
1996	8412	3477	2700	626	2035
1997	8354	3524	2622	620	2035
1998	8139	3336	2579	615	2024
1999	8230	3315	2536	612	2024
2000	8111	3223	2488	606	1926
2001	8147	3628	2831	596	1926
2002	8435	4037	3098	604	1907
2003	8580	4208	3171	612	1907
2004	8610	4384	3204	624	2122
2005	8744	4287	3369	643	2122
2006	8620	4306	3106	651	2182
2007	8659	3606	3080	**1115**	**1750**
2008	8798	4,172	2,811	1,044	1,736
2009	8,960	4,144	4,028	1,090	1,803
2010	9,407	4,060	4,326	1,151	1,735

Fiscal Year	Institutional Data	
	Physical Size	
	Total Building Space	Total Research Building Space
	Square feet	Square feet
1990	6,366,700	1,147,299
1991	6366700	1,147,299
1992	6366700	1,147,299
1993	6511900	1,148,091
1994	6544146	1,149,529
1995	6653146	1,149,529
1996	6718146	1,171,187
1997	6718146	1,171,187
1998	6718652	1,171,693
1999	6718652	1,171,693
2000	6718652	1,171,693
2001	6796102	1,172,597
2002	6799145	1,172,597
2003	6802745	1,172,597
2004	6813324	1,172,597
2005	6925267	1,224,617
2006	6913471	1,224,617
2007	7068817	1,218,098
2008	7208817	797,032
2009	7249000	807,648
2010	7450000	810,000

Fiscal Year	On-Campus Stationary		
	Other On-Campus Stationary Sources		
	Natural Gas	LPG (Propane)	Coal (Steam Coal)
	MMBtu	Gallons	Short Tons
1990			
1991			
1992			
1993			
1994			
1995			20233
1996			19443
1997	58,807		22717
1998	104,822		22995
1999	98,058		22892
2000	96,486		21963
2001	103,020		22787
2002	102,155		21864
2003	104,706		23958
2004	115,315		24097
2005	108,453		24059
2006	113,063		24297
2007	107,146	6,841	25864
2008	103,403	8,867	24510
2009	100,913	6,416	23,749
2010	118,180	5,418	27,137

Fiscal Year	Direct Transportation Sources	
	University Fleet	
	Gasoline Fleet	Diesel Fleet
	Gallons	Gallons
1990		
1991		
1992		
1993		
1994		
1995		
1996		
1997		
1998		
1999		
2000	81,930	12,987
2001	101,363	16,520
2002	99,005	19,805
2003	97,870	29,686
2004	103,370	36,341
2005	104,362	41,560
2006	96,069	34,851
2007	94,888	35,091
2008	98,304	38,386
2009	96,729	41,822
2010	99,441	50,511

Fiscal Year	Refrigerants & Chemicals		
	Refrigerants & Chemicals		
	HFC-134a	HFC-404a	HCFC-22
	Pounds	Pounds	Pounds
2008	33	190	390
2009	33	190	390
2010	33	190	390

Fiscal Year	Agriculture Sources	
	Fertilizer Application	
	Synthetic	% Nitrogen
	Pounds	%
2007	30,746	**21%**
2008	33,456	21%
2009	48,594	14.50%
2010	46,114	14.50%

Fiscal Year	Agricultural Resources					
	Animal Husbandry					
	Dairy Cows	Beef Cows	Swine	Goats	Sheep	Horses
	#	#	#	#	#	#
1990						
1991						
1992						
1993						
1994	152	1,168	346	0	1,559	11
1995	156	926	159	0	1,524	11
1996	163	858	199	0	1,855	11
1997	146	788	116	1	1,422	7
1998	0	909	99	1	1,189	6
1999	0	1,016	207	1	1,184	6
2000	0	1,023	268	1	1,142	6
2001	0	853	180	1	976	5
2002	0	880	238	1	850	4
2003	0	652	97	1	851	4
2004	0	537	143	1	788	4
2005	0	629	159	1	681	4
2006	0	646	128	0	964	4
2007	0	705	137	0	1,103	4
2008	0	728	92	0	1,118	3
2009	0	693	112	0	1,140	2
2010	0	763	116	0	1,190	2

Fiscal Year	--- Scope 2 Emissions Sources ---		
	Purchased Electricity, Steam, and Chilled Water		
	Electricity	Steam	Chilled Water
	CLICK TO SET eGRID SUBREGION	CLICK TO SET FUEL MIX	CLICK TO SET FUEL MIX
	kWh	MMBtu	MMBtu
1990			
1991			
1992	53,445,897	-	-
1993	53,941,369	-	-
1994	52,184,047	-	-
1995	56,167,979	-	-
1996	46,972,247	-	-
1997	60,338,399	-	-
1998	58,092,656	-	-
1999	58,793,723	-	-
2000	58,604,939	-	-
2001	60,436,600	-	-
2002	56,858,767	-	-
2003	60,759,668	-	-
2004	60,748,033	-	-
2005	60,840,819	-	-
2006	59,372,098	-	-
2007	63,602,733	-	-
2008	65,921,694	-	-
2009	66,024,455	-	-
2010	66,990,963	-	-

Fiscal Year	--- Scope 3 Emissions Sources ---							
	Commuting - click here to enter data							
	Faculty / Staff Commuting				Student Commuting			
	Automobile	Bus	Light Rail	Commuter Rail	Automobile	Bus	Light Rail	Commuter Rail
	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles
2007	972,468	21,476	-	-	747,978	332,366	-	-
2008	943,616	20,839	-	-	778,148	345,772	-	-
2009	981,972	21,686	-	-	788,730	350,474	-	-
2010	951,739	21,018	-	-	751,100	333,753	-	-

Fiscal Year	Directly Financed Outsourced Travel	
	Air Travel	
	Faculty / Staff	Students
	Miles	Miles
1990		
1991		
1992		
1993		
1994		
1995		
1996		
1997		
1998	16,100	
1999	66,240	
2000	36,000	
2001	78,433	
2002	6,903,773	
2003	4,291,792	
2004	4,506,532	
2005	11,167,532	
2006	11,722,533	
2007	19,351,563	
2008	18,877,452	
2009	26,170,530	
2010	24,612,175	

Fiscal Year	Non-Additional Renewable Energy Certificates (RECs)
	Green Power Certificates
	kWh
2006	
2007	
2008	16,200
2009	15,600
2010	14,800

Fiscal Year	Solid Waste
	Landfilled Waste
	No CH4 Recovery
	Short Tons
2000	
2001	
2002	2,111
2003	1,766
2004	1,696
2005	1,528
2006	1,433
2007	1,295
2008	1,593
2009	999
2010	1,099

Appendix B: GHG Emissions Inventory Data After Conversion to Metric Tons of CO2e

(Note: All amounts are in Metric Tons of CO2e)

Fiscal Year	Scope 1						
	Co-gen Electricity	Co-gen Steam	Other On-Campus Stationary	Direct Transportation	Electric Fleet	Refrigerants & Chemicals	Agriculture
	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2
1990	-	-	-	-	-	-	-
1991	-	-	-	-	-	-	-
1992	-	-	-	-	-	-	-
1993	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	2,279.0
1995	-	-	40,391.4	-	-	-	1,970.0
1996	-	-	38,649.0	-	-	-	1,968.1
1997	-	-	48,078.5	-	-	-	1,731.5
1998	-	-	51,173.5	-	-	-	1,291.6
1999	-	-	50,475.5	-	-	-	1,456.7
2000	-	-	48,575.0	861.7	-	-	1,476.7
2001	-	-	50,211.8	1,070.6	-	-	1,219.9
2002	-	-	48,082.2	1,082.8	-	-	1,246.1
2003	-	-	51,954.9	1,171.1	-	-	938.5
2004	-	-	52,530.5	1,288.7	-	-	813.0
2005	-	-	52,094.1	1,350.1	-	-	901.7
2006	-	-	52,796.9	1,208.5	-	-	964.7
2007	-	-	55,540.3	1,200.4	-	-	1,088.5
2008	-	-	52,744.4	1,264.1	-	601.1	1,103.0
2009	-	-	51,133.1	1,284.6	-	601.1	1,074.5
2010	-	-	55,163.2	1,375.5	-	601.1	669.4

Fiscal Year	Scope 2	
	Purchased Electricity	Purchased Steam / Chilled Water
	MT eCO_2	MT eCO_2
1990	-	-
1991	-	-
1992	34,208.4	-
1993	34,525.5	-
1994	33,400.7	-
1995	35,950.6	-
1996	30,064.9	-
1997	38,619.9	-
1998	37,182.5	-
1999	37,631.3	-
2000	37,510.4	-
2001	38,682.8	-
2002	36,392.8	-
2003	38,889.6	-
2004	38,882.1	-
2005	38,941.5	-
2006	38,001.5	-
2007	38,522.6	-
2008	39,927.1	-
2009	39,989.4	-
2010	39,676.9	-

Scope 3									
Fiscal Year	**Faculty / Staff Commuting**	**Student Commuting**	**Directly Financed Air Travel**	**Other Directly Financed Travel**	**Study Abroad Air Travel**	**Solid Waste**	**Wastewater**	**Paper Purchasing**	**Scope 2 T&D Losses**
	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2			MT eCO_2
1990	-	-	-	-	-	-	-	-	-
1991	-	-	-	-	-	-	-	-	-
1992	-	-	-	-	-	-	-	-	3,383.2
1993	-	-	-	-	-	-	-	-	3,414.6
1994	-	-	-	-	-	-	-	-	3,303.4
1995	-	-	-	-	-	-	-	-	3,555.6
1996	-	-	-	-	-	-	-	-	2,973.4
1997	-	-	-	-	-	-	-	-	3,819.6
1998	-	-	13.1	-	-	-	-	-	3,677.4
1999	-	-	52.9	-	-	-	-	-	3,721.8
2000	-	-	28.0	-	-	-	-	-	3,709.8
2001	-	-	60.9	-	-	-	-	-	3,825.8
2002	-	-	5,359.7	-	-	2,288.7	-	-	3,599.3
2003	-	-	3,331.9	-	-	1,914.3	-	-	3,846.2
2004	-	-	3,498.6	-	-	1,839.2	-	-	3,845.5
2005	-	-	8,669.8	-	-	1,656.8	-	-	3,851.4
2006	-	-	9,100.6	-	-	1,554.1	-	-	3,758.4
2007	398.1	386.5	15,023.3	-	-	1,403.9	-	-	3,809.9
2008	386.3	402.0	14,655.3	-	-	1,727.3	-	-	3,948.8
2009	402.0	407.5	20,317.1	-	-	1,082.7	-	-	3,955.0
2010	399.4	419.7	18,381.4	-	-	1,105.5	-	-	3,924.1

	Offsets	
Fiscal Year	**Additional**	**Non-Additional**
	MT eCO_2	MT eCO_2
1990	-	-
1991	-	-
1992	-	-
1993	-	-
1994	-	-
1995	-	-
1996	-	-
1997	-	-
1998	-	-
1999	-	-
2000	-	-
2001	-	-
2002	-	-
2003	-	-
2004	-	-
2005	-	-
2006	-	-
2007	-	-
2008	-	(9.8)
2009	-	(9.4)
2010	-	(9.1)

Fiscal Year	Total Scope 1	Total Scope 2	Total Scope 3	Biogenic	Total Offsets	Total Emissions	Net Emissions
	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2
1990	-	-	-	-	-	-	-
1991	-	-	-	-	-	-	-
1992	-	34,208.4	3,383.2	-	-	37,591.6	37,591.6
1993	-	34,525.5	3,414.6	-	-	37,940.1	37,940.1
1994	2,279.0	33,400.7	3,303.4	-	-	38,983.1	38,983.1
1995	42,361.4	35,950.6	3,555.6	-	-	81,867.6	81,867.6
1996	40,617.1	30,064.9	2,973.4	-	-	73,655.4	73,655.4
1997	49,810.0	38,619.9	3,819.6	-	-	92,249.5	92,249.5
1998	52,465.1	37,182.5	3,690.5	-	-	93,338.1	93,338.1
1999	51,932.3	37,631.3	3,774.6	-	-	93,338.1	93,338.1
2000	50,913.4	37,510.4	3,737.8	-	-	92,161.7	92,161.7
2001	52,502.4	38,682.8	3,886.7	-	-	95,071.8	95,071.8
2002	50,411.1	36,392.8	11,247.6	-	-	98,051.5	98,051.5
2003	54,064.5	38,889.6	9,092.4	-	-	102,046.5	102,046.5
2004	54,632.2	38,882.1	9,183.3	-	-	102,697.7	102,697.7
2005	54,345.9	38,941.5	14,177.9	-	-	107,465.4	107,465.4
2006	54,970.1	38,001.5	14,413.1	-	-	107,384.6	107,384.6
2007	57,829.2	38,522.6	21,021.7	-	-	117,373.5	117,373.5
2008	55,712.6	39,927.1	21,119.7	-	(9.8)	116,759.5	116,749.7
2009	54,093.3	39,989.4	26,164.3	-	(9.4)	120,247.0	120,237.6
2010	57,809.3	39,676.9	24,230.1	-	(9.1)	121,716.4	**121,707.3**

Appendix C: Emissions Factors for On-Campus Stationary

	Natural Gas		
Fiscal Year	kg CO_2 / MMBtu	kg CH_4 / MMBtu	kg N_2O / MMBtu
1990	52.75574094	0.005275	0.0001055
1991	52.75574094	0.005275	0.0001055
1992	52.75574094	0.005275	0.0001055
1993	52.75574094	0.005275	0.0001055
1994	52.75574094	0.005275	0.0001055
1995	52.75574094	0.005275	0.0001055
1996	52.75574094	0.005275	0.0001055
1997	52.75574094	0.005275	0.0001055
1998	52.75574094	0.005275	0.0001055
1999	52.75574094	0.005275	0.0001055
2000	52.75574094	0.005275	0.0001055
2001	52.75574094	0.005275	0.0001055
2002	52.75574094	0.005275	0.0001055
2003	52.75574094	0.005275	0.0001055
2004	52.75574094	0.005275	0.0001055
2005	52.75574094	0.005275	0.0001055
2006	52.75574094	0.005275	0.0001055
2007	52.75574094	0.005275	0.0001055
2008	52.75574094	0.005275	0.0001055
2009	52.75574094	0.005275	0.0001055
2010	52.75574094	0.005275	0.0001055

	Propane		
Fiscal Year	kg CO_2 / gallon	kg CH_4 / gallon	kg N_2O / gallon
1990	5.415527764	0.000910565	5.46339E-05
1991	5.399094438	0.000907802	5.44681E-05
1992	5.414033825	0.000910314	5.46189E-05
1993	5.390273168	0.000905793	5.43476E-05
1994	5.433622564	0.000913077	5.47846E-05
1995	5.409394889	0.000910063	5.46038E-05
1996	5.394464183	0.000907551	5.44531E-05
1997	5.392665554	0.000908305	5.44983E-05
1998	5.405368807	0.000907802	5.44681E-05
1999	5.414637998	0.000908305	5.44983E-05
2000	5.385505759	0.000906044	5.43626E-05
2001	5.399094438	0.000907802	5.44681E-05
2002	5.394464183	0.000907551	5.44531E-05
2003	5.421503518	0.00091157	5.46942E-05
2004	5.404915677	0.00090931	5.45586E-05
2005	5.401773284	0.00090931	5.45586E-05
2006	5.401773284	0.00090931	5.45586E-05
2007	5.401773284	0.00090931	5.45586E-05
2008	5.401773284	0.00090931	5.45586E-05
2009	5.401773284	0.00090931	5.45586E-05
2010	5.401773284	0.00090931	5.45586E-05

Coal

Fiscal Year	kg CO_2 / Short Ton	kg CH_4 / Short Ton	kg N_2O / Short Ton
1990	1993.070709	0.22362835	0.033554851
1991	2014.94396	0.222816	0.03343296
1992	2019.153949	0.2222674	0.033350644
1993	1996.065832	0.2216555	0.03325883
1994	1983.055917	0.22080095	0.033130607
1995	1981.442818	0.220284	0.03305304
1996	1972.923156	0.2201785	0.03303721
1997	1964.608088	0.2197565	0.03297389
1998	1969.418218	0.22029455	0.033054623
1999	1963.476292	0.2196299	0.032954894
2000	1964.419455	0.2197354	0.032970724
2001	1949.611799	0.21807905	0.032722193
2002	1937.350683	0.21670755	0.032516403
2003	1922.825976	0.21508285	0.032272621
2004	1912.356869	0.2139118	0.032096908
2005	1912.356869	0.2139118	0.032096908
2006	1912.356869	0.2139118	0.032096908
2007	1912.356869	0.2139118	0.032096908
2008	1912.356869	0.2139118	0.032096908
2009	1912.356869	0.2139118	0.032096908
2010	1912.356869	0.2139118	0.032096908

Fiscal Year	eCO2		
	Natural Gas	LPG (Propane)	Coal (Steam Coal)
	MT eCO2 / MMBtu	MT eCO2 / gallon	MT eCO2 / Short ton
1990	0.0529083	0.0054526	2.008146397
1991	0.0529083	0.0054361	2.029964884
1992	0.0529083	0.0054511	2.03413789
1993	0.0529083	0.0054272	2.011008522
1994	0.0529083	0.0054708	1.997940998
1995	0.0529083	0.0054465	1.99629305
1996	0.0529083	0.0054315	1.987766276
1997	0.0529083	0.0054297	1.979422759
1998	0.0529083	0.0054424	1.984269161
1999	0.0529083	0.0054517	1.978282429
2000	0.0529083	0.0054224	1.979232704
2001	0.0529083	0.0054361	1.964313387
2002	0.0529083	0.0054315	1.951959812
2003	0.0529083	0.0054587	1.937325578
2004	0.0529083	0.005442	1.926777525
2005	0.0529083	0.0054388	1.926777525
2006	0.0529083	0.0054388	1.926777525
2007	0.0529083	0.0054388	1.926777525
2008	0.0529083	0.0054388	1.926777525
2009	0.0529083	0.0054388	1.926777525
2010	0.052908294	0.005438837	1.926777525

Appendix D: List of Contacts

Input	University of Wyoming Source
Institutional data	
Budget	
Operating	Budget Office
Research	Office of Research and Economic Development
Energy	Physical Plant
Population	Office of Institutional Analysis
Physical Size	Real Estate Operations & University Facilities Planning
Purchased electricity	Physical Plant
Purchased steam/chilled water	N/A
On-campus cogeneration plant	N/A
Stationary sources of emissions on campus	Physical Plant
University fleet	Fleet Services
Air travel	Accounts Payable
Commuting	Stantec Consulting survey
Agriculture	Various
Solid waste	Physical Plant
Refrigeration and other chemicals	Physical Plant
Offsets	Real Estate Operations and Physical Plant