California State Polytechnic University, Pomona

Greenhouse Gas Emissions Inventory Report

Update 2006-2009

(1995-2009)

Report Issue Date: November 2010

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The Climate Commitment Task Force wishes to thank all of those named in this report who contributed time and information to this inventory.

1.0 Executive Summary

This report summarizes Cal Poly Pomona's anthropogenic green house gas emissions for fiscal years 2006-2009. It is an update to the original report issued in November 2007, which was comprised of fiscal years 1995-2005. The inventory process is a first step towards quantifying the environmental impact of the University's Operations relative to greenhouse gas emissions. The inventory serves as a baseline and guide for future reduction strategies as Cal Poly Pomona moves toward the long-term goal of achieving carbon neutrality. Periodic updates of the document provide information regarding Cal Poly Pomona's progress toward this goal.

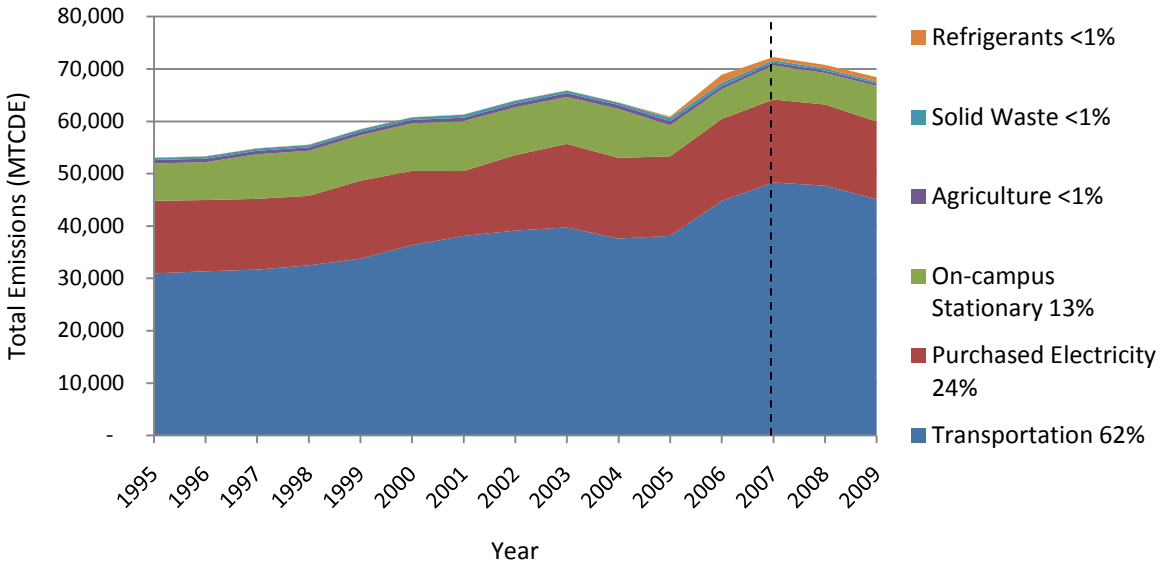
The report also identifies emissions reporting challenges specific to the institutional organization of the Cal Poly Pomona campus and offers some suggestions for improvement. By detailing these difficulties, the document is meant to inspire further refinements at Cal Poly Pomona while providing a useful account of the process to assist both future researchers and other institutions facing similar challenges. This updated report observes changes that have been made since the original research was done, and it proposes further modifications.

Cal Poly Pomona is committed to addressing the issue of climate change. As a Charter signatory of the American College & University Presidents' Climate Commitment, Cal Poly Pomona has agreed to proactively monitor and ultimately neutralize its green house gas emissions. The institution has also pledged to increase climate change research and educational curriculum focused on environmental sustainability. The inventory is an essential component for identifying emission sources. It is an integral part of the Climate Commitment and will continue to be periodically updated as additional data becomes available.

Cal Poly Pomona's greenhouse gas inventory reports emissions of the six greenhouse gasses covered under the Kyoto Protocol: Carbon Dioxide (CO_2), Methane (CH_4), nitrous oxide (N_20), hydro-fluorocarbons (HFC), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). Using a model built by Clean Air-Cool Planet, emissions are reported in Metric Tons Carbon Dioxide Equivalents (MTCDE). This value takes into account the Global Warming Potential (GWP) of the individual gases recorded and converts their forcing power into carbon dioxide equivalent values.

Greenhouse Gas Emissions by Sector at Cal Poly Pomona (MTCDE)

Source: CA-CP Campus Calculator, CPP Emissions Inventory 1995-2009

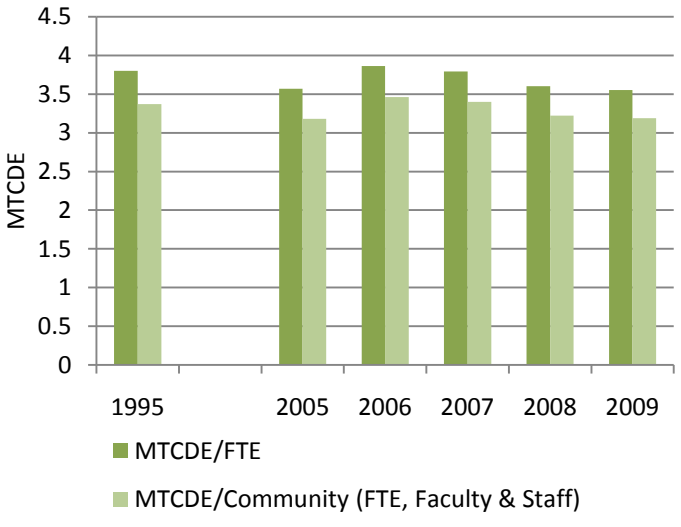


*Presidents' Climate Commitment signed in 2007

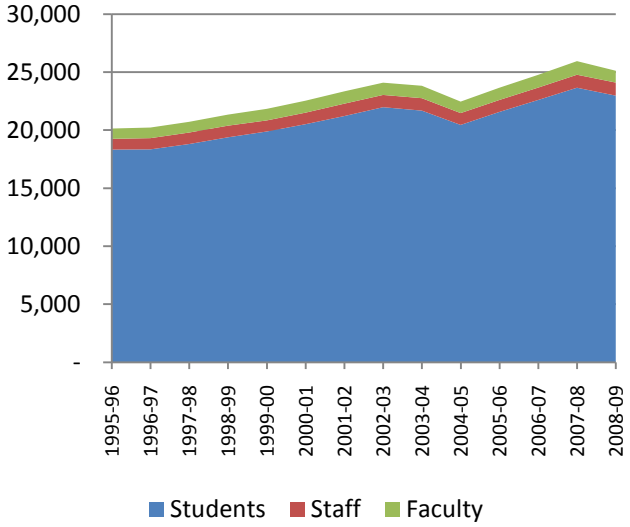
Inventory Results

- On an annual basis, Cal Poly Pomona has emitted an average of approximately 69,051 metric tons of Carbon Dioxide Equivalents (MTCDE) during 2006-2009.
- There was a net increase (+12%) in total emissions from 2005-2009 (60,231 MTCDE in 2005 to 67,283 MTCDE in 2009).
- Campus emissions have increased annually by 3.02% in the 2005-2009 period; however, this number may be misleading due to wide variation. Campus emissions appear to have peaked at 70,030 MTCDE in 2007, the year of the first publication of this inventory, with the greatest percentage increase (13.6%) occurring from 2005 to 2006. Emissions have fallen at an average of ~2.7% in the two years since.
- Emissions per FTE dropped from 3.8 MTCDE in 1995 to 3.57 MTCDE in 2005, and down slightly to 3.55 MTCDE per FTE in 2009.
- The full time student equivalent (FTE) population grew by an average of 2.3% per year from 13,799 in 1995 to 18,757 in 2009. FTEs increased in 2006 at 5.6% per year with a peak in 2007, but growth has slowed to an average of 0.2% per year since 2007.
- Building square footage increased 34% from 3,112,617 in 2005 to 4,167,374 in 2009.
- Transportation is the primary source of emissions at Cal Poly Pomona; emissions increased to 64% in 2009 from 60% in 2005.
- Student commuting is the largest source of emissions within the transportation category.
- Energy in the form of purchased electricity and natural gas are the second largest source of emissions.
- Emissions due to solid waste, agriculture, and refrigerants are negligible.

Emissions per FTE and per Community (MTCDE)



Campus Population



Executive Summary

Total CPP Greenhouse Gas Emissions in MTCDE:

Fiscal Year	Purchased Electricity	On-campus Stationary	Transportation						Ag.	Solid Waste	Refrig-erants	**Total Emissions**
			Fleet	Student Commuters	Faculty-Staff Comm.	Financed Travel	Air Travel	Study Abroad				**(MTCDE)**
1995	13,869	7,126	706	21,337	4,881	141	3,419	235	657	406	58	**52,835**
2005	15,194	5,932	1,051	23,745	5,182	149	3,644	2,174	764	609	283	**58,727**
2006	15,642	5,686	1,038	32,241	3,982	155	3,294	2,052	558	658	1,546	**66,852**
2007	15,855	6,517	939	34,088	4,020	164	3,475	2,822	538	435	609	**69,462**
2008	15,493	6,036	957	33,767	3,908	154	3,289	2,822	430	415	688	**67,959**
2009	14,834	6,803	925	31,954	3,622	150	3,218	2,630	451	361	869	**65,817**

Percent Change in Emissions per Source for 1995, 2005, & 2009:

Source	MTCDE			Total % Change			Average Annual % Change		
	1995	2005	**2009**	95-05	**05-09**	95-09	95-05	**06-09**	95-09
Purchased Electricity	13,869	15,194	**14,834**	10%	**-2%**	7.0%	1.3%	**-0.6%**	0.7%
On-campus Stationary	7,126	5,932	**6,803**	-17%	**15%**	-5%	-0.8%	**3.9%**	0.6%
Univ. Fleet	706	1,051	**925**	49%	**-12%**	31%	4.4%	**-3.1%**	2.3%
Student Commuters	21,337	23,745	**31,954**	11%	**35%**	50%	1.2%	**8.8%**	3.3%
Fac./Staff Commuters	4,881	5,182	**3,622**	6%	**-30%**	-26%	0.7%	**-8.1%**	-1.8%
Air Travel	3,419	3,643	**3,218**	7%	**-12%**	-6%	0.7%	**-2.9%**	-0.3%
Directly Financed Travel	141	149	**150**	6%	**0.7%**	6%	0.7%	**0.2%**	0.5%
Study Abroad	235	2,174	**2,630**	825%	**21%**	1019%	37.7%	**6.3%**	28.7%
Agriculture	657	764	**451**	16%	**-41%**	-31%	1.5%	**-11.4%**	-2.2%
Solid Waste	406	609	**361**	50%	**-41%**	-11%	5.1%	**-10.9%**	0.5%
Refrigerants	58	283	**869**	388%	**207%**	1398%	39%	**54%**	58%
Transp. & Distrib. Losses	1,372	1,503	**1,467**	10%	**-2%**	7%	1.3%	**-0.6%**	0.7%
Offsets (Composting)	(339)	(501)	**(658)**	48%	**31%**	94%	15%	**19%**	5%
Total Emissions	**53,868**	**59,728**	**66,626**	**10.9%**	**12%**	**24%**	**1.1%**	**3.0%**	**1.6%**

Sources of CPP's Emissions by percent for 1995, 2005, & 2009:

Source	% MTCDE		
	1995	2005	2009
Energy: Purchased Electricity	26%	25%	22%
Energy: On-campus Stationary Source	13	10	10
Transportation	57	60	64
Agriculture	1.2	1.3	<1
Solid Waste	<1	1.0	<1
Refrigerants	<1	<1	1.3
*Average percent of emissions per category over the 2006-2009 inventory period: Energy: Purchased electricity 22%, Energy: On-campus stationary source 9%, Transportation 61%, Agriculture <1%, Solid Waste <1%, Refrigerants 1%.			

Kg Emissions by Type of Gas for 1995, 2005, & 2009:

Source	1995	2005	2009
Carbon Dioxide (CO_2)	52,335,422	57,767,978	64,643,191
Methane (CH_4)	32,063	44,606	35,756
Nitrous Oxide (N_2O)	3,327	3,573	2,945
PFC	-	-	-
HFC	-	-	23
Sulfur Hexafluoride (SF_6)	-	-	-
*HCFC & CFC	34	166	449

*HCFCs and CFCs are not part of the six greenhouse gases specified by the Kyoto protocol; IPCC and US EPA protocol do not require them for reporting purposes.[1] Both families of compounds are in the process of being phased out under the Montreal Protocol.[2] As they constitute a significant portion of CPP's GHG emissions from refrigerants, this inventory includes both CFCs and HCFCs.

Key Findings and Recommendations

General

Key Finding

Net energy consumption and greenhouse gas emissions have increased since 2005. However, there is a defined peak in emissions in 2007, with GHG emissions declining across most sectors through 2009. Additionally, total GHG emissions produced from many sources have declined since 2005; the notable exception is the Transportation sector, which is the largest contributor to GHG emissions and which has continued to grow.

Transportation

Key Finding

Transportation is the primary source of GHG emissions at CPP. In 2005, transportation was 60% of CPP's total emissions, while it grew to be 64% of total emissions in 2009. The vast majority is attributed to student commuters. From 2005 to 2009, student commuters increased their emissions contribution from 23,745 to 31,954 MTCDE; in the same time period, emissions contributions from nearly all other transportation sources decreased.

Recommendations

1. Employ a digitalized and standardized process for recording mileage of airline travel on University (including Study Abroad), CPP Foundation, and ASI business. Data should be easily retrieved on a fiscal year basis with distinct data for Students and Faculty/Staff.
2. Employ a digitalized and standardized process for recording mileage of vehicle travel on University, CPP foundation, and ASI business. Data should be easily retrieved on a fiscal year basis with distinct data for Students and Faculty/Staff.
3. Continue to collect and analyze student commuter data (the 2009 transportation survey serves as a competent model, but a GHG Inventory-specific survey would be best serve the campus) on a regular basis, with data collected at least every other year. This will both more accurately ascertain GHG emission contribution and assess the impact of reduction programs.

Non-Vehicular Energy

Key Finding
Non-vehicular energy (purchased electricity and on-campus stationary generation) is the second largest source of GHG emissions at CPP. This sector produced 35% of CPP's total emissions in 2005 and 32% in 2009. However, total emissions in the sector did increase slightly from 21,126 MTCDE in 2005 to 21,637 MTCDE in 2009. The contribution to emissions from purchased electricity did decrease over the inventory period, but emissions from on-campus stationary generation increased.

Recommendations
4. Suggest Foundation management to modify their current policies to mandate the tracking and generation of summarized annual consumption reports for University Village and Innovation Village
5. Initiate an effort to increase metering or develop reliable methods for estimating consumption in individual buildings on campus to assess energy usage for various campus activities and provide feedback on the effectiveness of reduction strategies. A method for prioritizing metering installation should be developed.

Agriculture and Solid Waste

Key Finding
Agriculture, including landscaping, and solid waste appear to have little impact on CPP's total GHG emissions. From 1995 to 2009, these sectors have each contributed only ~1% per year to total emissions.

Recommendations
6. Develop an improved centralized tracking method for recording quantities of synthetic and organic fertilizers used in agricultural and landscape activities and their respective percentages of nitrogen.
7. Conduct carbon sequestration inventory of campus landscape to assess current rates of sequestration that serves as offset for greenhouse gas emissions.
8. Return to the generation of recycling reports (like those prior to 2009) which provide accurate yearly information about solid waste produced, amount recycled and quantity composted.

Refrigerants

Key Finding
Refrigerant gases are not a significant source of GHG emissions on campus. Through most of the inventory period, less than 1% of CPP's total emissions came from this sector. However, by 2009 refrigerant gases' contribution increased to produce 1.3% of CPP's total emissions. It is still a small percentage, but MTCDE originating in this sector have increased an average of 106% per year from 2006-2009 and should thus be monitored.

Recommendations
9. Monitor refrigerants for the continued sharp increase in emissions.
10. Work with outside vendors and all entities on campus to ensure that emissions are consistently reported on an annual basis.

2.0 Introduction

Early in 2007, Cal Poly Pomona University president J. Michael Ortiz dedicated his support to the American College and University Presidents' Climate Commitment (ACUPCC), a coalition of college and university presidents and chancellors concerned about the adverse impacts of global warming. As of August 2010, a total of 674 colleges and universities nationwide had joined this consortium by signing a commitment to go "carbon neutral." Signatory schools acknowledge the scientific consensus that global warming is real and carries the potential for widespread economic and environmental disruption. The Presidents' Climate Commitment call for leadership states that "reversing global warming is the defining challenge of the 21st century."[3]

The Presidents' Climate Commitment is a call to action. Participating institutions will develop a plan within two years of signing the commitment that prescribes a strategy toward achieving climate neutrality by a specific target date. The initial steps toward the development of this plan are the creation of institutional structures charged with the plan's implementation and a comprehensive inventory of greenhouse gas (GHG) emissions produced by the campus that will be updated periodically. Colleges and universities involved in the Climate Commitment must develop methods of easily and accurately tracking the institution's carbon footprint. They must also provide intermittent reports of progress to the Association for the Advancement of Sustainability in Higher Education (AASHE) once the plan has been drafted.

Upon signing the Presidents Climate Commitment, President Ortiz created the Presidents Climate Commitment Task Force, a coalition of members from every division within the Cal Poly Pomona campus, co-chaired by Dr. Ed Barnes, Vice President for Administrative Affairs, and Dr. Kyle D. Brown, Director of the John T. Lyle Center for Regenerative Studies. In 2009, the Task Force produced the CPP Climate Action Plan (CAP), Pathway to Climate Neutrality. Included in the CAP is a target date of carbon neutrality of 2030 along with supporting emissions targets for 2015. The CAP gives direction for meeting these goals through a series of benchmarks in five sectors: Transportation; Facilities; Energy Supply; Agriculture, Landscape, Solid Waste and Refrigerants; and Education, Research and Outreach. Methods of choosing strategies and measuring and evaluating results are included in the CAP; it also provides for the responsibility of implementation of strategies and monitoring progress. Updated through 2009, this campus-wide inventory of GHG emissions provides additional data with which it is possible to evaluate CPP's movement toward its targets.

California's Leadership

The State of California has distinguished itself as a leader in greenhouse gas reduction. AB 32, signed into law by Governor Arnold Schwarzenegger in 2006, charges the Air Resources Board (ARB) with monitoring and reducing GHG emissions and calls for the reduction of GHG emissions to levels equivalent to those produced in 1990 by the year 2020.[4] The language of AB 32 addresses global warming issues specific to California, such as the danger presented to the state's water supply by the loss of Sierra snowpack, the already degraded condition of the State's air quality, and the vulnerability of natural habitat of the State's coastlines to rising sea levels attributed to global warming.

The state of California has also recently addressed GHG emissions reduction with enactment of several other laws and regulations. The Air Quality Resources board approved regulations requiring automakers to sell only vehicles with set limits on GHG emissions to California dealers by model year 2009.[4] Similarly, in 2002 the state adopted a Renewable Portfolio Standard (RPS) requiring energy providers to obtain at least 20% of their power from renewable energy resources by the year 2010.[5] In the same year as the landmark enactment of AB 32, the California Energy Commission also established Appliance Efficiency Regulations, whereby 21 major categories of federally and non-federally regulated appliances sold in California must operate at a greater level of efficiency than those established by federal standards.[6] These state level efforts have set strong leadership precedents for other states and large in-state institutions, such as Cal Poly Pomona.

The CSU System

The California State University (CSU) system operates 23 campuses throughout the state, which support a total of 433,000 students and 44,000 faculty and staff.[7] It is one of the largest university systems in the world. As such, the CSU system recognizes that it is a major consumer of energy and natural resources and there is a need to strive for greater energy efficiency and for reduction of its carbon footprint.[8] Since the enactment of AB 32, CSU has invested in projects leading to greater energy efficiency on its campuses, and has stated a goal to reduce campus-wide production of GHG emissions by 160,000 metric tons by the year 2020.[8] Through its efforts toward cleaner energy, the university system was rated by the U.S. Environmental Protection Agency as the 5th largest purchaser of renewable energy in the higher education sector as of April 2009.[9] The CSU system has also adopted sustainable building practices per Executive Order 987, requiring new construction projects to be designed with "consideration of optimum energy utilization, low life cycle operating costs, and compliance with all applicable energy codes and regulations."[10]

Cal Poly Pomona's Greenhouse Gas Inventory

This report summarizes Cal Poly Pomona's anthropogenic green house gas emissions for fiscal years 2006-2009. The inventory process is a first step towards quantifying the environmental impact of the University's operations relative to greenhouse gas emissions. The inventory reports emissions of the six greenhouse gasses covered under the Kyoto Protocol: Carbon Dioxide (CO2), Methane (CH4), nitrous oxide (N20), hydrofluorocarbons (HFC), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6).

Using a model created by Clean Air-Cool Planet (CA-CP), emissions are reported in Metric Ton Carbon Dioxide Equivalents (MTCDE). This value takes into account the Global Warming Potential (GWP) of the individual gases recorded and converts their forcing power into carbon dioxide equivalent values. The Clean Air-Cool Planet model is consistent with guidelines of the Intergovernmental Panel on Climate Change (IPCC).

The purpose of the inventory is to track emissions trends and assist policy makers in developing reduction strategies. The inventory fulfills an integral component of the Campus Climate Commitment, which is aimed at developing a measured plan for achieving carbon neutrality. This document will continue to be updated in future years as Cal Poly Pomona actively engages the tasks of greenhouse gas emissions mitigation and reduction.

Global Warming Potential

Global warming potentials (GWPs) are used to compare the abilities of different greenhouse gases to trap heat in the atmosphere. They are based on the radiative efficiency (heat-absorbing ability) of each gas relative to that of carbon dioxide (CO_2), as well as the decay rate of each gas (the amount removed from the atmosphere over a given number of years) relative to that of CO_2. The GWP provides a construct for converting emissions of various gases into a common measure (carbon dioxide equivalents). The GWP then reflects the radiative forcing or relative power of a gas relative to CO_2. It refers to the total contribution to global warming resulting from the emissions of one unit of gas relative to one unit of carbon dioxide. For example, if methane has a global warming potential of 21, 1 lb. of methane has the same impact on climate change as 21 lbs. of carbon dioxide; thus 1 lb. of methane is counted as 21 lbs. of carbon dioxide equivalent.

Atmospheric Lifetimes & Global Warming Potential (GWP) of Primary Greenhouse Gases:*

Gas	Atmospheric Lifetime (yrs)	GWP (100 yr interval)
Carbon Dioxide (CO_2)	50-200	1
Methane (CH_4)	12	21
Nitrous Oxide (N_2O)	114	310
HFC - 134a	15	1300
HCFC - 22	12	1700
HFC - 404a	>48	3260
Sulfur Hexafluoride (SF_6)	3200	23900
*Source: CA-CP V.6.5		

Primary Greenhouse Gases

• Carbon Dioxide (CO_2): Anthropogenic carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed as part of the biological carbon cycle.

• Methane (CH_4): Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

• Nitrous Oxide (N_2O): Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

• Fluorinated Gases: Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting substances (i.e., CFCs, HCFCs, and halons). These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases ("High GWP gases"). On campus, these gases are associated with refrigeration and air conditioning equipment.

3.0 Cal Poly Pomona Inventory Process

Introduction

This report is an update to the original GHG inventory, which was a project that originated in a Regenerative Studies methods and application graduate studio taught by Task Force members Dr. Kyle D. Brown and Dr. Rick Willson during the winter quarter of 2007. Students examined the scientific research behind climate change, global warming policy, and opportunities for improving energy efficiency and mitigating greenhouse gas emissions. These investigations were then applied to the university setting, as students used the Clean Air-Cool Planet Campus Carbon Calculator to begin an inventory model of Cal Poly Pomona's GHG emissions. Their efforts established the groundwork for this inventory report. The original inventory covered fiscal years 1995-2005, and this updated document appends fiscal years 2006-2009.

Clean Air-Cool Planet Campus Carbon Calculator

Clean Air-Cool Planet is a non-partisan 501(c)3 nonprofit organization that partners with corporations, campuses and communities to work toward the goal of reducing greenhouse gas emissions.[11] The Clean Air-Cool Planet Campus Carbon Calculator (CA-CP) was created by Clean Air-Cool Planet to model greenhouse gas emissions.[11] The CA-CP provides researchers with a framework for the collection, analysis, and presentation of data constituting an inventory of the emissions of greenhouse gases attributable to the operations of an institution. Version 6.5 was used for this inventory.

The CA-CP is an electronic MS Excel workbook. The data input fields include campus energy use (including transportation), agricultural production, refrigerant use, and solid waste. Once the data input is complete, CA-CP calculates estimates of the campus-wide greenhouse gas emissions. CA-CP enables the calculation of emissions for the years 1990-2009 and the projection of emissions through 2060, and it aids in producing charts and graphs which illustrate changes and trends in the quantity of the institutional emissions over time. The model's spreadsheets are based on workbooks provided by the Intergovernmental Panel on Climate Change (IPCC, www.ipcc.ch) for national-level inventories.

The Clean Air-Cool Planet Campus Carbon Calculator Model was initially chosen because it has a proven track record at large universities (Harvard, Tufts and UC Santa Barbara, among others). A condition of the Presidents Climate Commitment is that the GHG inventory must comply with the standards of the Greenhouse Gas Protocol (GHG Protocol) created by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI).[12] The Clean Air-Cool Planet Campus Carbon Calculator is consistent with the GHG Protocol, and therefore it is suitable for the purposes of the Cal Poly Pomona GHG inventory.

Inventory Methodology/Description

There are seven categories of data within the CA-CP calculator: institutional data, energy, transportation, agriculture, solid waste, refrigeration, and GHG emission offsets. Each category is broken down into subcategories, and not all subcategories apply to every institution. The table below lists the CA-CP GHG emissions data categories that were applicable to the Cal Poly Pomona Campus, and inventoried for this study.

GHG Emissions Data Categories Applicable to Cal Poly Pomona Campus:

Institutional Data	Energy	Transportation	Agriculture	Solid Waste	Refrigerants	Offsets
Budget Population Physical Size	Purchased electricity Natural Gas Propane	University fleet Student/faculty/ staff air travel Student/faculty/ staff commuter miles	Fertilizer application, Animal agriculture	Landfill waste w/ CH4 recovery	HFC 134a, HFC 404a, HCFC 22, CFC 12, HCFC 22, HCFC 21, R 401a	Composting

Temporal Boundaries

This inventory looks at Cal Poly Pomona operational data between fiscal years 2006-2009.

Study Boundaries

This inventory looks at the operations of Cal Poly Pomona University, and its affiliates, Cal Poly Pomona Foundation (CPP Foundation) and Associated Students, Inc. (ASI). While the latter two organizations are not technically a part of Cal Poly Pomona, the management of many of the University's programs and operations is deeply intertwined with the operations of both CPP Foundation and ASI. The CPP Foundation, established in 1966, provides housing, dining, retail, and other non-state services to the University. As a tax-exempt non-profit auxiliary of the CSU system, the Foundation is a partner in the educational mission of Cal Poly Pomona, and responds to the needs of the University by keeping costs affordable and adjusting its operational schedule to the academic year. As a separate organization, the Foundation has its own building facilities, administration and staff, office of accounting, and it owns and operates a separate vehicle fleet.

ASI is also a tax exempt, non-profit auxiliary of Cal Poly Pomona. This organization provides the administrative structure for student government on campus and student representation within the larger CSU system. ASI also invests in programs and services intended to support student-run clubs and associations, athletics, and other operations that aim at further academic enrichment. The Bronco Student Center, which hosts a food court and various recreation opportunities, is owned and operated by ASI. Like CPP Foundation, ASI has offices, administration, and staff that are separate from that of the University. Unlike the Foundation, it does not own and operate a vehicle fleet.

When possible, CPP Foundation and ASI operations were inventoried along with the University due to the complex and interrelated nature of all three organizations. All three operate within the Cal Poly Pomona campus land borders and are essential to the function and operation of the University. Thus, emissions produced by each organization must be claimed as Cal Poly Pomona campus-produced emissions. Many of the University operations overlap with the other organizations as well—some examples are the fact that CPP Foundation often fuels its vehicle fleet from campus-owned fueling stations, Foundation solid waste eventually enters and University waste stream, and many University faculty and student travel records are processed through ASI's office of accounting. Both auxiliary organizations are responsible for discrete GHG emissions-producing activities on campus such as refrigeration gases and methane solid waste emissions that result from CPP Foundation dining activities. The University Village, a residential facility owned and operated by CPP Foundation, is a significant consumer of purchased energy.

Emissions resulting from activities of Cal Poly Pomona's College of the Extended University (CEU) has also been included in the inventory where possible. The CEU offers continuing education courses (credit, non-credit, credential, test preparation and personal enrichment) through Cal Poly Pomona to community members, professionals and traditional students. Student enrollment for this inventory reflects CEU enrollment data, though its influence is thought to be minimal. The CEU additions to commuting miles for the inventory are also considered to be very slight as many classes are taught online. Most classes are taught in regular CPP classrooms, and energy consumption is thus already included in University figures. However, the office for the CEU is in Innovation Village, therefore, for reasons discussed below, its energy usage was not included in this inventory.

Innovation Village, located on campus land and leased by the CPP Foundation to support private enterprise, has not been included in the inventory the lack of influence the University has with the procedures of the organizations therein and to the lack of available data from all users.

Off-campus property owned or leased by the University has not been included. Emissions from these activities are estimated at well under 5% of the institutions total annual GHG emissions, and are therefore assumed *de minimis* emissions. Categorizing these emissions as *de minimis* and not calculating them for the inventory is acceptable per the California Climate Action Registry General Reporting Protocol, V3.1 January 2009.

For this inventory of Cal Poly Pomona's GHG emissions, researchers have complied with actions required of Presidents Climate Commitment signatory schools as found on page 11 of the American College and University Presidents Climate Commitment Implementation Guide, V.1.0:

Inventory Process

1. To inventory GHG emissions identified by the Kyoto Protocol: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6).[13]
2. To inventory scope 1 and scope 2 emissions (see table below), emissions from commuting and air travel, and when possible, emissions from other sources that are "large and can be meaningfully by the institution."[14]

This inventory covers scope 1, 2 and 3 as comprehensively as possible given the limitations described herein. The majority of CPP's emissions fall into Scope 3 because of the high volume of commuters. Scope 1, 2 and 3 emissions are defined as shown:[15]

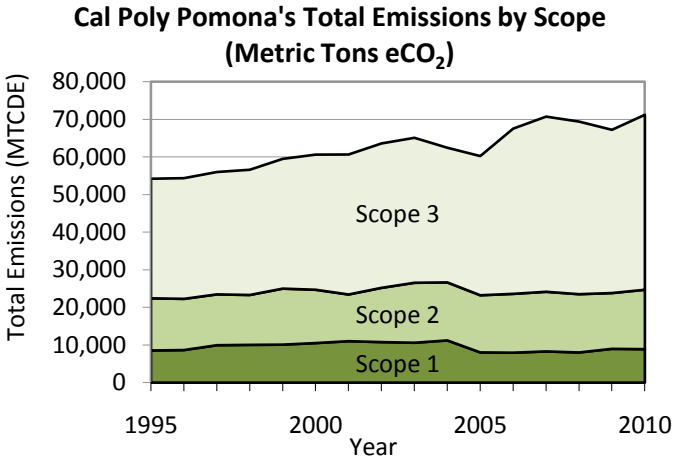
Scope 1	"Direct emissions from sources that are owned and/or controlled by your institution. This includes combustion of fossil fuels in college-owned facilities or vehicles, fugitive emissions from refrigeration, and emissions from on-campus agriculture or livestock husbandry. Your institution has complete control over these emissions, and they are no-one else's responsibility."
Scope 2	"Indirect emissions from sources that are neither owned nor operated by your institution but whose products are directly linked to on-campus energy consumption. This includes purchased energy: electricity, steam, and chilled water."
Scope 3	"Other emissions attributed to your institution, deemed "optional" emissions by corporate inventories. This includes emissions from sources that are neither owned nor operated by your institution but are either directly financed or are otherwise linked to the campus."

Limitations of the Model (CA-CP Calculator)

There are factors related to greenhouse gas production at Cal Poly Pomona that the CA-CP does not take into consideration. Some areas that the model neglects to provide input fields for are worth mentioning, because they represent integral processes in the daily function of the campus.

CA-CP does not take into consideration many sources of "embodied energy," which is a term used to describe all of the energy that is used directly or indirectly to create a service or product. For example, drinking water has a high embodied energy, because a large amount of energy is expended in transporting, processing and treating water for consumption. The CA-CP does not take into account the embodied energy of water (drinking or sewage treatment), paper production, food production, procurement, or construction materials. The energy used to transport water is especially significant in southern California, where much of the drinking water is transported from distant locations.

Additionally, CA-CP does not take into account summer school. As Cal Poly Pomona has a significant population of summer school students, it was important to take this into account for an accurate report. Most information is reported per fiscal year; thus the only fields that were impacted by this were those having to do with commuting behavior. The authors of the report supplemented the calculator in order to include this data.



Changes to the Model in this Update (Clean Air-Cool Planet Campus Calculator)

Two important changes have been made to the CA-CP since the original report was submitted with data through 2005. The new inventory includes both air mileage from study abroad and directly financed outsourced travel in non-commuter vehicle miles. Both additions will increase the scope 3 and net emissions reported in the inventory.

Institutional Data

The inventory model requires institutional data related to budgets, student, faculty and staff populations and total building square footage. This data serves as the foundation for some of the descriptive statistics generated by the model. The CSU system did not track student population in full-time vs. part-time student enrollment numbers until 2003; instead it used full-time equivalent student enrollment (FTES), and total full-time enrollment. The FTES population is the sum of the total quarter student credit hours for the academic year divided by 45 (15 credits per fall, winter, and spring quarters). Because the Institutional Data section of the CA-CP requires full vs. part-time student enrollment, the FTES totals were subtracted from the total student population to obtain a rough part-time population number for each year. The FTES number was used in place of an actual full-time population number. As a result, the population numbers entered into the full-time column of the model are slightly inflated, while the part-time numbers are slightly deflated. After comparing the numbers to a small sampling of years with available full-time/part-time population breakdowns, the margin of error was found to be small. From 2003 until present, data was available to provide actual numbers of full- and part-time students in this inventory.

Data Supplier/Contact

Operating Budget: Mark Lopez, Director, Budget Services
Notes: Years 1997-2005 provided. Previous years estimated by subtracting out the annual percentage increase in budget dollars.

Research Dollars: Dr. Donald F. Hoyt, Assoc. Vice President, Research & Graduate Studies

Energy Budget: George A. Lwin, Manager, Energy Services, Facilities Planning and Management
Notes: Consumption data at the Foundation operated University Village were added to the University totals provided by George Lwin.
Since the energy budget is projected, we chose to use actual expenditure numbers for our budget figures for greater precision.

Population Data:
California State University Office of the Chancellor Website: www.calstate.edu/as/stat%5Freports/

Cal Poly Pomona Office of Institutional Research & Academic Resources – Common Data Sets 2003-2009: www.csupomona.edu/~irar/dataset/

4.0 Inventory Results

The greenhouse gas emissions inventory revealed that Cal Poly Pomona emitted approximately a net of 66,625 MTCDE in 2009, as compared to 59,730 MTCDE in 2005. The majority of Cal Poly Pomona's emissions come from transportation. In 2009, 64% of total emissions were from transportation. Within this sector, student commuting is the largest emissions source. After transportation, purchased energy in the form of electricity and natural gas is the largest source of emissions. These emissions are tied to the operations of the campus' facilities, primarily the buildings.

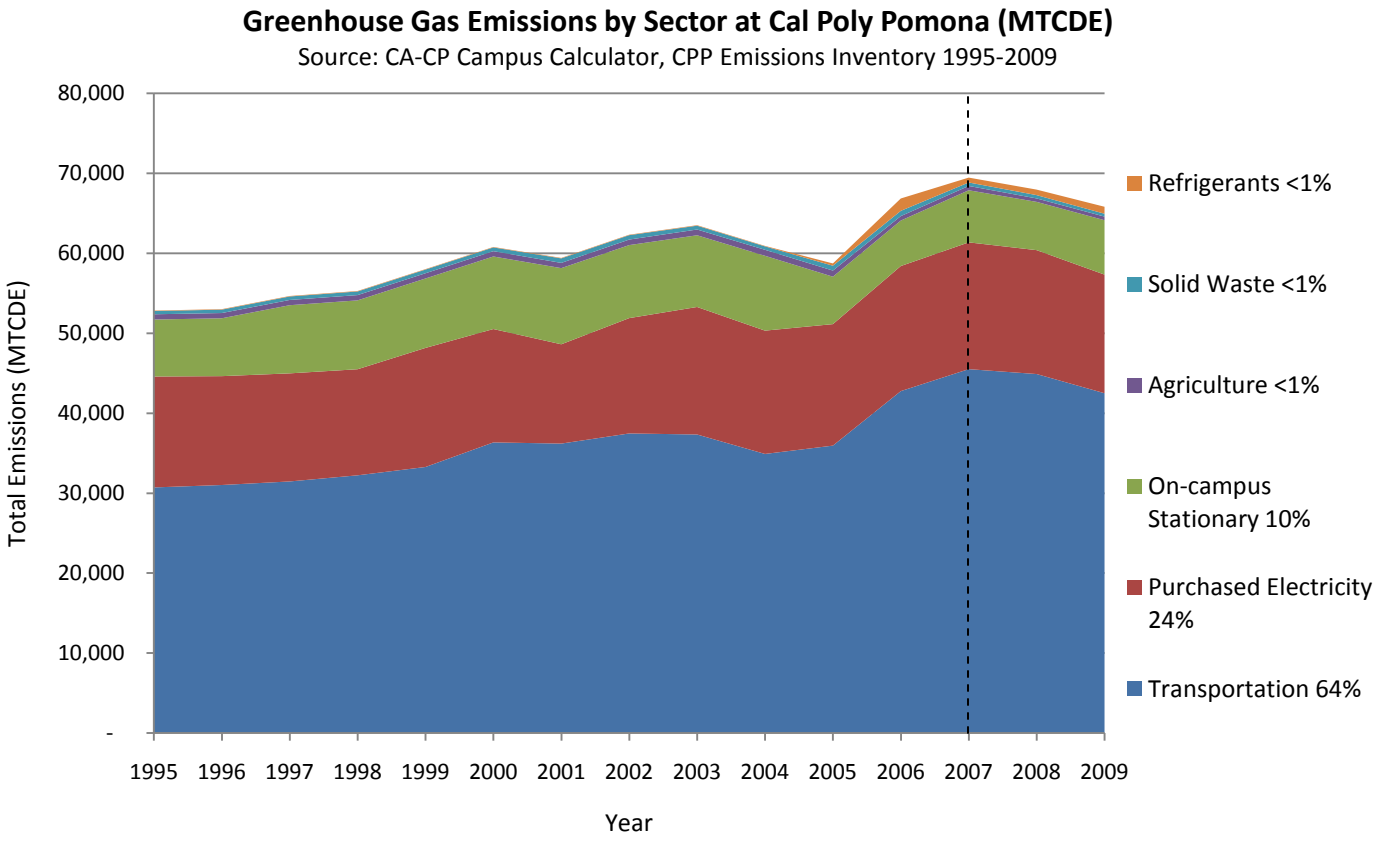
Although total emissions have increased at Cal Poly Pomona, per person emissions dropped slightly from 3.8 MTCDE in 1995 to 3.55 in 2009. The rise in overall emissions may be attributed to growth in the overall campus population and the expanded facilities infrastructure required to support it. Supporting this theory is the growth of the full-time student population from 16,754 in 2005 to 18,757 in 2009. Building square footage also increased 34 percent from 3,112,617 in 2005 to 4,167,374 in 2009.

There is a slight dip in emissions registering in 2004 and a peak in 2007. Both correspond to slight decreases and increases in the campus population, respectively. Additionally, in 2007 Cal Poly Pomona published the first inventory and began to devote more attention to its greenhouse gas emissions and carbon footprint. Other factors increasing the variability of the annual emissions totals include temperature and the amount of construction activities on campus. For example, in a particularly hot year cooling loads may increase and register as an overall increase in emission totals for that year.

Emissions due to solid waste, agriculture, and refrigerants were small. Although not as significant, the University should consider improving data collection and recording methods for ease in assembling future inventories. Refrigerant contribution to total emissions registers some growth in recent years, although it may be attributed to better record-keeping. Due to the high global warming potential of these gases, this increase may warrant monitoring.

At present, it is difficult to compare Cal Poly Pomona's emission levels to those of other schools. Because of climatic variability, difference in campus sizes, differences in research foci, and differences in the ages of facilities, caution should be exercised in extracting comparisons to other inventory documents. The inventory is meant to serve as a benchmarking document for the institution over time.

As the details of this report reveal, certain data sets within each sector were estimated with samples constructed from existing data sets. A conservative default setting was used in the model.



*Presidents' Climate Commitment signed in 2007

5.0 Transportation Emissions Inventory

Introduction

The burning of gasoline, diesel and jet fuel by various modes of transportation contribute significantly to increasing levels of carbon dioxide emissions in the atmosphere. According to the US Department of Energy 2009 report, the transportation sector was responsible for 33 percent of the total carbon dioxide emissions in the United States and is second only to the electric power generation sector.[16] Of all modes of transportation, motor vehicle gasoline produced the greatest quantity of CO_2 emissions. The CA-CP inventory revealed that daily commuting to campus and university-related air travel were the most significant source of greenhouse gas emissions at CPP. As a commuter campus, the reduction of this GHG emission source represents the greatest challenge to achieving the goal of climate neutrality.

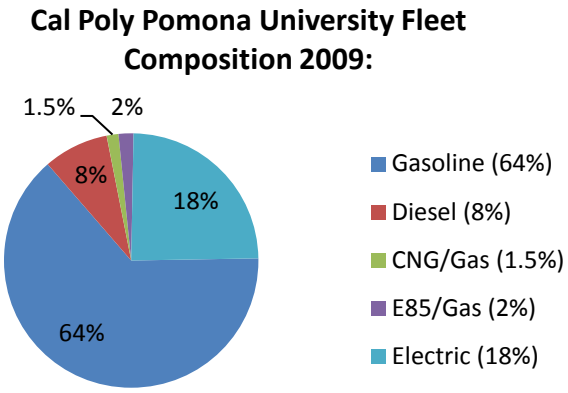
The following inventory categories were investigated at Cal Poly Pomona:

- Cal Poly Pomona Campus vehicle fleet
- Daily commute by students, faculty and staff
- Air travel by faculty, staff and students
- Directly financed outsourced travel (new)
- Study abroad air travel (new)

Data Collection for Campus Fleet Vehicles

Cal Poly Pomona University Fleet

Reflecting both University growth and a continued drive toward greater sustainability, the Cal Poly Pomona campus fleet has changed somewhat in composition while growing from 235 University-owned cars, trucks, vans and buses in 2007 to 274 in 2009. As shown in the chart below, the majority of these vehicles are gasoline powered (64%, down from 73% in 2007), with a large component of electric vehicles (18%), and smaller components of diesel (8%, up from 3% in 2007), CNG/gasoline (1.5%), and E85/gasoline (2%). The increased number of diesel vehicles also displays the University's move to utilize biodiesel. Detailed historic data on the composition of the fleet was not available. Campus fleet vehicles fuel at campus-owned fueling stations and at private, off-site vendors, with the majority of fuel supplied by campus-owned stations. Annual gas and diesel quantities were provided by Peter Graves, Lead Auto and Equipment Mechanic, from fuel-purchase records going back to the year 2000 (for on-campus fueling) or the year 2004 (for off-site fueling).



Both on-campus and off-site quantities were combined in the CA-CP inventory, while quantities of different types of fuel were entered separately to reflect their different emissions factors. In addition, the fuel quantities reflect the operation of other equipment which falls outside of the defined campus fleet and the scope of transportation, such as mowers, forklifts, and other University-owned equipment. Peter Graves also provided annual natural gas quantities for the years 2001-2009 based on vendor records. For early years with missing records, estimations were input based on averages generated from the available years. CPP's electric vehicle fleet is not factored into the transportation sector, because these vehicles are charged by purchased electricity that is included in the "Non-Vehicular Energy" section of the inventory.

Cal Poly Pomona Foundation Fleet

The CPP Foundation owns vehicles used by all of its operations, including Foundation Administration, Dining Services, Kellogg West, Central Maintenance Department and Foundation Housing. Foundation fleet vehicles fuel at Cal Poly Pomona campus-owned fueling stations, or at off-site vendors. No financial records are available to provide Foundation fuel quantity data for the inventory; however, because some of Foundation's fleet operations do fuel on campus, those fuel quantities are included in the inventory with the Cal Poly Pomona University fleet data.

Fuel Use by Type for 1995-2009:

Fiscal Year	Gasoline	Diesel	Natural Gas	B20*
	Gallons	Gallons	MMBtu	Gallons
1995	61,487	13,668	330	-
1996	61,487	13,668	330	-
1997	61,487	13,668	330	-
1998	61,487	13,668	330	-
1999	61,487	13,668	330	-
2000	65,008	12,236	330	-
2001	67,434	15,452	357	-
2002	71,880	23,080	353	-
2003	67,510	23,064	284	-
2004	74,552	37,178	314	-
2005	65,276	44,864	305	-
2006	66,256	42,622	310	-
2007	66,078	33,396	242	-
2008	66,143	35,097	242	-
2009	64,820	33,521	97	425

*B20 tank installed summer 2009

Collection of Commuter Data for Students, Faculty and Staff

Student Commuter Data

In November 2009, a transportation survey[17] was administered to a sample of Cal Poly Pomona faculty, staff, and on- and off-campus students. The survey provided additional data from which student commuting behavior could be investigated. Thus, this inventory uses the more recent data from this survey for years 2006-2009 to input use of various transportation options, such as bus, train, carpooling or driving alone. The report takes into account average miles traveled per trip and how many trips per week are taken by each student.

The inventory combines the data of student commuters according to the percentages of those living on- and off-campus in each particular year. The CA-CP calculator version (5.0) used for the 1995-2005 GHG inventory used estimated miles per day, whereas the current version (6.5) used in this updated report uses miles per week. The data therefore better reflects the commuting behavior of both full and part time students. The CA-CP calculator also veers away from reporting on summer students in the current version. Since Cal Poly Pomona has historically had a significant summer student population, this inventory does incorporate summer commuting behavior according to the number of students enrolled in the summer session of each particular year.

Off-campus residents were estimated to make 8.28 one-way trips to Cal Poly Pomona per week with an average of 17.77 miles per trip. On-campus residents made 4.81 trips per week. As data was lacking for the miles driven on a trip by on-campus students, the report used the 17.77 miles average for off-campus commuters. Over the 2006-2009 period, students averaged ~7.9 trips per week, travelling 17.77 miles each trip.

For years 1995-2005, the inventory used results from an assessment of Cal Poly Pomona parking and transportation needs completed in June 2000 by KAKU Associates International Parking Design, Inc.[18] For inventory purposes, the average student commute was estimated at 14 miles per trip (x 2 trips per day for 132 days per year).

Faculty and Staff Commuter Data

Cal Poly Pomona participates in annual surveys for the South Coast Air Quality Management District (AQMD). These surveys record a week's commuting behavior in regards to number of trips, manner of transportation, and miles traveled. The survey is compulsory for all faculty and staff. It is optional for students, and the sample of student behavior recorded was not descriptive of the entire student population. Therefore, the afore-mentioned Transportation survey was used for student data. AQMD surveys with the applicable information were available and used in this report for years 2006-2009.

For data prior to 2006 and applied in the original GHG inventory, Rideshare surveys were used. The campus Rideshare Office keeps records of faculty and staff participation in the rideshare program, and was able to provide survey data for most of the years between 1998-2005. Years with missing data (1995-1998, 2002 and 2003), were input based on averages of years with data. As with the student commuter data, the values entered into the CA-CP model are percentages of the total faculty and staff population that drive alone, carpool, or use public transportation. The average faculty commute was estimated at 25 miles per trip (x 2 trips per day for 245 days per year), while the average staff commute was 14 miles per trip.

Transportation Emissions

Student Commuting Behavior

Students						
Fiscal Year	% Drive Alone	% Carpool	% Bus	% Rail	Trips/ Week	Miles/ Trip
1995-2005	75%	13%	1%	-	10.00	14.00
2006	75.21%	16.67%	4.78%	0.44%	7.86	17.77
2007	76.25%	16.03%	4.68%	0.43%	7.93	17.77
2008	76.78%	15.70%	4.63%	0.42%	7.96	17.77
2009	76.78%	15.70%	4.63%	0.42%	7.96	17.77
2006-2009 (Average)	76.25%	16.03%	4.68%	0.43%	7.93	17.77

Faculty & Staff Commuting Behavior

Faculty										
Fiscal Year	% Drive Alone	% Carpool	Trips/ week	Miles/ Trip	% Bus	Trips/ week	Miles/ Trip	% Rail	Trips/ week	Miles/ Trip
1995-2005	94.00%	5.00%	10.00	25.00	1.00%	10.00	25.00	-	-	-
2006	61.82%	5.01%	7.11	21.07	0.30%	6.00	15.77	0.22%	7.33	54.55
2007	60.97%	4.85%	7.06	19.73	0.30%	6.00	6.20	0.20%	5.00	47.30
2008	61.54%	6.04%	7.13	20.39	0.19%	6.00	6.78	0.15%	4.67	40.94
2009	59.76%	5.99%	7.07	21.06	0.47%	5.11	8.87	0.12%	4.00	24.33
2006-2009 (Average)	61.02%	5.47%	7.09	20.56	0.31%	5.78	9.40	0.17%	5.25	41.78
Staff										
Fiscal Year	% Drive Alone	% Carpool	Trips/ week	Miles/ Trip	% Bus	Trips/ week	Miles/ Trip	% Rail	Trips/ week	Miles/ Trip
1995-2005	73.00%	24.00%	10.00	14.00	1.00%	10.00	14.00	-	-	-
2006	65.32%	23.87%	9.33	16.79	0.37%	5.71	11.01	0.09%	10.00	40.00
2007	65.05%	22.58%	9.27	16.78	0.48%	7.71	6.65	0.11%	6.00	37.50
2008	66.27%	22.62%	9.46	16.03	0.44%	6.25	11.48	0.14%	8.00	44.25
2009	61.92%	21.78%	9.28	16.09	1.61%	7.39	9.27	0.57%	6.14	24.13
2006-2009 (Average)	64.64%	22.71%	9.33	16.43	0.72%	6.77	9.60	0.23%	7.54	36.47
* The percentages will not sum to 100 percent, reflecting the use of modes of transportation that do not emit GHGs (e.g. walk or bike) and non-commuting work days (e.g. sick, vacation or off-campus work).										

Data Collection for Air Travel

The University

The University requires faculty and staff to provide detailed accounts of travel expenses in order to receive reimbursements for campus-related travel. For the purposes of the inventory, air travel miles were obtained by calculating the distance between the destination locations recorded on the travel reimbursement forms. The forms are completed manually and archived in the University accounting department. This method presented some challenges for retrieving the data efficiently, as found in the original inventory (1995-2005). For this reason a 20% sample was taken of all forms completed during the 2005 fiscal year. Based on the data found in the sample, the average mileage per capita for both faculty and staff was calculated to be 1,394 miles. Total air miles

were calculated by multiplying the sample mileage estimate by faculty and staff population data specific to each year. To maintain consistency, the total air mileage for 2006 and 2007 was estimated in the same manner.

The University began tracking air miles traveled at the start of fiscal year 2008; therefore data for years succeeding 2007 are based on actual mileage.

CPP Foundation

Similar to the University, the CPP Foundation requires detailed accounting of travel for reimbursement. However, until summer of 2007, the Foundation did not archive reimbursement forms in a location separate from other expense-related documentation, nor did the database system provide a means to estimate the total number of travel records for a given year. Because this method of archiving made it impossible to obtain a reasonably accurate data sample, CPP Foundation air travel miles were not estimated for the inventory prior to 2008. As of the beginning of fiscal year 2008, CPP Foundation began tracking air mileage. While records do not distinguish between faculty and staff travel and student travel, it is assumed that faculty and staff travel makes up the majority of Foundation mileage. Thus, the actual air mileage documented by CPP Foundation is attributed to faculty and staff for this inventory.

Associated Students, Inc.

Most student travel and a significant portion of faculty travel is recorded and reimbursed through the Associated Students, Inc. (ASI) office. Similar to the CPP Foundation, the ASI's method of archiving travel records did not facilitate an effective means of data sampling that would enable a reasonable estimation of annual air travel mileage. However, in summer 2010 ASI began a move to a new system that should allow for easier access to travel records. The system was not yet available to obtain data at the time of this report, but the expectation is for simpler retrieval in the future.

Because most of university related student air travel records are processed by ASI, the inability to sample these records effectively leaves a significant gap in the inventory with regard to student air travel. To account for this absence of data, an estimation was made based on the assumption that ¼ of the student population would travel 300 miles annually. For each year between 2006-2009, this number was multiplied by the total student population in order to obtain a rough estimation of student air travel miles. This maintains consistency with the method employed in the original inventory.

Directly Financed Outsourced Travel

The updated version of CA-CP includes emissions from other University-related travel besides air-mileage. Because precise data was limited and the source was estimated to be <5% of total emissions and classifiable as de minimis, a sampling of travel reimbursement forms taken from 2005 was used to estimate travel in all reported years for faculty and staff.

Study Abroad

The second addition to the new version of CA-CP is air miles traveled for study abroad. Mileage was calculated by estimating air miles to and from Los Angeles to each study abroad participant's destination. At Cal Poly Pomona, students may choose to travel abroad with a CSU International Program, a Cal Poly Pomona Study Abroad Program, an Exchange Program, or a variety of Independent Programs. Complete data was not available for all years 2006-2009; in years that lacked precise and descriptive data for all participants, the inventory extrapolates data from known information in other years.

Key Finding

Transportation is the largest source of GHG emissions at CPP. This sector produced 64% of total emissions in 2009, up from 60% in 2005. On the whole, however, the transportation sector looks to have peaked in 2007 and total emissions have been declining since.

Campus Fleet Vehicles

The composition of fuel types used has changed throughout the years, with gasoline and diesel use peaking in 2002 and 2004, respectively. This may be attributed to the addition of 35 new electric and more efficient vehicles to the campus fleet in 2003 and 2004. The use of diesel declined significantly in 2009, probably as a result of a switch to biodiesel. As previously mentioned, some of the fuel quantities reported are used for non-fleet equipment outside of the transportation sector. Conversely, as energy used for electric vehicles is factored into "Non-Vehicular Energy" as purchased electricity, the transportation contribution to greenhouse gas emissions is likely less in this calculation than in reality.

Student and Faculty/Staff Commuters

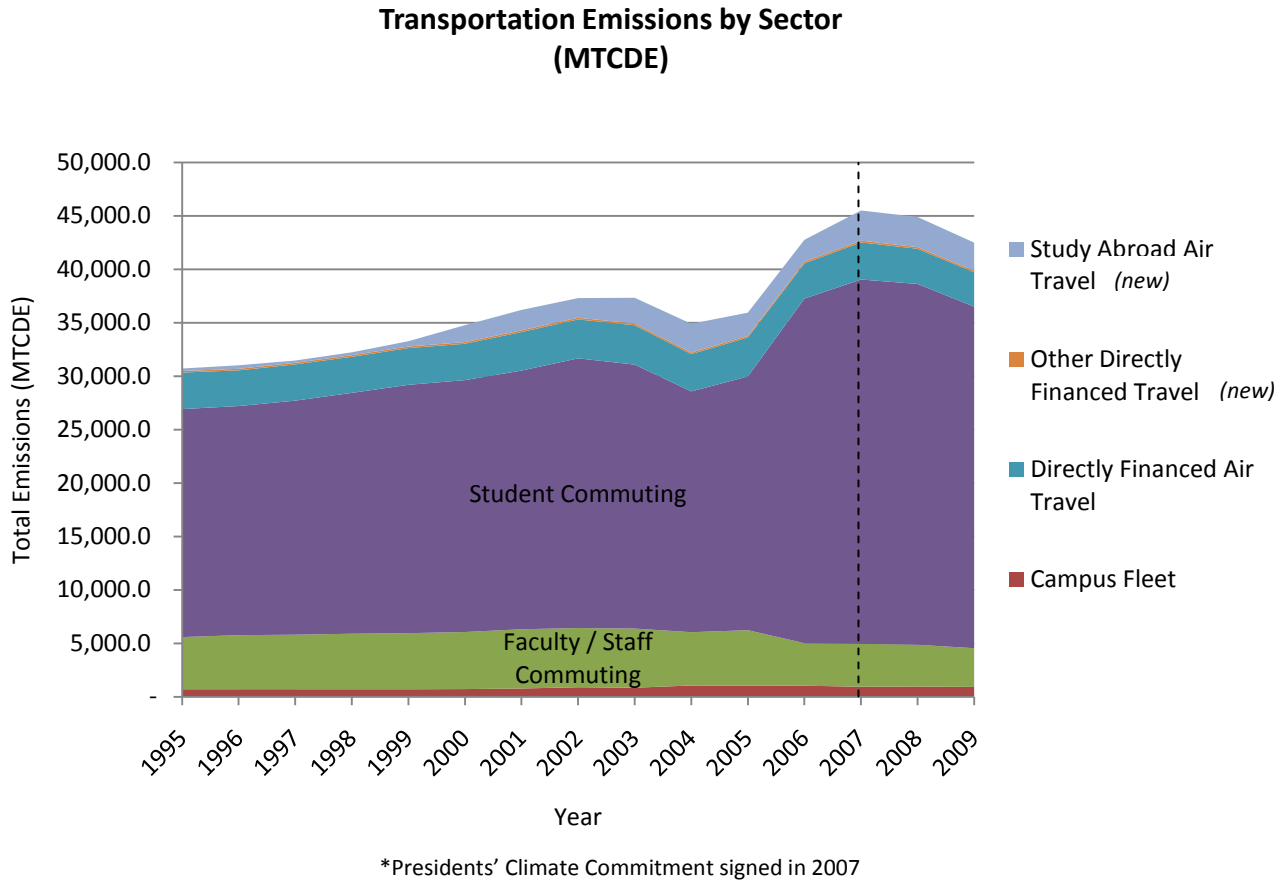
As the data from different years were based on different surveys, the impact of commuters on Cal Poly Pomona's greenhouse gas emissions may demonstrate an artificial change from 1995-2005 to 2006-2009. Due to additional surveys and more accessible records, the data available for more recent years was more complete and provided a more detailed breakdown of behavior than did the data

used in the original inventory. For one, the AQMD surveys provide a better understanding of the impact of sick and vacation days on average faculty/staff commuting behavior in addition to abbreviated workweeks. The data in the updated inventory do not assume that each person travels to CPP Monday-Friday; rather, the recent data better reflect days spent away from work/school and the use of different methods of transportation throughout the week.

As more data has become available, it is shown that the original inventory may have over-estimated the greenhouse gas emissions from faculty and staff commuters while underestimating the emissions from student commuters. Notably, student commuters were found to account for 8000 MTeCO2 per year more in 2009 than was estimated in 2005.

2009 Commuting Emissions Breakdown:

2.9% Fleet and other Directly Financed Outsourced Travel
66.1% Student Commuters
14.4% Faculty and Staff
10.5% Directly Financed Travel (Air and Other)
6.1% Study Abroad



Recommendations

Reducing the GHG emissions produced by CPP's significant commuter population is a formidable task. A first step in this process is to enable a more efficient method of accounting for emissions produced by the transportation sector. Although data collection has improved since the original inventory, it is critical that CPP continue to improve on its record-keeping and accessibility of transportation data for a clearer picture of the total emissions to be offset. The financially separate but operationally intertwined nature of the University, CPP Foundation, and ASI makes accessing the travel records a difficult and time consuming task.

In the future, a possible data collection solution would be to centralize the processing and archiving of travel mileage on a central database. While this might be difficult due to the independent operations of the three organizations, a unified method of collecting mileage data, and processing and archiving commuter information is needed.

- Develop a standardized process for recording mileage of airline travel on University, CPP Foundation, and ASI business. Data should be digitally archived for easy retrieval and tracking.
- Establish a method for collecting and analyzing student commuter behavior data on a regular basis in order to better ascertain the baseline contribution to greenhouse gas emissions and assess the impact of reduction programs. Data should be collected at least every other year.
- Develop a method to record study abroad air miles traveled each year.

Data Supplier/Contact

University Fleet Fuels: Peter Graves, Lead Auto Equipment Mechanic, Facilities Management

Commuting Behavior: David Flores, Rideshare Coordinator, Parking & Transportation Services

Directly Financed Travel, University: Kathy M. Harper, Secretary, Finance & Administrative Services

Air Travel, University: Al Viteri, Director of Accounting Services, Finance & Administrative Services

Air Travel, Foundation: Haleh Minakary, General Business Manager, Financial Services

Air Travel, ASI: Powell Velasco, Associate Executive Director, Assoc. Students, Inc.

Study Abroad: Laura Lee, Administrative Analyst Specialist, International Center

6.0 Non-Vehicular Energy Emissions Inventory

Introduction

Non-vehicular energy is the second largest source of greenhouse gas emissions on campus after transportation. The greenhouse gases associated with energy production include carbon dioxide (CO_2), and methane (CH_4). Carbon dioxide and nitrous oxide emissions occur during the combustion of fossil fuels (during the production of electricity, etc.) and methane (CH_4) from natural gas.

Energy emissions are quantified based on the total units of fuel consumed per fuel type. The primary fuels powering CPP are purchased electricity and natural gas. Purchased electricity is mainly used for air conditioning, refrigeration, lighting, equipment loads and some heating. Natural gas is mainly used for heating and hot water loads. In 2009, CCP's emissions from purchased electricity were 14,834 MTCDE produced from consumption of 45,083,891 kWh. In 2009, emissions attributed to natural gas consumption were 6,802.8 MTCDE from 128,521 MMBtu. Since quantification of emissions is based on fuel type, the mix of fuels used to produce electricity must be provided. CPP's purchased electricity fuel mix is composed of varying percentages of coal, natural gas, nuclear, hydroelectric, and renewable fuel sources.

CPP has proactively endeavored to reduce its energy consumption during the inventory period with upgrades to more efficient HVAC, lighting and equipment in addition to policy modifications. At a minimum, new capital projects exceed California Title 24 requirements by 15% and renovation projects by 10%. Other energy saving projects in 2010 include new solar photo voltaic (PV) systems to produce over 1 Mega Watt (MW) of renewable energy. Other policy modifications also include a 4/10 summer work schedule for energy savings.

Electricity consumed in the process of moving water for use on campus and the treatment of sewage water is not factored into the inventory, as CPP does not purchase energy directly associated with these activities.

Data Collection

The inventory model requires input of energy data from two categories:

1) Purchased electricity
2) On campus stationary sources

The university does not purchase steam or chilled water. Purchased electricity data was input per annual kWh consumed. On-campus stationary sources include fuels purchased by the university, such as on-campus cogeneration plants and stationary heating, cooling, cooking, laboratories, etc (powered by propane, natural gas, distillate oil, or other non-electric fuel sources). Fuel used in vehicles is excluded, as it is accounted for in the transportation section. Natural gas totals were input into this category per annual MMBtu consumed. Propane was also included in this section, as much of its current use is for non-vehicular stationary generation. However, until the retirement of the CPP trams in 2004, propane was used primarily for the transportation sector. The inventory includes it here to reflect recent activity.

CA-CP has several built in analysis tools related to energy consumption. George Lwin, Energy Service Manager of Campus Facilities Planning and Management, provided data for these categories, including the campus' total building space entered in square feet and annual energy budget information. These data fields work in concert with population and consumption data to describe emission trends.

The University

Mr. Lwin provided annual totals of purchased electricity from Southern California Edison (SCE) and natural gas from Southern California Gas Company. Lead Auto Equipment Mechanic Peter Graves provided annual data for propane from Ted Johnson Propane.

Power mix data was not available from the provider for all years; thus the regional default mix provided in the model was selected for inventory purposes. The model's mix is based on the EPA's eGRID database. The EPA metric is based on regional power plant emissions data, not the composition of the source fuels electricity is derived from. The authors believe this data can be considered "conservative," likely resulting in slightly greater emissions than the actual energy mix.

For comparison purposes, the model was also run using custom fuel mix data from the California Energy Commission. In this scenario, the Energy Commissions' "net power mix", which is a regional summary of fuel mix data indicative of the general fuel mix provided by California power vendors, was input into the model. When the California net power mix was used, there was a significant drop in emissions. In the future, CPP should ensure that the power vendor is providing fuel mix data records, in order for the correct purchased mix to be factored into emissions calculations.

CPP Foundation

The University was able to provide electricity and natural gas consumption data for all buildings except the Innovation Village industrial park. Due to the current building management policies, gathering energy data was not feasible. The University Village apartment buildings electricity data was provided by SCE. Natural gas records were obtained from SoCalGas from 2008-2010 but limited to their two year record storage capacity.

Key Finding

Non-vehicular energy is the second largest source of greenhouse gas emissions at CPP. In 2009, 32% of total emissions came from this sector, down from 35% in 2005. At <1% of stationary source emissions in 2009, CPP propane use since the retirement of the trams in 2003 contributes very little to total emissions.

2009 Non-Vehicular Energy Emissions Breakdown:

68.6% Purchased Electricity
31.4% Natural Gas and Propane Consumption (on-campus stationary sources)

Recommendations

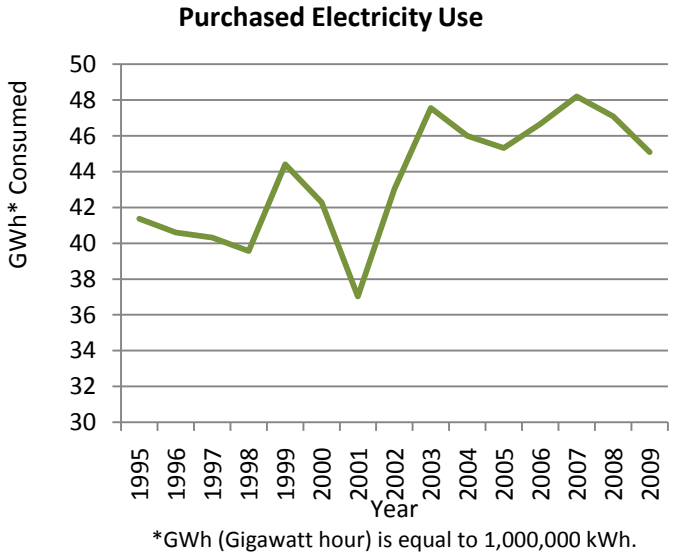
- Initiate an effort to increase metering of individual buildings on campus, to assess energy usage for various campus activities, and to provide feedback on the effectiveness of reduction strategies. A method for prioritizing metering installation should be developed.
- Require Foundation management to modify their current policies to mandate the tracking and generation of summarized annual consumption reports for University Village and Innovation Village.

Data Supplier/Contact

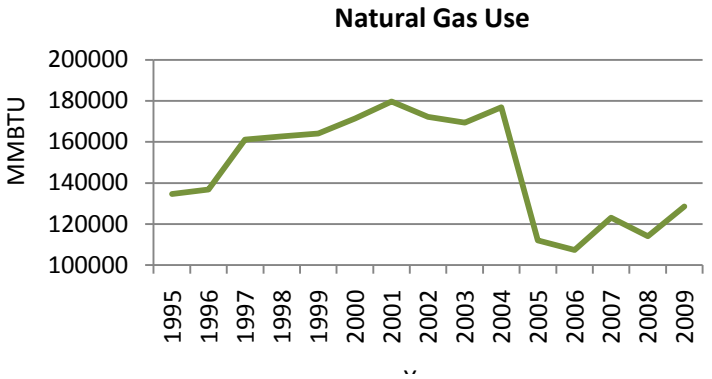
Purchased Electricity & On-Campus Stationary Sources (Natural Gas):
University: George A. Lwin, Manager, Energy Services, Facilities, Planning & Management

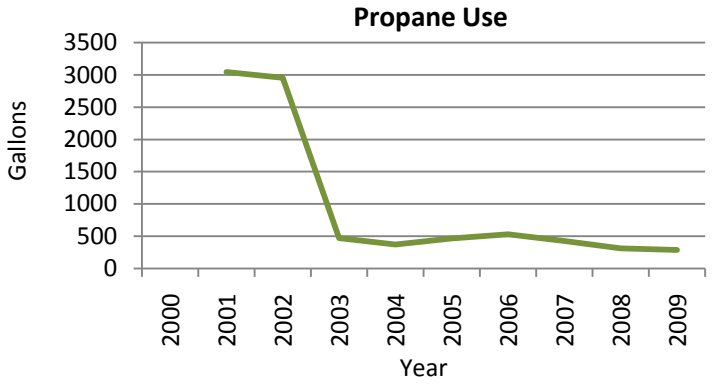
Foundation: Sherry L. Flamino, Assistant Director, Housing Operations, Foundation Housing Service
Notes: University Village Apartments data was added to the University totals provided by George Lwin.

On-Campus Stationary Sources (Propane): Peter Graves, Lead Auto Equipment Mechanic, Facilities, Planning & Management



*GWh (Gigawatt hour) is equal to 1,000,000 kWh.





7.0 Agriculture and Landscape Emissions Inventory

Introduction

The agricultural and landscape component of the greenhouse gas inventory is primarily concerned with methane (CH_4) and nitrous oxide (N_20). Most livestock animals release methane produced by microbes in the gut and from the decomposition of their manure. Nitrous oxide is associated with fertilizer application on crops, fields and grounds. While produced in much smaller quantities than carbon dioxide on campus, these gases have greater global warming potentials: methane has a GWP of 23, and nitrous oxide has a GWP of 296.

Cal Poly Pomona's agriculture- and landscape-based methane and nitrous oxide gases are created by the small number of livestock kept on campus and by the evapotranspiration of plants that have been synthetically and organically fertilized. Overall, methane and nitrous oxide make up a very small percentage of Cal Poly Pomona's total carbon footprint.

Data Collection

Methane-based agricultural emissions were determined by a simple head count inventory of beef cows, swine, goats, sheep and horses entered into the CA-CP model.

Nitrous oxide-based emissions were calculated by inputting quantities of organic and synthetic fertilizer, soil amendments and mulch used on campus grounds into the CA-CP calculator. Because the nitrogen content in fertilizers is directly related to the release of nitrous oxide into the atmosphere, nitrogen percentages per applied pounds were input into the calculator. Livestock head count data also contributed to total agricultural nitrous oxide emissions.

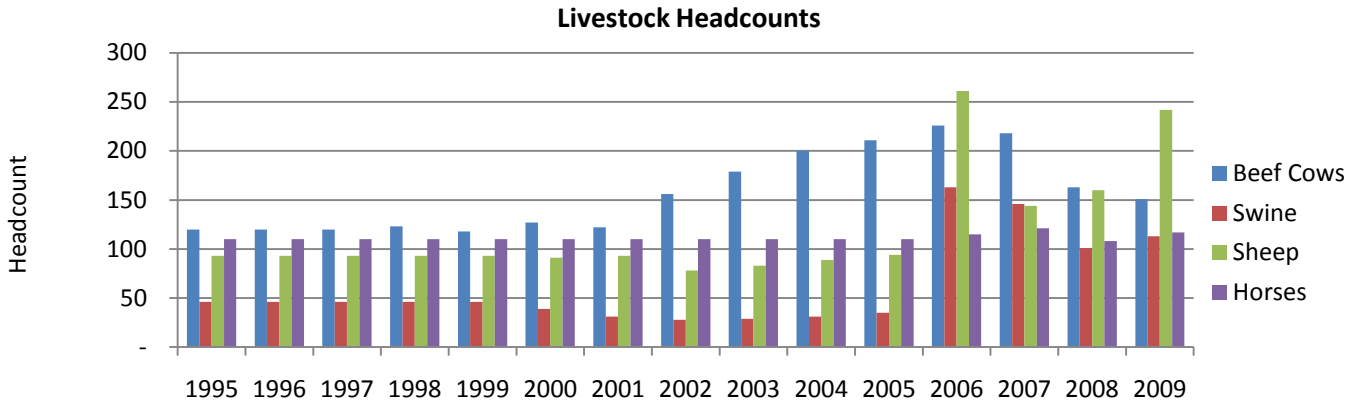
The data required to calculate campus fertilizer use was researched, estimated and synthesized from three different campus entities, each with its own recording method. Agricultural fertilizer data was based on estimates provided by Dan Hostetler of the Plant Sciences department. Horticultural fertilizer data was calculated by bag count by Monica Salembier of the Plant Sciences department. Landscaping fertilizer data was gathered by reviewing purchase orders entered in Facilities' maintenance management database, with vendor names provided by Richard Farmer, Steven Willison and Daniel Vest. Quantities and percentages for two years where little-to-no relevant landscaping purchasing information was found were estimated based on averages of three years for which more detailed purchasing information was available. For purchase orders without descriptive line items, Daniel Vest provided two fiscal years' worth of supplementary invoices for one vendor. When additional documentation was unavailable, Richard Farmer and Steven Willison estimated what percent of a typical total purchase from each vendor went toward fertilizer, mulch and/or soil amendments. Pounds of agricultural, horti-cultural and landscaping fertilizer were then combined and nitrogen percentages averaged. The results were entered into the CA-CP model, which converted the data to metric tons of Scope 1 fugitive emission CO_2 equivalents.

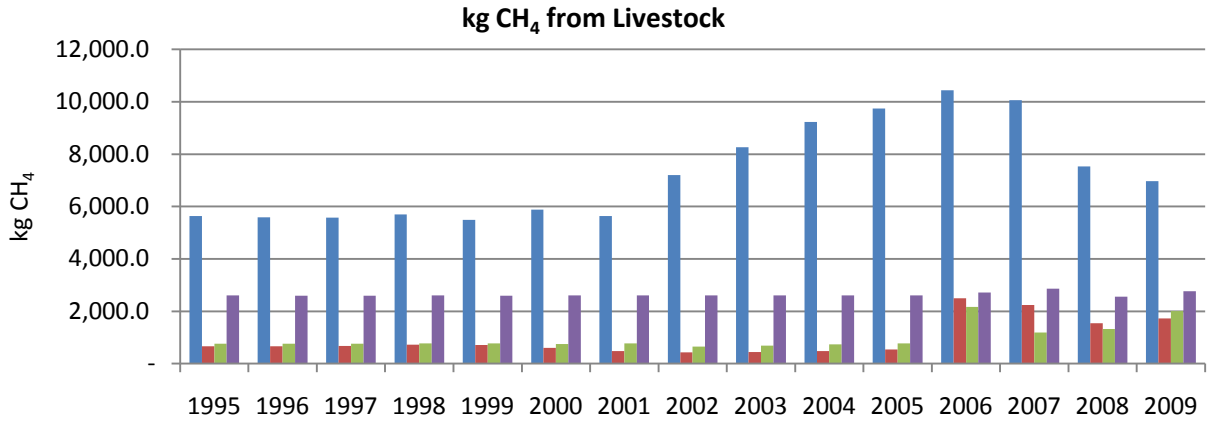
Key Finding

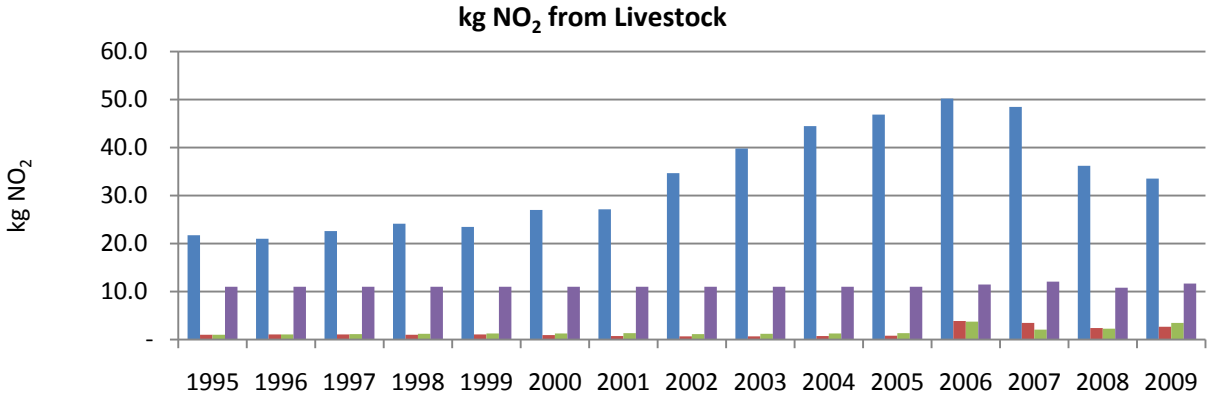
Agriculture and landscaping appears to have a small effect on Cal Poly Pomona's total carbon footprint. As in the 1995-2005 report, this sector produced 1% of Cal Poly Pomona's total emissions from 2006-2009.

Livestock

Total livestock counts increased by approximately 12% from 2005 to 2009. However, 2005 and 2009 emissions comparisons show decreases in total methane (-16%) and total nitrous oxide (-28%). This may be attributed to a decrease within the total livestock population of beef cows, which emit substantially larger quantities of greenhouse gases than do other campus livestock species. Sheep, which primarily account for the total livestock count increase, release significantly lower numbers of both compounds.







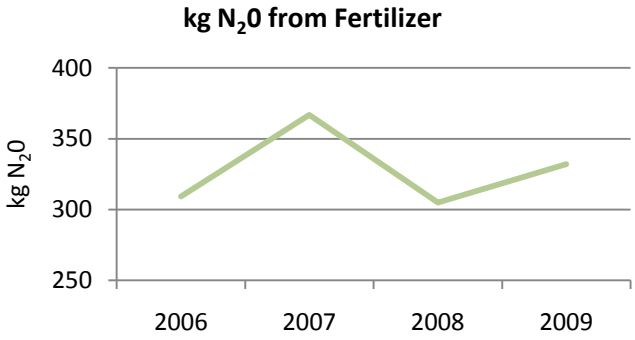
Fertilizers

Budget reductions, crop species rotations, land reallocation and procedural changes have all impacted fertilizer use at Cal Poly Pomona since the 1995-2005 inventory. Due to State of California budget cuts, Landscape Services changed procedural policy by switching to slow-release and other more effective types of synthetic fertilizers, increasing the use of organic mulch (a portion of which is sourced from on-site tree maintenance), applying fertilizers only in high traffic areas, and increasing the frequency of soil testing to monitor fertilizer levels. In 2007, Landscape Services also installed an automated central irrigation system covering approximately 80% of the campus landscape area that is able to better manage water use on campus, thereby

improving the efficiency of fertilizer applications and reducing the amounts of fertilizer used.

Agricultural land has also undergone changes and fluctuations since the last report. Cropland was reduced from 30 to 10 acres at Innovation Village, a 65 acre commercial development built on land leased by Cal Poly Pomona. Union Pacific rail construction impacted 30 acres of agricultural land for two years during the 2005-2009 reporting period; however, only 4 acres was lost upon completion of the project. The Plant Science department's crop rotation practices indicate that a single land plot receives different amounts and types of fertilizer with each crop's specific requirements. While detailed yearly crop information was not provided for this reporting period, alfalfa, citrus, avocado and stonefruit were cultivated – each of which require less intensive fertilizing than crops grown in previous years. Finally, 12 acres of trees planted on formerly open land may have played a role in reducing campus greenhouse gas emissions, as trees sequester and store carbon from the atmosphere.

As such, Cal Poly Pomona's greenhouse gas emissions from fertilizer show a sharp decrease from 1995-2005 report to 2006-2009. However, a comparison of the two reports may yield artificial results due to several influencing variables: different calculation methods used, changes in total acreage reported, modified land use, different recordkeeping practices and estimates based on partial data. Nonetheless, it may be reasonably concluded that procedural and land use changes have reduced greenhouse gas emissions in this sector since the last report.



Recommendations

- Continue landscaping practices which increase the use of organic mulch and improve the efficiency of synthetic fertilizer applications.
- Increase the planting of crops that self-fertilize or otherwise require less use of synthetic fertilizer.
- Increase the practice of allowing cropland to lay fallow, in order that decomposing organic matter may provide soil nutrients and thereby reduce the need for synthetic fertilizers.
- Continue soil testing to monitor nutrient levels, thus improving the efficiency of fertilizer applications.
- Improve, standardize and centralize tracking method for pounds of fertilizer used for agricultural, horticultural and landscape activities.
- Conduct carbon sequestration inventory of campus landscape to assess current rates of sequestration that serves as offset for greenhouse gas emissions.

Data Suppliers/Contacts

Fertilizer Application, Agriculture: Daniel G. Hostetler, Chair, Plant Sciences Department
Fertilizer Application, Horticulture: Monica P. Salembier, Nursery Tech, Plant Sciences Department
Fertilizer Application, Landscaping: Richard C. Farmer, Manager, Landscape Services, Facilities Management; Steven G. Willison, Lead Gardening Specialist, Facilities Management; Daniel P. Vest, Administrative Support Coordinator I, Facilities Administrative and Energy Services
Livestock Headcounts: Dr. Broc A. Sandelin, Associate Professor, Animal & Veterinary Sciences

8.0 Solid Waste Emissions Inventory

Introduction

According to the EPA, landfills produced approximately 22% of the total anthropogenic methane (CH4) emissions in the United States during the year 2008.[19] As the organic matter in solid waste decomposes in a landfill, it produces methane, a greenhouse gas 21 times more potent than carbon dioxide.[20] Organic waste at Cal Poly Pomona is mainly composed of food waste, green waste, and paper products such as cardboard, copy paper, napkins, and paper towels. CA-CP uses emission factors for an average composition of organic matter likely to be in the solid waste stream. The emissions factor is applied to annual tons of waste to generate emissions totals. On-campus composting provides significant offsets to total greenhouse gas emissions.

Before the year 2000, Cal Poly Pomona sent its solid waste to Spadra Sanitary Landfill, located on campus property and operated by the County of Los Angeles Sanitation District under a joint powers agreement between the University and the County. In 2000, the University began sending solid waste to Puente Hills Landfill and sending other construction and demolition waste to West Valley Materials Recovery Facility (MFR) in Fontana, CA. Waste is currently sent to West Valley and is not generally landfilled; rather it is sorted, recycled and recovered for redistribution to third-parties for further use.[21] Waste eventually moves to the El Sobrante and/or Mid-Valley landfills. All landfills to which Cal Poly Pomona sent or currently sends solid waste have operational methane-gas recovery programs.[22]

The energy generation taking place at Spadra Sanitary Landfill calls for further examination. The University owns the landfill property; however it sold the rights for energy generation from the methane, which takes place off University property. The potential to include this resource as an on-site energy asset under the terms of the campus climate commitment should be considered in the planning process.

Data Collection

Since the passage of AB 75 in 1999, all California state agencies and large facilities are required to file an annual report detailing solid waste reduction practices with the Department of Resources Recycling and Recovery (CalRecycle). Solid waste data for Cal Poly Pomona was collected from the CalRecycle website, where the annual reports are posted by Cal Poly Pomona's Facilities Planning & Management recycling coordinator. Records are available from CalRecycle for the years 2001-2009.

The CPP Foundation owns and operates most of the dining facilities on campus and uses separate receptacles for waste. The waste produced by Foundation activities eventually enters the same solid waste stream as the University, where it is diverted, disposed and eventually reported to CalRecycle with Cal Poly Pomona's annual data. Recycling, grass cycling and the majority of compostable materials are hauled away and processed off site. On-site composting quantities reported to CalRecycle reflect the composted waste of research-related animals only. Other composting activities that occur on campus are not reported to the recycling coordinator.

Estimating Data for CA-CP Input Worksheet:

As part of the prior joint powers agreement between Cal Poly Pomona and Los Angeles County, solid waste produced on campus was deposited free of charge at Spadra Sanitary Landfill during its years of operation. For this reason, no financial records exist to indicate annual tonnage of solid waste produced before 2000. For the purposes of the CA-CP model, the solid waste tonnage for 1995-2000 was estimated by an average of .18 tons per full-time equivalent student (FTES). From 2001 to 2007, records were available from the Facilities Planning and Management's recycling coordinator with estimated categorical data. After 2007, Cal Recycle adopted new reporting procedures. The new per capita disposal and goal measurement system moves the emphasis from an estimated diversion measurement number to using an actual disposal measurement number as a factor. Additionally, it includes an evaluation of program implementation efforts. However, the new reporting structure does not allow for the measurement of on-campus composting behavior. For this purpose, the incomplete on-campus composting data for years 2008 and 2009 were based on data from the previous year. This estimate is considered to be conservatively low in consideration of long-term data and behavioral trends.

Key Finding

Solid waste is not a major source of emissions on the Cal Poly Pomona Campus. This sector comprised less than 1% of CPP emissions.

Solid Waste Emissions

Recommendations

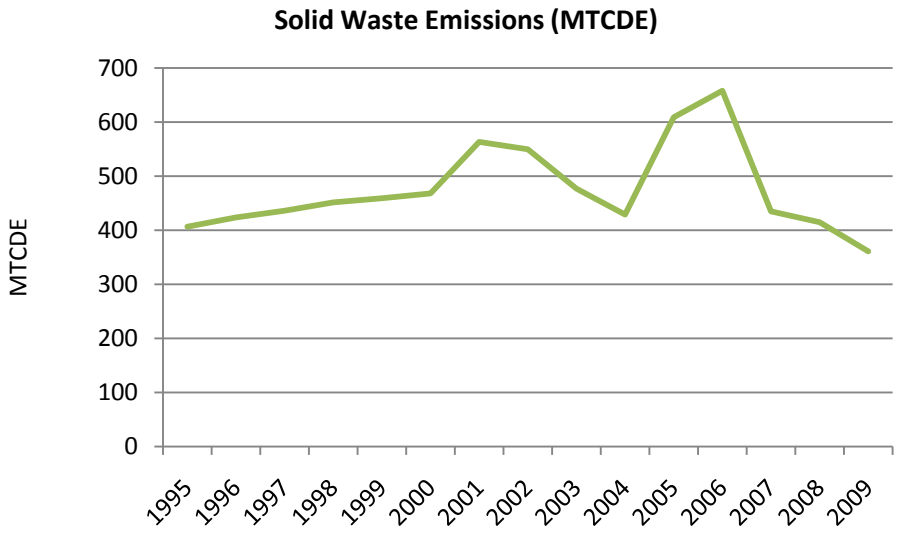
- Continue to report on actual disposal measurements in the standard form required by CalRecycle.
- Additionally, this inventory requires that on-campus composting continue to be recorded for each year. This may be accomplished with either actual measurements or with the previously used method of estimation.

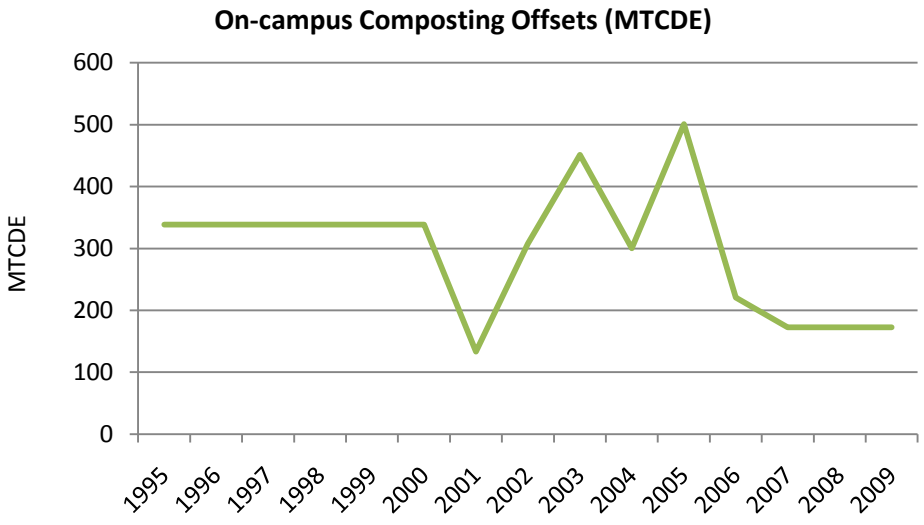
Data Supplier/Contact

Short tons of Landfilled Waste with CH4 recovery and electricity generation:

CA Department of Resources Recycling and Recovery: CalRecycle, www.calrecycle.ca.gov

Monika Kamboures, Recycling Coordinator, Facilities Planning and Management





9.0 Refrigerants Emissions Inventory

Introduction

Refrigerant gases are a significant factor in global warming because of their high global warming potentials (GWP) and ozone depletion potentials (ODP). Per the Montreal Protocol, chemicals and gases such as halons and chlorofluorocarbons (CFCs) are being phased out due to their harmful effect on the earth's ozone layer, and as such they are not required for inclusion in the CA-CP inventory. However, descriptions of types and amounts of refrigerant emissions reported in the "Other" column of the CA-CP reporting tool show that Cal Poly Pomona has emitted HCFCs and CFCs during the inventory period, and the emissions resulting from these compounds have been included in this CPP GHG inventory. Refrigerant gases emitted by Cal Poly Pomona during the inventory period have GWPs ranging from 1100 (R 401a) to 8500 (CFC 12).

Refrigerant gas emissions occur because of equipment leaks or because of normal recharging. During mechanical failure, gas can leak out of refrigeration or air-conditioning equipment and must be replenished before the equipment is returned to service. Section 608 of the Clean Air Act regulates refrigerant and air-conditioning equipment leaks by instituting recycling and recovery management, sales restrictions and safe disposal measures.[23]

Quantifying the impacts of refrigerant emissions is made more complicated when operating efficiency variables are considered. For example, a gas may have a high GWP but operate at an efficiency level that negates the GHG production of other gases used to power the equipment. Thus, although they have higher global warming potentials, some gases allow the equipment to operate more efficiently and require less energy to operate. Overall, refrigerant gases make up a very small percentage of Cal Poly Pomona's total carbon footprint.

Data Collection

Refrigerant emissions data was taken from the annual emissions reports prepared by David L. Patterson, Director of Cal Poly Pomona's Office of Environmental Health and Safety (EHS), as a requirement of the South Coast Air Quality Management District (AQMD). Refrigerant emissions fall into the AQMD's "Specific Organics" and "Toxic Air Contaminants/Ozone Depleting Compounds" reporting categories. In theory, all academic departments, Campus Facilities Management, University Housing and independent contractors servicing the campus' main chiller and refrigeration at the Collins School of Hospitality Management submit their emissions data to EHS. EHS then consolidates the data for inclusion in the annual report.

Foundation Facilities Management does not report emissions totals to AQMD or EHS. Based on service records, Foundation Facilities Manager Steve Whippie and HVAC technician Raul Partida were able to estimate how much of each gas was emitted by Foundation-managed equipment over the inventory period. These amounts were added to the University totals.

Equipment managed by Foundation includes:

- All refrigeration and AC for Bldgs. 76, 77, 78, 97 and the University Village
- All AC for Bldgs. 55 and 66
- All refrigeration for food courts, CLA Pony Express, and the ENV Café
- All AC in the CTTI Building
- Refrigeration in the Geneva Café in the American Red Cross Building

Refrigerants Emitted on Campus

Quantities, GWP and ODP of all reported refrigerant emissions are listed in the table "Global Warming Potential (GWP) and Ozone Depletion Potential (ODP) of Refrigerant Emissions Reported at Cal Poly Pomona." This table includes a breakdown of types and amounts of refrigerants reported as "Other."

Refrigerants Emitted at CPP with GWP & ODP:

Gas	GWP (100 year interval)	ODP	Pounds Emitted 2006-2009
HFC-134a	1300[24]	0.59[25]	45
HFC-404a	3260[2]	0.03[3]	80
HCFC-22	1700[2]	0.05[4]	2895
Other: HCFC-21	240[26]	.04[4]	<1
Other: CFC-12	8500[27]	1[5]	359
Other: R-401a	18[28]	0[6]	20

Refrigerant Emissions

Key Finding

Refrigerant gases are not a significant source of GHG emissions on campus. This sector comprised less than 1% of Cal Poly Pomona's emissions.

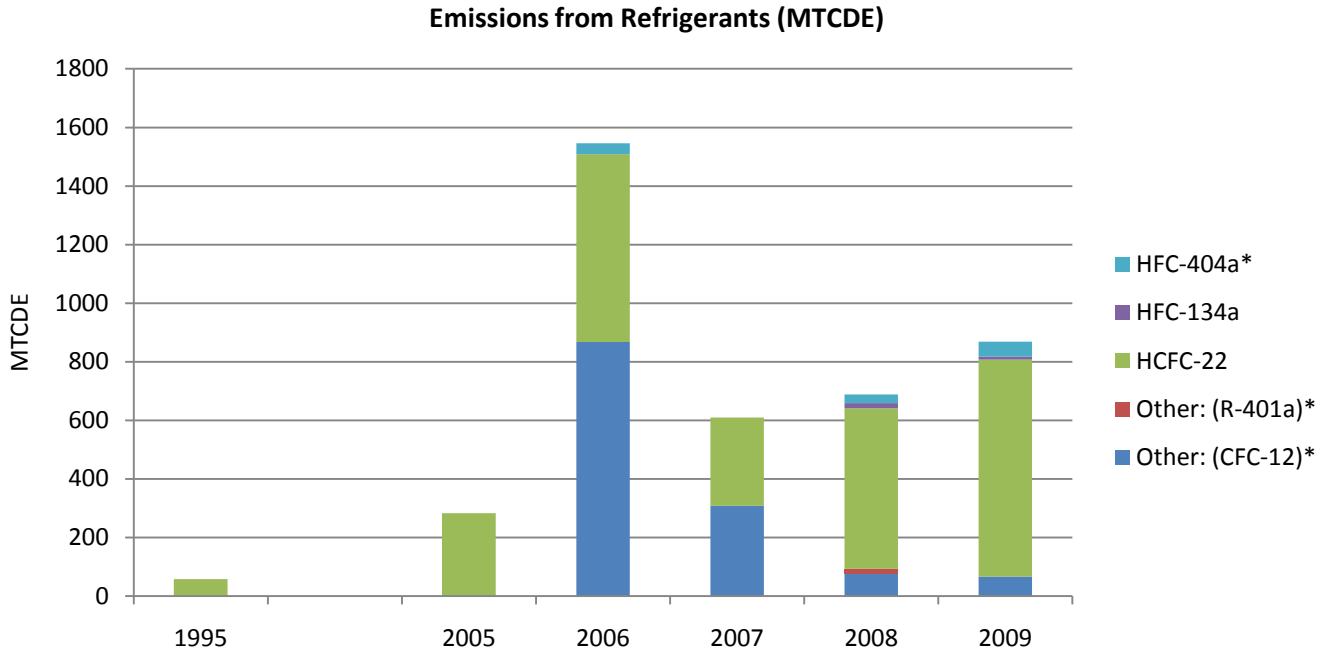
Recommendations

- Commission and perform regular maintenance on mechanical cooling systems to minimize leaks and breakdowns.
- Replace older equipment with newer models that minimize or eliminate the need for ozone-depleting substances.
- Replace oversized equipment with efficient models that are correctly sized for need.
- Work with campus entities and independent contractors to improve, standardize, and centralize tracking methods to ensure consistency and thoroughness of annual reports.

Data Suppliers/Contacts

University: David L. Patterson, Director, Environmental Health and Safety

Foundation: Steven A. Whippie, Facilities Manager, Foundation Facilities Management; Raul Partida, Foundation Facilities Management



* Not included in 2007 report (1995-2005)

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[13] *Implementation Guide.* Version 1.1. American College and University Presidents Climate Commitment, 2009. p.13.

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