University of La Verne

Greenhouse Gas Emissions Inventory

(Fiscal year 2005 – 2009)

Reported: July 2010

Prepared by:

Allison Marsh (B.S. Biology)

Amanda Parra (B.A. Environmental Biology)

Dylan Rivera (B.A. Psychology)

Michael G. Wolfsen (Lead Consultant)

American College & University Presidents Climate Commitment

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Table of Contents

List of figures

List of tables

List of appendices

Introduction

The University of La Verne is deeply rooted in a commitment to respect the environment and that philosophy is clearly stated in the Mission Statement:

"The University affirms a philosophy of life that actively supports peace with justice, the health of the planet and its people. Therefore, in light of this affirmation, it encourages students to become reflective about personal, professional, and societal values. It also encourages values-based ethical behavior."

Based on those values, in 2008, President Steve Morgan signed an agreement to include La Verne in the American College & University Presidents Climate Commitment (ACUPCC). President Morgan said. "The University of La Verne's Mission Statement speaks directly to helping our students understand the impact humans have on their environment. So I believe it is essential for us to be part of a nationwide effort to seek solutions to this imminent threat."

With the signing of the ACUPCC agreement, the University has committed to demonstrate its values through the adoption of the roadmap envisioned by the ACUPCC:

1. Establish an institutional structure to oversee the development and implementation of the schools program to comply with the ACUPCC.
2. Complete an emissions inventory within a year.
3. Within two years, establish a climate action plan that sets a target date with interim milestones for becoming carbon neutral.
4. Take immediate steps to reduce greenhouse gas emissions by choosing from a list of tangible action options.

5. Integrate sustainability into the curriculum, making it part of the educational experience.
6. Make climate action plan, inventory and progress reports publicly available.

La Verne had formed a Sustainable Campus Committee in 2002 and completed a draft campus environmental audit. The Sustainable Campus Committee has continued to be active as the Sustainable Campus Consortium and has published a Sustainability Checklist which identified actions in process and challenges remaining. The University has recently completed construction on a Campus Center that has achieved a LEED silver rating. There has been considerable action by all departments towards developing a sustainable campus including education, waste reduction, recycling, energy management and green purchasing. However, much work is yet to be done to comply with the ACUPCC commitments. This Inventory is the analytical tool that will inform the direction of the University's Climate Action Plan

Tool: Clean Air-Cool Planet Model

The GHG assessment has been documented using the Clean Air-Cool Planet (CA-CP) Calculator. This model is used by many universities within the ACUPCC group and was selected on the basis of simplicity of use and a sound track record with many colleges and universities. Clean Air-Cool Planet is a non-profit, non-partisan organization the works with campuses, corporations and communities to work towards the reduction of greenhouse gas emissions. This organization has created the CA-CP Campus Carbon Calculator to model emissions.

There are three benefits from using the Calculator:

1. Greenhouse Gas Emissions Inventory: Collecting, analyzing, and presenting data on the emissions of greenhouse gases attributable to La Verne operations. This step provides an essential foundation for focused, effective collaboration on the issue of climate change at the University.
2. Forecasting Emissions: Projection of the university's current trends and alternate scenario emissions will provide a context for choosing emission reduction goals and the projects needed to meet those goals.

3. Evaluate Carbon Reduction Projects: Developing a portfolio of proposed carbon reduction projects will create an effective climate plan that will address the specific emissions identified.

Inventory Methodology/Description

Three levels of responsibility for emissions, also known as scopes, have been identified by the CA-CP model and are required by the ACUPCC to be reported. Scope 1 emissions are considered direct emissions from sources that are owned and/or controlled by the University (Hough et al., 2008). They include on-campus stationary source, direct transportation sources, refrigerants and other chemicals. Scope 2 emissions are considered indirect emissions from sources that are neither owned nor operated by the University, but are directly linked to on-campus energy consumption (Hough et al., 2008). Purchased electricity was the only scope 2 emissions that were reported. Scope 3 emissions are considered emissions attributed to the University. They include commuting, directly financed outsourced travel, study abroad travel, solid waste, paper waste, and waste water (Hough et al., 2008).

Scope

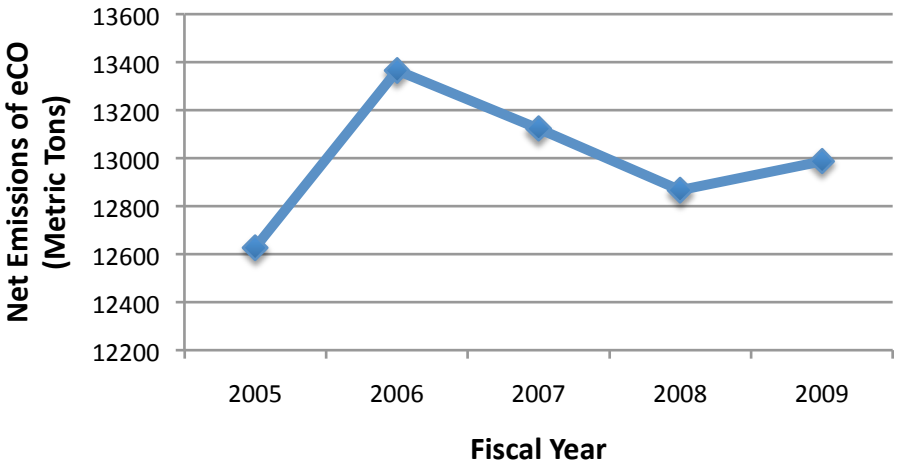
The scope of this study addressed data from the years 2005 to 2009. The physical boundary was limited to facilities that are owned by the University. Leased facilities were not considered due to the limits of influence the University has over energy sourcing and consumption, as well as other data points not within La Verne's control. Regional campuses currently have activities that represent emission levels that are deemed to be minimal compared to the main campus.

Executive Summary

As the University of La Verne has acknowledged the need to be accountable for their contributions to global climate change, this report has been created to provide detail on the University's emissions of the six GHG: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_20), hydrofluorocarbons (HFC), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6) determined by the Kyoto Protocol. Inventory was collected for the purpose of providing a baseline study of the University's GHG emissions and for providing information on emission trajectories so that reduction goals are practical and obtainable. Inventory findings, methodologies, and recommendations included in this report should be used to implement sustainable practices on behalf of a university-wide initiative to reduce emissions and ideally work toward achieving carbon neutrality.

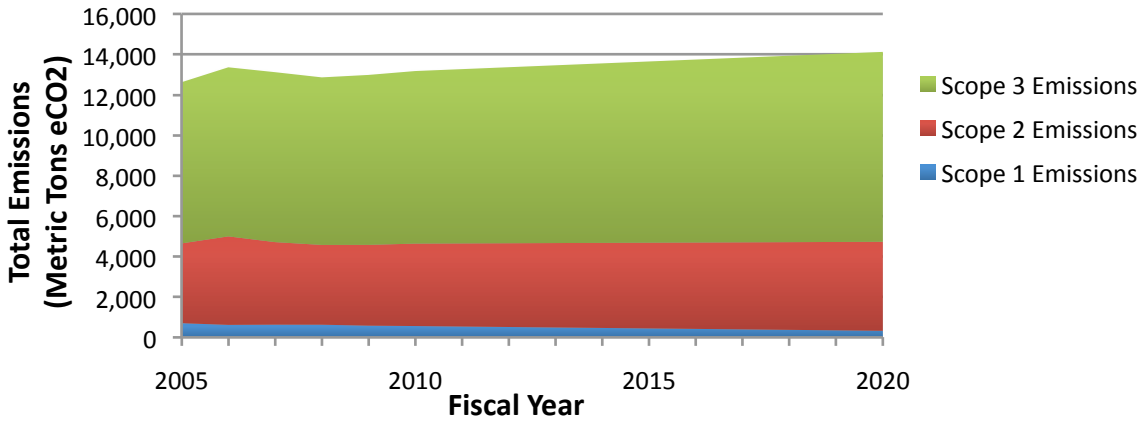
Results from the Carbon Calculator show that improvements aimed at lowering emissions need to be implemented. La Verne's net emissions show little fluctuation from 2005 – 2009 with the exception of 2006 (Figure 1). A peak in 2006 resulted from an increase in study abroad travel and purchased electricity. From 2005- 2006, study abroad travel was responsible for producing an increase of 278,301 kg of CO_2. Purchased electricity also contributed 42,941.6 kg of CO_2 more than the previous year. Over the five year period being analyzed, electricity consumption ranked the highest in 2006. The University generated average net emissions of 12,994.44 tons of carbon dioxide equivalents (eCO_2) annually from 2005- 2009.

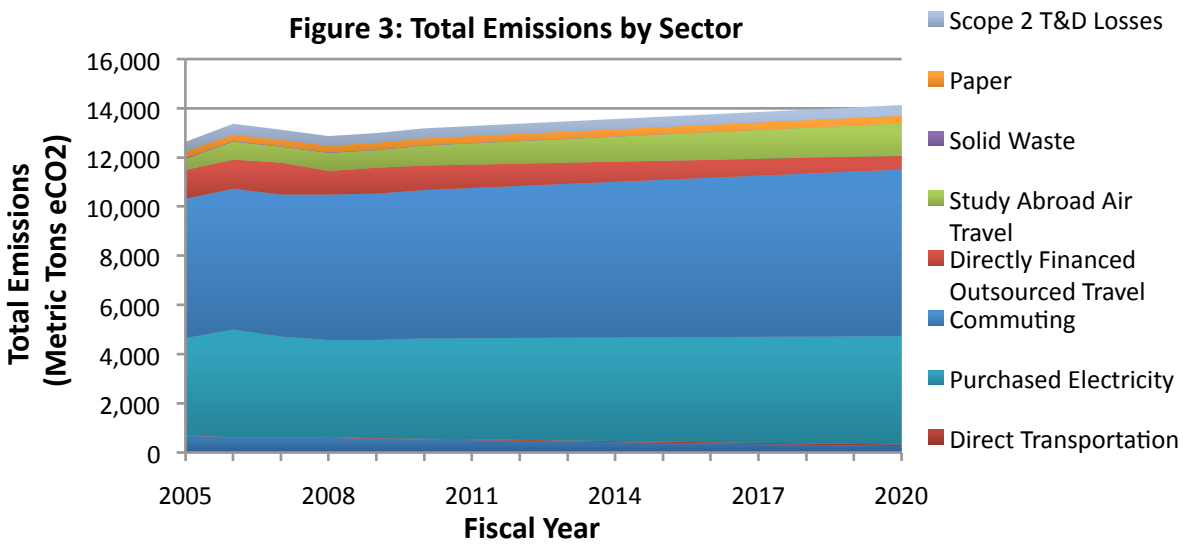
Figure 1: Net Emissions of eCO2



Scope 1 emissions contributed the least amount of carbon dioxide equivalents to the total emissions of the University and are projected to decrease over the next ten years with continued improvements in natural gas usage (Figure 2). Scope 2 emissions, purchased electricity, contributes less than ½ of total emissions with projections expected to remain constant over the next ten years. Scope 3 emissions accounted for more than ½ of the total emissions reported by the University and are expected to gradually increase over the next ten years. Emissions due to commuting, study abroad travel, and directly financed outsourced travel were the bulk of Scope 3 emissions (Figure 3).

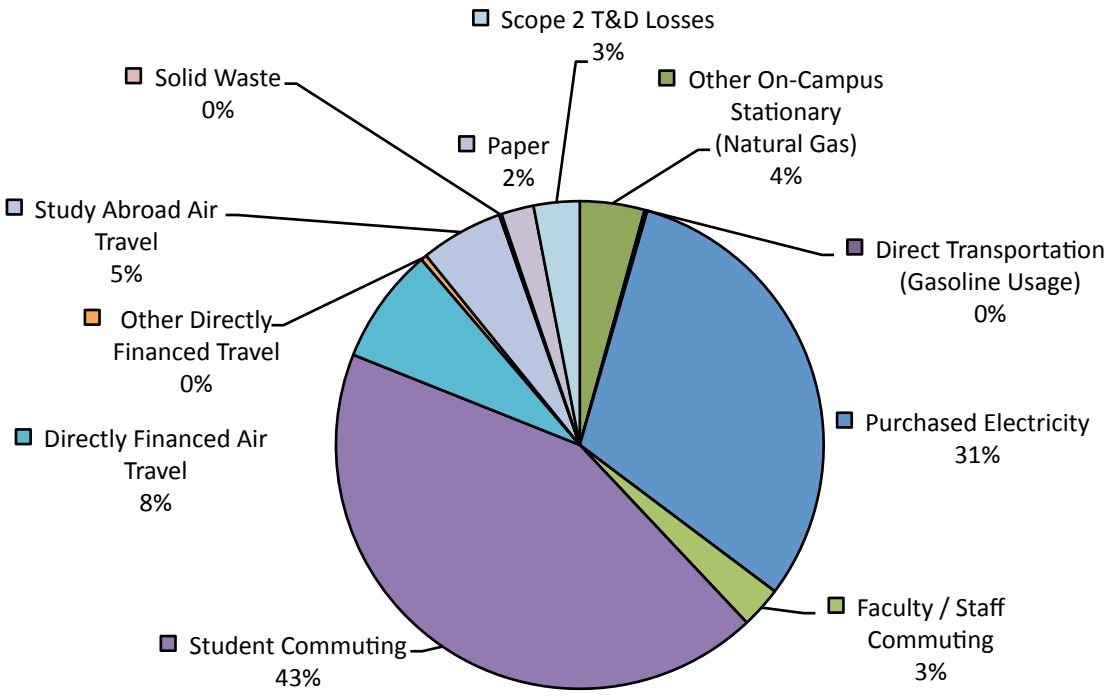
Figure 2: Total Emissions by Scope





The breakdown of carbon dioxide equivalents for 2009 displayed how the contributions of different sectors add to the University's total GHG emissions (Figure 4). Student commuting accounts for 43% of total GHG emissions and contributes an average of 5,346,066 kg of CO_2, 1,069.4 kg of CH_4, and 368.08 kg of N_2O from 2005- 2009. The greatest concern following student commuting is purchased electricity, which accounts for 31% of total GHG emissions. Other sectors are classified as de minimus (contribute less than 5%) and are not required to be included in the inventory, however, it is imperative that they are, so that the University can collect a comprehensive inventory of their GHG emissions. Sectors represented as contributing 0% of carbon dioxide equivalents, such as solid waste, direct transportation, and other directly financed travel account for an amount less than 0.5%.

Figure 4: Breakdown of carbon dioxide equivalents for 2009



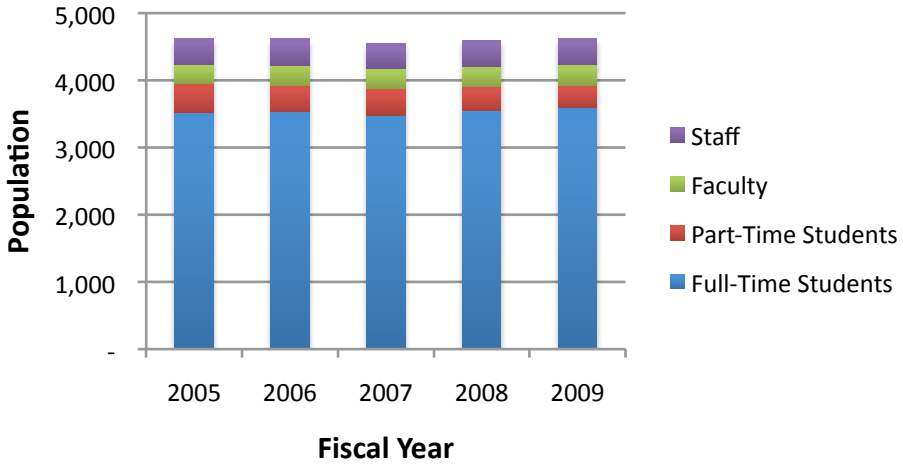
GHG Emissions Inventory

Institutional Data

Population Size

In order to provide a foundational source of data and to normalize the green house gas emissions from the University of La Verne when compared to other institutions, student, faculty, and staff populations must be considered. The University's full-time student population attending classes on the main campus has remained relatively consistent at approximately 3,500 students since 2005, with an average increase of 0.5% each year for the past five years (Figure 5). Unlike the slight increase in full-time student population, there has been an average 6% decrease per year in the part-time student population. The University's faculty population has increased by an average of 2% each year, but staff population has remained relatively consistent. Projections by Homa Shabahang, Ph.D, Vice-President of Enrollment Management, predict the undergraduate student population to increase 1% each year in the next four years.

Figure 5: Campus Population



Methodology

Student, faculty, and staff population numbers were acquired by the University of La Verne Fact Book, published by the Office of Institutional Research at the University of La Verne. The student population included in the institutional data includes all undergraduate, graduate, DPA, EdD, PASC, PsyD, and Law students enrolled in main campus programs. Since the University of La Verne does not track part-time student enrollment for main campus programs, a method acquired from Cal Poly Pomona's GHG Emissions Inventory was used to estimate the part-time student population. Student full-time equivalents were used for the actual full-time population number and this number was subtracted from the total student population to obtain an approximate number of part-time students. This method produced a slightly overstated full-time student population and a slightly deflated part-time student population.

Faculty and staff were broken down into full-time and part-time workers in the Fact Book. Since the carbon calculator does not distinguish between full-time and part-time faculty, the total number of full-time faculty was added to a ¼ of part-time faculty to more accurately project full-time faculty equivalents. This same method was done for the staff population, except ½ the amount of part-time staff was added to the total number of full-time staff.

Recommendations

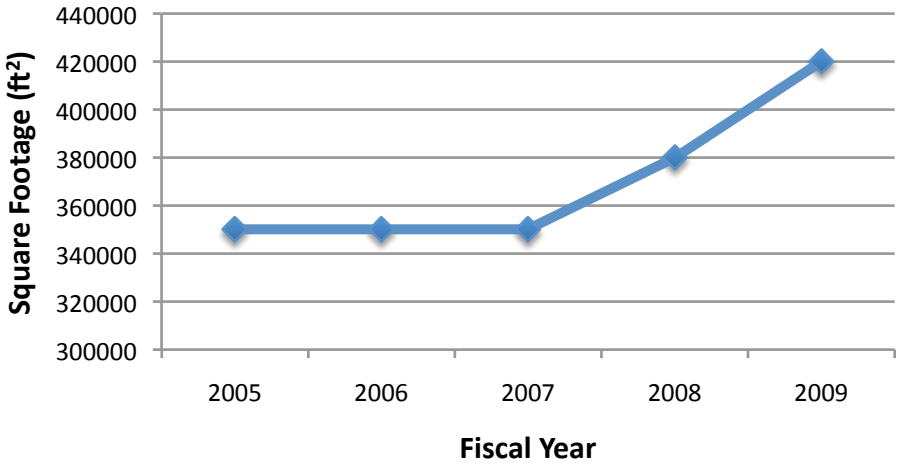
Unlike student population numbers, the faculty and staff population are not presented as full-time equivalents. In the future, the Office of Institutional Research may want to conduct their own full-time equivalents for faculty and staff

Physical Size

Data on annual total building space provides insight on total size of a university in relationship to GHG emissions. Fluctuations in the physical size of La Verne resulted from the expansion of the Sports Science & Athletics Pavilion in 2008 and the addition of the Campus Center in June 2009 (Figure 6). The Campus Center is notable for being the first building in the city of La Verne to earn the Silver LEED certification from the US Green Building Council. This prestigious certification is only granted to buildings which meet rigorous standards of environmental

consciousness such as water efficiency, use of recycled materials, and energy consumption. Other University structures have been altered within the time span of the report, but these changes were renovations and have not impacted the total square footage in any way.

Figure 6: Physical Size



Methodology

The information was derived from an estimate created by the Senior Director of Central Services and Capital Planning, Raymond "Chip" West, III. Prior to this estimate, there was not a current figure for the University's total square footage, since all numbers were calculated based on a map of La Verne created in 1978. Mr. West developed his estimate to meet the Western Association of Schools and Colleges (WASC) accreditation standards. WASC accreditation is used to determine the quality of a school and efforts made towards continual self-improvement. Mr. West calculated his estimate by personally entering each building on La Verne's campus and recording the dimensions of each area. Mr. West decided the category of use for each space he measured based on his professional opinion. Although his estimate is rather accurate, it is not entirely representational of the entire square footage of La Verne since limited access was granted for some zones under construction and occupied residence halls during the period measurements were taken. Considering that Mr. West was working alone, and that there was scant data for square footage to be found, and he had a strict timeline to follow, he did a remarkable job of providing a sound estimate of campus-owned space.

Recommendations

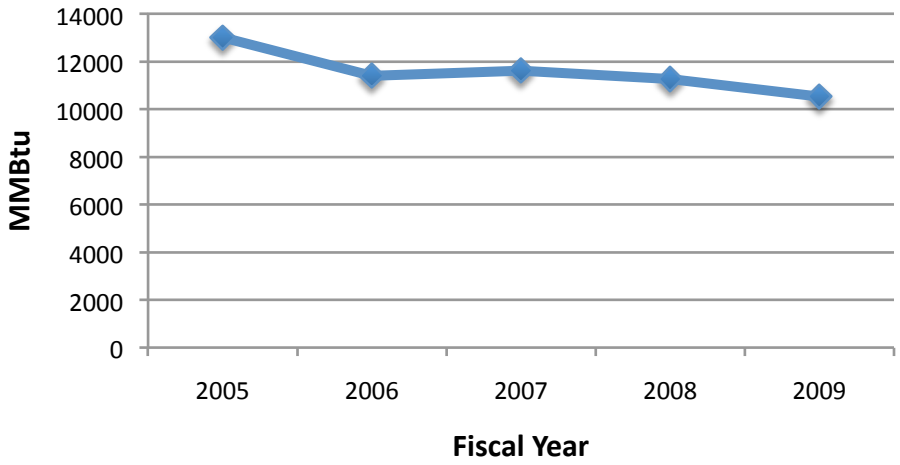
The estimate provided in this report is by no means the terminus for detailing the square footage of the University. Mr. West is currently in the process of cataloging exact square footage details of each building owned by La Verne using a software program known as "Accendo", which creates detailed virtual maps of campus buildings. Accendo allows for a standardized measure of La Verne's square footage and zonal use categorization, therefore allowing for not only a more accurate depiction of total square footage, but also of total square footage in each category of use. Maps will be equipped with the exact square footage of each zone in addition to a variety of details such as types of carpet, location of fire extinguishers, faculty occupying the space, color of wall paint, etc. Accendo mapping is predicted to be complete by 2011. This is a remarkable project that will supply an astonishing amount of information in a neatly ordered and easily accessible program.

Scope 1 (Direct) Emissions Sources

On-Campus Stationary Source (Natural Gas Emissions)

Natural gas is considered a Scope 1 emissions source, since it is combusted on campus to provide heat in buildings. Natural gas contributes 4% of total GHG emissions at La Verne. The graph details the trend in natural gas usage over the period studied at the University (Figure 7). Natural gas usage peaks during the winter months, when heating is used more frequently.

Figure 7: Natual Gas Usage



Methodology

Initially, data for natural gas usage at the University was sought at the Facilities building. As it turned out, Facilities did not have the original copies of the billing invoices; these were held in the Accounts Payable Department. Since the Facilities Department did not keep records of natural gas usage, the data had to be gathered in a more convoluted manner—namely, by investigating the total amount of money spent on natural gas and then computing the amounts consumed based on annual natural gas rates. It would have been possible to attain exact numbers of natural gas purchased by examining archived billing invoices, however, the data used reflects a valid approximation of usage.

Sandy Lejay, Accounts Payable Manager provided a vendor analysis report that detailed the sums paid by the University to Southern California Gas Company from July 2004 to June 2009.

Although La Verne has numerous accounts with Southern California Gas Company—a result of virtually each building tapping into a different gas main—the total amount of money paid to each individual account was included in one lump sum in Lejay's report.

Southern California Gas Company yielded the billing rates for the years required. Prices for natural gas fluctuate not only with the year, but also in terms of amount of gas consumed. There are two types of gas rates—Tier One, which is a baseline rate, and Tier Two, which is a discounted rate for gas purchased in bulk above a certain rate. Southern California Gas Company provided the Tier One and Tier Two rates per calendar year. Since Accounts Payable records yearly sums paid based on the fiscal year of the University (July through June), it was necessary to take the averages between years for both Tier One and Tier Two rates, and then blend these two averages to yield the best-fitting rate with which to compute total therms consumed. Therms were then converted to MMBtu (the unit of measure the CA-CP calculator desires) by dividing each sum by ten. This method of working backwards to obtain amount of gas consumed proved to be surprisingly accurate—when checked against addition of therms based on a year's worth of invoices, the number calculated backwards was only off by a small percent.

Recommendations

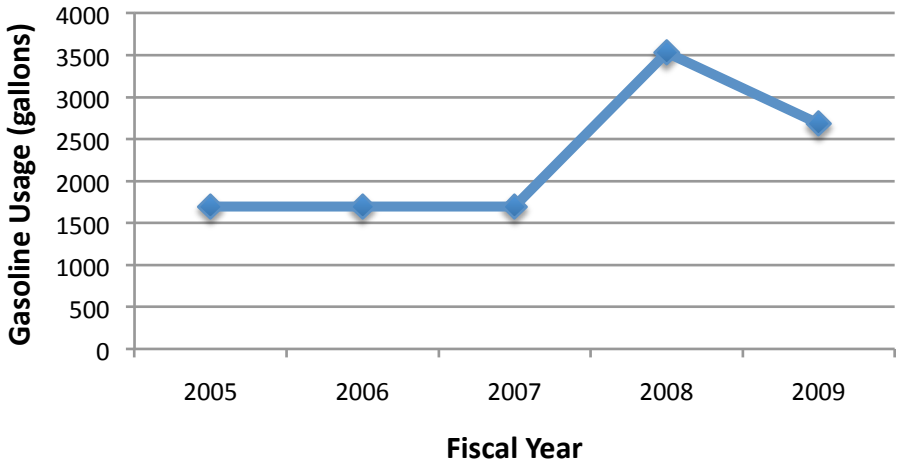
In order to achieve an actual number of therms used and not a close estimate, it is necessary to track the therms used on monthly basis from the billing invoices received, perhaps by asking Accounts Payable for copies to be delivered as invoices are received. Another option may be to contact Southern California Gas Company and ask them to compile a monthly/annual total usage report of consolidated the University's natural gas accounts.

Direct Transportation Sources (Gasoline Emissions)

The University's vehicle fleet consists of less than 10 vehicles (trucks, vans and SUVs). Gasoline consumed (unleaded and diesel) by University-owned vehicle accounts for less than 0.5% of

total GHG emissions at La Verne. The graph depicts total yearly amounts in gallons of gasoline used by campus-owned vehicles (Figure 8).

Figure 8: Gasoline Used by University-owned Vehicles



University Fleet

According to Mike Nunez, Director of Campus Safety and Transportation, the transportation department owns four vans and one pick-up. Three older vans that are used to travel less than a 20 mile radius, one 2002 van (purchased used with approximately 49,000 miles) used for traveling farther distances and one pick-up truck used to transport items less than a 10 mile radius. Leased vans are used for traveling distances farther than a 20 mile radius and University gas cards are used to fuel these vehicles. Mileage logs are kept for leased vans and Campus safety vans and are maintained through Mike Nunez. The Natural Science Division owns two vehicles that travel approximately the same mileage annually; however mileage from the newest vehicle was not included because it was purchased after the time frame of the project. Mileage logs are not kept for these vehicles. According to Maggie Mantecon, OIT Office Coordinator, the facilities department owns two vehicles, a pick-up truck and a flatbed truck. The flatbed truck is rarely used and the pick-up truck is used for traveling distances within a 10 mile radius. Facilities do not keep a mileage log for the pick-up; however, it is generally used to pick up supplies from local hardware stores.

Methodology

Mike Nunez, Director of Campus Safety and Transportation was the first point of reference in discovering where records of gas consumption for University-owned vehicle were maintained. He provided insight on campus fleet vehicles and revealed that mileage logs are kept for some vehicles; however, Mr. Nunez did not hold records of total gasoline purchased. Accounts Payable holds records for all gasoline purchased by campus-owned vehicles, with the exception of purchases for the suburban, which the Biology Department owns and maintains.

Sandy Lejay, Accounts Payable Manager was able to provide a vendor analysis report detailing the yearly sums paid to Shell Gasoline by the University. La Verne has a single account with Shell Gasoline, with numerous Shell account cards existing. The University has maintained this account since June 2006, with prior gasoline purchases belonging to another unknown account. The previous account would most likely be found via archived invoices, but time constraints did not allow for an investigation into this possibility. In order to compute the amount of gasoline used in gallons, it was necessary to divide yearly sums paid to Shell by yearly gasoline rate averages. The Bureau of Labor Statistics holds online records which contain monthly gasoline averages for the United States. A more accurate record of native gasoline price averages exists in the Lundberg Report, but contact was not reciprocated with this organization in the duration of this project.

The total amount of gasoline used in gallons from the Shell account was calculated using the averages obtained from the online Bureau of Labor Statistics database. The total gasoline consumed by the Biology Department suburban was calculated by dividing the yearly mileage (obtained by taking total mileage on the vehicle and dividing by years owned) by the MPG of the vehicle. Added together, the sums of gallons of gasoline from the Shell calculation and the Biology suburban calculation yielded the total yearly amount of gasoline consumed by campus-owned vehicles. Data for the years prior to the Shell account was extrapolated due to missing data and time constraints. Contact with Shell Support Services revealed that they did not have

the ability to generate total gasoline usage for fiscal years 2005- 2009. During interviews with staff, the researchers were not able to identify reasons for the variability in yearly usages.

Recommendations

Calculations based on amounts of gasoline purchased would be more accurate if local and not national averages were used. It would be beneficial to subscribe to the Lundberg Report to have access to such data. Sums of gasoline purchased by the Biology Department should be maintained to provide for a more accurate measure of gasoline consumption. Consolidation of accounts should be considered, so that data is more easily accessible. Reference to vehicle fleet summaries is suggested for future inventories. Review of mileage logs as a means of tracking gas efficiency should also be considered.

Refrigerants and Other Chemicals

A component of greenhouse gas emissions inventory includes analysis of the types of refrigerants used and modifications of chiller systems in order to reduce energy consumption as a university-wide initiative. The types of the refrigerants used throughout the University include R-22, R-134a, R-143a, R-502 and R-12 (Table 1). Global warming potentials (GWP) were determined based on CA-CP inventory. Emissions of refrigerants from the University are minimal, similar to other campuses due to the limited amount of accessible data. South Coast Air Quality Management District (SCAQMD) 2006-2007 reports reveal that there were not any refrigerant leaks from the Trane unit (storage capacity of 193 lbs. of R-22) used for the Arts and Communications Building. As for the McQuay unit (storage capacity of 51 lbs of R-22), a leak occurred in 2006, which resulted in 0 lbs recovered and 51lbs. of additional refrigerant needed. The York unit (storage capacity of 1600 lbs of R-134A) had a leak in 2007, which resulted in 1475 lbs. recovered and 125 lbs. of additional refrigerant needed.

Table 1: Refrigerant gases used by the University of La Verne

Refrigerant	GWP (100 Year) based on CA-CP	Refrigerant Usage
Freon R-22 (HCFC)	1,700	Used in majority of AC units
R-134 (HFC)	1,300	Used in York and Smardt Chiller located in central plant, split AC in Hanawalt house, possibly carrier chillers in Founder's Hall computer room and possibly carriers in RCA Building, which is included in central services.
R-143a (HFC)	4,300	Used in 8-split AC, which holds 80lbs and is located in the Campus Center.
R-502 (Blend of R-22 and R-115) (CFC)	4,500	Used in refrigeration condensers in Davenport Dining Hall
R-12 (CFC)*	8,500	Possibly used in refrigeration condensers in Davenport Dining Hall

(Report from EMCOR Services)

The University has made significant progress in reducing their energy expenditure over the last four years through modifying the central plant chiller system. In 2006, the University installed a chiller loop system and expanded the Central plant to reduce energy consumptions, increase efficiency, and maximize cost savings. The addition of the chiller loop system converted 45 compressor operated AC units into chilled water air-handling units. Expansion of the central plant included the addition of a 400 ton Smardt Turbocor Chiller that demands fewer kilowatts per ton (kW/ton) and operates at variable frequencies to prevent the system from continually running at full capacity. The Hartman Loop System was also installed to measure kilowatt per hour (KWh) needs, match chilled water supply by demand, and then control pump and chiller speeds, so that only the needed amount of chilled water is produced (EMCOR Group, 2009). The process of converting the old chiller system into a green chiller plant has led to an estimated savings of 368, 141 kWh and over $50,000 per year.

Methodology

Information on the refrigerant usage and expansion of the central chiller plant was supplied by the Director of Facilities Management, Robert Beebe and Account Manager, Michael Brewer

from EMCOR Service Mesa Energy Systems, Inc. Robert supplied information regarding the justifications for expanding the Central Plant, analysis of chiller system comparison, and estimated cost savings. SCAQMD Reports (2006- 2007) showed documentation of unit leaks and audits on units using greater than 50 lbs of refrigerant, however, the University had no documentation on units using less than 50 lbs. of refrigerant. Michael Brewer had access to a spreadsheet that noted location of equipment, tonnage of equipment, and the type of refrigerant used for each unit. The GWP numbers were determined based off EF_GWP spreadsheet in the Carbon Calculator. The GWP for R-502 was determined from Xuan and Chen, 2004.

Recommendations

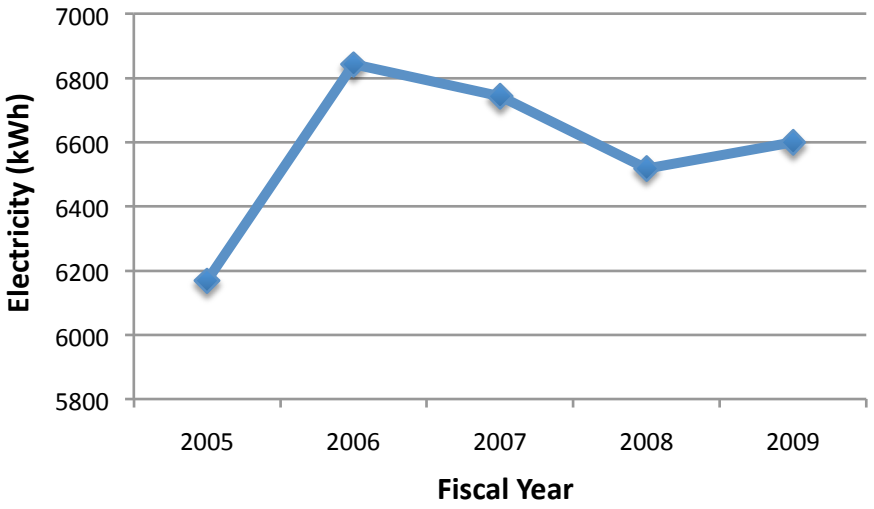
Facility Department should consider a regular audit to assure that refrigerants are of limited impact. SCAQMD reports should be easily accessible from servicing companies as well as campus entities. Information regarding total amount of refrigerant being used should be determined even for units less than 50 lbs., considering that there is a large number of small units throughout the University.

Scope 2 (Indirect) Emissions Sources

Purchased Electricity

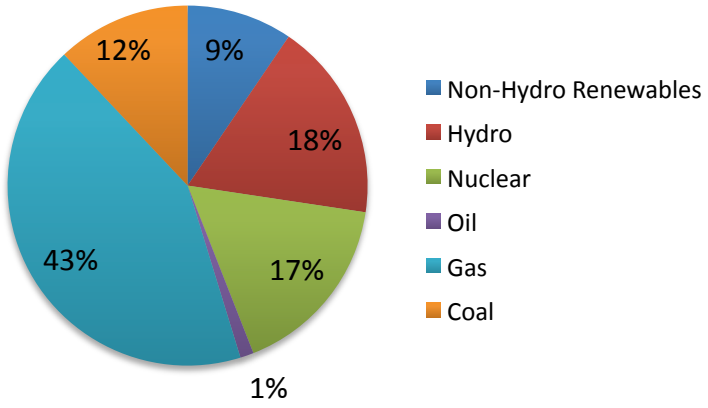
Purchased electricity accounts for 31% of GHG emissions produced by La Verne in 2009. The graph details total kilowatt per hour of electricity consumed by the University on a yearly basis (Figure 9).

Figure 9: Electricity Usage



According to an online EPA database, the electricity the University purchases is primarily generated using natural gas rather than the more common national medium of coal. This difference accounts for smaller GHG emissions generated by local electricity production—roughly ½ the carbon dioxide generated by the national average and less than 2.5% of sulfur dioxide than the national average. Southern California Edison (SCE) currently purchases about 43% of their electricity from natural gas sources (Figure 10). Production of electricity from coal burning accounts for approximately 12% of SCE's electricity source. Cleaner methods of electricity production that emit lower GHG emissions are being investigated

Figure 10: Southern California Edison Electricity Sources



Methodology

The Facilities Department of La Verne holds nicely charted electricity usage on a yearly basis. Data regarding electricity usage was directly obtained from Facilities and cross referenced using yearly sums paid to SCE obtained from Sandy Lejay, Accounts Payable Manager calculated against yearly averages.

Recommendations

Facilities should continue to closely and thoroughly monitor electricity usage at La Verne, not much needs to be improved upon in terms of tracking electricity usage.

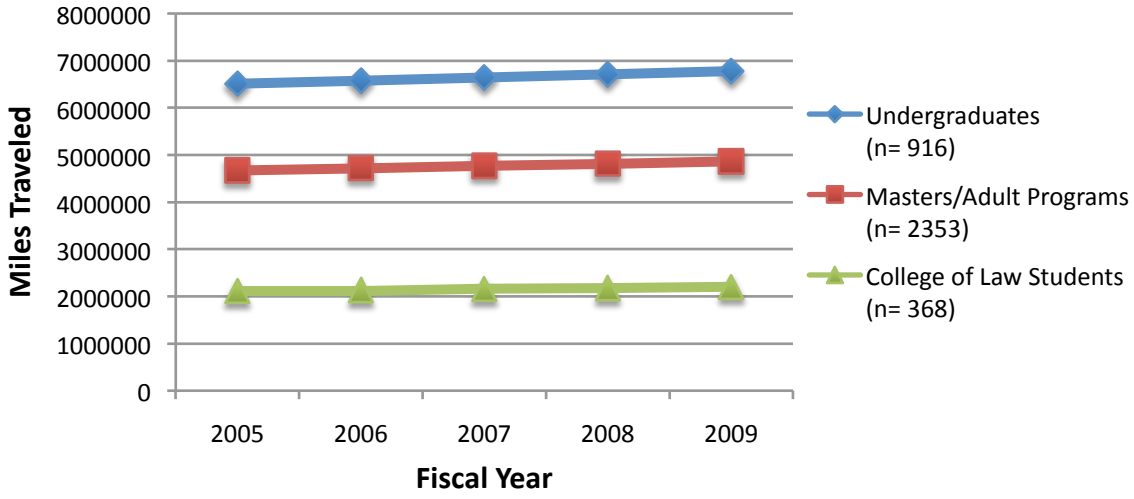
Scope 3 Emissions Sources

Commuting

Daily commuting by students, faculty, and staff to and from the University of La Verne has proven to be a significant source of green house gas emissions according to the carbon calculator. Student commuting contributed to 43% of the carbon emissions from the University in 2009. According to the Vice-President of Enrollment Management, Homa Shabahang, Ph.D, 64% of the undergraduate population commutes approximately 4 days a week; the other 36% are residents on campus. Dr. Shabahang also pointed out that there are roughly 400 online students at the University, so no commute is required from them. Dr. Shabahang estimated that all College of Law Students commute 3 to 4 days weekly, where Graduate and Adult students commute 2 days per week. Due to lack of student commuter surveys, all estimates for student commuting are based on the assumption that all students personally drive their own vehicle to the University. While it is more than likely that some students carpool, bike, walk, or take the bus, there are no records to support this data so for the sake of a conservative estimate, all data was imputed as single commuters.

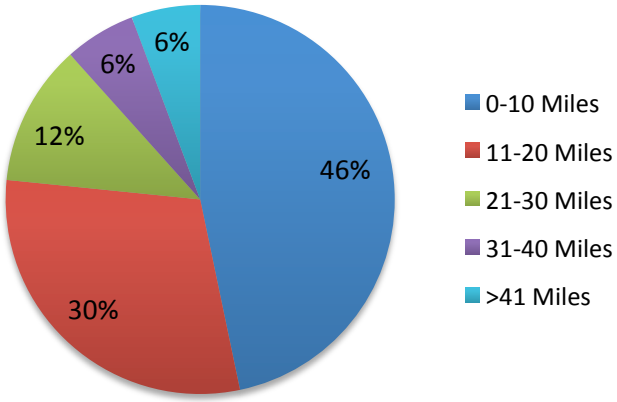
Mapping of student commuter distances in 2009 was possible for undergraduate, Masters and Adult Programs, and College of law students through GIS analysis performed by George Checkal, GIS Specialist (Appendix 2). Results revealed that commuting undergraduates (64% of 1432) contribute the greatest amount miles traveled to/from the University (Figure 11). However, 61% more Masters and Adult Program students commute, but traveled considerably shorter distances than undergraduates. College of Law students traveled the least amount of miles to/from the University. Commuter mileage prior to 2009 was predicted based off of Homa Shabahang's, Ph.D, Vice-President of Enrollment Management, projections that campus population increases by 1% each year. Data was degraded by 1% each year to find commuter mileage from 2005- 2008.

Figure 11: Total Student Commuting Miles



Commuter data from 2009 showed that of the 3637 commuting students (undergraduates, Masters/Adult program, and College of Law students) 76% of them traveled 20 miles or less to get to/from the University and more than 94% of commuters were found to live within a 40 mile radius of the University (Figure 12).

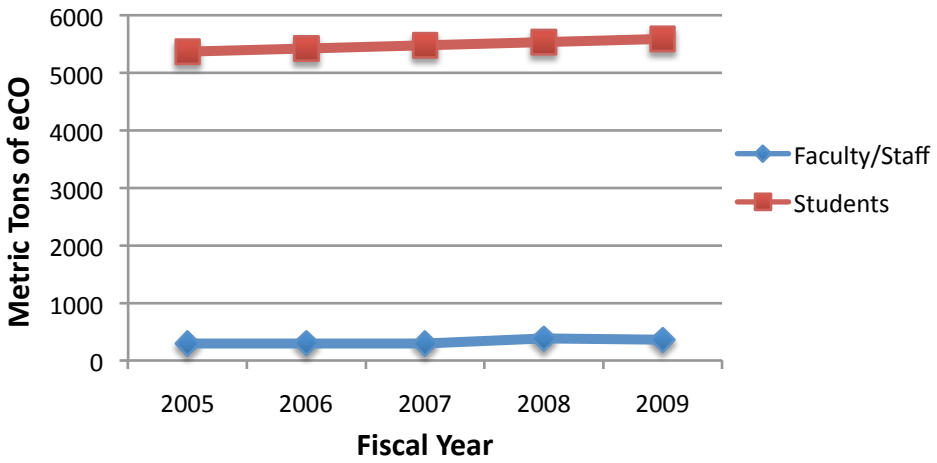
Figure 12: Student Traveled Distance to/from the University in 2009



Faculty and staff have a more concrete set of commuter data due to annual employee commuter surveys. Commuting from faculty and staff contributed to 3% of the total carbon emissions in 2009. The annual survey results were accessed through Tiffany Smith, Human

Resources Assistant and Events and Transportation Coordinator. The survey results of 2009 show that 43% of faculty and staff members drive their own personal vehicle 5 times a week to the University, for 35 weeks out of the year at a mileage distance of approximately 15 miles one-way. Ten percent of the faculty and staff were found to carpool with one or more other people, where only 0.2% of faculty and staff members travelled by bus to the University. The overall commuting emissions for faculty, staff, and students throughout the five past years can be seen in Figure 13.

Figure 13: Commuting Emissions



The University Human Resources Department participates in an Employee Commute Reduction Program and reports carpool activity levels annually to the South Coast Air Quality Management District. The key reporting metric is Average Vehicle Ridership. The reporting is limited to employees who report to work between the hours of 6:00AM and 1000 AM and as such is a partial reflection of potential ridesharing. The HR Department sponsors marketing activities annually to encourage and support the program.

The mandatory Average Vehicle Ridership goal for the University is 1.5 riders per vehicle. When reporting began in 2006, the Ridership was reported to be 1.18AVR. In 2007 and 2008, the AVR rose to 1.543 and 1.45 respectively. For 2009, the Ridership has declined to 1.31AVR. That reduction in participation has been largely due to the disruption of established carpools

through staff changes at the University. The HR Department continues to work on strengthening the program through internal marketing efforts.

Methodology

Determining emissions from commuters proved to be one of the most challenging tasks of the inventory process. The lack of transportation-related surveys made it especially hard to predict student-commuting habits. Luckily, the Human Resources Department gives out an Air Quality Management District (AQMD) survey to all full-time university employees and students. This survey does not differentiate between students, faculty, and staff, so ratios were calculated based on the percentage of faculty and staff in a given year (student commuting was not calculated based on this method due to the fact that a portion of the entire student population was not surveyed; only student employees were accounted for). The survey was able to produce a variety of useful results for the past three years. Such results include how many faculty and staff members drive alone, carpool, take the bus, take the train, walk, bike, and drive a zero emissions vehicle. These numbers could then be extrapolated to represent a certain percentage of faculty and staff that use a particular mode of transportation and how often the average employee was commuting to work. It was estimated that employees are present 35 weeks out of the year, slightly more than the weeks in a semester.

A zip code analysis of the AQMD survey results (done by Metro) was able to give an estimate of the approximate number of miles per commuting trip for each faculty or staff member. The zip code analysis breaks down how many employees work with a 5 mile, 10 mile, or 20 mile radius. Any person who commutes more than 20 miles was also represented on the zip code analysis map, and they were estimated to have commuted 40 miles for a one-way trip to the University. By knowing how many employees drove a certain approximate distance, the average distance could be calculated. The average distance varied from 14 to 16 miles throughout the years; this may seem low when compared to other schools, but the University of La Verne has a significant number faculty, staff, and students who live within a 5-mile radius.

GIS analysis data provided an approximate number of commuting students (undergraduate, Masters/ Adult Programs, and College of Law students) per mileage radius category based on zip code information. The number of students per each category was multiplied by the mileage radius category, the approximate number of trips to/from the University per week (Dr. Shabahang's predictions), and by number of school weeks in a year, excluding spring break to get the total number of miles traveled per year. Due to time constraints, a 16-week semester system was used for all calculations; however, it is known that there are quarterly terms for some Masters programs, but data did not allow distinguishing between different programs.

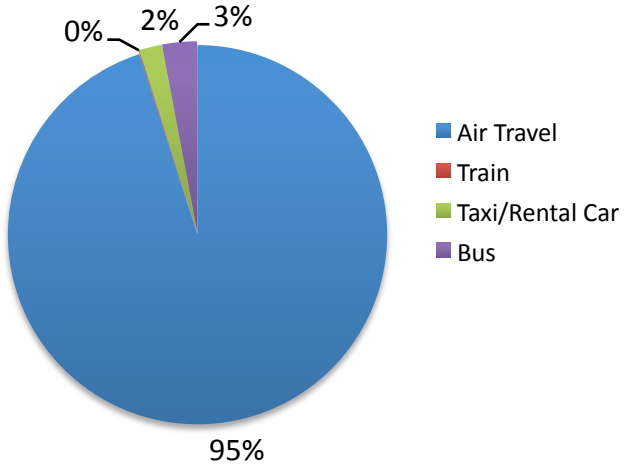
Recommendations

To better calculate the impact of emissions from commuting sources, a method for collecting and analyzing commuter behavior needs to be established. A commuter survey is probably the best method for gaining solid commuting data. Information needed should include mode of transportation, number of persons in the vehicle, approximate distance of travel, and number of trips to the University per week. Conducting a commuter survey before each person could purchase a school-parking permit could provide valuable commuter information.

Directly Financed Outsourced

Directly financed outsourced travel includes all faculty, staff, and student miles traveled that are paid for by the University. This includes all vehicles or aircrafts not owned by the University. Directly financed outsourced travel accounts for 8% of the total emissions. Directly financed air travel from faculty and staff attributed to 95% of the total outsourced travel in 2009 (Figure 14). This is equivalent to 1003.1 metric tons of CO_2. Bus and train travel are estimated to have stayed relatively consistent over the past five years, contributing a combined total of less than 4% of all directly financed outsourced travel. Bus travel by sports teams using Lion Express contributed to approximately 2% of directly financed outsourced travel. Bus mileage has remained relatively consistent over the past two years, with a slight decrease in 2009. The bus percentages presented in this inventory are a conservative estimate in that it includes only records for one bus company, when the University often uses the services of a few different companies.

Figure 14: Directly Financed Outsourced Travel 2009 (Metric Tons of eCO2)



Methodology

Calculation of air miles traveled by faculty and staff was done through records of American Express Business Travel Services (AXO) provided by Judith Stillwell of the Treasury, Management, and Budget Department. AXO is an online travel-booking program for airline travel, hotel reservations, and car rental services for University faculty and staff. An executive summary report gives the total amount of air miles traveled by faculty and staff that used AXO for booking. Not everyone uses AXO, but Judith came up with an approximate percent of people (75% in 2007, and 85% in 2008 and 2009) who do use the online system. Calculations were then done to determine the total air miles traveled with one year, including people who did not book through AXO. AXO records begin in 2007, so the years of 2005 and 2006 were estimated by averaging the number of air miles per faculty and staff member for 2007 and 2009 (2008 mileage numbers were not included because air travel was abnormally low that year due to the University's push for decreased expenditures due to the weak economy) and then adjusting the them for the size of faculty and staff in either 2005 or 2006.

The same executive report summarizes the number of days a rental car was used by faculty or staff using the AXO booking system. Again, this was only a certain percent (40% in 2007, 45% in 2008, and 50% in 2009) of the total number of employees using AXO, so calculations were made to get the total number of days rental cars were used by all employees. This number was

multiplied by 100 miles/day based on Judith's professional estimate. Faculty and staff also use taxis when traveling and Judith estimated that 65% of the people who travel by air take a taxi. The number of taxi riders was then multiplied by Judith's estimate of 50 miles to and from the airport. The taxi miles and rental car miles were added together to impute into the carbon calculator. Again, data for 2005 and 2006 were unavailable due to the new booking system, so the rental car mileage and taxi mileage for 2007 was also used as an estimate for the years 2005 and 2006.

Directly financed train travel could not be specifically separated out from the University's travel reimbursement forms. For inventory purposes, Judith Stillwell was able to estimate that approximately 30 faculty and staff members ride the train twice a year to Los Angeles for business reasons. A two-way trip from La Verne to Los Angeles is approximately 70 miles so calculations were done to represent the mileage of 60 trips per year. According to Judith, the number of people riding the train for the past five years has remained relatively constant.

Bus travel records for Lion Express were obtained through travel and transportation transaction reports from accounts payable. The records document the amount spent on Lion Express bus travel for 2010. Judith's estimate of $3 per gallon and the American School Bus Council's estimate of 7 miles per gallon for large capacity buses allowed for approximate bus mileage to be calculated. Due to the relative consistence of sports travel, this calculated mileage was used as the data for the past five years.

Recommendations

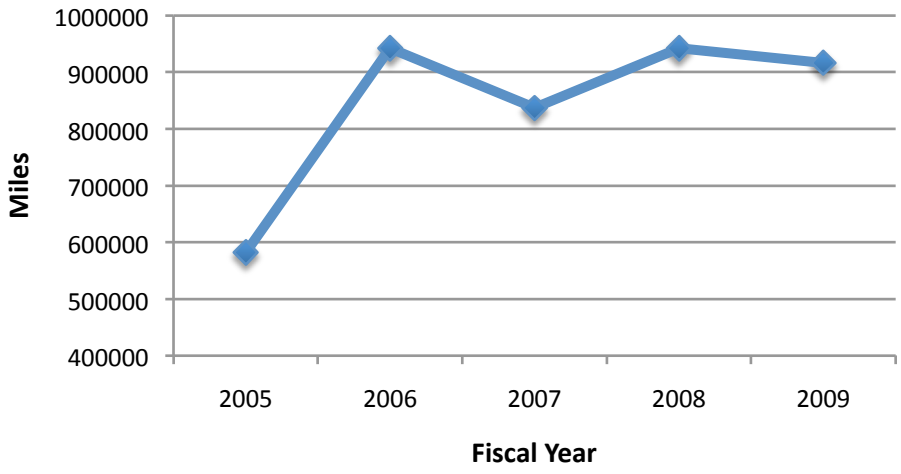
Calculating mileage for air travel, rental cars, and taxis proves to be a daunting task when two different record keeping systems (AXO and expense reimbursements) are being used by the University. To consolidate all the data into one system, it is recommended that 100% of University financed travel should be booked online using AXO. A great advantage to AXO is that it keeps a mileage record of air travel, something that cannot be currently retrieved when looking up expense reimbursement forms.

Ultimately, a centralized database to process and archive all travel mileage is needed to establish a unified method of inventory collection. While this might not be feasible for the University at this time, some sort of electronic mileage catalog should be implemented as soon as possible.

Travel Study Abroad Travel

Although study abroad travel and other school-related international travel is usually financed by the students themselves, the GHG Inventory Committee decided to include these air miles into the report. This allows the University to take a sense of responsibility for the green house gas emissions created of behalf of school-related travel. Study abroad air travel, including all short-term study programs, account for 5% of the green house gas emissions produced at the University of La Verne in 2009. Study abroad travel miles have remained relatively high in the past four years, with year 2008 almost having doubled the amount of miles as in 2005 (Figure 15). While it might be unrealistic and undesirable by the University to decrease air miles contributed by study abroad problems, offsets for air travel should be explored as an alternative to cutting these important educational travel opportunities.

Figure 15: Study Abroad Miles Traveled



Methodology

The air miles traveled by students studying abroad in semester or yearlong programs were calculated through the information provided by the University's International and Study Abroad Services (ISAS). ISAS keeps records of the different locations of study abroad travel and how many students annually attend the trips. Using the air mileage calculator at www.webflyer.com, the mileage from Los Angeles International Airport (LAX) to the capital city, or other city if noted, of the study abroad country could be estimated. This number was then doubled (for two-way travel) and multiplied by the number of students who studied abroad in that country for a particular year.

The University of La Verne has many well-established short-term study abroad programs throughout the different academic departments. They often take advantage of January Interterm, spring break, and summer to travel and study internationally. Mileage for air distance was calculated using www.webflyer.com, but concrete records for the short-term travel programs is currently lacking at the University. The location and number of students traveling was verified by some of the professors themselves, but for those that could not be reached, the online class registration site was used. This site was able to go back six years to show how many students were registered in a particular International Studies Course. The number of students plus one (for the professor), was multiplied by the two-way travel distance of their particular area of study. The mileage of short-term study abroad travel was added to the mileage of semester or yearlong study abroad travel to get an overall number of annual air miles traveled by study abroad students.

Recommendations

The study abroad air travel miles are a good estimate based on the methods of calculation, but the accuracy could probably be improved if two record-keeping strategies were implemented. First, there needs to be records kept, possibly by ISAS, on all short-term study abroad travel that occurs in January, over spring break, or in the summer. Secondly, air mileage could be more accurate if the city flown into was recorded, not just the county. Instead of assuming that

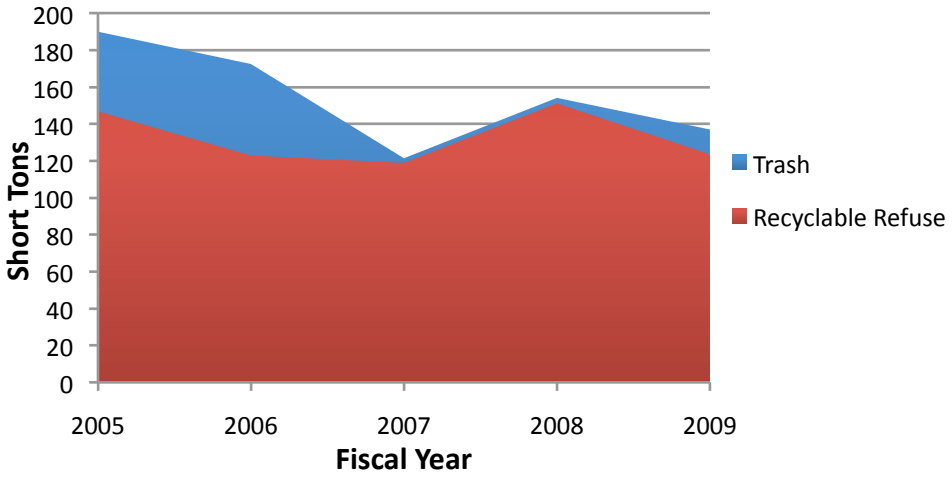
the travelers flew into the capital, knowing the airport and city of arrival and departure would make the calculations more accurate.

Solid Waste

Solid waste sent to landfills generates methane gas (CH_4) that contributes to the accumulation of greenhouse gasses in the atmosphere. The University is doing their part to reduce greenhouse gas emissions associated with waste by promoting a university-wide recycling program that strongly encourages staff, faculty, and students to recycle waste. Refuse reports on annual waste and recyclable refuse reflects the University's attempt to lower greenhouse gas emissions associated with solid waste.

Solid waste comprises less that 0.5% of the University's emissions for 2009. The amount of short tons of municipal solid trash has been reduced over a five year period; however, a predictable negative trend cannot be suggested due to the fluctuation between annual amounts (Figure 16). Recyclable refuse includes cardboard bales, green waste, and paper trash, which has been recently converted to co-mingle recycling (paper, plastics, aluminum, etc.). The decrease in 2007 and sudden peak in 2008 of both recyclable refuse and solid municipal trash should be further investigated to determine reasoning behind such fluctuation. An average of 46% of trash is being diverted to recycling annually. Hazardous waste was not include in trash data because State Board of Equalization (BoE) invoices reveal that the University is a small generating entity (produces <5 tons annually). Food waste generated from Davenport Dining Hall and Barbara's Place Café was not included into the annual tonnage of trash because data was not available. Sodexo waste management account information provided by Patricia Snyder, Waste Management Inc. Account Manager, revealed that they currently require pick-ups five times a week from two 3-yard dumpsters (approximately carrying 125- 175lbs of food waste) due to the addition of Barbara's Place Café in August 2009.

Figure 16: Short Tons of Trash and Recyclable Refuse



The University's solid municipal waste is transported via Waste Management Inc. to the El Sobrante Landfill in Corona, California. El Sobrante has been capturing methane emissions generated from waste and converting it to electricity since 2004. Green waste is retrieved from Waste Management as well, and is either chipped for mulch or used as alternative daily cover in the landfill to reduce odor and trash litter.

Methodology

Solid waste and recyclable refuse information was gathered from Robert Beebe, Director of Facilities Management. He provided a professional estimate of 190 tons of solid waste generated in 2005 due to the lack of data available. Data regarding green waste, cardboard bales, and co-mingled recycling is accessible through the Facilities Management website http://www.laverne.edu/resources-services/facilities-management/recycling/updates. Patricia Snyder, Account Manager from Waste Management Inc., provided details on lanfill information as well as Sodexo account information. Jeff Boster, Saftey Specialist from Risk Management provided BoE invoices.

Recommendations

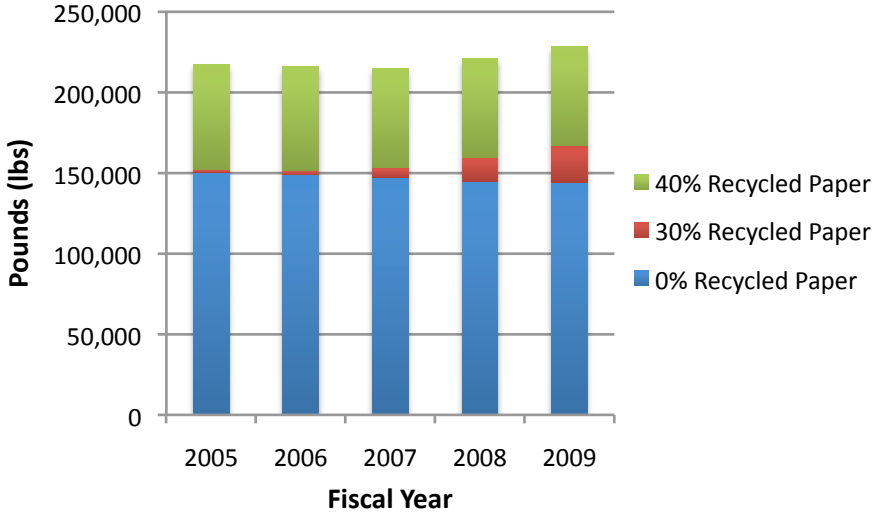
Evidence of waste fluctuations should be thoroughly investigated and data should be cross referenced using account invoices provided by Sandy Lejay, Accounts Payable Manager.

Tracking the amount of waste being retrieved by Waste Management should continue being monitored and record keeping of food waste data should be implemented.

Paper Waste

Paper usage accounts for 2% of the University's emissions. Virgin paper usage accounts for the greatest amount of paper usage (Figure 17). Data revealed that in 2009, the University had a 6% decrease of 0% Recycled Paper, a 9% increase of 30% Recycled Paper, and a 2% decrease of 40% Recycled Paper since 2005. Information given from Deborah Deacy, Director of Purchasing and Procurement showed that there has been a 23% increase of 30% Recycled Paper usage from 2008 to 2009. The Graphics Department only uses 40% Recycled Paper in the 28 different copy machines distributed throughout different departments and does not give inidivuals the freedom to select the grade of paper being used. Based on the results, it is apparent that the University needs to investigate sustainable practices in regards to paper usage to reduce the amount of virgin paper being used

Figure 17: Paper Usage



Methodology

Data from years 2005 and 2006 were estimated due to the lack of available information. Estimated values for 0% Recycled Paper were determined by finding the average difference between years with data and subtracting that value from the more recent year. Estimated values for 30% Recycled Paper were determined based on the average percent increase of given years. Deborah compiled raw data from summary reports of paper purchased from Staples Advantage. Partial data was annualized (divided by the number of months of available data then multiplied by 12), so that quantities simulated like data. Specialty items including vellum, cardstock, construction paper, parchment, etc. were excluded from paper usage. Raffi Zinzalian from La Verne Graphics supplied raw data of number of sheets of paper used each year from 28 copiers distributed throughout the University. The data was coverted into reams and then converted into pounds (1 ream = 20 lbs).

Recommendations

Open purchase orders from departments should not allow individuals to choose the type of paper used. Restricting order selection to only recycled paper would be the most feasible solution to increasing recycled paper usage. Data regarding paper inventory should be tracked monthly by department. Converting files to PDF format and making double-sided copies are two alternatives to reduce paper usage that should be explored in more detail.

Water Waste

There was a limited amount of data available on waste water; however, information regarding total water usage for the entire campus has been determined from 2001- 2002. From that information, average water use per day was determined. This type of information can provide valuable data on the types of water saving solutions that should be implemented university-wide. As for the extent of this project, the available water data was not useful for the GHG inventory because it dealt with total water usage and not the total amount of waste water being treated at a central treatment system.

Methodology

Information was gathered from an environmental audit report performed in 2001-2002 from (need name). The report revealed that waste water from the University is treated at the Miramar Treatment plant in Claremont, California using a chloramine process.

Recommendations

Further investigation of waste water usage and treatment methodologies should be explored. The Metropolitan Water District (MWD) should have access to information regarding water treatment methodologies. University total water usage, although not useful for the extent of this project, should continue to be tracked and monitored.

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Appendix 1: Overview of Annual Emissions (2005-2009)

Select Year -->	2005	Energy Consumption	CO_2	CH_4	N_2O	eCO_2
		MMBtu	kg	kg	kg	Metric Tons
Scope 1	Co-gen Electricity	-	-	-	-	-
	Co-gen Steam	-	-	-	-	-
	Other On-Campus Stationary	13,001.8	685,919.6	68.6	1.4	687.9
	Direct Transportation	210.6	14,769.6	3.0	1.0	15.1
	Refrigerants & Chemicals	-	-	-	-	-
	Agriculture	-	-	-	-	-
Scope 2	Purchased Electricity	47,807.3	3,931,603.9	31.1	53.7	3,948.2
	Purchased Steam / Chilled Water	-	-	-	-	-
Scope 3	Faculty / Staff Commuting	4,137.9	290,231.7	57.7	19.9	297.4
	Student Commuting	74,716.4	5,239,150.2	1,048.0	360.7	5,370.0
	Directly Financed Air Travel	5,652.8	1,109,861.2	10.9	12.6	1,113.8
	Other Directly Financed Travel	744.5	53,263.3	6.1	2.3	54.1
	Study Abroad Air Travel	2,294.8	450,545.5	4.4	5.1	452.2
	Solid Waste	-	-	1,327.0	-	30.5
	Wastewater	-	-	-	-	-
	Paper	-	-	-	-	267.7
	Scope 2 T&D Losses	4,728.2	388,839.9	3.1	5.3	390.5
Offsets	Additional					-
	Non-Additional					-
Totals	Scope 1	13,212.4	700,689.2	71.5	2.4	703.0
	Scope 2	47,807.3	3,931,603.9	31.1	53.7	3,948.2
	Scope 3	92,274.5	7,531,892.0	2,457.2	405.9	7,976.2
	All Scopes	153,294.3	12,164,185.1	2,559.8	462.0	12,627.5
	All Offsets					-
					Net Emissions:	**12,627.5**

Select Year -->	2006	Energy Consumption	CO_2	CH_4	N_2O	eCO_2
		MMBtu	kg	kg	kg	Metric Tons
Scope 1	Co-gen Electricity	-	-	-	-	-
	Co-gen Steam	-	-	-	-	-
	Other On-Campus Stationary	11,416.6	602,291.0	60.2	1.2	604.0
	Direct Transportation	210.6	14,769.6	3.0	1.0	15.1
	Refrigerants & Chemicals	-	-	-	-	-
	Agriculture	-	-	-	-	-
Scope 2	Purchased Electricity	53,029.5	4,361,065.5	34.5	59.6	4,379.5
	Purchased Steam / Chilled Water	-	-	-	-	-
Scope 3	Faculty / Staff Commuting	4,194.4	294,189.9	58.5	20.1	301.5
	Student Commuting	75,471.1	5,292,070.9	1,058.6	364.4	5,424.3
	Directly Financed Air Travel	5,727.8	1,124,572.2	11.1	12.7	1,128.6
	Other Directly Financed Travel	744.5	53,263.3	6.1	2.3	54.1
	Study Abroad Air Travel	3,712.2	728,846.5	7.2	8.2	731.5
	Solid Waste	-	-	1,204.6	-	27.7
	Wastewater	-	-	-	-	-
	Paper	-	-	-	-	266.1
	Scope 2 T&D Losses	5,244.7	431,314.2	3.4	5.9	433.1
Offsets	Additional					-
	Non-Additional					-
Totals	Scope 1	11,627.2	617,060.6	63.2	2.2	619.2
	Scope 2	53,029.5	4,361,065.5	34.5	59.6	4,379.5
	Scope 3	95,094.5	7,924,257.0	2,349.4	413.7	8,366.8
	All Scopes	159,751.2	12,902,383.1	2,447.0	475.5	13,365.5
	All Offsets					-
					Net Emissions:	**13,365.5**

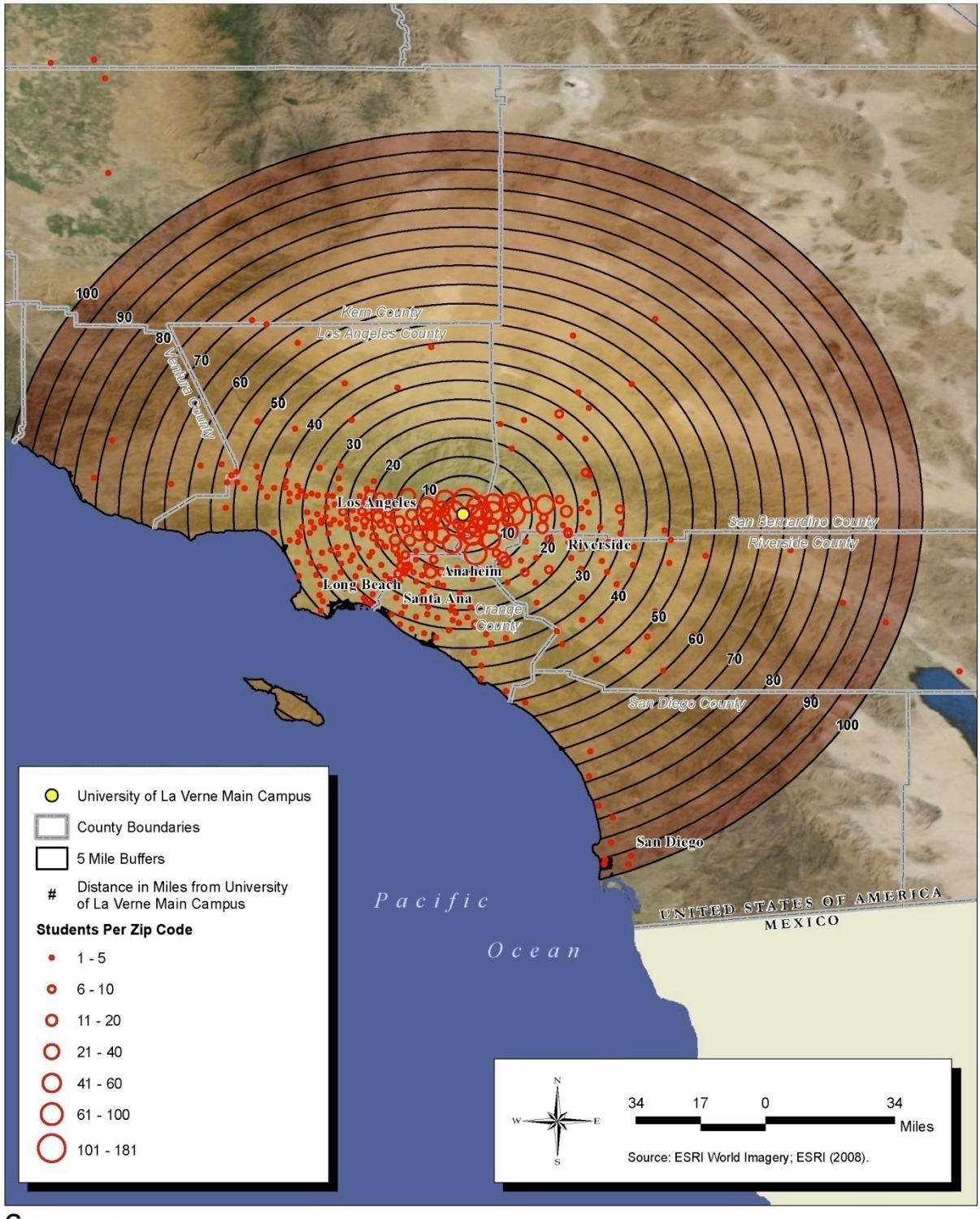
Select Year -->	2007	Energy Consumption	CO_2	CH_4	N_2O	eCO_2
		MMBtu	kg	kg	kg	Metric Tons
Scope 1	Co-gen Electricity	-	-	-	-	-
	Co-gen Steam	-	-	-	-	-
	Other On-Campus Stationary	11,624.9	613,277.6	61.3	1.2	615.1
	Direct Transportation	210.6	14,769.6	3.0	1.0	15.1
	Refrigerants & Chemicals	-	-	-	-	-
	Agriculture	-	-	-	-	-
Scope 2	Purchased Electricity	49,175.4	4,066,136.5	34.0	58.7	4,084.3
	Purchased Steam / Chilled Water	-	-	-	-	-
Scope 3	Faculty / Staff Commuting	4,108.9	288,199.2	57.3	19.7	295.4
	Student Commuting	76,233.4	5,345,526.1	1,069.3	368.0	5,479.1
	Directly Financed Air Travel	6,308.2	1,238,526.2	12.2	14.0	1,243.0
	Other Directly Financed Travel	744.0	53,228.2	6.1	2.3	54.0
	Study Abroad Air Travel	3,297.7	647,459.2	6.4	7.3	649.8
	Solid Waste	-	-	848.0	-	19.5
	Wastewater	-	-	-	-	-
	Paper	-	-	-	-	264.8
	Scope 2 T&D Losses	4,863.5	402,145.4	3.4	5.8	403.9
Offsets	Additional					-
	Non-Additional					-
Totals	Scope 1	11,835.5	628,047.2	64.3	2.2	630.2
	Scope 2	49,175.4	4,066,136.5	34.0	58.7	4,084.3
	Scope 3	95,555.7	7,975,084.3	2,002.6	417.2	8,409.5
	All Scopes	156,566.6	12,669,268.1	2,100.8	478.2	13,124.0
	All Offsets					-
					Net Emissions:	**13,124.0**

Select Year -->	2008	Energy Consumption	CO_2	CH_4	N_2O	eCO_2
		MMBtu	kg	kg	kg	Metric Tons
Scope 1	Co-gen Electricity	-	-	-	-	-
	Co-gen Steam	-	-	-	-	-
	Other On-Campus Stationary	11,262.5	594,163.6	59.4	1.2	595.9
	Direct Transportation	438.7	30,764.9	6.2	2.1	31.5
	Refrigerants & Chemicals	-	-	-	-	-
	Agriculture	-	-	-	-	-
Scope 2	Purchased Electricity	47,535.9	3,930,571.8	32.8	56.8	3,948.1
	Purchased Steam / Chilled Water	-	-	-	-	-
Scope 3	Faculty / Staff Commuting	5,268.0	369,453.6	73.6	25.4	378.7
	Student Commuting	77,003.4	5,399,521.3	1,080.1	371.8	5,534.4
	Directly Financed Air Travel	4,597.3	902,622.9	8.9	10.2	905.9
	Other Directly Financed Travel	741.6	53,062.7	6.0	2.3	53.9
	Study Abroad Air Travel	3,712.7	728,950.1	7.2	8.3	731.6
	Solid Waste	-	-	1,076.5	-	24.8
	Wastewater	-	-	-	-	-
	Paper	-	-	-	-	271.6
	Scope 2 T&D Losses	4,701.4	388,737.9	3.2	5.6	390.5
Offsets	Additional					-
	Non-Additional					-
Totals	Scope 1	11,701.3	624,928.5	65.6	3.3	627.4
	Scope 2	47,535.9	3,930,571.8	32.8	56.8	3,948.1
	Scope 3	96,024.4	7,842,348.5	2,255.6	423.5	8,291.2
	All Scopes	155,261.6	12,397,848.8	2,354.0	483.5	12,866.7
	All Offsets					-
					Net Emissions:	**12,866.7**

Select Year -->	2009	Energy Consumption	CO_2	CH_4	N_2O	eCO_2
		MMBtu	kg	kg	kg	Metric Tons
Scope 1	Co-gen Electricity	-	-	-	-	-
	Co-gen Steam	-	-	-	-	-
	Other On-Campus Stationary	10,531.1	555,573.9	55.6	1.1	557.2
	Direct Transportation	333.6	23,391.8	4.7	1.6	24.0
	Refrigerants & Chemicals	-	-	-	-	-
	Agriculture	-	-	-	-	-
Scope 2	Purchased Electricity	48,125.3	3,979,310.2	33.2	57.5	3,997.1
	Purchased Steam / Chilled Water	-	-	-	-	-
Scope 3	Faculty / Staff Commuting	4,955.6	347,518.9	69.4	23.9	356.2
	Student Commuting	77,781.2	5,454,062.0	1,091.0	375.5	5,590.3
	Directly Financed Air Travel	5,090.9	999,533.9	9.8	11.3	1,003.1
	Other Directly Financed Travel	718.1	51,410.7	5.7	2.2	52.2
	Study Abroad Air Travel	3,611.8	709,131.3	7.0	8.0	711.7
	Solid Waste	-	-	956.9	-	22.0
	Wastewater	-	-	-	-	-
	Paper	-	-	-	-	279.4
	Scope 2 T&D Losses	4,759.6	393,558.2	3.3	5.7	395.3
Offsets	Additional					-
	Non-Additional					-
Totals	Scope 1	10,864.7	578,965.8	60.2	2.7	581.2
	Scope 2	48,125.3	3,979,310.2	33.2	57.5	3,997.1
	Scope 3	96,917.3	7,955,214.9	2,143.1	426.6	8,410.2
	All Scopes	155,907.3	12,513,490.9	2,236.5	486.8	12,988.5
	All Offsets					-
					Net Emissions:	**12,988.5**

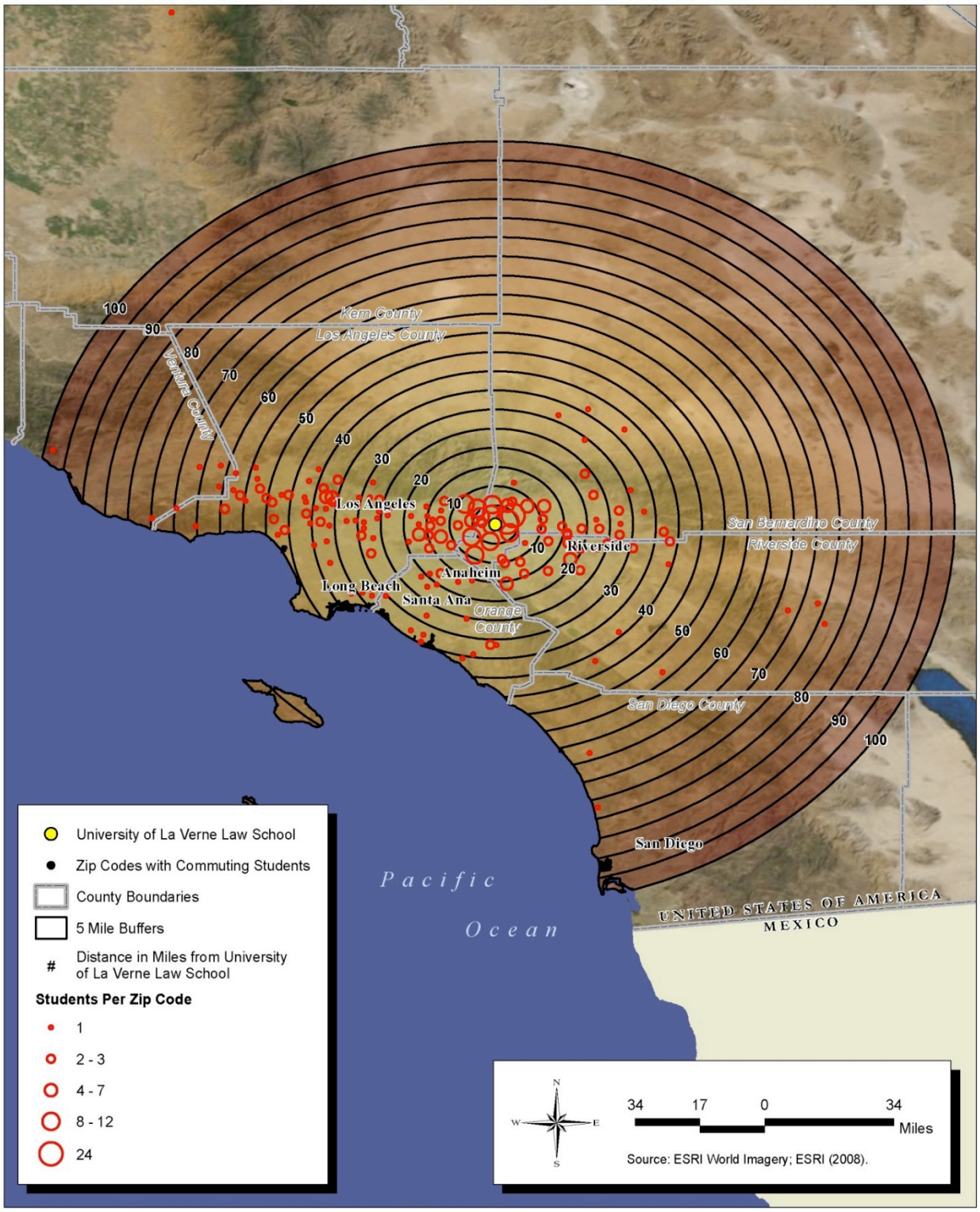
Appendix 2: *GIS Analysis of Commuter Students*

Student Commutes To University of La Verne Masters and Adult Programs



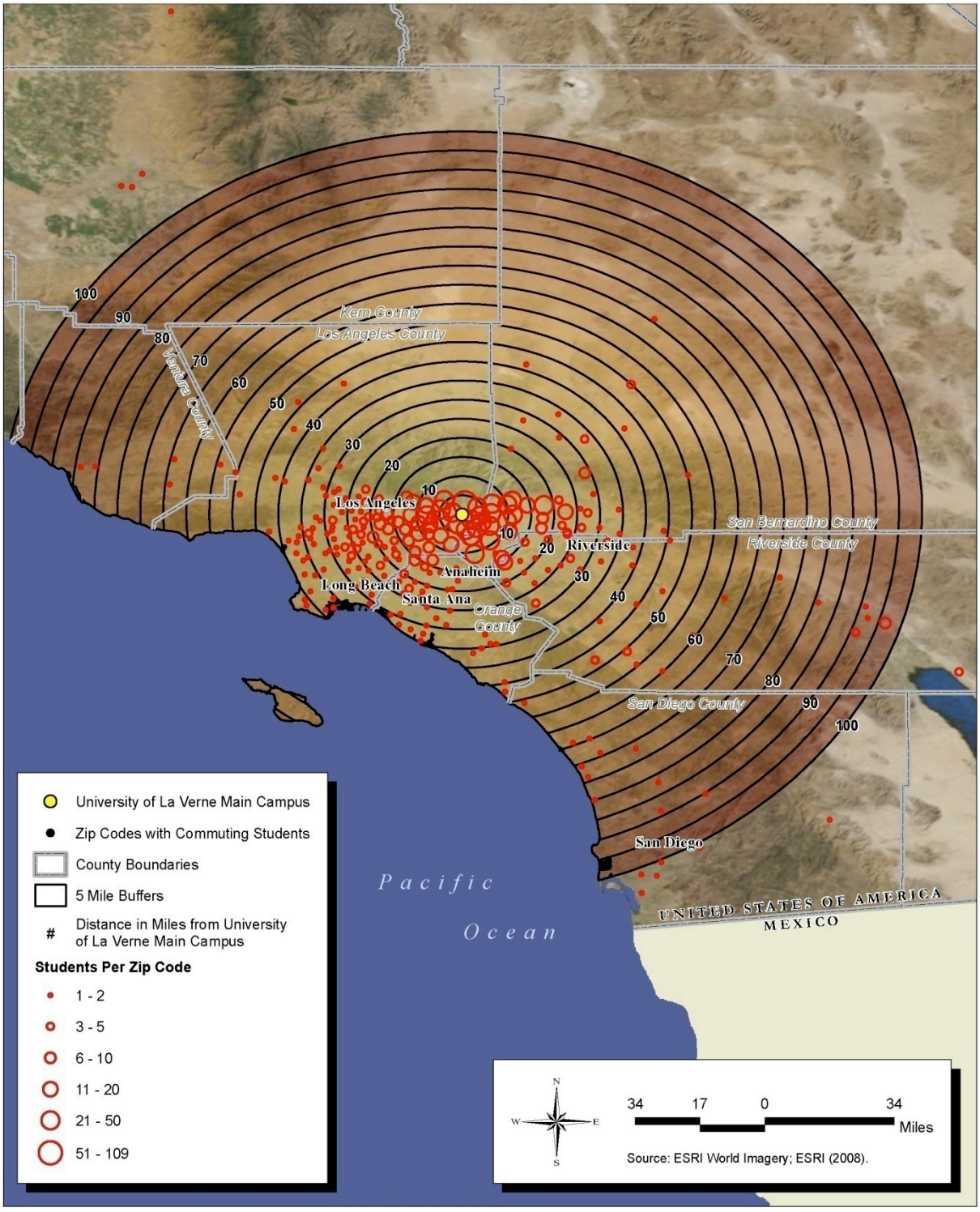
GC Cartography

Student Commutes To University of La Verne Law School



Cartography

Undergraduate Student Commutes To University of La Verne



Cartography