# LOYOLA UNIVERSITY NEW ORLEANS GREENHOUSE GAS EMISSIONS INVENTORY

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For the Loyola Sustainability Committee

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In 2009 Loyola joined the American College and University Presidents Climate Commitment (ACUPCC). This inventory of greenhouse gas emissions from university operations fulfills a part of the commitment. It will serve as a baseline to measure future emissions against and will allow the Provost's Sustainability Committee to plan for emission reductions, eventually reaching net zero emissions.

## GREENHOUSE GASES

Greenhouse gases absorb heat that would normally leave the earth's atmosphere, thereby warming the planet. There are six greenhouse gas classes that are covered by the Kyoto Protocol, the international treaty addressing climate change. They are carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), sulfur hexafluoride (SF6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). In this and many other inventories, total emissions of greenhouse gases are expressed in Metric Tons of Carbon Dioxide Equivalent (MTCDE). Carbon dioxide equivalents are determined by multiplying the quantities of other gases by their global warming potential (GWP), which is a measure of how much more they contribute to the greenhouse effect than carbon dioxide. For example, methane has a GWP of 25, meaning that it can trap 25 times more heat in the atmosphere than carbon dioxide.

## SCOPES

This inventory follows the method outlined by the World Resources Institute GHG Protocol for assigning responsibility for greenhouse gas emissions to an institution, called scopes. Scope 1 emissions are those that the institution has direct control over and that generally occur on site. Examples include burning fuel for electricity or heat, burning fuel in vehicles, and direct releases of greenhouse gases. Scope 2 emissions are those that the institution has relatively direct control over, but generally occur off-site. Purchased electricity, steam and chilled water are included in scope 2. Scope 3 emissions are those that the institution has relatively little control over, but are still a result of its operations. Employee and student commute, waste, business travel and study abroad air travel fall into this scope. Loyola's sources of emissions and their scopes are shown in table A.

**TABLE A: LOYOLA'S EMISSION SOURCES BY SCOPE**

| **Scope 1 Sources** |
|---|
| Natural gas used in boilers and chillers |
| Gasoline used in university fleet |
| **Scope 2 Sources** |
| Purchased electricity |
| **Scope 3 Sources** |
| Faculty, staff and student commute |
| Business travel |
| Study abroad travel |
| Solid waste disposal |

## BOUNDARIES

The physical boundaries of this inventory are Loyola University's 2 campuses, located at 6363 St. Charles Avenue and 526 Pine Street in New Orleans, Louisiana. The temporal boundaries are Loyola's fiscal years 2007 through 2011, or August 1, 2006 to July 31, 2011.

## METHOD

Data were collected during June - August 2011. Various departments were contacted for data on travel, campus energy use, vehicle fuel use, waste, and commuting. After processing and analysis (described in detail in Appendix A) data were input into the Clean Air – Cool Planet (CA-CP) Campus Carbon Calculator. The CA-CP calculator was chosen as the inventory tool because it is recommended by the ACUPCC Implementation Guide. Using a methodology similar to other signatories means that Loyola's emissions can be readily compared to other institutions.

Robust data on commuting and business travel were not readily available for Loyola, so emissions were estimated based on trends at neighboring Tulane University. The Tulane and Loyola main campuses share a boundary, and some services for students. The commuting methodology assumes that students, faculty, and staff at Loyola have similar residence patterns within the metro area. Tulane's commuting emissions are based on a survey, so those trends were applied to the Loyola population. The business travel methodology assumes that Tulane and Loyola faculty and staff travel about the same amount per person. For detailed methodology by emissions source, see the appendix.

*Emission coefficients*

Except in industries where emission monitoring technology is already in place, generally emissions are calculated from a set of emission coefficients that quantify the amount of carbon dioxide equivalent per unit. For most emission sources, like gasoline and natural gas, the emission coefficient is fixed and is based on the amount of carbon and other elements in the fuel that form greenhouse gases. For other emission sources, like electricity, the emission coefficient varies greatly depending on the energy sources used to generate them. For example, a utility making electricity mainly from coal, which has a high carbon content per unit, will have a much higher emission coefficient than one making electricity from mainly natural gas and nuclear.

The makers of the CA-CP Campus Carbon Calculator have done the work of compiling emission factors. Most of the emission coefficients are fixed, but there are two options for determining the electricity emission coefficient in the CA-CP Calculator. Users can choose to enter the fuel mix used by their utility if they know it. Users can also choose to use a regional emission coefficient that is published by the Environmental Protection Agency (EPA) and calculated from data on individual power plants and utilities. This inventory uses the EPA factor for the SERC Mississippi Valley Region. Like the choice of calculator, the use of a regional emission coefficient allows for comparison of *operations* among institutions rather than the performance of Loyola's utility.

## RESULTS

The results are presented below in Table B and Charts A through F.

**TABLE A: LOYOLA'S EMISSIONS BY OPERATING SECTOR**

| Sector | Emissions in MTCDE | | | | | Percent Change | |
|---|---|---|---|---|---|---|---|
| | FY2007 | FY2008 | FY2009 | FY2010 | FY2011 | FY07 to FY11 | FY10 to FY11 |
| Buildings | 23,861 | 22,801 | 22,794 | 23,754 | 20,687 | -13.30% | -12.91% |
| Vehicle Fleet | 72 | 81 | 74 | 48 | 39 | -45.48% | -19.41% |
| Commute | 4,490 | 4,633 | 4,816 | 7,999 | 5,947 | 32.44% | -25.65% |
| Business Travel | 9,928 | 10,070 | 10,513 | 10,819 | 11,252 | 13.33% | 4.00% |
| Study Abroad | 4,301 | 4,688 | 3,352 | 4,519 | 4,519 | 5.06% | 0.00% |
| **Total** | **42,652** | **42,273** | **41,550** | **47,139** | **42,443** | **-0.49%** | **-9.96%** |

**CHART A: LOYOLA'S EMISSIONS BY SCOPE**

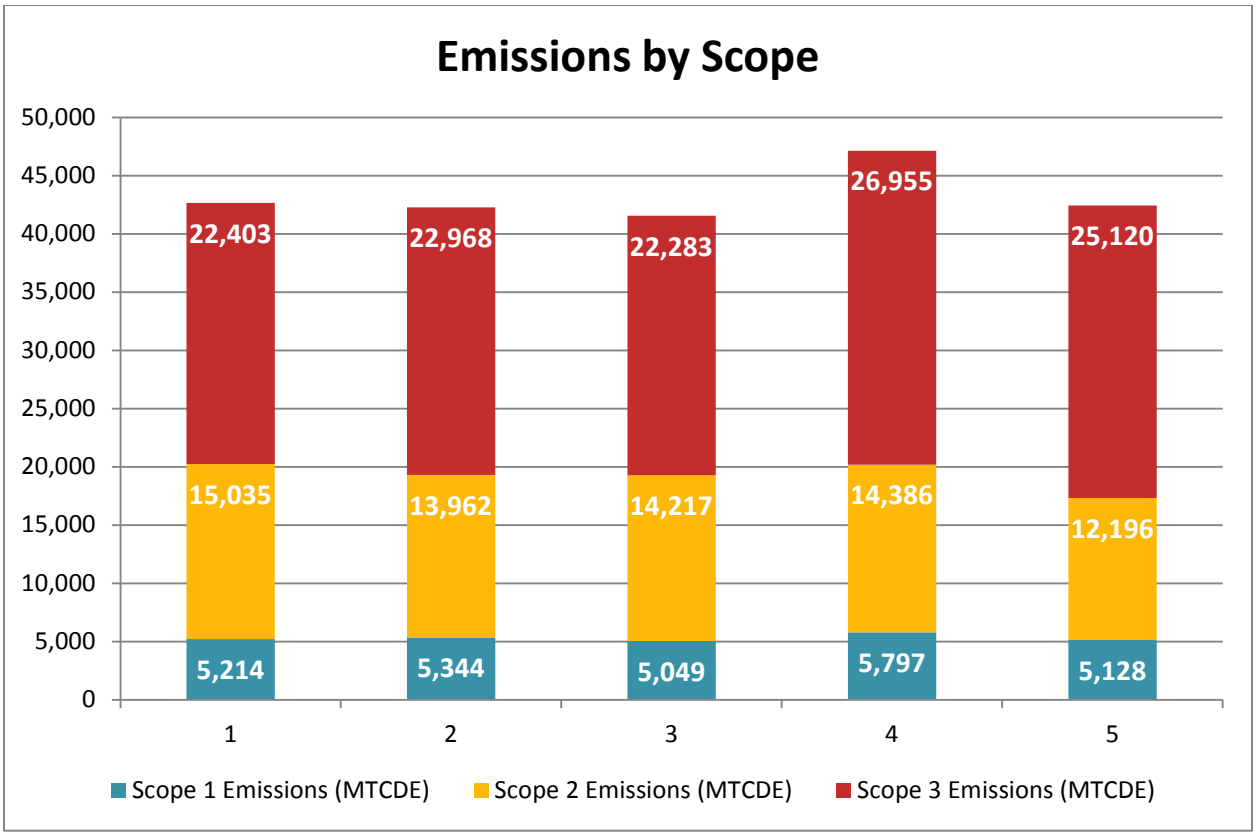


CHART B

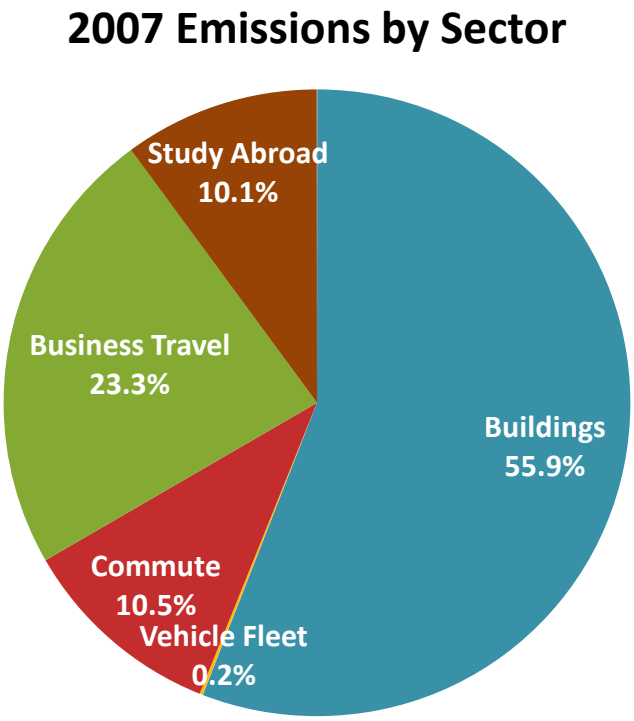



CHART C

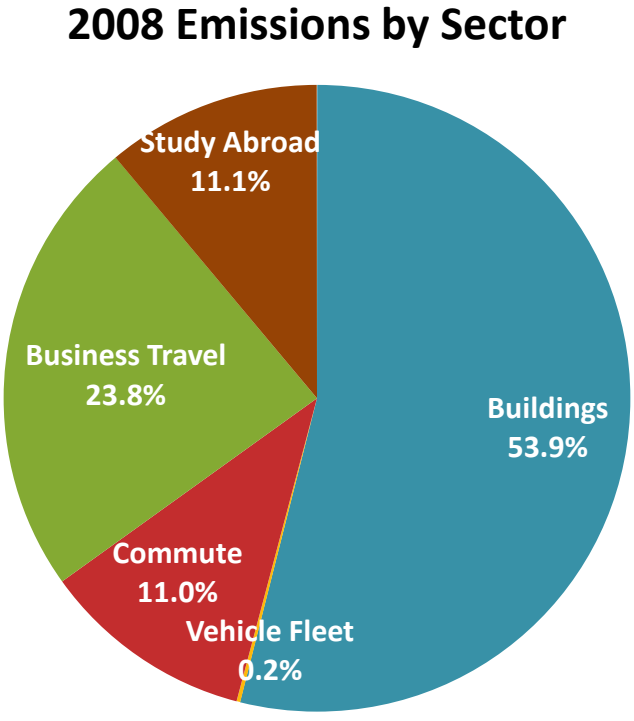


CHART D

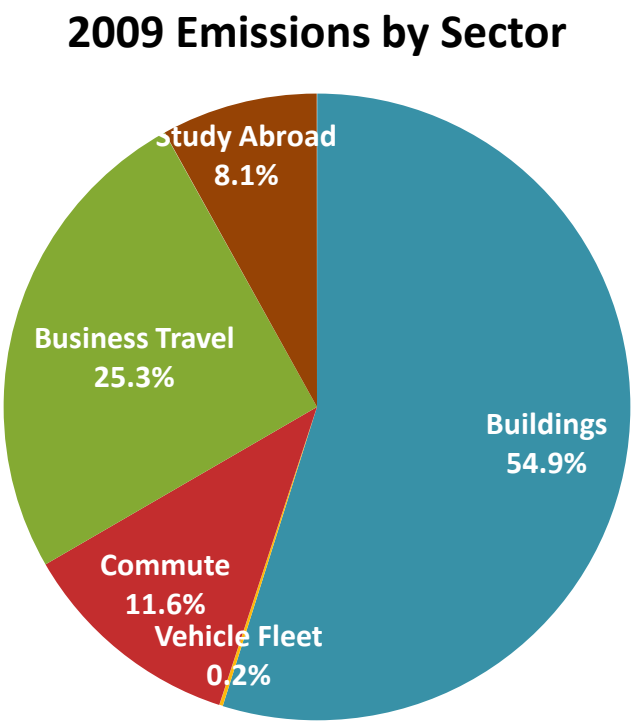



CHART E

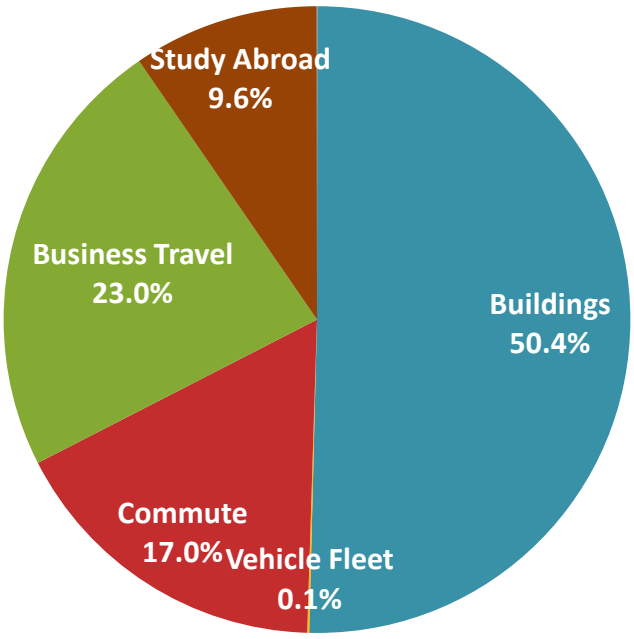
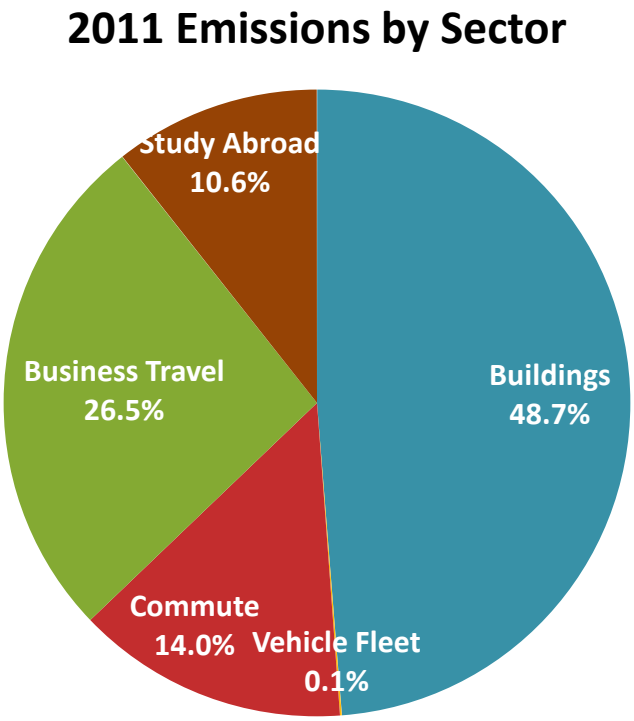


CHART F




## DISCUSSION

With the exception of a small spike in 2010, emissions have remained around 42,000 MTCDE per year. Since Loyola has not undergone any major new construction or changes in operations over that time, a flat trajectory is to be expected. The source of the spike in 2010 appears to be a corresponding spike in enrollment of commuting students.

In order to compare Loyola's emissions to other ACUPCC signatories, total emissions are normalized by both full time enrollment and by building area. The results are presented in Table C. Here, full time enrollment (FTE) counts each full time student as 1 and each part time student as 0.5. The column ACUPCC Average is from the ACUPCC reporting website and is based on emission inventories for Loyola's peers, master's colleges and universities.[1] Though Loyola's emissions are higher than those of their ACUPCC peers, emissions per student shows consistent improvement and emissions per 1,000 sq. ft. of building area are relatively stable.

[1] N=143, http://rs.acupcc.org/stats/ghg-scope-stats/ accessed August 10, 2011.

**TABLE B: LOYOLA'S NORMALIZED EMISSIONS COMPARED TO OTHER ACUPCC SIGNATORIES**

| Normalized Emissions | FY2007 | FY2008 | FY2009 | FY2010 | FY2011 | ACUPCC Average |
|---|---|---|---|---|---|---|
| Total Student Population (FTE) | 4174 | 4174 | 4294 | 7843 | 5646 | |
| Per FTE Emissions | 10.22 | 10.13 | 9.68 | 6.01 | 7.52 | 4.65 |
| | | | | | | |
| Total Building Area (sq. ft.) | 1,332,852 | 1,332,852 | 1,332,852 | 1,332,852 | 1,332,852 | |
| Emissions per 1,000 sq. ft. | 32.00 | 31.72 | 31.17 | 35.37 | 31.84 | 16.36 |

## FUTURE INVENTORY IMPROVEMENTS

Future inventories will benefit from better tracking of greenhouse gas emission related data at the university. As described in Appendix A, many sources are estimated based on the limited data available. This could be achieved by centralizing operations of some sectors, like the vehicle fleet. Various departments own and maintain their own vehicles and tracking of fuel use is their responsibility. Creating a centralized vehicle fleet or using a fleet re-fueling credit card system would put the responsibility of tracking fuel use on one department or individual.

Similarly, Loyola does not have a good way of tracking business travel built into their system. Individuals are reimbursed for their own travel and all travel modes (as well as entertainment and some other expenses) are counted under the same accounting sub-code. There are a number of options for improving business travel tracking. The most accurate, but perhaps most expensive, option would be to engage the services of a travel agency for the university and require that all university financed travel be booked through them. Part of the contract with the travel agent could stipulate that they provide data on all travel to the person or department compiling Loyola's GHG inventory. As an added advantage to that method, the travel agent could help Loyola employees and students to purchase offsets for their air travel emissions. A second option would be to track travel expenses separately in the financial system. Different sub-codes could be established for each mode of travel and emissions could be estimated from dollars spent on each mode. A final option could be for the provost and/or human resources department to require reporting of travel as part of faculty and staff performance reviews. When employees report on their activities for the year, they could include a section on trips taken for university business.

Better understanding of Loyola's commuting habits would also improve the accuracy of the greenhouse gas emissions inventory. In this version, assumptions are based on trends gleaned from a survey at neighboring Tulane University. Conducting a similar survey of Loyola's employees and students would ensure that those assumptions are accurate.

# APPENDIX A: DETAILED METHODOLOGY BY EMISSION SOURCE

*Scope 1 – Natural Gas*

Loyola uses natural gas for its boilers and chillers. Data on annual use were collected from the campus facilities services department and converted to MMBtus (Million British Thermal Units) from CCF (thousand cubic feet). The facilities services department tracks natural gas purchases for their own use, and they provided a copy of their spreadsheet.

*Scope 1 – Gasoline*

Loyola does not have a centralized vehicle fleet and tracking of gasoline use is not consistent among departments that operate vehicles. The facilities services department provided their records of monthly vehicle fuel expenses for the period of the inventory. They do not track actual gallons purchased, so gallons were estimated from cost. The monthly average cost of fuel, in dollars per gallon, was gleaned from the Energy Information Administration's *May 2011 Monthly Energy Review*. The facilities services monthly cost was divided by those figures to determine gallons purchased.

The Loyola Police Department does not track purchases of gasoline or annual mileage of their vehicles. They were able to provide a list of the vehicles they own, the current odometer reading and the date each was purchased. The fuel economy of each vehicle was researched, and the mileage was divided evenly among the years the vehicle has been in operation. A rough estimate of gallons of gasoline used per year was calculated by dividing the annual mileage by the fuel economy in miles per gallon.

*Scope 1 – Diesel*

Diesel fuel is occasionally used for back-up power generation. During the period of this inventory, no major storms or power outages required use of the generators. An insignificant amount of fuel was used for routine testing and maintenance.

*Scope 1 – Direct Emissions of Greenhouse Gases*

Data on direct emissions of greenhouse gases were requested from the facilities services department and from the campus chemical hygiene officer. Facilities services contracts with McQuay Services and GMC Services to maintain its cooling equipment. Facilities estimates that over the 5 years included in this inventory, less than 10 pounds of refrigerants have been added to the chillers. The chemical hygiene officer reports that Loyola has not purchased or used any greenhouse gases for research during the period of the inventory.

*Scope 2 – Purchased Electricity*

Loyola purchases its electricity from the local utility, Entergy. Data were provided by the facilities services department in the form of a spreadsheet used to track utilities internally. Annual use in kilowatt hours (kWh) was input into the CA-CP calculator.

*Scope 3 – Commuting*

Average commute distance for faculty, staff, and students was determined from zip codes. Google Maps was used to determine the distance between area zip codes and Loyola University. The length of the first route suggested by Google Maps was used because it is assumed to be the most efficient route between the center of the zip code area and Loyola's campus. Lists of zip codes of faculty and staff were provided by human resources and counts of students per zip code were provided by the director of student records. For students, the zip code count was multiplied by the round-trip distance between each zip and Loyola. The total round-trip distance was then divided by the total count of commuting students to determine the average commute distance. For faculty and staff, the round trip distances for each zip code where they reside were averaged using Excel to determine the mean commute distance.

Assumptions were made about the number of days per week and weeks per year that people commute. For students, it was assumed that they commute an average of 4 days per week. This is based on the fact that around forty percent of students each year are part time. It is assumed that students commute 32 weeks per year because the fall and spring semesters are approximately 16 weeks each. For faculty, it is assumed that they commute 4.2 days per week. This is based on the fact that between 36 and 41 percent of faculty are part time. It is assumed that faculty commute 40 weeks per year because they commute during the 2 16-week semesters and approximately 4 more weeks per semester when they do research and prepare for classes. It is assumed that staff commute 5 days per week because less than 15% are part time and staff typically work regular 40-hour per week schedules. It is assumed that they commute 46 weeks per year because each staff member is given 15 paid holidays (3 weeks) and between 12 and 20 days of vacation (about 3 weeks on average).

The breakdown of drivers, carpoolers, bus riders, and streetcar riders is based on the statistics at neighboring Tulane University. Tulane conducted a survey of their commuters to determine their mode of travel. Their figures were rounded for Loyola since actual data does not exist and rounding generalizes the results a little more. Though it is unlikely that Loyola's commuter habits are much different from Tulane's, Loyola should conduct a similar survey in the coming year. The results of that survey can be used to update this inventory with more accurate distribution of commuting modes next year.

*Scope 3 – Study Abroad*

The Center for International Education compiles statistics on students that go abroad as part of their studies. They provided their annual report that lists each destination country and the number of students that travelled there. For this inventory, emissions are calculated only for the round trip flight between New Orleans International Airport (MSY) and the student's destination. Any travel within the host country is not counted. Distances were recorded from the calculator at Climate Friendly[2]. Where more than one airport was available at the destination, the international airport was chosen whenever indicated. The report only indicates country of destination, but in some cases there are two or more cities in each country that have study abroad programs (indicated on Loyola's study abroad website). In those cases, one city was chosen per country. In some cases, there were multiple programs (e.g. summer and fall) in one city and only one in other cities, so the city with multiple programs was chosen to represent the country. In other cases, the largest or most central city in the country was chosen. In all cases, the round trip distance in miles between New Orleans and the destination city

[2] https://climatefriendly.com/flight

was multiplied by the number of students in the program at that destination for each year. The total number of miles flown by all students in study abroad was entered into the CA-CP Calculator.

*Scope 3 – Business Travel*

Loyola does not track individual trips taken by faculty and staff. The university's Division of Financial Affairs was contacted to find out if spending on travel is tracked by mode (e.g. plane tickets vs. rental cars vs. hotel costs) in the accounting system, but all travel falls under a single accounting sub-code and cannot be separated. In order to estimate greenhouse gas emissions from university financed business travel, individuals at the college level were contacted to compile information for their departments. Responses varied, especially since data were collected during summer when many people are away, but some departments were able to provide details on trips taken during recent fiscal years. They provided the dates of individual trips, the destination, and the mode of travel. From that data, round-trip distances between New Orleans and the destination city were recorded from Climate Friendly (for flights) or Google Maps (for vehicle trips). As of August 10, 2011, not enough data were available to extrapolate business travel patterns for the entire university.

As an alternative, data from neighboring Tulane University were analyzed to determine travel patterns. It was assumed that 100% of Tulane faculty and 25% of Tulane staff travelled for business during their 2006-2008 inventory period. Using that assumption, their annual reported air miles and annual reported vehicle miles were divided by the travelling population to determine average air miles and vehicle miles travelled per person per year. Those figures were then averaged across all three years and multiplied by the travelling population at Loyola, using the same assumptions. The resulting total air miles and vehicle miles were then entered into the CA-CP Calculator. Totals vary by year based on faculty and staff population.

The inventory will be revised once enough data on actual Loyola travel can be collected. If the current method of asking departments and schools to report travel fails, other methods will be explored. It is possible that a survey of faculty and staff could yield meaningful data. It is also possible that financial records will have to be further explored.

*Scope 3 – Waste*

Data on waste disposal were requested from Facilities Management. They reported that six (6) 8-yard containers are emptied 6 days per week and 51 weeks per year. Using a conversion factor for residential waste[3] of 225 pounds/yard, it is estimated that Loyola throws away 1,679 tons of waste per year. Facilities also reported that the dining services contractor operates an additional three (3) 8-yard containers that are also emptied 6 days per week and 51 weeks per year. The conversion factor for food waste is 1500 pounds per yard, meaning that 5508 tons of waste per year is disposed.

[3] http://www.recyclemaniacs.org/doc/measurement-tracking/conversions.pdf