

# GREENHOUSE GASES (GHG) EMISSIONS REPORT

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August 2008



BALL STATE  
UNIVERSITY.

## PREFACE

In December of 2006, President Jo Ann Gora joined with eleven other members of the Leadership Circle of presidents and chancellors of American colleges and universities as a signatory to the American College & University Presidents Climate Commitment (ACUPCC). Since that call to colleagues, a total of 558 counterparts have signed. A goal of the ACUPCC is to, "...exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality". Signatories commit their institutions to, "...initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible". As part of this plan, the institutions are directed to, "...complete a comprehensive inventory of all greenhouse gas emissions (including emissions from electricity, heating, commuting, and air travel) and update the inventory every other year thereafter".

This report is the inaugural attempt at establishing the "carbon footprint" of Ball State University, the key descriptor of the university's greenhouse gas emissions. It is produced under the auspices of Ball State University's Council on the Environment (COTE) and at the direction of Professor Robert J. Koester, COTE Chair and Director, Center for Energy Research/Education/Service.

It became apparent very early in the development of this report that a major obstacle to its completion would be the assembling of the necessary base data. In some areas complete accurate data are available; in other areas, data are not obtainable. For example, precise numbers are available for university energy purchases, while there currently is no central repository for university-sanctioned faculty, staff and student air travel. This should not be interpreted as a criticism of university record keeping; until the advent of this report, there was no necessity to assemble much of the needed information. However, over the upcoming academic year, a concerted effort should be made to assemble accurate data for inclusion in the required report in 2010.

But in the context of data acquisition, it should be noted that many members of our Ball State University and Muncie communities expended time and energy in quest of the, sometimes unobtainable, information needed for this report. These persons, in alphabetical order, are:

- Debra Atkinson, Institutional Research Analyst, BSU
- Debbra Bear, Accounting/Accounts Representative, Office of Accounting, BSU
- Gregory Graham, Interim Director, Facilities Planning, BSU
- Brenda Kearns, Transportation Supervisor, BSU
- Kevin Kenyon, Associate Vice President, Facilities Planning and Management, BSU
- Larry King, General Manager, MITS, Muncie
- John Lewis, Director, University Dining, BSU
- Tammy Sue Neal, Technical Asst, Student Affairs and Enrollment Management, BSU
- Michael Planton, Associate Director, Landscape/Environmental Management, BSU
- Frank Sabatine, Assoc. Provost, Econ Dev and Dean, School of Ext. Education, BSU
- David Schoen, Acting Chair, Department of Urban Planning, BSU
- Randy Sollars, Director of University Budgets, BSU
- Matt Stephenson, Director, Purchasing and Central Stores. BSU
- John Taylor, Land Manager, Field Station and Environmental Education Center, BSU
- Rhonda Thomas, Human Resources Representative, BSU
- Michael Twigg, Assistant Head, Acquisitions Services, University Libraries, BSU
- Amy Wagner, Computer Systems Coordinator, University Dining, BSU
- Sue Weller, Director of Facilities Business Services and Transportation, BSU
- Nancy Wray, Manager, Office of Parking Services, BSU

Robert A. Fisher  
Professor of Architecture  
Resident Fellow, Center for Energy Research/Education/Service

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## I. EXECUTIVE SUMMARY

### A. The Study

#### **What is “Carbon Neutrality”?**

The ACUPCC goal of achieving carbon neutrality begs definition of the term. ACUPCC defines carbon neutrality as, “...having no net greenhouse gas (GHG) emissions, to be achieved by minimizing GHG emissions as much as possible, and using carbon offsets or other measures to mitigate the remaining emissions”.

#### **The Means of Achieving Carbon Neutrality**

Carbon neutrality, if achievable, must be a resolute goal of the institution and must employ a number of strategies including, but not exclusively, utilizing the energy sources that appear to be the most free of “The Law of Unintended Consequences”: specifically, energy conservation and the use of renewable, “green”, energy sources.

#### **The Goals of this Study**

The establishment of the magnitude and composition of Ball State University’s greenhouse gas emissions, the first goal of this study, will enable the university to focus its emissions reduction attention and resources in the areas that will achieve the greatest benefit; the ultimate goal of this and future studies.

#### **The Geographic Limits of this Study**

The geographic limits of this study are the Ball State University facilities in Muncie and the university’s various field station farms and their contained woodlands, grasslands, etc. Emissions from Ball State’s Indianapolis “Indy Center” are not included because the university has no operational control over the leased facility.

#### **The Means by Which the Carbon Footprint is Calculated**

The instrument used for calculating Ball State University’s greenhouse gas emissions is the Clean Air–Cool Planet (CA-CP) Greenhouse Gas Emissions Calculator. It is recognized by the ACUPCC as an acceptable means of establishing the “carbon footprint” and thus the greenhouse gases footprint for the university.

#### **The Carbon Footprint Groups**

The carbon footprint groups included in this CA-CP calculator are the following:

##### **1. Emission Sources:**

- On-Campus Energy
- Off-Campus Energy
- Transportation
- Commuting Faculty, Students and Staff
- Solid Waste Disposal
- Greenhouse Gases other than CO<sub>2</sub>
- 

##### **2. Emission Offsets:**

- ‘Green’ Electricity Credits
- Composting
- Forest Preservation

#### **Excluded Potential Emission Sources**

Some carbon footprint reports by other institutions include emissions from: 1.) the manufacture and transportation of consumable materials—food, paper and plastic—and 2.) buildings construction.<sup>1</sup> These aspects are not included here primarily because they are not required in the CA-CP calculator. But further, it was very difficult to achieve an even reasonably accurate estimate of the emissions resulting from these areas of the university’s operations even when accurate data were available or, conversely, because data were simply unavailable. For

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<sup>1</sup> It should be noted that under the 2007-12 BSU Strategic Plan, all new construction must achieve LEED Silver Certification. This translates to a required reduction in construction waste; the construction of the Letterman Building, the first LEED Silver Building to be built on campus achieved 85% waste reduction during its build out.

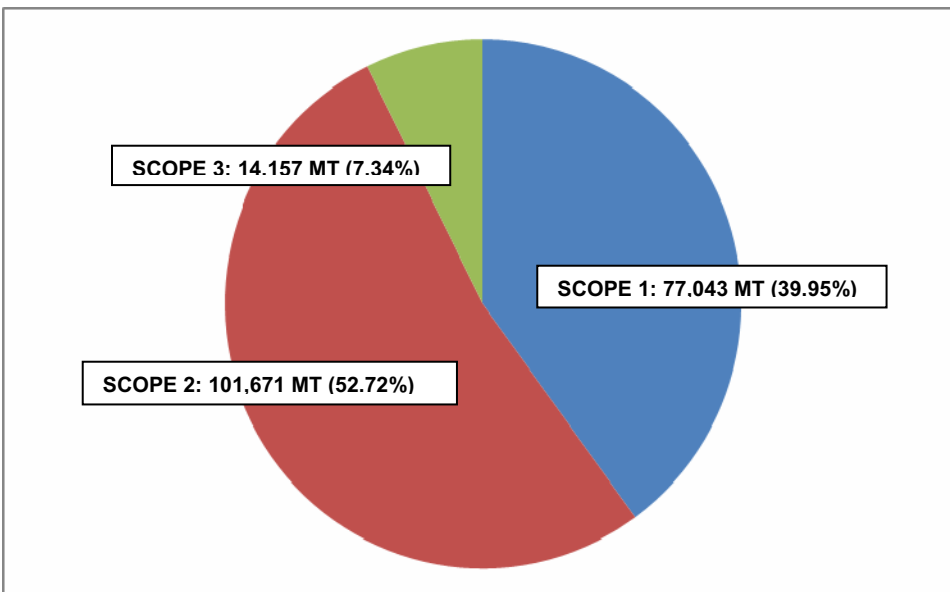
example, no accurate data are available on university plastics use, only partial, albeit extensive, data are available regarding quantities of paper purchased and while accurate information is available regarding university food purchases, attempting to establish transportation emissions for these products was a task outside the time constraints of this study.

### Total Emissions Summary

For categorizing sources of emissions, the CA-CP calculator utilizes three scopes that were jointly established by the Business Council for Sustainable Development and World Resources Institute. These three scopes are:

- Scope 1** Direct sources of greenhouse gas emissions from sources that are owned and controlled by the institution. For Ball State, this means emissions from the burning of coal and natural gas and emissions from fuel combusted by all of the university's vehicles.
- Scope 2** Emissions from imported sources of energy, for Ball State this is solely electricity.
- Scope 3** All other indirect sources of greenhouse gas emissions that may result from the activities of the institution, but occur from sources owned or controlled by others. For Ball State, these are air travel and commuting travel by members of the university community and the solid waste disposal of the university.

Figure 1 illustrates the distribution of the total greenhouse gas emissions (eCO<sub>2</sub>)<sup>2</sup> of **192,857 MT**<sup>3</sup> into these three emission scopes.



**Figure 1**

In considering these results, the obvious observations are that emissions resulting from the generation of the electricity used by the university account for almost 53% of the greenhouse gas emissions attributable to Ball State's operation and almost 40% of total emissions result from on-campus combustion of coal, natural gas and gasoline and diesel vehicle fuel. The equally obvious conclusion is that these are the areas where severe reduction must occur.

<sup>2</sup> eCO<sub>2</sub>: Carbon dioxide and carbon dioxide equivalent greenhouse gases, including: methane, nitrous oxide, hydro fluorocarbons, per fluorocarbons and sulfur hexafluoride.

<sup>3</sup> MT: Metric Ton, or Tonne, a measurement of mass equal to 1,000 kilograms, or 2204.6226 pounds

## B. The Observations

### 1. General Observations

The burning of coal as the primary source for meeting Ball State's energy needs is already having a negative financial impact on the university and this impact could be exacerbated in the future if there is a post-election change of attitude regarding mechanisms for reducing greenhouse gas emissions. To wit:

- These financial impacts would be ameliorated somewhat by the increased combustion efficiency of the new heat plant; the proposed **Circulating Fluid Bed (CFB) Boiler** is estimated to be 88% efficient, while the existing stoker boilers are, on average, 74% efficient. This would mean an approximate 16% decrease in purchased coal and a concomitant decrease in financial impact.

### 2. Observations Regarding Emissions

- To achieve climate neutrality under the terms of the American College & University Presidents Climate Commitment, all Scope 1 and 2 emissions, as well as those Scope 3 emissions from commuting and from air travel paid for — by or through — the institution, must be neutralized
- The primary source of greenhouse gas emissions resulting from fulfilling Ball State University's energy needs is the burning of coal: coal burned to generate the electricity purchased by the university and coal burned to meet on-campus energy needs.
- To achieve climate neutrality for its operations, the university must pursue a three-pronged approach: energy conservation, the replacement of "dirty" energy sources with "green" energy sources and the development of energy offsets. Over the long term, any one, or even two, of these approaches alone simply will not make it possible to bring the university's greenhouse gasses to net zero.

### 3. Observations Regarding Data

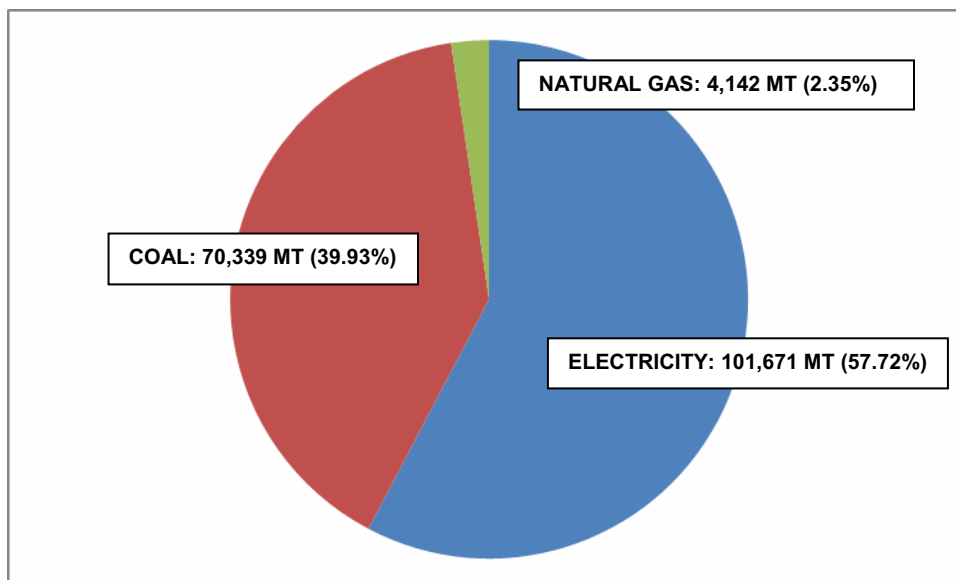
- The most reliable sources of data were those related to the university's energy needs: the quantities of electricity purchased, coal and gas consumed and vehicle fuel consumed by university vehicles.
- The least reliable were those data related to student, faculty and staff commuting and air travel by university personnel. The lack of data in these areas required approximations bordering on speculation. Fortunately, the emissions from these two sources account for only a small percentage of the total emissions: the estimate in this report places that percentage at 5.7%. So, even if the estimate is 50% low, these emission areas would represent less than 9.5% of the total and would not seriously compromise the validity of the emissions total. Nevertheless, in the interests of accuracy, efforts should be mounted during the upcoming year to identify student, faculty and staff commuting patterns and habits and to quantify the number of air miles flown annually by members of the university community.
- And finally, the other areas where more accurate reporting would be helpful are the quantities of solid waste going to landfill and the quantity of waste composted.

## II. FINDINGS: EMISSIONS SOURCES

### A. Off-campus and On-campus Stationary Energy Sources

1. Emissions from energy sources other than the transportation sources detailed in the next section of this report are those from:
  - Off-campus electricity production
  - On-campus stationary sources, which at Ball State are the result of coal and natural gas combustion.
2. The quantities associated with these emissions sources are as follows;
  - Electricity 104,000,000 kWh<sup>4</sup>
  - Natural Gas 78,000 (Dth)<sup>5</sup> MMBtu<sup>6</sup>
  - Coal 36,500 STons<sup>7</sup>

Figure 2 illustrates the distribution among the three emission sources of the total of **176,152 MT** of greenhouse gas emissions attributable to the production of On-Campus Energy.



**Figure 2**

This graphic illustrates that coal is the source of over 97% of the greenhouse gas emissions attributable to the meeting of Ball State's energy needs. It is the main fuel used in the generation of electricity in Indiana and coal is the predominant fuel used to meet on-campus energy needs.

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<sup>4</sup> **kWh:** Kilowatt Hour

<sup>5</sup> **Dth:** Decatherm, a unit of heat equal to 1,000,000 British thermal units (BTU)

<sup>6</sup> **MMBtu:** 1,000 x 1,000 Btu or 1,000,000 Btu

<sup>7</sup> **STons:** Short tons, United States measure of mass equal to 2000 pounds

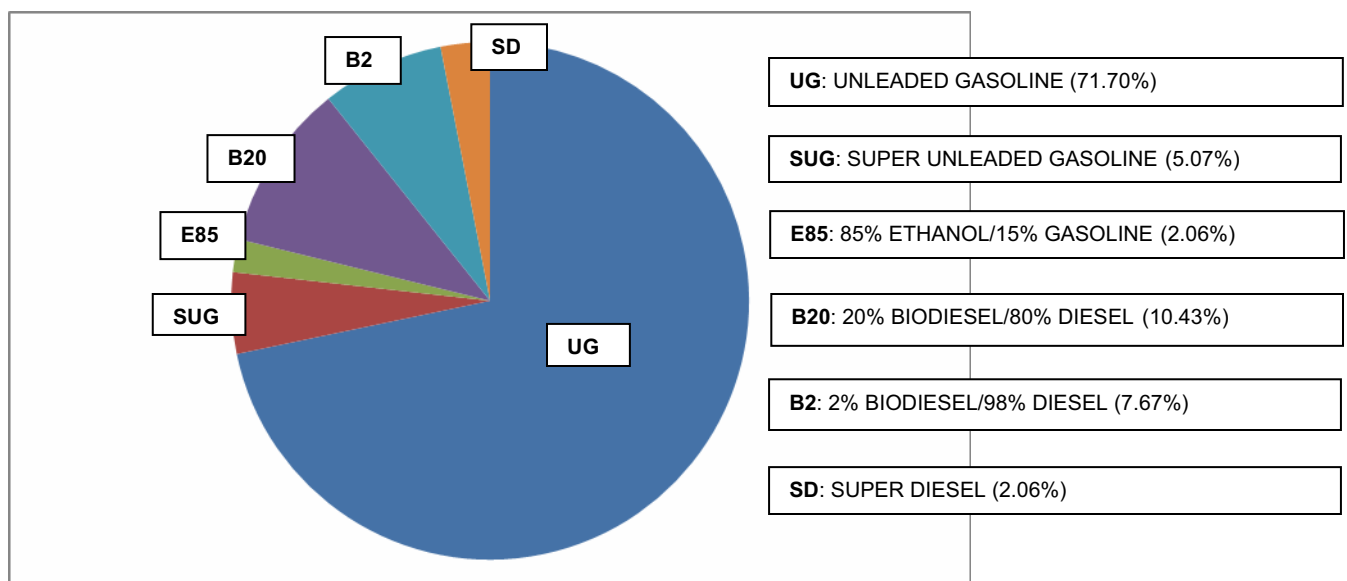
## B. Transportation Sources

1. Transportation emission sources include emissions from vehicle fuel consumption as a result of:
  - faculty, students and staff travel
  - campus busses
  - everyday activities such as moving equipment and furnishings, building maintenance and repair, mail delivery, etc.
  - management of the campus grounds: grass mowing, snow plowing, plant material weeding, pruning and irrigation, etc.
  - campus security
2. The university uses a number of different types of fuels. These fuels and number of gallons registered for each last year are as follows:
  - Unleaded gasoline 168, 886.7 + \*31,239.1 = 200,125.8 (Use 200,126)
  - Super unleaded gasoline 14,154.1 (Use 14,154)
  - E85—a mixture of 85% ethanol and 15% gasoline 5,738.3 (Use 5,738)
  - B20 biodiesel—20% biodiesel and 80% diesel 29,119.4 (Use 29,119)
  - B2 biodiesel—2% biodiesel and 98% diesel 21,402.8 (Use 21,403)
  - Super diesel 8,568.8 (Use 8,569)

\*All but one of the above quantities are available because the vehicles were fueled at the university refueling station, but university personnel also refuel at commercial stations when their trips take them beyond the capacity of one tank of fuel. When they refuel, they use a Voyager credit card and last year, 31,239.1 gallons of fuel were charged on this card. Although there is no record of the type of fuel pumped, it is highly likely that the fuel was unleaded gasoline, so this quantity was added to the above resulting in a total of 200,125.8 gallons of unleaded gasoline.

And finally, occasionally the university must lease commercial vehicles for university personnel when university vehicles are unavailable. There are no records of the fuel usage by these vehicles. And, although this probably accounts for only a small percentage of the total fuel usage by the university, in the interests of full reportage, in the future, a technique for recording this fuel usage should be devised.

Figure 3 shows the distribution of the university's annual consumption of **279,109 gallons** of vehicle fuel among the six fuel types utilized.



**Figure 3**

The combustion of these fuels resulted in greenhouse gas emissions of **2,562 MT**.

### C. Faculty, Staff and Student Commuting Sources

The university's commuting emissions footprint has three contributing groups: commuting faculty, commuting students and commuting staff. For each of these groups, it was necessary to operate on limited data to develop the inputs required by the CA-CP work sheet. The work sheet requires, for each of the three subject groups, the following inputs:

1. % of the total group commuting by personal vehicle, and of these, the following:
  - a. % Driving alone
  - b. % Carpooling
  - c. Trips commuting per day
  - d. Days commuting per year
  - e. Miles per trip
2. % of the total group commuting by bus, and of these, the following:
  - a. Passenger trips per day
  - b. Passenger trips per year
  - c. Passenger miles per trip
3. The work sheet also asks for information about commuting by rail, an input of no relevance to Ball State.

In the absence of any substantial data regarding faculty, student and staff commuting habits, the following assumptions were made.

#### 1. For Faculty

- a. Commuting Mode: 95% commute by personal vehicle (The companion assumption is that the remaining 5%—approximately 45 faculty members—walk or bicycle to campus)
- b. Carpooling: Of the 95% personal vehicle users, the assumption is that they all drive alone (To date, the university had not established a carpooling program; this will change with the coming Academic Year).
- c. Trips per Day: To arrive at a trips per day estimate, the assumptions were the following:
  - 50% of the faculty @ 2.5 trips per day (0.5 for a restaurant lunch trip)
  - 25% of the faculty @ 4 trips per day (2 trips for lunch at home)
  - 25% of the faculty @ 2 trips per day (brown bag or lunch on campus)

The weighted average trips per day resulting from these assumptions is 2.75

- d. Commuting Days Per Year: To arrive at a commuting days per year estimate, the assumptions were the following:
  - During the academic year, the faculty of 917 averages 4 days commuting per week for 30 weeks.
  - During the summer, the aggregate summer semester plus summer terms faculty of 768 averages 3 commuting days per week, the equivalent of 2.51 days per week for a faculty of 917. (This conversion was necessary because the CA-CP calculator makes no allowance for commuting habits of summer faculty numbers.)

These assumptions yield the estimated number of days commuting for a faculty of 917 of 145.1 days ( $4 \times 30 + 2.51 \times 10 = 145.1$ ). Given the number of assumptions imbedded in this calculation, it was considered prudent to round this number up to 150 commuting days per year.

- e. Miles per Trip: Miles per trip were calculated by Professor David Schoen using a *minimum path distance* utility in a Geographic Information System (GIS) software package. Results from this analysis were then queried using database technology, and SQL statements, to determine that the average minimum commuting distance for the faculty is 4.7 miles. Given the fact that people do not always travel by the shortest distance, but choose their own "quickest" route (typically longer distance but faster driving times) and that they often make side trips on the way to and from work, this number was rounded up to 5 miles per trip.

#### 2. For Staff

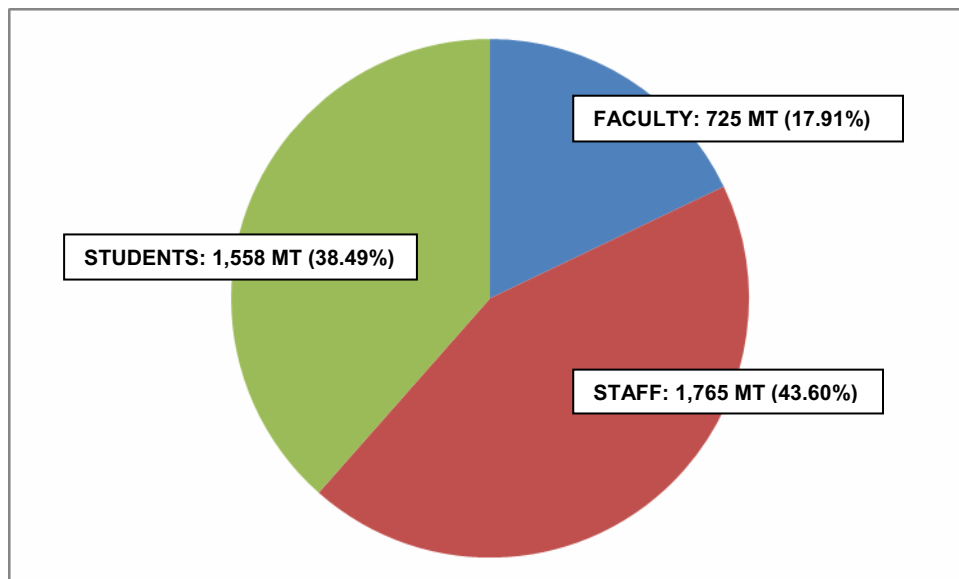
- a. Commuting Mode: 100% commute by personal vehicle
- b. Carpooling: The companion assumption is that all staff drive alone (As noted above, attempts within the university to establish a carpooling program have not been successful).

- c. Trips Per Day: To arrive at a trips-per-day estimate, the assumptions were the following:
- 50% of the staff @ 2 trips per day (brown bag lunch or lunch on campus)
  - 25% of the faculty @ 2.5 trips per day (0.5 for a restaurant lunch trip)
  - 25% of the faculty @ 4 trips per day (2 trips for lunch at home)
- The average trips per day resulting from these assumptions is 2.625 trips per day
- d. Commuting Days per Year: To arrive at a commuting days per year estimate, the following factors were considered:
- The total maximum possible working days per year is 260
  - There are 9 holidays per year
  - The number of vacation days per staff member varies from 12 to 24, with an average being 18 days
  - The number of sick days per staff member varies from 6 to 12, with an average of 9 days
- The resultant of these subtractive factors—using averages for vacation days and sick days—is 224 commuting days per year ( $260 - 9 - 18 - 9 = 224$ )
- e. Miles per Trip: The same Professor Schoen-authored GIS assessment that was utilized for the faculty was used for the staff and yielded a miles per trip of 3.9. Employing the same logic used for faculty commuting patterns, this number was rounded up to 4 miles per trip.

### 3. For Students

- a. % Commuting by Personal Vehicle: To arrive at a number for students commuting by personal vehicle, it was necessary to eliminate those students walking, bike riding or bus riding to class. Professor Schoen was able to provide a good estimate of the number of students who are within walking and biking distance, a distance from the center of campus estimated at roughly two-thirds of a mile—a 15 to 20 minute walk at a reasonably brisk pace (see Appendix C). This number is 12,645 students and includes 6155 students in residence halls and 6490 in rental housing. And, Mr. Larry King, General Manager of MITS, has provided data for city bus ridership by students. His combined count for the two bus routes serving the campus, Routes #14 and #16, is 10,250 per week. If one assumes 6 round trips per week per student, 1,708 students ride a city bus each day. These two student cohorts combined—the riders/bikers and the bus riders—represent 87% of the fulltime student enrollment, leaving only 13% commuting to class via personal vehicle.
- Carpooling: Because these students are probably commuting from diverse locations, it is unlikely they will be carpooling
  - Trips per Day: Assume 2 trips per day
  - Commuting Days per Year: For the Academic Year, assume 120 days (4 days per week x 30 weeks) and for Summer School assume 30 days (3 days per week x 10 weeks).
  - Miles per Trip: Professor Schoen's computer analysis yielded a number for personal vehicle commuting students of 4.66 miles per trip which was rounded up to 5 miles per trip.
- b. % Commuting by Bus: The number of 1708 student bus riders (from above) represents 10.35% of the fulltime student total enrollment. Given the approximations involved in this calculation, a value of 10% seemed to be an appropriate number.
- Passenger Trips per Day: The assumption is two trips per day
  - Passenger Miles per Trip: The MITS system uses a “pulse” route system with busses going out and returning to the main downtown station by essentially the same route, so the total round trip distance for each route must be divided by two to give the length of the route. And, if the reasonable assumption is made that, since the route passes through the university with university stops about midway, the length of the students' ride would be one-half of the one way trip. For Route #16, this distance is 2.475 miles (9.9 miles round trip ÷ 4) and for Route #14, 2.175 miles (8.7 miles round trip ÷ 4). But, the ridership for Route #16 is 9,033 per week and for Route #14 is 1,219, so finding an average length of ride would logically require a weighted average. Such a weighted average calculation yielded average passenger miles per trip number of 2.44 miles:  $(2.475 \times 9,033) + (2.175 \times 1,219) \div 10,252 = 2.439$ . But, the logic of this approach notwithstanding, given the assumptions and approximations in arriving at the base numbers of the calculation, it seemed that a rounded-up miles per trip of 2.5 would be a more defensible number.

These student, faculty and staff commuting numbers yielded an emission number of **4,048 MT** distributed among the three source groups as seen in Figure 4.



**Figure 4**

The total greenhouse gas emissions from student, faculty and staff commuting represents only 2.1% of the university's 192,871 MT of emissions and faculty commuting, for example, is only 0.38% of those total emissions. But, nevertheless, strategies for reducing these emissions should be developed. However, this can only happen when student, faculty and staff commuting habits and patterns are accurately determined.

#### **D. Air Travel Sources**

In the absence of any available repository of air travel data for Ball State University, it was necessary to be rather inventive in an attempt to achieve an, admittedly, very proximate estimate of air travel miles by university personnel. The first bit of inventiveness was to mine the carbon emissions report by Purdue University (*Carbon Neutrality at Purdue, 2007*) for its estimate of the miles flown by Purdue personnel; the second was to develop a formula for prorating the Purdue number to Ball State's smaller size.

The assumption was made that faculty travel by air is a factor of the combination of faculty size and the amount of research and sponsored programs expenditures and that Purdue's air travel number can be reduced to a Ball State appropriate number using these two statistics for the two institutions.

The Purdue study estimated the average number of annual air miles for their faculty for the interval 2004-2006 at 33,528,270. Purdue lists 1,952 continuing faculty and lecturers; Ball State's figure is 917 for a ratio of 1 to 0.47, Purdue to Ball State. Purdue's research budget for 2005-06 was \$395,900,000; Ball State's 2005-06 numbers were \$23,396,082 for a ratio of 1 to 0.059, Purdue to Ball State. If the faculty ratio is used, the Ball State air travel miles would be estimated at 15,758,287 miles ( $33,528,270 \times 0.47 = 15,758,287$ ); if the research funding ratio is used, the Ball State air miles estimate would be 1,117,188 miles ( $33,528,270 \times 0.059 = 1,978,168$ ). For lack of any information suggesting a different approach, these two values were averaged to yield an estimated number of 8,868,227.5 miles flown by Ball State personnel.

Given the multiplicity of assumptions made in the calculations, this estimate of Ball State's air miles flown was rounded up to 9,000,000 so as not to give the false impression of greater precision than that which was achieved. These air miles represent **6,992 MT** of greenhouse gas emissions. Combining these air travel emissions with the commuting emissions yields a total of **11,040 MT** of emissions resulting from all modes of student, faculty and staff transportation.

Figure 5 compares the emission values from commuting and from air travel.

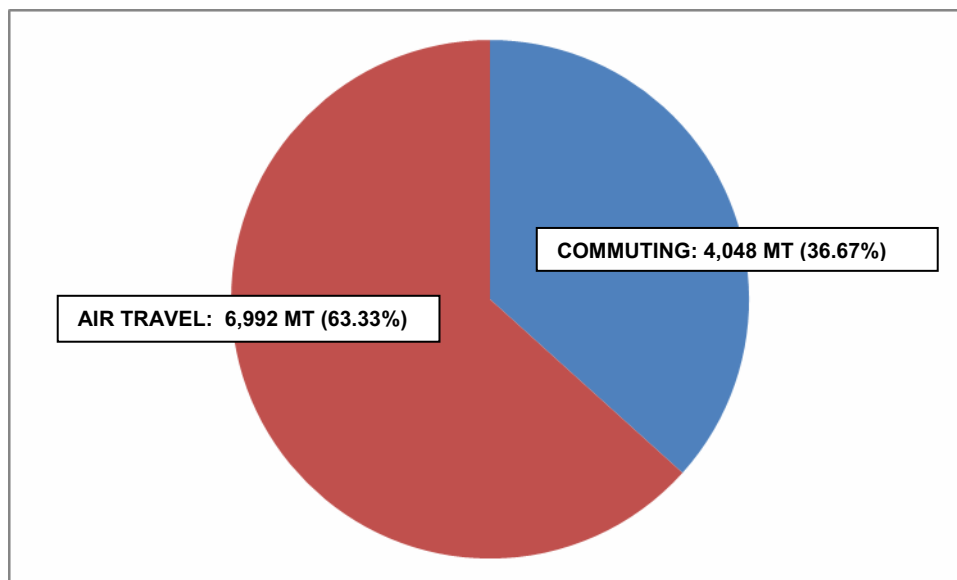


Figure 5

Although the estimated air travel emissions are substantially greater than those attributed to commuting, they still represent less than 4% of the university's total emissions. It is difficult to predict whether or not these emissions can be reduced without accurate data regarding air travel destinations and purposes

#### E. Solid Waste Disposal Source

The university generates waste as the resultant of its operation. Of this waste, only that which is trucked to a landfill is considered by the CA-CP Calculator as a contributor to greenhouse gas emissions because it releases methane as it decomposes. The university does not have precise solid waste figures for 2007 because of a change of waste hauler, but past years' averages were 3,150 tons of trash each year. (It is worth noting as a counterpoint that recycled materials averaged 627.6 tons per year.) These 3,150 tons of solid waste are responsible by CA-CP calculation for **3,110 MT of eCO<sub>2</sub> emissions, 1.6% of the university's total emissions (Note: this is the first use of this equivalency).**

There are potential solid waste sources that are not included in the above 3,150 tons number. These are:

- Construction waste: Currently, the general contractor on each project has the responsibility for a monthly reporting of materials disposal and recycling. This reportage has not been made consistently and has not been popular with the contractors. (Although the LEED Silver certifiability of all new construction that is called for in the University's strategic plan will have an impact; as noted in a prior footnote, the construction of the Letterman Building yielded 85% waste recovery.)
- Another pair of elusive solid waste figures are those connected with student move-in and move-out. Containers are provided for trash/recycling for residence hall students for the fall move-in and the spring move-out. Most of the move-in discarded material is cardboard and is recycled, but nearly all the move-out material is trash and is unaccounted for.

So, a way of accurately tracking these latter waste streams should be devised if the university is going to have an accurate picture of its volume of solid waste.

#### F. Greenhouse Gasses Other Than Carbon Dioxide

When chlorofluorocarbons (CFCs) were found to damage the ozone, they were required to be phased out and replaced with hydro fluorocarbons (HFCs). These gasses are most commonly used as refrigerants. Subsequently, these gasses also were found to be significant greenhouse gasses, so they are included as emissions in the calculator. But, the university does not intentionally release any of these gasses and it is not possible for the university to determine how much might be released unintentionally, so these were determined to be null values in the calculator.

### **III. FINDINGS: EMISSIONS OFFSETS**

#### **A. 'Green' Electricity Credits**

It is becoming a common practice for universities to offset a percentage of their greenhouse gas emissions through the purchase of Tradeable Renewable Energy Certificates (TRECs), also known as “green energy credits”. This is the purchase of energy credits for energy produced by renewable means, such as wind or solar.

Currently, Ball State does not engage in this practice.

#### **B. Composting**

Composting is considered an offset because, when properly managed—and Ball State’s composting program is very competently managed—it does not produce methane emissions and when applied as an amender to soils—as Ball State’s is—it results in carbon storage.

It is estimated that the university composts 3000 tons of matter per year, but this composting generated an eCO<sub>2</sub> offset of only **550 MT**.

#### **C. Woodlands and Grasslands Sequestration**

Plants take in carbon dioxide and give off oxygen as a natural part of their growth, but they sequester carbon differently depending on the age and nature of the vegetation, with impacts ranging from “carbon source” to “carbon neutral” to “carbon sink”. John Taylor, Ball State’s Field Station Land Manager, has done a detailed carbon sequestration analysis of the university’s farms, woods and wildlife areas, including the Off-Campus Cooper-Skinner and Hults Farm properties as well as the On-Campus Christy Woods. His conclusion is that these areas are essentially carbon neutral, with the acreage of “carbon sink”—successional woods, prairies and meadows—equal that of “carbon source” areas—mowed areas and croplands—with over one-half the acreage, that of mature woods, being “carbon neutral”. Moreover, the composition of the campus landscape would suggest that the carbon sequestration provided by the trees that are at successional stage is more than offset by the carbon source of the mowed lawns and cultivated plant material.

Consequently, no value was registered in the CA-CP Calculator for “Forest Preservation”.

<u>Categories and Sub-Categories</u>	<u>Data</u>
○ Budgets	
• Operating	\$351,331,271
• Research	\$18,084,449
• Energy	\$7,427,561
○ Population	
• Full-Time Students <sup>1</sup>	16,963
• Part-Time Students <sup>1</sup>	3,067
• Summer Students <sup>1</sup>	
Semester	1,539
First Term	3,057
Second Term	2,212
Average	4174
• Faculty	915
• Staff	1,856
○ Building Area	
• Total	6,753,062 Sq. Ft.
• Research Building Area	N/A
○ Campus Stationary Energy	
• Coal	36,500 STons
• Natural Gas	78,000 (Dth) MMBtu
• Electricity	104,000,000 kWh
○ University Vehicles Fuel	
• Unleaded Gasoline	200,126 Gals
• Super Unleaded	14,154 Gals
• Gasoline (E85)	5,738 Gals
Total Gasoline	220,018 Gals
• Biodiesel (B2)	21,403 Gals
• Biodiesel (B20)	29,119 Gals
• Super Diesel	8,569 Gals
Total Diesel	59,091 Gals
○ Air Travel (All Personnel)	9,000,000 Miles
○ Commuting	
• Academic Year Students	
% by Personal Vehicle	13%
% Drive alone	100%
% Carpool	0%
Trips/Day	2 Trips/Day
Days/Year	120 Days/Year
Miles/Trip	5 Miles/Trip
% by Bus	10%
Trips/Day	2 Trips/Day
Days/Year	120 Days/Year
Miles/Trip	2.5 Miles/Trip
• Summer School Students	
% by Personal Vehicle	13%
% Drive alone	100%
% Carpool	0%
Trips/Day	2 Trips/Day
Days/Year	40 Days/Year
Miles/Trip	5 Miles/Trip
% by Bus	10%
Trips/Day	2 Trips/Day
Days/Year	40 Days/Year
Miles/Trip	2.5 Miles/Trip

• Commuting Faculty	
% by Personal Vehicle	<u>95%</u>
% Drive alone	<u>100%</u>
% Carpool	<u>0%</u>
Trips/Day	<u>2.75 Trips/Day</u>
Days/Year	<u>150 Days/Year</u>
Miles/Trip	<u>5 Miles/Trip</u>
% by Bus	<u>0%</u>
• Commuting Staff	
% by Personal Vehicle	<u>100%</u>
% Drive alone	<u>100%</u>
% Carpool	<u>0%</u>
Trips/Day	<u>2.625 Trips/Day</u>
Days/Year	<u>224 Days/Year</u>
Miles/Trip	<u>4 Miles/Trip</u>
% by Bus	<u>0%</u>
• Solid Waste Disposal	<u>3,150 STons</u>
○ Greenhouse Gasses Other Than Carbon Dioxide	<u>0</u>
○ 'Green' Electric Credits	<u>N/A</u>
○ Composting	<u>3000 STons</u>
○ Forest Preservation/Campus Trees	<u>0 Net MTonnes</u>

<sup>1</sup>Head count

**Summary of eCO<sub>2</sub> Emissions in Metric Tonnes****Totals**

• Scope 1	77,043
• Scope 2	101,671
• Scope 3	14,157
• Total All Scopes	192,871

**Scope 1**

• On-campus Stationary/ Natural Gas	4,142 <sup>1</sup>
• On-campus Stationary/ Coal	70,339 <sup>1</sup>
• Campus Fleet	2,562

**Scope 2**

• Purchased Electricity	101,671
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**Scope 3**

• Student Commuting	1,588
• Faculty Commuting	725 <sup>2</sup>
• Staff Commuting	1,765 <sup>2</sup>
• Air Travel	6,992
• Solid Waste	3,119

**Offsets**

• Composting	(550)
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**Summary of Emission Demographics****Emissions**

• Grams eCO <sub>2</sub> / Operating Budget \$	549
• Kilograms eCO <sub>2</sub> / Research Budget \$	10.67
• Kilograms eCO <sub>2</sub> / Energy Budget \$	10.03
• Metric Tonnes eCO <sub>2</sub> / Student	10.43
• Metric Tonnes eCO <sub>2</sub> / Total University Population	9.07
• Kilograms eCO <sub>2</sub> / Total Building Area	28.6

**Summary of Energy Use**

• Btu / Operating Budget \$	5,810
• Btu / Research Budget \$	112,920
• Btu / Energy Budget \$	274,900
• Btu / Student	110,400,000
• Btu / Total University Population	96,000,000
• Btu / Total Building Area FT <sup>2</sup>	302,410

<sup>1</sup> These values are an interpolation of the CA-CP Calculator result. The calculator gave only a total for on-campus energy emissions. A separate calculator was used to determine that 4,143 MT of the total were attributable to the 78,000 MMBtu of natural gas combustion, leaving the remainder of the 74,481 MT of eCO<sub>2</sub>, 70,339 MT, coming from the burning of coal.

<sup>2</sup> The CA-CP Calculator provided a total for faculty and staff commuting combined. The values shown here were arrived at by using the respective fuel consumption values provided by the calculator—81,123 gallons for faculty and 197,525 gallons for staff—to proportion the emission values.

