

Western Michigan University Greenhouse Gas Emissions Inventory 2012

**ENVS 4100
Appropriate Technology and Sustainability – The
Campus as a Living, Learning Laboratory**

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Table of Contents

I.	Executive Summary	3
II.	Introduction	5
III.	Methodology and Data	7
IV.	Best Practices on Campus	11
V.	Best Practices at Peer Institutions	11
VI.	Discussion	12
	a. Scope I	12
	b. Scope II	15
	c. Scope III	15
VII.	Limitations of Data	18
VIII.	Conclusion	19
IX.	References	19
X.	Appendices	20
	a. Group Contact List	20
	b. Meeting Log	20
	c. Email Contact Log	20

I. Executive Summary

Western Michigan University has been a constant frontrunner in the issue of sustainability and has even been named as one of the "nation's most environmentally responsible 'green colleges'" by Princeton Review. WMU is currently an ACUPCC signatory and has recently developed a Climate Action Plan. As a part of the ACUPCC guidelines, a greenhouse gas (GHG) emissions inventory must be performed every other year. Since signing the ACUPCC, WMU has completed few inventories. This presented itself as a project needing immediate attention. This inventory will provide a checkpoint for our commitment to the Climate Action Plan submitted by Dr. Paul Pancella and Dr. Harold Glasser in April of 2012. The Climate Action Plan outlines a strategy to become a zero GHG emissions campus by 2065. In order to follow this Climate Action Plan we must begin to monitor our GHG emissions on an annual basis to ensure that we are meeting the trajectory for climate neutrality. This investigation does just that.

A greenhouse gas emissions inventory has been done on WMU's campus multiple times within recent years including 2008 and 2009. These GHG inventories were used to help develop the Climate Action Plan and continue to be of use in developing new sustainability projects on campus. The 2012 greenhouse gas emissions inventory can be used to further develop these sustainability initiatives and possibly evoke new initiatives to grow. This inventory is also helping to fulfill the Talloires Declaration, another document signed by our university President committing us to environmental sustainability in higher education. With this inventory we are practicing multiple actions outlined by the Talloires Declaration: 1) Increase awareness of environmentally sustainable development, 2) Create and institutional culture of sustainability, 3) Practice institutional ecology, and 4) Maintain the movement.

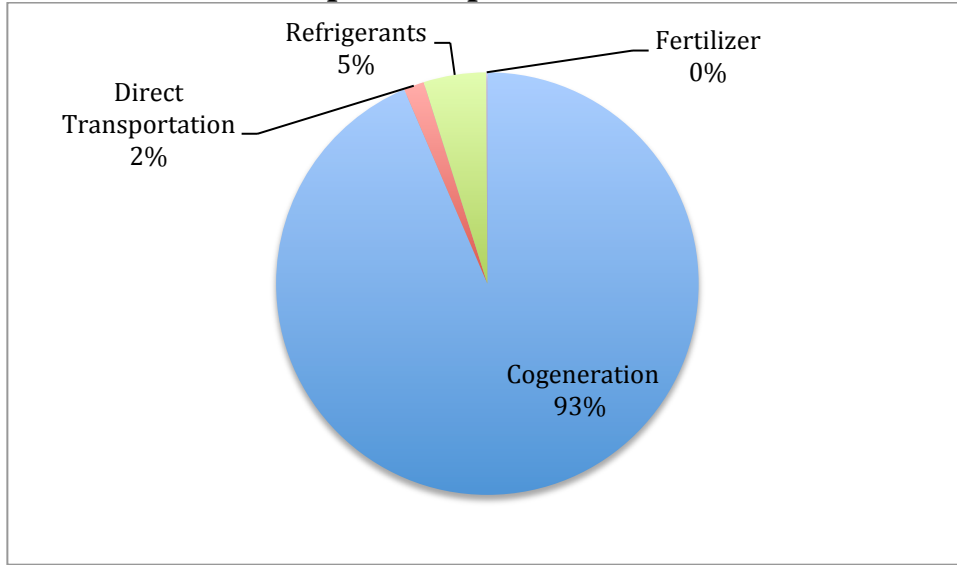
This GHG inventory will focus on a few main greenhouse gases including CO₂ (carbon dioxide), CH₄ (methane), N₂O (nitrous oxide), O₃ (tropospheric ozone), and fluorinated gases (including chlorofluorocarbons and other dominant greenhouse gasses). Carbon dioxide is the most abundant of the greenhouse gases and therefore acts as a representation of climate change. As you will see, our emissions will be converted into CO₂ equivalents (eCO₂) to better understand the affect they have on the atmosphere.

In 2012 the university produced 103,419.35 metric tons (MT) of eCO₂ in emissions. That equals out to 4.72 MT eCO₂ per full time equivalent (FTE) faculty, staff, and student. Below are the breakdowns of emissions by scope.

Scope I: Direct emissions from university owned sources

- Cogeneration: 65,908.5 MT eCO₂
- Direct Transportation: 1,101.4 MT eCO₂
- Refrigerants: 3,384 MT of eCO₂
- Fertilizer: 50.54 MT eCO₂

Graph 1: Scope I Emissions



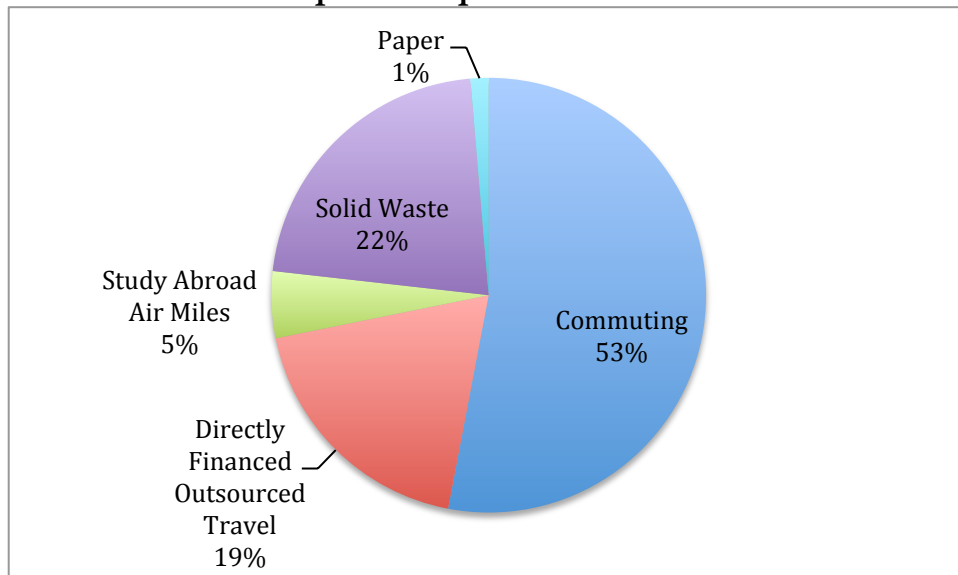
Scope II: Indirect emissions from sources not owned or operated by the university but that still contribute to energy consumption on campus

- Purchased Electricity 5,836.5 MT eCO₂

Scope III: Emissions from sources not owned or operated by the university that are encouraged by the university

- Commuting: 14,382.3 MT eCO₂
- Directly Financed Outsourced Travel: 5,107 MT eCO₂
- Study Abroad Air Miles: 1,346.75 MT eCO₂
- Solid Waste: 5,936 MT eCO₂
- Paper: 366.4 MT eCO₂

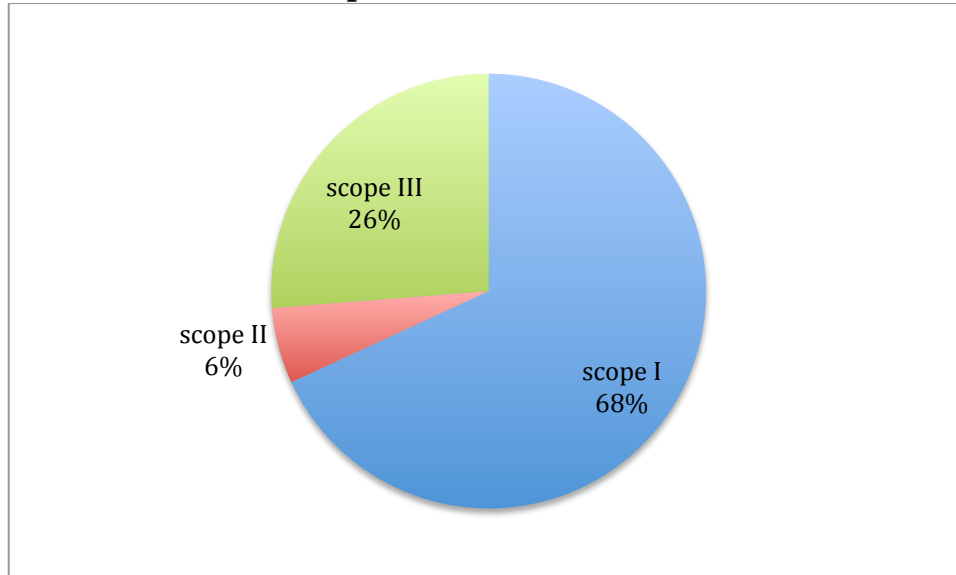
Graph 2: Scope III Emissions



Total Emissions: The total emissions from all 3 scopes combined

- Scope I: 70,444.4 MT eCO₂
- Scope II: 5,836.5 MT eCO₂
- Scope III: 27,138.45 MT eCO₂
- Total: 103,419.35 MT CO₂

Graph 3: Total Emissions



II. Introduction

Western Michigan University is one of few universities with the dedication to sustainability that we have. It has been a point of pride for many students to be able to identify with a campus focused on such sustainable practices. The university is committed to providing the best learning environment for its students and has done so through sustainable activities. WMU has developed a mission statement that is “to advance responsible environmental stewardship”. The President’s Universitywide Sustainability Committee is dedicated to advancing environmental education and projects on campus.

Overall, WMU has developed a desire to educate its students in a way that prepares them for global citizenry. The students are educated in various cultural and religious backgrounds and understand the differences between ourselves and the people that live on the opposite side of the world. The university is preparing its students to understand the connection the each person has to one another and how a single decision can affect all of humanity. That is why this greenhouse gas emissions project is necessary on campus. We do not think about affecting people in third world countries when we drive to class or use electricity. This project shows exactly how we are affecting the rest of the world when we carry on our daily routines. We can even use this inventory to develop new ways to promote sustainability on campus and decrease our carbon footprint. It is necessary to submit to the ACUPCC every other year but provides so much more to the student and faculty at WMU.

Greenhouse gas emissions are something that we produce every day without thinking about it. We do not understand the damage that we are doing to our planet's climate. Various countries, universities, businesses, and families are already committed to becoming carbon neutral; many are not. We are fortunate enough to attend a university that is committed to becoming carbon neutral. It is our responsibility to model ideal behavior as a university and as students when it comes to sustainability practices.

Our university has signed the Talloires declaration, the ACUPCC which states that “the American College & University Presidents Climate Commitment is a high-visibility effort to address global warming by garnering institutional commitments to neutralize greenhouse gas emissions, and to accelerate the research and educational efforts of higher education to equip society to re-stabilize the earth's climate.” A few short years ago we were not a part of this organization because we did not fully understand our GHG impact. A group of dedicated students stepped up, completed a GHG inventory and the ACUPCC was finally signed. In order to continue to call ourselves a member of the ACUPCC we must complete a GHG inventory every other year. That is what we are here to do and what we hope to establish as a result of this project.

In order to complete an adequate GHG inventory, a proper understanding of common greenhouse gases is necessary. According to the EPA, the principle greenhouse gases that are effecting climate change are the following:

Carbon Dioxide (CO₂): Carbon dioxide is the primary greenhouse gas that is contributing to recent climate change. CO₂ is absorbed and emitted naturally as part of the carbon cycle, through animal and plant respiration. Human activities, such as the burning of fossil fuels (oil, natural gas, and coal) and changes in land use, release large amounts of carbon to the atmosphere, causing CO₂ concentrations in the atmosphere to rise.

Methane (CH₄): Methane is emitted during the production and transport of coal, natural gas and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

Nitrous Oxide (N₂O): Nitrous Oxide is emitted through agricultural activities and natural biological processes, as well as during the combustion of fossil fuels and solid waste.

Tropospheric Ozone (O₃): Chemical reactions create ozone from emissions of nitrogen oxides and volatile organic compounds from automobiles, power plants, and other industrial and commercial sources in the presence of sunlight

Fluorinated Gases: Hydrofluorocarbons (HFCs), chlorofluorocarbons (CFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆) are synthetic, powerful greenhouse gases that are emitted from various industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting substance (i.e. CFS, HCFS, and halons). These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they

are sometimes referred to as High Global Warming Potential (GWP) gases.

Looking forward and determining what will happen after this project is over is one of the hardest parts of the project. The Strategic Sustainability Initiative Report says it better than I ever could:

“The most outstanding of these institutions share three important characteristics (Glasser, 2003). First, these “sustainability leaders” have adopted serious strategies for systematically addressing the sustainability of their institutions. They have built a ‘campus culture of sustainability’ by creating policies that state their commitment to sustainability and they have plans in place that lay out how they intend to achieve them. Second, these institutions have provided the resources to implement their sustainability plans. They hire staff, form committees, allocate or re-allocate budgets, identify grants, and show clear administrative support for sustainability initiatives. Third, these sustainability leaders keep track of where they have been, where they are, and where they are headed in terms of sustainability. They measure and track their progress toward sustainability, facilitate continuous improvement by updating goals and benchmarks, and regularly meet to share learning and identify new opportunities for collaboration.

WMU has signed the ACUPCC, the Talloires Declaration, has created the PUSC, and has written an environmental mission statement. We are one of these “outstanding institutions.” If we want to continue at the top we must focus on point three: keeping track of where we’ve been, where we are, and where we’re going. This GHG inventory is dedicated to do just that.

III. Methodology and Data

A greenhouse gas emissions inventory can be conducted in a variety of ways. Identifying the sources of data and the depth of data to be collected will aid in the success of a GHG inventory. Some sources of emissions are greater than others and deserve more dedication in this inventory than the others. This report is to be submitted to the ACUPCC and will therefore include a great deal of information. Some data points are more difficult to obtain than others and will need to be adjusted or altered to fit the calculator. This report is important to the continuation of progress with the Climate Action Plan and must therefore be highly valued.

Boundaries of the Inventory

The biggest boundary of this investigation is the spatial restriction of data to only main campus, East campus, the power plant, and the Parkview campus. It is practical to only include these campuses due to the difficulty in acquiring data from satellite campuses and the limited time frame of this project. This will ease the difficulty and accuracy of the project at a smaller scale.

The amount of data points included in the project is a decision made mostly on the accessibility of the data. Points that were too difficult to acquire or too detailed were left out of the project simply because of time constraints. The possible sources of data that could be included in this report are quite extensive. Investigation of the more detailed aspects of emissions should be sought after in the future when time and resources are properly available.

The Clean Air – Cool Planet campus calculator was decided as the main tool for use in this project due to its extensive detail and the ability to leave out information that is not relevant. This calculator provided a great deal of information that would otherwise be difficult to find (i.e. emission factors for various emission sources). This tool also helps to divide up data points into easily accessible collections that help to eliminate confusion in calculations. The instructions that are included in the calculator are extremely detailed and provide an excellent source of information when questions arise.

Each scope in the tool is dedicated to a different responsibility that the university has with each type of emission. The scopes are broken up in the following way.

Scope I: Includes direct emissions that arise from sources that are owned or controlled by the university itself. This includes the burning of fossil fuels in university vehicles and facilities like the Beam Power Plant, fugitive emissions from refrigerants, fertilizer application to lawns, and more. WMU is completely responsible for emissions included in scope I.

- On-Campus Stationary Sources: emissions from all campus run fuel combustion, steam generation, and electricity generation
- Direct Transportation Sources: emissions from the university fleet vehicles
- Refrigeration and other Chemicals: fugitive emissions from refrigerants and other sources.
- Agriculture: fertilizer application to university lawns

Scope 2: Indirect emissions from sources that are not owned or operated by the institution but whose products contribute to energy consumption. This includes purchased electricity, steam and chilled water.

- Purchased Electricity: an emission from the production of any electricity the institution purchases
- *Western does not purchase steam or chilled water*

Scope 3: This includes emissions from sources that are neither owned nor operated by the university but are directly financed (i.e. travel miles reimbursed by the university) or are otherwise linked to the campus through influence or encouragement (i.e. regular faculty, staff, and student commuting). Scope 3 emissions that were included are as follows.

- Solid Waste: emissions from managing daily waste
- Directly Financed Outsourced Travel: emissions from travel that is paid for by

- the institution
- Commuting: emissions from regular commuting by faculty, staff, and students to and from campus
- Study Abroad Air Travel: emissions from students flying to and from study abroad locations
- Paper: amount purchased (including recycled content)

Offsets: The CA-CP Calculator hand book explains that “your footprint is what it is, regardless of what happens outside of your campus. However, if you use your financial control over outside entities in a way that creates a net reduction in worldwide carbon emissions that otherwise would not have occurred, you can justly declare that you have “offset” another entity’s carbon.” Western currently has offset areas but they are not included in the inventory in order to accurately determine our emissions. In the future, offsets may be included if the advising faculty believes that it is appropriate to include them in the data.

Calculating Emissions: Data was first collected for as many of the categories included in the calculator as possible. All collected data points were then stored in the Clean Air – Cool Planet campus calculator. Upon further investigation it was determined that calculating emission factors and emission totals would be easier if done through a personalized spreadsheet due to the fact that not all categories on the CA-CP calculator are utilized. Information from the CA-CP calculator was still used in the calculation, mainly emission concentrations and emission factors that would otherwise be difficult to determine. The ACUPCC recommends this calculator and that is mainly why the information was still used from it. It was developed based on the workbooks set out by the Intergovernmental Panel on Climate Change (IPCC) and was changed to incorporate college and university emissions. As the IPCC is reassessed changes keep occurring to the calculator and the most recent update was used for this project.

Collection Methods: The 2012 GHG inventory would not have been completed if it were not for the dedication of faculty and staff throughout the university. The majority of the information in this inventory came from multiple emails being exchanged between various faculty members and myself. I would first like to lend a special thank you to Jeff Spoelstra, Sustainability Coordinator, and Chris Caprara, Energy Administration Manager, for their commitment to this project and their help with data collection.. Other faculty and staff members involved in the project include:

Jeff Spoelstra, Sustainability Coordinator

- Timeline
- Referenced various contacts
- Answered intermittent questions
- Commuting information

Chris Caprara, Energy Administration, Manager

- On-campus stationary sources
- Purchased electricity
- CA-CP calculator guidance

Tim Holysz, Landscape Services

- Fertilizer information

Donald Penskar, Logistical Services

- References for fertilizer, paper, directly financed outsourced travel, etc.

Kelly Davidson, Payroll & Disbursement Office

- Outsourced travel information

Tom Ramsdell, Purchasing

- Paper consumption

Michelle Metro-Roland and Bradley Ryktarsyk, Study Abroad

- Study abroad destinations

Vicki Cox, Maintenance Services

- Direct transportation fuel usage

Carolyn Noack, Waste Reduction Services, Manager

- Solid waste
- Diversion strategies

Anand Sankey, Engineering Division, Director

- Refrigerants

A complete email correspondence with the above faculty and staff can be found in Appendix C. A meeting list with a select number of the above faculty and staff can be found in Appendix B. Student, faculty, and staff enrollment was acquired through the office for Institutional Research's website and yearly publications. Building square-footage was determined through simple calculations using data from Facilities Management's building list webpage.

Collecting data for this project was difficult yet feasible. All of the information necessary was collected and catalogued. Each piece of information, when received, was relocated to the CA-CP spreadsheet in order to keep things organized and in one place. Some data points needed to be converted and altered in order to use them in the formulas that the calculator uses. Each scope required a different data set and a different amount of time dedicated to it. Scope III by far required the most work and was the most tedious to acquire.

Previous GHG inventories were also very critical in this project's success. The data used in those inventories was especially helpful in determining our progress so far concerning the Climate Action Plan. The previous inventories also provided a great deal of information regarding where to acquire data. The departments that were contacted in previous inventories were usually the same department that needed to be contacted for this inventory. With this inventory now completed, future students and faculty members can now access to a better record of our emissions.

IV. *Best Practices On Campus*

The best example that I can think of to demonstrate best practices on campus concerning the GHG inventory is the use of the inventory in the past. We have had 3 inventories completed (this being the fourth) that have helped us to understand our impact on campus. The use of these inventories to develop sustainability projects, cultivate the Climate Action Plan, and just develop a sustainable environment on campus is a very good practice.

Western has done a great job of promoting sustainability through projects and GHG inventories have helped that. Investigations of composting, waste reduction, recycling projects, and many other things have stemmed from the work that has been done for GHG inventories. The Office for Sustainability remains steadfast in the fight for sustainable practices on campus and is continuing to move forward. Many of the projects currently being completed for this class are helping to expose sustainable lifestyles to the students and faculty on campus. The super-green dorm currently being investigated by another group in this class is one of the most forward thinking projects of the class. If a super-green dorm could be implemented at Western sustainability would become a must. We have already seen great strides in the efforts made by the staff at the Office for Sustainability to promote healthy living, investigations of world problems, and to understand our place in this world.

V. *Best Practices at Peer Institutions*

Many universities use the same process that we do to complete their GHG inventories. Many have faculty that is dedicated to the inventory on an annual basis but overall the process is the same. Collect and analyze data from different departments on campus. A big thing that is similar is that most universities use the Clean Air – Cool Planet carbon calculator because it has become standardized and is recommended by the ACUPCC. This is a good thing because we can look at other universities inventories and compare them to our own to see when WMU stands in comparison to everyone else. This would be a great thing to investigate if more time was allotted for this project.

VI. Discussion

The following several sections focus on the data collected for each area of the inventory: scope I, scope II, and scope III. Each area includes different data points collected from various people across the university and they have been compiled here.

a. Scope I

Cogeneration

Cogeneration is the use of a power plant to produce both electricity and steam concurrently. This cogeneration of energy makes it much more thermodynamically efficient than it would be in a traditional plant to produce energy. The waste heat energy from the production of electricity is used to help the plant produce steam, which can either be used for heating or for producing more electricity with a gas or steam powered turbine.

Western Michigan University currently runs two separate power plants, the Robert M. Beam Plant on Stadium Drive, and the Energy Resource Center (ERC) located on the Parkview Campus. The Beam Plant is a cogeneration plant that produces the majority of the electricity for campus while the ERC strictly produces steam. Both power plants are run solely on natural gas. The table below shows the emissions factors of CO₂, CH₄, and N₂O for natural gas combustion in a cogeneration plant that was used in our calculations.

Table 1: Cogeneration Emissions Factors and CO₂ equivalents

CO ₂ (eCO ₂)	kg CO ₂ /MMBtu	CH ₄ (eCO ₂)	kg CH ₄ /MMBtu	N ₂ O (eCO ₂)	kg N ₂ O/MMBtu
1	52.76	21	5.28E-03	310	1.06E-04

Between both power plants on campus, 1,239,270 MCF of energy were produced in 2012. This released 65,908.5 MT eCO₂ into the atmosphere. A breakdown summary of each different emission can be found in Table 2 below.

Table 2: Greenhouse Gas Summary for Cogeneration

kg CO ₂ /MMBtu	kg CH ₄ /MMBtu	kg N ₂ O/MMBtu
65,383,885	6537.1	130.7

There are a few limitations to the data included in cogeneration. The data collected was based off of the assumption that one MCF of natural gas was equal to one MMBtu of energy produced. This is not always the case but it is generally accepted as true. Therefore this assumption was used in calculations.

Direct Transportation

Direct transportation sources include any fuel powered, university owned vehicle. The emissions factors listed below were used to determine the CO₂ equivalent emissions contributed by our university fleet vehicles. The table shows emission factors for both gasoline and diesel fueled vehicles.

Table 3: Transportation Emissions Factors and CO₂ Equivalents

	CO ₂ (eCO ₂)	CH ₄ (eCO ₂)	N ₂ O (eCO ₂)
	1	21	310
Fuel Type	kg CO ₂ /Gallon	kg CH ₄ /Gallon	kg N ₂ O/Gallon
Unleaded	8.865	1.86E-03	6.23E-04
Diesel	10.257	5.67E-04	2.57E-04

The university used approximately 105,215 gallons of gasoline and 13,969 gallons of diesel fuel for 2012. The university's gasoline use produced 932,710.1 kg of CO₂, 196.2 kg of CH₄, and 65.6 kg of N₂O. Diesel use produced 143,281.2 kg of CO₂, 7.9 kg of CH₄, and 3.6 kg of N₂O. 957 MT eCO₂ from gasoline and 144.4 MT eCO₂ from diesel results in a total of 1,101.4 MT of eCO₂ produced by university fleet vehicles in 2012. Table X shows a breakdown of each type of emission generated in transportation by fuel type.

Table 4: Greenhouse Gas Summary for Direct Transportation

Fuel Type	kg CO ₂ /gallon	kg CH ₄ /gallon	kg N ₂ O/gallon
Unleaded	932,710	196.2	65.6
Diesel	143281.2	7.9	3.6
Total	1,075,991	204.1	69.2

This data set has great limitations considering the lack of detail provided by logistical services. Fuel usage was provided in a single lump sum and not divided amongst department. A detailed description of use by department would help to develop a plan to reduce fuel consumption in university fleet vehicles.

Refrigerants

Refrigerants are known for escaping from closed systems. Refrigerants that are lost from a system are referred to as fugitive emissions. Any refrigerant added to a system, which is not reclaimed (properly removed and disposed of), is in this case considered a fugitive emission and is included in our calculations in this section.

Refrigerants in general have a huge effect on global warming. Some Refrigerants such as CFC's (chlorofluorocarbons) deplete the ozone layer, which is an important layer of our atmosphere that protects us from ultraviolet radiation. Due to their high global warming potential, refrigerants should be monitored closely and regulated properly.

All refrigerants used at Western Michigan University fall into one of four categories of which some were discussed earlier: chlorofluorocarbons (CFC's), hydrochlorofluorocarbons (HCFC's), hydrofluorocarbons (HFC's), or a mixture of two or more. The chemical structures of these molecules are somewhat similar yet different in an important way. The specific global warming potential of these molecules depends on the structure of the compound. Chlorofluorocarbons have all the hydrogen molecules of the parent hydrocarbon replaced by chlorine, while hydrochlorofluorocarbons have a portion of their hydrogen molecules

replaced by chlorine, and hydrofluorocarbons do not contain any chlorine molecules. Below is a table taken from the 2007 base GHG inventory containing each refrigerant, the type of refrigerant it is, and its global warming potential (in comparison to carbon dioxide).

Table 5: Global Warming Potential of Common Refrigerants

Refrigerant	Type	GWP (CO ₂ = 1)
R-11	CFC	4,600
R-12	CFC	10,600
R-22	HCFC	1,700
R-134a	HFC	1,300
R-401a	Mixture	1,100
R-402b	Mixture	2,200
R-404a	Mixture	3,784
R-500	Mixture	4,080
R-502	Mixture	6,200

Western Michigan University actually only uses mainly two of these refrigerants: R-12 and R-134a. In 2012, 7.63 lbs of R-134a and 702.81 lbs of R-12 were lost as fugitive emissions. As seen in the table below, 3,384 MT of eCO₂ were released from the use of refrigerant on campus in 2012.

Table 6: Refrigerant CO₂ Equivalents

Refrigerant	lbs	MT eCO ₂ /lb	Total MT eCO ₂
R-12	702.81	4.808	3379.2
R-134a	7.63	0.648	4.9
Total	710.44		3384.1

This data is also limited like the rest of the data in this summary. I am unaware of the use of any other refrigerants on campus and therefore the total amount may be lower than the actual use. These were the only totals given by Chris Caprara from Facilities Management.

Fertilizer

A small amount of fertilizer is used on campus property. The fertilizer used contains 25% Nitrogen, 0% Phosphorus, and 20% Potassium Oxide. There were 241 bags applied, each weighing 50 lbs for a total of 12,050 lbs applied to the University's campus. This contributes 50.54 MT eCO₂ to our emissions.

The information regarding fertilizer was fairly straightforward and should be fairly accurate. No other agriculture releases of CO₂ are significant on campus and therefore were not included in this calculation.

b. Scope II

WMU is not capable of generating enough power for the entire university and must therefore acquire it in some other way. Consumers Energy provides an appropriate amount of energy to run campus as efficiently and cheaply as possible. When demand is low, such as at night, less energy is used and the remainder is sold back to Consumers to keep campus efficient at all times

The Clean Air-Cool Planet calculator determines emissions from purchased electricity based on the university's eGrid region, which happens to be RFCM. The fuel mix and resulting emissions for the region are determined by the average of the region as a whole. Different mixes produce different emissions and so it is important to take into account the region in which the university is located. The emissions factors for the RFCM region are shown in the table below.

Table 7: Purchased Electricity Emission Factors

kg CO ₂ /kWh	kg CH ₄ /kWh	kg N ₂ O/kWh	MT eCO ₂ /kWh
0.74893	6.75E-05	9.58E-06	7.53E-04

Emissions for 2012 are approximately 7,710,000 kWh of electricity. This contributed 5836.5 MT of eCO₂ to emissions. A loss of 9% is also taken into consideration because of some heat transfer when passing electricity through the grid.

Table 8: Greenhouse Gas Summary for Purchased Electricity

kg CO ₂	kg CH ₄	MT eCO ₂
5803471.2	520.425	5836.47

c. Scope III

Commuting

Vehicular travel to and from campus is a complicated data set to compile. The 2011 transportation survey was used to generate data concerning commuting to campus. The Bronco Transit bus system and Kalamazoo Metro Transit bus system both are free to students and they are encouraged to take advantage of the free public transportation. This has an impact on the emissions released by vehicles traveling to campus. This does not mean however that our personal vehicle emissions are low by any means. Students still prefer to drive to campus even though parking lots are crowded and far away from buildings.

In 2012, 14,382.3 MT of eCO₂ were produced through commuting to campus. The emissions factors for both cars and buses can be seen below.

Table 9: Commuting Emission Factors (Car)

kg CO ₂ /mile	kg CH ₄ /mile	kg N ₂ O/mile
0.366766239	7.72E-05	2.58E-05

Table 10: Commuting Emission Factors (Bus)

kg CO ₂ /mile	kg CH ₄ /mile	kg N ₂ O/mile
0.321217508	1.78E-05	8.05E-06

This data set was quite difficult to determine because of the lack of reliable data to base it off of. The 2011 Transportation Survey was used but averages were still used to determine actual amounts. We are also unaware of the number of faculty working in the summer and the distance that students drive during the summer. All of these things could drastically alter the emissions for commuting.

Directly Financed Outsourced Travel

All travel that is sponsored by the university that does not use a university vehicle would fall under this category. Air travel, rental cars, and charter buses are all examples of directly financed outsourced travel that are included. Air travel paid for by the university contributed 4822.7 MT eCO₂ and rental cars/buses produced approximately 284.3 MT eCO₂.

Table 11: Air Travel Emissions Factors

kg CO ₂ /mile	kg CH ₄ /mile	kg N ₂ O/mile
0.544242097	5.20E-06	5.98E-06

Table 12: Rental Car/Bus Emissions Factors

kg CO ₂ /mile	kg CH ₄ /mile	kg N ₂ O/mile
0.366766239	7.72E-05	2.58E-05

This would be a great area for reduction in emissions for the university. With a total of 5107 MT eCO₂ we could easily reduce this number. Choosing to drive a car (personal or rental), would be smart way to offset a great deal of emissions from air travel. This would be an interesting area to investigate further in the future.

Study Abroad Air Miles

Study abroad emissions fall under scope III because the university does not own the transportation service yet it is encouraged to be used. The table below summarizes the destinations, mileage, and number of students that studied abroad in 2011. This data is a bit different from the rest of our data because it is a year behind. The study abroad publication is not released until October of the following year and therefore 2012 will not be available until October of 2013. This information is still fairly accurate since approximately the same percentage of the student body studies abroad every year.

Table 13: Study Abroad Air Mileage Summary

Destination	Miles	# Students	Total Miles
Germany	4405	56	246680
Argentina	5598	2	11196
Panama	2328	1	2328

Peru	3790	1	3790
Australia	9272	21	194712
Philippines	8143	1	8143
Hungary	4820	1	4820
Bangladesh	7911	1	7911
Belgium	4145	2	8290
Ireland	3666	23	84318
Belize	1703	12	20436
Israel	6195	1	6195
Italy	4808	28	134624
Japan	6299	10	62990
Bolivia	4449	1	4449
Canada	744	2	1488
South Africa	8494	4	33976
Spain	4186	51	213486
China	7793	33	257169
Malaysia	9280	9	83520
Costa Rica	2219	15	33285
Tanzania	8206	1	8206
Thailand	8568	23	197064
Cyprus	5945	1	5945
Czech Republic	4544	78	354432
Mexico	1691	17	28747
Egypt	6129	7	42903
UK	3950	52	205400
Mozambique	8924	1	8924
Uruguay	5671	5	28355
Ethiopia	7563	1	7563
Netherlands	4114	12	49368
France	4134	22	90948
Russia	4974	3	14922
Total		498	2466583

The 2011 emissions due to study abroad travel equals about 1346.75 MT eCO₂. This data, like previously stated is not as current as it should be but it still provides valid information. Another problem with this data is that the city destinations of the students are not provided. Therefore, the capitol of the country was used as the destination and the distance of that from Kalamazoo was used as the air mileage.

Solid Waste

Solid waste is something that many people at the university are committed to reducing. Diversion rates are high and continue to get higher as our commitment to diversion grows. This has a significant impact on the amount of methane and other greenhouse gases that are

released into the atmosphere. This past year, 5936 MT eCO₂ was generated. There are no methane capturing or energy production practices involved in our waste disposal that we are aware of. A way to possibly decrease the emissions contributed to our waste would be to look into CH₄ capturing and energy production. We could greatly decrease our impact by investigating and possibly implementing these techniques.

This data may not be completely accurate because it does not include construction or demolition waste. I raised the question to a staff member of CA-CP and she determined that it was up for interpretation. In order to follow what has done in the past I opted to leave out construction and demolition waste.

Paper

The university purchases large amounts of paper on an annual basis. Various types, colors, and sizes of paper are used all across campus. The table below illustrates the emission factors for various types of paper used on campus. The majority of our paper is 30% recycled content and it makes up 304,092 lbs of the paper that is used on campus. The recycling rate of paper on campus is over 90% and this is extremely helpful in reducing our emissions when it comes to waste and paper purchases.

Table 14: Paper Emission Factor by Recycled Content (RC)

10% RC	30% RC	50% RC	100% RC
MT eCO ₂ /lb	MT eCO ₂ /lb	MT eCO ₂ /lb	MT eCO ₂ /lb
0.001306	0.001187	0.001067	0.000769

Paper purchases in 2012 produced 366.4 MT eCO₂. This is a very small amount considering the amount of paper that is recycled. Of course, the amount recycled could always be better and we must strive for that through now that we have this information.

VII. *Limitations of Data*

There were many limitations to the data discussed within each section previously. Mainly the time limit imposed on this project prevented a great deal of information from being investigated further. Details about electric and steam generation could help to solidify numbers concerning the cogeneration plant. Given more time and more resources, a study about commuting habits would be very beneficial to the data in this study. The commuting data was only an estimate and would be more accurate with a current study with this project.

Future work would definitely be beneficial to this project. It should be completed on a yearly basis to keep the university responsible for it's climate neutrality commitment that is stated in the Climate Action Plan.

VIII. Conclusion

Western Michigan University has come a long way since the first GHG inventory was done so we could sign the ACUPCC. We have committed to climate neutrality by 2065, and we have created many sustainability opportunities on campus for students and faculty. I would love to see this project continued into the future in order to hold us accountable for our commitment. I would love to see a position at the office for sustainability that is dedicated to the upkeep of our GHG emissions records. This record of immense amounts of data will help to keep GHG inventories accurate in the future. If this is continued on an annual basis it will encourage transparency between departments concerning data that is included in this study.

This inventory is not only helping to fulfill ACUPCC requirements but it is also reminding us of the actions outlined by the Talloires Declaration: 1) Increase awareness of environmentally sustainable development, 2) Create and institutional culture of sustainability, 3) Practice institutional ecology, and 4) Maintain the movement.

IX. References

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X. Appendices

a. Group Contact List

Name	Phone	Email
Christian Galbraith	(269)626-4020	christian.galbraith@wmich.edu

b. Meeting Log

Meeting with Jeff Spoelstra 2/15/13 1:00 PM Office for Sustainability

Discuss final project goals → Do actual inventory, “create guidebook”
Get contact information: Chris Caprara, facilities management
How to do calculations? → Clean Air – Cool Planet Campus Calculator

Meeting with Chris Caprara 3/14/13 3:30 PM Office for Sustainability

Chris will get Scope I and II data
Get contact information: Tim Holysz, landscape services; Vicki Cox, university fleet
Look up enrollment info from Office for Institutional Research
Use Excel for graphs for report
Fiscal year or calendar year? → Ask Jeff!

Meeting with Jeff Spoelstra 3/15/13 3:00 PM Office for Sustainability

Get contact information: Carolyn Noack, solid waste
Get info then decide on fiscal vs. calendar year
Present to PUSC in April?? → Ask Dr. Glasser
Email with any questions

Meeting with Carolyn Noack 3/25/13 3:00 PM Office for Sustainability

Discuss solid waste → construction vs. regular
Recycled materials
Paper purchased → % recycled content
Email Tim Holysz for incineration?

Meeting with Chris Caprara 4/5/13 12:00 PM Facilities Management Office

Discuss use of carbon calculator → use excel spreadsheet
Determine emissions factors of each source
Request refrigerant information

c. Email Contact Log

COPIED EMAIL 2/11/13 4:49 PM

Dear Jeff,
Christian is doing the GHG inventory for her 4100 class.

She will get in touch with you to set up a meeting. I'll come if I can, but I want you two to meet as soon as

possible and discuss strategy.

Thanks,
Harold

RECEIVED EMAIL 2/11/13 10:42 PM

Hi Christian,
I look forward to chatting.

I suggest you call me Tuesday morning after 10:30 a.m. We can schedule a time to dive into this work.

Jeff

SENT EMAIL 2/13/13 3:41 PM

Jeff,
I apologize for not getting back with you [yesterday](#), I've had a lot of stuff going on lately regarding the Environmental Studies Gwen Frostic Lobby Day. Are you free at all this week where we could meet? I am free all day on [Friday](#) if that works for you. Let me know.

Thanks,
Christian

RECEIVED EMAIL 2/13/13 3:47 PM

How about Friday at 1 p.m.?

Jeff

SENT EMAIL 2/14/13 12:51 PM

That sounds great! I'll see you then!

Christian

COPIED EMAIL 2/15/13 1:38 PM

Hello Chris,
I met with Christian today. She is in Dr. Glasser's 4100 class and will finalize her project proposal on Sunday.

She indicated that she will complete a full GHG inventory during the course of her project this semester. We discussed a few other angles on the project as well like:

- 1) significantly refining/updating all Scope 3 information
- 2) establishing a protocol that WMU can use for annual GHG inventory updates
- 3) focusing on one thing in greater depth (e.g., air travel, or transportation)

Christian is reviewing the Clean Air Cool Planet tool in detail now, and she has already reviewed the WMU Climate Action Plan.

She is interested in meeting or talking with you soon and I've cc'ed her here to help facilitate that.

Will you be able to assist with an update for the Scope I and II categories (and advise on Scope III) in time for Christian to incorporate them into her complete GHG inventory?

Feel free to give me a call before or after chatting with Christian.

Thanks for lending your experience and expertise.

Jeff

COPIED EMAIL 2/15/13 8:22 PM

Jeff,

Sorry I missed your phone call the other day. I will be happy to provide my assistance.

Christian: please let me know when you would like to try and meet, and I will let you know my availability.

Chris

SENT EMAIL 2/18/13 1:35 PM

Jeff,

I have attached my final project proposal that I submitted to Dr. Glasser. If you have any questions or comments let me know. Thanks!

Christian

SENT EMAIL 2/18/13 3:49 PM

Chris,

I would love to meet with you sometime before Spring Break. Are you available at all this week? If you just let me know what times you're available I can hopefully work it into my schedule. If you can just email me back and let me know I would greatly appreciate it. Thanks.

Christian

RECEIVED EMAIL 3/4/13 8:59 AM

Christian,

Sorry for taking so long to get back to you, I thought I did but your email was still in my inbox.

I hope after spring break isn't too late. Let me know, and I will be more than happy to meet with you first thing next week.

Chris Caprara

SENT EMAIL 3/11/13 10:24 AM

Chris,

When are you available this week? I can work with my schedule so we can meet whenever you are available. Just let me know what works best for you. Thanks.

Christian

SENT EMAIL 3/13/13 4:02 PM

Jeff,

I hope everything is going well with you. I'm trying to get the GHG inventory rolling a little bit faster and I am having trouble getting ahold of Chris. If you can possibly email him and see when he is available to meet with me that would be great. I also would like to meet with you to work on the Scope 3 numbers so that we can get that done. If you could let me know when you're available that would be great. Thanks!

Christian

RECEIVED EMAIL 3/14/13 9:40 AM

Christian,
Do you have time this afternoon?

Chris

SENT EMAIL 3/14/13 12:09 PM

Chris,
I'm available after 3:30. Would that work for you?

RECEIVED EMAIL 3/14/13 12:55 PM

Yes. That works. Where would you like to meet?

Chris

SENT EMAIL 3/14/13 1:45 PM

Chris,
Wherever is best for you. I'll be in wood hall until 3:15.

RECEIVED EMAIL 3/14/13 1:54 PM

I could meet you at Harold's office? It would be less of a walk for you than coming all the way over here. Just shoot me an email and let me know.

Chris

SENT EMAIL 3/14/13 2:05 PM

That would work. I'll meet you there at 3:30.

Christian

RECEIVED EMAIL 3/15/13 1:25 PM

Christian,
Hi. I've not forgotten about you.

Can you call me in the office to discuss next steps. I'm here today.

Jeff

SENT EMAIL 3/15/13 1:33 PM

Jeff,
I'm actually going to be coming by the office in about an hour. Will you be there then?

Christian

COPIED EMAIL 3/15/13 1:27 PM

Hi Chris,
Christian and I will connect later today or this weekend to discuss next steps on the GHG inventory. Have you been able to connect with her?

Thanks,
Jeff

RECEIVED EMAIL 3/15/13 1:33 PM

Yes. Stop by my desk.

Jeff

RECEIVED EMAIL 3/17/13 11:26 AM

Hi Christian,

Attached please find our answers on this year's Princeton Review - Green section.

I specifically suggest that you read the part on how I answered the Commute Modal stuff for faculty and students.

I'll send background on that in a moment.

Jeff

RECEIVED EMAIL 3/17/13 11:29 AM

(2011 Green Report Card Attached)

From Jeff

RECEIVED EMAIL 3/17/13 11:31 AM

Attached, raw .csv file (opens in MSExcel) of transportation results.

More to come.

Jeff

RECEIVED EMAIL 3/17/13 11:35 AM

Results .pdf

Jeff

COPIED EMAIL 3/17/13 11:40 AM

Hi Chris,

Christian and I met Friday, where I learned that you two already connected. Thanks!

I've shared some stuff that should help here on the transportation/commute side and directed her toward Carolyn Noack for solid waste and related stuff.

I redirected her to you on the wastewater question, because I've assumed that like everyone else, we don't meter wastewater - we just metered city water use and assume wastewater volumes? Is that correct? Who does the monitoring?

I have a bit of "coming up to speed" to do on the Clean Air Cool Planet spreadsheet.

Harold has suggested that Christian could present her results at the April PUSC meeting.

Thanks,

Jeff

COPIED EMAIL 3/18/13 11:38 AM

Jeff,

That is correct. Waste water is measured by the amount of domestic water metered.

That is something that I will be able to supply.

Chris

SENT EMAIL 3/18/13 12:48 PM

Tim Holysz,

My name is Christian Galbraith and I am currently assisting the Office for Sustainability in conducting a greenhouse gas emissions inventory for 2012. I am in need of a great deal of information and have been told that you may be able to assist me. If you could provide me with the synthetic fertilizer use (in pounds) for campus and its nitrogen content (%), and the organic fertilizer use (in pounds) for campus and its nitrogen content (%) I would greatly appreciate it. If you have any questions please feel free to contact me. Thank you.

Christian Galbraith

SENT EMAIL 3/18/13 1:05 PM

Donald Penskar,

My name is Christian Galbraith and I am currently assisting the Office for Sustainability in conducting a greenhouse gas emissions inventory for 2012. I am in need of a great deal of information and have been told that you may be able to assist me. I am looking for a variety of information regarding the university's directly financed outsourced travel (air, train, bus, and rental car miles), university fleet vehicles (gallon use for gas, E85, diesel, etc.), and paper use (lbs used and lbs recycled). If you can provide me with any of the above information or at least point me in the direction of the person who could provide me with that information it would be greatly appreciated. If you have any questions please feel free to contact me. Thank you.

Christian Galbraith

RECEIVED EMAIL 3/18/13 3:02 PM

Christian,

Please see as follows:

1. Travel information can be obtained from Kelly Davidson or Jennifer Halseth in the Payroll & Disbursement Office - they handle all corporate travel for University staff.
2. Fuel usage information will reside with Vicki Cox in our Maintenance Stores area. We do not distribute E-85 from our depot here in Campus Services, so I have copied Jeff Alexander to see if he has any data on that, or if we use it at all.
3. Paper usage information can be obtained from Tom Ramsdell here in the Purchasing Office.

I have copied all of these folks on this email for your convenience....please feel free to call with any questions.

Don

RECEIVED EMAIL 3/18/13 3:29 PM

I think I can help you out.....give me a little time !

Thanks

Tim Holysz

COPIED EMAIL 3/18/13 7:18 PM

Dear Tim,
Thanks very much for helping Christian out.

She is doing a great job taking the lead on helping us to do the GHG inventory for WMU, which is due in April!

Cheers,
harold

SENT EMAIL 3/19/13 11:36 AM

Don,
Thank you so much for your help with this! I will soon be in contact with all of the people you suggested.
Thanks!

Christian

RECEIVED EMAIL 3/20/13 4:56 AM

Good morning to All!! OK....here are the figures for 2012 !!

We used 241 / 50lbs bags of 25-0-20.
Each bag is applied at the rate of 1# of N/1000 sq'
Each bag when applied goes for 12,500sq'
There is 43,264 sq" to an acre.
241 bags = 3,012,500 sq' or 69.6 acres
We applied 2 applications over 34 acres
Total mow-able acres on Campus = 197 acres

I hope this helps!
Timmy :)

COPIED EMAIL 3/20/13 8:16 AM

Dear Tim,
Thanks very much.

Do the "Total mow-able acres" include Parkview and CHHS or are they just main campus?

Do you apply fertilizer on the CHHS and Parkview properties?

Thanks again and all the best,

harold

COPIED EMAIL 3/20/13 8:23 AM

Dear Don,
Thanks very much for your assistance.

Kelly, Tom, Vicki, Jennifer—I want to thank you all for your assistance with the Greenhouse Gas Inventory. This is part of WMU and President Dunn's commitment to the American College and University

President's Climate Commitment (ACUPCC)—and a requirement of our participation.. President Dunn is on the national steering committee of the ACUPCC.

CHRISTIAN—please remember that part of your 4100 project is to document all of these details to facilitate future GHG inventories. It's likely that we will do an update every year, although we might not update all data (especially that which requires surveys every year). Those pieces of data might simply be renormalized to enrollment to obtain a new estimate.

Cheers,
harold

COPIED EMAIL 3/20/13 10:49 AM

Yes, the figures include COE/BTR and CHHS.
NO.....we have used compost tea.

Tim Holysz

RECEIVED EMAIL 3/21/13 9:36 AM

Hi Christian,

Well, it sounds like you are engaged in an exciting project. Could we meet to discuss what information you need and what information is available? What is the timeline for this request?

Kelly

COPIED EMAIL 3/21/13 11:56 AM

Dear Kelly,

Thanks for your assistance We are on a tight deadline. Christian needs all the requested data by [April 3](#).

This is a university project and we need to submit our GHG inventory to the ACUPCC (President Dunn is on the National Steering Committee).

Contact Jeff Spoelstra, cc'd above, if you have any questions (Jeff is WMU's Sustainability Coordinator).

We very much appreciate your assistance.

Cheers,
Harold

SENT EMAIL 3/21/13 12:28 PM

Kelly,

Thank you so much for your help with this. I have a pretty busy schedule so if you know when you're free I can make time to meet with you then. If I can hopefully get this information by the first week of April that would be wonderful. Thank you again for your help!

Christian Galbraith

RECEIVED EMAIL 3/21/13 1:02 PM

Christian,

I talked to Jeff regarding the information we have available here. Don Penskar's team would have contact information for bus vendor and university fleet. There would be no information available for train.

We will contact Enterprise our car rental company to see what information they may have. They currently do not report any mileage information to us and I am unaware that they keep track of that.

Here is the information regarding miles flown for calendar year 2012 which is supplied to us quarterly from AAA our travel management company who books WMU flights (except for some exceptions). Student abroad uses other sources for travel arrangements.

International Travel

Total Miles Flown: 4,077,812

Average Miles per trip: 9,184

Domestic Travel

Total Miles Flown: 4,755,125

Average Miles per trip: 1,972

Best Regards,
Kelly Davidson

RECEIVED EMAIL 3/22/13 12:06 PM

Christian,
Number of miles driven tracked by our rental car company Enterprise.

2012
756,119 miles

Have a great weekend,

Kelly

SENT EMAIL 3/22/13 12:33 PM

Kelly,
Thank you so much for your help! I greatly appreciate it! Have a wonderful weekend as well.

Christian

SENT EMAIL 3/25/13 12:21 PM

Tom,
My name is Christian Galbraith and I am currently assisting the Office for Sustainability in conducting a greenhouse gas emissions inventory for 2012. I am in need of a great deal of information and have been told that you may be able to assist me. Don Penskar has sent me to you to obtain information on the paper usage on campus (lbs used and lbs recycled). If you could possibly get me this information by [April 8th](#) I would greatly appreciate it. Thank you.

Christian

SENT EMAIL 3/25/13 12:23 PM

Michelle,
My name is Christian Galbraith and I am currently assisting the Office for Sustainability in conducting a greenhouse gas emissions inventory for 2012. I am in need of a great deal of information and have been told that you may be able to assist me. Harold Glasser has sent me to you to obtain information about study abroad air travel. I need the total number of air miles traveled for study abroad in 2012. If you can provide

me with that information I would greatly appreciate it. If not could you possibly put me in contact with someone who could help me? Thank you so much.

Christian

SENT EMAIL 3/25/13 12:26 PM

Vicki,

My name is Christian Galbraith and I am currently assisting the Office for Sustainability in conducting a greenhouse gas emissions inventory for 2012. I am in need of a great deal of information and have been told that you may be able to assist me. Don Penskar has sent me to you to get information regarding university vehicles. I need gallon usage for gas, E85, diesel, and any other fuels that we use in university vehicles. I also need the kWh usage of our electric fleet. If you could get me this information by [April 8th](#) I would greatly appreciate it. If not could you put me in contact with someone who can provide me with this information? I greatly appreciate your help. Thank you.

Christian

SENT EMAIL 3/25/13 12:46 PM

Carolyn,

My name is Christian Galbraith and I am currently assisting the Office for Sustainability in conducting a greenhouse gas emissions inventory for 2012. I am sorry I have not yet contacted you but I was waiting to hear back from a few other people to see if they could provide me with some information before I asked you for it. I am still in need of the short tons of incinerated waste (if we have any) and the short tons of landfill waste (divided into CH₄ recovery and electric generation, CH₄ recovery and flaring, and no CH₄ recovery). Also, I was wondering if you had any information on the amount of paper recycled on campus (I've already asked Tom Ramsdell about the amount purchased but I wasn't sure if he could provide me with the amount recycled). If I could get this information by [April 8th](#) I would greatly appreciate it. If you do not have any of this information could you possibly point me in the direction of who I could ask for it? I appreciate your help with this. If you have any questions you can email me or contact Jeff Spoelstra who is helping me with this project. Thank you so much.

Christian

SENT EMAIL 3/25/13 2:04 PM

Chris,

Hello! I hope your weekend went well. I was wondering how everything was going with collecting information for Scope I and II. I would like to have all of that information put into the calculator by the end of this week. So if you could get that to me it would be great. I really appreciate your help with this by the way. I would not be as successful without your help. Thanks and hopefully I will hear from you soon!

Christian

RECEIVED EMAIL 3/25/13 2:05 PM

Christian,

I think I need a little more information to provide the appropriate data. I have the data for tons of landfilled material, but I need to know if you want just regular municipal solid waste (normal household and business waste), or if it should include construction & demolition debris. As far as I know, we do not incinerate any of our waste, except possibly medical waste. Unfortunately, I don't know who to ask for that information.

In 2012 WMU recycled 676.39 tons of paper and cardboard. In addition, we donated (waste prevention) 4.49 tons of paper.

I look forward to hearing from you again.

Carolyn

SENT EMAIL 3/25/13 2:10 PM

Carolyn,

I believe that it includes just regular municipal solid waste but I am not sure. I will do a little bit more research and see exactly what they mean. Will you be at the office [today](#) at 3:30? Our class is meeting there [today](#) and it would probably be easier to talk to you in person.

Christian

RECEIVED EMAIL 3/25/13 2:12 PM

Christian,

I'll be here, but I have a 3:30 and a 4:30 meeting. I can meet a few minutes before class, or about 4ish.

Carolyn

SENT EMAIL 3/25/13 2:14 PM

Carolyn,

I can come over around 3:00 if that would work for you.

Christian

RECEIVED EMAIL 3/25/13 2:19 PM

See you then.

Carolyn

RECEIVED EMAIL 3/25/13 4:21 PM

Christian,

Attached is a green usage report from Office Depot the supplier for our office products. I hope this helps.

Tom.

SENT EMAIL 3/25/13 4:26 PM

Thanks Tom! That is exactly what I needed!

Christian

SENT EMAIL 3/25/13 4:57 PM

Claire,

Dr. Harold Glasser, Executive Director for Campus Sustainability, put me in contact with you a little while ago about a question I had concerning the Carbon Calculator. I just wanted to follow up in case you failed to receive the message. I was wondering if the solid waste category includes construction and demolition waste as well as regular wastes or if it went in another category. I appreciate your help and you can contact me at the phone number below or reply to this email. Thanks again!

Christian

RECEIVED EMAIL 3/27/13 11:28 AM

Hi Christian,

Thanks for getting in touch with your question on solid waste numbers and construction and demolition waste at Western Michigan University.

That is a common area of confusion.

I am no longer working for Clean Air-Cool Planet, but I'm copying Anna Mika and she can help you decide which numbers to use.

Sincerely,
Claire Roby

RECEIVED EMAIL 3/27/13 12:10 PM

Hi Christian,
Could you repeat your question?

Thanks,
Anna

RECEIVED EMAIL 3/27/13 1:00 PM

Christian,
I'm so sorry.

I haven't forgotten about you. I will have your stuff for you by [tomorrow](#).

Chris

SENT EMAIL 3/27/13 2:37 PM

Hello Anna,
I'm trying to do a GHG Inventory for Western Michigan University and I've come across a few different numbers concerning solid waste. When the Carbon Calculator asks for solid waste does that include construction and demolition waste as well? Or does that go somewhere else? I appreciate your help. Thank you.

SENT EMAIL 3/27/13 2:38 PM

Thank you Chris! I appreciate it!

Christian

RECEIVED EMAIL 3/27/13 2:59 PM

Christian,
Unleaded gallons used for 2012 is 105,215. Diesel gallons for 2012 is 13,969. As far as the electric vehicles you would need to contact Facilities Management (Kris Kenz 7-8425 oranand.sankey@wmich.edu), I believe they track those figures.

Please contact me with questions or if any further information is required.

SENT EMAIL 3/27/13 3:05 PM

Thank you so much! I really appreciate your help with this.

Christian Galbraith

RECEIVED EMAIL 3/27/13 3:51 PM

That's a great question. Some schools do include C&D waste in their inventories (e.g. <http://rs.acupcc.org/ghg/1128/>). It could fall outside your inventory boundary, but if you're interested in including it then I would encourage you to do so. It's worth looking at the AASHE resources, other

GHG inventories on the ACUPCC Reporting site or doing a Google search to see how other schools are dealing with this.

There currently isn't a separate category for C&D waste in the Campus Carbon Calculator. You would have to put it under "landfilled waste."

I hope that helps,
Anna

RECEIVED EMAIL 3/27/13 4:34 PM

Dear Christian,

I checked with Dr. Blyth, the Director of Study Abroad & Global Program Development regarding your inquiry. We will have official numbers for study abroad in **October 2013** for academic year 2011-12. The numbers for academic year 2012-13 will not be available until **October 2014**. That said, we actually do not have data regarding airline miles. The report on study abroad participation will have destinations but we do not have a way to assess actual travel miles flown by students as we do not receive their itineraries.

Should you have other questions please feel free to contact Dr. Blyth at jane.blyth@wmich.edu.

Best,
Michelle

RECEIVED EMAIL 3/28/13 9:03 AM

Christian,

This is the first of a handful of email.

This is the Main campus electric consumption. There is a lot of info on there but take a look at the notes, and the example. Please let me know if you have any questions. I should have availability this afternoon if you need clarification on any of these documents.

Thanks,
Chris

SENT EMAIL 3/28/13 12:40 PM

Michelle,

Would you be able to provide me with a list of cities flown to and the number of students that flew there? I can do some simple calculations and come up with a general idea of the number of miles flown. This data needs to be submitted to the ACUPCC by the end of the semester so it would not be feasible to wait until October for the actual numbers. I have CCed Dr. Blyth in case you cannot provide me with the information and she can. Thank you for your help with this, I greatly appreciate it.

SENT EMAIL 3/28/13 12:55 PM

Thanks Chris! I was talking to Dr. Glasser the other day and he said you may be able to provide me with information regarding the total square footage of the buildings on campus, the total used square footage of the buildings on campus, and the pounds of refrigerants used (I wasn't sure if you said before that you would get me this information). Again, thanks for your help with this!

RECEIVED EMAIL 3/28/13 2:06 PM

Dear Christian,

I am sorry but we do not have official numbers of students that we can release right now. In addition, we do not have a general database that would list where each of the students flew. I would be happy to provide you with numbers for 2010-2011 but that is the most up to date official report that we have.

Regards,
Jane Blyth

RECEIVED EMAIL 3/29/13 11:18 AM

Christian,
This spreadsheet contains the info for natural gas and electric consumption at the Parkview campus.

I think Environmental Health and Safety maintains refrigerant use on campus.

Chris

RECEIVED EMAIL 3/29/13 11:20 AM

Sorry,
You need this too.

This is the steam production at the main campus plant. You will need this to determine how much of the gas at the main co-gen plant is used for steam and electric.

All the gas at the Parkview campus is used for steam.

Hope this helps.
Chris

SENT EMAIL 4/1/13 3:48 PM

Jane,
Would you be able to send me the 2010-2011 information? I would greatly appreciate it. Thank you!

SENT EMAIL 4/1/13 3:50 PM

Michelle,
I emailed Jane but she is out of the office this week. Could you possibly provide me with the 2010-2011 information for study abroad? I would greatly appreciate it. Thanks.

RECEIVED EMAIL 4/3/13 1:40 PM

Dear Christian,
Bradley Ryktarsyk, my assistant, will be getting you the official numbers from the IIE Open Doors Report. These numbers however are only broken down by country, not city or program.

Best,
Dr. Metro-Roland

SENT EMAIL 4/3/13 1:41 PM

Patricia,
I know this is kind of last minute but I am currently trying to do a greenhouse gas emissions inventory for WMU and I am in need of a few more pieces of information. Chris Caprara from Facilities Management suggested I contact your department concerning the amount of refrigerants used on campus in pounds (the different categories are HFC-134a, HFC-404a, HCFC-22, HCFE-235da2, HG-10, and Other). Would you be able to provide me with this information? If not, could you possibly connect me with some one who could? Thanks.

SENT EMAIL 4/3/13 1:42 PM

Michelle,

That will work out perfectly. Thank you for your help!

SENT EMAIL 4/3/13 1:54 PM

Chris,

Thanks for all of the information you sent me. Are you available at all to meet so that you could help me to put these numbers into the calculator? I would greatly appreciate it. Thanks!

RECEIVED EMAIL 4/3/13 2:30 PM

Dear Christian,

Please find attached the 2010-2011 Open Doors Study Abroad report. There is a break down of all countries where WMU students studied during the 2010-2011 academic year beginning on page 3. I hope this is of help.

Bradley Ryktarsyk

SENT EMAIL 4/3/13 4:09 PM

Bradley,

Thank you so much for your help with this! I greatly appreciate it!

RECEIVED EMAIL 4/3/13 4:56 PM

Hi Christian:

That information is tracked at Facilities Management. The last time that I asked for information regarding CFC's, I had to ask Chris's boss.

Chris, do you want to check with Anand on who might be managing?

Thanks,

Pat

COPIED EMAIL 4/4/13 9:07 AM

Anand,

Do you know where this list is maintained?

Thanks,

Chris

RECEIVED EMAIL 4/4/13 9:08 AM

Christian,

Yes. I think I have some time [tomorrow](#) afternoon.

SENT EMAIL 4/4/13 11:53 AM

Chris

Would you be available around 1 PM?

RECEIVED EMAIL 4/4/13 2:20 PM

Christian,

I apologize. I actually have a meeting at 2pm. I can meet at 1, just keep in mind that I will only be able to meet until about 1:45.

We can reschedule to the morning if that works better for you.

SENT EMAIL 4/4/13 5:55 PM

Chris

What time in the morning?

RECEIVED EMAIL 4/4/13 7:16 PM

Christian,

I assume you are working directly or indirectly for the Office for Sustainability. If you can confirm this, I do have the information.

Also - if you could provide the types of CFC and time interval (calendar year or fiscal year)

Sincerely

Anand

SENT EMAIL 4/4/13 9:24 PM

Anand,

Yes, I am working for the Office for Sustainability through the ENVS 4100 class. I have CCed Dr. Glasser on this email in case you would like any information from him. I am looking for the pounds of HFC-134a, HFC-404a, HCFC-22, HCFE-235da2, HG-10, and other refrigerants used in the calendar year of 2012. I hope this helps. Please feel free to email me or call me if you have any more questions. I greatly appreciate your help with this.

RECEIVED EMAIL 4/5/13 8:38 AM

Christian,

I am open all morning. All I have is that meeting at 2.

Chris

SENT EMAIL 4/5/13 9:04 AM

Chris,

I just made an appointment to get my oil changed at 10:30 so would maybe noon work? I know it's not really the morning but it would give us time before your meeting.

RECEIVED EMAIL 4/5/13 9:05 AM

Christian,

Yes. Noon is fine. Where do you want to meet?

SENT EMAIL 4/5/13 9:36 AM

Chris,

I can come to you this time if you want I'm just not sure where your office is.

RECEIVED EMAIL 4/5/13 9:42 AM

I am on the second floor. There is all permit parking in the lot between the football stadium and out building.

You can come in through that back door, and you will walk through the carpentry shop. Just follow that hallway the way until you almost reach the front door. There will be an open door on the right that has another small hallway, this will lead you to some stairs. Take the stairs up and turn left. Follow the hallway until you reach the glass door. Our front desk will show you where my desk is.

Call me if you need help. Its a little confusing if you haven't been in here before.

Chris

SENT EMAIL 4/5/13 9:46 AM

Chris,

Thanks! I'll see you at noon!

RECEIVED EMAIL 4/8/13 11:13 AM

Christian,

According to FM website CFC reports....

R-134A = 7.63 lbs

R-12 = 702.81 lbs

R-11 = 0 lbs

Chris