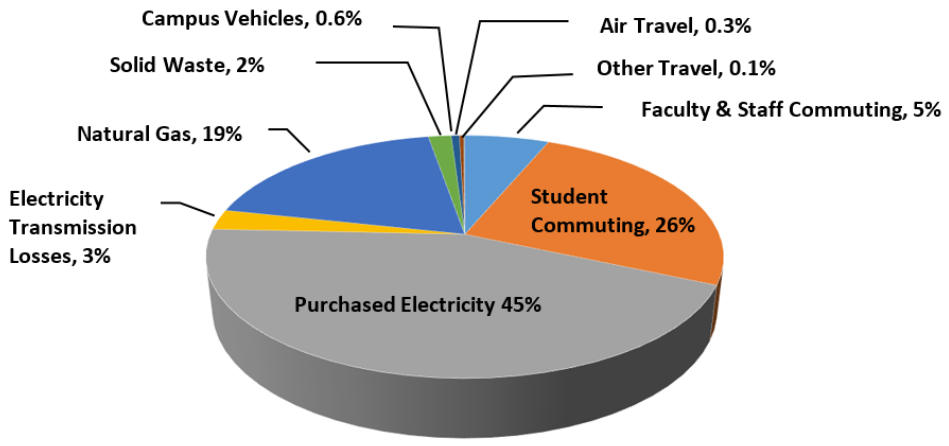
2014

Washtenaw Community College Greenhouse Gas Inventory



Prepared by:
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Executive Summary

This report on the greenhouse gas emissions of Washtenaw Community College has been prepared in support of the college's participation in the American College and University Presidents' Climate Commitment (ACUPCC). This report updates WCC's GHG inventory for fiscal years 2013 and 2014.

The college's goal as stated in the WCC Climate Action and Sustainability Plan is to reduce its GHG emissions to zero by the year 2060, a reduction of about 2% of 2014 levels per year.

Relative to 2003, the first year for which GHG data has been collected, WCC's total CO_2 emissions have increased 39%. Relative to 2008 when the first Greenhouse Gas Inventory was conducted, total emissions have increased by 6%. And relative to 2012, the year of the last GHG Inventory report, emissions are up by 5%, suggesting that the college may be starting to slow its rate of increase in emissions. Notably, emissions spiked as high as 72% about 2003 in 2010 and 2011 during a spike in student enrollment suggesting that the college's emissions are not well controlled with respect to enrollment. Natural gas consumption, which increased by 57% from 2008 to 2014 accounted for most of the overall increase in emissions. Electricity consumption actually decreased (-1%). Part of this large increase in natural gas consumption appears to be related to very cold winters in the last two years.

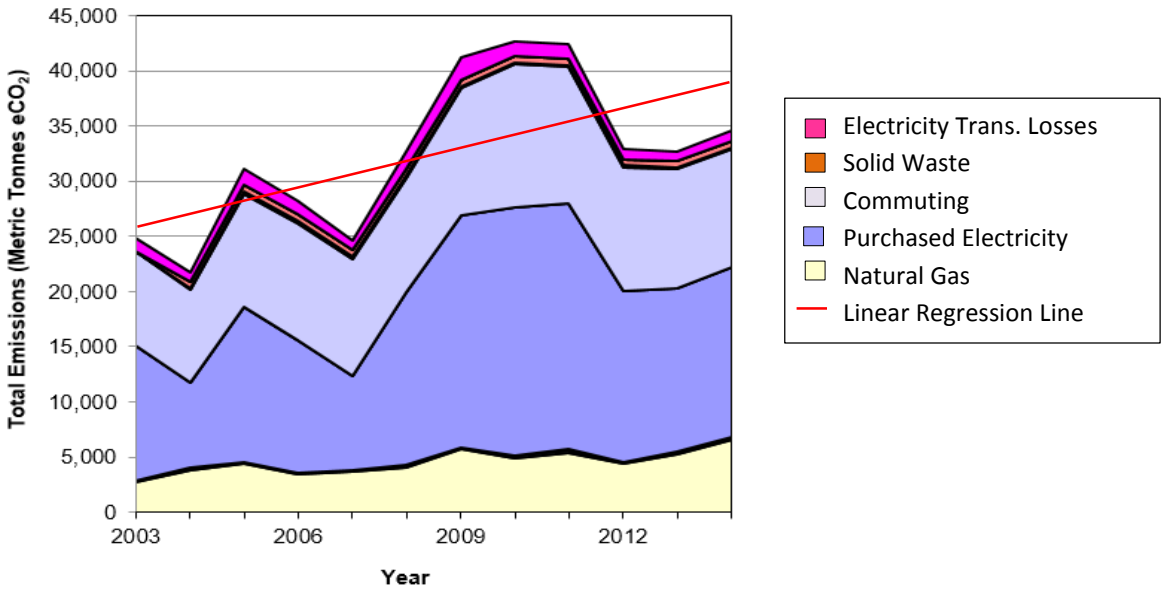

Figure 1. WCC Greenhouse Gas Emissions by Sector, 2003 - 2014

For the year 2014, it was estimated that the college's total GHG emissions were 34,617 metric tons carbon dioxide equivalent (eCO_2), with electricity (purchased and transmission losses) and commuting (student, faculty and staff) being the biggest contributors (48% and 31%, respectively). Other significant contributors included stationary sources, i.e. burning natural gas to heating the buildings (19%) and solid waste (2%). The remaining emission sources combined are about 1% of total emissions).

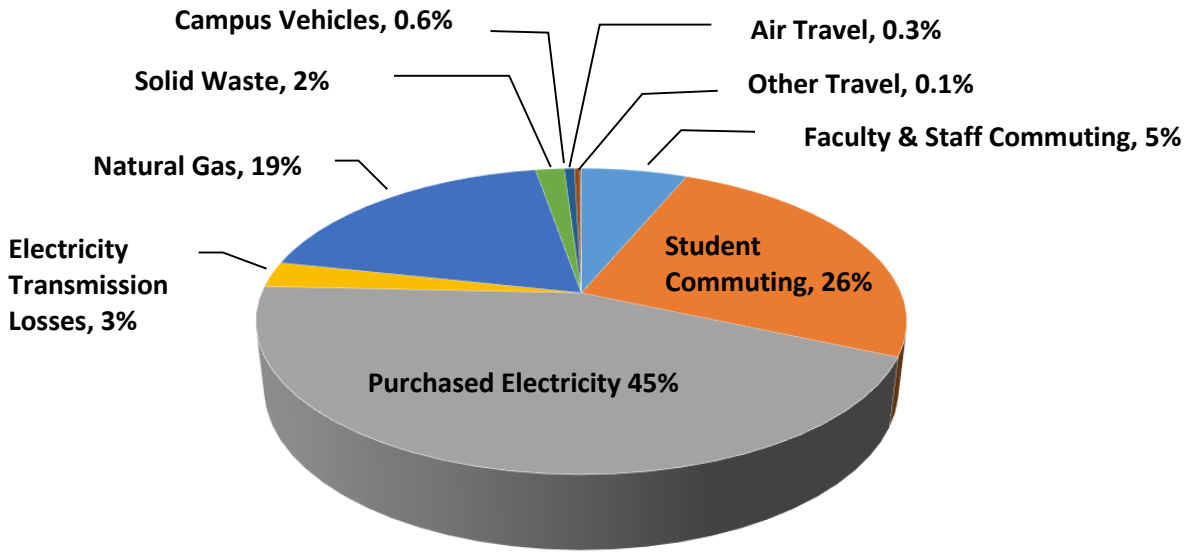

Figure 2. WCC Greenhouse Gas Emissions by Source (%) - 2014

Relative to other two year colleges participating the ACUPCC, WCC's overall emissions are about 24% higher per square foot and about 77% higher per full time equivalent student. In 2008 the college was very close to the average, so it has lost considerable ground to other colleges in the last six years.

At today's prices for carbon offsets (averaging about $18/tonne[1]), 2% of WCC's emissions could be offset for about $13,000. It would cost $630,000 to offset all carbon emissions. To meet its climate action goals and avoid these costs, Washtenaw Community College will need to make serious commitment to reducing emissions from purchased electricity, natural gas and commuting.

[1] Explaining the Price of Voluntary Carbon Offsets, Climate Change Economics, Vol. 1, No. 2 (2010) 93-111, ©World Scientific Publishing Company, http://environment.yale.edu/kotchen/pubs/explain.pdf

Introduction

This report on Washtenaw Community College's carbon emissions has been prepared as a step toward taking responsibility for our impact on climate change. Conducting a Greenhouse Gas (carbon emission) Inventory is one of the requirements of The American College and University President's Climate Commitment (ACUPCC). The Commitment was signed by WCC president Larry Whitworth in 2007, and re-signed by incoming president Rose Bellanca in 2012. The ACUPCC represents a commitment by over 600 American colleges and universities to reduce their greenhouse gas emissions (carbon emissions), and thereby lessen their impact on global climate change.

By signing the commitment, WCC is acknowledging not only the harmful impact higher education can have on the environment, but also the positive role colleges and universities can take while society seeks out a solution to global warming.

The requirements of the ACUPCC are as follows:

- Take immediate, tangible steps to reduce greenhouse gas emissions.
- **Complete a greenhouse gas emissions inventory with followup inventories every two years**.
- Set a target date and interim milestones for becoming climate neutral.
- Make climate neutrality and sustainability a part of the curriculum and other educational experience for all students.
- Make the surrounding community aware of the institution's participation in and progress toward implementing the ACUPCC, and initiate community outreach projects related to sustainability and climate change.
- Develop a plan to finance the mitigation strategies and other efforts described in the climate action plan.
- Track the institution's progress in achieving the goals set out in the climate action plan.

Two previous greenhouse gas (GHG) reports have been prepared. WCC's first GHG report, was prepared for fiscal year 2008 in order to meet the first requirement of the American College and University Presidents Climate Commitment (ACUPCC). A second report was submitted in 2012 to meet the requirement of submitting a report every two years.

Methodology

There is no unanimously agreed upon method for performing a greenhouse gas inventory. The most widely used process for calculating higher education institutional emissions data is to use the Clean Air Cool Planet (CA-CP) Campus Carbon Calculator. It has been used by over 1,000 campuses and is the "tool of record" for most of the 600 signatories to the American Colleges and University Presidents Climate Commitment. It has now been taken over by the University of New Hampshire. The calculator is an Excel spreadsheet that is free for anyone to download at the CA-CP website. The 2014 report has been prepared using the UNH Campus Carbon Calculator version 7.0 .

Scope of the Emissions Inventory

The scope of this carbon emissions inventory was limited to the college's main campus in Ann Arbor, Michigan. The dates indicated in the inventory represent fiscal years. For example, 2014 is the inventory for July 1, 2013 to June 30, 2014.

Metrics

The following section explains some of the metrics used in this report which may be unfamiliar to the reader.

Fiscal Year Equated Students
The population of students at Washtenaw Community College is calculated using the Fiscal Year Equated Students. FYES is reported on yearly in the Michigan Community College Activities Classification Structure (ACS)[2], a report filed yearly by all community colleges in the state of Michigan. FYES is not the same as the individual amount of students who attend full-time or part-time.

FYES is calculated in the following manner:

$$FYES = \frac{Total\ Fiscal\ Year\ Student\ Contact\ Hours}{496}$$

* 496 is the number of contact hours for an equivalent full-time student

Metric Tons Carbon Dioxide equivalent (MT CO_2) and Global Warming Potential
There are many gases that contribute, in varying degrees, to global warming. For the purpose of having a standard measure, the global warming potential (GWP) of a gas is often referenced in its CO_2 equivalency, or eCO_2. For example methane (CH_4) is 34 more potent than carbon dioxide in trapping heat on the planet. Therefore, 1 metric ton of CH_4 is equal to 34 metric tons of CO_2 (34 MT eCO_2).
Table 1 below lists the Global Warming Potential (GWP) of some common greenhouse gases and some of their human sources.

Greenhouse Gas	GWP (100-yr)	Anthropogenic Sources
Carbon Dioxide CO_2	1	fossil fuels
Methane CH_4	34	livestock, landfills, natural gas fields, etc.
Nitrous Oxide N_2O	298	fertilizer, animal waste soil cultivation, etc.
Sulfur Hexafluoride SF_6	22,800	electrical insulation industry
R-404a (HFC)	3,300	refrigerant

Table 1: Global Warming Potential of Gases [3]

[2] Michigan Community College NETwork http://www.michigancc.net/acs/databooks.aspx
[3] "Anthropogenic and Natural Radiative Forcing". In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Institutional Data

Institutional data is a significant part of a greenhouse gas report. It allows the college to compare its greenhouse gas emissions to other colleges of similar population size, building size, and financial levels. As mentioned above, the ACUPCC has been signed by over 600 colleges and universities, many of them significantly smaller or larger than WCC. By comparing itself to similar colleges, WCC can distinguish areas of greater concern as it moves towards creating a zero emissions institution. Tracking institutional data also allows the college to analyze how greenhouse gas emissions are related to these different factors.
The figures in **Table 2** are taken from Michigan Community College Activities Classification Structure (ACS), except the Faculty and Staff data which was provided by the WCC Human Resource Department.

Note that faculty and staff figures are calculated by using the full-time equivalent employee formula:

$$Full\ time\ equivalent = Full\ time\ employees + (Part\ Time\ Employees \times 0.5)$$

Year	Operating Budget (inflation adjusted)	Energy Budget (inflation adjusted)	FYES (students)	Faculty	Staff	Building Space (sq. ft.)
2009	$ 75,770,521	$ 2,478,732	8,769	385	631	1,007,499
2010	$ 78,064,247	$ 2,121,316	9,984	372	660	1,007,251
2011	$ 82,077,459	$ 2,065,230	9,522	371	637	1,007,816
2012	$ 81,195,844	$ 1,963,337	8,536	361	630	1,174,726
2013	$ 86,171,983	$ 2,320,070	8,151	374	628	1,174,726
2014	$ 77,738,474	$ 2,370,825	8,081	364	602	1,189,661

Table 2: Washtenaw Community College Institutional Data

Emission Scopes 1, 2, and 3

Scope 1 emissions are reported GHG emissions that result from sources owned or controlled by Washtenaw Community College. This includes natural gas burned to heat buildings, gasoline and diesel fuel used to operate college owned vehicles, and fugitive emissions (leaks) of refrigerants into the atmosphere.

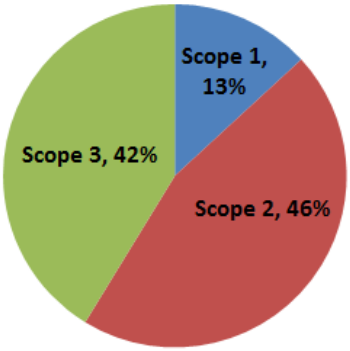

Figure 3. WCC eCO_2 Emissions by Scope

Scope 2 emissions are reported indirect GHG emissions that are a consequence of activities that take place within the organizational boundaries of WCC. However, the actual emissions occur at sources owned or controlled by another entity. The significant source in this category is the electricity the college purchases to operate the lights, power pumps and fans, and power all of the computers and other equipment that is plugged into the wall. Because the electricity purchased by WCC comes from DTE Energy, it is mostly derived from burning coal, a major source of greenhouse gases.

Scope 3 emissions consist of all indirect emissions not covered in Scope 2. Examples of Scope 3 emissions include commuting, air and auto business travel, and solid waste. Compared to a university which might have significant Scope 1 and 2 emissions from dormitory buildings, community colleges typically have significant Scope 3 emissions because of the high amount of commuting from its students.

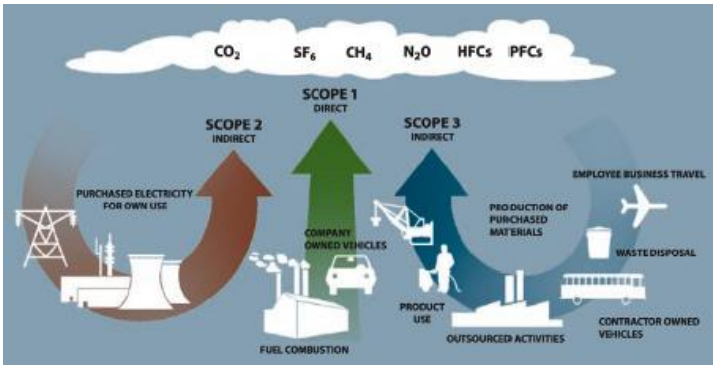

Figure 4. Scope 1, 2, and 3 Emissions[4]

[4] http://www.yale.edu/sustainability/images/emissions.jpg

WCC 2014 Greenhouse Gas Emissions			
	Source	**Consumption**	**Metric Tonnes eCO2**
Scope 1	Other On-Campus Stationary (natural gas to heat buildings and water)	124,212 MMBtu	6,604
	Direct Transportation (campus vehicles)	15,139 gal gasoline and 6219 gal diesel fuel	202
	Refrigerants & Chemicals	0 pounds HFC-404a	0
	Scope 1 Total		**6,806**
Scope 2	Purchased Electricity	19,866729 KWH	15,455
	Scope 2 Total		**15,455**
Scope 3	Student Commuting	21,912,061 miles by car 1,831,223 miles by bus	8,842
	Faculty & Staff Commuting	4,667,246 miles by car 222,590 miles by bus	1,829
	Directly Financed Air Travel	221,552 miles	113
	Other Directly Financed Travel	73,151 mile by car 687 miles by train	28
	Solid Waste	190 tons	589
	Scope 2 T & D Losses (Electricity transmission and distribution losses)		955
	Scope 3 Total		**12,356**
	Overall Total		**34,617**

Table 3. Summary of Washtenaw Community College 2012 Greenhouse Gas Emissions

Table 3 above summarizes the college's greenhouse gas emissions for the fiscal year ending June 30, 2014. Scope 1 emissions resulting primarily from fossil fuels burned on campus, represent about 19% of the college's total emissions. Just as an individual might turn down their thermostat in the winter and turn it up in the summer to reduce their heating and cooling bills, the college is making efforts to reduce its energy consumption by making adjustments in the building automation software. When the Occupational Education Building was remodeled in 2010, a large ground source heat pump system (geothermal energy) was installed that provides most of the heating and cooling for the building. The campus has also purchased a few electric vehicles. All of these measures reduce the college's Scope 1 emissions. In some cases, such as geothermal energy and electric vehicles, it shifts the emissions to Scope 2, Purchased Electricity. A future challenge will be to obtain our electricity primarily from renewable sources rather than from burning coal.

Scope 2 emissions as recorded by the college are solely from purchased electricity and represent 45% of the colleges overall emissions. As mentioned above, these emissions are especially high since they are derived primarily from burning coal. The college has taken steps to reduce electricity use by installing variable speed motors on pumps and fans, by turning off parking lot lights at night, by installing LED lighting, by installing occupancy sensors to control building lighting and by encouraging students and staff to turn off lights and computers when not in use. A micro-turbine was installed in 2014 which burns natural gas to produce electricity. Because the fuel is natural gas rather than coal, and because transmission costs for this electricity are nil, the micro turbine may be reducing the total emissions somewhat, although mostly it is moving the emissions from Scope 2 (Purchased Electricity) to Scope 1 (fuel consumed on campus.) In spite of these measures, Scope 2 emissions have decrease only slightly (1%) since the 2008 report. More needs to be done to reduce electricity consumption, and eventually the college will need to get its electricity from a renewable energy source that does not produce greenhouse gas emissions.

Scope 3 emissions are indirect emissions that the college generally has less direct control over. The big two in this category are Student Commuting and Faculty/Staff Commuting. Together they represent 36% of the college's total emissions. To reduce these emissions, the college has tried to encourage bus transportation through a bus pass program (free bus fare leaving campus for students, staff and faculty). Efforts have also been made to encourage carpooling and bike riding. The Commuting emissions in this report are a projection from a several year old survey based on numbers of students, staff and faculty. A new survey will be conducted in 2015 to get more up to date information. No significant efforts have been made to reduce Directly Financed Travel, but it is a small part of the overall emissions. The campus has made significant efforts to reduce solid waste in recent years. With the appointment of a full time Recycling Manager and a few staff, recycling signage and pickup has been improved and a food prep waste composting program has been implemented. In addition, the student environmental club, STEMS has implemented some new ideas in making recycling easier and more accurate. As a result of these and other efforts the college has consistently placed in the top ten in the Waste Minimization category of the annual RecycleMania contest. Scope 2 Transmission & Distribution Losses are directly related to the amount of electricity the college purchases from "the grid" and can only be reduced by reducing our electricity consumption or producing electricity on campus.

Emissions Inventory Details

On-Campus Stationary (Natural gas to heat buildings and water) — **6,604 MT eCO_2**

The ACUPCC considers stationary combustion "the burning of fuels to produce electricity, steam, heat, or power using equipment in a fixed location such as boilers, burners, heaters, furnaces, incinerators, kilns, ovens, dryers, and engines."[5] WCC primarily uses natural gas on the campus to heat buildings and water.

For the 2013-2014 school year WCC created 6,600 MT e CO_2 by using 1,210,000 CCF (hundred cubic feet) of natural gas. The natural gas itself is delivered to the college via DTE Energy Company. The data for this source was calculated from past DTE natural gas bills provided from the WCC Financial Services department.

Direct Transportation (Campus vehicles) — **202 MT eCO_2**

WCC, like many other colleges, owns and operates vehicles used for business, operational, and maintenance purposes. In addition to the fuel requirements of these vehicles, WCC also needs fuel for the large trash compactor on site and their backup generators, which are periodically tested.

The majority of the fuel was purchased from G.E. Wacker and a small portion was purchased from Corrigan Oil. The records for these transactions were provided by the WCC Financial Services department.

For the 2013-2014 school year WCC used 15,100 gallons of Mid-grade lead free gasoline and 6,220 gallons of Ultra Low Sulfur Diesel, resulting in a total of 202 MT eCO_2.

[5] http://acupcc.aashe.org/instructions-ghg-report.php#emissionsinventory

Refrigerants & Chemicals	0 MT eCO_2

Refrigerants and chemicals fall under the category of fugitive emissions. These are defined as "the intentional or unintentional release of GHGs in the production, processing, transmission, storage, and use of fuels and other substances."[6] This impacts WCC's GHG inventory because the college has periodic fugitive releases of fluorocarbons during the use of its air conditioning equipment.

No refrigerants were purchased by the Facilities Department in 2013/2014. Data was obtained from the Manager of Mechanical and Electrical Systems. Small amounts of refrigerant were purchased by the Auto Service and HVAC departments, but the data was not available at the time of this report. It was assumed that all purchases were made to replace refrigerants that had leaked or escaped during maintenance. To the extent that purchases were made to charge new equipment or to replace refrigerants that were effectively captured and disposed of, this could result in an inflated number for "fugitive emissions".

Though the total amount of refrigerants typically released to the atmosphere by the college is very small, the extremely high global warming potential of this gas (3,922 times the impact of CO_2) can cause a significant effect.

Purchased Electricity	15,781 MT eCO_2

The electricity that WCC purchases is generated by the DTE Energy Company. The data for this source was calculated from past DTE electricity gas bills. For the 2013-2014 school year WCC created 15,500 MT eCO_2 by using 20,800,000 kWh of electricity.

This equate to about 22,000 kWh per community member (FT student staff or faculty). For reference, in 2013, the average annual electricity consumption for a Michigan residential utility customer was about 8,000 kWh according to the U.S. Energy Information Administration (EIA).[7]

Student Commuting	8,842 MT eCO_2

Student commuting habits are difficult to estimate. Many methods and assumptions are made during the process of calculating miles driven by students to/from the college. The numbers in this report are simply projections of the 2008 data based on student enrollment (FYES) numbers. The methods and assumptions are listed below.

Roger Mourad from the Institutional Research Department provided the non-online semester credits[8] associated with the student's home zip code. The zip codes were then entered into Google Maps to determine the distances in miles between the zip code and Washtenaw Community College.

The non-online semester credits are highly skewed toward zip codes which are closer to the WCC Campus. Therefore, the miles were weighted proportional to the number of non-online semester credits taken.

[6] http://acupcc.aashe.org/instructions-ghg-report.php#emissionsinventory
[7] http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3
[8] It is assumed that online students do not commute to the college.

Equation used for One-Way Student Distance Travelled:

$$\sum\left(\frac{Non-Online\ Semester\ Credits}{Total\ Non-Online\ Semester\ Credits}\times Miles\right)=Weighted\ Average\ Distance\ Traveled$$

= 12.37 one-way miles travelled

Bus commuting was computed to be 8% based on a survey done by the Ann Arbor Transit Authority (AATA). Because no actual numbers were available, it was estimated that 2% of students carpool and 90% of students drive their personal vehicles to and from the college.

It has also been assumed that the typical full time student makes 8 one-way trips per week at 30 weeks per year. Therefore, it has been calculated that during the 2013-2014 school year students drove a total of 21,900,000 miles, consuming 907,000 gallons of gasoline, and rode the bus for a total of 1,830,000 miles, consuming 57,300 gallons of diesel fuel. The fuel consumption in this scenario is equivalent to 8,842 MT eCO_2.

Faculty & Staff Commuting **2,236 MT eCO_2**

The method for calculating the faculty and staff commuting data is the same as the student data, apart from for the following exceptions.

- Faculty are assumed to make 8 trips per week, 40 weeks per year
- Staff are assumed to make 10 trips per week, 47 weeks per year
- Faculty/Staff bus use is 5% based on the AATA survey

From these assumptions, during the 2013-2014 school year faculty and staff drove a total of 4,670,000 miles, consuming 193,000 gallons of gasoline, and rode the bus for a total of 22,600 miles, consuming 7,000 gallons of diesel fuel.

Directly Financed Air Travel **113 MT eCO_2**

Directly Financed Air Travel refers to any air travel taken by faculty or staff on behalf of WCC. This category can include travel for business meetings and conferences paid by, or reimbursed through, the college. Data for this report was a projection of the 2008 data based on the relative number of faculty and staff employed by the college in those years.

The 2008 data was calculated as follows. Financial Services provided all flight purchases made by employees P-cards. The information provided had the departing and destination airport codes. The codes were entered into the website http://www.webflyer.com/travel/milemarker/ to determine the miles between airports. Using this methodology we determined that there were approximately 222,000 miles flown by WCC faculty and staff during the 2013-2014 school year. This is the equivalent of 113 MT eCO2.

Other Directly Financed Travel	28 MT eCO_2

This category refer to any other travel taken by faculty or staff who were reimbursed by WCC for travel on college business. The amount of money paid to college employees for personal mileage reimbursement was provided by Financial Services and then divided by the IRS mileage reimbursement rate. Primarily this travel occurs by automobile. The numbers also include a small amount of train travel.

It has been determined that there were 73,200 miles reimbursed. This is equivalent to 28 MT eCO_2.

Solid Waste	589 MT eCO_2

Solid waste numbers were provided by the Facilities & Maintenance staff. 190 short tons of solid waste were disposed of by the college during the 2013-2014 school year. This is equivalent to 589 MT eCO_2. It should be noted that although the total tons of solid waste dropped by about 10% since the 2008 report, emissions reported have increased by over 150%. This is due to updates in the Campus Carbon Calculator to account for the availability of more complete information about the emissions levels associated with solid waste."[9]

Scope 2 T&D Losses (Electricity Transmission and Distribution Losses)	955 MT eCO_2

Scope 2 T & D represent losses associated with the transmission and distribution of purchased electricity. Therefore the emissions are a function of the amount of electricity the college uses. Despite the name, T&D losses are a Scope 3 emission. The emissions are calculated automatically from the amount of purchased electricity entered. The emissions associated with Scope 2 T&D losses for WCC are 955 MT eCO_2.

Offsets	0 MT eCO_2

At this point, Washtenaw Community College has chosen to invest in improvements to the infrastructure rather than purchase "carbon offsets". At today's prices for carbon offsets (averaging about $18/tonne[10]), 2% of WCC's emissions could be offset for about $13,000. It would cost $630,000 to offset all carbon emissions.

The forest land at Washtenaw Community College was not considered an offset for the following reasons.

The ACUPCC in their white-paper title "ACUPCC Voluntary Carbon Offset Protocol", 11/2008, gives this criterion for an offset: *Offset projects are real and emissions reductions are additional: Projects result in actual reductions of GHG emissions and would not have otherwise occurred under a reasonable and realistic business-as-usual scenario.*

[9] http://campuscarbonblog.org/changes-to-v6-85/

[10] Explaining the Price of Voluntary Carbon Offsets, Climate Change Economics, Vol. 1, No. 2 (2010) 93-111, ©World Scientific Publishing Company, http://environment.yale.edu/kotchen/pubs/explain.pdf

Also, in an article written by Jennifer Andrews, Campus Program Manager of the Clean Air- Cool Planet, titled "A recommendation on How to Account for Carbon Sinks in Campus Forests or Lands[11]", it was written that "The institutional GHG inventory is not meant to be an inventory of all existing institutional carbon exchange, but rather, a snapshot of the ways in which institutional activities are further altering the equation of global atmospheric carbon exchange in any given year."

With this being said, instead of counting the carbon as an offset, WCC should report on any changes to the land that may result from land altering decisions. Such as, in the case of new development on campus, where an area of forest is removed, it would be reasonable to record the carbon discharged as a negative offset. Conversely, if WCC were to acquire additional land that had no forest, and chose to surrender that land to a perpetual forest land then the case could be made to record that land as an offset.

Trends

In order maximize the amount of information in the trend graphs, we have started with 2003, the earliest year for which we were able to get good data on electricity and natural gas consumption. Not all of the other emission related numbers were available, so some have been estimated, based on known institutional data like building square feet, numbers of faculty and staff, and numbers of students.

The graph in Figure 5. shows a significant increase in WCC's greenhouse gas emissions since 2003, as represented by the Linear Regression line. Possibly the years 2012-2014 show a decrease in recent emissions, though it is difficult to determine given the large variations in previous years. The dark purple band representing electricity shows the most variation. The causes of the increase and of the variations are explored further below.

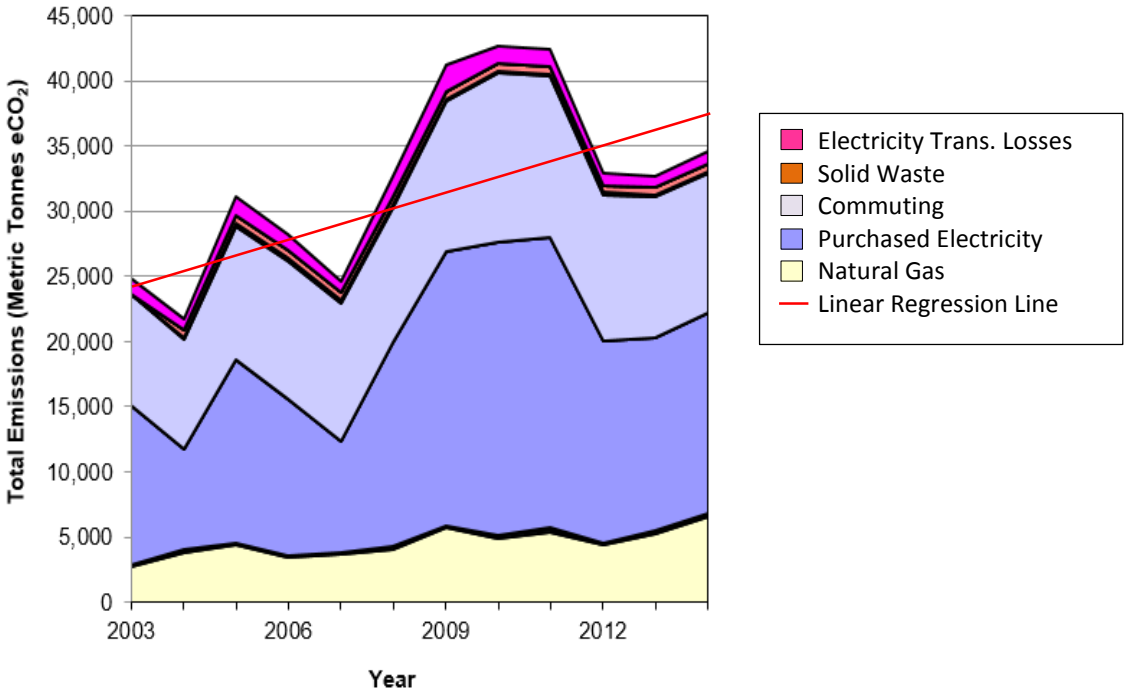

Figure 5. Total Emissions (MT eCO_2) for the years 2003-2014

[11] A Recommendation on How to Account for Carbon Sinks in Campus Forests or Lands, *By Jennifer Andrews, Campus Program Manager, Clean Air-Cool Planet,* http://www.aashe.org/blog/recommendation-how-account-carbon-sinks-campus-forests-or-lands

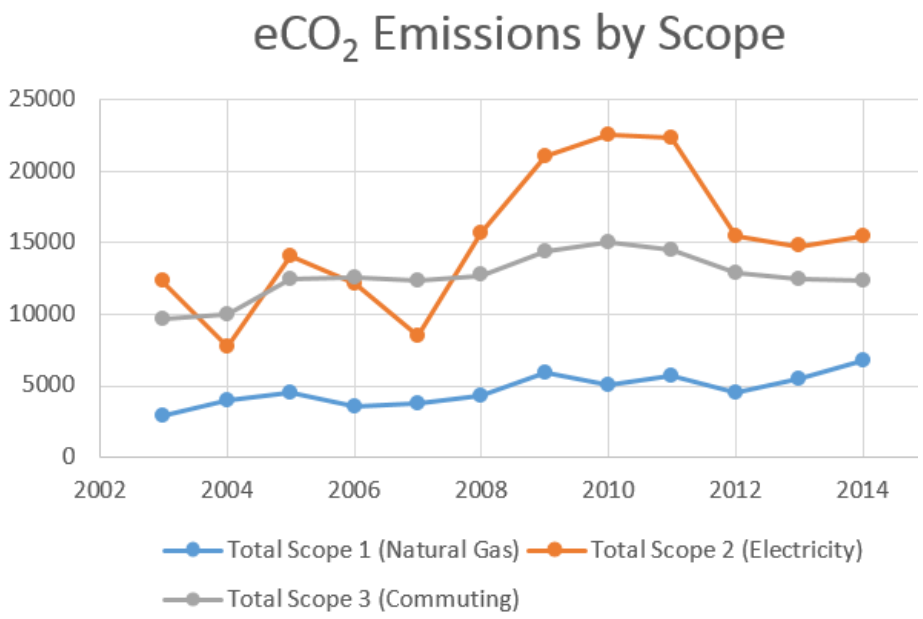

Figure 6. Total Emissions (MT eCO_2) By Scope – 2003 to 2014

Figure 6. shows more clearly the relative contributions and trends of Scope 1 (Natural Gas), Scope 2 (Electricity) and Scope 3 (Commuting) emissions. Emissions in all three areas have continued to rise since 2003. A linear regression shows that Scope 1 emissions have risen 84%, Scope 2 emissions have risen 71% and Scope 3 emissions have risen 25%. Scope 1 (Natural Gas) emissions have risen especially rapidly in the last three years. Scope 2 (Electricity) emissions may have leveled off in the last three years, though clearly at a higher level than in 2003.

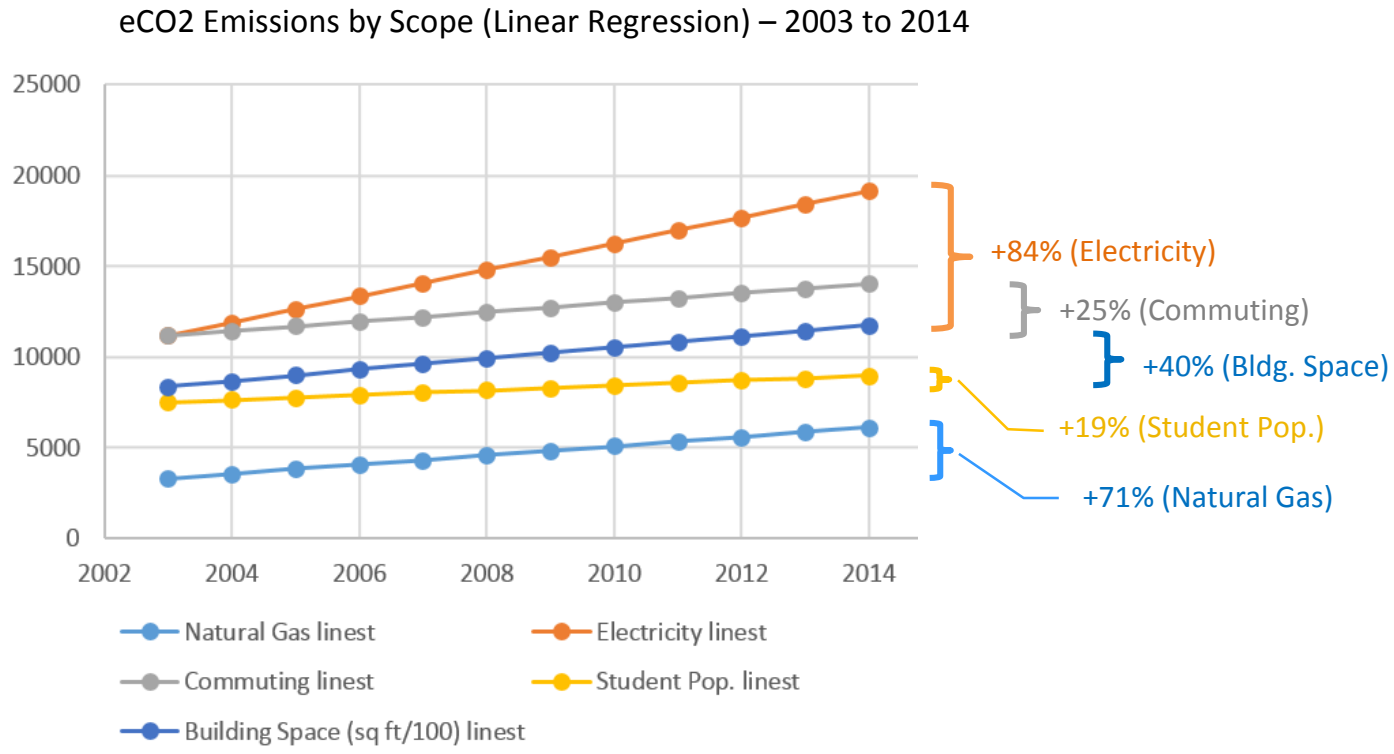

Figure 7. Total Emissions (MT eCO_2) By Scope – 2003 to 2014

In order to better view the long term trends of emissions without the variations, a linear regression was performed on each curve using the Excel LINEST function. These are plotted in Figure 7. along with a linear regression of Student Enrollment and Total Building Space (Sq. Ft. / 100). This shows that Electricity emissions have risen 84%, Natural Gas emissions have risen 71%, both significantly more than Student Enrollment and Building Space. Commuting emissions have risen 25%, somewhat faster than Student Enrollment to which it is closely tied.

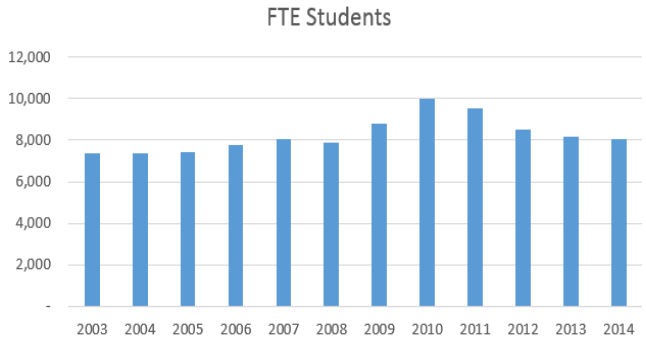

Figure 8. Student Enrollment from 2003 – 2014

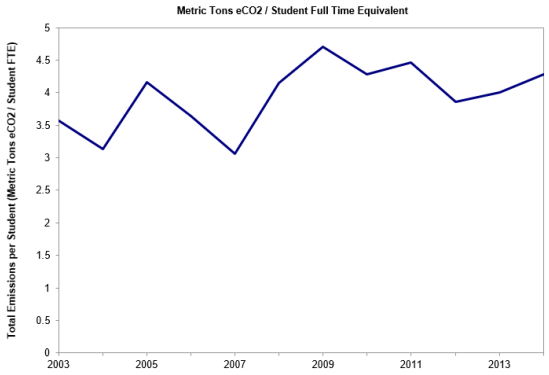

Figure 9. eCO_2 Emissions per Student

The graph in Figure 8. shows student enrollment from 2003 to 2012. There is a clear peak around 2010 which would correspond to a peak in student commuting emissions at that time. Figure 9. however shows that the variation in eCO_2 emissions is not strictly due to variations in enrollment since Emissions per Student are also high in the years 2009 - 2011.

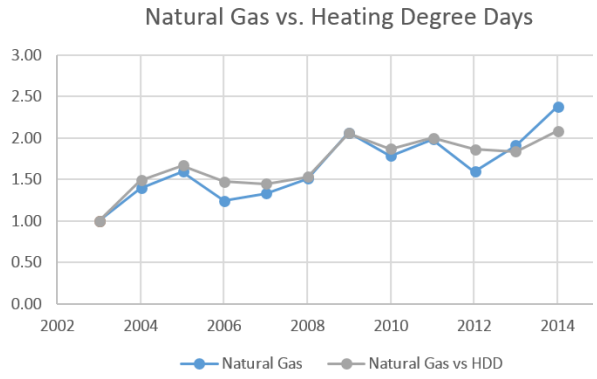

Figure 10. Natural Gas Emissions per Heating Degree Days (normalized)

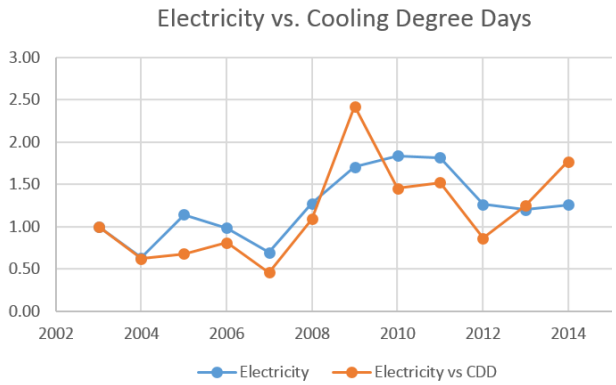

Figure 11. Electricity emissions per Cooling Degree Day (normalized)

Figure 10. Shows plots of emissions due to burning natural gas, and emissions due to burning natural gas per heating degree days. If the college's emissions from natural gas were increasing due to especially cold weather, the second plot would be relatively flat. Although there appears to be some flattening, the overall trend is increasing emissions from natural gas regardless of the weather. s respectively.

Figure 11. Shows plots of emissions due to consuming electricity, and emissions due to consuming electricity per cooling degree days. If the college's emissions from electricity were increasing due to especially hot weather and the need for more air conditioning, the second plot would be relatively flat. Clearly that is not the case here. Electricity demand has not been primarily affected by the weather.

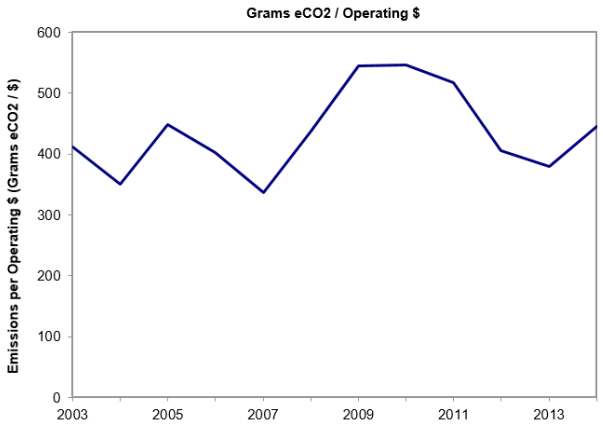

Figure 12. Emissions per operating dollar estimates the overall emissions efficiency of the institution

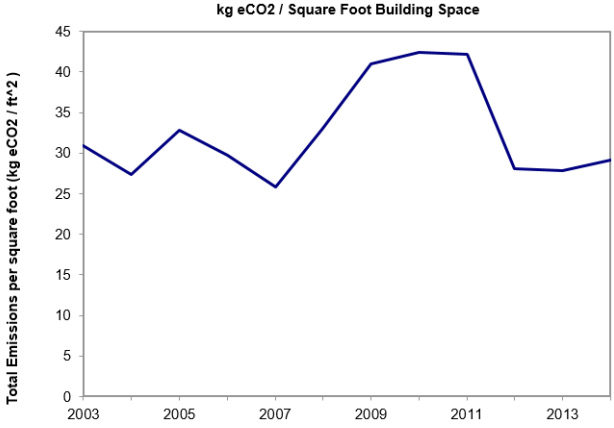

Figure 13. Emissions per square foot of building space is another estimate of the overall emissions efficiency of the institution.

Figures 12. and 13. depict the emissions efficiency of the institution over time. As with the other graphs, there is a peak in emissions (loss of efficiency) in 2005 and around 2010, both in terms of emissions per dollar of operating expenses and in terms of emissions per square foot of building space.

Comparing Emissions to Other Colleges

Tables 4 and 5 below illustrate WCC's emissions per 1,000 sq ft of building space, and per full time equivalent student respectively, compared to colleges of similar Carnegie Classification (i.e. Associates and Tribal Colleges). The figures for the 181 colleges included in the averages below are from the ACUPCC website. http://rs.acupcc.org/stats/ghg-scope-stats/

Compared to the 2012 report, WCC's emissions per sq ft have increased significantly (+4.6%) and other college's emissions have decreased significantly (-8.2%). Compared to the 2012 report, WCC's emissions per student have increased significantly (+14.7%) and other college's emissions have not changed significantly (-0.4%).

	Associate's and Tribal Colleges (*n*=181)		Washtenaw Community College	
	Average Emissions per 1,000 sq ft	**Percent of Gross**	**Average Emissions per 1,000 sq ft**	**Percent of Gross**
Scope 1	2.6 MT eCO2	11%	5.7 MT eCO2	20%
Scope 2	8.4 MT eCO2	36%	13.0 MT eCO2	45%
Scope 3	12.6 MT eCO2	53%	10.4 MT eCO2	36%
Gross Emissions	23.5 MT eCO2	100%	29.1 MT eCO2	100%

Table 4: Emissions (MT eCO_2) per 1000 sq ft

	Associate's and Tribal Colleges (*n*=181)		Washtenaw Community College	
	Average Emissions per Student	Percent of Gross	Average Emissions per Student	Percent of Gross
Scope 1	0.32 MT eCO2	13.2%	.84 MT eCO2	20%
Scope 2	0.90 MT eCO2	37.3%	1.91 MT eCO2	45%
Scope 3	1.20 MT eCO2	49.5%	1.52 MT eCO2	36%
Gross Emissions	2.42 MT eCO2	100%	4.28 MT eCO2	100%

Table 5: Emissions (MT eCO_2) per Full Time Equivalent Student

Summary

The college's goal as stated in the WCC Climate Action and Sustainability Plan[12] , completed in January 2014, is to reduce its greenhouse gas (GHG) emissions to zero by the year 2060, a reduction of about 2% of 2014 levels per year. Since 2003, the first year for which GHG data has been collected, WCC's total CO_2 emissions have increased almost 40%. Relative to 2008 when the first Greenhouse Gas Inventory (GHGI) was conducted, total emissions have increased by only 6%, suggesting that the college may at least be starting to slow its rate of increase in emissions, though not it is not yet actually reducing them. Variations in emissions over the years show some sensitivity to student enrollment, building space and weather, but lack of a clear correlation with these factors suggests that the college is just using more energy each year as it tries to meet demands for space, comfort and technology.

Relative to other two year colleges participating the American College and University Presidents Climate Commitment, WCC's overall emissions have increased significantly since the 2008 GHGI. The college may be able to take advantage of its participation in the ACUPCC by learning from its sister institutions.

Washtenaw Community College can meet its climate action goals by making a serious commitment/investment to reduce electricity and natural gas consumption, generate electricity from carbon free renewable sources and reduce single occupant commuting by automobile. The alternative, buying carbon offsets, would be very expensive. At today's prices for carbon offsets (averaging about $18/tonne[13] and expected to climb in the future), it would cost $630,000 per year to offset all of WCC's carbon emissions.

[12] Washtenaw Community College Climate Action and Sustainability Plan http://rs.acupcc.org/cap/1189/
[13] Explaining the Price of Voluntary Carbon Offsets, Climate Change Economics, Vol. 1, No. 2 (2010) 93-111, ©World Scientific Publishing Company, http://environment.yale.edu/kotchen/pubs/explain.pdf