

Greenhouse gas emission inventory for
West Chester University, baseline year 2005:
Report to the Environmental Council

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Introduction

In early 2007, West Chester Borough Council approved an advisory committee, Borough Leaders United for Emission Reduction (BLUER), to study greenhouse gas (GHG) emissions in the Borough and to make recommendations to reduce emissions.¹ BLUER reports to Council through the Parks, Recreation, and Environmental Protection (PREP) committee. Five BLUER members were chosen to represent different sectors of the Borough: businesses, residents, county government, and West Chester University.² I was nominated to be the University's representative by the WCU Environmental Council and was approved by Borough Council.

The Borough is one of nine townships and municipalities in Pennsylvania to commit to membership in ICLEI – Local Governments for Sustainability.³ West Chester is one of a smaller number who are participating in ICLEI's Cities for Climate Protection (CCP) Campaign; CCP cities are committed to mitigating climate change by following ICLEI's Five Milestones.⁴ In the context of ICLEI's Milestones, the GHG inventory provides a basis for setting reduction targets and developing an action plan. BLUER has adopted a goal of reducing the Borough's emissions to 10% below 2005 levels by 2015. The University's GHG inventory was undertaken as a component of the Borough's inventory.

Growing numbers of universities are developing GHG inventories to understand and to mitigate their climate impact. For example, the Association for the Advancement of Sustainability in Higher Education (AASHE)⁵ lists 31 institutions that have completed inventories;⁶ many of these institutions are among the 548 signatories (as of 27 May 2008) of the American College and University Presidents Climate Commitment.⁷ Many more inventories are in progress. For example, at a meeting of the Climate Change and Energy committee of the Pennsylvania Environmental Resource Consortium (PERC)⁸ in May 2008, at least fifteen institutions in Pennsylvania indicated they were doing or had completed an inventory. For WCU, the inventory

¹ BLUER on the Borough website: <http://www.west-chester.com/bluer.php>

² Membership of BLUER on the Borough website: http://www.west-chester.com/boards_and_commissions.php

³ ICLEI USA site: <http://www.iclei-usa.org/>

⁴ The milestones are: i) Conduct a baseline emissions inventory; ii) Adopt an emissions reduction target for the forecast year, iii) Develop a local action plan, iv) Implement policies and measures, v) Monitor and verify results. See <http://www.iclei.org/index.php?id=810>

⁵ WCU is one of 380 4 year institutions that are AASHE members as of May 2008; <http://www.aashe.org/index.php>

⁶ List of inventories posted on the AASHE site: http://www.aashe.org/resources/ghg_inventories.php

⁷ As of 27 May 2008, WCU was not one of the 548 signatories. <http://www.presidentsclimatecommitment.org/>

⁸ PERC on the PA Department of Environmental Protection website: <http://www.paconsortium.state.pa.us/about.htm>

process exemplifies the University's commitment under the Responsiveness Transformation of the Plan for Excellence⁹ to "assess and reduce the ecological impact of the University."

Inventories of GHG emissions are attaining importance for Universities and other businesses because they provide a basis for quantifying and then registering emissions reductions. For example, The Climate Registry recently (May 2008) released reporting and verification protocols for GHG emissions.¹⁰ Reductions in GHG emissions already have economic value (e.g., the Global Emissions Exchange; or the Chicago Climate Exchange)¹¹ and that value is likely to increase.

Scope

A GHG inventory helps to direct the more detailed mitigation planning process by quantifying the importance of various sectors' emissions. For BLUER's purposes, WCU's inventory defines the rough proportion of the Borough's emissions that are associated with the University. For WCU, it provides an estimate of the emissions associated with various aspects of University operations.

BLUER's inventory is supposed to include all emissions that originate in the Borough, including fuel combustion within the Borough (e.g., gasoline, natural gas, fuel oil), emissions from power plants supplying the Borough's electricity, and waste disposed in the Borough that generates emissions at landfills. The University is not located entirely within the Borough; significant parts of the campus are also in West Goshen Twp. and East Bradford Twp. It was not possible to differentiate WCU's emissions by municipality. For example, data for electricity consumption was just known in the aggregate. However, it is clear that WCU has a significant contribution in the Borough through its North campus operations, particularly the steam plant. Similar considerations apply to waste, to service vehicles and other equipment. For inventory purposes, BLUER assigned all of WCU's emissions to the Borough. From the University's perspective, BLUER's inventory includes the entire campus across all municipalities.

BLUER estimated emissions by road vehicles from average annual daily traffic (AADT) data and roadway miles in the Borough to obtain vehicle miles traveled (VMT). These VMT presumably include WCU students and employees who drive on Borough streets but they likely exclude larger numbers who arrive on parking lots in West Goshen or East Bradford without having driven on Borough streets (e.g., students arriving on M lot from Rte 202/Matlack St.). From the University's perspective, BLUER's inventory excludes significant vehicle emissions which the University is in a position to further inventory and mitigate.

BLUER's inventory does not include other types of off-campus emissions which the University could control or mitigate. For example, long-distance airline travel by faculty and staff to attend conferences and workshops could generate substantial emissions; establishing a policy to offset

⁹ A link to WCU's updated plan can be found at: <http://www.wcupa.edu/selfstudy/>

¹⁰ The Climate Registry "sets consistent and transparent standards for the measurement, verification, and public reporting of greenhouse gas emissions throughout North America in a single unified registry." Web site: <http://www.theclimateregistry.org/index.html>

¹¹ Global Emissions Exchange website: <http://www.globalemissionsexchange.com/>; Chicago Climate Exchange website: <http://www.chicagoclimatex.com/>

these emissions is recommended under the American College and University Presidents Climate Commitment.

Data and methods

Data collection began in early 2007 with the objective of obtaining an inventory for calendar year 2005, which BLUER selected as its base year.

- Bruce Wilson, Facilities Management, provided monthly usage amounts and other information for electricity, natural gas, fuel oil, and coal for 2005. About 7% of WCU's electricity is purchased from renewable sources under a state program.
- Royston Gathings, Facilities Management, provided mileages and fuel types of University vehicles and the amount of fuel consumed by other equipment ("small lawn tractors, push mowers, chain saws, edgers, line painting machines, pressure washers, etc." and for "backhoe and large tractors."). Data was available for the year December 2005 through November 2006.
- Dennis Kryszan, formerly Facilities Management, provided monthly amounts of land-filled waste for 2005.

Physical units of energy consumption and waste disposal (e.g., kWh of electricity, tons of coal, ccf of natural gas) were converted to GHG emissions (equivalent tons of CO₂) using the Clean Air and Climate Protection (CACP) software, version 1.1, developed by Torrie Smith Associates for ICLEI and others, supported by the US EPA¹². The software uses commonly accepted values of CO₂ emissions coefficients¹³.

Adjustment and pre-processing of some data was necessary before entry into the software:

- Electricity was separated into green electricity (7% of total) and standard electricity (93% of total). The software assumed no GHG emissions for green electricity and used GHG emission coefficients applicable to the Mid-Atlantic Area Council for standard purchases.
- Vehicle mileages were broken down by fuel type: gasoline, diesel, or CNG. According to Royston, bi-fuel vehicles "generally... are run on CNG almost all the time." It was assumed 90% of bi-fuel miles are on CNG and 10% on gasoline. Software calculations of GHG emissions were based on the assumption that the vehicles were in the "light truck/SUV/pick up" category.
- Information on the composition of land-filled waste generated by WCU was not available. Estimates of land-filled MSW composition for the PA Department of Environmental Protection's Southeast Region¹⁴ were used to subdivide the total waste into CACP software categories: paper products, 35.1%; food waste, 12.2%; plant debris, 5.7%; wood/textiles, 13.4%; all other waste, 33.6%. The same proportions were used for the Borough's waste in BLUER's inventory.

¹² CACP software web site: <http://www.cacpsoftware.org/>

¹³ According to the software documentation, "The main source for carbon dioxide (CO₂) emission coefficients was the 1605 Voluntary GHG Emissions Reporting Guidelines produced by the DOE (<http://www.eia.doe.gov/oiaf/1605/ggrpt/>), 2001.

¹⁴ Report available at: http://www.dep.state.pa.us/dep/deputate/airwaste/wm/Recycle/Waste_Comp/9-SE.pdf

Results

Emissions for each source were calculated as equivalent tons (= 2000 lbs) of CO₂. The following table presents WCU's GHG inventory for the nominal base year of 2005:

Source	Use	Physical units	CO ₂ emitted	%	
Coal	Space heat; water heating	6954 tons	14,501 tons	34.6%	47.4%
Fuel oil		193,654 gallons	2,240 tons	5.3%	
Natural gas		498,080 ccf	3,139 tons	7.5%	
Electricity	Electricity; A/C; lighting	37,285,872 kWh	20,907 tons	49.9%	49.9%
Green electricity		2,806,464 kWh	0 tons	0.0%	
Vehicles	Transportation	367,000 miles	264 tons	0.6%	0.7%
Equipment	Grounds work	3,962 gallons	40 tons	0.1%	
Solid waste	Landfilled waste	1,609 tons	838 tons	2.0%	2.0%
			41,929 tons	100.0%	

The inventory shows that WCU generates about 19% of BLUER's estimate of the Borough's GHG emissions for 2005 (221,583 tons).

Electricity is WCU's largest single source of emissions, even though 7% of the University's electricity use comes from renewable sources and does not generate emissions. The largest fuel source is the coal burning steam plant which is responsible for nearly 35% of emissions. Solid waste is 2% of emissions; University owned vehicles and equipment are less than 1% of the total.

The University's ongoing improvements in reducing electricity consumption, increasing the efficiency of the heating plant and beginning the installation of geothermal heating and cooling on North Campus should significantly improve (i.e., reduce) the GHG inventory bottom line.

Magnitude of additional emissions

The University has the capacity to reduce or mitigate GHG emissions which are not included in the inventory because they do not occur on campus. Emissions from students, faculty, and staff commuting by car was studied by students in Humans and the Environment (ESS 102) in 2004. Based on surveys of commuting students conducted in spring 2004 they found that "each week the average commuter travels about 137 miles, and that all commuters to WCU use about 34,000 gallons of gasoline..."¹⁵ Over two 15-week semesters this amounts to about 10,000 tons of CO₂, or about 1/4 of the University's inventoried emissions.

Airline travel by University employees is a potentially significant source of emissions for which no data have been collected. To get a rough idea of the potential, assume that the annual airline travel is equivalent to each of the roughly 515 faculty and upper level administrators taking one round trip, cross country flight. This travel would generate about 1500 tons of emissions¹⁶, or about 3.5% of the inventoried emissions. Reducing the amount of airline travel might not be feasible but offsets that help reduce carbon emissions can currently be purchased for about \$10/ton, or about \$15,000 for the hypothetical scenario.

¹⁵ Commuting to WCU: Implications for Carpooling and Carbon Emissions by Tim Lutz and students from ESS 102, May 2004. Available from Tim Lutz, Dept. of Geology & Astronomy.

¹⁶ Airline carbon calculator, CarbonFund.org, 2007: <http://www.carbonfund.org/>