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Inventory of Greenhouse Gas Emissions
2005-2009

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SustainVU
Growing Responsibly

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The Sustainability and Environmental Management Office

(SEMO) is a collaborative venture between Vanderbilt Environmental Health and Safety and Vanderbilt University's Plant Operations Department. SEMO's mission is to initiate, promote, coordinate, evaluate and encourage environmental management and sustainability initiatives that improve Vanderbilt's impact on the community and environment.



The Plant Operations Department provides facilities support for all construction, renovation and routine maintenance of University Central space and facilities; housekeeping services for approximately 5.8 million square feet of academic, administrative, residential, and recreational space; grounds care for 330 acres that are a registered arboretum; turf care for athletic fields; and utilities for University Central and the Medical Center.



Campus Planning and Construction (CPC) aims to present a physical environment that meets the programmatic requirements of its customer base while visually expressing the quality to which Vanderbilt University aspires. Functions closely related to the delivery of new facilities are performed by the Facilities Information Services unit within CPC. This group addresses the inventory and management of Vanderbilt's construction document library, GIS mapping and documentation of all utilities, and tracking of floor plans for the Space Inventory and Accounting processes.

The Division of Public Affairs serves as the institution-wide hub for communications, marketing and public policy initiatives. Whether developing unique relationships with and communicating to Vanderbilt's vast array of external and internal constituencies, promoting government and community initiatives, or creating a broader, deeper and more complete understanding of Vanderbilt, each and every activity of the division supports the University's academic missions of teaching, research, service and patient care.

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VANDERBILT UNIVERSITY INVENTORY OF GREENHOUSE GAS EMISSIONS 2005-2009

EXECUTIVE SUMMARY

This report is a summary of greenhouse gas (GHG) emissions for Vanderbilt University for the calendar years 2005, 2006, 2007, 2008, and 2009. This GHG emissions inventory is intended to provide trending information for the development and implementation of future GHG emission reduction strategies. It is not intended to draw comparisons with other institutions. The GHG inventory was conducted by Vanderbilt's Sustainability and Environmental Management Office (SEMO).

Background

On February 23, 2009, Vanderbilt announced that an initial GHG inventory, or carbon footprint, would be developed. Vanderbilt emits GHGs through its daily operations, such as energy consumption in campus buildings, burning of coal and natural gas at the on-campus co-generation power plant, the use of fuel to power Vanderbilt's university-owned vehicles, and the disposal of waste generated by Vanderbilt. The initial baseline inventory capturing average annual GHG emissions for calendar years 2005 to 2007 was released in conjunction with the publication of the University's Environmental Commitment Statement on April 21, 2009¹. This inventory was developed using methodology and carbon calculators commonly used at that time.



On October 30, 2009, the U.S. Environmental Protection Agency (EPA) issued the *Mandatory Greenhouse Gas Reporting Rule* [40 CFR Part 98], which requires annual reporting of GHG emissions from large sources in the United States. Vanderbilt, along with many other institutions of higher education, will be required to report annual emissions to the EPA for the 2010 calendar year². Under the EPA's GHG Reporting Rule, the scope of stationary sources and some emissions factors vary from those utilized in Vanderbilt's initial baseline GHG inventory. Therefore, in an effort

¹ Vanderbilt University's Baseline Greenhouse Gas Inventory Report is available at <http://www.vanderbilt.edu/sustainvu> or may be requested by emailing SustainVU@vanderbilt.edu.

² 30 October 2009. "40 CFR Parts 86, 87, 89 et al. Mandatory Reporting of Greenhouse Gases; Final Rule." U.S. Environmental Protection Agency. Available <http://www.epa.gov/climatechange/emissions/downloads09/GHG-MRR-Full%20Version.pdf>.

to use a single, consistent methodology for calculating and reporting GHG emissions for the university, emissions from calendar years 2005-2007 (those years included in the original baseline inventory) have been recalculated utilizing the EPA's scope and emissions factors for relevant stationary sources. Emissions from sources not covered by the EPA's GHG Reporting Rule were calculated using emissions factors from the Clean Air – Cool Plant Campus Carbon Calculator™ or emission factors developed for specific on-campus activities. The same methodology was used to determine GHG emissions for the calendar years 2008 and 2009.

This report will establish Vanderbilt's annual GHG emissions from 2005 to 2009 so that the Vanderbilt community can better understand its own unique impact on the environment and determine the most effective improvement strategies to implement in the future. This report replaces the original baseline inventory report published April 21, 2009.

Process & Methodology

The Vanderbilt Sustainability and Environmental Management Office (SEMO), in collaboration with the Plant Operations Department, Campus Planning and Construction, and the Division of Public Affairs, began the planning process for conducting Vanderbilt's GHG emissions baseline inventory at the request of Vanderbilt's Faculty Senate in December 2008. This planning group determined the physical (organizational) boundary of what would be included in the GHG inventory, along with the identification of GHG emission sources at Vanderbilt and the determination of the time period for collecting data retroactively to 2005.



The physical boundary for Vanderbilt University's GHG inventory includes the "core" 330 acres of Vanderbilt University property and encompasses academic, residential, research, and patient care buildings located within this area. Off-site buildings, such as satellite medical clinics and the One Hundred Oaks outpatient medical clinics and operations, are not included in this inventory. By including Vanderbilt's patient care facilities (which are typically excluded by other universities in their GHG emissions calculations), Vanderbilt's GHG inventory is unique and largely comprehensive. The core Vanderbilt campus contains over 230

buildings, comprising over 17 million gross square feet of space³.

Campus operations that produce GHGs and are included in this inventory are: electricity and steam production at the on-campus, co-generation power plant; electricity purchased from Nashville Electric Service (NES); university-owned vehicle fuel use; refrigerant releases; anesthetic gas use; fuel used in vehicles owned by Vanderbilt University faculty and staff commuting to work; air travel paid for by the university; and disposal of waste generated by Vanderbilt.

Under the EPA's GHG Reporting Rule, facilities which emit 25,000 or more metric tons carbon dioxide equivalent (MTCO₂E) per year must submit annual emissions reports. At Vanderbilt, this includes coal and natural gas use at the on-campus co-generation power plant and natural gas use by boilers in individual campus facilities. Therefore, emissions from these sources are calculated using emissions factors established by the EPA. For all additional emissions from university activities that are not required to be reported to the EPA, a standardized, publicly available GHG calculator/spreadsheet for universities called the Clean Air – Cool Plant Campus Calculator™ was utilized to store collected data and convert our university-specific data into a common GHG emission unit using established emissions factors for specific activities (i.e., gallons of fuel, commuter miles, tons of waste disposed, etc.). This calculator is the most commonly used among U.S. colleges and universities. Results were compiled for academic and research operations, including medical research functions, and separately for patient care operations, with integrated totals also reported. Upon its completion, this GHG inventory report was presented to a committee of reviewers prior to publication.

Findings

Vanderbilt University's total GHG emissions for calendar years 2005 to 2009 are presented in Table ES.1 and Figure ES.1. Total GHG emissions decreased by 7.8% from 2008 to 2009 and by 2.4% overall from 2005 to 2009.

³ February 2010. ReVU: Quick Facts about Vanderbilt. Available <http://www.vanderbilt.edu/about/facts/>.

Calendar Year	Academic & Research Areas (MTCO ₂ E)	Patient Care Areas (MTCO ₂ E)	Total GHGs Emitted by VU (MTCO ₂ E)
2005	296,465	179,260	475,725
2006	295,825	182,548	478,374
2007	308,604	189,958	498,562
2008	313,341	189,985	503,327
2009	288,343	175,896	464,240

Table ES.1. Total Vanderbilt GHG Emissions, Calendar Years 2005-2009.

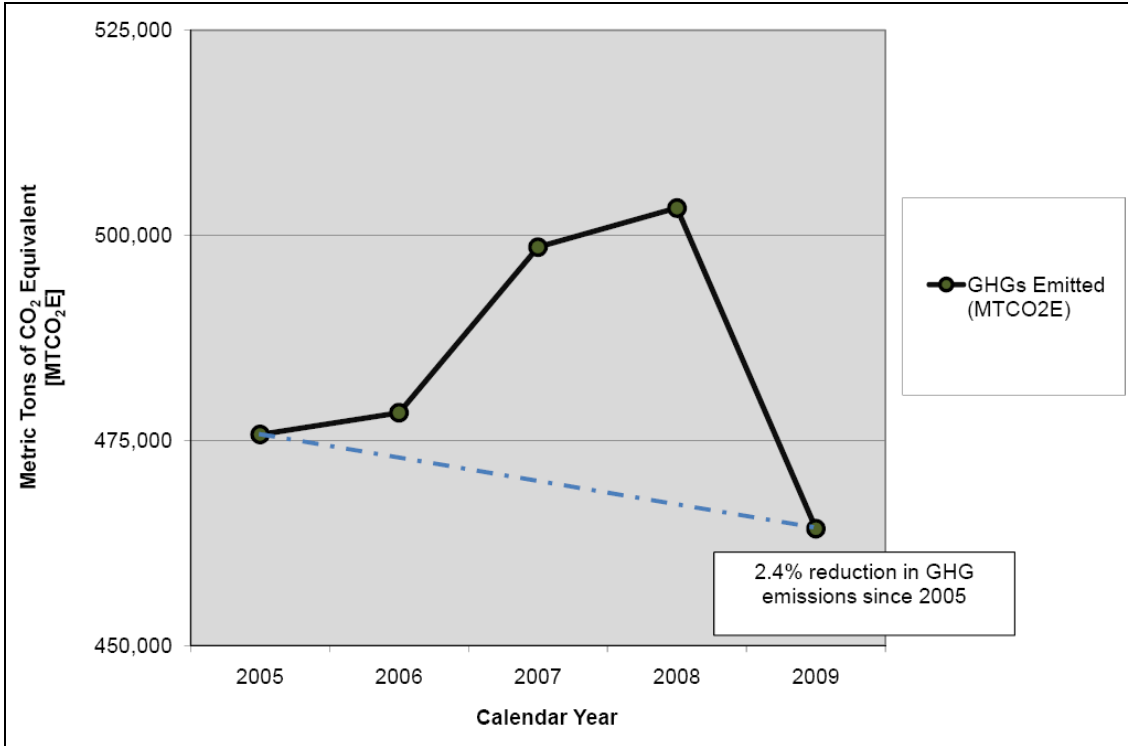


Figure ES.1. Total Vanderbilt GHG Emissions, Calendar Years 2005-2009.

Emissions data from the five year period included in this report indicates that each year academic and research areas accounted for approximately 62% of total GHG emissions while patient care areas accounted for approximately 38% of total GHG emissions, as is indicated in Figure ES.2 below.

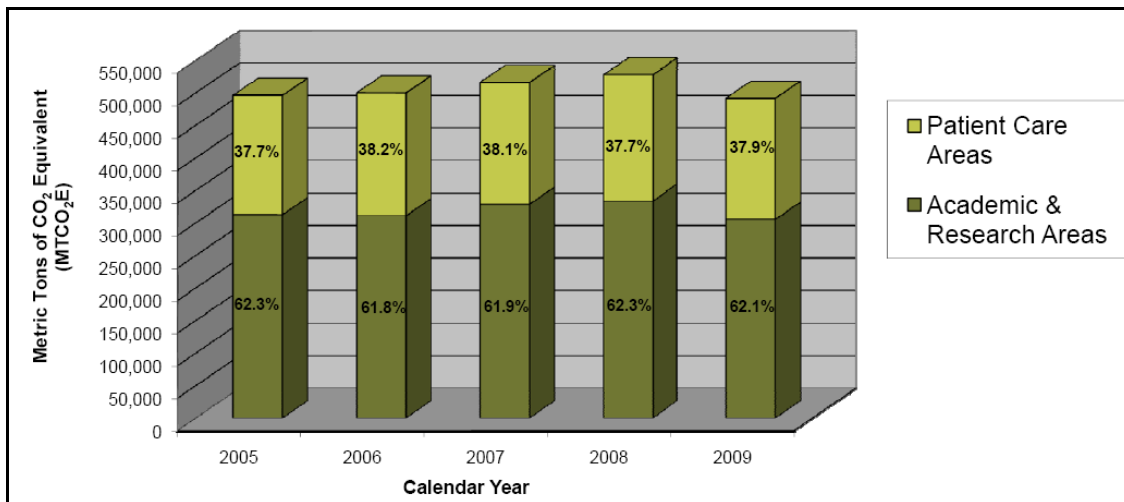


Figure ES.2. Total Vanderbilt GHG Emissions, Calendar Years 2005-2009.

Each year, the inventory results further demonstrate that purchased electricity, coal use at the on-campus co-generation power plant, faculty and staff commuting, and natural gas use at the on-campus co-generation power plant were the most substantial sources of GHG emissions, accounting for 94-96% of annual GHG emissions from Vanderbilt University, as is illustrated by emissions sources for calendar year 2009 in Figure ES.3. For more detail and emission source information for years preceding 2009, please reference Tables C.2, D.2, E.2, and F.2 and Figures C.1, D.1, E.1, and F.1 in the appendix. As the 2009 total GHG emissions reductions illustrate, reducing energy consumption and supporting alternative transportation methods have the most potential to reduce GHG emissions at Vanderbilt.

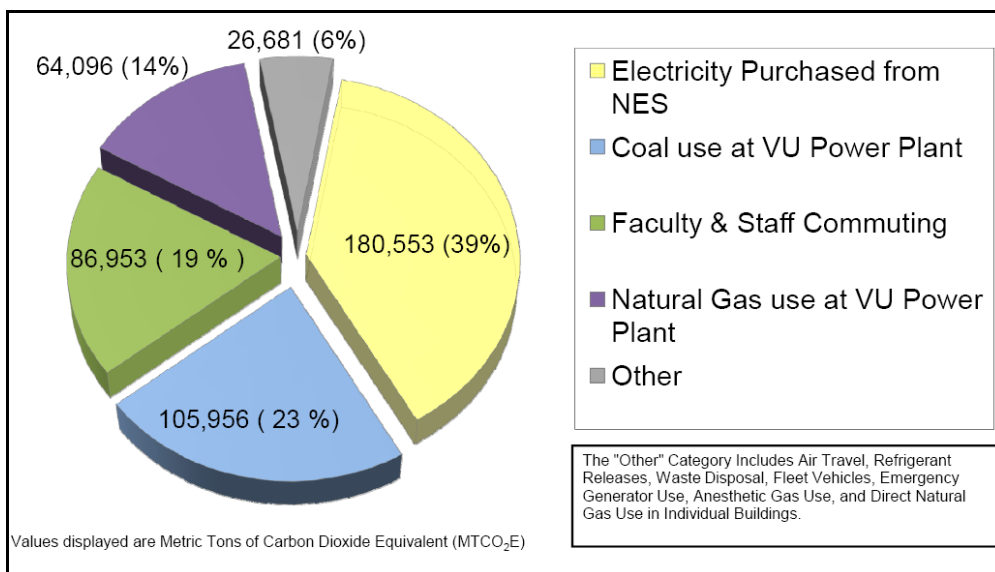


Figure ES.3. GHG Emissions Sources, Calendar Year 2009.

Interpreting Vanderbilt's Results

Only a very small portion of universities nationwide have completed GHG inventory reports and made them publicly available at this time. Thus, Vanderbilt has acted proactively by taking this important step. Additionally, most university GHG inventory reports do not include research and/or patient care activity, making Vanderbilt's report more comprehensive than most and more comprehensive than what is required by the EPA.

While reports exist for a small number of Vanderbilt's peer institutions, drawing comparisons between universities is difficult. Each school has its own defining characteristics and mix of variables even within the shared, primary emissions attributes. Thus, the only useful standard to which Vanderbilt can accurately compare its GHG emissions in the years to come is its own emissions, utilizing consistent interpretations as presented in this initial report. Emphasis has been placed throughout this report in trending and evaluating the five years of Vanderbilt data available instead of comparisons to other institutions

The authors recognize the tendency to place Vanderbilt's results in context with those of other universities, even though this would be misleading. If comparisons are made, then several factors should be considered when comparing the university's GHG emissions to others:

- 90% of Vanderbilt undergraduate students live in on-campus residence houses, which are supplied using centralized utilities such as chilled water, steam heat, and electricity. Colleges and universities with larger commuter populations and/or off-campus housing would have substantially smaller Scope 1 emissions (on-site sources) and larger Scope 3 emissions (indirect sources).
- Vanderbilt was awarded \$520 million⁴ in 2009 to conduct scientific and medical research, with a majority of the research occurring in laboratories on campus. Vanderbilt University has over 800 research laboratories, which are significant consumers of energy through the operation of lab equipment.
- The Vanderbilt University Medical Center (VUMC) provides regional health care 24 hours per day, 7 days per week, 365 days per year. Very few universities have on-campus patient care that matches the size and extent of operations of VUMC.

⁴ According to 2009 research information found in ReVU: Quick Facts about Vanderbilt. Available <http://www.vanderbilt.edu/about/facts/>.

When compared to other major research institutions, Vanderbilt's GHG emissions compare quite reasonably. Table ES.2 and Figure ES.4 below illustrate Vanderbilt's normalized emissions in relation to several other universities with large amounts of on-campus research.

University	Total Emissions (MTCO ₂ E)	Emissions per 1,000 Square Feet	Emissions per Student	Emissions per Person on Campus	Emissions per \$1,000 Research Awarded
University of Michigan ⁵	592,000	19.1	14.8	7.6	0.58
Duke University ⁶	433,961	31.2	34.1	9.5	0.79
Emory University ⁷	419,231	46.6	25.4	20.4	1.19
Washington University – St. Louis ⁸	409,500	28.0	29.8	24.2	0.72
University of Pennsylvania ⁹	355,829	29.9	18.0	8.8	0.42
Vanderbilt University – Academic & Research Areas Only ¹⁰	288,343	31.3	23.8	12.7	0.55

Table ES.2. Comparison of 2009 VU GHG Emissions with Other Universities.

⁵ GHG emissions, GSF, and student, faculty, and staff populations for FY 2009 retrieved from http://www.oseh.umich.edu/pdf/09_report.pdf. 2008-2009 research expenditures from <http://mmd.umich.edu/forum/michigan.php>.

⁶ GHG emissions and GHG emissions per 1,000 GSF for 2007 retrieved from http://sustainability.duke.edu/climate_action/inventory.php. Student population from 2007 retrieved from http://library.duke.edu/uarchives/history/duke_statistics.html. 2009 employment data retrieved from <http://www.dukenews.duke.edu/resources/quickfacts.html> was utilized because 2007 employment data could not be located. Research awards for FY 2007 retrieved from Duke's 2007 financial report at https://finance.duke.edu/resources/docs/financial_reports08.pdf.

⁷ GHG emissions, GSF, and student, faculty, and staff populations for FY 2007 retrieved from http://sustainability.emory.edu/uploads/press/2010/03/2010031214250142/GHG_Executive_Summary.pdf. Research awards for FY 2007 retrieved from Emory's 2007 Annual Report at <http://www.emory.edu/president/documents/annualreport.2007.pdf>.

⁸ GHG emissions, GHG emissions per 1,000 GSF, and GHG emissions per person for FY 2009 retrieved from <http://www.wustl.edu/initiatives/sustain/assets/GHGEmissions.pdf>. Student population for 2009 retrieved from <http://www.wustl.edu/about/facts/students/index.html>. Research awards for 2008-2009 retrieved from <http://www.wustl.edu/about/facts/rankings/index.html>.

⁹ GHG emissions, GSF, and student, faculty, and staff populations for 2009 from ACUPCC's website at <http://acupcc.aashe.org/ghg/258/>. Sponsored projects as of December 2009 retrieved from <http://www.upenn.edu/about/facts.php>.

¹⁰ GHG emissions for CY 2009 from academic and research areas only. 2009 research dollars awarded.

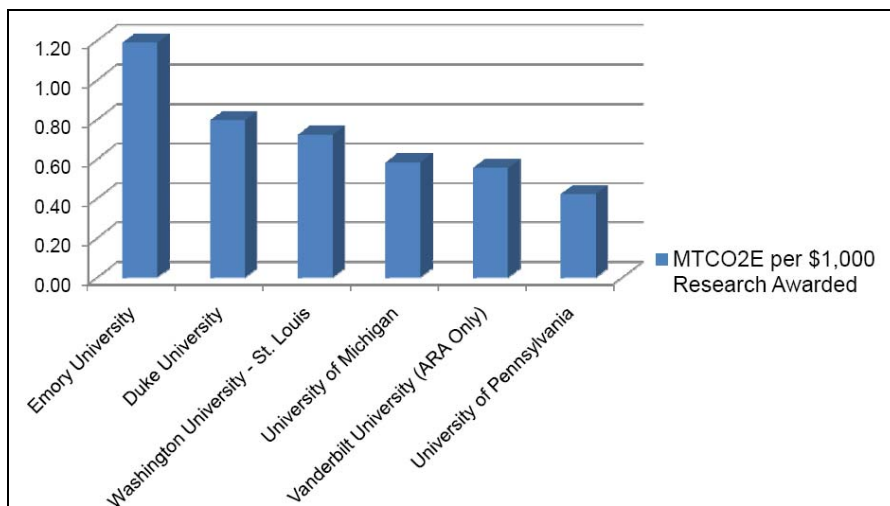


Figure ES.4. Comparison of VU GHG Emissions with Other Universities, by Research Dollars Awarded.

Future Plans

This inventory provides campus stakeholders with a consistent means of calculating annual GHG emissions and sufficiently detailed information to make informed decisions to determine reduction strategies and compare future changes in GHG emissions on campus. Annual emissions inventories will be conducted in the future to measure progress, which will be made publicly available the SustainVU website¹¹.

In the interim, each member of the Vanderbilt community should take part in reducing GHG emissions at Vanderbilt by:

- Turning off lights, computer equipment, and electronics when leaving a room;
- If you have control of a thermostat, adjusting it to a reasonable temperature (68-70°F in the winter and 75°F in the summer) and dress in layers to moderate your own personal temperature;
- Wasting less by reducing consumption and recycling;
- Walking, biking, carpooling, or taking mass transit to and from work;
- Reducing unnecessary vehicle idling.



More information on ways the Vanderbilt community can save energy can be found on the ThinkOne website¹².

¹¹ The SustainVU website may be accessed at <http://www.vanderbilt.edu/sustainvu>.

¹² The ThinkOne website may be accessed at <http://www.vanderbilt.edu/sustainvu/thinkone>.