Baseline Inventory of Greenhouse Gas Emissions 2005-2007

VANDERBILT UNIVERSITY

SustainVU
Growing Responsibly

Cover photo by Robert Wheaton

Developed By

Andrea George, PhD, CHMM
Director, Sustainability and Environmental Management Office

Steven Gild, MS, CHMM
Environmental Management Systems Coordinator, Sustainability and Environmental Management Office

Kendra Abkowitz, **MA**
Sustainability Professional, Sustainability and Environmental Management Office

Produced collaboratively by the Sustainability and Environmental Management Office with the Plant Operations Department, Campus Planning and Construction Department, and the Division of Public Affairs.

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.

Published April 22, 2009

ACKNOWLEDGEMENTS

The report authors gratefully acknowledge the following individuals for providing data to SEMO and sharing their insight on operations that produce greenhouse gas emissions:

Roger Bess*, Director of Utilities, Plant Operations*; James "Darren" Bevill, *Campus Energy Manager, Plant Operations;* Roland Brunhoeber, *Assistant Director, VUMC Plant Services*; LouAnn Burnett, *Assistant Director, Environmental Health and Safety;* Melanie Byers, *Senior Safety Officer, Environmental Health and Safety;* Sheri DiGiovanna, *Manager of Strategic Projects, Procurement and Disbursement Services*; Angela Durham, *Associate Director, Division of Animal Care*; David Frye, *Allied Waste;* Cliff Joyner, *Assistant Vice Chancellor for Real Estate Operations*; Lance Hale, *Manager, Office of Traffic and Parking*; Elizabeth Hiett, *Coordinator of Inventory Management, VUMC Plant Services*; Camp Howard, *Director, Dining Services*; Lieutenant Troy Huffines, *Police Department*; Jack Jacobik, *VUMC Parking and Transportation Services;* Jessica Ji, *Student Worker, SEMO*; Susan Johnson, *Assistant Director, Environmental Health and Safety;* Francis Kovac, *VUMC Parking and Transportation Services;* Verlan "Jim" LaFleur, *Manager, Heating and Air Conditioning Repair Shop, Plant Operations*; Mitchell Lampley, *Director of Engineering, Plant Operations*; David Manning, *Grounds Maintenance, Plant Operations*; Andy Miller, *Assistant Director, Environmental Health and Safety;* Karen Montefiori, *Sourcing Analyst, Information Technology Services*; Judson Newbern, *Deputy Vice Chancellor for Facilities and Environmental Affairs*; Missy Pankake, *Public Affairs Officer, Vanderbilt News Service*; Bill Page, *Manager, Storeroom, Plant Operations*; Mark Petty, *Assistant Vice Chancellor for Plant Operations*; Billy Roberts, *Manager, Heating and Air Conditioning Repair Shop, VUMC Plant Services*; Karen Rolling, *Director, Human Resources*; Benji Rust, *Vanderbilt Real Estate*; Tom Seider, *System Specialist, VUMC Plant Services*; Gary Streaty, *Director, VUMC Parking and Transportation Services*; Ian Strug, *Student Worker, SEMO*; Dan Sullivan, *SteriCycle*; Larry Tidwell, *Manager, Special Equipment Repair, VUMC Plant Services*; Richard Warf, *Senior Accountant, Plant Operations;* Kevin Warren, *Assistant Director, Environmental Health and Safety*; Robert West, *Vehicle Fleet Manager, Plant Operations*; Robert Wheaton, *Executive Director, Environmental Health and Safety*; and Barbara White, *Central Parking*.

The report authors gratefully acknowledge the following individuals for assisting SEMO with reviewing the baseline greenhouse gas inventory:

James Clarke, *Professor, Civil and Environmental Engineering; Chair, Environmental Advisory Committee*; Brent Fitzgerald, *President, Students Promoting Environmental Awareness and Responsibility*; Marcus Mendenhall, *Research Associate Professor, Free Electron Laser Center*; Judson Newbern, *Deputy Vice Chancellor for Facilities and Environmental Affairs*; Missy Pankake, *Public Affairs Officer, Vanderbilt News Service*; Cynthia Paschal, *Associate Professor, Biomedical Engineering and Radiology, Chair, Faculty Senate*; Mark Petty, *Assistant Vice Chancellor for Plant Operations*; and Robert Wheaton, *Executive Director, Environmental Health and Safety*.

VANDERBILT UNIVERSITY BASELINE INVENTORY OF GREENHOUSE GAS EMISSIONS, 2005-2007

EXECUTIVE SUMMARY

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

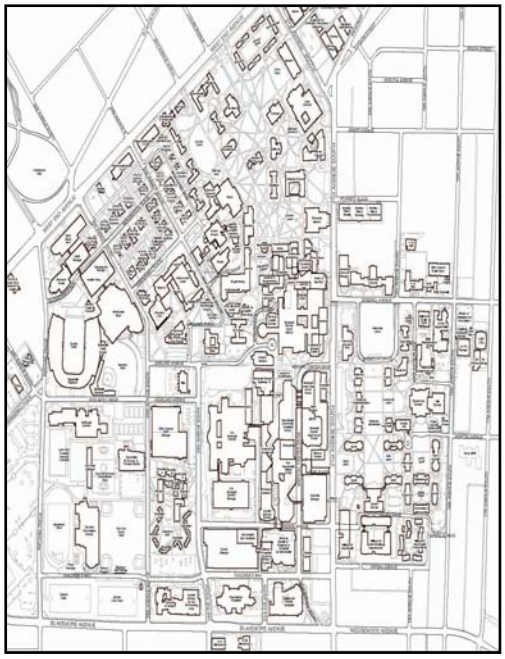
Background

On February 23, 2009, Vanderbilt announced that an initial greenhouse gas inventory would be developed. Because the combination of the variables differs vastly across the communities forming each institution, every university must establish its own greenhouse gas emissions baseline, or carbon footprint. Vanderbilt emits greenhouse gases 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. This report will establish a baseline of Vanderbilt's average annual greenhouse gas emissions from 2005 to 2007 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 inventory is being released in conjunction with the publication of the University's Environmental Commitment Statement.

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 greenhouse gas 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 baseline

greenhouse gas inventory, along with the identification of greenhouse gas emission sources at Vanderbilt and the definition of the baseline time period.



The physical boundary for Vanderbilt University's baseline greenhouse gas 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 greenhouse gas emissions calculations), Vanderbilt's greenhouse gas inventory is unique and largely comprehensive. The core Vanderbilt campus contains over 190 buildings, comprising over 16.5 million gross square feet of space.

Campus operations that produce greenhouse gases 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.

A standardized, publicly available greenhouse gas 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 greenhouse gas 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, the baseline greenhouse gas inventory report was presented to a committee of reviewers prior to publication.

Findings

During the calendar years 2005 to 2007, Vanderbilt University's average yearly greenhouse gas emissions are estimated to be 487,000 metric tons of carbon dioxide equivalent ($MTCO_2E$). Academic and research areas accounted for 302,000 $MTCO_2E$ (62%) of this yearly average; patient care areas accounted for 185,000 $MTCO_2E$ (38%). More detail is provided in Table ES.1 and Figure ES.1.

Source	Academic & Research Areas ($MTCO_2E$)	Patient Care Areas ($MTCO_2E$)	Total Emissions by Source ($MTCO_2E$)
Scope 1 Greenhouse Gas Emissions: On-Site Sources			
Coal use at VU Power Plant	76,177	41,018	117,195
Natural Gas use at VU Power Plant	24,408	13,143	37,551
Natural Gas use in Individual Buildings	2,457	1,323	3,780
Diesel-Powered Generators	635	342	977
Refrigerant Releases	133	0	133
Fleet Vehicles	1,822	2,032	3,854
Anesthetic Gas Use	1	3,126	3,127
Subtotal of Scope 1 Emissions:	105,633	60,984	166,617
Scope 2 Greenhouse Gas Emissions: Electricity Purchases			
Electricity Purchased from NES	144,200	77,646	221,846
Scope 3 Greenhouse Gas Emissions: Indirect Sources			
Faculty & Staff Commuting	46,227	44,384	90,611
Air Travel	5,259	-	5,259
Waste Disposal	1,098	1,689	2,787
Subtotal of Scope 3 Emissions:	52,584	46,073	98,657
Total Baseline Emissions, rounded to the nearest 1,000 metric tons:	**302,000**	**185,000**	**487,000**

Table ES.1. Baseline Greenhouse Gas Emissions Inventory Summary, Annual Average, 2005-2007.

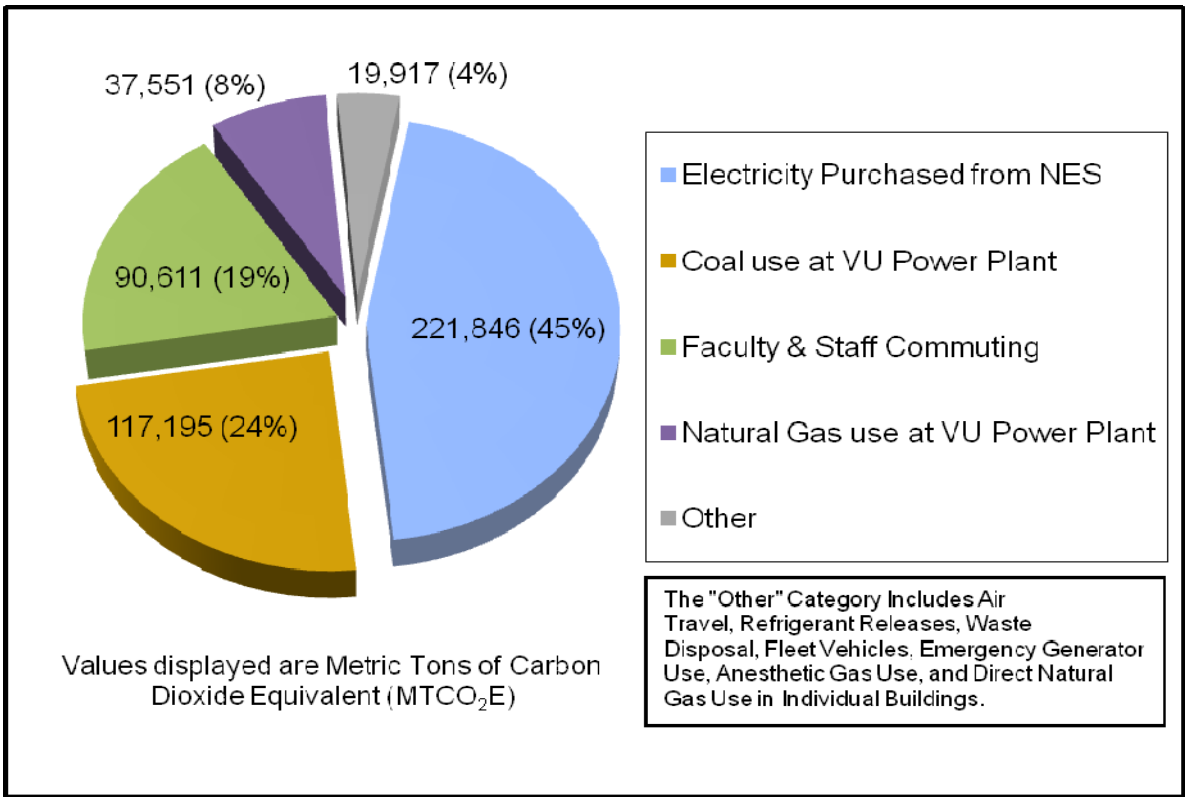


Figure ES.1. Vanderbilt University Baseline Emissions by Source, Annual Average, 2005-2007.

The baseline inventory results illustrate 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 greenhouse gas emissions, accounting for 96% of the annual average greenhouse gas emissions from Vanderbilt University. Thus, reducing energy usage and supporting commuter choice programs have the most potential to reduce greenhouse gas emissions at Vanderbilt University.

Interpreting Vanderbilt's Results

Only a very small portion of universities nationwide have completed greenhouse gas inventory reports and made them publicly available. Thus, Vanderbilt is acting proactively by taking this step. Additionally, most university greenhouse gas inventory reports do not include research and/or patient care activity, making Vanderbilt's report more comprehensive than most.

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 greenhouse gas emissions in the years to come is its own baseline, utilizing consistent interpretations as presented in this initial report.

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 greenhouse gas emissions to others:

- 93% of Vanderbilt undergraduate students live in on-campus residence houses, which are supplied using centralized utilities such as chilled water, heat, electricity, and air conditioning. Colleges and universities with larger commuter populations and/or off-campus housing would have potentially smaller Scope 1 emissions (on-site sources) and larger Scope 3 emissions (indirect sources).
- Vanderbilt was awarded $520 million[1] in 2008 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 huge consumers of energy through the operation of lab equipment.
- The Vanderbilt Medical Center 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 Vanderbilt Medical Center.

When compared to other major research institutions, Vanderbilt's greenhouse gas emissions compare quite reasonably. Table ES.2 below illustrates emissions per $1,000 of research awarded to Vanderbilt University in relation to several other universities with large amounts of on-campus research.

Comparison by Research Awards	
University	**Average $MTCO_2E$ per $1,000 Research Awarded during 2005-2007**
University of Maryland – College Park	1.02
University of Michigan	0.77
Vanderbilt University	0.64
University of Pennsylvania	0.60

Table ES.2. Comparison of VU Greenhouse Gas Emissions with Other Universities, by Research Dollars Awarded.

[1] February 2009. ReVU: Facts about Vanderbilt. Available http://www.vanderbilt.edu/facts.html.

There is currently no standardized methodology for calculating university carbon footprints. Therefore, our own baseline emissions presented in this report provide the only applicable standard to which Vanderbilt can assess its greenhouse gas emissions in the years to come.

Future Plans

This first inventory provides a baseline to enable campus stakeholders to have sufficiently detailed information to make informed decisions to determine reduction strategies and compare future changes in greenhouse gas emissions on campus. Annual emissions inventories will be conducted in the future to measure progress, which will be made publicly available on www.vanderbilt.edu/sustainvu.

In the interim, each member of the Vanderbilt community should take part in reducing greenhouse gas 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 website at www.vanderbilt.edu/sustainvu/thinkone.