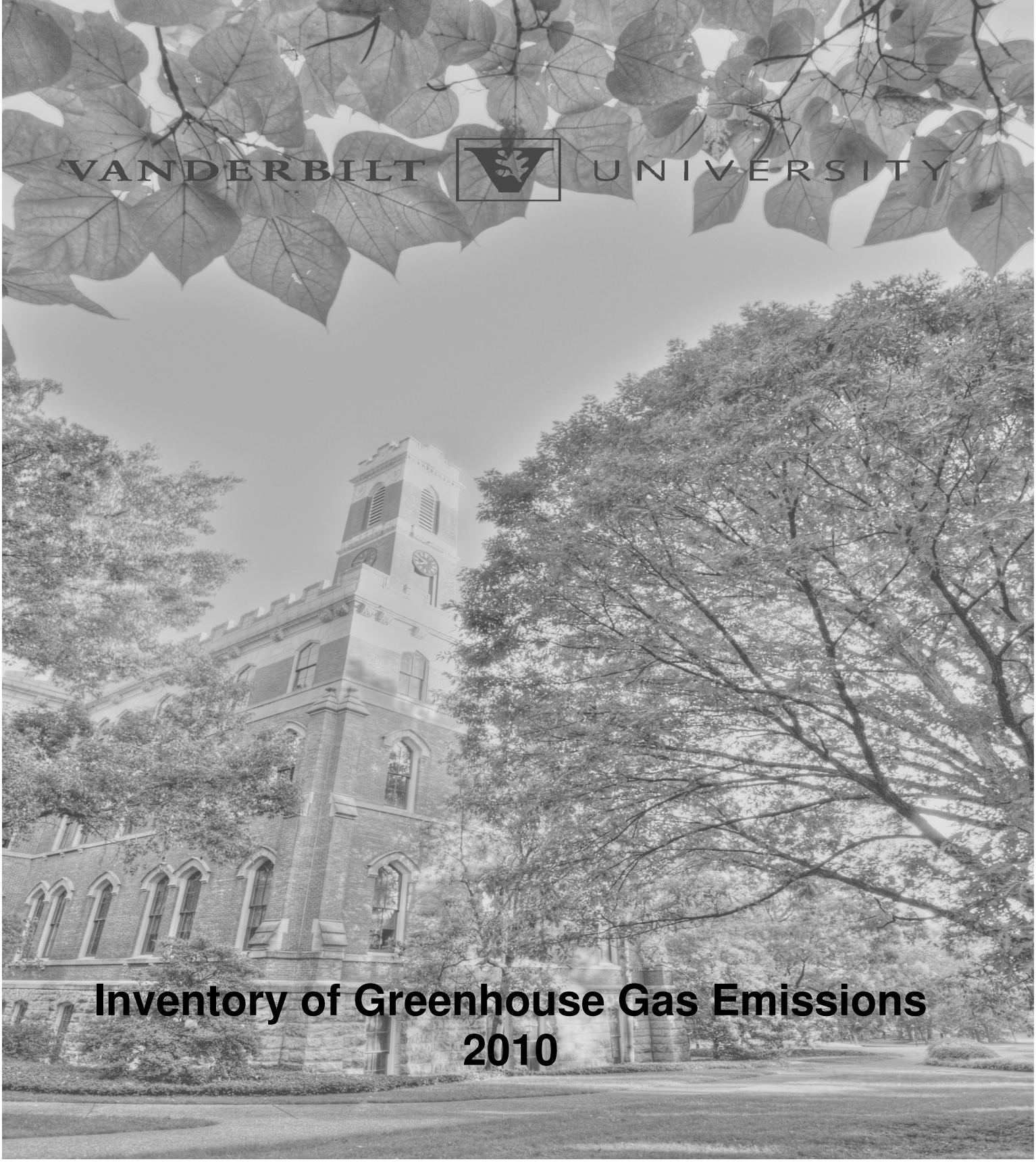

Inventory of Greenhouse Gas Emissions 2010

VANDERBILT UNIVERSITY
MEDICAL CENTER

VANDERBILT
UNIVERSITY

SustainVU
VANDERBILT

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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.

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VANDERBILT UNIVERSITY INVENTORY OF GREENHOUSE GAS EMISSIONS 2010

EXECUTIVE SUMMARY

This report is a summary of greenhouse gas (GHG) emissions for Vanderbilt University for the calendar year 2010. This GHG emissions inventory is intended to portray Vanderbilt's current carbon footprint as accurately as possible and to provide trending information to show progress in GHG emissions from 2005-2010. It is not intended to draw comparisons with other institutions. The GHG inventory was developed by Vanderbilt's Sustainability and Environmental Management Office (SEMO).

Background

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 University released its first GHG inventory report in April 2009 for calendar years 2005-2007[1].

In October 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, are now required to report annual emissions to the EPA[2]. 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[1]. Therefore, in an effort to use a single, consistent methodology for calculating and reporting GHG emissions for the university, emissions for Vanderbilt, including those years prior to 2009, were calculated utilizing the EPA's scope and emissions factors for relevant stationary sources. Emissions from sources not covered by the

[1] Vanderbilt University's Inventory of Greenhouse Gas Emissions 2005-2007 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 at http://www.epa.gov/climatechange/emissions/downloads09/GHG-MRR-Full%20Version.pdf.

EPA's GHG Reporting Rule were calculated using emissions factors from the Clean Air – Cool Planet Campus Carbon Calculator™ or emission factors developed for specific on-campus activities.

This report, a supplement to previous reports[3], establishes Vanderbilt's GHG emissions from calendar year 2010 so that the Vanderbilt community can better understand its own unique impact on the environment now and in the past and determine the most effective improvement strategies to implement in the future.

Process & Methodology

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 18 million gross square feet of space[4].

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 ($MTCO_2E$) 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

[3] Vanderbilt University's Inventory of Greenhouse Gas Emissions 2005-2009 report is available at http://www.vanderbilt.edu/sustainvu/ or may be requested by emailing SustainVU@vanderbilt.edu.
[4] June 2011. ReVU: Quick Facts about Vanderbilt. Available http://www.vanderbilt.edu/about/facts/.

using emissions factors established by the EPA. For calendar year 2010, Vanderbilt University emissions from EPA-required sources amounted to 159,663 $MTCO_2E$, which was reported to the EPA on September 28, 2011. 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 Planet 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 2010 are presented in Table ES.1 and Figure ES.1. Total GHG emissions decreased by 1.9% from 2009 to 2010 and by 4.3% overall from 2005 to 2010.

Calendar Year	Academic & Research Areas ($MTCO_2E$)	Patient Care Areas ($MTCO_2E$)	Total GHGs Emitted by VU ($MTCO_2E$)
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
2010	284,506	170,754	**455,261**

Table ES.1. Total Vanderbilt GHG Emissions, Calendar Years 2005-2010.

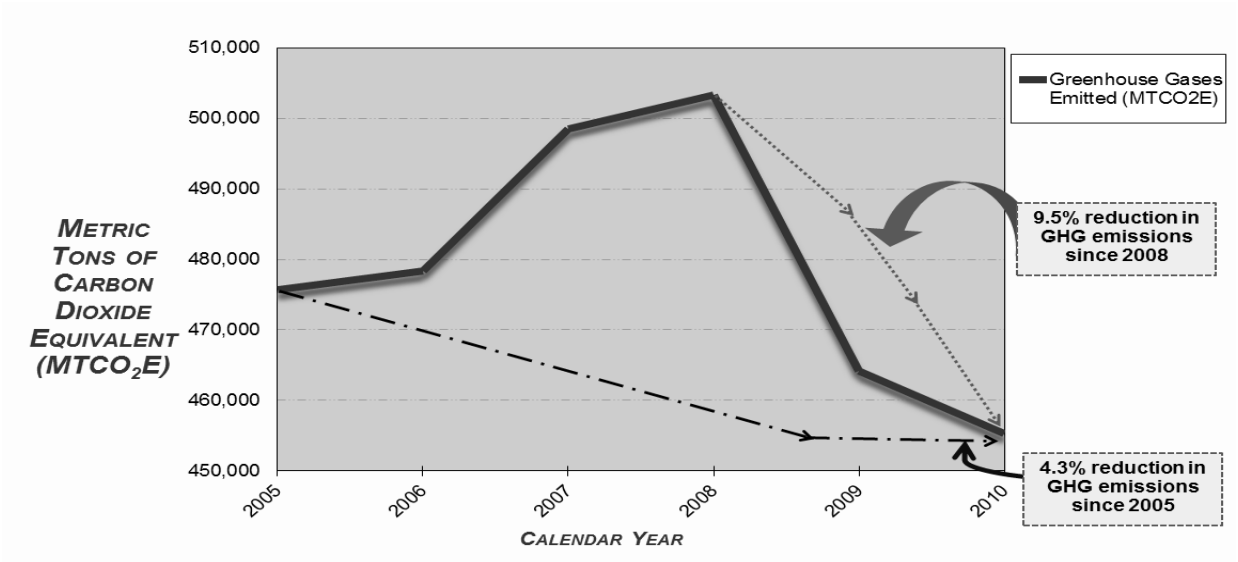

Figure ES.1. Total Vanderbilt GHG Emissions, Calendar Years 2005-2010.

Emissions data from 2010 indicates that academic and research areas accounted for 62.5% of total GHG emissions while patient care areas accounted for 37.5% of total GHG emissions. As in previous reports, the inventory results 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. These accounted for 94% of GHG emissions from Vanderbilt University, as is illustrated by emissions sources for calendar year 2010 in Figure ES.2. As the 2010 total GHG emissions reductions illustrate, reducing energy consumption and supporting alternative transportation methods have the most potential to reduce GHG emissions at Vanderbilt.

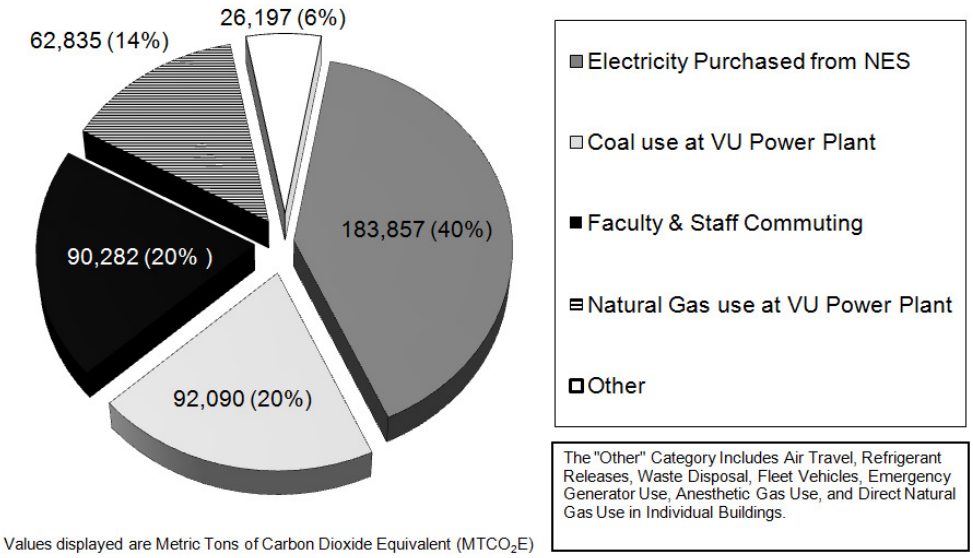

Figure ES.2. GHG Emissions Sources, Calendar Year 2010.

Between 2005 and 2010, Vanderbilt University's GHG emissions have decreased by 18% on a per gross square foot basis, by 14% on a per person basis, and by 29% per million research dollar awarded to VU. Considering that Vanderbilt's on-campus square footage has increased by almost three million square feet since 2005, it is clear that VU Plant Operations, VUMC Plant Services, Campus Planning and Construction, and VUMC Space and Facilities Planning are significantly improving the energy efficiency of Vanderbilt's buildings in the midst of continued growth.

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 six 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:

- 89% 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 $615 million[5] in 2010 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.

Table ES.2 and Figure ES.3 below illustrate Vanderbilt's normalized emissions in relation to several other universities with large amounts of on-campus research.

University	Total Emissions ($MTCO_2E$)	Emissions per 1,000 Square Feet	Emissions per Student	Emissions per Person on Campus	Emissions per $1,000 Research Awarded
University of Michigan[6]	671,605	19.75	16.12	8.3	0.61
Duke University – Campus Only[7]	307,746	30.2	22.49	9.02	0.59
Washington University – St. Louis[8]	409,500	28.0	29.26	24.2	0.58
Emory University[9]	305,819	33.98	22.85	11.79	0.57
University of Pennsylvania[10]	288,140	21.06	11.71	6.40	0.34
Vanderbilt University – Academic & Research Areas Only[11]	284,506	30.7	22.8	12.42	0.46

[5] According to 2010 research information accessed in June 2011 in ReVU: Quick Facts about Vanderbilt. Available http://www.vanderbilt.edu/about/facts/.
[6] GHG emissions, GSF, and student, faculty, and staff populations for FY 2010 retrieved from 2010 Annual Sustainability Report Raw Data, http://www.ocs.umich.edu/10AERrawdata.shtml. 2010 research expenditures from 2010 Financial Report, http://www.finops.umich.edu/reports/2010/pdf/UMfinrepFY10lr.pdf.
[7] GHG emissions, GSF, and student, faculty, and staff populations for 2009 as reported to ACUPCC, http://rs.acupcc.org/ghg/1510/. 2009 research dollars retrieved from Financial Statements 2009/2010, https://finance.duke.edu/resources/docs/financial_reports.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 enrollment for Fall 2010 retrieved from http://www.wustl.edu/about/facts/students/index.html. Research awards for 2010 retrieved from http://www.wustl.edu/about/facts/assets/pdf/FastFacts2010.pdf. 2010 data was used where comparable 2009 data could not be located.
[9] Emissions data for 2010 from http://sustainability.emory.edu/html/dashboard/other-ghg-sources.html. University faculty, staff, and student population from 2010 Facts and Figures at http://www.emory.edu/home/about/factsfigures/index.html. GSF for FY 2007 retrieved from http://sustainability.emory.edu/uploads/articles/2010/10/20101005135950 29/GHG_Executive_Summary.pdf. GSF from FY 2007 was used because GSF from FY 2010 could not be located. 2010 research dollars from http://www.emory.edu/president/annual-report/ar2010/murphree.html.
[10] GHG emissions, GSF, and student, faculty, and staff populations for 2009 from ACUPCC's website at http://rs.acupcc.org/ghg/1516/. Sponsored projects for 2009 retrieved from http://www.archives.upenn.edu/primdocs/uph/uph4_5/2009fin_report.pdf..

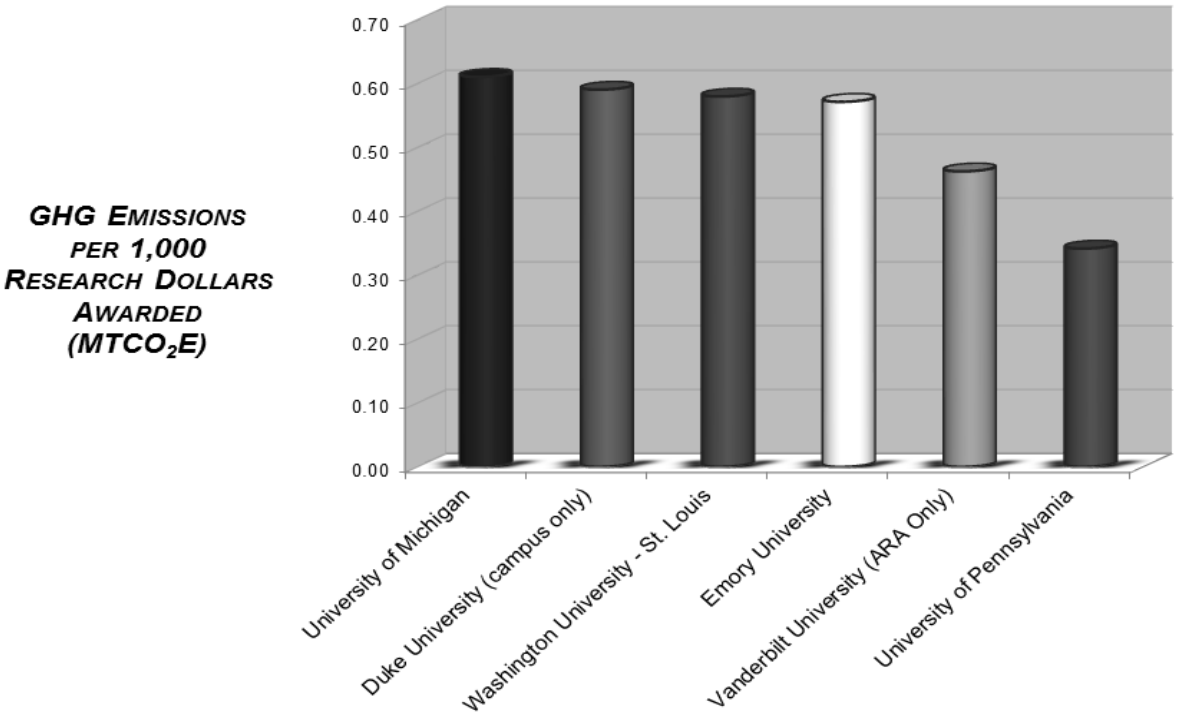

Table ES.2. Comparison of 2010 VU GHG Emissions with Other Universities.

Figure ES.3. 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 website[12].

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;

[11] GHG emissions for CY 2010 from academic and research areas only. 2010 research dollars awarded.
[12] The SustainVU website may be accessed at http://www.vanderbilt.edu/sustainvu.

- 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[13].

[13] The ThinkOne website may be accessed at http://www.vanderbilt.edu/sustainvu/thinkone.