A Carbon Footprint for the Universities at Shady Grove: FY 2009-2011

The UNIVERSITIES at Shady Grove

Coordinated By:

Jessica Nardi, Coordinator for Administration and Finance, The Universities at Shady Grove

Written By:

Sean Williamson, Program Manager for Climate Change and Energy at the Environmental Finance Center, University of Maryland

The Environmental Finance Center (EFC) at the University of Maryland is one of ten University-based centers across the county providing communities and organizations with the tools and information necessary to manage change for a healthy environment and an enhanced quality of life. EFC believes that environmental finance can be used to develop a shared community vision. Our focus is on protecting natural resources by strengthening the capacity of local decision-makers to analyze environmental problems, develop innovative and effective methods of financing environmental efforts, and educate individuals about the role of finance and economic development in the protection of the environment. More information about the EFC can be found online at: http://www.efc.umd.edu/.

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Executive Summary

In 2009, the Universities at Shady Grove (USG) signed the American Colleges and Universities Presidents' Climate Commitment (ACUPCC) and joined 600-plus higher education institutions, in addition to the institutions of the University System of Maryland (USM), in committing to climate neutrality. The report that follows is an inventory of greenhouse gas emissions for USG and a first major step towards meeting the commitment. The ACUPCC commitment reflects USG's strong sustainability ethic and aligns with ongoing efforts on the USG campus related to the construction of energy efficient buildings, flexible and convenient scheduling for students and employees, sustainable waste management, and water conservation.

USG is a unique institution in both its mission and history. USG is a regional education center serving nine Maryland higher education institutions, and as such, does not have its own students or faculty, though it does employ USG-financed staff. While the shared student and faculty model complicates carbon accounting practices, discussed in more detail below, the most significant environmental aspect of the USG mission is the regional focus. Located in economically thriving and heavily populated Montgomery County, USG provides a first-rate campus and educational experience in close proximity to the many employees and students of the University System of Maryland who live in or near Montgomery County (USG has no on-campus housing). In the absence of USG, students would need to travel a greater distance to their home institutions or secure housing away from home, the environmental and financial ramifications of which are substantial. By offering its educational services and facilities to Montgomery County and nearby residents, USG is a sustainable and green institution.

The USG campus and entire regional education model are relatively young. In turn, the campus is in a growth phase in terms of physical space, community size, and services provided. The commitment to climate neutrality, and other sustainability goals, will be a challenge as USG seeks to grow without detracting from the local or global environments. USG recognizes the fact that more space and more people could likely necessitate greater natural resource consumption. Nonetheless, USG is presented with a rare opportunity in the realm of higher education: by expanding now, USG can invest in the best and cleanest technologies in a way that larger and older institutions with existing building stocks cannot. USG is well positioned to build upon its past sustainability efforts, including specifically the construction of the award-winning Camille Kendall Academic Center, through the continued adoption of low-carbon goods and services.

The report that follows presents USG's inaugural greenhouse gas (GHG) inventory with supporting contextual information, descriptions of activity data and sources, methods of GHG estimation, and results, including normalization metrics. The remainder of the executive summary highlights key GHG inventory results.

GHG emissions at USG have hovered around 10,000 metric tonnes of carbon dioxide equivalent ($MTCO_2e$) for the past three years (see Table ES.1). During this period USG has had the smallest carbon footprint among all USM institutions (ACUPCC Reporting Website, 2013). Given the institution's ongoing growth and the fact that the inventory methods are very inclusive (e.g., students and faculty from throughout the USM are included in the inventory), USG has accomplished much to-date.

Between FY 2009 and 2011 total GHG emissions increased by 12 percent, which was primarily the result of increasing student size and associated commuting patterns. Other major GHG emissions sources including purchased electricity and fuel consumption for heating and cooking remained stable or decreased during the same period (see Table ES.1).

For the near-term, total GHG emissions are liable to increase in tandem with student and employee growth, along with the addition of new campus buildings. Nonetheless, USG will remain on-focus with GHG emissions by targeting normalization metrics and ensuring these do not grow drastically. Namely, USG seeks to stabilize or decrease GHG emissions per student, per community member, and per unit of space (discussed in more detail below).

Table ES.1. Total GHG emissions ($MTCO_2e$) by source, 2009-2011

Source	FY 2009 (Baseline)	FY 2010 (Current)	FY 2011 (Current)	*10-11% Change*	*09-11 % Change*
Heating and Cooking Fuel	1,071.5	929.9	922.5	-13.2%	-13.9%
Direct Transportation	1.5	1.3	1.3	-15.8%	-14.5%
Refrigerants & Chemicals	0.0	0.0	6.3	*N/A*	*N/A*
Fertilizer Application	0.8	0.8	0.8	0.0%	0.0%
Purchased Electricity	3,182.0	3,127.5	3,169.6	-1.7%	-0.4%
Transmission & Dist. Elect. Losses	314.7	309.3	313.5	-1.7%	-0.4%
Faculty / Staff Commuting	294.9	366.9	387.3	24.4%	31.3%
Student Commuting	4,350.8	5,418.0	5,642.1	24.5%	29.7%
Directly Financed Air Travel	15.0	26.3	22.5	75.3%	49.9%
Other Directly Financed Travel	4.1	4.2	4.4	2.1%	7.4%
Solid Waste	146.5	119.9	132.2	-18.2%	-9.8%
Wastewater	2.3	2.1	2.0	-9.0%	-10.9%
Paper	11.9	11.9	11.9	0.0%	0.0%
Scope 1	1,073.8	932.0	930.9	-13.2%	-13.3%
Scope 2	3,496.7	3,436.8	3,483.0	-1.7%	-0.4%
Scope 3	4,825.5	5,949.2	6,202.4	23.3%	28.5%
All Offsets	25.5	56.8	124.1	123.0%	387.4%
Total	9,370.6	10,261.1	10,492.2	9.5%	12.0%

1. Institutional Background

Established in 2000, The Universities at Shady Grove (USG) is the first University System of Maryland (USM) regional educational center. As a regional education center, USG is not a stand alone educational institution, but rather a partnership of nine USM institutions working towards a common mission of, "supporting and expanding pathways to affordable, high quality public education that meet the distinctive needs of the region and are designed to support workforce and economic development in the state."[1]

Physical Space

Located in heavily populated and economically thriving Montgomery County, USG's Rockville campus serves Maryland higher education institutions, businesses, and communities. The conveniently located USG campus is a resource for the employees and students of nine geographically dispersed USM institutions, including: Bowie State University, Salisbury University, Towson University, the University of Baltimore, the University of Maryland Baltimore County, the University of Maryland College Park, the University of Maryland Baltimore, the University of Maryland Eastern Shore, and the University of Maryland University College. Each of these USM institutions lends its faculty expertise to coursework completed on the USG campus, largely for the benefit of the significant USM student population that resides in and around Montgomery County. USG is entirely a commuter institution; there is no on-campus housing available. Due to the significant local population of students and employees served by USG, and the alternative – Montgomery County area students and employees traveling to other USM institutions throughout the state – USG views itself as a green campus providing a green, community-based service.[2]

The campus sits on 60 square acres and consists of a new parking garage and three primary buildings – the first built in 1992 and third in 2007 (see Table 1). The three buildings total 309,000 square feet of space; including the 193,000 square foot parking garage, the total equals about 502,000 gross square feet of space. A fourth building around 120,000 gross square feet in size is being planned. The building, which would house biological sciences, computer sciences, and engineering programs, is tentatively slated to open in FY 2018.[3]

The feature building of the USG campus is the newly constructed, LEED-Gold certified Camille Kendall Academic Learning Center (Building III). When opened, the Camille Kendall Academic Learning Center was the largest higher education building to achieve LEED-Gold certification within the State of Maryland.[4] The building,

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[1] *Source: Universities at Shady Grove (USG), 2000. Report to the Community, A Decade of Achievement through Partnerships: 2010-2010*

[2] *Source: Personal communication at USG with Karen Mitchell. December 4, 2012.*

[3] *Source: Personal communication via phone with Jessica Nardi. November 5, 2012.*

[4] *Source: USG, 2007. Camille Kendall Academic Center: Self Guided Tour.*

which won the Public Building of the Year Award in 2007 from the Maryland Chapter of American Institute of Architects, includes:

- Green flooring made from recycled glass and bamboo, a renewable resource;
- Energy star appliances in the kitchen and all recreational lounges;
- Green education features such as an energy bike for generating power with alternative energy, plaques and touchscreens to explain green design, and a small-scale model green roof for teaching;
- Thermal treated windows and a state-of-the-art HVAC system for reducing building heat, cooling, and power needs;
- A green roof, native plant landscaping, and a low water use irrigation system.

Additionally, the new parking garage includes environmentally sustainable design features such as solar-powered stairway lights, a high efficiency elevator, and is composed of recycled materials. Also, 74 percent of the unused construction material from the building was recycled.[5] The two older USG buildings are currently undergoing retrofits for the purpose of attaining LEED certification for Existing Buildings.

Table 1. Description of USG buildings *(Source: Personal Communication with Columbus Mack at USG. September 25, 2012)*

Building #	**Year Opened**	**Size (Gross Square Feet)**	**Note**
I	1992	~49,900	LEED E&B Certification Underway
II	1995	~66,900	LEED E&B Certification Underway
III (Camille Kendall Academic Center)	2007	~192,000	LEED Gold Certified
Parking Garage	2009	~193,000	Green garage incl. LED lighting throughout

The USG facilities consist of classrooms, computer labs, group meeting rooms, and offices for both USG and USM employees. There are two spaces, both within the new Camille Kendall Academic Learning Center, which are leased out to tenets: the USG bookstore and the Green Grove Café. USG pays the utilities (e.g., electric, water) within these leased spaces, which necessitates these spaces be included within the GHG inventory organizational boundary (discussed further below).

Additionally, USG operates a conference center and provides event services. Open to the public, the conference center consists of an 8,700 square foot ballroom, a 300-seat auditorium, and classrooms. Events range in size from 6 to 4,000 people with

[5] *Source: USG, 2009. Press release: The Universities at Shady Grove Celebrates Opening of First New Environmentally Sustainable Campus Parking Garage.*

primary users including local governments (e.g., Montgomery County), the federal government (e.g., NIH, FDA), and non-profit and corporate organizations. Most events consist of 100-300 people, and occur during the busy seasons in the fall and spring with a lull during the summer and winter holidays. Bon Appetite, the in-house food service vendor that operates the Green Grove Café, is available to cater events.[6]

The USG conference center creates a significant influx of external visitors, many of who are not affiliated with USG. Over the course of a year there are 600-750 events and as many as 65,000 visitors. A detailed explanation of how/whether to account for these visitors in the USG GHG inventory is provided below.

Students

Given USG's status as a regional institution, USG has a unique relationship with its students and their home institutions. USG is not a degree-granting institution. Students can take courses at USG, but will earn their degrees from their home institutions. USG considers students that take courses at USG to be its own and it seeks to provide a great educational experience for those students.

In Fall 2011, USG had slightly over 4,000 students including approximately 2,500 undergraduate and 1,600 graduate students (see Table 2). As a young and growing institution, USG has seen significant increases in its student population over the past half-decade. Between Fall 2008 and Fall 2011, the total undergraduate headcount increased 31 percent while the graduate headcount increased 37 percent. Increases in student size are correlated with increased course offerings over the period.

Table 2. USG undergraduate and graduate unduplicated headcount, by institution, fall 2008-2011 (*Source: USG Headcount, Fall 2006-2011 w/ 2012-2013 projections*)

	Fall 2008	**Fall 2009**	**Fall 2010**	**Fall 2011**
Undergraduates				
Salisbury University (SU)	10	24	23	18
Towson University (TU)	95	53	44	68
University of Baltimore (UB)	54	85	112	119
UM Baltimore (UMB)	132	229	226	242
UM Baltimore County (UMBC)	202	218	278	338
UM College Park (UMCP)	560	648	652	685
UM Eastern Shore (UMES)	66	85	91	98
UM University College (UMUC)	776	968	984	918
Total Undergrad	*1895*	*2310*	*2410*	*2486*

[6] *Source: Personal communication with Carl May, Director of Conference and Event Services, and Jessica Nardi via phone call. September 30, 2012.*

	Fall 2008	Fall 2009	Fall 2010	Fall 2011
Graduate				
Bowie State University (BSU)	39	51	32	38
Salisbury University (SU)	0	0	0	2
Towson University (TU)	51	115	131	112
University of Baltimore (UB)	79	82	59	96
UM Baltimore (UMB)	175	228	250	250
UM Baltimore County (UMBC)	65	85	79	89
UM College Park (UMCP)	615	632	703	736
UM University College (UMUC)	109	153	206	233
Total Graduate	*1133*	*1346*	*1460*	*1556*
Total Undergrad & Graduate	*3028*	*3656*	*3870*	*4042*

The distribution of USG students across USM institutions is not uniform. In Fall 2011, about 35 percent of USG students called the University of Maryland College Park (UMCP) their home institution and 28 percent of students called the University of Maryland University College (UMUC) their home institution. Historically, it has been the case that UMCP and UMUC account for about two-thirds of USG's student size with the remaining USM institutions accounting for the last one-third. However, it is important to note that some USM institutions have no undergraduate students at USG (e.g., Bowie State University), some have no graduate students at USG (e.g., University of Maryland Eastern Shore), and some have no students at all (e.g., Frostburg State University, Coppin State University).

The manner in which students utilize USG programs and course offerings varies widely. USG students may be taking USG courses exclusively or they may be splitting their time between courses offered at their home institution and courses offered at USG. Moreover, students enrolled in USG programs may be part-time or full-time students. Of the approximately 2,500 undergraduate students who participated in USG programs in Fall 2011, about 1,500 were full-time (daytime) students.[7] The remaining undergraduate students were evening students who typically take fewer credit hours.

USG, like a number of its partner USM institutions, supports students at different stages in their careers, including a large number of full-time workers. In turn, USG offers online courses through its partner institution's programs. Also, USG undergraduate students are typically third and fourth year students nearing graduation; many of these students enroll in internships and earn credit hours. The median age for all undergraduates is 25 while the median age for all graduate students is 29.[8]

[7] *Source: USG Fall 2011 Student Demographic Report.*
[8] *Source: See previous.*

One of the many goals of USG when launched was to provide Montgomery County with an additional higher education center accessible to its emerging student population. Prior to the establishment of USG, the USM had no institutional representation within Montgomery County. Currently, there are 80 degree programs serving USM students in Montgomery County and nearby locations. Moreover, the Montgomery College to USG pathway allows a large number of Montgomery College students to transfer to USG to complete their bachelor's degree. USG student demographic reports (FY 2008-2011) indicate USG is successfully serving Montgomery County students. Approximately 66 percent of undergraduate students, and 37 percent of graduate students call Montgomery County home (see Table 3).[9] USG also attracts undergraduate students from Prince George's County and Frederick County, among other locations. Graduate students, on the other hand, are more often spread throughout the greater Washington, D.C. metropolitan region.

Table 3. USG undergraduate and graduate distribution by state and county *(Source: USG, Student Demographic Reports 2009-2011)*

	Fall 2008 (FY 2009)	**Fall 2009 (FY 2010)**	**Fall 2010 (FY 2011)**
Undergraduates			
Montgomery	66%	65%	66%
Prince George's	7%	7%	6%
Frederick County	5%	5%	5%
Unknown/Other	22%	23%	23% (2% is VA)
Graduates			
Maryland	75%	75%	76%
Montgomery	*50%*	*48%*	*49%*
Prince George's	*6%*	*8%*	*7%*
Frederick	*4%*	*6%*	*4%*
Other MD	*40%*	*40%**	*40%*
Virginia	6%	5%	5%
D.C.	3%	3%	4%
Unknown/Other	16%	17%	15%

* Note: MD graduate counties sum greater than 100%; adjusted to = 100% in methods for estimating commuter GHGs (see methods worksheet)

Observed behavior suggests that when students take courses at USG, they are only taking courses at USG; the exceptions are UMCP and UMUC students, who are more likely to continue taking classes at their home institutions. Therefore, with the exception of UMCP and UMUC students, it is unlikely that USG students are traveling to or from their home institution with any frequency while enrolled in USG courses. Instead, it seems as though most USG students are commuting from their personal homes, which predominately fall in Montgomery County (see Table 3).[10]

[9] *Source: See previous.*

[10] *Source: Personal communication with Karen Mitchell, Mary Lang, Jessica Nardi and Columbus Mack at USG. September 25, 2012.*

The number of credit hours per student varies by USM institution (see Table 4). Regarding undergraduates, University of Baltimore students and UMUC students typically take fewer credit hours compared to their USM peers. Most undergraduate courses are 3 credit hours and meet 1-2 times per week. Regarding graduate students, University of Maryland-Baltimore (UMB) students take considerably more credit hours in a year than their USM peers, which is the likely influence of the UM-Baltimore pharmacy program. Most graduate courses are 3 credits and meet just once per week with the exception of the UMB pharmacy program, which meets five days per week. Very few classes are held on Fridays while some classes are held on weekends.[11] Note that tables 3 and 4 are referenced extensively in the methods for estimating GHG emissions from student commuting (see methods below).

Table 4. USG credit hours/student head count, by status, by institution FY 2009-2012 *(Calculated: see note below)**

	FY 2009	**FY 2010**	**FY 2011**	**FY 2012**
Undergraduates				
Salisbury University (SU)	27.9	28.5	30.1	32.5
Towson University (TU)	16.0	29.0	30.3	31.9
University of Baltimore (UB)	12.4	13.2	12.5	13.4
UM Baltimore (UMB)	28.2	24.4	26.2	23.5
UM Baltimore County (UMBC)	21.4	23.6	22.6	22.4
UM College Park (UMCP)	27.0	24.7	25.0	25.9
UM Eastern Shore (UMES)	21.9	23.5	24.7	24.3
UM University College (UMUC)	10.6	10.1	10.1	10.5
Total Undergrad	18.6**	18.1	18.3	19.0
	FY 2009	**FY 2010**	**FY 2011**	**FY 2012**
Graduate				
Bowie State University (BSU)	8.9	7.2	9.8	9.9
Towson University (TU)	22.0	12.0	11.6	12.2
University of Baltimore (UB)	6.4	7.1	9.2	6.2
UM Baltimore (UMB)	19.2	19.5	21.2	22.9
UM Baltimore County (UMBC)	11.5	12.3	10.3	10.9
UM College Park (UMCP)	12.3	17.5	15.4	13.3
UM University College (UMUC)	8.2	7.1	7.0	6.4
Total Graduate	12.8**	14.9	14.2	13.1

* Calculated by first deriving credit hours from FTE where undergrad FTE = 30 credits/year and grad FTE = 24 credits year *(Source: Regional Center Headcounts and FTE, FYs 2008-2011)*; Subsequently divided institution credits/year by corresponding fall headcount to arrive at results (see Table 2); ** the aggregate undergrad and graduate values are calculated by dividing total credit hours by the total number of students

[11] *Source: Personal communication with Elizabeth Yackley via phone call. October 23, 2012.*

Employees

USG has three types of employees including: (1) USG staff, coordinators, facility managers, and other individuals employed directly by USG and responsible for day-to-day operations; (2) non-teaching USM program managers and administrators responsible for representing their home institution and coursework offered through their home institution at USG; and (3) USM faculty and instructors responsible for actually teaching the courses offered at USG through their home institutions (see Table 5). Although some teaching faculty also double as program administrators, all attempts to avoid double counting are taken in the analysis that follows. The latter two types of USG employees are not technically financed by USG, but are instead financed by their home USM institution.

Table 5. Three types of USG employees and headcounts for FY 2009-2011 *(Source: Employee data pulls conducted by J. Nardi and E. Yackley)*

	Type 1 USG-financed employees*	**Type 2** USM-financed employees (Non-teaching program coordinators)**	**Type 3** USM-financed employees (Teaching Faculty)***
FY 2009	65.5	25	210
FY 2010	66.5	32.5	300
FY 2011	81.5	32	320

* In FY 2009-2011, there were two part-time employees (< 30 hours/week) accounting for 1.5 full-time employees; ** Most program administrators are on campus at least 3 days per week although variation exists across work schedules (see methods discussion below); *** Teaching faculty, with the exception of nursing and pharmacy program instructors, are on campus ~1-day per week

USG staff (Type 1 above) has more regular commuting habits compared to USM program managers and teaching faculty (Types 2 and 3). Anecdotal reports and results from the 2012 USG staff transportation survey indicate that USG staff are typically on campus 5 days per week with the exception of a few part-time employees. Additionally, most employees travel by single occupancy vehicle (87 percent), followed by carpooling with one other person (5 percent), bus (3.5 percent), and subway and walking (remainder).[12] In terms of employee home locations, there are no available data as of late 2012, but anecdotal reports suggest most staff live in Montgomery County.[13]

USM program managers and faculty (Types 2 and 3 above) have less regular commuting patterns. Among the UMB pharmacy and nursing programs, most program administrators and teaching-faculty are on campus 5 days per week. Otherwise, USM teaching faculty is typically on the USG campus only when leading a course and most faculty members teach a single course per week. Collectively, the

[12] *Source: USG Staff Transportation Survey (Conducted for LEED EB certification). Completed in November 2012.*

[13] *Source: Personal communication with Karen Mitchell at USG Campus. December 4, 2012.*

entire body of faculty instructors is on campus, on average, 1.3 times per week.[14] Most faculty members are provided with offices at their home institutions though some have offices at USG. Similarly, USM program managers split their time between their home campuses and the USG campus. However, most program managers have offices at the USG campus and tend to be on campus more frequently than teaching faculty (i.e., 3-4 days per week). Looking at course loads for teaching faculty, and removing online course instruction, as well as assuming no more than one trip per day, it is estimated that in the Spring 2013 semester, USG faculty will come to campus, on average, 16 times.[15] Beyond these general commuting trends, there is variability across the USM institutions and academic programs in terms of when and how often employees are on the USG campus.[16]

In the fall of 2012, a transportation survey of program managers and faculty was administered (Type 2 and 3). Results from the survey suggest a majority of faculty spend zero days per week on their home campus and at least one day per week at the USG campus (see Table 6). Additionally, 96 percent of faculty and program managers reported commuting by single occupancy vehicle, followed by carpooling (3 percent), and the UM-College Park Shuttle (1 percent).

Table 6. Where USG program managers and faculty spend their time *(Source: 2012 faculty survey)*

Days per Week	***0***	***1***	***2***	***3***	***4***	***5***	***5+***
% of employees reporting attendance to home institution	46	21	10	12	4	6	1
% of employees reporting attendance to USG Campus	3	29	13	10	13	29	3

Expected Growth

Over the course of the next decade USG is anticipating significant growth in physical space, student size, and program offerings. USG is a new and quickly expanding institution that is serving a dynamic, young, and growing population in Montgomery County and nearby areas. USG intends to grow sustainability through this period of expansion, but the differences between older and more established institutions, which are relatively stable in their community size and physical space, and USG, must be acknowledged for carbon footprint comparison purposes.

[14] *Source: Personal communication with Elizabeth Yackley via email. January 11, 2013.*
[15] *Source: Personal communication with Elizabeth Yackley via email. January 11, 2013.*
[16] *Source: Personal communication with Jessica Nardi and Elizabeth Yackley via email. January 2013.*

2. President's Climate Commitment

In December 2009, Executive Director of The Universities at Shady Grove, Stewart Edelstein, signed the American Colleges and Universities President's Climate Commitment (ACUPCC). With this signing, USG joined the other University System of Maryland institutions in committing to the three following tasks: (1) commit to at least three tangible action items immediately, (2) complete a GHG inventory within one year and periodically thereafter, and (3) develop a Climate Action Plan with a GHG neutrality target date and mitigation strategies for meeting that target. Responsibility for executing the ACUPCC was placed with the USG Green Committee.

Early Tangible Action Items

The implementation profile and early tangible action item description for USG can be found online at: http://rs.acupcc.org/ip/1032/. USG selected the following four early action items:

1. Establish a policy that all new construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.

   USG's newest building, the Camille Kendall Academic Center, opened in 2007, is LEED Gold certified. In addition, USG also has a green garage and is currently undergoing the steps necessary to earn LEED EB® certification for the remaining two buildings.

2. Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such products exist.

   USG formally incorporated this practice into campus policy when it submitted to the U.S. Green Building Council its application for LEED certification for the Camille Kendall Academic Center.

3. Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.

   As part of its LEED certification application, USG adopted a transportation plan in 2006 that included alternative transportation options. USG is accessible by bus, UM College Park shuttle, has electric charging stations, and encourages carpooling and fuel-efficient vehicles through a preferred parking program.

4. Participation in the Waste Minimization component of the RecycleMania competition, and adopt 3 or more associated measures to reduce waste.

   USG collects plastic, paper, cans, glass and compostable material (from the cafeteria). In addition USG routinely holds collection events for spent

batteries, light bulbs, printer/copy cartridges, and small electronics. Last, USG purchases non-toxic cleaning supplies and holds regular paper shredding events.

GHG Inventory

In compliance with ACUPCC reporting requirements, USG completed its first GHG inventory for CY 2009 in October of 2011. This document revises the initial inventory (see results below) and reflects the changes online at the ACUPCC reporting website: http://rs.acupcc.org/ghg/1919/.

Climate Action Plan

In 2012, USG completed a Climate Action Plan including reduction targets and mitigation strategies, which was submitted it to the ACUPCC reporting website and may be found at: http://rs.acupcc.org/cap/981/. The USG Climate Action Plan sets the following goals:

- A 25 percent reduction by 2020 relative to a 2011 baseline (Commensurate with the MD Greenhouse Gas Reduction Act of 2009;
- A 50 percent reduction by 2035 relative to a 2011 baseline;
- Carbon neutrality by 2050.

3. Inventory Overview

As outlined in the institutional background section, USG is an atypical institution with regards to both its educational and operating structure. In turn, conducting a GHG inventory must begin by carefully aligning the inventory boundaries (i.e., temporal and organizational boundaries) and methods with the institution's unique structure.

Organizational Boundary

In parallel with other USM institutions, *USG has adopted a financial control definition* to establish its organizational boundary. The rules and guidelines that constitute this boundary are strictly followed for relevance, completeness, consistency, and accuracy. The financial control boundary adheres to the three following guidelines:

1) Only include buildings owned or controlled by USG or for which USG pays the electric-power and other utility bills;
2) For estimating regular commuter emissions, include all USG employees in addition to all USM faculty and students, regardless of their affiliation with their home institution;
3) Travel to and from USG facilities by non-USM members (e.g., Montgomery County public officials) will not be included in the GHG inventory.

As a result of the financial control boundary definition, the USG will include all three buildings on their Rockville campus plus leased space (i.e., the book store and the Green Grove Café) for which USG pays utility bills. In addition, electricity consumption for the USG parking garage is included (as a component of building III). Including the parking garage, the campus physical footprint covers approximately 502,000 gross square feet. The physical footprint of the USG GHG inventory will expand with new building construction and operation (e.g., planned fourth USG building).

USG intends to account for the regular commuting patterns of all employees and students to and from USG including those individuals which are not uniquely its own (i.e., other institution's faculty and students). For example, a Salisbury University employee who spends part of her time at USG and part of her time at her home institution will be captured in the USG inventory. While this approach could create double-counting issues because individuals may be counted at both their home institution and USG, we believe it is both responsible and conservative to account for these individuals. The goal is to develop a methodology robust enough to account for only USG travel, and not home institution travel, which will abate double counting concerns with the home institutions.

An alternative approach, which would remove the double counting concern, might be to not count employees and students from other USM institutions at all. An argument could be made that Salisbury University employees are paid by Salisbury

University and should be captured by the Salisbury University GHG inventory. However, USG does not adhere to this approach and seeks to take full responsibility for how USM employees and students use USG facilities. USG recognizes that it thrives on a working partnership with the USM institutions, and has a financial stake in its relationship with these institutions. Therefore, USG will account for all employee and student commuting regardless of home institution affiliation. The methods for estimating commuting patterns and allocating responsibility are discussed in more detail below.

Finally, note that USG will not account for GHG emissions related to visitor travel to and from its conference center facilities. USG assumes that users of the conference center facilities, including Montgomery County and the U.S. government, are financially responsible for their travel and are therefore responsible for associated GHG emissions. Similarly, when USG finances travel for its employees to attend events, USG will be responsible for capturing those GHG emissions. As stated above, USG is responsible for GHG emissions associated with operating the conference center facility (e.g., electricity, solid waste).

Temporal Boundary

USG has opted to capture GHG emissions on a fiscal year (FY) basis because it aligns with and streamlines other reporting requirements. Fiscal years begin July 1 and end June 30, with the first FY captured by USG being FY 2009 (July 1, 2008). FY 2009 was selected as the first inventory year because it is recent and has high-quality, readily available data.

Operational Boundary, Sources and Activity Data

The USG GHG inventories include three scopes of operations including emissions from directly financed activity (Scope 1), purchased electricity (Scope 2), and indirectly financed activity (Scope 3). These scopes and the activities within them correspond to those outlined in the World Resources Institute/World Business Council for Sustainable Development GHG protocol.

The distinction in scope is important because it indicates USG's capacity to control emissions. Scope 1 emissions can be controlled fairly easily (e.g., change in fertilizer application policy or fleet technology) while Scope 3 emissions are more difficult to control due to their indirect nature. Each scope has a different set of activities that fall within it. Each of these activities must be captured for a comprehensive GHG inventory (see Table 7).

Table 7. USG activity data by scope, units or inputs, and note about activity

Activity Data	Input/Units	Note
Scope 1		
Purchased fuels for heating/cooking	Therms purchased; convert to MBTUs	USG uses primarily natural gas; data from Washington Gas Services utility invoices; diesel used for back-up generators
Purchased fuel for USG vehicles	Gallons purchased	USG has one gas-powered pick-up; data available from USG records
Fertilizer application	Pounds applied; % N of fertilizer; organic vs. synthetic	Data available from vendor records
Refrigerant released	Pounds released	Examples include CFCs, HFCs, and HFEs; data available in regular reports to EPA
Scope 2		
Purchased electricity	Kilowatt-hours (kWhs)	Data available from utility invoices from PEPCO, sorted by 3 buildings and month
Fuel Mix	% attributable to generating sources	Use EPA eGRID 2012, MD mix to align with USM methods
Scope 3		
Employee commuting	Vehicle miles traveled; convert to gasoline combusted w/ fuel economy	Data from surveys, HR employee numbers; requires assumptions
Student commuting	Vehicle miles traveled; convert to gasoline combusted w/ fuel economy	Data from surveys, student enrollment and demographic reports; requires assumptions
Paper procurement	Reams or pounds of paper; % recycled	Data available from USG records
Wastewater	Gallons of sewer water	Data available from WSSC invoices; assumed to be processed at the Blue Plains WWTP
Air travel (Financed by USG)	Miles traveled	Data available from USG records
Rail travel (Financed by USG)	Miles traveled	Data available from USG records
Reimbursed travel (Financed by USG)	Miles traveled	Data available from USG records
Solid waste generated	Short tons generated	Data available from vendor records
Offsets		
Compost	Short tons generated	Data available from vendor records
Renewable Energy Credits	Megawatt-hours (MWhs)	Not directly purchased; calculated based on RPS law

General Methods and Tools

The GHG inventories for FYs 2009-2011 are completed using the most current version (v6.8) of the Clean Air Cool Planet Campus Carbon Calculator (CA-CP). The tool is widely used among higher education institutions and is regularly updated to reflect new findings in climate science. The CA-CP calculator translates activity data (e.g., gallons of gasoline consumed) into GHG emissions by using emission factors (e.g., CO_2 per gallon of combusted gasoline). This is performed for all GHGs (e.g., methane, chlorofluorocarbons, etc.) and a final normalized value that captures all GHGs known as metric tons of carbon dioxide equivalent ($MTCO_2e$) is calculated.

In addition to the data entry and conversion platform provided by the CA-CP calculator, the FY 09-11 inventories include USG-tailored GHG analysis to account for USG's unique commuting situation, the Maryland electricity fuel mix, and corresponding renewable energy credits from the state's Renewable Portfolio Standard. All methods employed to estimate GHG emissions at USG are explained in further detail in the source descriptions below.

4. Detailed Source Descriptions, Activity Data and Methods

The following section outlines each of the three emissions scopes captured in this inventory, the activities included within those scopes, and methods for transforming available activity data into acceptable inputs for the CA-CP Campus Carbon Calculator.

Scope 1

Purchased Fuels for Cooking and Heating

USG purchases natural gas for heating and cooking purposes from Washington Gas Services. Heat for the three USG buildings comes from on-site, natural gas-fired boilers. Natural gas is used for cooking as well, performed at the Green Grove Café and kitchen-classrooms on the USG campus. Natural gas invoices from Washington Gas present total consumption in therms. To convert therms to MBTU (Millions of British Thermal Units), the unit needed for input into the CA-CP Campus Carbon Calculator, divide therms by 10.

Peak natural gas consumption occurs during the coldest winter months (see Figure 1). As the largest USG building, the Camille Kendall Academic Center consumes the most natural gas – about double the amount consumed by each of the other two campus buildings. For the period FY 2009-2011, the month of January has, on average, required the most natural gas, which is correlated with the coldest weather and greatest heating demand. In contrast, July and August, on average, each required less than one-quarter the amount of natural gas of January.

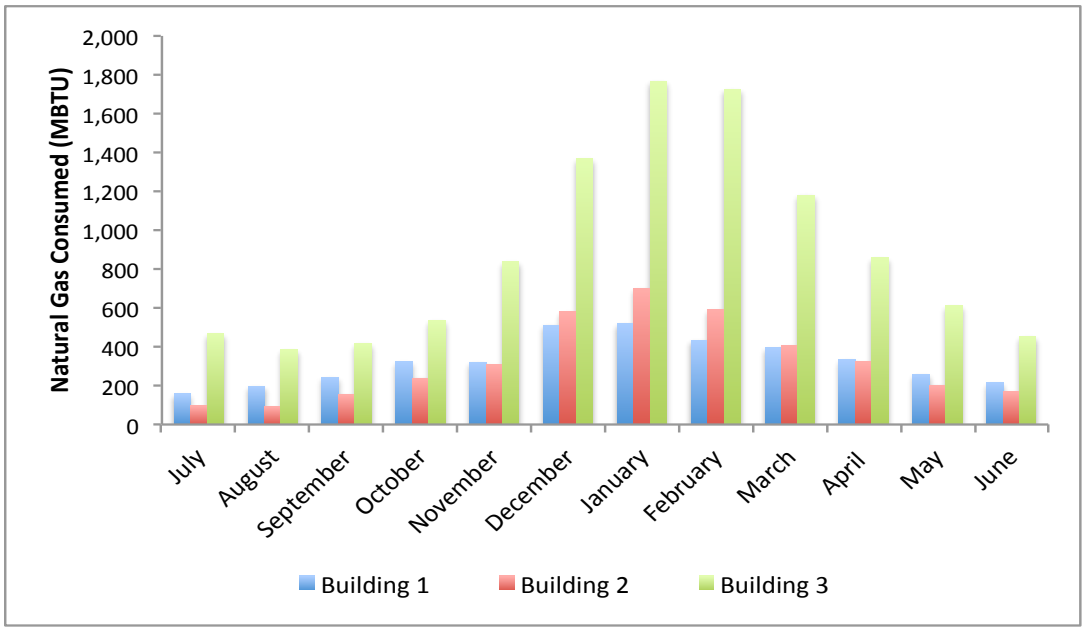

Figure 1. 3-year average of natural gas consumption (in MBTU), by month, and building, FY 2009-FY 2011 *(Source: Utility invoices provided by Columbus Mack)*

Table 8. USG natural gas consumption and associated metrics, FY 2009-2011
(Source: Utility invoices provided by Columbus Mack)

Year	Purchased Natural Gas (MBTUs)	NG per GSF (MBTU/GSF)*	HDDs[17]	Natural Gas per HDD (MBTUs/HDD)
FY 2009	20,262	0.065	4,889	4.144
FY 2010	17,486	0.056	4,623	3.782
% Change 09-10	-13.70%	-13.85%	-5.44%	-8.74%
FY 2011	17,413	0.056	4,907	3.549
% Change 10-11	-0.42%	0.00%	6.14%	-6.16%

* Excludes the parking garage because garage is not heated

Total natural gas consumption decreased between FY 2009 and FY 2011 by about 14 percent. Comparing FY 2009 to FY 2011, USG decreased its natural gas consumption per unit of space and per heating degree-day (see Table 8). Heating degree-days (HDDs) is a figure that approximates building heating needs and is calculated as the difference between 65 degrees Fahrenheit and the daily average air temperature (65 degrees Fahrenheit is a common baseline temperature at which no building heating or cooling is necessary). Conversely, cooling degree-days (CDDs) indicates how much cooling is necessary based on the difference between the average air temperature and 65 degrees. In general, HDDs is directly correlated with natural gas consumption for heating purposes while CDDs is directly correlated with electricity consumption for air conditioning purposes (see electricity discussion below). For example, a cold, 30-degree January day would not generate any CDDs, but would generate approximately 35 HDDs.

Combustion of natural gas creates GHGs including carbon dioxide, methane and nitrous oxide. GHG emissions from natural gas combustion are estimated via total values of MBTU consumed for both heating and cooking purposes (see Table 8 and CA-CP Campus Carbon Calculator).

Purchased Fuel for Back-up Electricity Generation

USG has three diesel-powered, back-up electricity generators located in each of its buildings. The generators self-test regularly and consume diesel fuel in the process. The University of Maryland-College Park (UMCP) Facilities Management monitors the generators and, as of recently, "tops-off" the fuel tanks in the generators. Between 2011 and 2012, UMCP provided about 1,000 gallons of diesel annually for

[17] *Source: HDD and CDD data from the NOAA National Climatic Data Center available online at: http://www.ncdc.noaa.gov/temp-and-precip/time-series/.*

the three generators.[18] This fuel was not financed by USG, however, and is therefore not included in the GHG inventory. The presumption is that UMCP accounted for this diesel fuel in its GHG inventory via its fuel dispensation records.

For the period between FY 2009 and FY 2011, USG purchased diesel fuel twice – 508.1 gallons in March 2010 (FY 2010), and 168 gallons in August 2010 (FY 2011). Only these two procurements of diesel fuel are captured in the inventories for the period FY 2009-2011.[19]

Combustion of diesel fuel creates GHGs including carbon dioxide, methane and nitrous oxide. GHG emissions from diesel fuel combustion are estimated via total quantities of diesel fuel consumed (Gallons), which is the input for the CA-CP Campus Carbon Calculator.

Purchased Gasoline for USG Fleet

USG owns a single vehicle – a gasoline-powered pick-up truck. The quantity of gasoline purchased for the vehicle is tracked through gas dispensation records. Compared to the process for estimating gasoline consumption through commuter activity in scope 3, the methods for capturing scope 1 fleet-based emissions is straightforward and does not require estimation of travel behavior. In FY 2009, 164 gallons of gasoline consumed; in FYs 2010 and 2011, approximately 140 gallons of gasoline were consumed.[20]

Gasoline combustion creates GHG emissions including carbon dioxide, methane and nitrous oxide. The CA-CP Campus Carbon Calculator input for estimating GHG emissions from fleet usage is total gasoline consumption.

Fertilizer Application

Between FY 2009 and FY 2011, USG retained vendor services to have its property fertilized. A request was made to have the vendor provide information on its fertilizer applications. Specifically, USG requested to know the number of treatments made each year, the type of fertilizer used for each treatment (i.e., synthetic or organic), the nitrogen content of the fertilizer application (i.e., % N), and the total quantity applied (i.e., pounds of fertilizer). Each year there were four fertilizer treatments with an average of 19.25% nitrogen content and a total of 1,000 pounds of fertilizer applied (see Table 9).

[18] *Source: Personal communication with Columbus Mack at USG. December 4, 2012.*
[19] *Source: See previous.*
[20] *Source: See previous.*

Table 9. Fertilizer applications at USG, FY 2009-2011 *(Source: Fertilizer vendor provided information via Columbus Mack)*

	Treatment 1	**Treatment 2**	**Treatment 3**	**Treatment 4**
Fertilizer Type	Synthetic	Synthetic	Synthetic	Synthetic
Nitrogen %	13	0	32	32
Pounds applied	250	250	250	250

Fertilizer, and in particular, the nitrogen in fertilizer contributes to GHG emissions through the formation of nitrous oxides. As soil microbes are exposed to nitrogen, they manufacture nitrous oxides, a potent GHG, at a faster rate. To the extent fertilizer with less nitrogen can be used, and less total fertilizer, USG can reduce its GHG emissions from fertilizer application.

Refrigerant Released

Refrigerants are used in building heating and cooling because of their ideal thermodynamic properties. Common refrigerants include fluorocarbons and chlorofluorocarbons. Refrigerants are occasionally released into the atmosphere when building HVAC equipment is retrofitted or replaced – these refrigerant released are tracked and recorded at most organizations by Environmental Health and Safety departments per U.S. Environmental Protection Agency rules.

According to USG's HVAC technician responsible for tracking refrigerants, the kitchen equipment was under warranty and serviced as a part of the warranty contract associated with the original building construction. In turn, there were no refrigerant releases in FYs 2009 and 2010. In FY 2011, there were approximately 8.125 pounds of HCFC-22 released and 14 pounds of 407c.
Refrigerants are unlike carbon dioxide, methane, and other common GHGs. Refrigerants have a very high global warming potential and are capable of significantly more climate forcing (i.e., warming or cooling) relative to other GHGs. Nonetheless, refrigerants are infrequently emitted into the atmosphere and constitute a small volume of total GHG emissions emitted annually. By closely monitoring and controlling refrigerant emissions, USG can address a major source of GHGs at a relatively low cost. The CA-CP Campus Carbon Calculator input for estimating GHG emissions from refrigerant releases is the total weight of chemical released.

<u>Scope 2</u>

Purchased Electricity

Greenhouse gas emissions from purchased electricity are a function of the total electricity purchased (i.e., consumed) and the electricity fuel mix, or from what sources the electricity is generated. The CA-CP Campus Carbon Calculator also

estimates GHGs associated with electricity transmission and distribution losses based on the total amount of purchased electricity. Purchased electricity data for USG come from the monthly invoices provided by Pepco, the local electricity utility.

USG purchases 100 percent of the electricity it uses and generates none of it. In FY 2009, USG purchased approximately 5.61 million kWhs of electricity. In FY 2010 and FY 2011, less electricity was purchased despite bringing on new space via the parking garage in 2009 (see Table 10). Comparing the period FY 2009 to FY 2011, USG is decreasing its electricity consumption per unit of space and per cooling degree-day (CDD). Because USG buildings are cooled through electricity-based cooling systems (i.e., air conditioning), as opposed to the heating system, which relies on gas-fired boilers, CDDs are the more relevant weather-based metric for evaluating electricity consumption.

Table 10. USG purchased electricity and associated metrics, FY 2009-2011 *(Source: Utility invoices provided by Columbus Mack)*

Year	Purchased Electricity (kWhs)	Electricity per GSF (kWhs/GSF)*	CDDs	Electricity per CDD (kWhs/CDD)
FY 2009	5,618,223	18.0	997	5,635
FY 2010	5,530,640	11.0	1,197	4,620
% Change 09-10	-1.56%	-38.89%	20.06%	-18.01%
FY 2011	5,605,116	11.1	1,309	4,282
% Change 10-11	1.35%	0.91%	9.36%	-7.32%

* Includes the parking garage beginning in FY 2010 (opened in Fall 2009) because of lighting needs

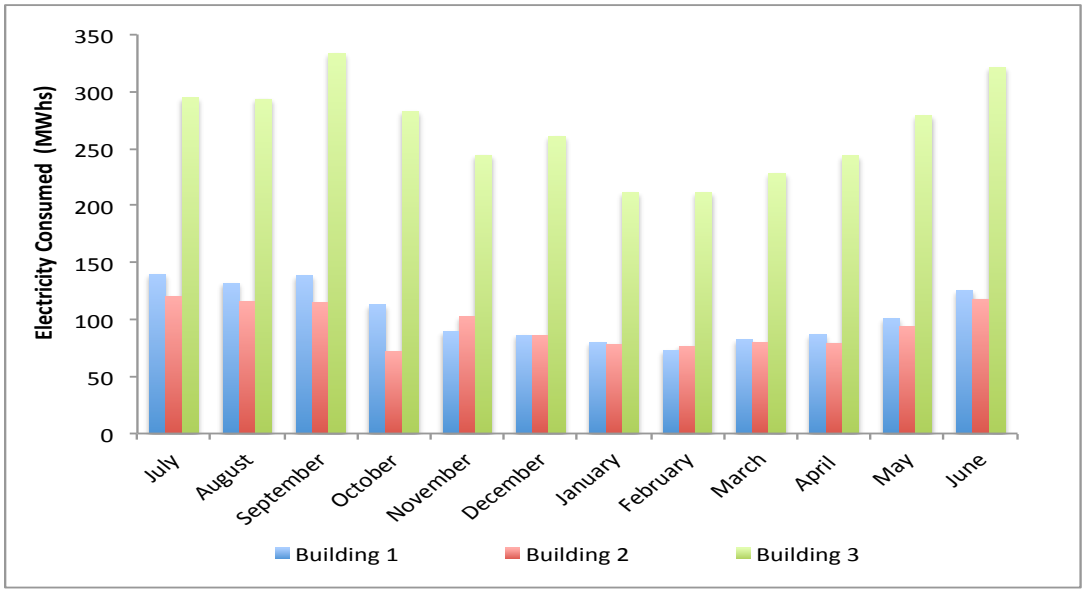

Figure 2. 3-year average of electricity consumption (in Megawatt-hours MWhs), by month, and building, FY 2009-FY 2011 *(Source: Utility invoices provided by Columbus Mack)*

As shown in figure 2, building 3 consumes about the same amount of electricity as buildings 1 and 2 combined. Peak electricity consumption occurs during the hot summer months indicating a significant end-use for USG purchased electricity is building cooling. September, the month of greatest average electricity consumption for building 3, requires approximately 1.6 times more power than January, the month with the least average electricity consumption, for building 3.

The fuel mix for purchased electricity is estimated from the U.S. Environmental Protection Agency's eGrid database.[21] For the period FY 2009-2011, summary results for the State of Maryland from eGrid 2012, Version 1.0 are used to represent the USG purchased electricity fuel mix. The eGrid 2012 database is the most current and captures only 2009 electricity generation data. Therefore, all three FYs represented in the current USG GHG inventory reflect only a single year (2009) of electricity generation in the State of Maryland (see Table 11).

Table 11. Electricity fuel mix (% generated from each source) for Maryland in 2009 and USG FYs 2009-2011 *(Source: U.S. EPA, eGrid 2012 database)*

Net Purchased*	Coal	Natural Gas	Distillate Oil (#1-#4)	Nuclear	Hydro-Electric	Biomass
1.24%	55.20%	4.04%	0.75%	33.24%	4.31%	1.21%

* Net purchased is treated as an unknown fuel source; for the purpose of estimating GHGs, the CA-CP redistributes the net purchased % across other known sources

Alternative methods for estimating the USG fuel mix could be adopted. For example, instead of aligning the fuel mix with the entire state of Maryland, USG could align the fuel mix the local utility, Pepco, which publishes its fuel mix online, or the NERC sub-region, which better approximates the broad geographic region from which USG actually draws electricity. Nonetheless, the state-aligned method of estimating electricity fuel mix is the accepted practice within the University System of Maryland and should be used henceforth for USG inventories. Note that a new eGrid database is released every two years (e.g., 2012 and 2010 are the most recent) and each release presents data 3-years in the past (e.g., the 2012 version presents the 2009 fuel mix, and the 2010 dataset presents the 2007 fuel mix). The next release will be the 2014 eGrid corresponding to 2011 data.

The USG GHG inventory internalizes Maryland's renewable portfolio standard (RPS). Maryland's RPS requires that load serving entities such as Pepco provide a certain percentage of their electricity from renewable energy sources. The exact amount of electricity to be provided from renewable sources escalates annually until the target of 20 percent renewable by 2022 is reached. The eGrid 2012 electricity fuel mix for Maryland (i.e., USG fuel mix in Table 11 above) does not reflect the Maryland RPS requirements in-part because it captures only 2009, but also because renewable

[21] *Source: U.S. EPA, 2012. 2012 eGrid Version 1.0, year 2009 Summary Tables: State of Maryland. Available online at: http://www.ncdc.noaa.gov/temp-and-precip/time-series/.*

electricity may be generated outside of Maryland and transmitted to the state or purchased by load serving entities via renewable energy credits (RECs).

The Maryland RPS is accounted for in the USG inventory by adding RECs proportional to the amount that should have been provided by Pepco and were **not** reflected in the eGrid data. The method for calculating RECs, presented in Table 12 below, considers any shortfall in renewable electricity supplied in the eGrid fuel mix relative to the RPS requirement for each year. Calculating the amount of RECs attributable to USG is based upon the following steps: (1) identify the total RPS requirement for each year, (2) calculate the renewable percentage provided by the eGrid fuel mix, being sure to disaggregate by RPS tier and to not double count any fuel source, (3) subtract the fuel mix sum from the RPS requirement and, (4) multiply that difference by the total purchased electricity to arrive at the total number of RECs delivered to USG (see Table 12).

Table 12. Methods for estimating USG RECs, FY 2009-2011 *(Calculated, see description above)*

Year and Quantity Purchased		**RPS Requirement (%)**				**Fuel Mix (%)**				**Multiplier**	**RECs (kWhs)**
Year	*Purchased Electricity (kWhs)*	*Solar*	*Tier 1*	*Tier 2*	*Total RPS*	*Sol.*	*Biomass (Tier 1)*	*Hydro (Tier 2 Max)**	*Sum*	*Total RPS Minus Sum*	*Electricity times multiplier*
2009	5,618,223	0.01	2.0	2.5	4.51	0	1.21	2.5	3.71	0.8	44,946
2010	5,530,640	0.025	3.0	2.5	5.525	0	1.21	2.5	3.71	1.815	100,381
2011	5,605,116	0.05	4.95	2.5	7.5	0	1.21	2.5	3.71	3.79	212,434

* The maximum requirement for tier 2 renewable resources, which includes hydroelectricity is 2.5 percent. The fuel mix exceeds this figure (4.31% from hydro), so the maximum of 2.5% is used in-lieu.

Scope 3

Student Commuting

Across the University System of Maryland, and all of higher education for that matter, colleges and universities are struggling with how to accurately and efficiently estimate GHG emissions from regular student commuting. As a result of data limitations, complex commuter behavior, and budget and time constraints, there is seldom a clear way forward with this estimation exercise. USG is no different in this regard – we seek a low-labor and low-cost method of accurately estimating commuter emissions. Furthermore, the adopted method should be sensitive to actual changes on the ground (i.e., how students commute) and repeatable in subsequent GHG inventories. The following section describes a method adopted specifically for estimating USG student commuter GHGs, which strives to meet the criteria described above.

First, it should be reiterated that USG has an atypical educational structure. There is no on-campus housing at USG, students are not technically USG's, and students may or may not be splitting their time among USG, their home campus, work, and/or

internships, which is common for the upperclassmen who makeup the USG student body. The aforementioned factors create unique challenges for accessing University System of Maryland student data and making assumptions about commuting patterns.

The methodology for estimating commuter GHGs begins with a closer look at available (and unavailable) data. The commuter data situation at USG is as follows:

- Available data and anecdotal information:
    - Student headcount, full time equivalency (FTE), credit hours by student home institution and status (e.g., undergraduate or graduate student) (see Tables 2 and 4);
    - Student home locale at state and county level, by status from the Annual Student Demographic Reports (see Table 3);
    - UM College Park students have access to a shuttle that runs between College Park and Shady Grove seven times per day;[22]
    - Anecdotal information about student commute patterns, including:
        - Most USG students are taking courses at USG only and not their home institution;
        - Most students commute to USG no more than 4 times per week with the exception of UMB pharmacy program students who commute to USG 5 times per week;
        - Most courses are 3 credits with graduate courses being offered typically just once per week and undergraduate courses 1-2 times per week;
        - Parking is free and most students commute to campus in single occupancy vehicles;
    - Supplemental data from the 2010 U.S. Census, including:
        - The home location, by percent of individuals age 18-30 for Montgomery County ZIP codes (and other regional counties);[23]
        - The road-networked distance between population centers in area counties and Montgomery County ZIP codes;[24]
- Unavailable data:
    - Student home ZIP or street level addresses;
    - Student commute mode information (i.e., bike, single occupancy vehicle, public transportation);
        - Note: A transportation survey of students was completed in 2011, but the results were inconclusive and not applied to the current GHG inventories;

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[22] *Source: University of Maryland College Park, Department of Transportation Services. 2012. Universities at Shady Grove Park and Ride Schedule. Available online at: http://www.transportation.umd.edu/images/Shuttle/Schedules%20pdfs/current/124_USG.pdf.*

[23] *Source: U.S. Census Bureau, 2010 Census. Available online at: http://2010.census.gov/2010census/data/*

[24] *Source: Google maps.*

- Student fuel efficiency information (i.e., make, model, year of vehicles).

With a better understanding of data availability, multiple methods, each with a different set of assumptions, are developed for estimating GHG emissions from commuting. Based on the fact that parking at USG is free and anecdotal evidence that most students drive to campus alone, we begin with the critical assumption that *100 percent of students commute to campus alone by gasoline-powered vehicles*. Additionally, note that we only account for regular commuting to USG for course purposes – trips solely for social or other purposes are not considered.

The general process for estimating GHGs from commuting begins with an estimation of student trips (see Table 13), represented by the following equation:

*TRIPS = Number of students (Headcount) * number of trips per week * number of weeks per year (standard value of 30 weeks/year = two 15 week semesters) * roundtrip factor (standard value of 2)*

Table 13. One-way trips taken by USG students, by FY, by institution *(Calculated, see methods above)*

	FY 2009	**FY 2010**	**FY 2011**	**FY 2012**
Undergraduate				
Salisbury University (SU)	2,400	5,760	5,520	4,320
Towson University (TU)	17,100	12,720	10,560	16,320
University of Baltimore (UB)	9,720	15,300	20,160	21,420
UM Baltimore (UMB)	31,680	54,960	54,240	58,080
UM Baltimore County (UMBC)	48,480	52,320	66,720	81,120
UM College Park (UMCP)*	92,400	113,520	114,480	122,400
UM Eastern Shore (UMES)	15,840	20,400	21,840	23,520
UM University College (UMUC)	93,120	116,160	118,080	110,160
Total Undergraduate	*352,740*	*433,140*	*453,600*	*479,340*
	FY 2009	**FY 2010**	**FY 2011**	**FY 2012**
Graduate				
Bowie State University (BSU)	4,680	6,120	3,840	4,560
Salisbury University (SU)	0	0	0	240
Towson University (TU)	12,240	20,700	15,720	20,160
University of Baltimore (UB)	9,480	9,840	7,080	11,520
UM Baltimore (UMB)**	52,500	68,400	75,000	75,000
UM Baltimore County (UMBC)	7,800	15,300	9,480	10,680
UM College Park (UMCP)*	100,200	103,260	116,040	121,980
UM University College (UMUC)	13,080	18,360	24,720	27,960
Total Graduate	*210,480*	*252,480*	*262,380*	*282,600*

* Accounts for trips avoided through use of UMCP-USG Park and Ride; ** Assumes UMB graduate students are commuting 5 times per week

The values for each of these inputs are constant with the exception of "number of trips per week," which varies across institutions depending on the number of credit hours per headcount, by institution (see step-by-step description below). Next,

student trips must be allocated geographically – from where are students coming? With information about the percentage of trips from particular locations and the distance between that location and USG, it is possible to estimate vehicle miles traveled (VMT) using the following equation:

*VMT = TRIPS * % of trips from location A * road-networked distance between location A and USG…repeat for all location A-Z*

The values for trip allocation across different geographic locations (ZIP code center or county population center) are derived from the known student home distribution values (see Table 3). However, the information in table 3 is low-resolution and there is a need for assumption making. For example, in FY 2011, 66 percent of undergraduate students came from Montgomery County, but where precisely in Montgomery County is unknown. The assumptions about where specifically students are commuting from are described in more detail below (see Appendix C). Last, GHGs are estimated through the following equation:

*GHGs = VMT * fuel efficiency (standard value set by CA-CP = 24.17 MPG) * emission factors ($MTCO_2e$ per gallon of gasoline)*

Within this general process of estimating TRIPS, VMT, and GHG emissions, there is significant room for assumption-making resulting in a range of outcomes. Table 14 below outlines 9 different methods, each with slightly varying assumptions, and outcomes for the number of student trips, vehicle miles traveled, and GHG emissions in FY 2011. The method highlighted in gray (1a1-Bus) reflects the actual methodology adopted for the period FY 2009-2011 (described in further detail in Box 1 below).

Among the 9 different methods for estimating student commuter GHGs, the range of TRIPS is ~178 thousand (Min. = 663k; Max. = 841k), the range of VMT is ~10 million (Min. = 13 million; Max. = 23 million), and the range of GHG emissions is 3,666 (Min. = 4,864; Max. = 8,530). The methods are based on reported data including student headcount, FTE, and known locations (by county) – as these data points change from year-to-year, commuter GHGs will reflect this change. Assumptions about where exactly in counties students are coming from, frequency of travel based on credit hours, and UMCP Park and Ride usage are not tied to any regularly reported data and should be tested against actual data (e.g., USG administered transportation survey). Method *1a1 – Bus* is selected as the preferred method because it is fine enough resolution to account for particular commute behaviors such as UMCP Park and Ride ridership and UMB Pharmacy students, while simultaneously being an efficient and repeatable calculation methodology. The step-by-step process for estimating student commuter GHGs via this method is described below.

Table 14. Total trips, VMT, and GHGs ($MTCO_2e$) in FY 2011 under 9 scenarios with varying assumptions *(Calculated, see methods above)*

Method Name	Description/Assumptions	# Trips	VMT	GHG ($MTCO_2e$)
1a1 – Bus	Disaggregates headcount by each institution; # of trips follows algorithm A*; Montgomery county students are distributed based on U.S. Census 2010 ZIP distribution and other locations by county population center (see Appendices A-C); Subtract UMCP trips for USG Park and Rid (Bus)***	663,480	15,147,794	5,642
1a1 – No Bus	Disaggregates headcount by each institution; # of trips follows algorithm A*; Montgomery county students are distributed based on U.S. Census 2010 ZIP distribution and other locations by county population center	715,980	16,254,680	6,054
1a2 – No Bus	Disaggregates headcount by each institution; # of trips follows algorithm A*; All students come from county population centers – do not breakdown MOCO by ZIP	715,980	16,630,095	6,194
1a3 – Bus	Disaggregates headcount by each institution; # of trips follows algorithm A*; Montgomery county students are distributed based on U.S. Census 2010 ZIP distribution and other locations by county population center; Assume all UMCP students come from College Park; Subtract UMCP trips for USG Park and Rid (Bus)***	663,480	13,058,445	4,864
1a3 – No Bus	Disaggregates headcount by each institution; # of trips follows algorithm A*; Montgomery county students are distributed based on U.S. Census 2010 ZIP distribution and other locations by county population center; Assume all UMCP students come from College Park	715,980	14,213,445	5,294
1a4 – No Bus	Disaggregates headcount by each institution; # of trips follows algorithm A*; All students travel from home institution regardless of distance	715,980	22,899,960	8,530
1b1 – No Bus	Disaggregates headcount by each institution; # of trips follows algorithm B**; Montgomery county students are distributed based on U.S. Census 2010 ZIP distribution and other locations by county population center	700,980	15,821,704	5,893
2b1 – No Bus	Aggregates headcount (No institution breakout); # of trips based on algorithm B**; Montgomery county students are distributed based on U.S. Census 2010 ZIP distribution and other locations by county population center	841,200	18,655,246	6,949

2b2 – No Bus	Aggregates headcount (No institution breakout); # of trips based on algorithm B**; All students come from county population centers – do not breakdown MOCO by ZIP	841,200	19,211,503	7,156

* Algorithm A: If number of credit hours/headcount (see Table 4) > 18, then commute 4 times/week; if between 12-18, then 3 times per week; if < 12, then 2 times per week AND assume all UMB graduate students travel 5 times per week (Represents Pharmacy School);
** Algorithm B = Algorithm A EXCEPT do not treat UMB Pharmacy School differently;
*** UMCP bus trips based on assumption of 20 undergrads per shuttle trip, 7 trips per day, 5 days per week, 30 weeks per year, 2 trips per student (Roundtrip) = 42,000 single occupancy trips avoided; and similar assumptions for 5 graduate students = 10,500 single occupancy trips avoided.

Box 1. Step-by-step methods for estimating student commuter GHGs

Initial Assumptions:

- 100% of students commute by single occupancy, gas-powered vehicles;
- Students are not commuting from work or their home campus, but from the home counties listed in Table 3 and further specified in Appendix C;

Step 1: Estimate credit hours by headcount, by institution, by status

- Using the Regional Center Headcount reports estimate the number of credit hours per headcount by institution and status (see Table 4);
  - Assume that the number of enrolled students does not differ significantly between the fall and spring semesters. Furthermore, note that the headcount figures do not account for students enrolled in only online courses. If a student is enrolled in at least one face-to-face course, they will be represented in the count total.[25]

Step 2: Estimate Student Trips

- Multiply output from step 1 (credit hours per headcount) by 2 (roundtrip) * 30 (weeks per year) * days per year (See algorithm below);
  - Algorithm: If more than 18 credits/headcount = 4 trips per week; if between 12 and 18 (inclusive of 12 and 18) = 3 trips per week; if less than 12 credits/headcount = 2 trips per week. EXCEPT all UMB Graduate Students = 5 trips per week;
- Subtract trips from College Park students based on the following calculation:
  - Assume 7 shuttle trips per day, 5 days per week, 30 weeks per year, 2 car trips avoided per bus ride per student AND 20 undergraduate students per bus ride AND 5 graduate students per bus ride for (-42,000 vehicle trips for UMCP undergraduates/year) and (-10,500 vehicle trips for UMCP graduates/year) (see Table 4);

Step 3: Allocate Student Trips By Geographic Locations

- Working with graduate and undergraduate students separately, as well as each institution, reference the Student Demographic Report home location numbers (see Table 3 and Appendix C);
  - Assume all undergraduates, regardless of institution, are distributed in the manner reflected in the Student Demographic Report (same for graduate

[25] *Source: Personal Communication with Mary Lang via email. October 24, 2012.*

students);
    - Assume within Montgomery County, students are distributed across 45 Montgomery County ZIP codes in a manner equal to the age 18-30 population (see Appendix A);
    - Assume students from other counties (listed) are coming from population centers (Appendix B);
    - Assume students from Virginia, DC, and Maryland (counties not listed) are equally distributed among the counties within 60 miles from the USG campus;
    - Assume students listed as other/unknown are distributed evenly across all counties;
- Multiply each trip value (separated by institution and status) by the percent geographic allocation and corresponding distance to arrive at vehicle miles travel;
- Sum the VMT across all institutions undergraduate and graduate;

Step 4: Calculate GHG Emissions Using CA-CP Calculator

- Plug value for vehicle miles traveled into CA-CP Campus Carbon Calculator, under Scope 3, "Student Commuting/Automobile;"

Repeat for each Fiscal Year

Employee Commuting

The methods for calculating employee GHG emissions were adopted through several pieces of information including employee counts, course scheduling data, two transportation surveys – one for regular USG staff and one for USM program administrators and teaching faculty – and anecdotal reports on commuting patterns. As highlighted in the employee portion of the introduction, employees come in three types and each has slightly varying commuting behavior and associated data. The methods for estimating vehicle miles traveled for each of these employee types are highlighted below.

Type 1 Employees – USG Staff[26]

Headcount data for FY 2009-2011 were provided anecdotally (i.e., no report is regularly generated) (see Table 5). At least two individuals were part-time employees working 30 hours per week for the period FY 2009-2011; these two individuals were treated as 1.5 full-time employees. To calculate the total number of trips taken by USG staff, the total number of employees was multiplied by 5 days/week, by 48 weeks/year, and by two times per day (i.e., one round-trip). This total trip value was subsequently multiplied by the

[26] *In late January 2013, a dataset of USG staff home zip codes was found and compared to the actual methods. The average one-way distances were compared and the actual methods were found to over-estimate average commute distance by about 4 miles. The next USG GHG inventory should incorporate actual USG staff home zip code data.*

mode-choice distribution estimated via the USG staff transportation survey – 87 percent of USG staff commute by single occupancy vehicle, 5 percent commute with one other person, and about 3.6 percent commute by bus (the remainder commute by subway or walk). Approximately 3.6 percent of USG staff commute trips are assumed taken by subway or by foot without generation of GHG emissions.

Once the total number of trips traveled is estimated, and separated by commute mode (see Table 15), the next step is to allocate those trips geographically. There was limited available data on the home addresses for USG staff, but communications with staff suggest most individuals live in Montgomery County. In turn, an assumption is made that all USG staff live within Montgomery County and are distributed across ZIP codes in a manner equivalent to the general working population of the county (age 18-60) (see Appendix D). The road-networked distance from each ZIP code to USG is calculated and multiplied by the total number of trips to arrive at vehicle miles traveled (VMT). The total VMT or miles traveled (MT) for each mode is input to the CA-CP Campus Carbon Calculator.[27]

Table 15. USG staff only total headcount, trips taken for commuting, and SOV vehicle miles traveled (VMT) and carpool/bus miles traveled (MT) *(Calculated, see methods above)*

Year	Total USG Staff	Total Trips	Single Occupancy VMT	Carpool MT*	Bus MT
FY 2009	65.5	31,440	298,702	8,500	12,142
FY 2010	66.5	31,920	303,262	8,629	12,328
FY 2011	81.5	39,120	371,667	10,576	15,108

* Carpool results are entered into the CA-CP by taking the total miles traveled and dividing by two and adding to the total SOV VMT total.

Type 2 Employees – Non-teaching Program Administrators

For the period FY 2009-2011, headcount data for non-teaching program administrators were provided through old business department records.[28] The data were sorted by program, which allowed for the separation of administrators in the UMB nursing and pharmacy programs, and all others. Observed patterns suggest that any employee associated with the nursing and pharmacy program, teaching or non-teaching, commutes to USG approximately 5 days per week. As for other non-teaching program administrators, a portion is full-time (commuting to USG about 4 days per week) and a portion is part-time (commuting to USG about 3 days per week).

[27] *Sources: Headcount data from J. Nardi reports; transportation mode choice from 2012 USG staff only transportation survey; and ZIP code allocation from U.S. Census Bureau, 2010 – traveled distances from google maps.*

[28] *Source: Personal communication with J. Nardi via email. January 8, 2013.*

In 2013, the split is about 62/38 percent for full-time and part-time employees, respectively, and this split is assumed to be unchanged back to FY 2009.[29]

Given this information, the total number of trips is calculated for full-time, part-time, and nursing/pharmacy program administrators. It is assumed that all program administrators work 48 weeks per year and commute two trips per day (i.e., one round-trip). The number of days traveled per week is sorted by each of the three types as outlined above. Next, using results from the 2012 faculty and program administrator transportation survey, we assume 96 percent of trips are made by single occupancy vehicle, 3 percent via carpooling with one other person, and the remainder by other modes not accounted for. Last, results from the 2012 survey indicate a weighted average commute distance of 20 miles (see Appendix E). The weighted average distance is calculated by weighting all trip distances by the frequency with which they occur. All program administrators are assumed to travel 20 miles per trip. Table 16 below shows results for both program administrators and faculty members. The total VMT or miles traveled (MT) for each mode is input to the CA-CP Campus Carbon Calculator.

Type 3 Employees – Teaching Faculty

For the period FY 2009-2011, headcount data for teaching faculty were provided from old course records.[30] The headcount data were not sorted by program – all teaching faculty are aggregated and assumed to share the same travel patterns regardless of program. To estimate commuting patterns, course schedule data were pulled on the Spring 2013 semester and commute frequency derived by the following methods:

- Course meetings approximately one trip to USG;
- Online courses were assumed to have no required commute;
- Faculty only commutes once per day if multiple classes held per day.

Based on this methodology, the average number of trips per semester for faculty members was estimated. On average, faculty members commute 16 times per semester and 1.3 times per week. It is assumed that faculty patterns in 2013 did not defer significantly relative to past years, and the results from 2013 are applied to the period FY 2009-2011.[31] Total one-way trips by faculty are equal to total teaching faculty headcount, times two for round-trips, times 32 (i.e., 16 trips over two semesters).

Next, using results from the 2012 faculty and program administrator transportation survey, we assume 96 percent of trips are made by single

[29] *Source: See previous*
[30] *Source: Personal communication with E. Yackley via email. December 21, 2012.*
[31] *Source: Personal communication with E. Yackley via email. January 11, 2013.*

occupancy vehicle, 3 percent via carpooling with one other person, and the remainder by other modes not accounted for. Last, the weighted average commute distance, equal to 20 miles, is used for teaching faculty; all teaching faculty are assumed to travel 20 miles per trip (see Appendix E). Table 16 below shows results for both program administrators and faculty members. The total VMT or miles traveled (MT) for each mode is input to the CA-CP Campus Carbon Calculator.

Table 16. Non-teaching program administrator (in gray) and teaching faculty headcounts, and vehicle miles traveled for FY 2009-2011

	Program Administrators (Non-teaching)*	**Total SOV VMT**	**Total Carpool MT ****	**Total Faculty (Teaching)**	**Total SOV VMT**	**Total Carpool MT****
FY 2009	25	149,745	4,967	210	256,982	8,064
FY 2010	32.5	209,068	6,579	300	367,118	11,520
FY 2011	32	206,139	6,480	320	391,592	12,288

* Only program administrator commuter estimates are disaggregated by nursing/pharmacy employees; ** carpool results are entered into the CA-CP by taking the total miles traveled and dividing by two and adding to the total SOV VMT total

Vehicle data was captured as a component of the 2012 faculty and program administrator transportation survey for the purpose of estimating fuel efficiency. Among the 21 survey entries for which there was interpretable vehicle information, the average fuel efficiency was 31.9 miles per gallon. However, that fuel efficiency estimate is not used to estimate GHG emissions because the sample size was not sufficiently large. Instead, the default CA-CP Campus Carbon Calculator fuel efficiency values are used to estimate fuel consumption for all employees. Note that the commute mode choice among non-teaching program administrators and teaching faculty, as well as the commute distance of these individuals, come from the same 2012 transportation survey and are used in the estimation of GHGs from commuting (see methods above). Although the response rate was calculated to be around 20 percent – that is 20 percent of all faculty and program administrators responded to the survey based on the 2013 headcount – the results of the survey should be applied cautiously. A larger sample size and more disaggregation across faculty and program administrators would improve accuracy in future.[32]

Sensitivity Analysis

Similar to the methods outlined above for students, the employee commuter GHG methods are scrutinized to sensitivity analysis. In other words, how do the results, presented as VMT values, change with adjustments in assumptions? A few of the key assumptions applied in the employee commuter methodology revolve around mode choice, commute frequency, and commute distance. The assumptions adopted were based on the best available data, and attempts were made to disaggregate across different employee types as each has distinct commuting habits. Nonetheless, given

[32] *Source: 2012 USG faculty and program administrator transportation survey*

the uncertainty around the assumptions used and the final result, it is a useful exercise to consider alternative assumptions. For FY 2011, three alternative assumptions, or modifications, are considered:

> Modification A – Assume all employees commute by single occupancy vehicle;
> Modification B – Assume all employees commute 240 days per year including both faculty and staff;
> Modification C – Assume USG staff is not traveling from areas around Montgomery County, but are instead traveling the weighted average distance equal to 20 miles.

Results from the analysis indicate that the total amount of VMT could be as high as 4.12 million per year (under all modifications) and as low as 984 thousand per year (under the FY 2011 adopted methods). In other words, by assuming that all employees commute by single occupancy vehicle, commute 240 days per year, and commute 20 miles to campus, the total amount of employee VMT would increase by approximately five times the amount estimated in FY 2011. This high mark of 4.12 million VMT is probably further from the true number than 690 thousand. It is important to note, however, that the assumption about commute frequency (i.e., 240 trips per year) has the greatest impact, particularly on teaching faculty, which only commute 32 times per year under the adopted methods.

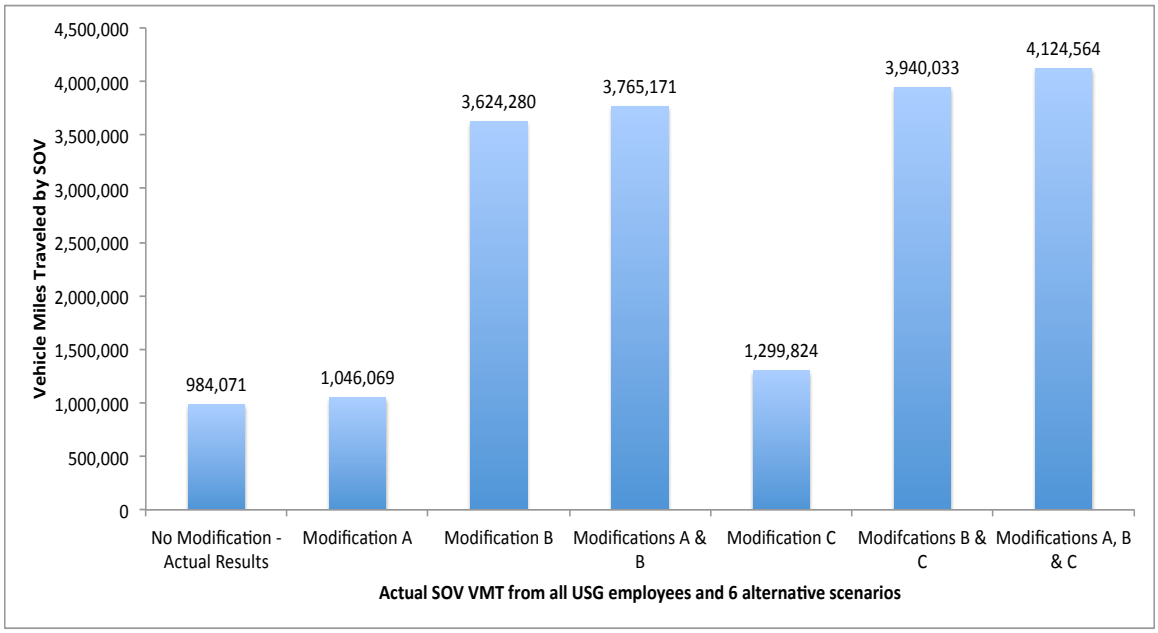

Figure 3. USG employee (staff, program administrators and faculty) total SOV VMT under alternative scenarios for FY 2011; no modification equals the actual methods used in the reported results. Modification A assumes all commutes are made by single occupancy vehicle, modification B assumes all employees commute 240 round-trips per year, and modification C assumes all commutes are equal to the 20 mile weighted average.

Paper Procurement

USG purchased an estimated 2,000 reams of 30 percent post-consumer recycled paper per year between FY 2009 and 2011.[33] For entry into the CA-CP Campus Carbon Calculator, reams were converted to pounds by assuming each ream weighed 5 pounds for a total of 10,000 pounds of paper purchased annually.

Paper procurement results in GHG emissions through the removal of trees for paper manufacturing and a resultant subtraction of carbon sequestration capacity from the ecosystem. Overall, the GHG emissions resulting from paper procurement at USG are very small.

Wastewater

Wastewater data are derived from invoices from the Washington Suburban Sanitation Commission (WSSC). The data are presented at the monthly resolution as gallons of sewer consumption, which must be distinguished from water consumption (i.e., water out, NOT water in). Note that in the invoices for building 1, water and sewer consumption are not distinguished and it is assumed that all water consumed goes to sewer (i.e., gallons of water consumption equal gallons of sewer consumption). For buildings 2 and 3, the amount of sewer consumption is specified and is less than water consumption, which is the result of water being used for irrigation or other purposes not requiring sewer use.

In FY 2009, 4.39 million gallons of wastewater were generated, followed by 3.99 million in FY 2010, and 3.91 million in FY 2011. Between FY 2009 and 2011, the total amount of sewer water consumed decreased by more than 10 percent.

For the purposes of entry into the CA-CP Campus Carbon Calculator, total gallons of wastewater consumed functions as the input. In addition, it is necessary to know how the wastewater is processed (e.g., anaerobic digestion, aerobic). Based on the fact that USG is serviced by WSSC, it is assumed that wastewater is processed at the Blue Plains Wastewater Treatment Plant, which equates to anaerobic digestion.

GHG emissions from wastewater result from the processing or decomposition of waste, which leads to methane emissions. Anaerobic digestion captures a great deal of methane from waste decomposition and lowers USG's GHG footprint.

Air Travel

Data from USG financed air travel was compiled from paper records. Total air mileage traveled by USG employees was available for CY 2009-2012. Due to the labor-intensive process of gathering the travel records and sorting by travel date, we assumed that all CY travel mileage estimates are equal to FY estimates. In FY (i.e.,

[33] *Source: Personal communication with Columbus Mack at USG. December 4, 2012.*

CY) 2009, 25,452 air miles were traveled, followed by 44,617 in FY (CY) 2010, and 38,144 in FY (CY) 2011. USG does not have a study abroad program for students.

Jet fuel combustion creates GHG emissions including carbon dioxide, methane and nitrous oxide. Total air mileage is entered into the CA-CP Campus Carbon Calculator.

Reimbursed Travel

All automobile and rail travel financed by USG (i.e., for business purposes) is captured in the GHG inventory. Automobile travel taken by employees in their personal vehicles and reimbursed by USG is captured in the inventory. Personal travel by employees not reimbursed by USG (e.g., commuting, trips to lunch) is not captured in this portion of the GHG inventory. Similar to air travel, all rail and personal vehicle travel records were in hardcopy form and made available as CY data. In turn, it is assumed that all rail and personal vehicle data presented in CY are equivalent to FY estimates for the purpose of the GHG inventory. In FY (CY) 2009, 10,960 miles of automobile travel were claimed followed by 11,265 miles in FY 2010, and 11,707 in FY 2011. In FY (CY) 2009, 164 rail miles were claimed followed by zero in FY 2010, and 364 in FY 2011.

Gasoline and diesel combustion create GHG emissions including carbon dioxide, methane and nitrous oxide. Total mileage estimates for rail and vehicle travel are entered into the CA-CP Campus Carbon Calculator.

Solid Waste Generated

GHG emissions from solid waste are based upon the total weight (short tons) generated and how that waste is processed. USG's solid waste vendor, LSI, provided solid waste data for the period FY 2009-2011.

Types of solid waste processing, among others, include landfilling without methane recovery, landfilling with methane recovery, and landfilling methane capture and combustion. For allocating USG solid waste processing across these methods, the U.S. average waste allocation is applied (see Table 17).[34] The assumption that USG solid waste is processed in a manner identical to the U.S. average should be tested in subsequent GHG inventories. In subsequent inventories, the allocation of USG waste across disposal methods should be set equal to the U.S. average, updated annually in the Municipal Solid Waste Fact Sheet.

[34] *Source: U.S. EPA, 2012. Municipal Solid Waste Fact Sheet. Available online: http://www.epa.gov/osw/nonhaz/municipal/msw99.htm.*

Table 17. Percent and weight allocation of solid waste generated by USG, FY 2009-2011

Year		**FY 2009**	**FY 2010**	**FY 2011**
Total Waste (Short Tons)		82.51	67.53	74.46
Method	Allocation (%)	Allocation (Short Tons)		
Landfilled	0.54	44.56	36.47	40.21
Recovered	0.34	28.05	22.96	25.32
Combustion w/ energy recovery	0.12	9.90	8.10	8.94

GHG emissions from solid waste occur as a result of the decomposition of waste material and subsequent release of methane. Solid waste data is entered into the CA-CP Campus Carbon Calculator as short tons and by the allocation method described above.

Offsets

In addition to the three emissions scopes, carbon offsets may be generated to reduce the net GHG emissions. USG will generate offsets via the crediting of RECs and composting.

Compost

USG began composting in the late fall of 2010 (FY 2011) and composted a total of 10.3 short tons of material in that year. The composting vendor provided weight data. Composting, if done correctly, is almost entirely aerobic and does not result in the release of methane, which would occur if compostable material were placed in a landfill. Additionally, the organic material in compost increases the capacity for soil to sequester carbon and is therefore considered an offset. The total weight of compost in short tons is the input for the CA-CP Campus Carbon Calculator.

Renewable Energy Credits

The amount of renewable energy credits (RECs) allocated to USG is explained in detail in scope 2 section above. In general, RECs represent avoided electricity generation from GHG-emitting sources and a net subtraction of GHGs. The total amount of RECs, measured in kWhs, is calculated above and input into the CA-CP Campus Carbon Calculator to compute offset. Note that USG does not purchase RECs directly and only accounts for RECs that should have been delivered under Maryland's Renewable Portfolio Standard.

5. GHG Inventory Results

Overview

Net GHG emissions (i.e., all scopes minus offsets) totaled 9,371 $MTCO_2e$ in FY 2009, 10,261 $MTCO_2e$ in FY 2010, and 10,492 $MTCO_2e$ in FY 2011. Consistent across all years, the single largest source is student commuting followed by purchased electricity, and fuel consumption for heating and cooking (see Figure 4, Table 18). The share of student commuting GHGs relative to total emissions increased between FY 2009-2011 while the share of emissions from both purchased electricity and fuel use for heating and cooking decreased (see Figure 4).

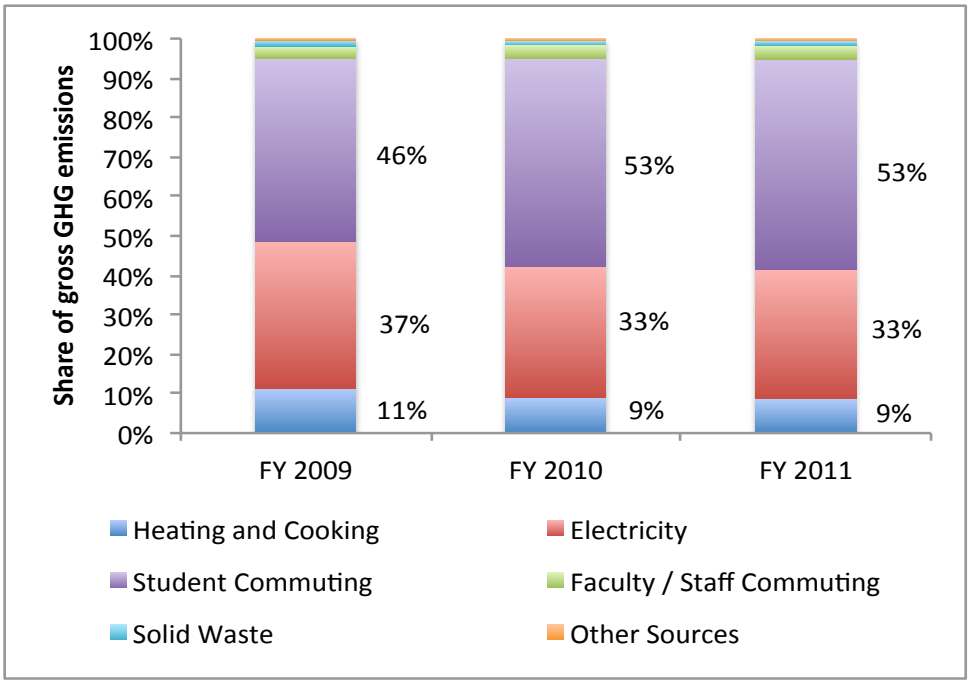

Figure 4. GHG emissions profile, FY 2009-2011

The growth in total GHGs between FY 2009 and 2011 of 12 percent is attributable primarily to student commuting, which had a GHG increase of nearly 30 percent during the period (roughly an increase of 1,300 $MTCO_2e$). While both the number of undergraduate and graduate students at USG increased between FY 2009 and 2011, by about 27 and 29 percent, respectively, the frequency with which each student type traveled differed – an important factor in explaining GHG trends. Undergraduate students traveled to USG slightly more often over the FY 2009-2011 period (about 93 round-trips per year in FY 2009 and 94 in FY 2011) as graduate students traveled to USG less often (93 round-trips per year in FY 2009 and 90 in FY 2011). In turn, commuter GHG emissions were amplified by undergraduate growth and their increasing need to be on campus for coursework, while graduate students, and graduate student growth, did not have as much of an impact because travel to campus was less necessary in 2011 than it was in 2009.

The yearly increases in both student and employee commuting GHGs are offset in part by steady decreases from solid waste, fuel consumption, and renewable energy credits allotted from Maryland's renewable portfolio standard.

Table 18. Total GHG emissions ($MTCO_2e$) by source, FY 2009-2011

Source	FY 2009 (Baseline)	FY 2010 (Current)	FY 2011 (Current)	*10-11% Change*	*09-11 % Change*
Heating and Cooking Fuel	1,071.5	929.9	922.5	-13.2%	-13.9%
Direct Transportation	1.5	1.3	1.3	-15.8%	-14.5%
Refrigerants & Chemicals	0.0	0.0	6.3	*N/A*	*N/A*
Fertilizer Application	0.8	0.8	0.8	0.0%	0.0%
Purchased Electricity	3,182.0	3,127.5	3,169.6	-1.7%	-0.4%
Transmission & Dist. Elect. Losses	314.7	309.3	313.5	-1.7%	-0.4%
Faculty / Staff Commuting	294.9	366.9	387.3	24.4%	31.3%
Student Commuting	4,350.8	5,418.0	5,642.1	24.5%	29.7%
Directly Financed Air Travel	15.0	26.3	22.5	75.3%	49.9%
Other Directly Financed Travel	4.1	4.2	4.4	2.1%	7.4%
Solid Waste	146.5	119.9	132.2	-18.2%	-9.8%
Wastewater	2.3	2.1	2.0	-9.0%	-10.9%
Paper	11.9	11.9	11.9	0.0%	0.0%
Scope 1	1,073.8	932.0	930.9	-13.2%	-13.3%
Scope 2	3,496.7	3,436.8	3,483.0	-1.7%	-0.4%
Scope 3	4,825.5	5,949.2	6,202.4	23.3%	28.5%
All Offsets	25.5	56.8	124.1	123.0%	387.4%
Total	9,370.6	10,261.1	10,492.2	9.5%	12.0%

Between FY 2009 and 2011, USG increased energy consumption by about 11 percent with most of that growth occurring between FY 2010 and 2011. In FY 2009, the single highest source of energy consumption was purchased electricity; in FY 2010 and 2011 energy consumed for the purpose of student commuting surpassed the amount of energy consumed for purchased electricity. The third largest source of energy consumption at USG is fuel for heating and cooking, which decreased annually between FY 2009-2011 (see Table 19).

Table 19. Total energy consumption (Millions of BTUs) by source, FY 2009-2011

Source	FY 2009	FY 2010	FY 2011	10-11% Change	09-11% Change
Heating and Cooking Fuel	20,262	17,556	17,436	-0.7%	-13.9%
Direct Transportation	21	17	18	1.2%	-14.6%
Purchase Electricity (Includes T&D Loss)	62,906	61,828	62,556	1.2%	-0.6%
Faculty/Staff Commuting	4,069	5,062	5,344	5.6%	31.3%
Student Commuting	60,042	74,768	77,862	4.1%	29.7%
Directly Financed Air Travel	75	131	112	-14.5%	49.9%
Other Directly Financed Travel	57	58	61	5.5%	7.6%
Scope 1	20,283	17,574	17,454	-0.7%	-13.9%
Scope 2	62,906	61,828	62,556	1.2%	-0.6%
Scope 3	64,242	80,019	83,379	4.2%	29.8%
Total	147,431	159,421	163,388	2.5%	10.8%

Key Source Level Findings

Key findings of each emission source are as follows:

- *Heating, cooking and misc. fuel* FY 2011 Rank: 3rd largest source of GHGs
  - GHG emissions from natural gas decreased every year between FY 2009 and FY 2011;
  - USG also became increasingly efficient in terms of natural gas consumption per unit of space and per HDD;
  - GHG emissions from diesel fuel for backup electricity generation account for a very small portion of total emissions (1.7 $MTCO_2e$ in FY 2011);
- *Direct transportation (USG-owned fleet)*
  - GHG emissions from USG owned vehicles is very minimal (1.3 $MTCO_2e$ per year in FY 2010 and 2011);
- *Refrigerant releases*
  - According to records, refrigerants were released in FY 2011 alone accounting for just 6.3 $MTCO_2e$;
- *Fertilizer application*
  - GHG emissions from fertilizer application were stable at .8 $MTCO_2e$ during the period FY 2009-2011;
- *Purchased electricity* FY 2011 Rank: 2rd largest source of GHGs
  - GHG emissions from electricity were highest in FY 2009 and lowest in FY 2010, though the difference is minimal (55 $MTCO_2e$);
  - Inter-annual differences in GHG emissions are attributable to total electricity consumption and not the fuel mix, which is constant across all FYs;

    - The addition of new space in FY 2010 (e.g., new parking garage) had a minimal impact on total electricity consumption and GHGs;
    - Roughly 310 $MTCO_2e$ of emissions were attributed to USG as a result of electricity transmission and distribution for each FY;
- *Faculty and staff commuting*
    - GHG emissions from faculty and staff increased 31 percent between FY 2009 and 2011, but still only account for 4 percent of total emissions in FY 2011;
    - The increase in faculty and staff commuting GHGs is driven by steady increases of both USG staff, program administrators, and teaching faculty;
- *Student commuting* FY 2011 Rank: Largest source of GHGs
    - GHG emissions from student commuting increased every year between FY 2009 and 2011 in tandem with increases in the total number of students;
        - The increase student commuting GHGs is only partially the result of increased course loads (2% increase in average credit hours per student between FY 2009 and 2011);
- *Directly financed air travel*
    - GHG emissions from air travel were at a minimum in FY 2009 and a maximum in FY 2010 with a difference of about 16 $MTCO_2e$;
        - USG has a very small carbon footprint from air travel relative to other USM institutions;
- *Other directly financed travel (e.g., reimbursed vehicle travel)*
    - GHG emissions from directly financed travel are stable around 4 $MTCO_2e$ for the period FY 2009-2011;
- *Solid waste*
    - GHG emissions from solid waste were at a maximum in FY 2009 and minimum in FY 2010 with a difference of about 27 $MTCO_2e$;
- *Wastewater*
    - GHG emissions from wastewater are very minimal at around 2 $MTCO_2e$ per year for the period FY 2009-2011;
- *Purchased paper*
    - GHG emissions from paper procurement are constant for the period FY 2009-2011 at 12 $MTCO_2e$;
- *Offsets*
    - Offsets from composting are present for only FY 2011 and equal a net subtraction of 4 $MTCO_2e$;
    - Offsets from RECs per Maryland's RPS increase every year between FY 2009 and 2011, mostly as a result of escalating RPS standards.

Normalization Metrics

USG is a growing institution with expectations to increase its physical and educational footprint over the next several years. In turn, it is important to normalize GHG emissions and energy consumption by physical size, number of students, and number of faculty and staff. Normalization metrics should be used to understand growth and to gauge GHG mitigation progress at USG.

Every year since FY 2009, the emissions per student and per community member (i.e., all students, staff, program managers, and teaching faculty) have decreased. With the addition of new space from the parking garage in FY 2010, the amount of emissions per thousand feet of gross space decreased significantly between FY 2009 and 2010. However, with no change in space between FY 2010 and 2011, the metric for emissions per unit of space again increased. Finally, the amount of emissions generated per unit of energy, or the carbon-intensity of the USG energy mix, remained fairly constant during the FY 2009-2011 period.

Table 20. GHG and energy metrics, 2008-2011 with annual changes

Metric	**FY 2009**	**FY 2010**	***09-10 % Change***	**FY 2011**	***10-11 % Change***
MTCO2e/Student	3.095	2.807	-9.3%	2.711	-3.4%
MTCO2e/1000 GSF Physical Space	30.352	20.452	-32.6%	20.912	2.3%
MTCO2e/Community Member	2.815	2.530	-10.1%	2.438	-3.7%
Mil. BTU/Student	48.689	43.605	-10.4%	42.219	-3.2%
Mil. BTU/ 1000 GSF Physical Space	477.543	317.744	-33.5%	325.651	2.5%
Mil. BTU/Community Member	44.293	39.315	-11.2%	37.966	-3.4%
MTCO2e/Mil. BTU	0.064	0.064	1.3%	0.064	-0.2%

6. Next Steps and Recommendations for Future GHG Reporting

With the completion of the FY 2010 and FY 2011 GHG inventories, and submission of the data for the January 2013 ACUPCC deadline, the next ACUPCC reporting requirement is a progress report of USG's Climate Action Plan (CAP) due in January 2014. This progress report will reflect implementation successes and challenges related to the USG GHG reduction target and corresponding mitigation strategies, which can be found in the CAP online at: http://rs.acupcc.org/cap/981/.

In addition to the regular ACUPCC reporting, the present GHG inventory process revealed several improvements that can be made in how USG collects and organizes data. However, prior to listing specific recommendations that USG can take, it should be emphasized that a number of limiting factors exist in terms of how the University System of Maryland (USM) provides USG with data on students and employees. For instance, the USM does not provide USG with information on student home addresses, which if made available, would improve the accuracy of commuter behavior and resultant GHG emissions estimates. In the absence of student address data, estimates of commuter behavior and GHG emissions will be tied to assumptions, which will not reflect actual changes in commuter behavior. In turn, it will be difficult to gauge the effectiveness USG's GHG mitigation and transportation policies.

This GHG inventory reporting effort, and the estimation methods captured herein, serve as one example of why the exchange of data between the University System of Maryland and USG is critical. New data reporting efforts, which would need to be coordinated between the USG and USM, could include:

- Produce student home address reports, made available to only USG administrators;
    - For the purpose of GHG estimations, only ZIP-code resolution is necessary;
- Generate USM/USG employee reports, including both teaching and non-teaching faculty headcounts, on a regular (i.e., annual) basis;
    - Higher resolution reports presenting faculty home institutions, and course load over a given semester will improve the accuracy of commuter behavior estimates;
    - Employee home address data at the ZIP-code level would also improve the accuracy of GHG estimates.

In addition to the higher-level data constraints shared between USM and USG, there are numerous actions USG can take in-house to facilitate future GHG inventory efforts and CAP implementation. The recommended actions for USG are as follows:

- Regularly collect and digitize utility, travel, refrigerant, solid waste, compost and all other activity data;
    - If monthly invoices are provided from utilities, these data points should be filed into a spreadsheet at the time of bill payment;

    - If invoices are not provided monthly (e.g., travel, fertilizer, refrigerant releases), then select an annual date (e.g., first of the year) at which point this data will be collected for the previous period;
    - Regardless of whether or not it is an GHG reporting year, data should be captured and organized to facilitate the process when data is needed for a reporting effort;
- Administer a regular transportation survey of students and employees to capture commuter behavior and track changes over time;
    - The survey does not need to be long or complex, and can be administered every 2-4 years and still retain relevancy;
    - Alternatively, parking permits could be tied to an application process that includes a short set of questions for capturing commuter behavior;
- Frequently reference the organizational boundaries of what is and is not included in USG GHG inventories as a means of understanding how growth and programmatic changes will impact GHG emissions;
    - USG claims activities over which it has *financial control* AND for all regular commuting to and from USG from the USM community;
- Document operational and structural changes at USG that are important to explaining changes in activity data and GHG emissions results;
    - For example, if boilers undergo maintenance and improve burn efficiency, this should be noted alongside natural gas consumption trend data;
- Conduct regular counts of USG faculty and program administrators at set points in the semester to be used as inputs to GHG inventory reporting;
- Regular run the methods for estimating teaching faculty commuting patterns based on course offerings and the methods established in this report;
    - 2013 is the first year for which USG was able to run this method, which will need to be replicated to estimate GHGs in all years going forward to begin capturing changes in faculty commuting frequency.

Appendices

Appendix – A

Distribution of Montgomery County population age 18-30 (Students) by ZIP code, and distance to USG *(Source: US Census Bureau, 2010; and Google Maps, 2012, road-networked distances)*

Montgomery County ZIP Codes	Percentage of MoCo County age 18-30 living in ZIPs	Road-networked commute (miles) from ZIP origin to USG
20812	0.02	12.5
20814	2.82	9.75
20815	2.22	12.25
20816	1.11	14.25
20817	2.43	10.75
20818	0.12	12
20832	2.30	12.25
20833	0.65	22.25
20837	0.53	15
20838	0.01	19.5
20839	0.02	17.5
20841	1.10	11.25
20842	0.13	18
20850	4.62	4
20851	1.80	5.5
20852	4.34	7.5
20853	2.83	7.25
20854	3.13	7
20855	1.30	7.25
20860	0.14	15.5
20861	0.15	17.25
20862	0.03	19.5
20866	1.46	21
20868	0.07	17
20871	1.28	13.5
20872	1.32	17.5
20874	6.68	8.25
20876	3.05	11.5
20877	4.22	6
20878	6.01	5.25
20879	2.83	8.5
20880	0.02	5.25
20882	1.17	17
20886	3.78	8
20895	1.46	11
20896	0.05	9.25
20899	0.01	5

20901	3.76	13.5
20902	5.59	10.5
20903	3.25	17
20904	5.83	17.5
20905	1.66	16.5
20906	6.79	12.5
20910	4.88	13.5
20912	3.01	17.75

Appendix B

Surrounding counties, assumed population centers, and distance to USG from population center (no counties over 60 miles are included) *(Source: Google Maps, 2012, road-networked distance)*

County	**Assumed Population Center***	**Road-networked distance (miles) from ZIP origin to USG**
Montgomery County, MD	Germantown	11
Prince Georges County	College Park	22
Washington, DC	Washington DC	23
Fairfax County & City of Fairfax, VA	Fairfax	25
Howard County, MD	Columbia	30
Frederick County, MD	Frederick	30
Prince William County, VA	Manassas	38
Carroll County, MD	Eldersburg	43
Loudon County, VA	Leesburg	45
Baltimore & Baltimore County	Baltimore	45
Jefferson County, WV	Charlestown	51
Anne Arundel County, MD	Annapolis	53
Washington County, MD	Hagerstown	54
Fauquier County, VA	Warrenton	57
Stafford County, VA	Stafford	60

Appendix C

Actual student trip allocation (geographic allocation) used for FYs 2009-FY 2011 and corresponding distance to USG *(Calculated, see methods above)*

		Allocation of Students in Location (Units as proportion)			**Road-networked Distance to USG Campus** (miles)
	ZIP or County Origin	FY 2009	FY 2010	FY 2011	
Undergraduates					
Montgomery County	20812	0.000	0.000	0.000	12.50
	20814	0.019	0.018	0.019	9.75

(ZIPs)	20815	0.015	0.014	0.015	12.25
	20816	0.007	0.007	0.007	14.25
	20817	0.016	0.016	0.016	10.75
	20818	0.001	0.001	0.001	12.00
	20832	0.015	0.015	0.015	12.25
	20833	0.004	0.004	0.004	22.25
	20837	0.004	0.003	0.004	15.00
	20838	0.000	0.000	0.000	19.50
	20839	0.000	0.000	0.000	17.50
	20841	0.007	0.007	0.007	11.25
	20842	0.001	0.001	0.001	18.00
	20850	0.030	0.030	0.030	4.00
	20851	0.012	0.012	0.012	5.50
	20852	0.029	0.028	0.029	7.50
	20853	0.019	0.018	0.019	7.25
	20854	0.021	0.020	0.021	7.00
	20855	0.009	0.008	0.009	7.25
	20860	0.001	0.001	0.001	15.50
	20861	0.001	0.001	0.001	17.25
	20862	0.000	0.000	0.000	19.50
	20866	0.010	0.009	0.010	21.00
	20868	0.000	0.000	0.000	17.00
	20871	0.008	0.008	0.008	13.50
	20872	0.009	0.009	0.009	17.50
	20874	0.044	0.043	0.044	8.25
	20876	0.020	0.020	0.020	11.50
	20877	0.028	0.027	0.028	6.00
	20878	0.040	0.039	0.040	5.25
	20879	0.019	0.018	0.019	8.50
	20880	0.000	0.000	0.000	5.25
	20882	0.008	0.008	0.008	17.00
	20886	0.025	0.025	0.025	8.00
	20895	0.010	0.010	0.010	11.00
	20896	0.000	0.000	0.000	9.25
	20899	0.000	0.000	0.000	5.00
	20901	0.025	0.024	0.025	13.50
	20902	0.037	0.036	0.037	10.50
	20903	0.021	0.021	0.021	17.00
	20904	0.038	0.038	0.038	17.50
	20905	0.011	0.011	0.011	16.50
	20906	0.045	0.044	0.045	12.50
	20910	0.032	0.032	0.032	13.50
	20912	0.020	0.020	0.020	17.75
Prince George's County	College Park	0.070	0.070	0.060	22.00
Frederick County	Frederick	0.050	0.050	0.050	30.00
Unknown/Remainder (County centers within 60	Montgomery County	0.015	0.015	0.014	11.00
	Prince George's County	0.015	0.015	0.014	22.00
	Washington, DC	0.015	0.015	0.014	23.00
	Fairfax County & City	0.015	0.015	0.014	25.00

miles)	of Fairfax, VA				
	Howard County, MD	0.015	0.015	0.014	30.00
	Frederick County, MD	0.015	0.015	0.014	30.00
	Prince William County, VA	0.015	0.015	0.014	38.00
	Carroll County, MD	0.015	0.015	0.014	43.00
	Loudon County, VA	0.015	0.015	0.014	45.00
	Baltimore & Baltimore County	0.015	0.015	0.014	45.00
	Jefferson County, WV	0.015	0.015	0.014	51.00
	Anne Arundel County, MD	0.015	0.015	0.014	53.00
	Washington County, MD	0.015	0.015	0.014	54.00
	Fauquier County, VA	0.015	0.015	0.014	57.00
	Stafford County, VA	0.015	0.015	0.014	60.00
Virginia	Fairfax County & City of Fairfax, VA			0.004	25.00
	Prince William County, VA			0.004	38.00
	Loudon County, VA			0.004	45.00
	Fauquier County, VA			0.004	57.00
	Stafford County, VA			0.004	60.00
Graduates					
	ZIP or County Origin	**Allocation of Students in Location** (Units as proportion)			**Road-networked Distance to USG Campus** (miles)
Montgomery County (ZIPs)	20812	0.000	0.000	0.000	12.50
	20814	0.011	0.010	0.011	9.75
	20815	0.008	0.008	0.008	12.25
	20816	0.004	0.004	0.004	14.25
	20817	0.009	0.009	0.009	10.75
	20818	0.000	0.000	0.000	12.00
	20832	0.009	0.008	0.009	12.25
	20833	0.002	0.002	0.002	22.25
	20837	0.002	0.002	0.002	15.00
	20838	0.000	0.000	0.000	19.50
	20839	0.000	0.000	0.000	17.50
	20841	0.004	0.004	0.004	11.25
	20842	0.001	0.000	0.000	18.00
	20850	0.017	0.017	0.017	4.00
	20851	0.007	0.006	0.007	5.50
	20852	0.016	0.016	0.016	7.50
	20853	0.011	0.010	0.011	7.25
	20854	0.012	0.011	0.012	7.00
	20855	0.005	0.005	0.005	7.25
	20860	0.001	0.000	0.001	15.50
	20861	0.001	0.001	0.001	17.25
	20862	0.000	0.000	0.000	19.50
	20866	0.005	0.005	0.005	21.00
	20868	0.000	0.000	0.000	17.00
	20871	0.005	0.005	0.005	13.50

	20872	0.005	0.005	0.005	17.50
	20874	0.025	0.024	0.025	8.25
	20876	0.011	0.011	0.011	11.50
	20877	0.016	0.015	0.016	6.00
	20878	0.023	0.022	0.022	5.25
	20879	0.011	0.010	0.011	8.50
	20880	0.000	0.000	0.000	5.25
	20882	0.004	0.004	0.004	17.00
	20886	0.014	0.014	0.014	8.00
	20895	0.005	0.005	0.005	11.00
	20896	0.000	0.000	0.000	9.25
	20899	0.000	0.000	0.000	5.00
	20901	0.014	0.014	0.014	13.50
	20902	0.021	0.020	0.021	10.50
	20903	0.012	0.012	0.012	17.00
	20904	0.022	0.021	0.022	17.50
	20905	0.006	0.006	0.006	16.50
	20906	0.025	0.024	0.025	12.50
	20910	0.018	0.018	0.018	13.50
	20912	0.011	0.011	0.011	17.75
Prince George's County	College Park	0.045	0.053	0.053	22.00
Frederick County	Frederick	0.030	0.045	0.030	30.00
Other Maryland	Howard County	0.060	0.059	0.061	30.00
	Carroll County	0.060	0.059	0.061	43.00
	Baltimore & Baltimore County	0.060	0.059	0.061	45.00
	Anne Arundel County	0.060	0.059	0.061	53.00
	Washington County	0.060	0.059	0.061	54.00
Virginia	Fairfax County & City of Fairfax, VA	0.012	0.010	0.010	25.00
	Prince William County, VA	0.012	0.010	0.010	38.00
	Loudon County, VA	0.012	0.010	0.010	45.00
	Fauquier County, VA	0.012	0.010	0.010	57.00
	Stafford County, VA	0.012	0.010	0.010	60.00
Washington, DC	DC	0.030	0.030	0.040	23.00
Unknown/Remainder (County centers within 60 miles)	Montgomery County, MD	0.011	0.011	0.010	11.00
	Prince Georges County	0.011	0.011	0.010	22.00
	Washington, DC	0.011	0.011	0.010	23.00
	Fairfax County & City of Fairfax, VA	0.011	0.011	0.010	25.00
	Howard County, MD	0.011	0.011	0.010	30.00
	Frederick County, MD	0.011	0.011	0.010	30.00
	Prince William County, VA	0.011	0.011	0.010	38.00
	Carroll County, MD	0.011	0.011	0.010	43.00
	Loudon County, VA	0.011	0.011	0.010	45.00

	Baltimore & Baltimore County	0.011	0.011	0.010	45.00
	Jefferson County, WV	0.011	0.011	0.010	51.00
	Anne Arundel County, MD	0.011	0.011	0.010	53.00
	Washington County, MD	0.011	0.011	0.010	54.00
	Fauquier County, VA	0.011	0.011	0.010	57.00
	Stafford County, VA	0.011	0.011	0.010	60.00

Appendix D

Employee trip allocation (geographic allocation) used for FYs 2009-FY 2011 and corresponding distance to USG *(Calculated, see methods above)*

ZIP-code	**Allocation of USG staff in location** (Units as proportion)	**Road-networked distance to USG campus** (miles)
20812	0.0002	12.5
20814	0.0294	9.75
20815	0.0273	12.25
20816	0.0146	14.25
20817	0.0327	10.75
20818	0.0020	12
20832	0.0252	12.25
20833	0.0075	22.25
20837	0.0060	15
20838	0.0002	19.5
20839	0.0002	17.5
20841	0.0105	11.25
20842	0.0018	18
20850	0.0478	4
20851	0.0156	5.5
20852	0.0435	7.5
20853	0.0287	7.25
20854	0.0445	7
20855	0.0145	7.25
20860	0.0018	15.5
20861	0.0018	17.25
20862	0.0003	19.5
20866	0.0139	21
20868	0.0008	17
20871	0.0132	13.5
20872	0.0134	17.5
20874	0.0629	8.25
20876	0.0270	11.5
20877	0.0355	6
20878	0.0657	5.25
20879	0.0264	8.5
20880	0.0005	5.25
20882	0.0142	17
20886	0.0353	8

20895	0.0182	11
20896	0.0008	9.25
20899	0.0002	5
20901	0.0365	13.5
20902	0.0503	10.5
20903	0.0247	17
20904	0.0535	17.5
20905	0.0179	16.5
20906	0.0615	12.5
20910	0.0443	13.5
20912	0.0275	17.75

Appendix E

Faculty (non-USG employees) commuting distribution from transportation
(Source: Transportation survey administered in Fall 2012)

Location (ZIP)	Percentage of Program Managers Reporting as Home Address	Distance to USG Campus from ZIP (miles)
20007	2.99%	15.2
20008	1.49%	13.1
20190	1.49%	21
20712	2.99%	18.6
20715	1.49%	32.7
20723	1.49%	28.6
20737	1.49%	23.3
20740	2.99%	19.4
20815	1.49%	12.25
20817	1.49%	10.75
20832	7.46%	12.25
20850	11.94%	4
20851	1.49%	5.5
20852	4.48%	7.5
20853	2.99%	7.25
20854	1.49%	7
20866	1.49%	21
20874	2.99%	8.25
20876	1.49%	11.5
20877	1.49%	6
20878	2.99%	5.25
20886	1.49%	8
20895	1.49%	11
20904	1.49%	17.5
20905	1.49%	16.5
20906	2.99%	12.5
20910	1.49%	13.5
21042	1.49%	35.2
21043	2.99%	35
21045	1.49%	26.4

21082	1.49%	64.3
21202	1.49%	44.3
21209	1.49%	46.2
21701	2.99%	34.9
21703	5.97%	32
21777	1.49%	34.4
21788	1.49%	44.2
21826	1.49%	133
22003	1.49%	20.3
22206	1.49%	24
22304	1.49%	25.9
22314	1.49%	26.2