Radford University Greenhouse Gas Inventory

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By
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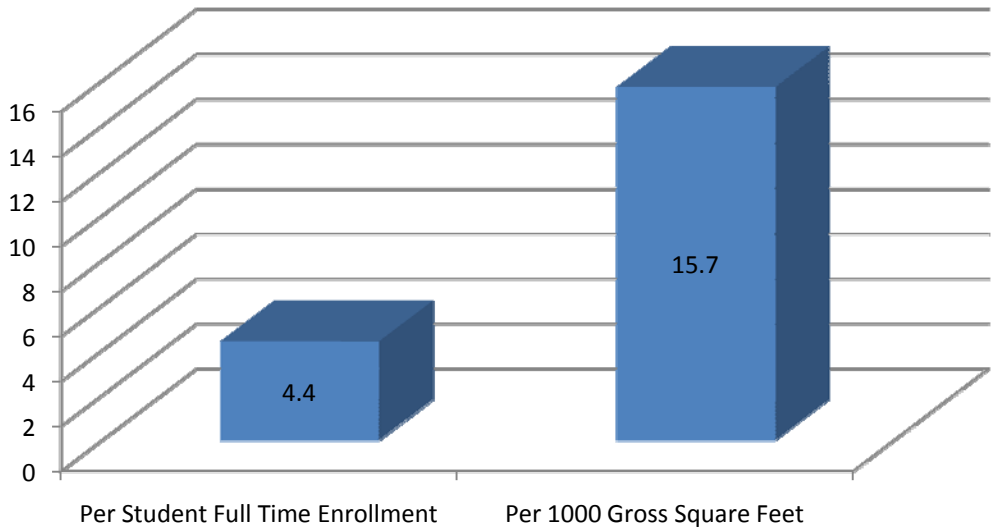
Summary

As a signatory of the American College and University's Presidents Climate Commitment (ACUPCC), Radford University has conducted its first publically available greenhouse gas (GHG) inventory. This inventory will serve as the baseline for future inventories and the upcoming development of the university's Climate Action Plan (CAP). The inventory baseline year covers the time period from July 1, 2009 to June 30, 2010 (FY2010) and the gross GHG emissions totaled **37,749.6** metric tons of carbon dioxide equivalent (MTCO2e).

Figure 1 Net Emissions (MTCO2e)



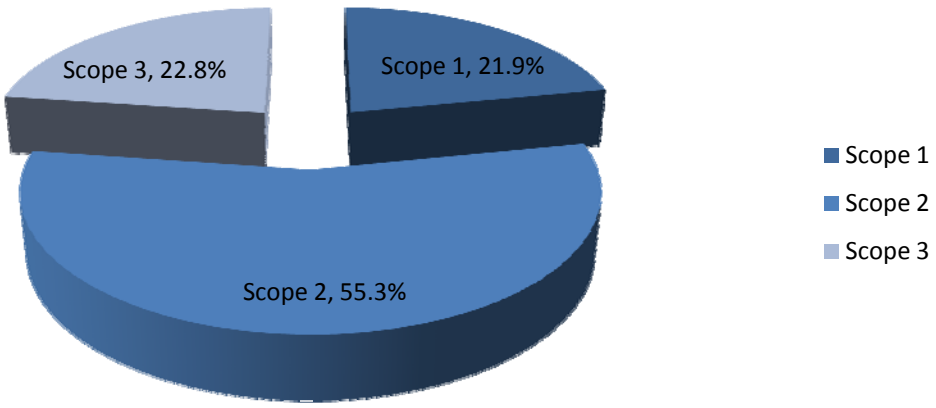
Introduction

Radford University is a coeducational, comprehensive public university offering 67 degree programs at the undergraduate level and 20 fields of study at the graduate level that have 18 options or specializations and seven post baccalaureate certificates. With approximately 9,000 students enrolled, RU recently celebrated its Centennial year (1910-2010). Most students live in one of the 15 university residence halls or in private accommodations within walking distance of the campus. RU's campus is located on the New River and provides great access to Claytor Lake, the Appalachian Trail, Blue Ridge Parkway, several parks (Radford Mountain Bike park, Bissett Park, Claytor Lake State Park, New River Trail, etc.), and nearby ski resorts.

Radford University's President Penelope W. Kyle signed the ACUPCC document in celebration of Campus Sustainability Day in October 2009 (implementation start date January 15, 2010). As an ACUPCC signatory, RU has committed itself to becoming climate neutral at some point in the future. Commitment step 1 included a) creating an institutional structure to guide the development and implementation of a CAP, b) completing a comprehensive GHG inventory within one year of the implementation start date, and c) developing a CAP within two years of the implementation start date. Commitment step 2 included initiating two or more actions from a list of seven to reduce greenhouse gases. At the time of the signing, RU had already taken many of the commitment steps that are outlined by the ACUPCC. RU had an institutional structure in place, the SustainABILITY Steering Committee (SSC), which was initiated in the Fall semester of 2008. In addition, RU had initiated four tangible actions including a LEED-Silver minimum standard for new campus construction, an Energy Star purchasing requirement, providing and encouraging public transportation access for students, faculty, staff, and visitors, and by participating in the Waste Minimization component of the national RecycleMania competition along with adopting 3 or more associated measures to reduce waste (e.g. campus recycling program, campus surplus department, using inter-office reusable envelopes, implementing campus printing initiatives, etc.).

The GHG inventory includes emissions from various areas across campus and even beyond. These areas are known as scopes and include scopes 1, 2, & 3. Scope 1 emissions are from direct sources on campus and include items like stationary and mobile fuel usage, refrigerants, and fertilizer. Scope 2 emissions are from indirect sources but are linked to the operations of campus including purchased electricity, steam, and chilled water. Scope 3 emissions are considered "upstream" emissions; they are also linked to the operating of campus. Possible scope 3 emissions include directly financed travel, commuting, solid waste, and others.

Figure 2 GHG Emissions by Scope Percentages FY2010



Methods

RU selected the Clean Air-Cool Planet (CACP) Campus Carbon Calculator to assist with the collection, calculation, and analysis of its emissions. The CACP Campus Carbon Calculator is a preferred tool of the ACUPCC as it was designed specifically for campuses, is consistent with GHG protocol standards, and is commonly used. While starting the collection process with earlier versions of the calculator, the CACP Campus Carbon Calculator (V.6.6) was the latest at the time of reporting with which incorporated data from the IPCC's Third and Fourth Assessment Reports.

The organizational boundary selected included all RU buildings under operational control or the control approach. The determination whether to include or exclude certain buildings was based on whether or not the university paid the utility bills. The temporal boundary selection was based on the fiscal year 2010 data (July 1, 2009-June 30, 2010). These determinations were largely selected for future reporting consistency and the relative ease of data collection.

The greenhouse gas inventory process included many individuals, departments, and the continued support from the SustainABILITY Steering Committee (SSC), the administration, and others without whom this inventory could not be completed. Every effort was made to provide the most comprehensive snapshot of Radford University's greenhouse gas emissions including the most accurate and up to date data available with the resources available. However, some assumptions were made due to limitations in data, time, or other resources. Some of the assumptions include air travel, faculty and student commuting, and weights of paper purchased.

- Air Travel- data were collected for fiscal year 2008 from the university travel partner and used for the most recent fiscal year. The departure and arrival locations were entered into a spreadsheet and the total distance of the flights were determined by using an external website (www.webflyer.com). Since campus individuals are now allowed to procure travel from various sources, this was the most recent year that campus travel was available from a single source.
- Faculty Commuting- data were collected for academic year 2008-2009 and, since the faculty numbers did not change significantly, they are used as a proxy for fiscal year 2010 figures. The report is available on the RU sustainABILITY publications website: www.radford.edu/rugreen
- Student Commuting- data were collected for the Spring 2010 semester and then doubled to include the Fall semester. To account for summer school student travel, roughly 28% of the Spring semester figure was added to get the total for the year since the enrollment was approximately 28% of the Spring semester. The report is available on the RU sustainABILITY publications website: www.radford.edu/rugreen
- Paper Purchased Weights- paper purchasing data were collected from RU's Materiel Management & Contracts Department. The paper figure is limited to general purpose/copier paper purchases from different suppliers and does not include every type of paper utilized within a year by the university. A single ream of paper was weighed and used to calculate the estimated total pounds of paper.

The greenhouse gas inventory process began with the data collection phase and the recognition that some data were not readily accessible or did not exist at all. It for this reason, that some data were collected over years while other data collected are for the most recent fiscal year only. An additional benefit from this method allows for the distribution of time, costs, and other resources to be dispersed over years. The next phase of the inventory included calculating the greenhouse gas emissions. As data were collected, they were entered into the CACP calculator to determine the relative amount of emissions. The final phase of the inventory includes the analyzing and summarizing of the results. Analyzing the data helps to understand what actions are contributing to the most emissions and where they come from. By summarizing the inventory and emissions results, the university is able to educate individuals and to take the steps necessary to reach its goal of carbon neutrality.

Inventory Results

From looking at the inventory results, it's obvious that purchased electricity (Scope 2) is responsible for the majority of RU's emissions. The emissions are indicative of how much of the electricity is used on RU's campus (lighting, cooling, and other systems) and also the fuel mix of the regional electrical supplies (largely coal based). Scope 1 and Scope 3 emissions are very similar as a percentage of the total emissions; however, Scope 3 emissions are typically seen as more directly related to individuals' personal behaviors.

Some of the table cells are blank either due to the fact that they do not apply to RU or the info was unobtainable or nonexistent within the resources allotted for the inventory. For example, RU does not have a cogeneration plant at this time; therefore the cells are left blank. Also, while some efforts like the collection of composting materials are taking place on campus, the associated offsets are not included since the materials are sent off campus. In addition, since the commuting data were calculated outside of the calculator, they represent the total carbon dioxide equivalents only, not the energy consumption, carbon dioxide itself, methane, nor the nitrous oxide emissions. Thus, the scope totals for those areas are slightly underrepresented; however, the total carbon dioxide equivalents are correct. There are no offsets identified in the CACP calculator overview table, thus RU's gross and net emissions are the same. The CACP calculator incorporates forest preservation, on-campus composting, and renewable energy certificates. However, when RU's recycling weights for many categories (cardboard, mixed paper, mixed metals, computers, & mixed recyclables/containers), not including the off-campus food waste composting, are entered into the Environmental Protection Agency's (EPA) Waste Reduction Model (WARM) calculator, there is indeed a reduction of emissions by 737 MTCO2e.

Table 1 Overview of Annual GHG Emissions

Fiscal Year	2010	Energy Consumption	CO_2	CH_4	N_2O	eCO_2
		MMBtu	kg	kg	kg	Metric Tonnes
Scope 1	Co-gen Electricity	-	-	-	-	-
	Co-gen Steam	-	-	-	-	-
	Other On-Campus Stationary	142,644.0	7,525,289.9	752.4	15.0	7,548.6
	Direct Transportation	6,132.3	409,149.1	65.3	23.4	417.8
	Refrigerants & Chemicals	-	-	-	-	249.8
	Agriculture	-	-	-	130.7	39.0
Scope 2	Purchased Electricity	228,204.0	20,792,153.8	185.2	259.6	20,874.1
	Purchased Steam / Chilled Water	-	-	-	-	-
Scope 3	Faculty / Staff Commuting	-	-	-	-	2,539.0
	Student Commuting	-	-	-	-	2,629.3
	Directly Financed Air Travel	4,825.7	947,457.3	9.3	10.7	950.9
	Other Directly Financed Travel	-	-	-	-	-
	Study Abroad Air Travel	-	-	-	-	-
	Solid Waste	-	-	13,823.3	-	345.6
	Wastewater	-	-	60.5	80.9	25.6
	Paper	-	-	-	-	65.4
	Scope 2 T&D Losses	22,569.6	2,056,366.9	18.3	25.7	2,064.5
Offsets	Additional					-
	Non-Additional					-
Totals	Scope 1	148,776.3	7,934,439.1	817.8	169.2	8,255.2
	Scope 2	228,204.0	20,792,153.8	185.2	259.6	20,874.1
	Scope 3	27,395.3	3,003,824.1	13,911.5	117.3	8,620.3
	All Scopes	404,375.6	31,730,417.0	14,914.5	546.1	37,749.6
	All Offsets					-
					Net Emissions:	**37,749.6**

Overview Table from the CACP Campus Carbon Calculator

Figure 3 Percentage GHG Emissions by Source

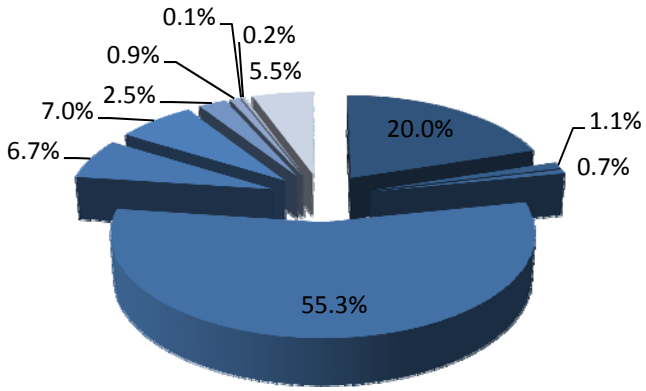
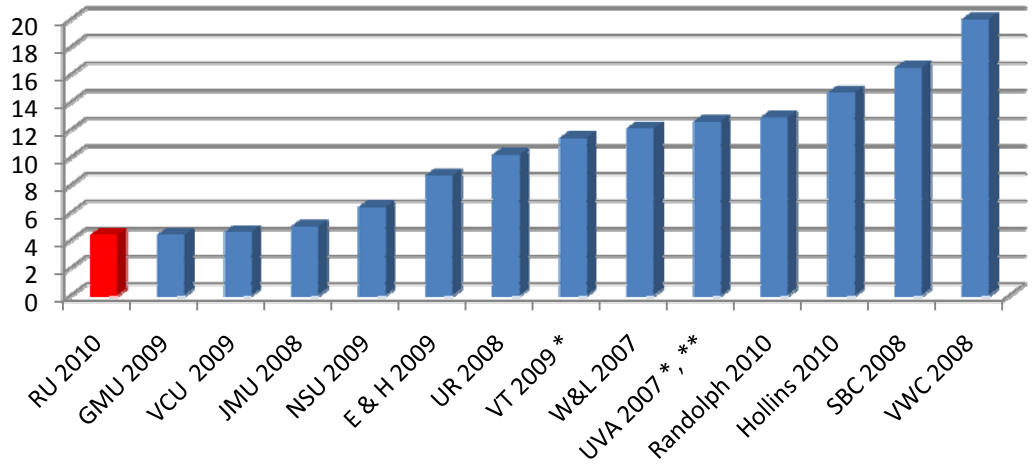


Table 2 Percentage GHG Emissions by Source

Scope 1	**21.9%**
Natural Gas	20.0%
Fleet Fuel	1.1%
Refrigerant & Chemicals	0.7%
Agriculture	0.1%
Scope 2	**55.3%**
Purchased Electricity	55.3%
Scope 3	**22.8%**
Faculty/Staff Commuting	6.7%
Student Commuting	7.0%
Air Travel	2.5%
Solid Waste	0.9%
Wastewater	0.1%
General Purpose/Copier Paper	0.2%
Transmission & Distribution Losses	5.5%

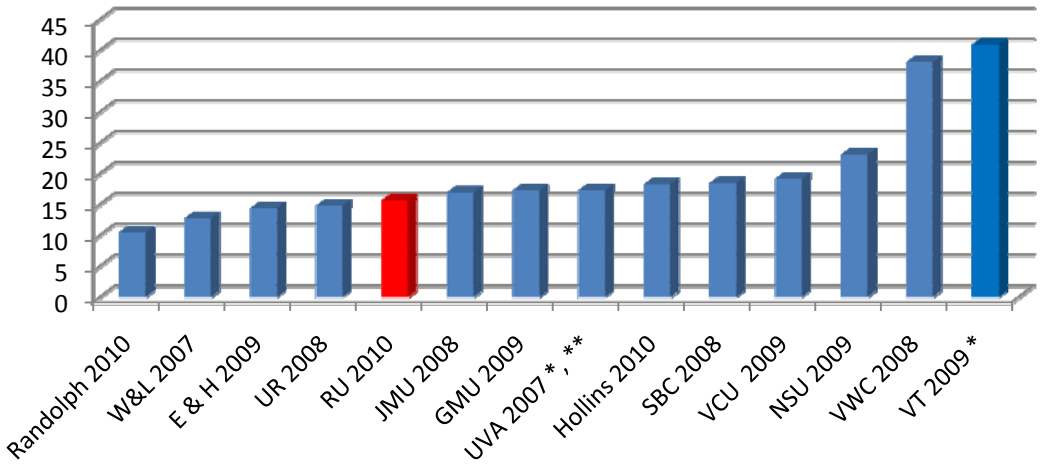
Directly comparing the total emissions inventories of other institutions to RU should be done with extreme caution due to the fact that no two institutions are exactly alike. Many factors affecting the emissions including the location of the institution (urban or rural), the educational focus (liberal arts, comprehensive, or research), and the type of facilities that exist on campus (e.g. a hospital) vary widely. However, the ACUPCC reporting website does try to normalize some of the data to allow for some comparability or benchmarking. The ACUPCC summary statistics include emissions per total student enrollment (FTE) and per 1,000 gross square feet of building space.

Figure 4 Net Emissions (MTCO2e) Per Full Time Enrollment of VA Institutions



Some VA ACUPCC signatories were excluded if there were no reports or there appeared to be an error on the ACUPCC reporting website
***VT & UVA are currently not ACUPCC signatories, **UVA figures are only for scopes 1 & 2**

Figure 5 Net Emissions (MTCO2e) Per 1000 Square Feet Of VA Institutions



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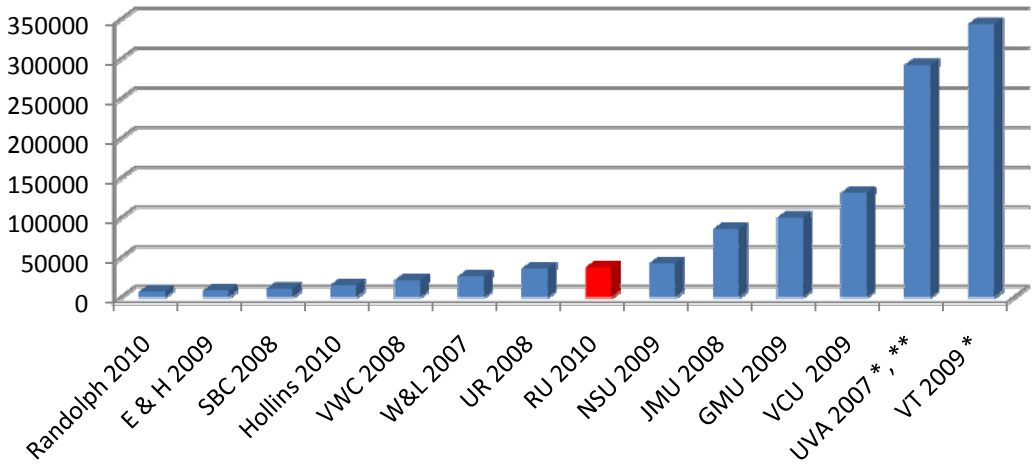
Intuitively, net GHG emissions have similarities to the normalized figures as well. There is a large variation within Virginia institutions ranging on the low end with Randolph College emitting 10,254 MTCO2e in 2010 to Virginia Tech emitting 344,000 MTCO2e in 2009. Some of the Virginia ACUPCC signatories were excluded due to an apparent error on reporting website system or the institution has not yet reported figures as of the date of this report. Those Virginia signatories include Ferrum College, Lynchburg College, Mary Baldwin College, and Shenandoah University.

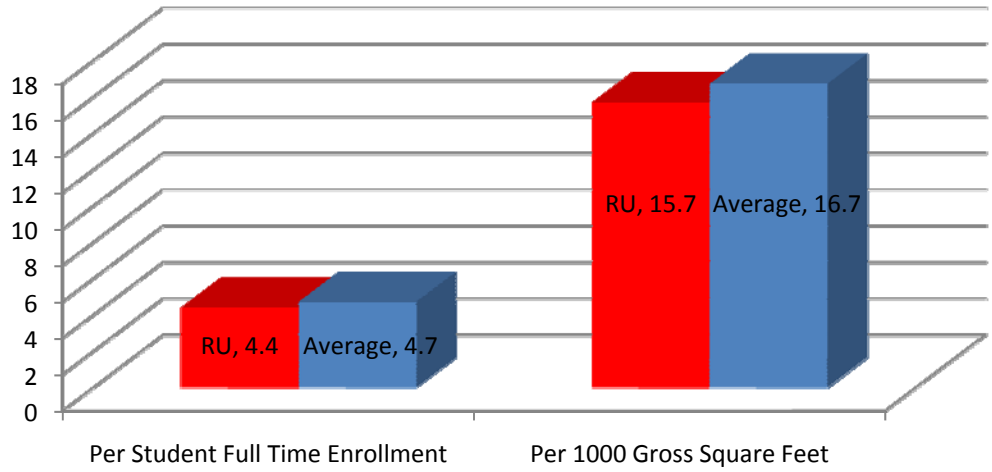
Figure 6 Net Emissions (MTCO2e) of VA Institutions



Some VA ACUPCC signatories were excluded if there were no reports or there appeared to be an error on the ACUPCC reporting website
***VT & UVA are currently not ACUPCC signatories, **UVA figures are only for scopes 1 & 2**

RU's normalized figures are slightly less than the ACUPCC's average emissions for Master's institutions. This is the case for both the full time enrollment and per 1,000 square feet categories. The number of Master's institutions is specifically noted as 138 GHG reports with some outliers being excluded from the total results.

Figure 7 Average Gross Emissions (MTCO2e) ACUPCC Master's Institutions



Comparing RU's total emissions to the ACUPCC Master's institutions average (26,802.2 MTCO2e) shows that RU is slightly higher. In addition, RU's scope 1 emissions are slightly higher than the average, the scope 2 emissions are significantly higher than the average, and the scope 3 emissions are significantly less than the average. Under the scope 1 area, RU's individual areas (21.9%) are consistent with the ACUPCC Master's average (24.5%). Under scope 2, RU's purchased electricity (55.3%) is significantly higher than the ACUPCC Master's average (41.4%). And most notably under scope 3 emissions, RU's commuting (13.7%- faculty, staff, & students combined) is significantly less than the ACUPCC commuting average (24.9%).

Figure 8 ACUPCC Average GHG Emissions by Source- Master's Institutions

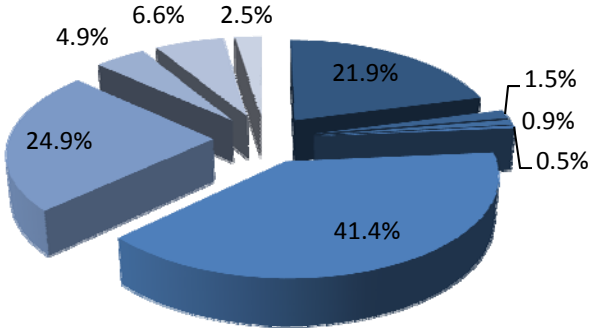


Table 3 ACUPCC Average GHG Emission by Source- Master's

Scope 1	**24.5%**
Stationary-Natural Gas, Cogeneration	21.9%
Mobile- Fleet Fuel	1.5%
Fugitive- Refrigerant & Chemicals, Agriculture	0.9%
Process-	0.5%
Scope 2	**41.4%**
Purchased- Electricity, Steam, Heat, Cooling	41.4%
Scope 3	**34.2%**
Commuting- Faculty, Staff, Students	24.9%
Custom Sources- Wastewater, Paper	4.9%
Air Travel	6.6%
Solid Waste	2.5%

While the individual percentages from the ACUPCC reporting website do not total the scope percentages, the figures were left in this report to provide some basic context.

Conclusions & Recommendations

RU has been taking steps to educate the campus community and to reduce energy consumption and the associated costs and emissions for many years. Many of the efforts, on both the academic and facility side, can be found in the sustainABILITY reports located on the sustainABILITY website.

Recommendations developed from this effort include initiating a system to track the air travel mileage of faculty/staff and students, study abroad, and continuing to conduct periodic research reports relating to the commuting patterns of RU's faculty, staff, and students that allows for the specific values to be entered into the CACP calculator so that all GHGs (methane, nitrous oxide, etc.) will be individually measured.

Reporting RU's GHG emissions annually is one way to benchmark the university's efforts for the coming years. The FY 2010 emissions inventory baseline will serve as the foundation for the development and implementation of the CAP and subsequent emission inventories. As reporting protocols evolve over the coming years, this inventory can and should be updated along with the subsequent inventories to track RU's mitigation progress. While specific emission-reducing strategies will be considered as part of the CAP process, efforts to ease the data collection process can and should implemented sooner rather than later.

Acknowledgements

Without the assistance, research, support, and efforts of many individuals, departments, and other structures, this GHG baseline inventory would not have been possible. Thank you to all involved many who are unnamed. If you have questions, feedback concerning this report, or want to find out more about RU's efforts, contact the SustainABILITY office by the website (www.radford.edu/rugreen) or by email at rugreen@radford.edu.

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