



sustainABILITY

RADFORD UNIVERSITY
CLIMATE ACTION PLAN
Spring 2013

Radford University is committed to being a model for sustainable campus practices and policies and recognized for our stewardship of economic, social, and environmental resources and for our academic commitment to sustainability.

Radford University’s Climate Action Plan serves as partial fulfillment of the requirements as a signatory of the American College & University Presidents Climate Commitment and the foundation for achieving climate neutrality.

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ACKNOWLEDGEMENTS

Many thanks to the multitude of individuals and organizations that contributed numerous hours of time, dedication, and ideas to the development of this plan. Of those individuals and organizations, many participated in workshops, meetings, and discussions that made this effort a collaborative success.

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EXECUTIVE SUMMARY

Climate Commitment

Building on a long and continuing history of using university resources wisely and in an efficient manner, Radford University has developed a comprehensive Climate Action Plan (CAP) that will serve as a living document tailored to the university to guide efforts to reach climate neutrality. On Campus Sustainability Day 2009, President Penelope W. Kyle and Radford University joined over 600 other colleges and universities in all 50 states representing over five million students in signing the American College and University Presidents Climate Commitment (ACUPCC). The ACUPCC's mission is to:

“accelerate progress towards climate neutrality and sustainability by empowering the higher education sector to educate students, create solutions, and provide leadership-by-example for the rest of society” (ACUPCC, n.d., ¶1).

Climate neutrality is further defined by the ACUPCC as “having no net greenhouse gas emissions”. To reach this aggressive goal, universities and colleges are called upon to take the following steps:

- Create an institutional structure to guide the university's efforts in the area
- Complete an comprehensive inventory of campus greenhouse gas emissions
- Develop an climate action plan to guide climate neutrality efforts
- Initiate at least two tangible actions to reduce greenhouse gas emissions

The Radford University Sustainability Steering Committee (SSC), formed in 2008 at President Kyle's direction, developed the following sustainability mission statement that was subsequently approved by the Board of Visitors in 2009. While understanding that any specific strategy recommendations will ultimately be dependent on the availability of future resources, including future funding, it is with this mission statement in mind that the SSC has developed and recommended the Radford University Climate Action Plan for acceptance and approval by the Board of Visitors and President Kyle.

Radford University is committed to being a model for sustainable campus practices and policies and recognized for our stewardship of economic, social, and environmental resources and for our academic commitment to sustainability.

Greenhouse Gas Inventory

The comprehensive baseline inventory of campus greenhouse gas emissions occurred for the fiscal year 2010 in which it was determined that 37,749 metric tons of carbon dioxide equivalent (MTCO₂e) were emitted due to Radford University's operations. Using procedures consistent with the ACUPCC implementation guide where little or no data is available, some assumptions were used to estimate the amount of emissions. While some categories of emissions are relatively small, for example agriculture and wastewater, the inventory should be considered a comprehensive snapshot to be used as the foundation for the university's first climate action plan.

Emissions Facts	
Serving Size 1 Campus (~185 acres)	
Students per Serving 8,878 students (FY2010)	
Amount per Serving	*MTCO ₂ e
GHG Emissions	37,749
GHG Emissions Percentage by Source	
Purchased Electricity	**55.3%
Natural Gas	20.0%
Student Commuting	7.0%
Faculty/Staff Commuting	6.7%
Transmission & Distribution Losses	5.5%
Air Travel	2.5%
Fleet Fuel	1.1%
Solid Waste	0.9%
Refrigerant & Chemicals	0.7%
General Purpose/Copier Paper	0.2%
Agriculture	0.1%
Wastewater	0.1%
*Metric Tons of CO ₂ equivalent	
**Percentages do not equal 100% due to rounding	
For More Info: www.radford.edu/rugreen	

Climate Action Plan Process

While the CAP is a comprehensive document to guide climate neutrality efforts, it is recognized that not all related efforts within the university could be captured during development of the CAP. This plan represents countless hours of dedication and hard work by students, faculty, staff, and community members who are motivated by strong beliefs around this effort. Abiding by the recommendations of the ACUPCC, the dedicated developers of the CAP focused on authoring a brief summary report that is comprehensible and accessible to the general public.

One of the commitments with signing the American College & University Presidents Climate Commitment is to achieve climate neutrality by developing an institutional plan including:

- A target date for achieving climate neutrality as soon as possible
- Interim target dates for goals and actions that will lead to climate neutrality
- Actions to make climate neutrality and sustainability a part of the curriculum and other educational experiences for all students
- Action to expand research or other efforts necessary to achieve climate neutrality
- Mechanisms for tracking progress on goals and actions

The following plan sets the foundation for that portion of the commitment. The Climate Action Planning process at Radford began in earnest during the Spring semester 2011. Over the course of many months, suggestions, recommendations, and ideas were collected and evaluated. Additional research as to the applicability of the recommendations to Radford University's campus was conducted before finalizing this document. To assist with organization and prioritization, the strategies were divided into various timeframes of implementation including short-term, mid-term, and long-term.

Overall Strategies

While educating those on campus and beyond around issues on climate neutrality including behavior changes and sustainability in general; conservation efforts, energy efficiency, & incorporating renewable energy generation opportunities are the overall strategies that Radford has chosen to embrace. It is expected that even if the efforts outlined in this report are fully implemented, there will be some level of remaining greenhouse gas emissions due to the ongoing operations of Radford University, including air travel and commuting, that will need to be addressed. These ongoing emissions will likely need to be offset by purchasing renewable energy credits (RECs) and/or carbon offsets to reach climate neutrality.

Climate Neutrality Target Date

The CAP has set forth goals to reach climate neutrality in what is considered an aggressive but obtainable goal. With over 650 climate action plans that have been publically submitted to the ACUPCC online reporting system, the most common target date is 2050. A range of target dates include those that have already achieved climate neutrality as early as 2009 to those that have set a target of 2099. Radford University has set **2040** as its climate neutrality target date, recognizing that this depends on many unforeseen factors at this time. The cost of current technologies and the development of future technologies are expected to heavily influence climate neutrality approaches. During the implementation phase of the CAP, the sustainability office will meet regularly with the Finance and Administration office to evaluate challenges and opportunities. The availability of other resources including faculty, staff, and students will also play a large role in this and future updates of the CAP.

Looking accurately into the future poses multiple challenges and will require consistent CAP revisions after many current stakeholders have left campus. Incorporating different timeframes of implementation, tracking its progress over time, and modifying the plan as needed, will ensure that Radford University accomplishes its long-term plan. This report represents Radford University's commitment to use all of its resources in a sustainable manner for future generations with the vision, courage, and determination to lay out a realistic plan to reach climate neutrality.

Reference

ACUPCC (n.d.) Mission and History. Retrieved April 7, 2012 from: <http://www.presidentsclimatecommitment.org/about/mission-history>

INTRODUCTION

BACKGROUND/HISTORY

The Climate Action Plan is the culmination of a process of increasing awareness and action on the part of Radford University. For example, in 1991, then-President Donald Dedmon along with the members of the Virginia College and University Presidents' Council, signed the Talloires Declaration, committing the university to a path to respond to environmental challenges faced by many. Radford continued its efforts on the facilities side as well including receiving grants in the mid-1990s to replace less efficient T12 fluorescent lighting style with the better quality, more efficient T8 style. In the mid-2000's, Radford began incorporating infrared technology and installing additional building automation systems to control Heating, Ventilation, and Air Conditioning (HVAC) controls in residential hall renovations.

With a long history of recognizing its leadership role in addressing environmental challenges that we face, during the Radford University convocation in August 2008, President Penelope W. Kyle announced that she was initiating an aggressive effort to make Radford University one of, if not the, most environmentally sustainable campus in the Commonwealth. She would be appointing a Sustainability Steering Committee (SSC) representing all parts of campus including student affairs, facility services, and academic affairs to recommend a course of action to meet that goal.

At the Steering Committee's first meeting in October 2008, President Kyle charged the committee with recommending to her and the Cabinet how to build new buildings that use less energy, to upgrade our recycling efforts and perhaps coordinate those with the City of Radford, and to consider other sustainability initiatives. Her goal was to have RU be recognized across the Commonwealth as a distinctly "green" campus. The Committee would serve as a venue for reviewing sustainability recommendations that cut across organizational boundaries and provide input into recommendations from the broad RU community.

Potential areas of focus included harnessing the energy of the student body as a driving force for sustainability initiatives; looking at LEED certification for all new buildings and renovations; conducting a baseline greenhouse gas emissions inventory; and, generally promoting sustainability which is a criteria by which external rating groups (e.g., Princeton Review) evaluate and rate universities. Another area of discussion should be exploring membership in the American College and the University Presidents' Climate Commitment (ACUPCC).

The ACUPCC was formally established in 2007 with the mission to "accelerate progress towards climate neutrality and sustainability by empowering the higher education sector to educate students, create solutions, and provide leadership-by-example for the rest of society". By signing the commitment, ACUPCC institutions have agreed to: 1) Complete an emissions inventory, 2) Within two years, set a target date and interim milestones for becoming climate neutral, 3) Take immediate steps to reduce greenhouse gas emissions by choosing from a list of short-term actions, 4) Integrate sustainability into the curriculum and make it part of the educational experience, and 5) Make the action plan, inventory and progress reports publicly available. The ACUPCC is celebrating five years of formal existence and has nearly 700 signatories including small technical colleges, community colleges, private and state-supported liberal arts universities, and large research universities.

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). 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.).

PROCESS

RU selected the Clean Air-Cool Planet's (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 Intergovernmental Panel on Climate Change'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.

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. For this reason, 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.

With the greenhouse gas inventory completed and publically available on the ACUPCC reporting website, attention then turned to developing the CAP. In determining the resources available, the SSC determined it was best to utilize the most amount of time available to the university. So, two deadline extensions were ultimately filed with the ACUPCC during the process.

In continued efforts, assistance from an outside consultant was sought to help launch the effort, gather information about campus attitudes and expectations, and provide technical expertise in a limited timeframe. Moseley Architects was selected as the consultant to assist Radford in this monumental effort. Along with Moseley, two other consultants, 2rw and LandDesign provided additional support.

To kick off the CAP development efforts, three one-hour workshops were hosted by RU's Sustainability Steering Committee on Thursday, April 28, 2011, in the Hurlburt Student Center to solicit campus input. The workshops were open to students, faculty, staff, and others that are interested in the development of the CAP. The workshops featured presentations on the CAP planning process, environmental issues and university efforts toward carbon neutrality as well as discussions during which ideas and suggestions were discussed.

Likely based on familiarity with the topic in general as well as personal beliefs, responses to questions on the CAP questionnaire varied greatly. When asked by what year should Radford commit to becoming carbon neutral, responses ranged from 2018 to 2050. Mitigation strategy recommendations included overall energy reduction, improved energy efficiency, implementing renewable energy, and transportation issues including "fixing" the Tartan Transit routes. Some recommendations on potential additional course offerings included alternative energy, special focus areas like the New River or environmental health topics, and including more Core or introductory courses that included sustainability-related topics. Additional responses to the most effective ways to inform and involve the broader campus included guest lectures, to campus competitions, community events, and more.

The SSC created two Technical Working Groups (TWG) to consider comments, study the options, and develop a comprehensive plan. The TWGs were formed during the 2011 Fall Semester. One of the TWGs was the Mitigation TWG which focused its efforts on energy usage and transportation related to campus operations, while the other, the Education, Research, and Outreach TWG, focused its efforts on curriculum, research, and the community. Both TWGs were tasked with submitting draft recommendations to the SSC by January 13th, 2012.

Invitations for volunteers to research and develop goals were sent out in September to the campus through various outlets including the RU Today, a newsletter published by the Office of University Relations, the sustainability website (www.radford.edu/rugreen), Facebook page, and others. Periodic progress reports were also relayed to campus using the same outlets. The SSC did not meet again until February to allow sufficient time to collect, analyze, and edit the recommendations. Collecting the recommendations and compiling them along with the other requisite info into a comprehensive document required considerable time and effort. So much so, that the SSC determined that a second four month extension would be beneficial to the overall process and document. With the draft recommendations and report in hand, it was time for routing the CAP document to various campus stakeholder groups to obtain comments, suggestions, and ultimately support for submitting the document to President Kyle and the Board of Visitors for approval. Upon receiving approval, the Sustainability Coordinator was responsible for submitting the CAP to the ACUPCC reporting website.



CAMPUS EMISSIONS

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. The inventory serves 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 (MTCO_{2e}).

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.

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.

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.

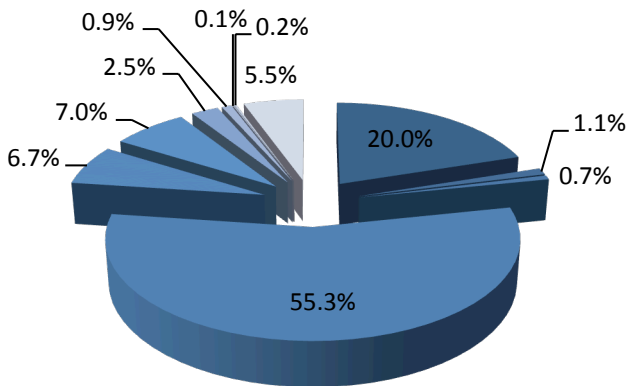
Some of the table cells are blank either due to the fact that they do not apply to RU or the info was unobtainable or nonexistent within the resources allotted for the inventory. For example, RU does not have a cogeneration plant at this time; therefore the cells are left blank. Also, while some efforts 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 MTCO_{2e}.

Table 1 Overview of Annual GHG Emissions

Fiscal Year	2010	Energy Consumption	CO ₂	CH ₄	N ₂ O	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 Clean Air-Cool Planet Calculator (v.6.6, totals may differ due to rounding)

Figure 3 Percentage GHG Emissions by Source*



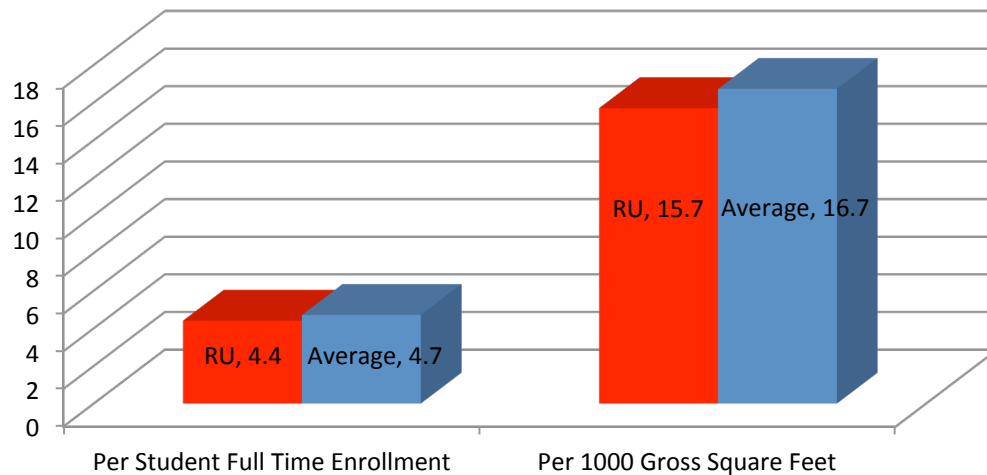
*Percentages do not equal 100% due to rounding

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%

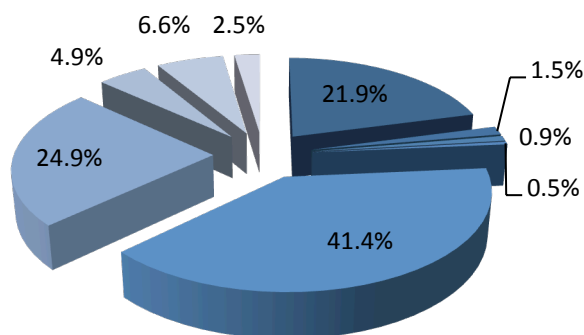
RU's normalized figures are slightly less than the ACUPCC's average emissions for Master's institutions. This is the case for both the full time enrollment and per 1,000 square feet categories. The number of Master's institutions is specifically noted as 138 GHG reports with some outliers being excluded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

Business as Usual

As part of any Climate Action Plan, it is important to first estimate what an institution's carbon emissions profile would look like into the future, based on planned and reasonably foreseeable growth in both student population and in the built environment, in the absence of any intentional carbon reduction programs. Specific mitigation strategies can then be proposed to reduce both existing and future carbon emissions in the quest for eventual neutrality.

Radford University does have plans for growth in the near term, with projections extending to 2017 for student population growth and projections extending to 2018 for building growth (see figures 1 and 2 below). The offices of Enrollment Planning and Management and Facilities Planning and Construction provided the expected growth rates.

Figure 1 Student enrollment growth beyond 2017 was modeled at a constant 1% per year.

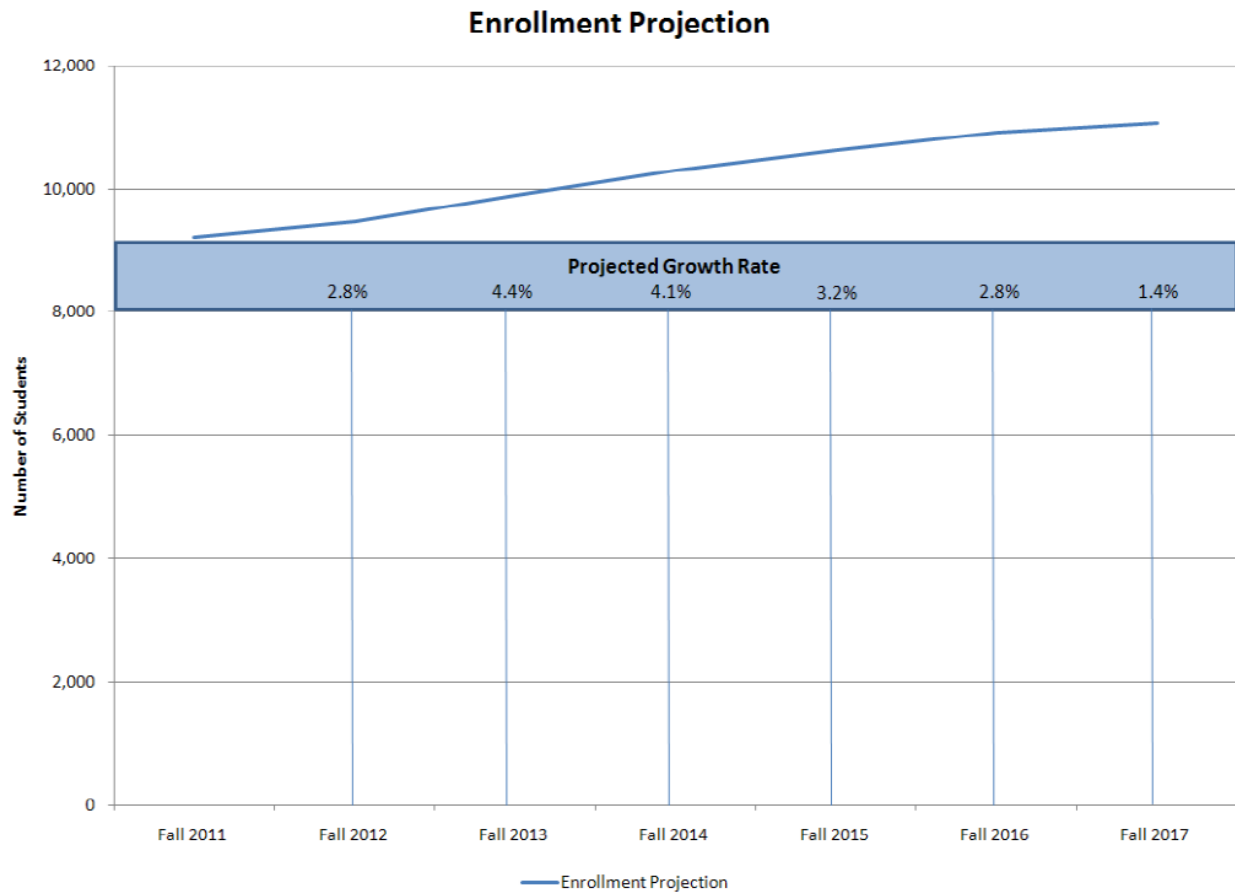
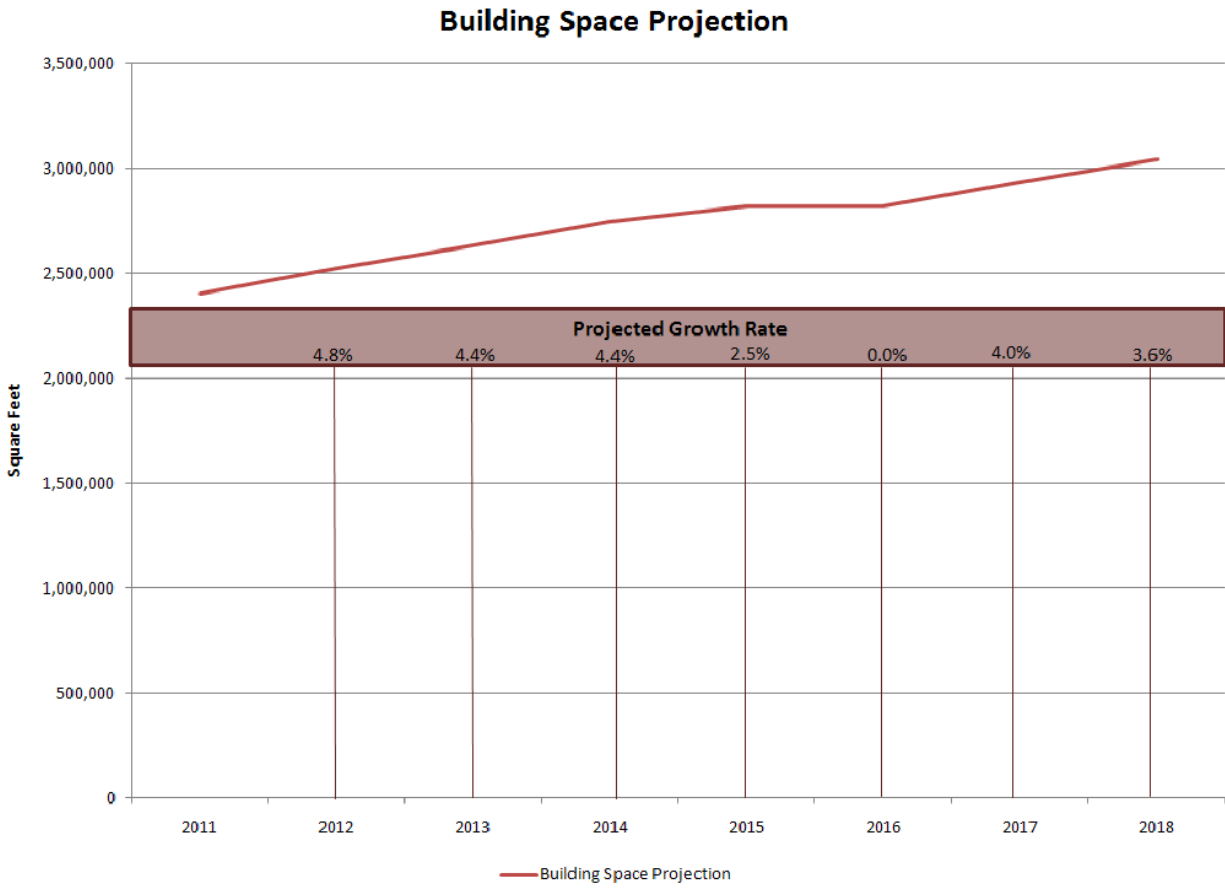
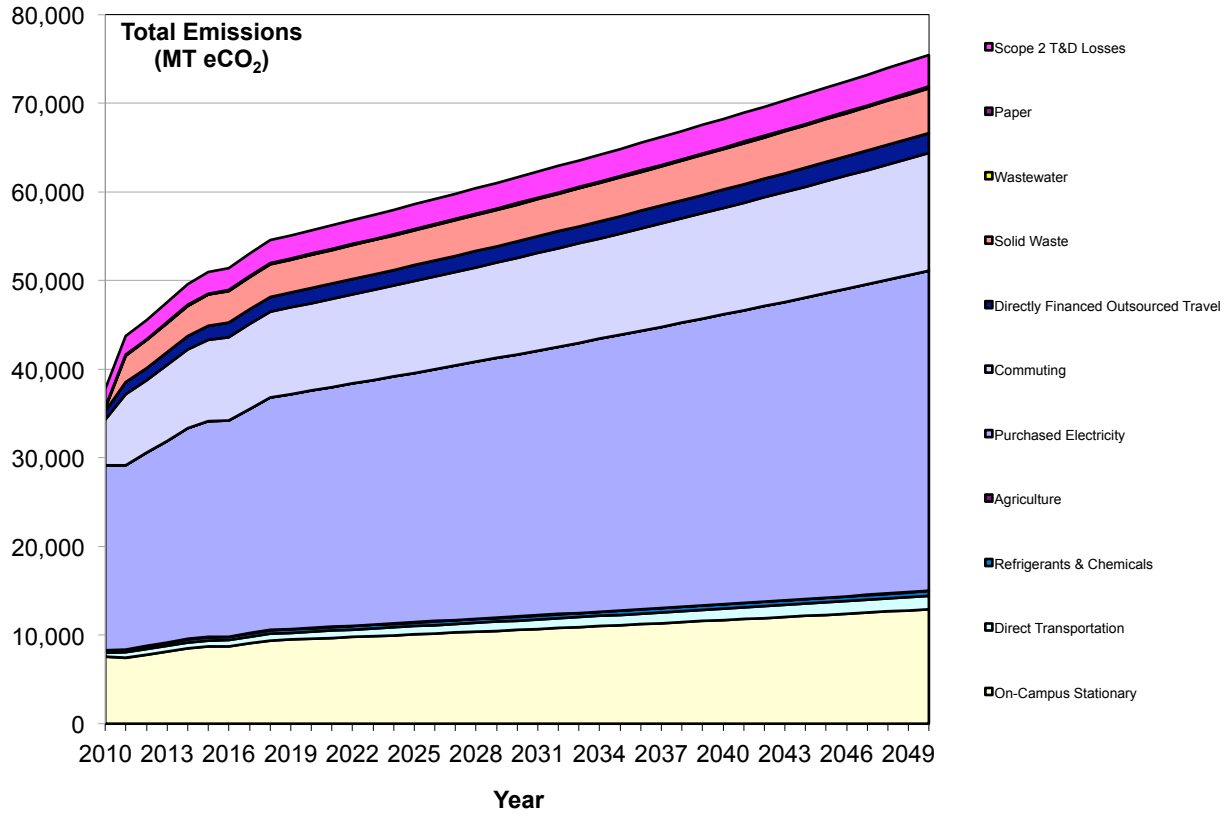


Figure 2 Building space growth beyond 2018 was modeled at a constant 1% per year.



Based on these “business as usual” assumptions, the total carbon emissions at Radford University in 2050 are predicted to almost double the 2010 baseline by growing to 75,456.5 MT eCO₂. Figure 3, below, depicts this growth in each of Radford University’s emission categories:

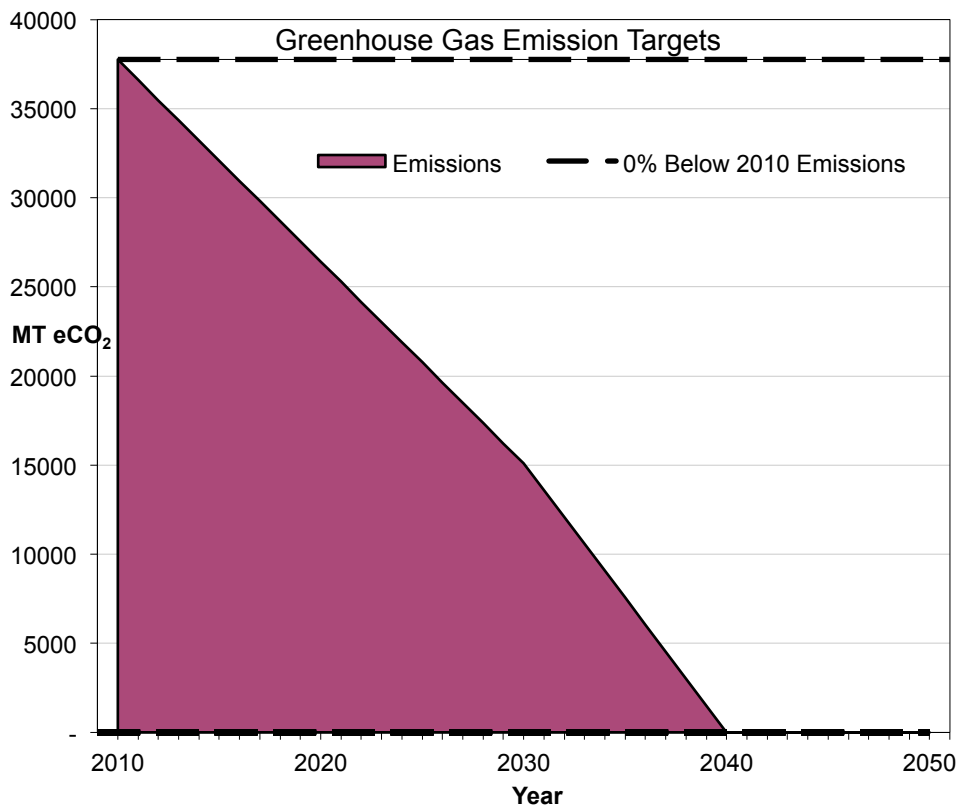
Figure 3 Business As Usual (BAU) Emissions



ACUPCC Plan Graph

As part of the ACUPCC, the Climate Action Plan should include a target date for achieving climate neutrality with interim targets for goals and actions that will lead to climate neutrality. It is recognized that this monumental task is based on an aggressive but ultimately attainable date. The target date and interim targets are based on a series of assumptions including reductions of the costs of current and future technologies, the growth of RU's campus, and the current and future campus resources available. A review of the current climate neutrality targets included in CAPs listed on the ACUPCC's reporting website shows that the modal target date is 2050. The range of target dates listed begins with an early date of 2009 and a late date of 2099. It is RU's goal to reach climate neutrality by 2040 with interim targets of a 30% reduction of greenhouse gas emissions from the fiscal year 2010 baseline by 2020 and a 60% reduction from the baseline by 2030. These are aggressive climate neutrality and interim goals that, as stated previously, depend on a number of factors. In addition, RU does not expect the emission reductions to necessarily continue in a direct linear fashion as shown in the graph below. More likely, campus greenhouse gas emissions are likely to increase in the near term, even while additional conservation and efficiency measures are taken due to the expected growth of campus building spaces and student enrollment. Realistically, the expected emissions reduction graph will likely be more curvilinear with the largest emission reductions occurring in later years.

Figure 4 Greenhouse Gas Emission Targets



MITIGATION STRATEGIES

The challenge for Radford University is to implement programs across all sectors of its operations to reduce carbon emissions while growing both enrollment and the built environment. This section explores mitigation strategies that will address these concerns.

From the fiscal year 2010 baseline greenhouse gas inventory, it is obvious that electricity and natural gas consumption combined with the transportation sector are the leading contributors of campus emissions. Generally, conservation efforts are typically one of the first focuses of campus sustainability efforts with energy efficiency efforts following those. These strategies typically produce some of the quickest paybacks and highest returns when evaluating a broad spectrum of strategies to reduce emissions. However, at some point, institutions with expected growths in student enrollment and building spaces, generation of electricity will have to play a larger role to reach climate neutrality. Additionally, other areas of campus contribute to the overall greenhouse gas inventory and these will require persistent attention as well. Outlined below are some of these areas and the expected strategies to neutralize the associated greenhouse gas emissions:

- Infrastructure-** focuses on the built environment by providing spaces that are conducive to learning and working on campus in a safe and efficient manner. This section has one of the largest potential reductions of greenhouse gas emissions while also having one of the largest potential cost implications as well. Currently, retrocommissioning of some campus buildings are taking place and capital projects are being designed to exceed ASHRAE minimum standards as finances are available. Additionally, capital projects are being designed and built to a campus standard that will achieve the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Silver rating as a minimum. Today's designs and building of Zero Energy Buildings (ZEB) is still limited at the commercial scale, thus, the cost is largely prohibitive. However, in the future as new technologies become available and the building industry improves and expands, the cost of ZEBs is expected to come down. When looking at decades down the road and with the anticipated growth on campus, ZEBs will become a substantial part of the university's commitment to achieving climate neutrality. While upfront capital costs are utilized for maximum benefit of space and usage demands, considering the life cycle costs of new or renovated campus buildings can reduce ongoing cost commitments for the university.

Strategy	Short Term	Mid-Term	Long-Term	Notes
Infrastructure				
Examine and pursue methods, strategies and possibilities of improving the energy performance of new and existing facilities while providing a comfortable and safe campus environment				
Retro-commissioning (RCx), & continuous commissioning (CCx)	Perform RCx on buildings with existing DDC controls. Expect 10% heating and cooling savings due to RCx.	Invest in CCx in order to maintain efficiency gains.		
New Construction- monitor current standards (ASHRAE 90.1 2007) & continue to evaluate ability to exceed minimum requirements	Continue with design measures to exceed minimum design standard by 15-20% (ASHRAE 90.1 2007)	Continue to evaluate new standards; Continue with design measures to exceed minimum design standard by 30% (ASHRAE 90.1 2007)	Continue to evaluate new standards & technologies based on feasibilities	Currently meeting LEED-Silver requirements for all new & renovation projects. Reference Executive Order No. 19 (2010) Conservation and Efficiency in the Operation of State Government
Zero Energy Buildings (ZEB) built after 2030		Evaluate ZEB financial impacts & begin designing & building to meet ZEB standard as feasible	Continue designing & building to meet ZEB standard as feasible	
Retrofit all pre-2030 bldgs to ZEB			Develop renovation schedule and include ZEB design standard to all renovation projects as feasible	

- Conservation-** while similar in its focus on buildings, it also includes operational aspects as to how the buildings are run to achieve various objectives. Conservation efforts are typically considered to have the largest returns regarding the cost to implement and the savings achieved. In the short term, continued efforts to convert existing fixtures to more efficient models through attrition can be implemented as resources are available.

Initially, this can be accomplished with relatively low costs with relatively high benefits received. However, in the mid- to long-term, complete retrofits with more difficult applications and newer technologies should be expected to cost considerably more.

Strategy	Short Term	Mid-Term	Long-Term	Notes
Conservation				
Identify and pursue conservation programs to reduce natural resource consumption				
Water conservation	Continue to implement water conservation strategies throughout campus (e.g. low-flow faucets, toilets, fixtures, etc.)			Reference Executive Order No. 19 (2010) Conservation and Efficiency in the Operation of State Government
Lighting- Buildings	Install vacancy /occupancy sensors and daylight harvesting systems where appropriate and phase out any remaining T12 and incandescent lamps in favor of T8 or T5s and CFLs in existing buildings. Design strategy for all new construction and major renovations should maximize daylighting and use low level ambient lighting with supplemental task lighting.		All new construction projects and major renovations should utilize LEDs in conjunction with previously noted design and control strategies.	Reference Executive Order No. 19 (2010) Conservation and Efficiency in the Operation of State Government
Lighting- Parking Lots Conversion (LEDs, Induction)	Identify & implement pilot project(s) to achieve 10% parking lot electricity reduction	Achieve 50% parking lot electricity reduction using more efficient technologies	Achieve 75% parking lot electricity reduction using more efficient technologies	
Lighting- Buildings	Install 25W T8 lighting through attrition as standard in place of the current 32W T8 lighting standard	Through attrition, complete campus turnover to 25W standard		Install reduced wattage light bulbs and programmable ballasts as campus standard
IT related power reductions due to technology improvements.	Apply power management settings at network level to reduce computer & monitor consumption. Replace printers, copiers, scanners, faxes, with high efficiency multi-function devices.	Use of new & existing technologies such as Learning Management System, Smart Phones, video conferencing, and other technologies to create more energy efficient business processes.		

- Generation-** focuses on campus efforts to generate more sustainable forms of energy to be utilized by campus. Energy generation, especially on a large scale for the university, has the potential to have a significant reduction of greenhouse gases due to the university’s location and its energy provider fuel mixes. Even with recent reductions in the cost to install energy generation systems, it is likely to be one of the largest costs included in this plan in the short-, mid-, and long-term. Offsets,

Strategy	Short Term	Mid-Term	Long-Term	Notes
Generation				
Examine and pursue appropriate alternate strategies that provide low-carbon energy				
Alternative Fuel (Biomass)	Conduct a feasibility study on a biomass boiler to reduce natural gas usage	If feasible, secure funding to design and construct a biomass boiler	Maintain savings throughout the design life of the boiler	
Alternative Fuel (Geothermal)	Conduct a feasibility study on geothermal potential to reduce natural gas usage	If feasible, secure funding to design and construct heating/cooling systems to utilize geothermal energy	Maintain savings throughout the design life of the system	
Solar thermal domestic hot water	Renovations and new construction projects should investigate the opportunity and feasibility of heating domestic water with solar energy or waste heat from other systems operation			
15% Renewable Energy target by 2025	Achieve 0.5% of electricity needs using renewable energy generation (solar, wind, geothermal, etc.)	Achieve 15% renewable energy generation (solar, wind, geothermal, etc.)	Achieve higher percentage targets to be developed in future revisions	Percentage reduction based on University’s electrical usage.
Offset 25% of total emissions by purchasing Renewable Energy Credits (RECs) and/or carbon offsets by 2025	Achieve 5% offset by 2017 as feasible	Achieve 25% offset by 2025 as feasible	Achieve remaining percentage required to offset remaining GHG emissions by 2050	Continually evaluate purchase of RECs and/or carbon offsets vs. investing in campus greenhouse gas emissions efficiencies

- Behavior, Work, & Living Environment-** focuses on student, faculty, and staff interactions and engagement with the built environment and operational aspects. The potential cost and greenhouse gas reductions associated

with these strategies can vary widely depending on the extent to which they are implemented. Existing energy awareness efforts have been conducted using minimal resources, however, expanding this effort to all areas of campus, using new technologies, and other possible ideas would require additional resources. And while short-term implementation costs of some of these are expected to be relatively low, the need for consistent campus-wide support is imperative for the mid- to long-term success. Mid-term and long-term costs for any additional requirements incorporated into purchasing policies should be expected to have some impact but the level is difficult to ascertain as vendors are expected to become more familiar with these types of requests and products will be more readily available and with reduced costs.

Strategy	Short Term	Mid-Term	Long-Term	Notes
Behavior, Work, & Living Environment				
Examine and pursue methods, strategies and possibilities of improving the energy performance of existing facilities while providing a comfortable and safe campus environment				
Energy awareness	Implement an organized, interactive, energy awareness program and make it part of standard ongoing operations. Possible ideas include Building Energy Reporting, Sustainable Office Certification Program, and Competition for all buildings (energy & water). The residential halls have participated in energy (electricity & water) conservation competitions. A possible idea to enhance to the competition might be to share a percentage of energy savings with winning residence halls. Also, a report could be placed in each hall informing residents of their performance and with strategies on how to reduce and reuse for next month. Reports could be web-based if feasible.			Reference Gov. McDonnell's Executive Directive #3 (2011)- Operational Improvements. Residential Hall ideas could include implementing small but effective strategies to aid in the sustainability efforts such as placing a plastic hanger in each student shower before move-in to encourage shorter showers, handing out a CFL to each freshman to use in their lamps, and requiring students to bring Energy Star appliances to campus.
Temperature Set Point Policy Implementation	Develop & implement campus policy			Reference Gov. McDonnell's Executive Directive #3 (2011)- Operational Improvements
Facility Utilization/Occupancy Scheduling Policy	Develop & implement campus policy	Maintain campus savings & implement into new/renovated buildings		
Environmentally Preferred Purchasing Policy	Develop and implement a campus-wide purchasing policy	Mandate policy to new or existing contracts as they are renewed		Computers- EPEAT ratings, Cleaning-Green Seal or Eco logo, Paper-Certifications or Recycled Content-increase recycled %, Vendor Code of Conduct for RU Logo items (Workers Rights Consortium or Fair Labor Assoc.), Local (250 miles or less) purchasing, 3 rd Party certifications (organic, MSC, Fair Trade, etc.), Vegan, Trans-fat free, Franchisee Guidelines, & others.
Sustainability Student Internship or Student Fellow Program	Create a program to include opportunities (1-10) for students from various majors	Enhance program to provide additional student opportunities (10-25)	Enhance program to provide additional student opportunities (25+)	Create a program to provide hands-on experience, education, and research opportunities and offer expanded capabilities of the sustainability staff. There are possible research collaboration opportunities with the Clean Energy Center at the SWVA Higher Education Center which engages in research best practices and alternative energy source solutions.
Peer-to-Peer Sustainability Education	Create peer-to-peer education program and a sustainable living reference guide.	Educate students about sustainability efforts and provide leadership opportunities (5-30) for students.	Enhance program to provide additional student opportunities (30+)	Peer-to-peer education programs provide activities, projects, and other opportunities for students to learn from their peers while living in campus residence halls, apartments, etc. The student leaders educate students on living more sustainably and conserving resources while on RU's campus. Sustainability-related topics typically include energy conservation (electricity and water), waste management and recycling, food, transportation, etc.
Performance	Create language that	Create language that requires existing position evaluations to		Performance Evaluations- include

Evaluations	requires new hire evaluations to consider more sustainable behaviors as a factor in the performance rating	consider more sustainable behaviors as a factor in the performance rating	language in all faculty, staff, etc. reviews
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- Transportation-** focuses on the numerous modes that students, faculty, and staff utilize to arrive on campus, travel around and beyond campus, and supply options that are more sustainable. Transportation emissions were the third largest emitter identified in the baseline inventory and with expected increases in student enrollment, and the associated faculty and staff positions, these would be expected to rise as well. A multipronged, comprehensive approach to address these emissions is needed to have the most impact. By providing multiple transportation options, incentivizing desired behaviors, and minimizing others, greenhouse gas reductions would be expected. Eliminating the availability of campus parking permits has obvious cost implications in the short-, mid-, and long-term time frames. Creating parking pricing structures that reflect the need, availability, and other objectives can offset some of the revenue reduction. Other options have already been investigated and other even pilot tested on campus with minimal investment.

Strategy	Short Term	Mid-Term	Long-Term	Notes
Transportation				
Identify and pursue conservation programs to reduce natural resource consumption related to vehicles				
Campus Fleet	Create a vehicle replacement plan for campus. Replace vehicles with higher efficient vehicles (miles per gallon).	Increase fleet MPG by 10%. Evaluate standards & technologies to include hybrid, electric, or other alternative fuel vehicles.		Increase fleet MPG by 15%. Evaluate standards & technologies to include hybrid, electric, or other alternative fuel vehicles.
Student Commuting	Option 1-Eliminate Freshman parking passes. Option 2- Sell parking passes at a higher rate depending on living distance to campus. Reduce student SOV commuters by 10%.	Increase parking permit costs. Reduce student SOV commuters by 20%.	Increase parking permit costs. Reduce student SOV commuters by 40%.	Approximately 20% of enrolled students are freshman. SOV=Single Occupant Vehicle. Consider future surveys including more detailed information regarding students' vehicles so a more accurate MPG average can be determined.
Faculty/ Staff Commuting	Prioritized Parking for Carpool and hybrid vehicles. Increase parking fees. Reduce faculty/staff SOV commuters by 5%.	Increase distance learning/online classes. Vehicle plug in stations. Provide on campus housing for employees. Incentivize living closer to campus. Reduce faculty/staff SOV commuters by 15% by 2017.	Increase distance learning/online classes. Reduce faculty/staff SOV commuters by 25% by 2027.	Future surveys can include more detailed information regarding faculty/staff vehicles so a more accurate mpg average can be determined.
Alternative Transportation on Campus	Institute car, ride and bicycling sharing programs. Purchase bikes for rental program. Install bike racks at all buildings on campus. Reduce overall transportation emissions by 2%.	Expand connectivity of bus system. Reduce overall transportation emissions by 4% by 2017.	Reduce overall transportation emissions by 6% by 2027.	City of Radford and VDOT have developed a long range transportation plan that should be coordinated with University's proposed improvements.
Preferred Parking Program	Develop & implement program to incentivize	Achieve a 50% alternative transportation rate	Achieve a 75% alternative transportation rate	Preferred parking program- carpool, vanpool, alt. fuel vehicles, etc.
Air Travel	Identify shortest/most effective routes and carriers. Track air travel by departments/ colleges. Enhance Video conferencing capabilities. Reduce Air Travel emissions by 5%.	Create Air Travel GHG Inventory for each department or college. Additional emissions to be offset by carbon offset purchase. Reduce air travel emissions by 25% 2017.	Reduce air travel emissions by 50% by 2027.	Reductions for air travel can be achieved by purchasing carbon offsets, selecting more direct routes, and minimizing the overall air travel by the University. The proposed GHG Inventory system per department can be used for future measuring as well.
Telecommuting Program	Implement program to achieve 20% participation rate of eligible positions	Achieve a 50% participation rate of eligible positions	Achieve a 90% participation rate of eligible positions	Reference Executive Directive #3 (2011)- Operational Improvements Human Resources & Travel
4-Day Work week	Develop & pilot project; achieve a 10% participation rate of eligible positions	Achieve a 50% participation rate of eligible positions	Achieve a 90% participation rate of eligible positions	Reference Executive Directive #3 (2011)- Operational Improvements Human Resources & Travel
No-Idling policy	Develop & implement policy to include faculty, staff,	Maintain campus savings		

	students, & visitors			
Campus Bike Plan	Develop campus bike plan & increase percentage of registered bicycles by 10%	Achieve 20% increase of registered bicycles	Achieve 30% increase of registered bicycles	Plan to include travel lanes, storage, campus map, and consideration of bike share program. Evaluate Bike-friendly University designation from League of American Bicyclists.
Distance Learning/ Online Classes	Measure & increase online course offerings by 10%	Achieve 30% increase in course offerings	Achieve 50% increase in course offerings	

- **Grounds-** focuses on actions and policies that create a more sustainable campus. Minimal costs (short-, mid-, and long-term) would be expected from implementing these strategies. Preliminary steps to implement these efforts have already been taken in some cases. While achieving certain levels of benefits, reduction of greenhouse gas emissions would be minimal when compared to other areas.

Strategy	Short Term	Mid-Term	Long-Term	Notes
Grounds				
Identify and pursue various programs to reduce natural resource consumption and enhance the campus environment				
Tree Campus USA	Investigate & apply for Tree Campus USA designation	Maintain requirements for designation		
Integrated Pest Management Policy	Develop & implement campus policy	Maintain campus policy & revise as needed		
Campus Organic Garden	Investigate feasibility of designating an on-campus organic garden maintained by students.	Develop garden as feasible	Provide 5% of vegetables and herbs used by food services.	Students can learn how to care for and tend to plants and the importance of organic foods. Possible project for the sustainability- themed hall.
Sustainable Landscape Policy	Develop & implement campus policy to reduce fertilizer emissions by 10%	Maintain policy & revise as needed to reduce fertilizer emissions by 50%	Maintain policy & revise as needed to use only organic fertilizers	Policy will consider Low-Maintenance Landscaping or "Greenscaping", Native Plants, Wildlife Habitats, Tree canopy cover target, among other items.

- **Waste Minimization-** focuses on reducing materials unnecessarily destined for the landfill or recycling centers including the transportation-related emissions that accompany them. By minimizing wastes on the front end, costs to recycle items or dispose of them properly will be reduced as well. Several composting pilot programs have been tested previously and implementation of available technologies or programs would be expected to have a higher cost than typical land filling options. However, savings through transportation and labor efforts would help to offset some of those costs and reduce the related greenhouse gas emissions.

Strategy	Short Term	Mid-Term	Long-Term	Notes
Waste Minimization				
Identify and pursue various efforts to reduce campus waste generation				
Waste Reduction	Work with retailers and dining providers for decreased packaging and more recycling during contract renewals.	Create waste awareness program on campus with goal of decreasing waste to landfills by 25% by 2017.	Create waste awareness program on campus with goal of decreasing waste to landfills by 35% by 2027.	Future measurement improvement includes tracking the weight of waste produced at each building on campus. Reference Executive Order No. 19 (2010) Conservation and Efficiency in the Operation of State Government

Paper Reduction	Reduce Junk Mail and phone books from campus. Create a paper monitoring program. Achieve 50% of all paper used on campus has 50% recycled content. Have paperless invoices for 25% of all departments and communications. Decrease paper consumption by 5%	Achieve 75% of all paper used on campus is 75% recycled content. Maintain paper consumption for 2017 year. Have paperless invoices for 100% of all departments and communications. Decrease paper consumption by 10% by 2017.	Achieve 90% of all paper used on campus is 100% recycled content and paper consumption is same as 2017 by 2027.	Develop/enhance a central purchasing reporting program for the entire University to better track materials purchased and quantities.
Temporary Food Event Policy	Develop and implement a campus-wide event policy	Continue temporary event policy, revised as needed	Continue temporary event policy, revised as needed	Policy will address temporary vendors/events that occur on campus throughout the year requiring vendors to comply with campus waste and recycling procedures
Composting program	Investigate & implement a composting/pulping program (on or off-campus)	Continue composting program to include pre- and post-consumer materials	Continue composting program to include pre- and post-consumer materials	RU has participated in different versions of composting programs in the past diverting ~700 lbs. a day from Dalton Dining Hall from the landfill.
Electronic systems for accreditation, assessment, annual reporting, and program review.		Investigate available systems to save ~30,000 pages a year by moving to electronic filing.		Radford University used two electronic systems to prepare and submit documentation for its decennial reaffirmation of accreditation by the Commission on Colleges of the Southern Association of Colleges and Schools (SACS). The first system, Compliance Assist, is a hosted system that is designed to prepare the Certification of Compliance and all supporting documentation in electronic form. It also serves as the website for Radford's reaffirmation. Plans are to implement the academic program review component of ComplianceAssist within the next year. The second system, WEAVEOnline, is also a hosted system that provides an electronic method of collecting and reporting assessment activities for every department and functional unit on campus. Prior to implementing these two systems, the University provided paper copies of documentation to support reaffirmation efforts.

- Recycling**- in combination with the waste minimization efforts, focuses on reusing materials and recycling materials that are no longer of immediate use on campus. Recycling efforts are the initial efforts recognized by many that speak to the level of commitment by a campus to operate in a more sustainable manner. Depending on the various streams, market fluctuations, and local or regional capabilities, recycling efforts often can either bring in revenue to be used to offset other programs or actually incur a direct cost. Greenhouse gas reductions are directly attributable to recycling efforts and the amount of material that is sent to the landfill.

Strategy	Short Term	Mid-Term	Long-Term	Notes
Recycling Identify and pursue various efforts to reuse campus wastes and recycling any remaining materials				

Recycling	Enhance campus recycling policy with defined target and goal percentages. Achieve and maintain recycling rate over 50% for campus. Create waste generation and recycling reports for campus.	All campus dining and events to be net-zero waste programs. Increase recycling rate for campus to 60%. Establish purchasing policy for campus that has overall recycled content requirements for per department.	Increase recycling rate for campus to 75% by 2027.	Future measurement improvement includes investigating the tracking the weight of recycling goods for each building on campus.
Recycling Streams	Investigate additional recycling stream opportunities and develop appropriate policies as needed	Investigate additional recycling stream opportunities and develop appropriate policies	Investigate additional recycling stream opportunities and develop appropriate policies	Possible additional streams: Chemical Reuse, Wood (trees & limbs 6" diameter or larger), Leaves, Ceiling tiles, Mattress recycling, Plastic bags
Recycling Programs	Continue existing programs and expand as able	Continue existing programs and expand as able		Existing programs include the RecycleMania competition, & Move In/Out (YToss?) programs. Additional efforts could include hosting a Recycling Olympics competition with students.
Reusable Office Supply	Create a reusable office supply program (closet, office, etc.)	Continue reusable office supply program		Program to reallocate campus office supplies that might otherwise be sent to the landfill or purchase additional supplies unnecessarily.



EDUCATIONAL, RESEARCH, & COMMUNITY OUTREACH STRATEGIES

- Education-** focuses not only on curricula but also co-curricular activities that help to broaden the overall campus experience for students, faculty, staff, and others while at Radford University. A course listing related to sustainability and/or climate efforts and effects is already available and will be updated periodically. While some of the strategies will have direct costs associated with them, they would be expected to be minimal or even incorporated into already existing or planned future efforts. The reduction of greenhouse gas emissions directly related to the education strategies outlined here would likely be minimal; however, they could lead to additional reductions in other areas as well.

Strategy	Short Term	Mid-Term	Long-Term	Notes
Education				
Expand and develop educational offerings to make climate neutrality and sustainability a more central part of the curriculum and offer other educational experiences so students can learn about climate change: its seriousness, causes, and solutions.				
Academic Integration & Course Support	Devote at least one lesson plan to energy issues in APST200 and other courses as applicable. Facilitate fieldtrips in thematically appropriate upper-level classes such as visits to active and inactive mountaintop removal coalmining sites.	Cross-list thematically appropriate upper-level classes with undergraduate and graduate sustainability degree courses.		Include energy issues in APST200, PHSC431, & other courses. Seek external funding to support regular offerings. Some courses are listed in the catalog but are rarely taught due to insufficient faculty availability. With additional resources, other courses could be developed, such as course on climate change and climate policy.
Speaker, Lecture, and Film Program	Establish funding sources to invite at least two guest lecturers per year for a community-wide event where the guest discusses regional energy and environmental issues.			Collaborate with other offices to support speakers, films, and other forums to raise awareness of historical, contemporary, and future information and ideas about energy consumption, natural resource extraction, and environmental considerations, and related service-learning opportunities.
Educating Students about Green Careers & Workshop Proposal	Foster greater interaction between students and adults who are active in sustainability to help them explore vocational and career options. Develop a Green Careers Workshop that will promote and educate RU students about green careers and sustainability. Develop a Graduation Pledge vowing to be socially and environmentally responsible citizens of the world they will enter after receiving their degrees. Emphasize Green Graduate Programs at the RU Graduate School fair.	Work to integrate this workshop into specific certification programs and degree programs at RU, as well as the general curriculum. Assess and research the impact of the Green Careers Workshop on student interest in sustainability.		Career Services can partner with other departments to provide workshops, tours, and panel discussions related to building a green workforce, exploring green careers, and preparing for and searching for green jobs. This can also include field trips to employers who are leaders or innovators. Workshops would be provided for University 100 classes, residential life, individual classes, and senior seminar classes. These workshops will introduce sustainability and green careers to students at Radford University.
Increased Emphasis on Distance Learning/ Online Education	Measure & increase online course offerings by 10% Require that all instructors teaching online courses complete the Faculty Development Institute or similar program	Increase online course offerings by 30%. All online courses taught will be Quality Matters certified within two years of implementation.	Increase online course offerings by 50%. All online courses taught will be Quality Matters certified within two years of implementation.	An increased emphasis on online education will reduce carbon emissions for both faculty and students. Successfully developing and offering online courses for faculty and students will require training and technological support. CITL can support this initiative through Faculty Development Institutes and certification of Quality Matters standards for online courses.
Faculty Development	Orient all new faculty to campus sustainability efforts. Develop <i>Our Turn</i> or other faculty development workshops on sustainability	Develop a network of faculty to promote sustainability pedagogy across the RU campus. Engage in strategic hiring to strengthen our expertise in sustainability		The Curriculum Subgroup (CS) of the SSC will work with the Faculty Development Center to train faculty who incorporate sustainability into

	and or climate change similar to current workshops on teaching writing and/or critical thinking.	and climate change.		courses across the curriculum and who use sustainable practices in their classes. The CS will work with the Center for Innovative Teaching & Learning to recruit faculty to teach sustainability topics in the Core Curriculum and across the curriculum.
Degree Development in Sustainability	Development of certificate program and one graduate degree in sustainability.	Development of one undergraduate degree and doctorate program in sustainability.	Integrate some aspect of sustainability into all curricula	The number of degrees or certificates received in sustainability will increase significantly.
Freshmen Education Campaign (University 100 & Quest)	Establish sustainability as required topic in freshmen orientation classes. Assess student knowledge and behaviors related to sustainability (Sustainability Literacy Assessment).	Assist NSP with access to speakers and experts in sustainability. Ensure Sustainability Office addresses new students and families; consider having each student sign a sustainability pledge during orientation; designing a residential orientation experience for freshmen interested in sustainability based degrees; developing an engaging video as a tool to educate freshmen and families.		The Curriculum Subgroup will partner with New Student Programs (NSP) to integrate sustainability education into the University 100 curriculum. Initial steps have been taken to educate peer leaders teaching the University 100 classes. University 100 is only a 10-week course with an array of topics competing for importance. The Curriculum Subgroup plans to assist NSP in with course evaluations to assess the effectiveness of the curriculum. Radford University's orientation program (Quest) facilitates the successful academic and personal transition of new students and their families into the Radford community. NSP will facilitate opportunities for new students and their families to learn about RU's commitment to sustainability and efforts regarding the Climate Action Plan.
Core Curriculum Integration	Provide the opportunity for any interested student to study issues of climate change and sustainability through the Core Curriculum.			Expose a larger number of underclass students to sustainability concepts and issues through the general education curriculum. The Curriculum Subgroup will work with the Core curriculum director and faculty to support the integration of sustainability as a Core topic. The goal would be to ensure that all students have the opportunity to study sustainability issues as part of the Core.
Promote Collections of Sustainability Resources	Add a Sustainability category to the library's Database Finder so that databases containing sustainability resources can be easily found by users.	Create an online guide to identify and provide access to the library's resources for sustainability research in a central location; create a public display of sustainability collections	Provide library instruction at the request of teaching faculty in the Environmental Studies and Sustainability program; and, support student course work through individual consultations with reference services staff; fund and develop print and online collections of sustainability resources	Promote materials in McConnell that pertain to sustainability research by creating finding aids and public displays to highlight collection resources. The library will also provide instruction and research support to students enrolled in courses in the Environmental Studies and Sustainability program or conducting research relating to sustainability in general.

- Research-** focuses on expanding the potential for faculty and students to conduct related research. While research and efforts to present the information like the Undergraduate/Graduate Engagement Forum and the Big South Undergraduate Research Symposium are already occurring, these strategies aim to enhance those opportunities while also seeking additional opportunities. While some strategies may request funding, most are

based to the ability to receive external funding through grants, donations, and the like. Greenhouse gas reductions could range from minor to more significant depending on the area of research conducted.

Strategy	Short Term	Mid-Term	Long-Term	Notes
Research				
Expand current research and develop future efforts related to the mitigation and adaptation of climate change, including opportunities for students.				
Interdisciplinary Research & Environmental Center Collaboration	Visit Appalachian Regional Reforestation Initiative (ARRI) sites in the Central Appalachian region to view best practices for reclaiming abandoned strip mine sites with proper soil preparation and hardwood plantings. Seek external funding to facilitate alternative spring break and Maymester travel/lodging for students to plant and monitor ARRI sites in Southwest Virginia. Seek in-kind donations from coal and utility companies, nurseries, and local governmental agencies to enable reclamation work.	Develop faculty-faculty and faculty-student research relationships across colleges centered on land issues in the region. Study macro-level land use in the NRV to determine best practices that are sustainable and that contribute to efforts to buy and eat locally. Pursue internal and external grants to facilitate this work.		With the determination of land use best practices, RU can employ these practices on its own property (e.g. growing various foods) and the multidisciplinary research teams can work with the RU Foundation to make smart land purchases for local carbon offsets. Researchers could continue to investigate the ability to obtain carbon offsets and/or create carbon credits through reforesting abandoned strip mine sites.
Faculty and Student Mini-grants for research on Sustainability and Environmental Issues	Create a sustainability literacy assessment which could potentially be utilized in freshman education campaigns. Seek internal (possibly from a student green fee, energy conservation programs, etc.) and external funding to support small grants to RU students for research projects.	Fund awards (\$8,000 annually) for competitive applications for joint faculty student research on sustainability which demonstrates the potential for application to campus. Identify and document changes on campus that result from faculty and student research on sustainability, whether funded or not.		By supporting this type of research, RU faculty and students learn about what practices are more sustainable and what types of policies and procedures can be used to implement them. They can also potentially see the impact of their work on campus. Grants could be awarded through a competition and the RU Environmental Center's advisory committee could choose the recipients. Recipients would be required to present their findings at an appropriate forum, such as the National Conference on Undergraduate Research. Students and faculty would not only be able to present their research at such conferences, but would also receive feedback from an outside audience, as well as share ideas and explore potential collaborations with researchers from other institutions.
Energy Dashboard Project	Install energy (electricity & water) "dashboards" in multiple residential halls. Educate students & reduce energy consumption in campus residential housing.	Use results to further reduce energy consumption in residence halls by 5 – 10%.		Data will be collected on energy use, student attitudes and practices, and responses to different outreach/education strategies.
Associate Network of Researchers & Research Consortium	Expand research and teaching around sustainability. Expand curricular offerings through Sustainability Research Consortium.	Expand to at least 40 organizations in the network. Expand to at least eight regional institutions in the consortium.		Seek external and internal funding with the assistance of Sponsored Programs and Grants Management to support the further development of a network of associates and affiliated organizations and individuals, as well as to raise the Environmental Center's presence both within and outside the University. Seek NSF funding for establishment of a consortium of regional small- to mid-sized colleges and other organizations for research and teaching around a sustainability theme of decentralized community water and energy. Pursue grants in collaboration with nonprofit organizations and academic institutions, as well as businesses and governmental and nongovernmental

				organizations.
Find Funding Opportunities & Partner with proposal development	Identify and provide funding sources related to sustainability issues to appropriate sustainability committee members; identify funding sources for mitigation strategies and disseminate to appropriate departments and programs.	Support sustainability funding initiatives that bring in at least \$200,000 annually to RU. Support faculty research and funding around sustainability issues, possible collaborators include the RU Environmental Center, Selu Conservancy, and others.		Sponsored Programs & Grant Management will work with the sustainability committee by disseminating targeted funding opportunities & proposal development, as well as, other sustainability areas of interest to the committee.

- Community Outreach & Other Efforts-** focuses on the university's efforts to provide both local and global education, knowledge, and behavioral opportunities while sharing successes on campus with the greater community. Whether working with community partners off campus or educating those that come to campus, Radford University recognizes its role of leadership and its ability to effect positive change from others to progress as well. Again, while some of the strategies will have direct costs associated with them, they would be expected to be minimal or even incorporated into already existing or planned future efforts. Reductions of greenhouse gas emissions would be expected to be minimal when compared to other categories of strategies and the campus baseline inventory.

Strategy	Short Term	Mid-Term	Long-Term	Notes
Community Outreach & Other Efforts				
Expand current community outreach efforts related to climate neutrality and sustainability as well as other relevant efforts potentially including community service or service learning activities, community partnerships, or community education initiatives. Reduce impacts on the environment in residential life and other campus operations to showcase the university as a model for sustainability.				
Host Conferences and Workshops		Employ a multidisciplinary team at RU to organize a climate/sustainability conference. Engage undergraduate and graduate students in the planning process. Encourage student and faculty research presentations.		Host national/international conferences and workshops on RU's campus. RU can continue to establish itself as a leader in this area and the entire campus would have multiple ways to participate in such a conference.
Athletics Education & Awareness Campaign	Start a sustainability campaign at various sporting events. Reach out to businesses within the community to sponsor the campaign or giveaways. Create Student-Athlete Education Video- starring Radford University Athletes. Increase the percentage of advertising, sponsorships, and promotions inside Dedmon Center using video board.			Educate student and general public spectators on living more sustainably. This could include educating the spectators of recycling bins that are placed throughout the arena via video board usage. These events would be promoted through Social Media, Website and Text Messaging advertising.
Environmental Studies Alternative Break Trips	Provide 5 trips per year with environmental issues as a central theme.	Provide 10 trips per year with environmental issues as a central theme.		Alternative Break Trips offer the opportunity for students to immerse themselves into local cultures, environments, and communities. These experiences can significantly contribute to transformational learning and commitment to ecological and environmental consciousness. With each trip accommodating at least 10 students, within 5 years, these trips should be engaging 50 students per year in these experiences.
Establish service-learning partnerships with public agencies and non-governmental organizations.	Establish formal relationships with five environmental agencies or organizations	Establish formal relationships with ten environmental agencies or organizations		Establishing partnerships with public agencies and non-governmental organizations with a mission related to conservation, environmental management/regulation, environmental education, and other environmental

				related work will allow for more opportunities for service-learning and community-based research. These partnerships will provide more opportunities for faculty to include environmental-related experiential learning in their courses. These partnerships and courses will allow more students to engage in service-learning with these organizations.
Clean with the Dean	Beautify campus and surrounding community, encourage students to be active in keeping the community litter free.	To involve 200 students annually.		Participate in a community and campus wide cleaning effort. The Dean of Students Office coordinates this event and Housing & Residential Life actively promotes and supports this event.
Sustainability-Themed Hall	One hall, approximately 30 students. Encourage residents to power down computers, turn off lights, unplug any unnecessary items. Residential Life staff will provide craft/arts from recycled material and possibly have organic foods for students to sample during the Green Hour. Provide more community cleanup efforts similar to Clean with the Dean during the academic year. Work in conjunction with Radford city for a possible River Cleanup during spring semester.			Students who reside on this hall will be considered sustainability students and will be committed to a more environmentally conscious lifestyle. A Living Green hall will create a multitude of collaboration and community outreach possibilities. Students will have the opportunity to connect with the other environmentally conscious organizations, students and faculty across campus. The Living Green hall can host programs demonstrating how to include sustainable habits into daily lives. Residential Life can also incorporate a volunteering requirement for students who reside on sustainability-themed hall. Students can also arrange community service.
Residential Life Staff Initiatives	The resident assistants and directors will be more mindful a when promoting hall programs and other activities.	Reduce resource use by 25%. Introduction of 'green' contests for both on and off campus students.		The directors will encourage staff members to reduce printing for advertising programs and to be more resourceful by taking advantage of social media for advertisement purposes.
Student Green Fee for a Greener Campus	If approved by students, a small fee could be attached to any enrolled RU student's tuition to be set aside for sustainability efforts (curricula, research, infrastructure, etc.). Another option would be for the administration to set aside a similar amount of money to be used for the same purposes.	Support the addition of renewable energy technologies to on-campus buildings to include residence halls, offices, student centers, parking lots, etc. and the addition of hybrid/electric transit system.	Support the addition of renewable energy technologies to on-campus buildings to include residence halls, offices, student centers, parking lots, etc. and the addition of hybrid/electric transit system.	Support the use of student fees to improve the sustainability of RU's curricula, research, infrastructure and culture. This type of funding for sustainable projects has been implemented by many institutions around the state and nation.
Participate in the Sustainability Tracking, Assessment, & Rating System (STARS) Program	Participate in AASHE's STARS program; Coordinate the dissemination and collection of materials for submission years.	Participate in AASHE's STARS program; Coordinate the dissemination and collection of materials for submission years.		The Sustainability Tracking, Assessment & Rating System™ (STARS) is a transparent, self-reporting framework for colleges and universities to measure their sustainability performance. STARS® was developed by AASHE with broad participation from the higher education community. https://stars.aashe.org/
Advertising & Promotion	Add to the existing directory of sources of information on climate change; To develop and disseminate additional educational or promotional materials on climate change; support and promote a series of educational and information exchange forums (seminars, discussions, workshops, etc.); promote the diffusion of information on climate change throughout the campus community. Support the development of a campaign slogan, along with a theme, graphics, and key		Contribute to the creation, distribution or support of products (high or low-tech) that can be incorporated into the curricula of Virginia's schools. To harness the natural curiosity and	Articulate and discuss the current state of knowledge of climate change and its impacts. It is considered important that these issues are brought to the fore so as to address public misgivings about climate change and elaborate the need to take action and develop an ethic of mitigation. University relations will help

	<p>messages; Consider developing an advertising campaign that includes billboard advertising; a poster campaign; point-of-action messages (stickers, signage) on recycling bins and other high traffic or visibility points, signs, etc.; Publish articles, both locally and regionally on RU's efforts to reduce greenhouse gas emissions</p>	<p>enthusiasm of young people and raise their level of awareness and understanding of climate change perhaps some kind of partnership with the College of Education and Human Development can create products about climate change and sustainability that can be incorporated into the curricula of Virginia's schools.</p>	<p>spread the word through the website, RU Today newsletter, Magazine of RU, and portal.</p>
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FUNDING, TRACKING PROGRESS, & MODIFYING THE PLAN

Sources and levels of financial support for Radford University's climate neutrality efforts are expected to be as diverse as the strategies employed. While exact levels of financial support are difficult to determine at this time, continued support from university administration should be expected. During the future phases of the CAP, the sustainability office will meet regularly with the Finance and Administration office to continue to evaluate challenges and opportunities. Additionally, efforts to implement a form of a student green fee, research mini-grant funding, and identifying additional opportunities through external agencies and organizations are all expected to assist with strategies to reach its climate neutrality goal. While prioritizing efforts and implementing those with the greatest emission reduction potential per unit of cost is desirable, this approach does not fully take into account the educational mission of higher education institutions. Thus, attempting to recognize the larger perspective should be taken into account when reviewing potential efforts.

The tracking of progress towards reaching climate neutrality will be primarily monitored through the periodic greenhouse gas inventories that are conducted as part of the ACUPCC. As discussed previously, the baseline inventory was conducted for FY 2010. Using established ACUPCC protocols, it is Radford University's intent to conduct the inventory for each year in order to provide a comprehensive perspective and allow for more detailed analysis of campus actions and behaviors. It can be anticipated that with the expected growth in student population and building square footage that greenhouse gas emissions may rise in the short term time frame. With additional deployment of technologies available today and the availability of new and emerging technologies in the future, progress will be realized with the goal to reduce greenhouse gas emissions to reach climate neutrality.

As for the Climate Action Plan, it is Radford University's intent to periodically revisit the plan to see how closely the actual greenhouse gas emission-reducing efforts mirror the detailed plan. Typical with most forward-thinking campus plans, there are internal and external factors that should be expected to affect the Climate Action Plan, both positively and negatively. With an intended every other year schedule to update or modify the plan as needed, the university can continue to track its progress towards climate neutrality.

All of Radford University's ACUPCC efforts will be available to the public in an effort to share experiences and assist others in their efforts to reach climate neutrality. Information that will be made available will include campus greenhouse gas inventories, climate action plan updates, and progress reports. This information will be shared through campus media channels including campus newsletters, websites, and social media. In addition to these, the information will also be shared with the Association for the Advancement of Sustainability in Higher Education (AASHE) for posting and dissemination through its channels including the ACUPCC reporting website.

CONCLUSION

Implementation of Radford University's Climate Action Plan will not occur quickly and should not be expected to be necessarily easy. Just as the development of the plan took dedication and hard work, implementation will require much more of the same. Available resources, financial and otherwise, will obviously greatly impact the university's efforts to reach climate neutrality. Continued efforts of various individuals, offices, department, committees, and the like will be required to implement, track progress, and modify the plan as needed. It is with a great sense of leadership, commitment, and responsibility that Radford University endeavors to reach its climate neutrality goal.



APPENDICES

Appendix A: The Association of University Leaders for a Sustainable Future's The Talloires Declaration

Appendix B: The American College and University Presidents' Climate Commitment (ACUPCC)

Association of University Leaders for a Sustainable Future

The Talloires Declaration 10 Point Action Plan

We, the presidents, rectors, and vice chancellors of universities from all regions of the world are deeply concerned about the unprecedented scale and speed of environmental pollution and degradation, and the depletion of natural resources.

Local, regional, and global air and water pollution; accumulation and distribution of toxic wastes; destruction and depletion of forests, soil, and water; depletion of the ozone layer and emission of “green house” gases threaten the survival of humans and thousands of other living species, the integrity of the earth and its biodiversity, the security of nations, and the heritage of future generations. These environmental changes are caused by inequitable and unsustainable production and consumption patterns that aggravate poverty in many regions of the world.

We believe that urgent actions are needed to address these fundamental problems and reverse the trends. Stabilization of human population, adoption of environmentally sound industrial and agricultural technologies, reforestation, and ecological restoration are crucial elements in creating an equitable and sustainable future for all humankind in harmony with nature.

Universities have a major role in the education, research, policy formation, and information exchange necessary to make these goals possible. Thus, university leaders must initiate and support mobilization of internal and external resources so that their institutions respond to this urgent challenge.

We, therefore, agree to take the following actions:

1) Increase Awareness of Environmentally Sustainable Development

Use every opportunity to raise public, government, industry, foundation, and university awareness by openly addressing the urgent need to move toward an environmentally sustainable future.

2) Create an Institutional Culture of Sustainability

Encourage all universities to engage in education, research, policy formation, and information exchange on population, environment, and development to move toward global sustainability.

3) Educate for Environmentally Responsible Citizenship

Establish programs to produce expertise in environmental management, sustainable economic development, population, and related fields to ensure that all university graduates are environmentally literate and have the awareness and understanding to be ecologically responsible citizens.

4) Foster Environmental Literacy For All

Create programs to develop the capability of university faculty to teach environmental literacy to all undergraduate, graduate, and professional students.

5) Practice Institutional Ecology

Set an example of environmental responsibility by establishing institutional ecology policies and practices of resource conservation, recycling, waste reduction, and environmentally sound operations.

6) Involve All Stakeholders

Encourage involvement of government, foundations, and industry in supporting interdisciplinary research, education, policy formation, and information exchange in environmentally sustainable development. Expand work with community and nongovernmental organizations to assist in finding solutions to environmental problems.

7) Collaborate for Interdisciplinary Approaches

Convene university faculty and administrators with environmental practitioners to develop interdisciplinary approaches to curricula, research initiatives, operations, and outreach activities that support an environmentally sustainable future.

8) Enhance Capacity of Primary and Secondary Schools

Establish partnerships with primary and secondary schools to help develop the capacity for interdisciplinary teaching about population, environment, and sustainable development.

9) Broaden Service and Outreach Nationally and Internationally

Work with national and international organizations to promote a worldwide university effort toward a sustainable future.

10) Maintain the Movement

Establish a Secretariat and a steering committee to continue this momentum, and to inform and support each other's efforts in carrying out this declaration.



American College & University Presidents' Climate Commitment

We, the undersigned presidents and chancellors of colleges and universities, are deeply concerned about the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic and ecological effects. We recognize the scientific consensus that global warming is real and is largely being caused by humans. We further recognize the need to reduce the global emission of greenhouse gases by 80% by mid-century at the latest, in order to avert the worst impacts of global warming and to reestablish the more stable climatic conditions that have made human progress over the last 10,000 years possible.

While we understand that there might be short-term challenges associated with this effort, we believe that there will be great short-, medium-, and long-term economic, health, social and environmental benefits, including achieving energy independence for the U.S. as quickly as possible.

We believe colleges and universities must exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality. Campuses that address the climate challenge by reducing global warming emissions and by integrating sustainability into their curriculum will better serve their students and meet their social mandate to help create a thriving, ethical and civil society. These colleges and universities will be providing students with the knowledge and skills needed to address the critical, systemic challenges faced by the world in this new century and enable them to benefit from the economic opportunities that will arise as a result of solutions they develop.

We further believe that colleges and universities that exert leadership in addressing climate change will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni and local communities.

Accordingly, we commit our institutions to taking the following steps in pursuit of climate neutrality:

1. Initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible.
 - a. Within two months of signing this document, create institutional structures to guide the development and implementation of the plan.
 - b. Within one year of signing this document, complete a comprehensive inventory of all greenhouse gas emissions (including emissions from electricity, heating, commuting, and air travel) and update the inventory every other year thereafter.
 - c. Within two years of signing this document, develop an institutional action plan for becoming climate neutral, which will include:
 - i. A target date for achieving climate neutrality as soon as possible.
 - ii. Interim targets for goals and actions that will lead to climate neutrality.
 - iii. Actions to make climate neutrality and sustainability a part of the curriculum and other educational experience for all students.
 - iv. Actions to expand research or other efforts necessary to achieve climate neutrality.
 - v. Mechanisms for tracking progress on goals and actions.

(continued...)

2. Initiate two or more of the following tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed.
 - a. Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.
 - b. Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.
 - c. Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution.
 - d. Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.
 - e. Within one year of signing this document, begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.
 - f. Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.
 - g. Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste.
3. Make the action plan, inventory, and periodic progress reports publicly available by submitting them to the ACUPCC Reporting System for posting and dissemination.

In recognition of the need to build support for this effort among college and university administrations across America, we will encourage other presidents to join this effort and become signatories to this commitment.

Signed,

President/ Chancellor Signature

President/ Chancellor Name

College or University

Date

Please send the signed commitment document to:

Presidents' Climate Commitment
c/o Second Nature
18 Tremont St., Suite 308
Boston, MA 02108

or fax to: 320-451-1612
or scan & email to: ACUPCC@secondnature.org