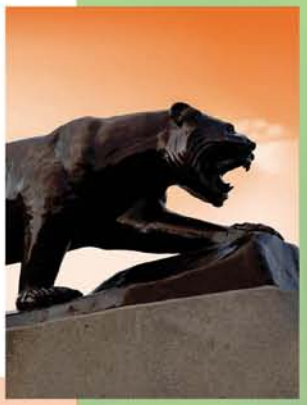
CLEMSON UNIVERSITY

Sustainability Action Plan



Submitted by the President's Commission on Sustainability, August 1, 2011

Version 1.0.9

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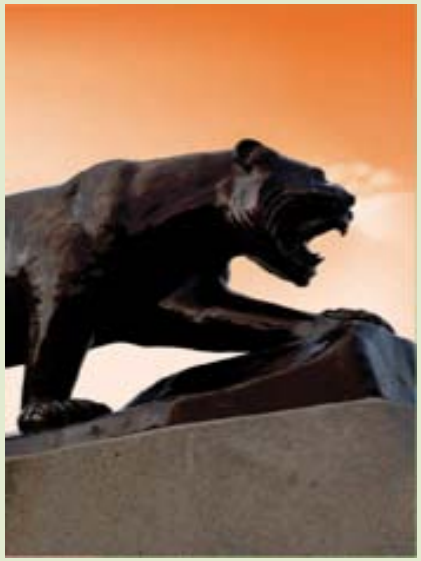
PRESIDENT'S LETTER

Clemson University's commitment to sustainability is fundamental. It is not something new. It is long-standing, deep and broad. It goes all the way back to our founder and our founding mission.

In an 1868 letter to the journal *American Farmer,* Thomas Green Clemson wrote:

"When nature's bank refuses to honor the drafts of the population for meat and bread … science is the only foundation on which we can depend for the recuperation of exhausted lands, or *sustaining* the fertility of those that are already tilled."



Sustainable agriculture and a sustainable economy – these were Mr. Clemson's goals in advocating for a college that focused on scientific education and research in the 19th Century. These issues are woven into the history of our institution and into the fabric of our academic enterprise across campus and across disciplines.

Sustainable Environment was one of the University's emphasis areas spelled out in a 10-year plan developed in 2000. We re-committed to that emphasis in the new Clemson 2020 Road Map.

Clemson University's concern for the environment and a sustainable future is reflected in the classroom, in the laboratory and in the field – arenas in which we carry out our missions of teaching, research and service.

As an institution, Clemson adopted a **Sustainable Building Policy** in 2004 and a sustainable **Energy Policy** in 2008. Clemson had the first LEED-certified public building in South Carolina and has now completed nine LEED-certified projects, with four others in the works. We pledged to reduce overall energy consumption 20% by the year 2020, and to increase energy sourcing from renewable resources by 10% by 2025. Energy use and carbon emissions on campus peaked in 2007, and have since declined even though we've added to the total square footage. Clemson is headed in the right direction, but we need to continue to improve.

I was a charter signatory to the **Presidents' Climate Commitment**, and Clemson is a member of the Association for the Advancement of Sustainability in Higher Education.

In 2009, we established the President's Commission on Sustainability with broad representation from every segment of the university community and responsibility to develop the comprehensive Sustainability Plan you have before you.

The plan is bold. It envisions the University as a living/learning laboratory where students are the top priority and sustainability is valued and integrated into every department and every discipline.

Some goals are do-able in the short term, even during a tough economy and a tight budget year. Other goals are longer-term and will require more buy-in from the community and more capital investment.

The goal to be essentially carbon neutral – a Net Zero Campus – by 2030 is particularly ambitious and aggressive. It will touch every aspect of campus life. It will require a comprehensive approach, including significant cultural and behavioral changes.

We also need to make major upgrades and investments in our aging campus infrastructure and eliminate the use of coal on campus. This work will require significant financial resources.

We have some very smart people who are working very hard to bring this about. Unlike some institutions whose plans stretch out to 2050, the President's Commission on Sustainability thought it was important to set an ambitious goal that could be achieved in a generation – by 2030.

I applaud them for that effort and thank them for their service. We look forward to a lively debate, ending in some consensus soon about where we go, together, from here.
Jim Barker

INTRODUCTION – A SUSTAINABILITY ACTION PLAN FOR CLEMSON UNIVERSITY

Clemson University began with a land gift from Thomas Green Clemson, and our heritage as a land-grant university has deep and broad ties to the environment. Since Clemson's founding, our students, faculty, and staff have worked to understand and sustain the role of the environment in meeting the needs of society. Clemson continues to address interrelated issues such as resource scarcity, rising energy and water costs, climate change, and the emergence of the green economy. These issues find Clemson and the global community at a moment of change and opportunity.

In 2007 Clemson President James Barker signed the American College and University Presidents' Climate Commitment, joining Clemson with more than 750 colleges and universities committed to working towards a sustainable future. As a signatory, Clemson University has committed to the following goals:

1. Sustainability will be an integral part of the educational experience for all Clemson students.
2. Clemson's campus will be a model of energy sustainability and operate as a "carbon neutral[1]" campus by 2030.

We will meet these goals through a series of action steps, which are denoted by the "•" symbol and outlined in this sustainability action plan.

Our pursuit of these ambitious goals is possible because of progress already made. For the education goal, students are engaged in sustainability action groups and living-learning communities, and have already established a "Sustainability Chair" in student government. Sustainability has widespread support among Clemson students: 86% of our students think Clemson should be a leader in sustainability.[2]

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[1] Carbon neutral means balancing carbon dioxide released with an equivalent amount sequestered or offset.

[2] 2011 Student Sustainability Survey.

There are dozens of sustainability-related courses in numerous majors. Researchers are active in fields from renewable energy to green building to sustainable agriculture. The carbon neutrality goal builds on Clemson's ongoing efforts to use cleaner sources of energy and improve energy efficiency, including in our buildings and transportation.

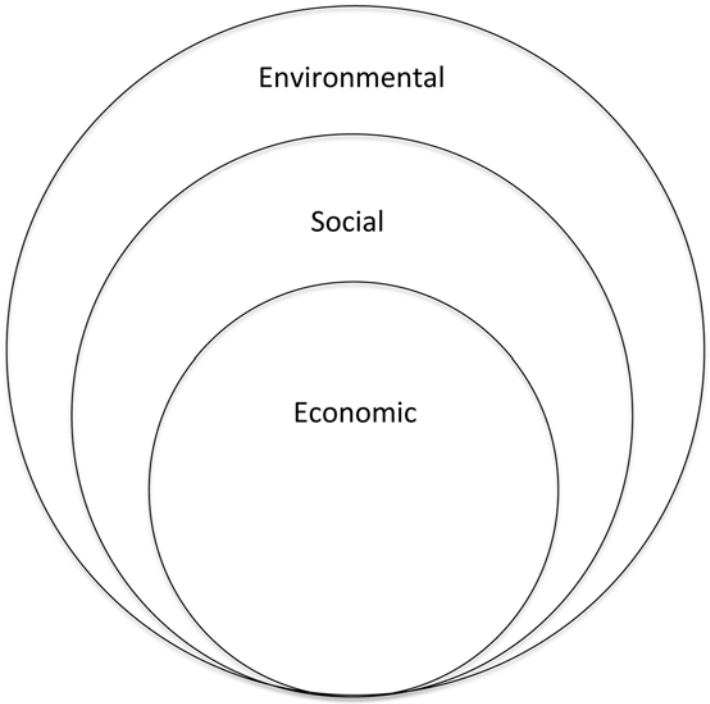
Ongoing efforts have positioned Clemson to pursue these two overarching goals; however, realizing them will require both sustained individual effort and selfless collaboration. Clemson students, faculty and staff must be committed and involved. This sustainability action plan is designed to help coordinate this effort by outlining specific steps and guiding principles that will help us meet our goals. Developed with input from a broad cross-section of Clemson's community, this action plan will only be successful with continuing input. The plan is updated annually, and we want to include your input. Please send us an e-mail at sustainability@clemson.edu.

78% of Clemson students feel a moral obligation to protect the environment. This self-motivation has led many students to be pro-active in spreading environmental awareness through organizations like Students for Environmental Action and Solid Green.

Guiding principles: Clemson as a living/learning lab

This action plan will balance environmental, social, and economic dimensions of sustainability, which is defined as meeting the needs of the current generation without compromising the ability of future generations to meet their own needs. The following figure shows the nested relationship between these dimensions of sustainability.

93% of Clemson students agree that we must strive to meet the definition of sustainability as we develop our society. The educational experiences proposed in the Action Plan will allow students to contribute to this goal.



Business leader Peter Senge explains: “The economy is the wholly owned subsidiary of nature, not the other way around. Similarly, there can be no healthy economy without a stable and vibrant social order.”

In addition to the three dimensions of sustainability, our efforts at Clemson are guided by the concept of the University as a living/learning lab. This encourages the study of all aspects of campus life, where sustainability initiatives emerge as a natural result of ongoing inquiry. Several organizing principles serve as filters:

- Students are the highest priority. Sustainability is about enabling them to create a future they want to inhabit.
- Sustainability is valued. As an institution of higher learning, we have a unique responsibility to lead in this area.
- Integrated solutions are better than piecemeal approaches. Integrated solutions ultimately will provide an enduring set of strategies that can be

adopted, modified and re-engaged over time. Systemic thinking is integral to understanding sustainability.

- Clemson University is in the "forever business." Strategies must make sense in the long term, not necessarily next month or next year.
- Sustainability will be integrated into every department.
- The University is a place for social and intellectual interaction, as well as a "place for learning."
- The unique culture and history of our campus must be considered in carbon neutrality planning.

Sustainability planning and implementation

The intent of this sustainability action plan is to provide a **framework that will empower people to take steps in a coordinated direction towards our sustainability goals**. Groups and individuals across the University are leading the ongoing activities outlined in this plan. Similarly, many groups and individuals are helping identify needed action steps. Ultimately, a successful action plan will affect and benefit the whole community, so all interested parties must have a voice. If you are not already involved, we want your input. Please send us an e-mail at sustainability@clemson.edu.

The **President's Commission on Sustainability (PCS)** was established by President Barker in 2009. A primary responsibility of the PCS is the development and maintenance of this action plan. Achieving the goals herein will require an iterative process:

1. Analysis and formulation of our action plan.
2. Implementation of the plan.
3. Assessment of the implementation.
4. Revisions to our plan based on the assessment.
5. Implementation of the revised plan.

The action plan will be updated at least annually.

Meeting the plan goals will require **financial and other resources**. These resources are identified and evaluated for appropriate relationships to specific action steps and to the vision and mission of Clemson. Discussion of requisite resources is included with each action step, for example:

- Networking with local, regional and global partners.
- Cost savings from conservation efforts.
- Federal and state grant funding.
- Private sector endowments.
- Entrepreneurial possibilities.
- Revenue sharing from green industry public/private partnerships.
- Revolving loan pools.

Clemson's sustainability action plan **supports the long-range Vision, Mission and Goals** of the University. A key goal in the 2020 Road Map is "to serve the public good by focusing on emphasis areas that address some of the great challenges of the 21st century – national priorities such as health, energy, transportation and sustainable environment." Sustainability encompasses each of these emphasis areas. At Clemson, thousands of diverse students have been afforded an education and a chance to change the world. This is the platform from which all of our sustainability efforts are launched.

"The essence of sustainability is within the DNA of Clemson's ideology."
President James Barker

ACTION STEPS FOR SUSTAINABILITY EDUCATION, CULTURE, AND LEADERSHIP

Vision: Sustainability will be an integral part of the educational experience for all members of the Clemson family, including current students, alumni, faculty, staff, supporters and the people of South Carolina and beyond.

Currently, Clemson students can choose from dozens of sustainability-related courses in various majors and minors. Researchers are actively pushing the frontiers of knowledge for a more sustainable future. Numerous other teaching, research and service activities address sustainability without explicitly mentioning it by name. Despite these efforts, many Clemson students graduate without considering sustainability issues. By signing the Presidents' Climate Commitment, Clemson has committed to making sustainability an integral part of the educational experience for all our students.

Student **learning objectives** help to guide our efforts and evaluate our progress towards this education goal. Prior to graduation, each Clemson student will be able to:

- Define sustainability.
- Identify and discuss fundamental issues of sustainability.
- Analyze how their values relate to sustainability, and how their actions impact sustainability issues.
- Recognize interrelated systems.
- Evaluate the role of their major in sustainability issues.
- Apply sustainability concepts on local and global scales.
- Practice change agent skills for sustainability.

The action items in this section will help our students achieve these learning objectives. Ultimately, the goal is to expand these learning objectives to all members

Including sustainability in curricular requirements has the potential to reach many students across multiple disciplines. 62% of Clemson students said they would be interested in taking sustainability courses that relate to their area of academic interest.

The need for sustainability education can be seen in the approximately 15% of Clemson students who admit to not understanding our use of natural resources. Including sustainability as a theme in program accreditation standards would help provide the resources needed to address this issue.

of the Clemson family. These interrelated action items fall into four general categories:

1. Curricular requirements and opportunities.
2. Co-curricular requirements and opportunities.
3. Leadership and outreach.
4. Actions to create a culture of healthy, sustainable living.

Within each category, an action item may be in progress, in the planning stage, or in need of a "champion" to turn it into a reality. If you would like to contribute to or add an action item, please e-mail sustainability@clemson.edu.

Curricular requirements and opportunities

The most direct way to achieve the vision for sustainability education at Clemson is through the classes students take. The action items in this section will ensure that sustainability is both addressed specifically and also integrated across the curriculum.

Ideas currently in action

- Offer discipline-specific courses that cover sustainability topics (Search by keyword at Clemson's syllabus repository).
- Include sustainability as a theme in program accreditation standards.
- Pursue various research projects, including theses and dissertations related to sustainability issues.
- Offer workshops through the Office of Teaching Effectiveness and Innovation in "Teaching Sustainability across the Disciplines."
- Include sustainability as a theme in Science, Technology & Society courses.

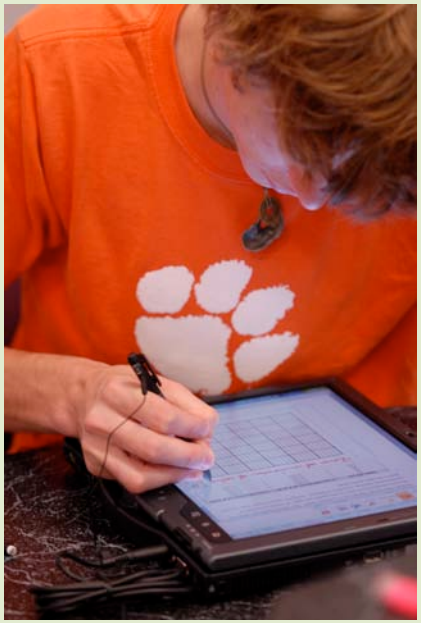
38% of our students consider their professors and peers to be their top sources of information on environmental issues. Co-curricular requirements would create forums where these important interactions can take place.

Ideas moving forward

- Expand and highlight opportunities to integrate sustainability into other courses or to develop new sustainability-focused courses, concentrating on first- and second-year courses that reach a broad audience.
- Establish an Institute for Sustainability Education that will help generate financial support for efforts towards these goals.

Ideas in need of a champion

- Implement a cross-disciplinary sustainability minor.
- Implement a sustainability option for general education courses.
- Include sustainability as an e-portfolio competency.
- Establish a formal support network for faculty who incorporate sustainability in their courses.
- Offer a sustainability certificate option.
- Offer incentive funding for revising courses to include sustainability.

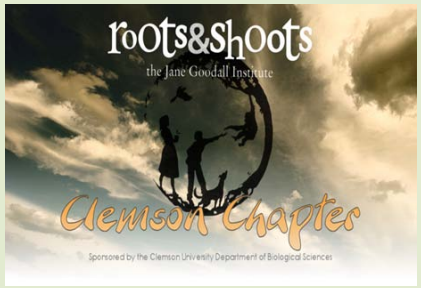


Co-curricular requirements and opportunities including service and civic engagement

Activities outside of the formal classroom setting are often the most memorable part of students' college experience. Action items in this section expand service and civic engagement activities related to sustainability. To make these co-curricular experiences even more meaningful, they are integrated into other aspects of campus life. For example, they may be part of introductory level courses within majors, other leadership and global citizenry workshops, or campus-wide service programs. This will help ensure that faculty and staff are actively involved in and can assess the experience, especially as it relates to the student learning objectives for sustainability. The entire campus community benefits from the learning and insight from such experiences.

Ideas currently in action

- Offer Creative Inquiry projects related to sustainability, where teams undertake intensive, discovery-oriented approaches to learning (Search Creative Inquiry projects).
- Offer service opportunities for undergraduate students. (Learn more about civic engagement opportunities).
- Establish a sustainability-focused Living-Learning Community, LIEF: Leading & Innovating for our Environment and Future. This community creates a unique experiential learning opportunity for community members to deepen their understanding of social, economic and environmental sustainability. Members learn to become agents of change and leaders for intergenerational equity and to drive sustainability efforts on the Clemson campus.
- Support student organizations. Many of the most significant sustainability efforts at Clemson have been initiated by student organizations, including:
    - Students for Environmental Action. Since 1990, Students for Environmental Action (SEA) has been working on environmental and sustainability issues. SEA challenges students to enrich their education with active, hands-on involvement in sustainability.
    - Solid Green is about taking pride in Clemson's campus, taking responsibility for keeping it clean and taking action to help sustain the environment for a better future. The goals of Solid Green are to raise awareness of littering on campus, recycling, energy and water conservation and other environmental issues; to promote clean-up activities and other events and to support student groups that promote environmental awareness.
    - The Dirt to Food's mission is to advance a culture of health and sustainability by connecting community members and creating opportunities to experience fresh, locally grown food. Our goal is to create a vibrant local food system that provides the structure needed for



members of our community to make healthier and more sustainable food choices.
    - Beyond Carbon was founded in the spring of 2010 and has since then worked with Clemson University towards a quick, safe transition away from using coal on campus. Its mission is to work with Clemson in its transition to clean energy sources.
    - Clemson Student Chapter of the Wildlife Society.
    - Tigers for Tigers.
    - USGBC Youth Student Chapter.
    - Entomology Club.
    - Students for a Sustainable Earth.
    - C.A.T. Citizen Action Team.
    - Clemson Student Chapter of the Society of American Foresters.
- Organize and publicize sustainability events including:
    - The annual National Teach-In on sustainability.
    - Earth Day and Earth Week, which are held during the spring semester to celebrate Clemson's sustainability efforts.
    - Farm Aid, which is an annual benefit festival put on by SEA to support Clemson's Student Organic Farm.

Ideas moving forward

- Establish an "Eco-Rep" program to provide peer-delivered sustainability education campus-wide.
- Create research apprenticeships and internships for graduate and undergraduate students interested in co-curricular sustainability activities.

Ideas in need of a champion

- Require that sustainability is part of a service requirement for undergraduate students. Whether through community service, philanthropy or advocacy activities, Clemson values service to others. Requiring **all** students to participate in a service learning activity will further our already strong

commitment to public service and also provide the rich, out-of-the-classroom experiences that lead to the deep learning that makes a lifelong impact. This activity can build on many service learning opportunities already available.

- Weave service learning components into introductory level courses so that they are verified and evaluated within the context of a course within a student's major.
- Expand collaboration between the academic and administrative sides of Clemson on issues related to sustainability. For example, engage architecture and engineering students and faculty teams in planning and assessment of new and existing buildings.
- Establish a day of service for the entire campus where students, faculty, staff, and alumni address a local sustainability issue.
- Incorporate sustainability into the e-portfolio requirements.
- Incorporate sustainability analysis and comparison into study abroad programs.
- Establish a system that is in place and ready to respond quickly with learning opportunities related to natural disasters such as the BP Oil spill.
- Engage the athletic department to harness the popularity and competitive spirit associated with college sports. For example, establish sustainability service competitions during sporting events.

Leadership and outreach - facilitate community connections

Limiting sustainability education to our campus would ignore the global scope of the problems we are trying to address through sustainability. The action items for leadership and outreach in sustainability education are designed to reach Clemson alumni and supporters as well as the people of South Carolina and beyond.

These activities align closely with the mission of Clemson's Public Service Activities (PSA) to develop and deliver science-based information specific to South Carolina's

needs. PSA has a presence in every county of the state. While the University's main campus covers approximately 1,400 acres and supports many of Clemson's academic and student life activities, an additional 17,000 acres of University research farms and forests surround the main campus. An additional 12,000 acres of Clemson land are distributed around the state, and the University also owns land in Italy and on the Caribbean island of Dominica. All of these properties are devoted to research and education.

Ideas currently in action

- Ensure that all PSA staff are well-versed in a clear and consistent sustainability message that includes audience appropriate educational materials. This includes developing sustainability talking points, collateral materials and a social media presence.
- As off-campus development projects are considered, plans will integrate campus building policies as well as sustainable building products and practices.
- Communicate and educate, using a variety of tools, the cost avoidance and life-cycle savings inherent in some sustainability measures.
- Ensure that Clemson's sustainability story is shared in a compelling way. Case study examples may differ by location, resources and scale, but they will be shared. The message is that sustainability is a Clemson University priority and it is also a process that can be incorporated community-wide.
- Cultivate relationships with community media outlets on Clemson's off-campus sustainability efforts.

Ideas moving forward

- With the assistance of a main campus representative involved in the Sustainability Action Plan, convene a group of Clemson's remote facility representatives to assess off-campus facilities and activities (strengths and gaps) in light of all of the strategies included in the Action Plan. Facilitate

connectivity with related on-campus partners. Determine applicability, an implementation strategy and time line for deployment of off-campus short- and long-term sustainability measures and determine evaluation metrics.

- Pursue external funding opportunities that target applied research and higher education for environmentally sound demonstration projects and processes in applied agriculture and natural resource science and/or economic strengthening initiatives.
- Develop and deploy broadband or distance learning and meeting connectivity, training and instruction modules for on- and off-campus students, faculty, staff and constituent partners.
- Identify potential community, business, non-profit and educational partners to enlist advice on sustainability efforts that would provide community and university benefit and potential for collaborative research and demonstration efforts.
- Partner with regional institutions to share lessons learned related to sustainability.

Ideas in need of a champion

- Make classes with a sustainability theme available online for free.
- Offer a network of speakers on various issues related to sustainability for free to any organization in South Carolina.
- Continuing education to offer courses on various issues related to sustainability.
- Engage alumni in the process by providing a framework and guidance for how to establish sustainability related service activities in their hometown or workplace.
- Hold regular meetings with other institutions' sustainability groups to share best practices.

Interest in a culture of healthy, sustainable living has already been established in the Clemson community. 86% of students have said they would be willing to reduce their consumption to protect the environment.

Create a culture of healthy, sustainable living

Action items in this section will help organize the systems and policies that drive Clemson. The goal is to organize these systems and policies so that they support, strengthen and enhance a culture of health and sustainability. This will enable all members of the campus community to achieve, learn and serve, which will lead to a society that is healthier and more socially just. There is a clear connection between the campus environment and the overall health of our students, faculty and staff. There is also a correlation between our health and our success, which has wider implications for society. According to sustainability education leader Anthony Cortese, "… education for and practicing how to achieve a healthy, just and sustainable society are critical to meeting higher education's social responsibility of providing the knowledge and educated citizenry for a thriving civil society."

35% of students buy locally grown or locally produced food on a regular basis. Encouraging a healthy lifestyle through the ideas outlined here can support the growth of this percentage.

These systems and policies can cover a range of areas. For example, it is imperative that we address the ecology of the community as a whole and evaluate what is good and bad for our overall health. Similarly, sustainability education requires an understanding of issues that stretches across traditional disciplinary boundaries. Action items in this section will help encourage the collaboration that is essential for a balanced view of these issues, and a successful long-term execution of this sustainability action plan.

Finally, equity and inclusion are a priority for a healthy, sustainable culture at Clemson. This necessitates the development of a diverse and multi disciplinary stakeholder group of faculty, staff, and students. This inclusive set of active stakeholders will create a more effective and innovative sustainability action plan.

Ideas currently in action

- Commitment to interdisciplinary position descriptions for 80 new faculty positions.
- Assess the feasibility of a pedestrian-only campus.

- Implement a survey of the Clemson community to identify sustainability knowledge, values, attitudes and behaviors.

Ideas moving forward

- Establish stress-management workshops open to all campus community members.
- Work with Human Resources to address health issues among faculty and staff and establish incentives that encourage increased physical activity and healthy diet.
- Provide more incentives for walking and biking on campus and in the Clemson Forest, including more bike racks and a bike rental or bike share program.
- Reduce toxic chemicals used on all campus grounds.
- Move toward a landscape that favors permaculture.
- Establish policies that require dining services to use a significant percentage of locally and/or organically grown food.
- Evaluate the sale of disposable water-bottles with reusable, free-refill drinking containers.
- Promote responsible student use and stewardship of the Clemson Experimental Forest.

Ideas in need of a champion

- Create social and physical environments that promote health, safety and learning.
- Implement a University-wide sustainable travel policy to encompass students, faculty, staff and administration.
- Provide incentives for developing new sustainability-themed courses to co-teach with faculty across departments.
- Give enhanced/special recognition in annual evaluations for interdisciplinary education activities (e.g. mentoring students outside the home department;

Currently, only 16% of students bicycle to campus. Some of the action items in this section will help increase this percentage.

developing course offerings that attract students from other disciplines; and supporting students outside the home discipline.)

- Develop and institute a formal Memorandum of Understanding across departments/colleges to track and exchange co-teaching and cross-enrollment. For example, develop a course of study that integrates classroom, research and internship experiences.

"Treat the earth well: it was not given to you by your parents,
it was loaned to you by your children."
American Indian Proverb

"We are more than the sum of all our knowledge,
we are the products of our imagination."
Ancient Indigenous Proverb

ACTION STEPS FOR ENERGY AND ENVIRONMENT

Vision: Clemson University will be a model of energy and environmental sustainability, including achieving a carbon neutral campus by 2030.

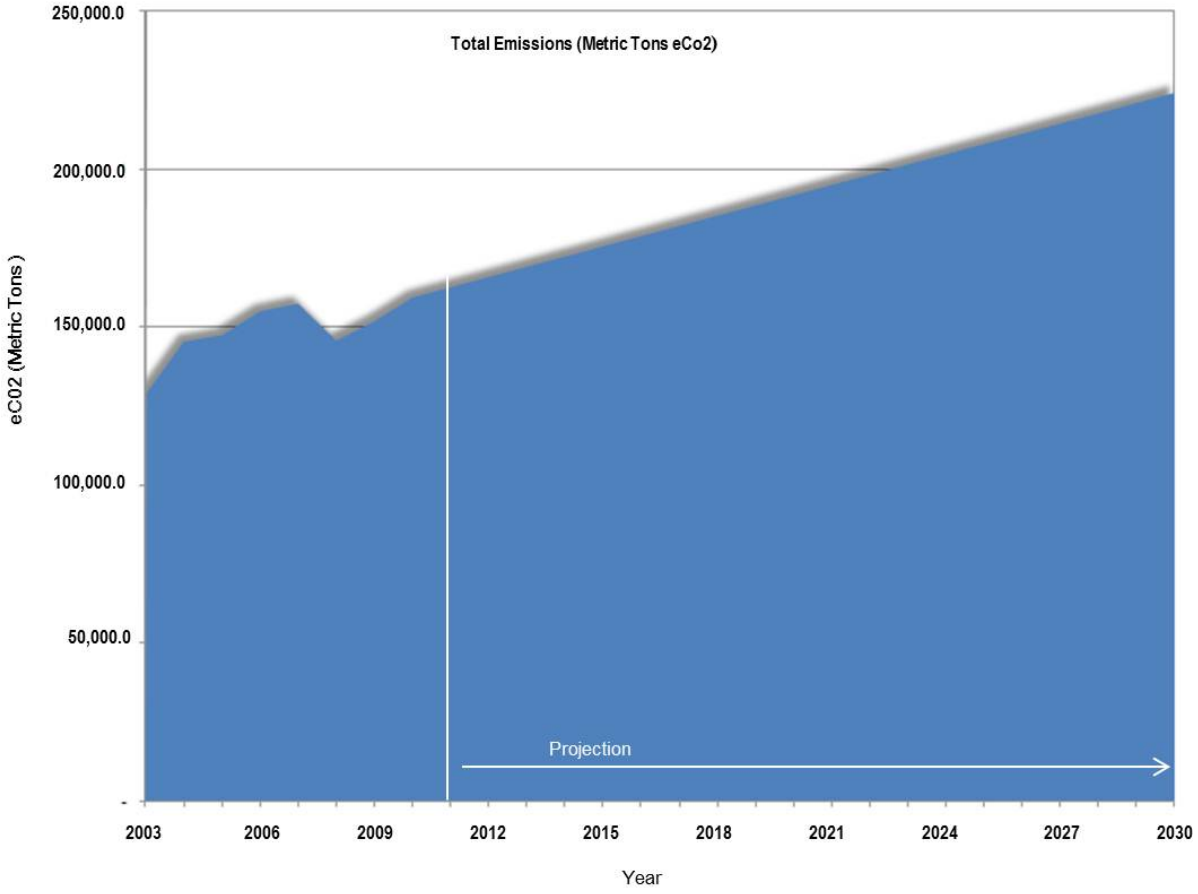
Complementing Clemson's goals for sustainability education are our sustainability goals for University operations. These goals include sustainability practices ranging from water to energy to the culture and leadership described previously.

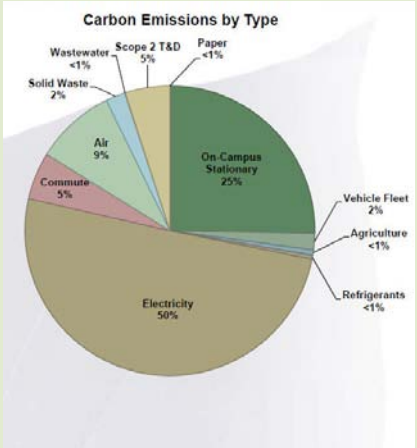
While the guiding sustainability goal for our University operations is to achieve carbon neutrality by 2030, there are important elements of sustainability that are not covered explicitly by this goal. These elements will still be pursued. Carbon neutrality was selected as an overarching goal because it is a broad umbrella that touches almost every aspect of life at the University. How the grass is fertilized and watered, how we travel, how we build and operate buildings, are all important aspects of our pursuit of carbon neutrality. Perhaps most importantly, energy and carbon emissions are directly related. Both the source of energy and how it is used are significant issues that are addressed in this Action Plan.

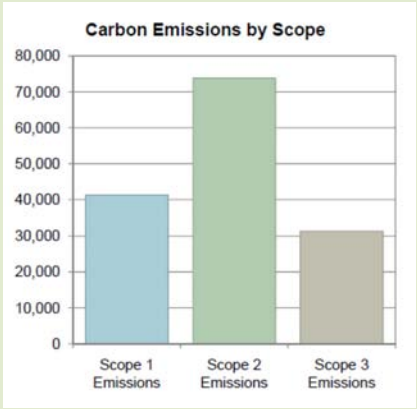
Clemson's action steps for energy and environment are aggressive. They show how the University eliminates or offsets more than 150,000 tons of carbon emissions in one generation while allowing for growth and change of the institution. There are significant hurdles we must overcome to achieve each and every one of the initiatives outlined here, but the Action Plan is achievable. There is no single solution. For example, achieving carbon neutrality by switching to 100% renewable energy is not a sustainable solution economically. The actual solution will have multiple layers and will require that we think strategically and in terms of years and decades to effect sustainable change on the scale that we project.

Clemson University currently emits approximately 150,000 metric tons of carbon equivalent every year. To put this in context, one metric ton of CO_2 is equivalent to: driving 2,400 miles in a car; burning 1/2 ton of coal; or using a 60-watt compact

fluorescent light bulb continuously for 13 years. The charts to the right show what sources are contributing to our emissions. The chart below describes how the emissions are projected to trend upward to approximately 225,000 metric tons by 2030 if no action is taken to reverse this trend.

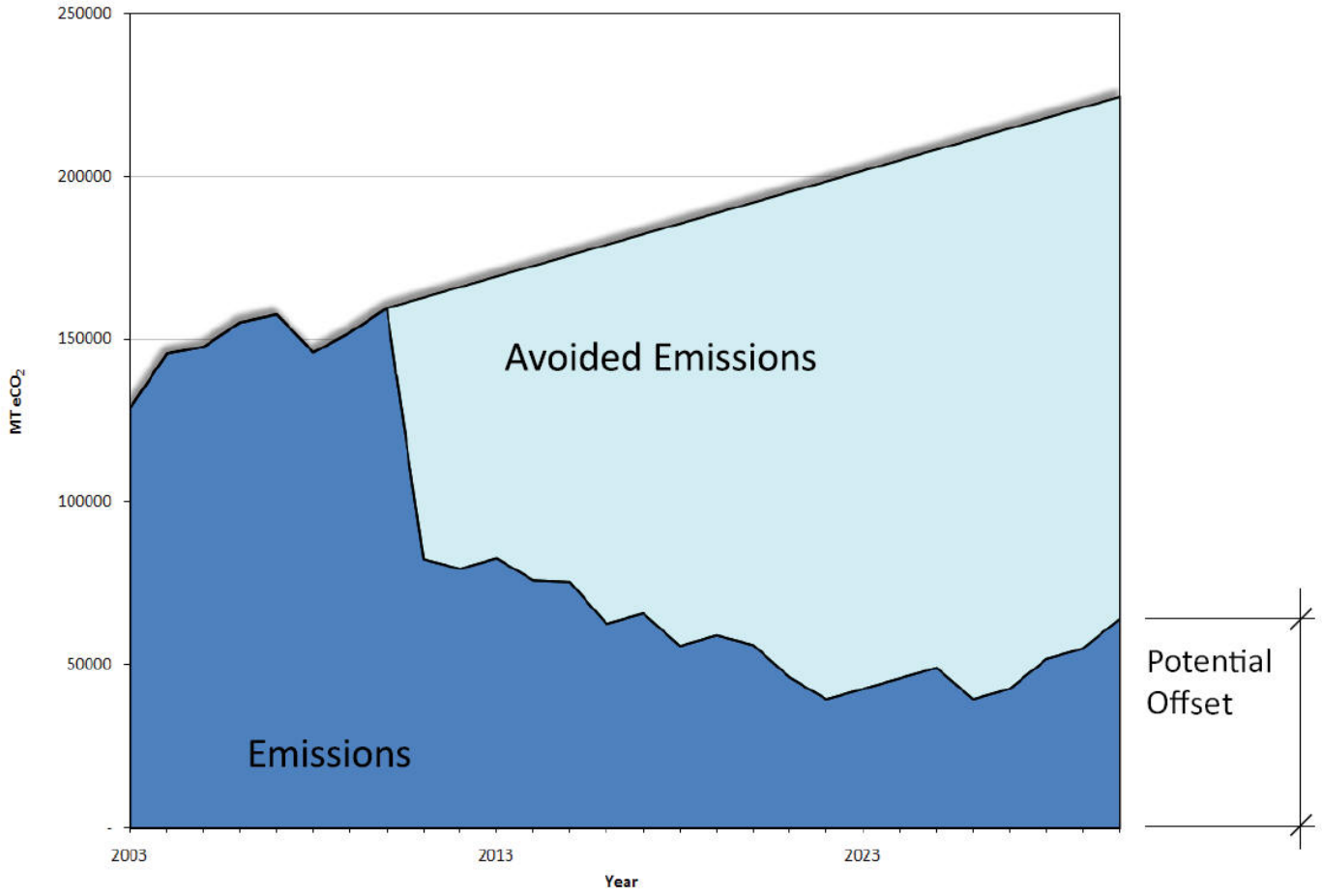






The big idea is to drive these emissions to zero. This will involve a host of action steps ranging from those that are simple and immediately save money, to those that are complicated and require long-term financial planning. Enacting all of these initiatives

as described in this Action Plan is projected to bring us to our goal of carbon neutrality by 2030.



Scope 1

- Natural gas
- Coal
- Vehicle fuel
- Fertilizer
- Refrigerants

Scope 2

- Purchased electricity

Scope 3

- Faculty/staff commuting
- Solid waste

Offsets

- None

The action steps to meet our goal of carbon neutrality by 2030 fall into the following eight interrelated categories:

- Carbon neutrality planning and policy.
- Cleaner supply: Carbon-free energy sources.
- Reduced demand: Energy system efficiency.
- Reduced demand: Building energy efficiency.
- Reduced demand: Transportation energy efficiency.
- Carbon offsets.
- Advances in technology.
- Other conservation, resource management and waste elimination efforts.

Within each category, action items may be ongoing, in the planning stage, or an idea in need of a "champion" to turn it into a reality. If you would like to contribute to or add an action item, please e-mail sustainability@clemson.edu.

Carbon neutrality planning and policy

This sustainability action plan is the latest in a series of planning and policy decisions Clemson has made on the path towards carbon neutrality. While action must follow, planning and policy are necessary first steps to encourage and coordinate this action.

Ideas currently in action

- Establish a sustainable energy policy. To meet the requirements of South Carolina Legislative Bill H4766 which became effective June 11, 2008, a campus wide Sustainable Energy Policy was approved by the Administrative Council with a goal of reducing energy consumption per gross square foot of building space on average by 1% per year beginning July 1, 2008. By adhering to this policy the University will reduce total energy consumption by 20% by

2020 relative to the fiscal year 2000 baseline (download the Sustainable Energy pdf).

- Establish the Clemson University Environmental Committee to help guide policy decisions.

Ideas moving forward

- Establish and publicize a Sustainability Action Plan goal of carbon neutrality by 2030.
- Use our campus as a "Net Zero," carbon neutral, living/learning lab. We will take a comprehensive approach, partnering with leaders in the energy industry. Clemson's utility infrastructure and unique University community environment are an ideal incubator that can be leveraged for the purposes of education, research, and ultimately economic development related to energy production, distribution, efficiency and conservation. This approach will also help meet the University's basic utility needs through a long range integrated and comprehensive energy and infrastructure plan focused on the "Net Zero" concept. For more information, download the Net Zero Energy whitepaper pdf.

Ideas in need of a champion

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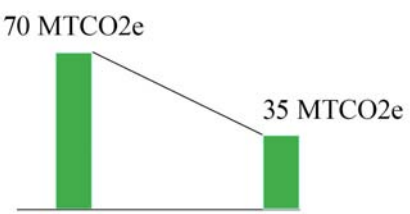
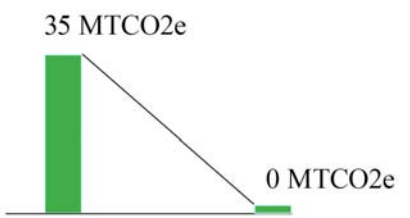
Cleaner supply: Carbon-free energy sources

Clemson University needs energy to function as a leading education and research institution. So, achieving carbon neutrality will require sources of energy that are carbon-free. Clemson's Sustainable Energy Policy includes a long-range goal of increasing its acquisition of energy from renewable resources by 10% by 2025. Action steps in this category will help to drive the use of renewable energy well beyond this level.



Duke Energy 50% reduction in 20 years



Coal Plant Replacement

Ideas currently in action

- Encourage and track Duke Energy's progress on their plan to reduce carbon emissions. Over half of Clemson's 150,000 metric ton carbon footprint is directly attributable to Duke Energy's use of coal, gas, and oil energy production. Duke Energy has articulated a plan and is tracking progress towards a major reduction in carbon emissions. In its sustainability plan and progress report, the company describes its plan to cut emissions in half by 2030. This will be done primarily through an increase in the use of nuclear power, and also through a growing use of renewable energy, and through major energy efficiency initiatives. Visit the Duke Energy website to review and download the report.
- Produce biodiesel from campus waste oils. Currently producing 5,000 gallons annually.

Ideas moving forward

- Remove coal-fired boilers on campus from service.
- Pursue opportunities to produce our own carbon-free energy through three primary approaches:
    - Determine "big-swing" projects to source renewable energy at less than or equal to current prices.
    - Evaluate other sourcing alternatives.
    - Evaluate possible on-site power generation and/or energy storage options including: combined heat and power, including microturbines; geothermal heat pump systems for heating and cooling; biofuels; solar thermal and photovoltaic; and energy storage alternatives such as batteries and thermal.

Ideas in need of a champion

- Partner with solar companies on demonstration projects.
- Use a biomass gassifier to produce electricity on campus. This will help us move CU to renewable energy, and also help us stay at the forefront of cutting-

edge research and development and industry partnerships. Algae cultivated on site can sequester emissions from the gassifier. The algae will use the carbon emissions to produce lipids. With technology and processes designed by students and faculty, we can harvest the algae and extract the oil from it. Two to four acres of algae can replace 100% of our diesel consumption on campus. A corresponding goal is to reduce natural gas consumption on campus to 0% by 2030.

- Use fast-growing trees from Clemson University forestland with sustainable land management practices and waste diverted from landfills to provide fuel alternatives.
- Implement Phase 1 of the Net-Zero Energy Initiative.
- Implement Phase 2 of the Net-Zero Energy Initiative.

Reduced demand: Energy system efficiency

Carbon free energy sources are less plentiful and often cost more initially than traditional sources of energy. Reducing demand through efficiency is typically a more cost-effective option to reduce carbon emissions. Achieving carbon neutrality will not happen without drastically improving the efficiency with which we manage energy use on campus. Part of this will include developing an efficient energy system that is both smart and interactive.

Ideas currently in action

- Implement real-time energy management. This system will enable: control and monitoring of the entire campus from a single interface; system access for research purposes; and data collection to encourage energy-saving behavior. This system will also serve as a backbone for future utility projects.

Ideas moving forward

- Align incentives to allow market mechanisms to function. This involves breaking down barriers to people recognizing the cost of their energy use. In just one of many examples, departments currently pay a set percentage for

energy use, which means they do not have a direct financial incentive to reduce energy consumption of their operations. A student-led initiative seeking to address this issue realigns the costs of this energy with the actual use of individual departments. The proposal was reviewed and approved by the Administrative Council. Download the Energy Savings Strategy pdf.

Ideas in need of a champion

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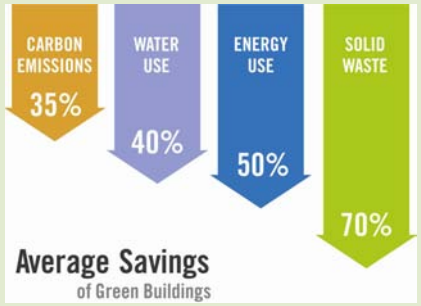
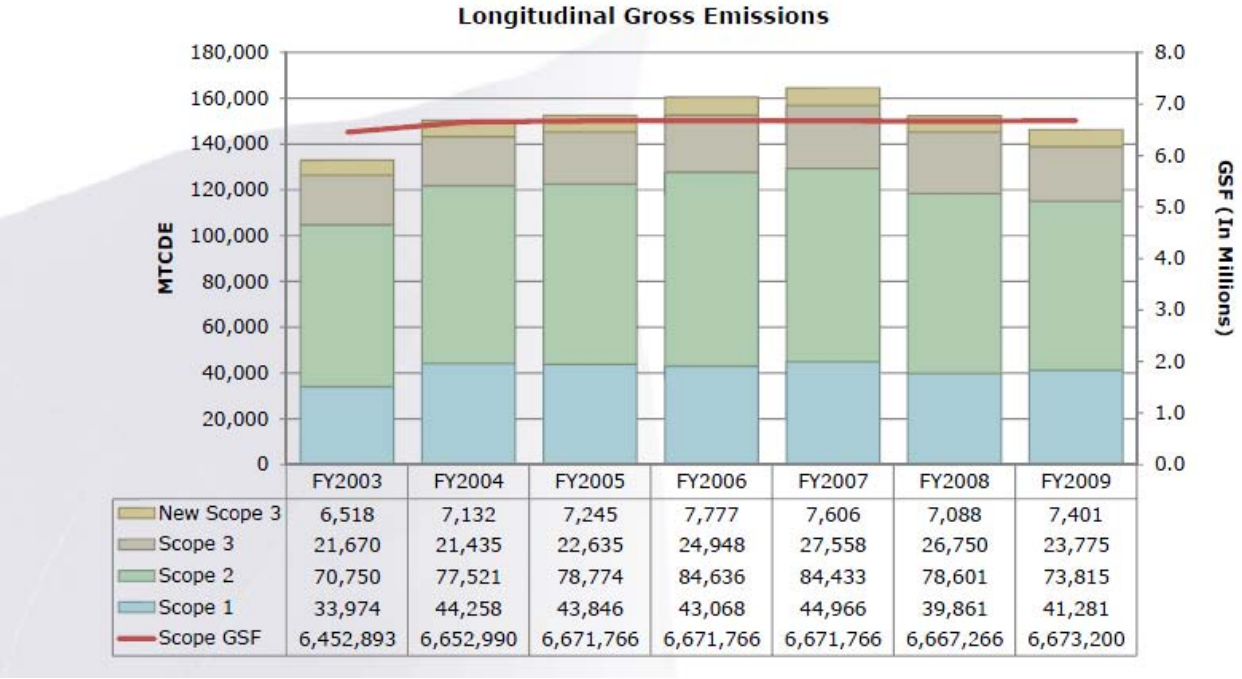
Reduced demand: Building energy efficiency

Clemson's campus includes over 6.6 million square feet of academic, research, housing, student life, and athletic spaces. The average age of these facilities is close to 40 years, even considering renovations. When many of the buildings on campus were designed and built, energy costs were a fraction of what they are today and the relationships between carbon dioxide emissions, climate change and quality of life were not a consideration. Tremendous energy and cost savings can be realized by improving energy efficiency in our existing buildings. Energy-efficient buildings include strategies such as efficient heating, cooling and lighting systems, and use of less carbon-intensive materials. Even as the total square footage of buildings continues to increase, efforts in building energy efficiency have resulted in an overall



emissions decrease since 2007.



	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009
New Scope 3	6,518	7,132	7,245	7,777	7,606	7,088	7,401
Scope 3	21,670	21,435	22,635	24,948	27,558	26,750	23,775
Scope 2	70,750	77,521	78,774	84,636	84,433	78,601	73,815
Scope 1	33,974	44,258	43,846	43,068	44,966	39,861	41,281
Scope GSF	6,452,893	6,652,990	6,671,766	6,671,766	6,671,766	6,667,266	6,673,200

Ideas currently in action

- Implement operational changes, such as installing high-efficiency fluorescent lighting in classrooms and facilities.
- Establish a Sustainable Building Policy. Clemson University is a leader in Green Building among universities across the country, having implemented a Sustainable Building Policy in 2005. The policy makes a clear statement that the University embraces these priorities and will invest in them on every major building project. Sustainable building includes not only energy use reductions, but also integrates building materials and methods that promote environmental quality, economic vitality and social benefit. A building's site, water management, energy performance, the materials and resources from which it is constructed, and the indoor environmental quality all play a part in

a building being environmentally responsible. In new construction and major renovations, Clemson University follows the U.S. Green Building Council's Leadership in Environmental and Energy Design (LEED®)[3] rating system and aims to achieve a LEED Silver rating for all newly constructed buildings and large renovations. The University has a number of projects that aim to meet varying degrees of LEED certification. Some examples include Advanced Materials Research Lab, Baruch Institute, Fraternity Quad, Graduate Engineering Center, ICAR Parking Structure / Office, Packaging Science Building, Rowing Facility, Sandhill Conference Center. Review the Sustainable Building Policy pdf.

Ideas moving forward

- Improve new and existing building energy efficiency. Incrementally improve energy efficiency in all new construction projects and major renovations so that by 2030 they are designed and constructed to be energy neutral. This means that in five years, University projects are intended to be 35% better than the ASHRAE 90.1 standard[4], in 10 years 50% better, 15 years 75% better, and by 2030, including renewable energy, the projects will be energy neutral.
- Implement energy conservation education. Efforts are ongoing to reduce energy use on campus by educating students and faculty on how to reduce their energy use through behavioral changes such as turning off lights, computers and other office equipment.
- Reduce energy consumption through reduced water use. This includes low-flow shower heads, which reduce water use and the energy needed to heat it; waterless or low-flow toilets which reduce water use and energy needed for treatment; and efficient chiller design to reduce water and energy use.

Many Clemson students are already practicing sustainable habits. 92% say they turn off lights and electronics when not in use and 63% say they adjust their thermostat to conserve energy.

[3] LEED is a certifying system designed for rating new and existing commercial, institutional, and multi-family residential buildings.

[4] ASHRAE 90.1 is a standard that provides minimum requirements for energy efficient designs for buildings except for low-rise buildings.

- Evaluate solar thermal and solar photovoltaic options for economic feasibility and for learning opportunities.

Ideas in need of a champion

- Evaluate the potential of using geothermal technology for all new building heating and air conditioning needs.

Reduced demand: Transportation energy efficiency

At the root of sustainability for transportation are options such as choice of route and choice of mode. The following strategies will improve the options for moving people and goods efficiently, economically and safely.

This action plan includes steps from the parking and transportation master plan, which acknowledges the need to limit automobile dependence and encourage the use of alternative transportation through a coordinated and fully supported Travel Demand Management (TDM) program. Within that plan, a range of TDM programs and activities are recommended to help reduce single occupancy vehicle travel. These programs will be introduced to the University community in a phased approach over several years to help build support and momentum for the overall program. Since TDM is a relatively new concept for many, it will take proper marketing and communication to ensure success.

Ideas currently in action

- Implement the Parking and Transportation Master Plan.
- Use smaller buses at night when fewer passengers are present.
- Explore and invest in ZimRide, a web-based rideshare program to facilitate increased carpool/vanpool opportunities for both planned and “on-the-fly” ridesharing.

Ideas moving forward

- Broaden the responsibilities of Parking Services to include TDM Services. The expanded Transportation Services Department will house the TDM program, transit coordination, fleet services, and parking enforcement. Including the TDM program in an overall transportation services department will facilitate coordination and cooperation between parking, transit, and alternative transportation. Capable professionals able to champion and effectively market these new transportation alternatives will staff this expanded department. Once in place, this new department must explore grant opportunities and both internal and external revenue sources to advance the action steps outlined here.
- Expand incentives to increase participation in carpools/vanpools. Offer incentives such as preferred parking, reduced parking permit fees, expanded guaranteed ride home program, and vanpool subsidies.
- Improve communication of rideshare incentives and benefits. The university must use websites, email campaigns, and other marketing techniques to communicate the financial and environmental benefits of ride-sharing.
- Explore fee structures that discourage single occupancy vehicle travel by making high occupancy travel more convenient and less expensive.
- Consider a proximity-based parking fee structure that increases fees for single-occupancy vehicles parked in preferred, core campus parking lots.
- Explore methods to reduce single occupancy vehicle travel for major event parking. These may include development of park-and-ride lots supported by transit and coordination of event-specific rideshare programs.
- Develop incentives and opportunities to bike or walk to campus.
    - Improve infrastructure to encourage cycling or walking to, from, and around campus. Continue to seek grant funding opportunities to facilitate infrastructure improvements such as bike lanes, pedestrian pathways, bike lockers and bike racks.

    - Develop and promote cycling incentive programs such as zero-interest bicycle loan programs or bike share programs.
- Consider implementing a compressed, four-day work week/class schedule. This would include developing the IT infrastructure necessary to make telecommuting, web conferencing, and distance learning more accessible to reduce travel needs.
- Develop and implement a plan that will limit on-campus parking. This may include elimination of freshman parking and limitation of sophomore parking to only those living on campus.

Ideas in need of a champion

- Evaluate ways to offset the environmental impacts of travel.
- Increase the availability and use of virtual meetings and teleconferences through better technology and management in existing facilities and through new facilities that may come on line.
- Purchase carbon offset credits with every airline ticket so that offsets and carbon emissions are balanced with each other.
- Phase out fuel-inefficient university fleet vehicles and replace with compact, hybrid, or more fuel-efficient vehicles when feasible.
- Provide a more robust range of options to accommodate group travel.
- Encourage the conversion of transit fleet vehicles to more fuel-efficient or alternative fuel vehicles.
- Reduce students living off-campus by 25% by 2020 and 50% by 2030.

43% of our students participate in carpooling. Increasing incentives will boost the amount of ride-sharing while enhancing sustainability awareness as well as benefitting the environment.

About 25% of Clemson students use public transportation such as the Clemson Area Transit (CAT) bus on a regular basis. Implementing a TDM program would increase CAT bus users by encouraging the use of public transportation.

Carbon offsets

No matter how well Clemson University does in achieving substantial short and long-term energy efficiencies in buildings and transportation and in maximizing the use of

renewable energy, some carbon offsets[5] will be needed to achieve carbon neutrality by our 2030 target date. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Offsets are often achieved through financial support of projects that reduce the emission of greenhouse gases.

Ideas currently in action

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Ideas moving forward

- Manage Clemson's Experimental Forest (CEF) to produce carbon offsets. Reforestation of recently cut areas is the standard sustainable approach on all CEF lands. Afforestation[6] is also a possibility if some University Farms operations are converted back to forestry. It is estimated that the existing growing stock of wood in the CEF exceeds 250,000 tons which is a credit to the sustainable forest management activities of the past 80 years. This growing stock cannot be used as a carbon offset because it is existing growing stock. However, the difference between what we grow annually in of tons of carbon and what we harvest annually to sustain the forest's many education and research activities can be used as an offset. Preliminary data suggest that we are growing on average 1.25 tons of carbon per acre per year. With the largest University forest that is contiguous with the campus in the country, we are in a unique position to determine the actual difference between this growth and harvest, and to use this offset in its overall balance of carbon use. Continued data collection will allow further refining of these numbers. All present and future forest management activities will be evaluated for applicability for building a carbon surplus, and at the same time providing for the sustainability of the Clemson Experimental Forest's soils, water resources,

[5] Carbon offsets are a reduction in emissions of carbon or greenhouse gases made in order to compensate for an emission made elsewhere.

[6] Afforestation is the planting of trees on lands that have not had trees for more than a generation.

wildlife, recreation, educational and research activities.

A forest management plan developed by staff foresters in collaboration with the Sustainable Forestry Initiative (with which Clemson is a partner) will ultimately lead to the CEF being certified as a Sustainable Forest under the Sustainable Forestry Initiative. This plan, along with the natural resource inventory recently completely, will assure the overall sustainability of the Clemson Experimental Forest and provide a carbon offset as a natural result of forest management. Therefore, one of our preliminary efforts will be to quantify the growth of the forest as compared to the harvest using the 50 years of accumulated data.

Ideas in need of a champion

- Identify offset possibilities in the following areas:
  - Renewable energy, which commonly includes wind power, solar power, hydroelectric power and biofuel. Some of these offsets are used to reduce the cost differential between renewable and conventional energy production, increasing the commercial viability of a choice to use renewable energy sources. In addition, with the advent of a new wind turbine project at the coast, Clemson will seek out partnering relationships that may allow the University to share the carbon offset credits associated with wind farms.
  - Energy efficiency, including projects such as cogeneration plants that generate both electricity and heat from the same power source, thus improving upon the energy efficiency of most power plants which waste the energy generated as heat.
  - Destruction of industrial pollutants, such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), which have a global warming potential many thousands of times greater than carbon dioxide by volume. Capturing and destroying these pollutants at their source is one source of carbon offsets.

- Other potential offset projects such as combustion or containment of methane generated by farm animals using an anaerobic digester, landfills or other industrial waste. Evaluate installation of methane digesters at the Starkey Swine Center and other actions at the Farms Operations are also possible.

- Identify and use local or regional offsets to balance carbon emissions.
- Plan and implement sequestration projects.
- Identify additional lands for forestry or other sequestration material.
- Identify regional renewable energy projects for investigation and review.

Advances in technology

There is some latitude that is taken by this action plan for future advances in technology. It is useful to note only 66 years separate the Wright bother's first flight at Kitty Hawk and the first steps taken on the moon. The first flier had 12 horsepower. The first lunar rocket (Saturn V) had 160,000,000. Each year since the industrial revolution has witnessed an ever increasing level of technological advancement. This action plan reasonably assumes that this trend will continue particularly in the arena of energy and the environment.

Other conservation, resource management and waste elimination efforts

We recognize that to build a sustainable campus, we need to do more than look at our energy and emissions. For example, with three record droughts in the past 15 years, water has become a key concern on par with energy use and carbon emissions. We must reconsider everything we purchase and determine if it is the best choice for us. Sometimes the lowest price has a hidden cost that must be considered. We have learned that to buy a more fuel efficient vehicle may cost a little more up front, but rewards are reaped for many years to come. This is also true in other purchases, from writing instruments to paper and from food to computers. Clemson University will develop a culture of procurement that asks the important questions and seeks

ways to reduce our waste throughout the product life-cycle. What is no longer needed will be reused as a first choice, recycled where possible, researched for alternative energy as the final means of diversion and buried only as a last resort.

Ideas currently in action

- Purchase food from local sources and make our own bread and dairy products.
- Purchase meat and organic produce from an on-campus farm.
- Compost post-consumer food scraps from two dining halls.
- Remove trays from dining facilities to discourage taking more food than will be consumed and reduce water consumption (nearly 2 million gallons reduced per year.)
- Use food management software to ensure that food production matches demand.
- Implement an end-of-year move-out program to divert students' unwanted goods from the waste stream.
- Implement a recycling program, which currently takes 26% of regular materials out of the waste stream.

Ideas moving forward

- Develop a "Bring Your Own Cup" (BYOC) strategy in our dining halls and meeting rooms.
- Expand the "trayless" dining program by converting all dining halls to a plate-only dining experience. Market to both current and prospective students the sustainable choice of this program.
- Expand recycling to all buildings. This includes expanding the current student pilot program that is removing trashcans from classrooms and offices while retaining the quality of spaces in campus buildings. Market the sustainability value of the program.
- Develop a "Need It – Use It" program for office supplies.

Ideas in need of a champion

- Collect unneeded items from across the campus at a convenient location to be shopped by departments. Market the program and include incentives for participation.
- Employ the use of concepts such as “atom economy” and “green chemistry” in all of our research programs to reduce the use of toxic solvents and reagents in chemistry and similar departments.
- Eliminate the use of styrofoam.
- Treat all paper documents as secure documents requiring destruction through recycling and prohibiting throwing in waste cans.
- Provide incentives for innovative ways to increase recycling rate.
- Set a goal of 75% recycling rate by 2020.
- Enforce the Construction & Demolition recycling plan on all projects. Raise the goal to 100% recycling rate with 75% as the minimum.
- Integrate in-vessel compost program through research and class studies.
- Integrate mushroom compost research with on-campus composting.
- Research alternative energy as a means of diverting material not recyclable or compostable.

“In our every deliberation, we must consider the impact of our decisions on the next seven generations.”
The Great Law of the Iroquois Confederacy

The ideas proposed here are already supported by the following percentages of students who currently participate in these sustainable behaviors on a regular basis:

- *45% use as little water as necessary*
- *31% buy second-hand goods*
- *72% recycle*
- *80% use re-usable drinking bottles*

CONCLUSION

As we plan Clemson's sustainable future, we do so with a sense of our place in the world as a leading education and research institution. We have a responsibility to assume a leadership role in education and culture. In doing so, we embrace our interdependence with the local and global communities.

This action plan is limited by our geographic, cultural, technological and philosophical landscape. We recognize that we are working with the knowledge base we have, and that our plan is an educated best guess at the future. Our current paradigm frames only the present—not the future. Innovative new technologies will be developed. And, we are aware of the requirement for patience as we implement changes and find solutions to long-standing problems. As Clemson moves forward in creating a sustainable future, we are constrained only by the limits of our imagination. As Albert Einstein said, "Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution."

We recognize that achieving the goals outlined in this sustainability action plan will not be quick or easy. We recognize that achieving these goals will require the participation of all members of the Clemson family. And though the challenge is daunting, we know we can do it. Clemson is uniquely positioned to lead this change. Our students are learning the way this world works, and they are beginning to establish their adult life style. Here, bright minds are producing new ideas and it is here that educators engage with the world beyond the campus. We are united as One Clemson in this sustainability action plan, considering our lives and futures, and those of our children and grandchildren.

"To accomplish great things, we must dream as well as act."
Anatole France