Climate Action Plan

Mississippi State University

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HISTORY

Mississippi State University began as The Agricultural and Mechanical College of the State of Mississippi, one of the national Land-Grant Colleges established after Congress had passed the Morrill Act in 1862. It was created by the Mississippi Legislature on February 28, 1878, to fulfill the mission of offering training in "agriculture, horticulture and the mechanical arts . . . without excluding other scientific and classical studies, including military tactics." The College received its first students in the fall of 1880 in the presidency of Confederate General Stephen D. Lee. In 1887 Congress passed the Hatch Act, which provided for the establishment of the Agricultural Experiment Station in 1888. Two other pieces of federal legislation provided funds for extending the mission of the College: in 1914, the Smith-Lever Act called for "instruction in practical agriculture and home economics to persons not attendant or resident," thus creating the state-wide effort which led to Extension offices in every county in the State; and, in 1917, the Smith-Hughes Act provided for the training of teachers in vocational education.

By 1932, when the Legislature renamed the College as Mississippi State College, it consisted of the Agricultural Experiment Station (1887), the College of Engineering (1902), the College of Agriculture (1903), the School of Industrial Pedagogy (1909), the School of General Science (1911), the College of Business and Industry (1915), the Mississippi Agricultural Extension Service (1915), and the Division of Continuing Education, (1919). Further, in 1926 the College had received its first accreditation by the Southern Association of Colleges and Schools.

By 1958, when the Legislature again renamed the College, as Mississippi State University, the Office of Graduate Studies had been organized (1936), doctoral degree programs had begun (1951), the School of Forest Resources had been established (1954), and the College of Arts and Sciences had been created (1956).

The College of Architecture admitted its first students in 1973. The College of Veterinary Medicine admitted its first class in 1977, and the School of Accountancy was established in 1979.

As a Land-Grant institution, Mississippi State University is dedicated to the three broad purposes already mentioned-learning, research, and service: learning, on-campus and off-campus, to enhance the intellectual, cultural, social, and professional development of its students; research, both to extend the present limits of knowledge and to bring deeper insight, understanding, and usefulness to existing knowledge; and service, to apply knowledge and the fruits of research to the lives of people.

Fulfilling these purposes is the chief work of the large number of educational units that make up the total university, including, among others, the academic departments, schools, and colleges; Continuing Education; the Mississippi State University Extension Service, and the Mississippi Agricultural and Forestry Experiment Station.

The quality of the faculty, staff, and administrators ensures the high quality of the instruction, research, and service provided. The quality of the University's programs ensures that its students receive a well-designed and comprehensive education that will assist them to lead constructive lives and achieve their personal and professional goals.

(History taken from the University Website)

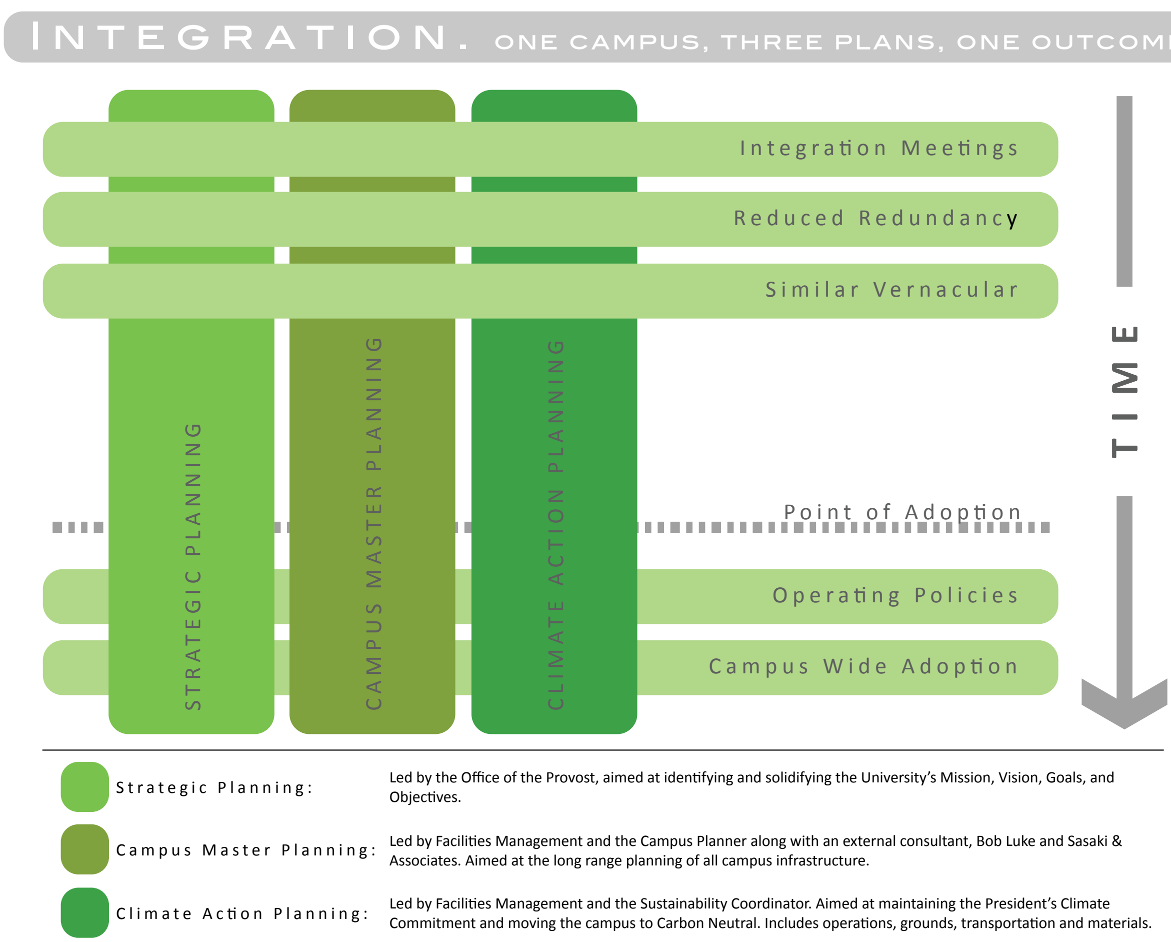
SUSTAINABILITY: 2006 - 2012

As a land-grant institution, multiple departments have a scholarly focus in areas tied to the social, environmental, or economic bottom line of sustainability. This focus has produced considerable scholarly output in terms of research and students who have devoted their professional life and practice to efforts that have, and still are, making an impact on our stewardship of the earth.

Today, Mississippi State houses multiple research, teaching, and service centers aimed specifically at the social, environmental, and economic issues that we face in today's world. Mississippi is a state rich in natural resources, culture, and history, but we are also a state with challenges in all three areas of the sustainability bottom line. From obesity and poverty, to the challenges of crop and food production in our Mississippi delta, we must ready ourselves to help educate future generations in a way that is socially responsible, economically sound, and environmentally conscious. It is for these reasons that the scholarly aspect of sustainability is a significant tenant of this Mississippi State Climate Action Plan.

In addition to this plan, the Mississippi State University Campus Master Plan has recently been adopted and this plan includes significant statements and details aimed at greater campus sustainability including Architectural Design Guidelines that focus not only on aesthetics but incorporate passive architectural aspects as well.

The MSU Strategic Plan is also being updated. The update of the Campus Strategic Plan will further focus the University mission, vision, and objectives to the tenets of sustainability. Along with this Climate Action Plan, the University is poised to integrate each of these focus areas in a manner that reduces redundancy and improves the effectiveness of each.



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In 2006, Mississippi State started a concerted effort to reduce our energy and utility cost. With rising utility rates, the campus was experiencing shortfalls in our utility budget and the administration took decisive steps to reduce our energy demand.

One of the first programs to be initiated was the holiday shut back program. This program recognized the significantly lower occupancy rates of holiday periods and drastically changed the heating and cooling set points for facilities not being utilized during these times.

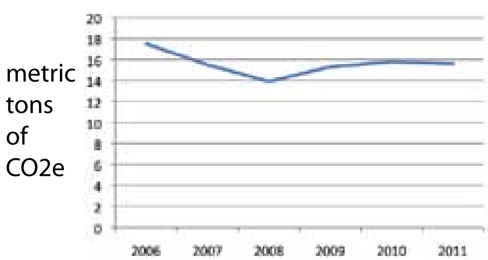
Setbacks were only made possible by the installation of a common mechanical control system around campus so that each facility can be controlled, monitored, and maintained by our utility team from a common point. A number of buildings are still without proper control systems and the continuation of this project is discussed further in this plan.

The third program was the completion and expansion of our central heating and cooling loop. This loop connects several buildings in the core of campus to a system that provides the needed cold and hot water used in heating or cooling the facility. This system eliminates the need for individual mechanical units at each facility and greatly increases efficiency for those facilities.

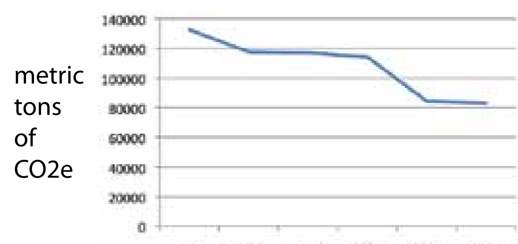
The fourth program was the replacement of old, inefficient steam boilers with new high-efficiency condensing boilers at the MSU Central Plant as well as other facilities across campus. Leveraging this technology, Facilities Management personnel realized a 40% reduction in gas consumption at the Central Plan in addition to significant natural gas reductions at other retrofitted facilities. This Central Plant is the key component for the central heated water loop and significantly increases the efficiency of that system.

The fifth project was the development of a Sustainability Policy that was adopted by the University's Executive Council. This policy requires that all new and or rehabbed facilities exceed the most current year of ASHRAE Standard 90.1 by 30% or in the event that this is too cost prohibitive that they design a facility with building systems with a 10 year pay back.

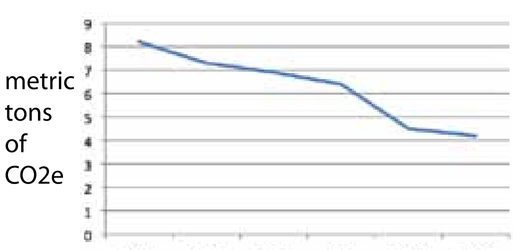
The initiation of these programs has significantly improved the ability of Campus Operations to monitor and optimize the efficiency of campus mechanical and electical systems.



per 1000 square feet



total emissions



per student FTE

Mississippi State University

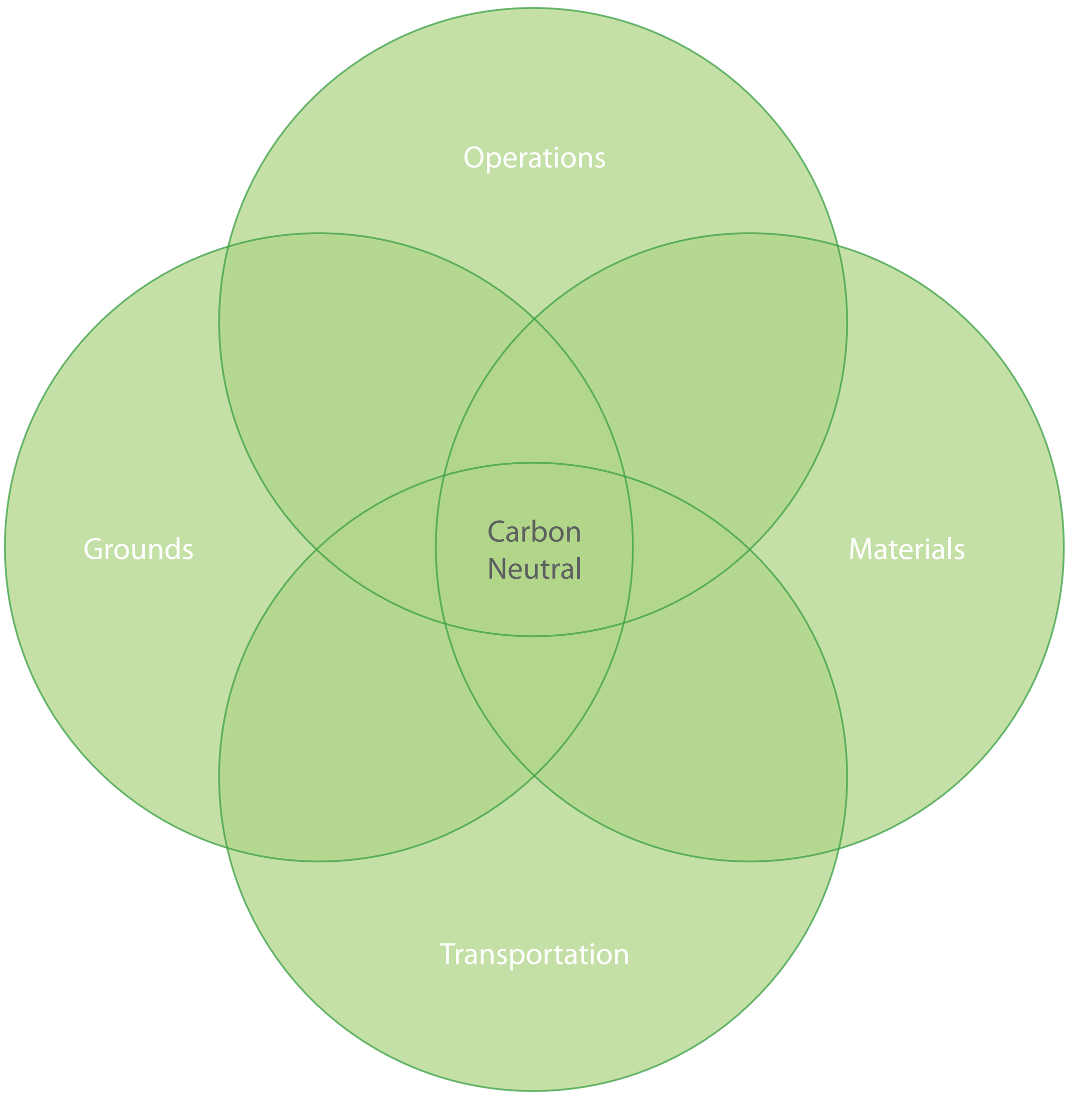
Greenhouse Gas Inventory: total emissions, emissions per student FTE, and per 1000 ft

Sustainability: 2012 - 2042

Despite the great work of the past 6 years, we still have considerable work that has to be accomplished both within our campus facilities as well as with the aspects of research, service, and teaching if we are to responsibly meet the challenges of today's world. The goal of this climate action plan is to produce a path by which Mississippi State University can reach carbon neutrality by the year 2042. In order to do so, we will focus on five areas. Four of these areas directly relate to the day-to-day operations of the campus while the fifth is education and research.

To develop the plan for each area, a task force was assembled for each focus area. A member of the University's Sustainability Committee led each task force, facilitated the task force discussion, and reported the focus area goals back to the Sustainability Committee. The five focus areas are as follows: operations, grounds, transportation, materials, and education/research.

The overarching goals of the four operational focus areas (operations, grounds, transportation, materials) are: 1) determine the carbon producing aspects of each area, 2) determine ways to either eliminate or reduce those carbon outputs, 3) determine potential sequestration opportunities. Each task force determined specific objectives necessary to reach these goals and they are as follows.



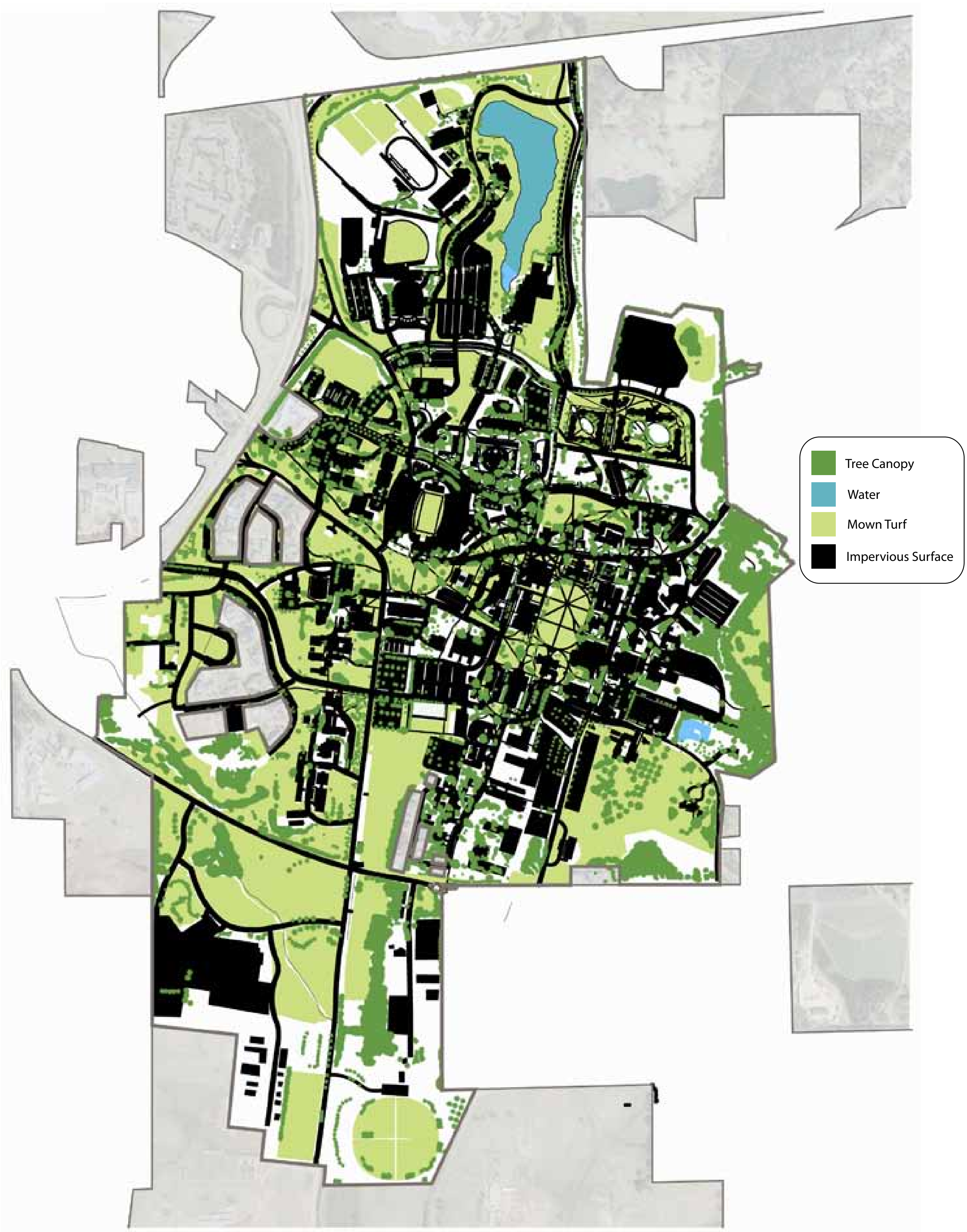
F o c u s   A r e a

The main campus of Mississippi State University consists of the campus core, north farm, and south farm. The farm areas are used for agricultural research and are excluded from this Climate Action Plan. The campus core, as shown below, is bound by Highway 182 and north farm to the north, Highway 12 to the west, south farm to the south, and the campus boundary to the east.

Within this boundary and our plan, there exists 161 facilities ranging in use from academic, research, administrative, commercial, residential, to athletics spread over +/- 800 acres. In addition to the facilities, there are over 400 acres of turf, 45 acres of canopy cover, and 160 acres of impervious surfaces (shown on page 11).

Areas excluded from the plan within the above mentioned boundaries are shown below and include areas not under the control of MSU Campus Services.

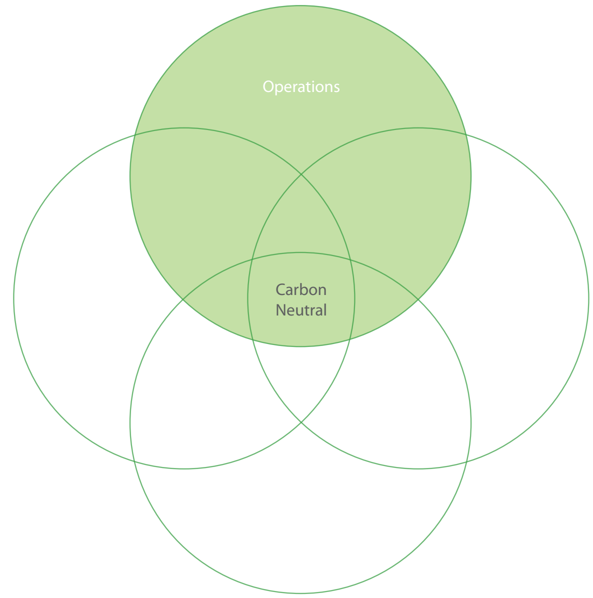
Mississippi State University
Campus and CAP Boundary



Mississippi State University

canopy, water, turf, and impervious surfaces

O p e r a t i o n s



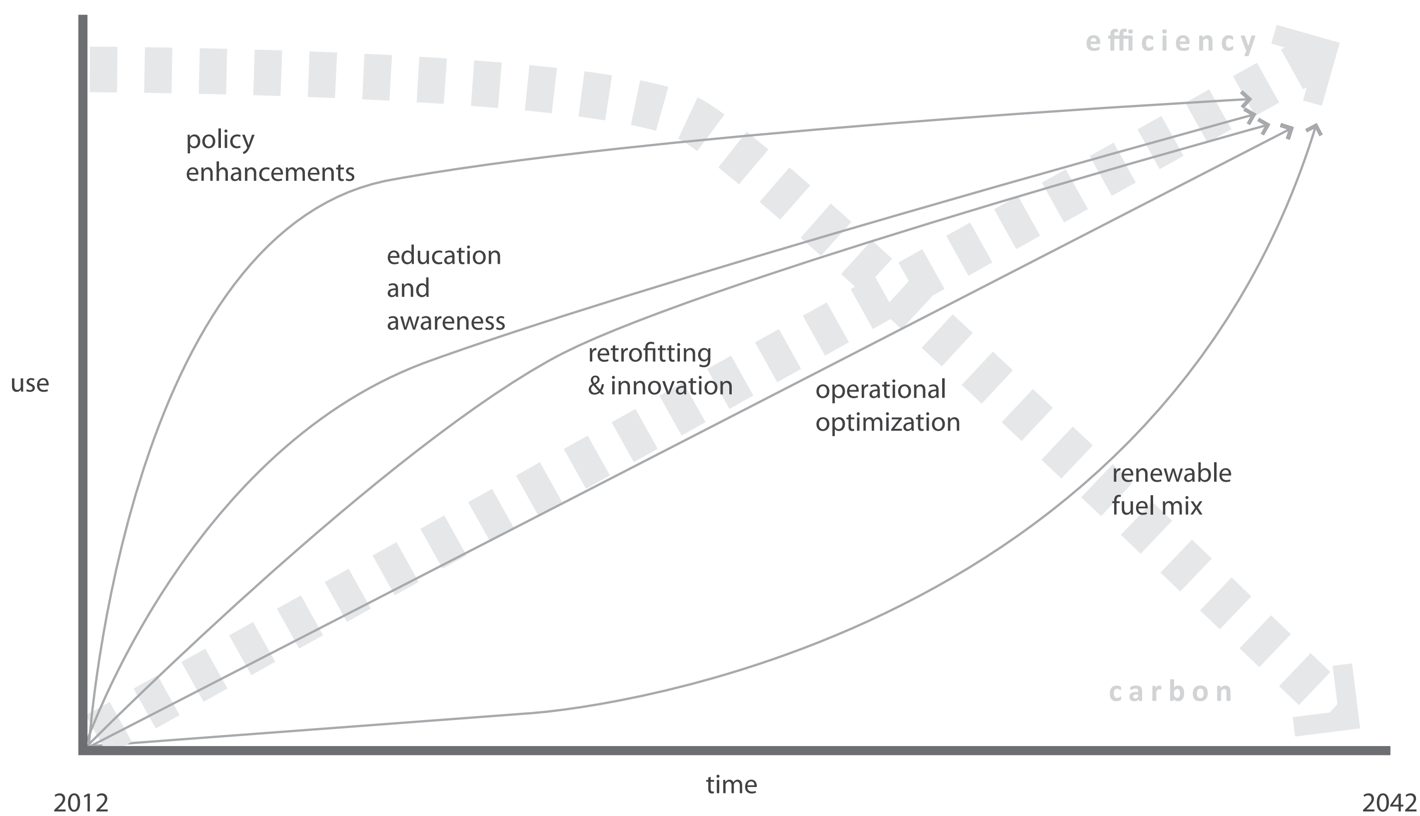
Operational objectives relate to energy and are categorized as clean energy generation, behavior modification, technology and innovation, retrofitting, and operational optimization. Operational activities at Mississippi State account for a 88% of our annual greenhouse gas emissions, therefore it is paramount that we become more efficient, we change behaviors, we find reliable renewable energy, and we innovate over time.

As a TVA campus our energy generation goals rely heavily on TVA's 2020, 2030, 2040 Climate Change Goals. A fuel mix with an increasing portfolio of renewable energy sources is vital for us to reach carbon neutral. In addition to the goals set forth by TVA, we will actively pursue on-site and regional renewable energy and hot water development and production.

Behavior modification comes through education and user engagement. We have witnessed some acceptance of energy efficiency measures because of advocacy programs, holiday shut back notifications, web campaigns, and earth day activities. Each of these will continue with an increased effort to promote awareness.

Operational optimization includes online commissioning tools that work along side our campus controls to indentify any facility operational issues. Controls also allow for increased operator reviews of all mechanical systems and allow for optimized cutbacks by limiting demand and load on electrical and natural gas systems.

Policy enhancements are needed to mandate a set point for all heating and cooling systems and to allow a



OPERATIONAL OBJECTIVES

2-degree variation by each user. Currently, we manage set points where there are proper controls and allow for these type of user variances, but there is no policy in place mandating these, thus they can be changed at the request of the user's department head.

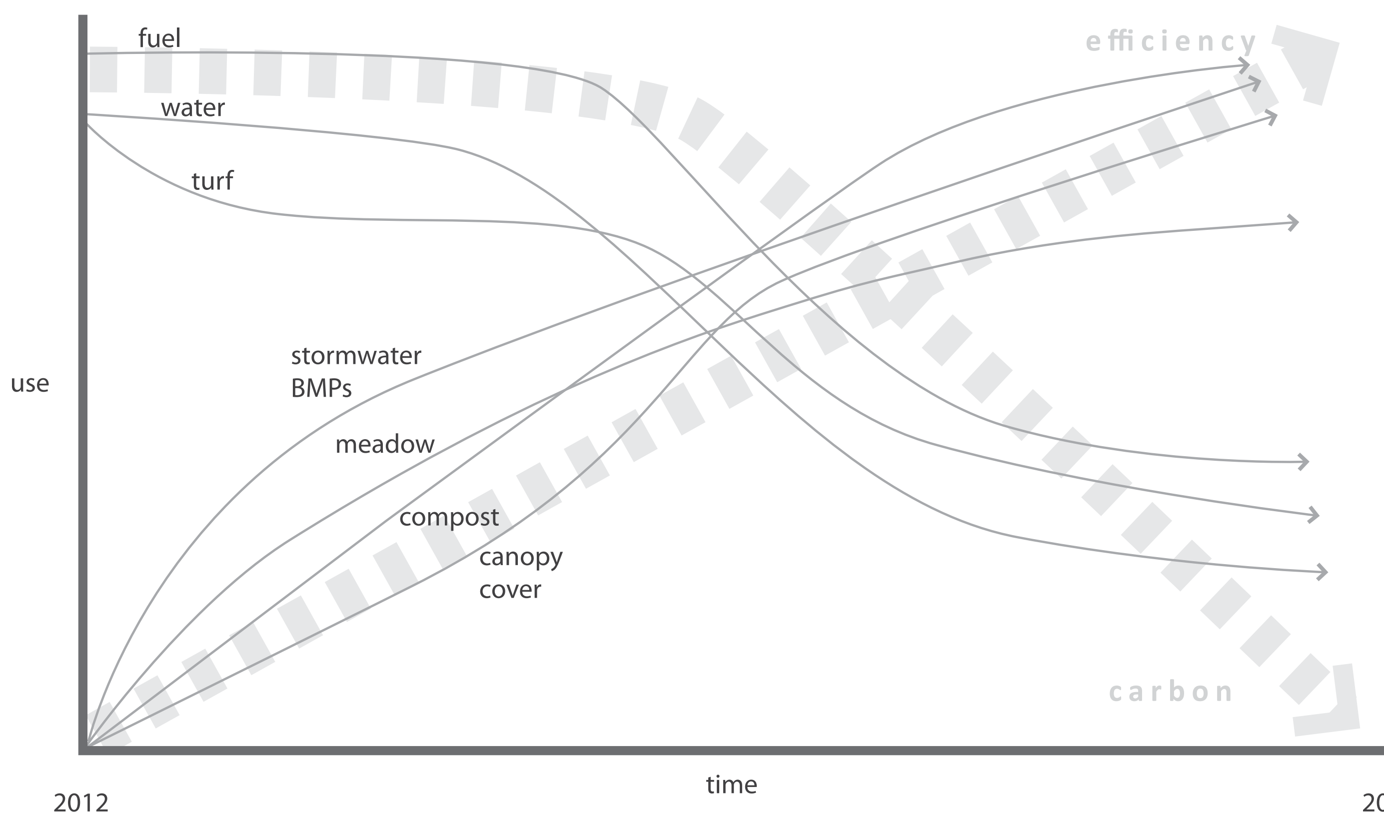
Retrofitting current systems will produce large reductions in greenhouse gas emissions. Retrofits that are planned for the next several years include a campus wide lighting upgrade, campus wide controls upgrade, boiler conversions, mechanical upgrades, and building envelope improvements.

Technology and innovation is a vital piece of the energy enhancement plan. With improving technology and continued innovation we expect continued improved and evolution in equipment, service, and efficiency. The technologies currently on the table include thermal storage at our central plant, software upgrades at our central plan, smart metering for all campus facilities, dynamic glass, and waste heat recovery at our generation plant.

G r o u n d s

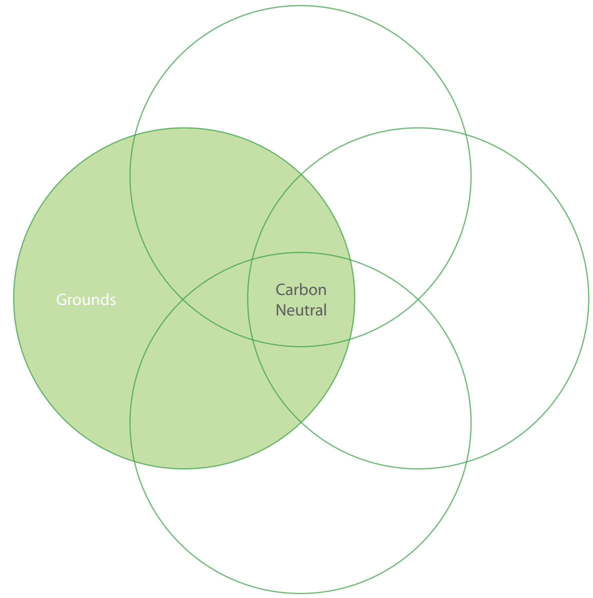
Grounds objectives relate to improved stormwater management, decreased turf area, increased efficiency of grounds maintenance equipment, and increased sequestration due to increased composting, reforestation efforts, and the development of prairie and wildflower areas in areas currently intensively maintained as turf.

Water is a vitally important resource and despite its lack of producing carbon or its ability to sequester carbon, its use and management directly impacts systems that do. Increased plantings of native landscapes reduce the need of irrigation, utilizing drip irrigation increases the effectiveness of irrigation on landscapes that require irrigation, water reuse from our lakes and ponds on campus provides a non-potable water source, and the



GROUNDS OBJECTIVES

innovative use of stormwater management best management practices all constitute ways in which the campus landscape can be used as a tool to conserve such a precious resource.

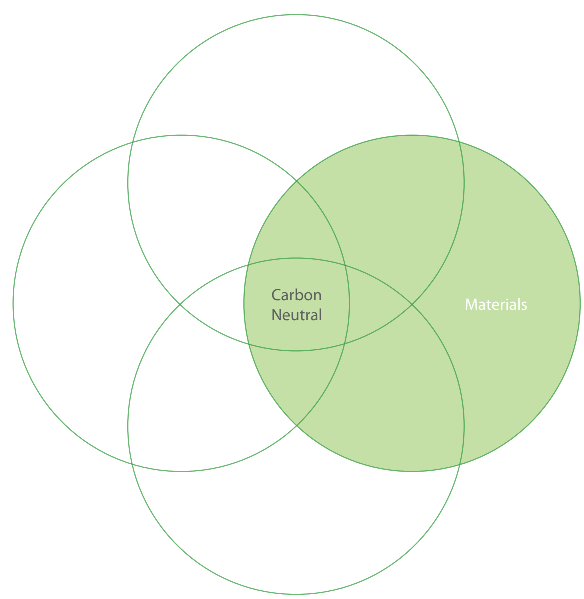


Several hundred acres of turf are intensively maintained across our campus. While a fair portion of these areas are used and should be maintained as turf areas, several areas exist that aren't used as turf areas and would benefit from reforestation or their conversion to wildflower or meadow areas. This would drastically decrease the demand for carbon producing maintenance and produce areas of sequestration across the campus. These areas would also increase biodiversity and increase aesthetic value due to diversity of landscape forms, colors, and textures.

Campus Landscape currently maintains over a thousand acres on our campus. This activity requires the constant movement of people and equipment, therefore creating a large source of carbon producing activity. This activity is fairly well orchestrated and with the introduction of equipment that reduces or eliminates their carbon production, we will over time significantly reduce our carbon production from vehicles.

As previously mentioned with reforestation and meadow conversion components, our campus landscape is our sequestration source. Another great source is our composting facility. We currently have an active composting process that is managed by campus landscape. This program receives landscape clippings and debris along with other compostable materials from our farm areas. We utilize a passive composting process and over time are interested in integrating a more active process that will increase our ability to receive and compost a more diverse material selection and produce compost in a more timely manner. The resulting compost not only helps in our sequestration efforts, but it produces a product that can be utilized across campus.

M a t e r i a l s

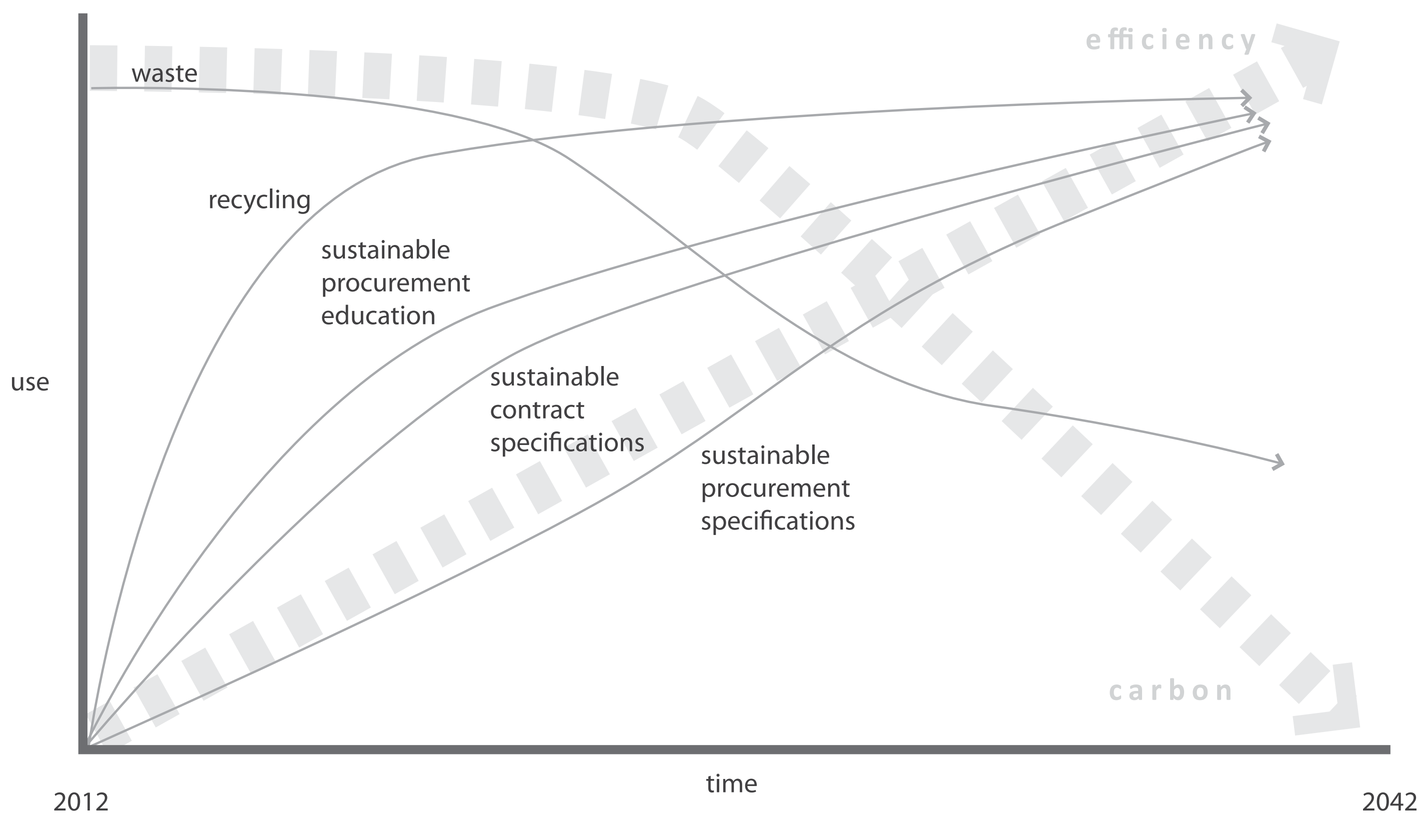


Material objectives relate to the procurement of products, materials, and supplies that are sustainable in terms of how they were produced, where they are transported from, and by whom they were produced. Also related is the process by which we determine contracts for the University and the formalization of sustainability as a criteria for proposal and contract evaluation. Waste minimization and recycling go hand in hand and complete the material cycle of how products and services are introduced to this campus to ultimately how we dispose of those products.

Assisting departments to write procurement specifications and contract language ensuring contractors, vendors and University departments use resources in the most sustainable manner is a process that will help guide the countless purchases occurring across campus. This will help insure that we are doing our part to become carbon neutral, and that we do business with those also concerned about sustainability.

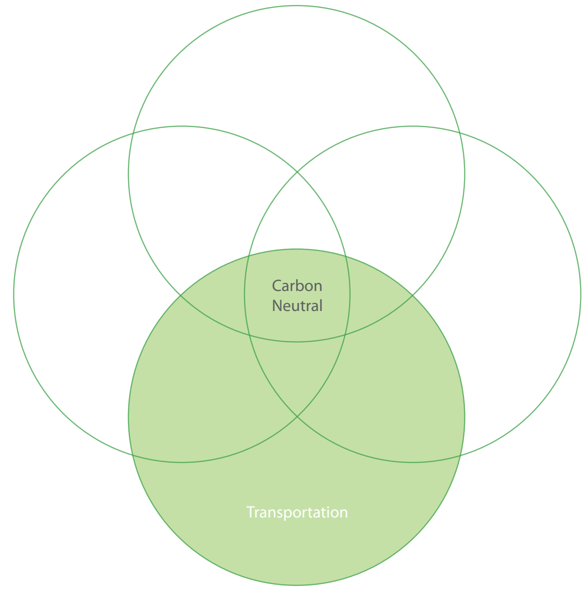
To help with purchasing, we will research products and practices to be used in the normal and unique business of the University. Due to a de-centralized procurement system, it is important that we educate and monitor University staff in the use of sustainable purchasing/procurement procedures. This aids in product selection from the State Contract as well as helping modify purchasing behaviors of individuals making purchasing on the procurement card.

Procurement directly relates to waste minimization, which directly relates to recycling. Our goal is to practice a more cradle-to-cradle thought process by purchasing items that do minimize our landfill impact by either being re-used, re-purposed, or recycled. We have witnessed drastic increases in our recycling program but much work has to be done both in education and collection.



MATERIALS OBJECTIVES

T r a n s p o r t a t i o n



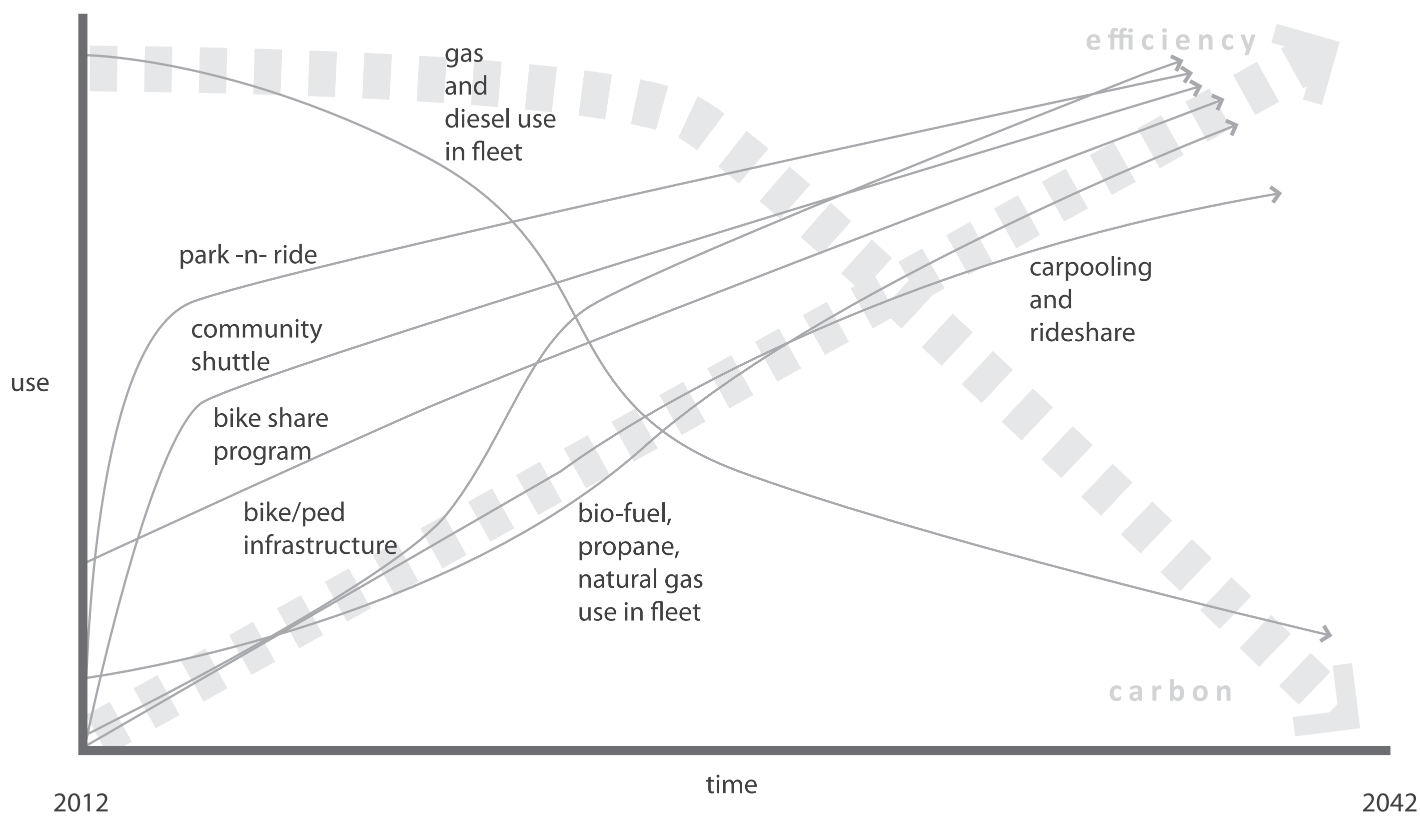
Transportation objectives relate to our shuttle system, bike share program, the enhancement of our bike/pedestrian infrastructure, carpooling, and ridesharing.

We will implement a community wide shuttle system to help reduce single occupancy vehicle traffic on campus. This will aid in the reduction of emissions and also help reduce the number of parking lots constructed. Currently our campus shuttle system carries 500,000 individuals a year around the campus. This year we will expand this system into the community and continue to look for ways to increase this coverage area.

Our bike share program has been a tremendous success since it began four years ago. This free program provides bikes across campus for anyone to use anywhere on campus. This year we have purchased 100 more bikes and look to increase these numbers in coming years. In addition to the bike share program, we have seen an increase in bike traffic on campus, therefore bike infrastructure has been improved and will continue to be a focus. This includes the development of dedicated bike paths, the installation of bike racks around campus and on our shuttles, and the education of students on bike safety.

Our campus shuttle fleet is a large source of carbon production. Our plan is to phase out diesel and gas shuttles and utilize shuttles running on bio-fuel, propane, and/or natural gas.

As a campus in a rural state, we have faculty, staff and students who often commute from distances greater



T R A N S P O R T A T I O N   O B J E C T I V E S than 25 miles. A large percentage of these come to campus from the same communities, thus making carpooling and ridesharing a great opportunity. However due to historically low gas prices and parking permits for campus, the incentive to do so never existed. This year will be the first year where campus parking has utilized a tiered parking permit fee aimed at incentivizing carpooling, riding sharing, and the utilization of our park and ride system.

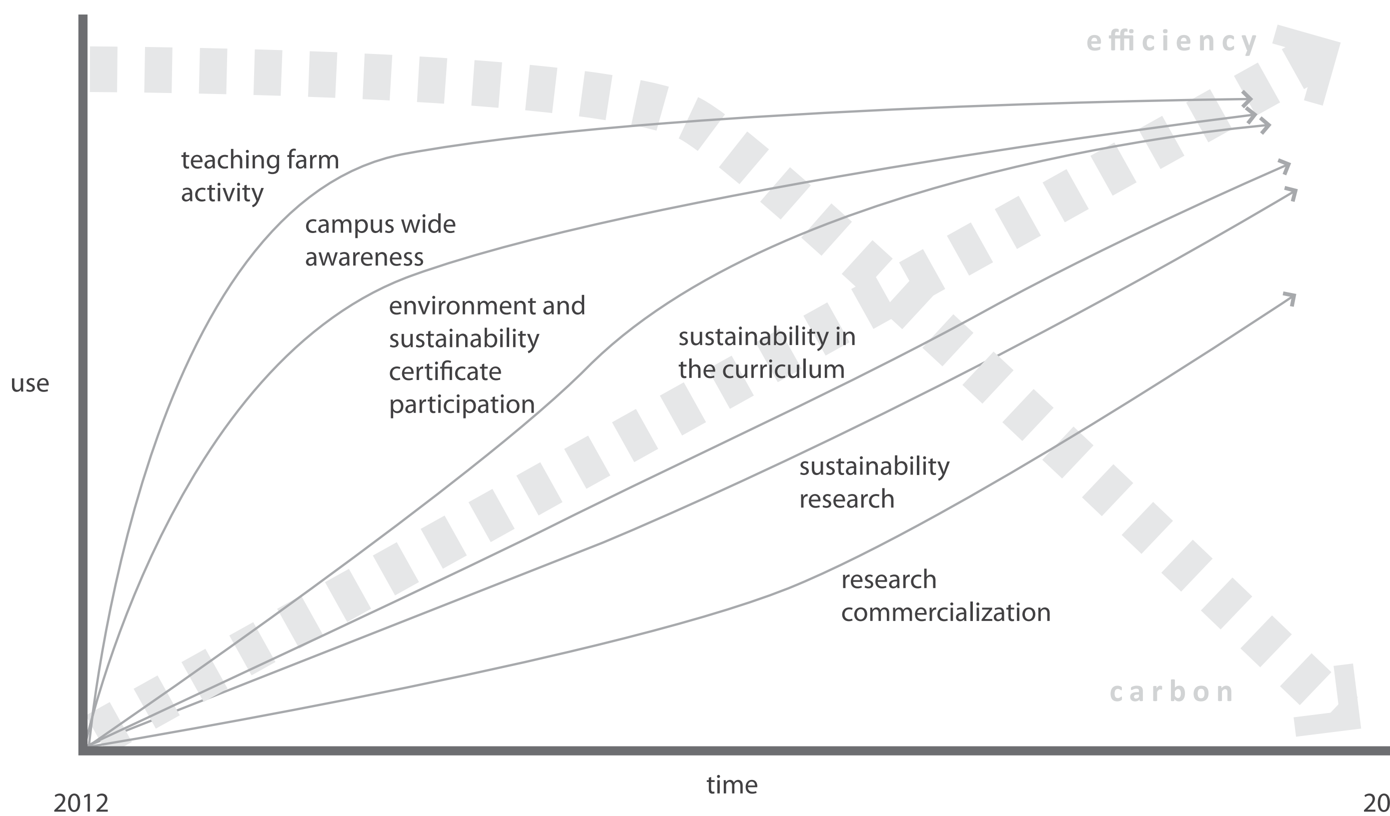
An immediate plan for transportation services is to create a survey for all faculty, staff, and students asking their travel behaviors. This information will allow us to specifically design our transit and carpool programs around each commuters needs.

A c a d e m i c s

Academic objectives relate to our land-grant mission of teaching, research, and service and our ability to increase the focus of sustainability in each of those areas.

There currently exist an Environment and Sustainability Certificate Program. This multi-disciplinary program is housed in the Office of the Provost and requires students to take courses in the humanities, social sciences, and sciences and engineering. This purposeful cross-pollination reflects the triple bottom line of sustainability and it is our goal to enhance the promotion of this program to increase student participation.

It is our goal to use the Certificate Program and other colleges of the University to explore the development of a multidisciplinary environmental science major. This will help in the discussion of creating sustainability and environmental science classes as part of the core curriculum.



A C A D E M I C   O B J E C T I V E S

Supporting the newly created 24-acre Bulldog Student Teaching Farm is also a goal. This farm will serve as a teaching and research tool for student on their quest to grow food, understand natural and food systems, landscape architecture, passive architecture, water, etc.

Increase the awareness of faculty, staff, and students of the need for well-defined sustainability efforts at Mississippi State University. Reducing carbon through projects and technology is a considerable task, but modifying the campus population's behavior is an equally important endeavor and one that must be done through education and leading by example. This will be a broad effort but one project is to enhance our earth day activities through annually bringing to campus at least one prominent speaker on sustainability.

Expand and take advantage of Mississippi State University's research efforts in the environment and sustainability area through expanding the work being done in the area of carbon sequestration and being more proactive in seeking funding opportunities for research in environment and sustainability.

Commercialize the results of the biofuels research at the Sustainable Energy Research Center and collaborate with regional utilities on the production of renewable energy and the production of low carbon emitting fuel sources.

Consider ways in which Mississippi State University can provide outreach in the area of sustainability.

Green Fund

The Mississippi State University Green Fund was just established as an opt-in contribution system for faculty, staff, and students. This fund will specifically be used for sustainability projects, local and regional renewable energy projects, and for the payment of student interns.

Each of these efforts will be in concert with this CAP and managed by the MSU Sustainability Committee upon recommendations from Green Fund Sub-Committee. More information can be found at www.sustainability.msstate.edu/greenfund. Specific expenditures will fall within the below percentages:

50% - On campus sustainability projects
30% - On-site and regional renewable energy development and production
20% - Student internships in the Office of Sustainability

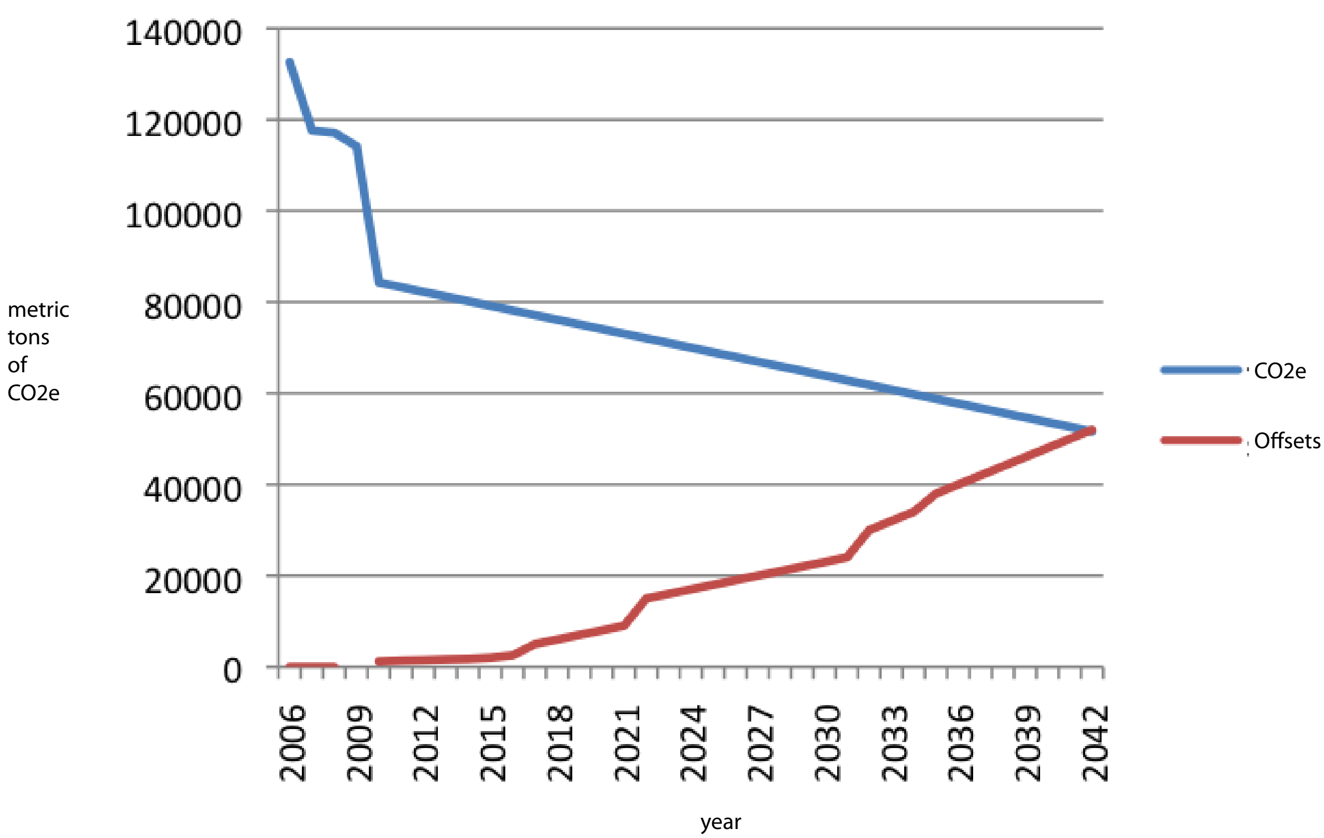
This fund is a joint effort of the Office of Sustainability, Students for a Sustainable Campus, and the Mississippi State University Sustainability Committee.

CARBON NEUTRAL

C a r b o n   N e u t r a l

As previously stated, the goal of this climate action plan is to chart the path for Mississippi State University to becoming carbon neutral by the year 2042. This 30 year plan is one that is intended to be flexible, but firm in its process of meeting the ideas and objectives as set forth for each focus area. Several factors are at play, thus a few assumptions and notes must be made. 1) With our limited focus area, our sequestration potential is minimal. 2) Offsets will largely consist of credits associated with on-site and regional renewable energy development and production. 3) Purchased electricity is the largest source of carbon production for the campus and falls within our Operational focus area, thus offering the greatest chance for improvement. 4) The greenhouse gas inventory average of the previous two fiscal years were used to determine the average GHG reduction for the linear reduction of GHG over the life of this plan to the year 2042.

The below graph showcases a projected path to carbon neutral and does so considering the above assumptions and notes and the before mentioned focus area projects. A more detailed chart of our operational plan follows starting on page 21.



Mississippi State University
Carbon Neutral

Climate Action Plan - Operation Goals

Category	Carbon Reduction Goal (lbs)	% of 2011 Baseline
Clean Energy Generation	100,200,000	45%
Education and User Engagement	11,100,000	5%
Operational Optimization	22,300,000	10%
Policy Enhancements	11,100,000	5%
Retrofit	44,500,000	20%
Technology and Innovation	33,400,000	15%
	222,600,000	**100%**

	Values				
Category	Sum of Carbon Reduction (Low)	Sum of Carbon Reduction (High)	Sum of % Reduction from Baseline (Low)	Sum of % Reduction from Baseline (High)	Sum of Budget Cost
Clean Energy Generation	140,818,500	93,839,000	63%	42%	$ 32,000,000
Education and User Engagement	6,663,000	20,035,500	3%	9%	$ 75,000
Operational Optimization	13,357,000	24,493,000	6%	11%	$ -
Policy Enhancements	4,457,500	8,915,000	2%	4%	$ -
Retrofit	42,234,000	67,093,500	19%	30%	$ 41,000,000
Technology and Innovation	23,458,500	44,381,500	11%	20%	$ 51,100,000
Grand Total	230,988,500	258,757,500	104%	116%	$ 124,175,000

Category	Goal	Description	Area of Impact	Percent of Total Source (Low)	Percent of Total Source (High)	Impact (Low)	Impact (High)	Unit	kwh total (Low)	kwh total (High)	ccf total (Low)	ccf total (High)	Start	Duration	Complete	Budget Cost	Carbon Reduction (Low)	Carbon Reduction (High)	Total Inventory (Low)	Total Inventory (High)	% Reduction from Baseline (Low)	% Reduction from Baseline (High)
Retrofit	Lighting Upgrades	retrofit over 4	Electricity	5%	8%	6120000	9790000	kwh	6,120,000	9,790,000	0	0	2012	2	2014	$ 6,500,000	9,486,000	15,174,500	213,158,682	207,470,182	4%	7%
Retrofit	Controls Upgrades	150000 MMBtu - 30% reduction (half elect)	Electricity	5%	7%	6120000	8570000	kwh	6,120,000	8,570,000	0	0	2012	5	2017	$ 3,000,000	9,486,000	13,283,500	203,672,682	194,186,682	4%	6%
Retrofit	Controls Upgrades	150000 MMBtu - 30% reduction (half gas)	Natural Gas	5%	7%	150000	200000	ccf	0	0	150,000	200,000	2012	5	2017		1,650,000	2,200,000	202,022,682	191,986,682	1%	1%
Technology and Innovation	Thermal Storage	kwh reduction from thermal storage advantage of lower ambient temps at night	Electricity	1%	2%	610000	2450000	kwh	610,000	2,450,000	0	0	2012	2	2014	$ 6,000,000	945,500	3,797,500	201,077,182	188,189,182	0%	2%
Technology and Innovation	Central Plant Optimization	Enhanced software for enhancing the efficiency of central plant operation.	Electricity	1%	2%	1220000	2450000	kwh	1,220,000	2,450,000	0	0	2014	1	2015	$ 100,000	1,891,000	3,797,500	199,186,182	184,391,682	1%	2%
Operational Optimization	Online Commissioning Tool	Ongoing algorithms that compare inputs/outputs from the campus control system to identify operational issues	Electricity	1%	3%	1220000	3670000	kwh	1,220,000	3,670,000	0	0	2012	3	2015		1,891,000	5,688,500	197,295,182	178,703,182	1%	3%
Operational Optimization	Online Commissioning Tool	Ongoing algorithms that compare inputs/outputs from the campus control system to identify operational issues	Natural Gas	1%	3%	30000	90000	ccf	0	0	30,000	90,000	2012	3	2015	$ -	330,000	990,000	196,965,182	177,713,182	0%	0%
Operational Optimization	Operator Reviews	Operator review and optimizing of the Building Automation Systems	Electricity	3%	5%	3670000	6120000	kwh	3,670,000	6,120,000	0	0	2012	10	2022	$ -	5,688,500	9,486,000	191,276,682	168,227,182	3%	4%
Operational Optimization	Operator Reviews	Operator review and optimizing of the Building Automation Systems	Natural Gas	3%	5%	90000	150000	ccf	0	0	90,000	150,000	2012	10	2022	$ -	990,000	1,650,000	190,286,682	166,577,182	0%	1%
Technology and Innovation	Smart Metering	Real Time Metering install w/ live dashboard and reporting	Electricity	2%	3%	2450000	3670000	kwh	2,450,000	3,670,000	0	0	2013	3	2016		3,797,500	5,688,500	186,489,182	160,888,682	2%	3%
Technology and Innovation	Smart Metering	Real Time Metering install w/ live dashboard and reporting	Natural Gas	2%	3%	60000	90000	ccf	0	0	60,000	90,000	2013	3	2016		660,000	990,000	185,829,182	159,898,682	0%	0%
Retrofit	Boiler Conversions	Approximatley 30 Buildings will still benefit from conversion to high efficiency condensing boilers	Natural Gas	3%	6%	90000	180000	ccf	0	0	90,000	180,000	2013	10	2023	$ 1,500,000	990,000	1,980,000	184,839,182	157,918,682	0%	1%
Retrofit	Mechanical Upgrades	Pressure Optimization, upgraded AHU's, Chillers, etc.	Electricity	5%	10%	6120000	12240000	kwh	6,120,000	12,240,000	0	0	2012	20	2032	$ 15,000,000	9,486,000	18,972,000	175,353,182	138,946,682	4%	9%
Technology and Innovation	Dynamic Glass	Enhance the building envelope via dynamic glass retrofits on old buildings and designed into new construction.	Electricity	3%	5%	3670000	6120000	kwh	3,670,000	6,120,000	0	0	2012	20	2032	$ 10,000,000	5,688,500	9,486,000	169,664,682	129,460,682	3%	4%
Technology and Innovation	Dynamic Glass	Enhance the building envelope via dynamic glass retrofits on old buildings and designed into new construction.	Natural Gas	3%	5%	90000	150000	ccf	0	0	90,000	150,000	2012	20	2032		990,000	1,650,000	168,674,682	127,810,682	0%	1%
Retrofit	Building Envelope Treatment	upgrade/add insulation and seal openings	Electricity	5%	7%	6120000	8570000	kwh	6,120,000	8,570,000	0	0	2013	29	2042	$ 15,000,000	9,486,000	13,283,500			4%	6%
Retrofit	Building Envelope Treatment	upgrade/add insulation and seal openings	Natural Gas	5%	7%	150000	200000	ccf	0	0	150,000	200,000	2013	29	2042		1,650,000	2,200,000			1%	1%
Operational Optimization	Demand Limiting and Load Rolling	Utilize Control System to cut back energy loads as they approach pre-set thresholds	Electricity	2%	3%	2450000	3670000	kwh	2,450,000	3,670,000	0	0	2013	2	2015	$ -	3,797,500	5,688,500	164,877,182	122,122,182	2%	3%
Operational Optimization	Demand Limiting and Load Rolling	Utilize Control System to cut back energy loads as they approach pre-set thresholds	Natural Gas	2%	3%	60000	90000	ccf	0	0	60,000	90,000	2013	2	2015	$ -	660,000	990,000	164,217,182	121,132,182	0%	0%
Education and User Engagement	Educational Campaign Phase 1	Promote awareness via student groups, earth day, holiday shutbacks, web campaign, etc.	Electricity	1%	3%	1220000	3670000	kwh	1,220,000	3,670,000	0	0	2013	3	2016	$ 25,000	1,891,000	5,688,500	162,326,182	115,443,682	1%	3%
Education and User Engagement	Educational Campaign Phase 1	Promote awareness via student groups, earth day, holiday shutbacks, web campaign, etc.	Natural Gas	1%	3%	30000	90000	ccf	0	0	30,000	90,000	2013	3	2016	$ -	330,000	990,000	161,996,182	114,453,682	0%	0%
Education and User Engagement	Educational Campaign Phase 2	Promote awareness via student groups, earth day, holiday shutbacks, web campaign, etc.	Electricity	1%	3%	1220000	3670000	kwh	1,220,000	3,670,000	0	0	2017	3	2020	$ 25,000	1,891,000	5,688,500			1%	3%
Education and User Engagement	Educational Campaign Phase 2	Promote awareness via student groups, earth day, holiday shutbacks, web campaign, etc.	Natural Gas	1%	3%	30000	90000	ccf	0	0	30,000	90,000	2017	3	2020	$ -	330,000	990,000			0%	0%
Education and User Engagement	Educational Campaign Phase 3	Promote awareness via student groups, earth day, holiday shutbacks, web campaign, etc.	Electricity	1%	3%	1220000	3670000	kwh	1,220,000	3,670,000	0	0	2021	3	2024	$ 25,000	1,891,000	5,688,500			1%	3%
Education and User Engagement	Educational Campaign Phase 3	Promote awareness via student groups, earth day, holiday shutbacks, web campaign, etc.	Natural Gas	1%	3%	30000	90000	ccf	0	0	30,000	90,000	2021	3	2024	$ -	330,000	990,000			0%	0%
Policy Enhancements	Setpoint Policy	Administration led policy change of temp setpoint, 2 degrees heating/cooling	Electricity	2%	4%	2450000	4900000	kwh	2,450,000	4,900,000	0	0	2015	1	2016	$ -	3,797,500	7,595,000	158,198,682	106,858,682	2%	3%
Policy Enhancements	Setpoint Policy	Administration led policy change of temp setpoint, 2 degrees heating/cooling	Natural Gas	2%	4%	60000	120000	ccf	0	0	60,000	120,000	2015	1	2016	$ -	660,000	1,320,000	157,538,682	105,538,682	0%	1%
Clean Energy Generation	TVA 2020 Climate Change Goal	http://www.tva.gov/environment/pdf/environmental_policy.pdf - TVA plans to move from 30% non-carbon generation in 2010 to 50% in 2020	Electricity	12%	16%	14690000	19580000	kwh	14,690,000	19,580,000	0	0	2010	10	2020	$ -	22,769,500	30,349,000	134,769,182	75,189,682	10%	14%
Clean Energy Generation	Anticipated TVA 2030 Climate Change Goal	Need to Substantiate - estimate 10%	Electricity	6%	8%	7340000	9790000	kwh	7,340,000	9,790,000	0	0	2020	10	2030	$ -	11,377,000	15,174,500			5%	7%
Clean Energy Generation	Anticipated TVA 2040 Climate Change Goal	Need to Substantiate - estimate 5%	Electricity	3%	4%	3670000	4900000	kwh	3,670,000	4,900,000	0	0	2030	10	2040	$ -	5,688,500	7,595,000			3%	3%
Technology and Innovation	Anticipated Technology Gains	A portion of our climate change goal will certainly be realized by harnessing technology and innovation that is not on the market at present.	Electricity	5%	10%	6120000	12240000	kwh	6,120,000	12,240,000	0	0	2012	30	2042	$ 10,000,000	9,486,000	18,972,000	125,283,182	56,217,682	4%	9%
Clean Energy Generation	Green Energy Purchase	Purchase Blocks of Green Energy from TVA for a Monthly Premium - May be best way to invest in Clean Energy Generation	Electricity	48%	10%	58750000	12240000	kwh	58,750,000	12,240,000	0	0	2013	29	2042	$ 2,000,000	91,062,500	18,972,000	34,220,682	37,245,682	41%	9%
Clean Energy Generation	Solar - Photovoltaic	Onsite clean energy production via photovoltaic solar installations	Electricity	1%	3%	1220000	3670000	kwh	1,220,000	3,670,000	0	0	2016	26	2042	$ 20,000,000	1,891,000	5,688,500	32,329,682	31,557,182	1%	3%
Clean Energy Generation	Solar Hot Water	Enhance domestic and HVAC hot water system production with supplemental solar hot water generators	Natural Gas	25%	50%	730000	1460000	ccf	0	0	730,000	1,460,000	2016	26	2042	$ 10,000,000	8,030,000	16,060,000	24,299,682	15,497,182	4%	7%
Technology and Innovation	Waste Heat Recovery at Generation Plant	Supplant Central Chilled and Hot water production utilizing waste heat from turbines for chilled/hot water through conversions - steam or absorption chillers. Direct exhaust to hot water.	Electricity	10%	10%	12240000	12240000		0	0	0	0			0	$ 25,000,000	-	-	24,299,682	15,497,182	0%	0%

Thanks

The multiple objectives listed above constitute our path to carbon neutral. Much work has been done, but much work lies ahead within the focus areas and across the campus. This plan and the process of becoming carbon neutral is a team effort. The core of that team is the MSU Sustainability Committee, to whom I owe great thanks. The committee consist of the following:

- Vice President of the Campus Services, Chair
- Sustainability Coordinator, Co-Chair
- Associate Director, Campus Landscape
- Associate Director, Planning, Design, and Construction
- Associate Vice President of Academic Affairs
- Athletic Director or designee
- Campus Planner
- Director of Parking Services
- Director of Procurement and Contracts
- Energy/Mechanical Engineer
- General Counsel or designee
- MAFES Engineer
- President, Faculty Senate
- President, Students for a Sustainable Campus
- President, Student Association
- Registrar
- Vice President of Budget and Planning or designee
- Vice President of Student Affairs or designee