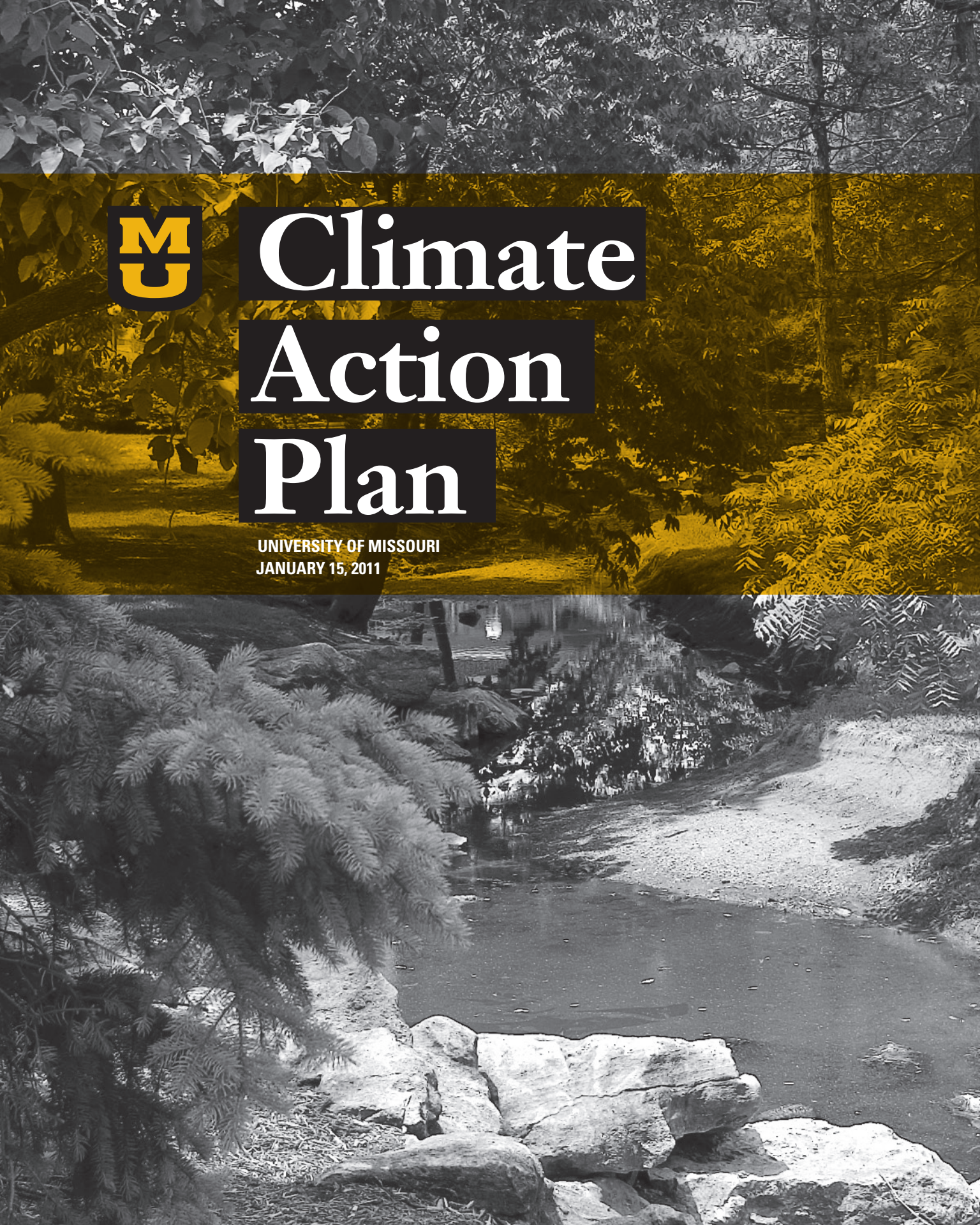

Climate Action Plan

UNIVERSITY OF MISSOURI
JANUARY 15, 2011

Photo Credit: Missouri Botanic Garden

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Cover Photo Credit: Mizzou Botanic Garden

Chancellor Deaton's Commitment

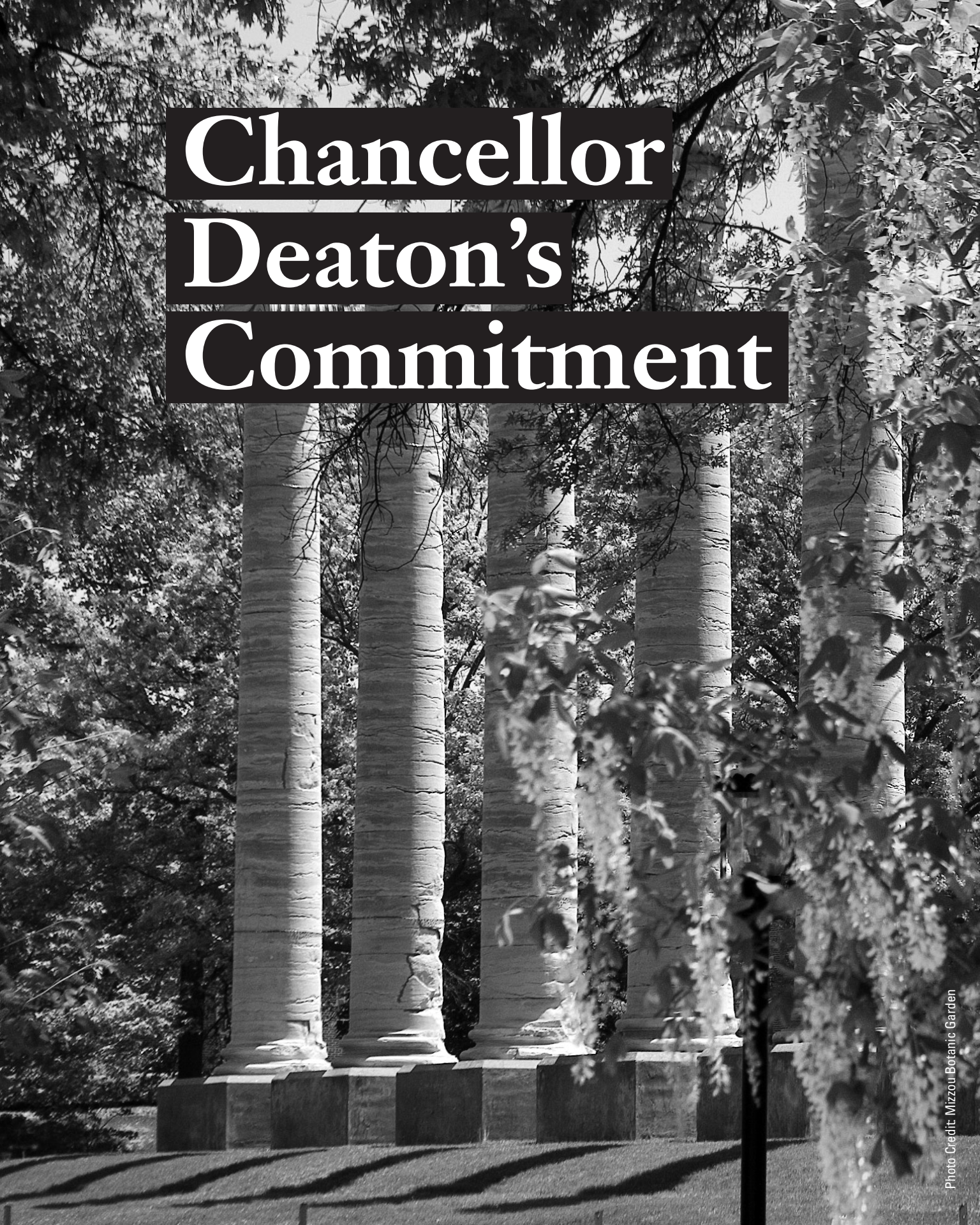


Photo Credit: Mizzou Botanic Garden

MU Chancellor Brady J. Deaton signed the American College and University Presidents' Climate Commitment (ACUPCC) in January 2009. In doing so, he joined more than 600 presidents and chancellors of colleges and universities in recognizing that global warming is real. We at MU are committed to reducing atmospheric carbon in sustainable ways in order to be responsible stewards of our energy resources and of our environment.

The signatories acknowledge the need to reduce global emissions of greenhouse gases by 80 percent by mid-century at the latest, in order to avert the worst impacts of global warming and to re-establish the more stable climatic conditions that have made human progress possible. They believe colleges and universities must exercise leadership by modeling ways to minimize global warming emissions and by providing the knowledge and the educated graduates to achieve climate neutrality. By signing, Chancellor Deaton committed the University of Missouri to take the following steps:

1. Develop a comprehensive plan to achieve climate neutrality as soon as possible:
    a. Within two months of signing, create institutional structures to guide the development of the plan (Established Sustainability Office, April 2009).
    b. Within one year, complete a greenhouse gas emissions inventory and update the inventory every other year thereafter (Submitted Jan. 15, 2010).
    c. Within two years, develop a Climate Action Plan (CAP), which includes:
        i. Target date for achieving climate neutrality as soon as possible
        ii. Interim targets for goals and actions that will lead to climate neutrality
        iii. Actions to make climate neutrality and sustainability a part of the curriculum and other educational experiences for all students
        iv. Actions to expand research or other efforts necessary to achieve climate neutrality
        v. Mechanisms for tracking progress on goals and actions
2. Initiate two or more tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed.
3. Make the plan, inventory and progress reports publicly available by providing them to the Association for the Advancement of Sustainability in Higher Education (AASHE).

Chancellor Deaton's pledge sent a clear message that MU is committed, financially and philosophically, to a carbon neutral future. Since the signing, he and the university have completed a number of the steps required by the ACUPCC, including creating the Sustainability Office, hiring a sustainability coordinator and charging the Environmental Affairs Committee to include comprehensive sustainability, hence renaming it the Environmental Affairs and Sustainability Committee. Of the commitment's options for required tangible actions, MU chose to:

1. Adopt an energy-efficient appliance purchasing policy;
2. Encourage use of public transportation;
3. Participate in the waste minimization component of the national RecycleMania, a competition and adopt three or more measures to reduce waste;
4. Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.

MU intends for this to be a living document. It will be a rolling five-year plan with annual updates.

This plan is framed around the following four topics:

- History and background
- CAP philosophy and approach
- Targets and goals
- Strategies and projects MU will undertake as part of this plan

Scope & Process

CAP Scope/Boundary

The University of Missouri is composed of multiple facilities in the greater Columbia region. In addition to the university's main campus, university holdings include the Ellis Fischel campus, the Lemone Industrial Park, South Farm, Columbia Regional Hospital and other sites. This Climate Action Plan's scope includes only facilities owned and managed by the university on the main campus. In order to better compare MU with its peers, this CAP also excludes university hospitals and health care facilities.

The university recognizes the contribution of these facilities and will develop a plan to address them in the future.

CAP Process

One year after signing the ACUPCC, the university submitted its Greenhouse Gas Inventory in January 2010. The deadline for submitting the Climate Action Plan is Jan. 15, 2011. MU engaged Sasaki Associates in association with Burns & McDonnell to complete the CAP. During the summer of 2010, the consultants worked closely with representatives from the Provost's Office, Campus Facilities-Energy Management, Environmental Health & Safety, Parking & Transportation, Office of Research, the Sustainability Office, and the Environmental Affairs and Sustainablility Committee.

Campus Involvement

The Environmental Affairs and Sustainability Committee, a Provost's standing committee, composed of MU students, faculty and staff, met with consultants three times over the summer. to provide input into the Climate Action Plan. The ongoing work of this group on environmental and sustainability issues contributed greatly to this plan.

Campus Background

MU was founded in 1839 and is the oldest state university west of the Mississippi River. Today the university has an enrollment of approximately 32,000 students in 19 schools and colleges and is a comprehensive research university.

MU's campus contains more than 6 million gross square feet of building space classified as Education and General (E&G), housing, teaching, research and administrative support. Nearly 70 percent of this space is more than 30 years old, and more than 40 percent of this space exceeds 50 years. These older structures constitute resources that, in future years, will continue to be valuable to MU. That value can be realized by a partnership of campus interests dedicated to achieving the most effective use of existing facilities to further MU's academic mission. New E&G space represents 25 percent of the total building area added to the campus since 1980. Student activity, residential, athletic, research and parking facilities constitute the balance of building growth during this period. Like other U.S. flagship universities, MU's expansion was a response to a range of needs to maintain the university's mission and to comply with changing standards and mandates. (2009 Campus Master Plan)

Statement of Values

"The University of Missouri, as the state's major land-grant university, honors the public trust placed in it and accepts the associated accountability to the people of Missouri for its stewardship of that trust. Our duty is to acquire, create, transmit and preserve knowledge and to promote understanding. We, the students, faculty and staff of MU, hold the following values to be the foundation of our identity as a community. We pledge ourselves, in the totality of our life together, in accord with these values: Respect, Responsibility, Discovery, Excellence." *chancellor.missouri.edu/plansPriorities/values.php*

Mission

"Our distinct mission, as Missouri's only state-supported member of the Association of American Universities, is to provide all Missourians the benefits of a world-class research university. We are stewards and builders of a priceless state resource, a unique physical infrastructure and scholarly environment in which our tightly interlocked missions of teaching, research and service work together on behalf of all citizens. Students work side-by-side with some of the world's best faculty to advance the arts and humanities, the sciences, and the professions. Scholarship and teaching are daily driven by a sense of public service – the obligation to produce and disseminate knowledge that will improve the quality of life in the state, the nation and the world." *missouri.edu/about/mission.php*

Commitment to Sustainability

On March 18, 2010, after signing the ACUPCC, the University of Missouri officially adopted its current Sustainability Policy Statement: "The University of Missouri embraces its role in providing a healthy and safe learning environment for its students, faculty and staff. Consistent with MU's mission and values, we are committed to leadership in demonstrating local and global environmental stewardship. MU recognizes the increasing need for policies and practices that reduce greenhouse gas emissions and has signed the American College and University Presidents' Climate Commitment with the goal of making the MU campus carbon neutral." *sustainability.missouri.edu/about/mission.html*

Further, MU has undertaken an ambitious program of environmental sustainability that includes, but is not limited to, the following actions:

- Incorporating sustainability and social responsibility in the teaching curriculum; researching, testing and implementing new sustainability initiatives; and disseminating effective sustainability practices
- Taking proactive steps to preserve, protect and renew natural resources, both locally and globally, thereby minimizing anthropogenic harm to the environment
- Identifying and utilizing environmentally friendly energy resources and employing a dynamic and proactive energy-conservation program
- Minimizing waste generation, recovering recyclable materials and safely managing necessary waste disposal
- Observing sustainable best practices in campus construction and procurement
- Researching and promoting sustainable practices in the growth, management and transportation of food
- Promoting clean, efficient and healthy transportation for all students, faculty and staff
- Each unit or department within the university is expected to evaluate current policies and practices on a regular basis with the goal of adopting and improving environmentally sustainable practices.

"We are stewards and builders of a priceless state resource, a unique physical infrastructure and scholarly environment in which our tightly interlocked missions of teaching, research, service and economic development work together on behalf of all citizens."

University of Missouri Mission Statement

Photo Credit: University Archives

Photo Credit: Publications and Alumni Communication

Master Plan

The MU Campus Facilities Master Plan was initiated in 1980 to study the use of campus land and buildings for optimum efficiency and aesthetic appeal. The plan is updated annually, widely distributed across campus (and the state), presented in a series of public hearings and used as a planning tool. It is identified as a draft each year, providing the opportunity to change with current fiscal, academic, administrative and technical conditions. It is a working tool used to stimulate dialogue and interaction among the many campus groups that might have direct or indirect interests in the development of the campus site. It is a yearly snapshot of the continuous planning process. A copy of the current plan is available on the Campus Facilities website at cf.missouri.edu/masterplan.

The plan follows a number of planning principles. Included among these are principles directly related to sustainability.

- Reinforce the University Mission & Values: Organize facilities and places to promote MU's mission and values.
- Pride of State: Express the importance of the campus to the state, nation and world.
- Diversity with Unity: Create and maintain campus settings that bring together the diversity of people, heritages and culture.
- Strong Sense of Place: Make the campus a distinctively meaningful and memorable place for all members of the university community and for the citizens of Missouri.
- Respect Natural & Architectural Heritage: Design facilities to respect the scale, materials and textures embodied in the historic architecture and natural landscape of the campus.
- Environmental Sustainability: Embrace suitable strategies in promoting sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality.
- Recruitment — Retention: Emphasize the qualities of the campus that help attract and keep students, faculty and staff.
- Planning & Design Integrity: Provide facilities and grounds that meet the functional needs of the institution and that comply with the intent of the design principles to provide an overall aesthetic and pleasing campus experience.
- Enhance Community Spirit: Locate campus functions in close proximity to enhance scholarly activities and social interaction within a safe and secure campus.
- Allow for Prudent Expansion of Campus Functions: Provide for facilities expansion in ways that respect neighbors and effectively utilize limited land resources, while conserving and protecting natural resources.
- Pedestrian Dominance: Maintain a pedestrian-dominant campus recognizing and gracefully accommodating the need for bicycles and vehicles.
- Transportation & Vehicle Circulation: Maintain a safe, functional and aesthetically compatible system of transportation, vehicle circulation and parking.
- Respond to Accessibility Needs: Continue the tradition of providing optimal access to persons with disabilities.
- Facilities & Grounds Stewardship: Preserve the quality and utility of existing facilities for sustainable use of established resources.

History of Sustain

ACADEMIC

Environmental education at MU has its primary origins in the 1970s, when student groups and individual faculty members began including environmental information in presentations and classes. The School of Natural Resources, a division of the College of Agriculture, Food and Natural Resources, has had a long history of promoting conservation education because of its focus on forests, fisheries and wildlife. In the 1990s a number of faculty, students and staff came together in a day-long workshop to establish a more formal program in environmental education. As a result of their efforts, the environmental studies program was established in 1995 to support interdisciplinary environmental education on the MU campus and help prepare students for environmental professions. *committees.missouri.edu/environmental-affairs/docs/eacfinalreport03.pdf*

In 1995, as an outcome of a faculty-convened meeting to jump-start environmental education, MU hired an environmental studies initiative director. Between 1998 and 2000, the department began offering a certificate program in environmental studies and in 2003 began the environmental studies major. Since then, the number of sustainability programs has been growing, including the creation of a sustainable agriculture degree program. The university completed an Academic Strategic Plan that includes sustainability in the fall of 2009.

ADMINISTRATION

Environmental Affairs and Sustainability Committee

The Environmental Affairs and Sustainability Committee is composed of students, faculty and staff. It first formed as the Environmental Affairs Council in 1990. In 2001 the group initiated an assessment of campus environmental sustainability with the intent of raising the university community's awareness of the role that MU plays in helping society become more environmentally sustainable. The Committee's initial study, released in April 2003, was the Committee's first attempt to address resource use and environmental issues at MU in a comprehensive manner. Each year since, questionnaires have been distributed to various departments to collect follow-up information. In 2009, Chancellor Deaton expanded the council's charge to include sustainability. The committee makes recommendations to the Provost to develop policies for environmental sustainability issues; to develop formal and informal mechanisms for improved education to enhance environmental and sustainability awareness; and to provide a biannual sustainability report to the Chancellor.

Sustainability Task Force

In 2007, a task force was convened by the vice chancellor for Administrative Services and the vice chancellor for Student Affairs to develop a sustainability plan for the University of Missouri. The task force identified seven university areas that were affected by sustainability practices. For each, the task force sought input across campus and produced a report for each section with recommendations for implementation, including:

- Appoint a sustainability coordinator
- Appoint a sustainability council
- Adopt a sustainability statement
- Review current policies and develop ongoing policies
- Create a campuswide communication plan for sustainability
- Identify funding for sustainability initiatives

1839 MU founded in Columbia

1888 Missouri Agricultural Experiment Station opened

1893 Combined Heat and Power Plant in operation

1917 Nation's first soil erosion study conducted at MU

1970 First Earth Day at MU

ability on Campus

MU Sustainability Office

In April 2009, based on the Sustainability Task Force's recommendations, MU created a new campus sustainability coordinator position and opened a sustainability office tasked with identifying, coordinating and supporting existing programs; developing communication strategies in support of campus sustainability; and identifying and encouraging more sustainability initiatives throughout the campus. The office is a collaboration among students, faculty and staff to promote environmental sustainability on campus and in the community.

STUDENT

Students have been involved in many important sustainability efforts at Mizzou. Several student groups work to foster environmental sustainability on campus, including Sustain Mizzou, Greeks Going Green, Tigers for Community Agriculture and others. Students were a driving force in a number of lobbying efforts with the administration, including encouraging Mizzou to sign onto the ACUPCC.

Additionally, students have secured funding and recognition for Mizzou, including: the National Wildlife Federation's 2008 Campus Chill Out contest in which Campus Facilities-Energy Management was recognized for its energy efficiency; securing internal and external funding for the Mizzou Dashboard program (2008), and participation in the Rocky Mountain Institute's 'Accelerating Campus Climate Initiatives' project.

Students voted in a referendum in February 2009 to instate a $1 per student per semester sustainability fee. This fee supports the MU Student Sustainability efort as well as one full-time staff employee and three student workers.

INFRASTRUCTURE

Energy

MU's Power Plant received a 2010 EPA Energy Star Combined Heat and Power Award from the U.S. Environmental Protection Agency. This is just one of many prestigious awards MU has earned for the work it has done to increase production efficiency and decrease energy use. Energy Management has been actively pursuing energy conservation, cost-saving opportunities since the mid-1970s. In 1990, a formal energy conservation program was created, and as a result, campuswide education and general (E&G) energy use per GSF has decreased by 13 percent and water use per GSF has decreased by 61 percent. This is true despite the fact that E&G space has grown by 32 percent during the same period. Energy Management keeps an updated list of energy conservation measures on its website: *http://www.cf.missouri.edu/.*

Transportation

From 1980 to 2010, MU doubled parking capacity on campus in efforts to keep up with a growing population and demand. Over the same period of time MU moved 80 percent of the surface paving found within the campus core toward the perimeter of campus into parking structures, resulting in a more pedestrian-friendly environment. The Campus Master Plan even incorporated a "closed campus" model, which limits private vehicle use on major campus roadways during peak academic periods. In addition to providing a safer pedestrian environment, this measure offers disincentives for drivers to use personal vehicles for short trips (Sustainability Task Force Report). Over the years, there have been some efforts on campus to promote sustainable transportation. These efforts include working with the City of Columbia to extend bike routes and bus routes to meet MU's population needs.

1981	1989	1990	1996	2004	2005	2010
First campus master planner hired	MU Tree Trails open	Chancellor Monroe funds energy efficiency measures	Advent of tire-derived fuel at Power Plant	College Ave. Pedestrian Bridge completed	Biomass first used at Power Plant	Climate Action Plan

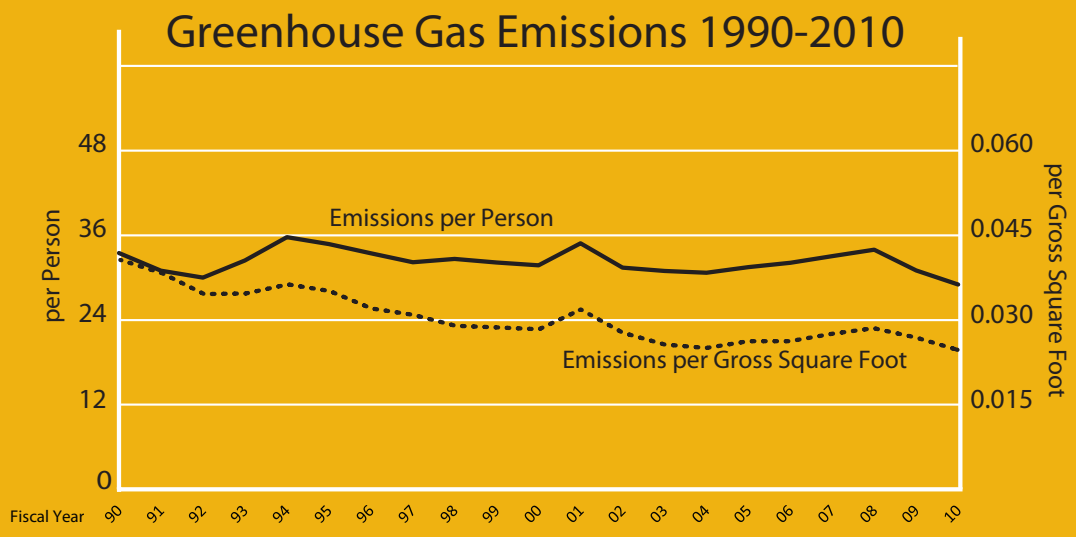
Key Issues & Oppo

ENERGY

The centralized MU Power Plant, distribution system and satellite chilled-water plants reach more than 14 million square feet of academic buildings, research facilities, laboratories, residence halls, dining facilities, athletic facilities, computing centers and administrative buildings. The primary services provided by Energy Management consist of electricity, thermal energy (steam), drinking water and chilled water. Thermal energy, or low-pressure steam, is used for the heating and cooling of buildings, hot water, and specialized medical and research uses for steam. This Climate Action Plan focuses on the contiguous, nonhospital campus.

The MU Power Plant is a combined heat and power (CHP) plant that meets MU's energy needs by maintaining the appropriate level of equipment redundancy and fuel flexibility necessary to provide reliable and cost-effective energy to the campus. The 66-megawatt CHP plant uses four coal-fired boilers, one gas/oil fired boiler, four steam turbine generators and two gas-fired combustion turbine generators with heat recovery steam generators to produce electric and thermal energy for MU. The plant burns a combination of coal, natural gas, biomass, tire-derived fuel and fuel oil.

MU's thermal demand is primarily met with steam from the solid-fuel boilers extracted through the turbine generators providing MU with thermal energy and co-generated electricity. Because the MU power plant has capacity to generate MU's entire electric demand, the remaining campus electrical energy either can be generated or purchased on the wholesale electric grid. These decisions are made daily, by the Energy Management department, based on economics and availability. Because the MU Power Plant is a CHP plant, it is capable of generating both steam and electricity at overall system efficiencies far higher than those of conventional central-station power plants. As a result of these high efficiencies and low cost of fuel, the costs are far lower than other similarly sized district energy systems in the Midwest .

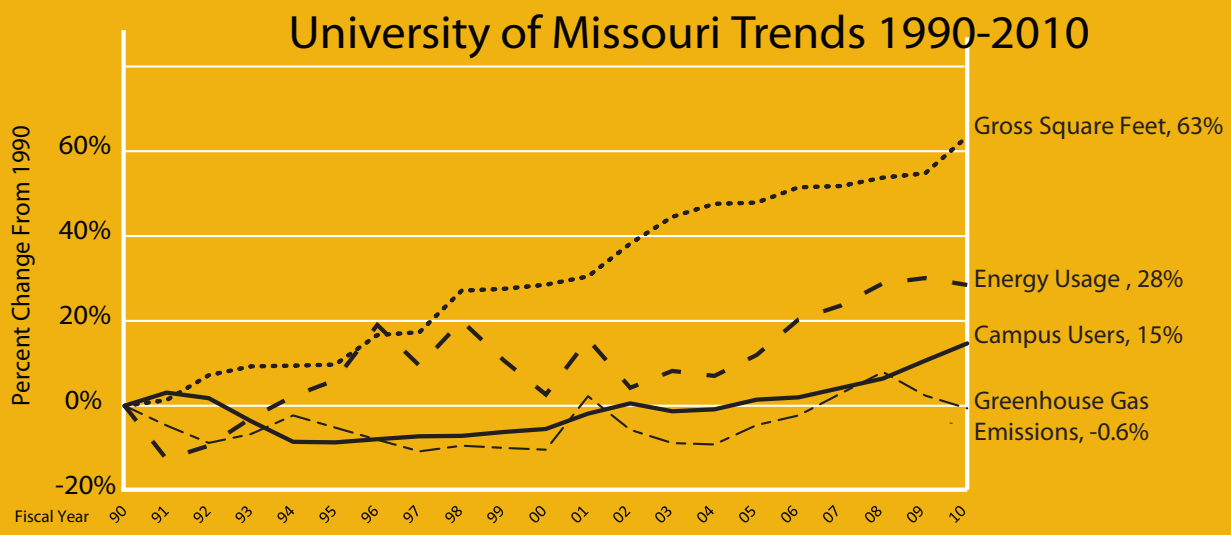


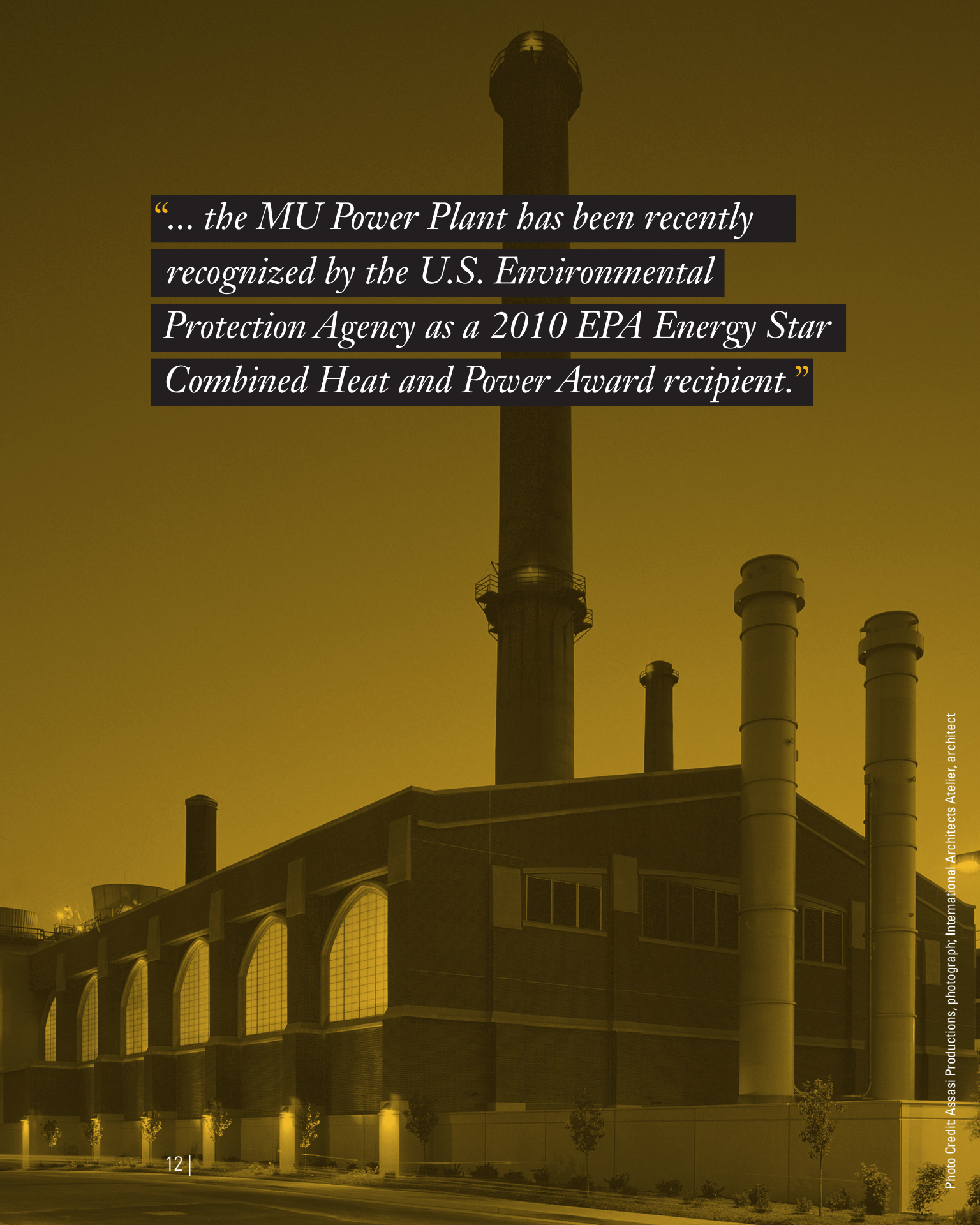
ortunities

MU is currently co-firing woody biomass with coal in its existing boilers and is working toward increasing the percentage of biomass. To reliably meet the steam requirements on the MU campus, MU is replacing one of the existing coal-fired boilers with a new renewable biomass-fired bubbling fluidized bed (BFB) boiler. The new boiler will be capable of operating on 100 percent biomass. MU is also replacing a significant portion of the existing fuel handling and storage system.

Like most of America, the single biggest challenge that the university faces as it endeavors to become a carbon neutral campus is its economic dependence on coal. Coal is plentiful and less expensive. It might appear that carbon neutrality will be challenging for a university that powers itself on coal. MU has made a commitment from the top-down by the chancellor and provost to eliminate MU's carbon footprint.

MU has a facilities staff up to the challenge. MU currently meters 100 percent of campus buildings' energy use and therefore has an extremely sophisticated knowledge of how its campus is using energy. Many of the easy, "low-hanging fruit" energy conservation items have been accomplished. Moving forward, MU has the opportunity to expand the previously acceptable payback period of five years to 10 or 15 years. While this plan focuses on E&G space, there is still much opportunity in non-E&G facilities. MU has already had some success in behavior modification through the Mizzou Dashboard project, which displays real-time energy use in a handful of residence halls.





"... the MU Power Plant has been recently recognized by the U.S. Environmental Protection Agency as a 2010 EPA Energy Star Combined Heat and Power Award recipient."

Photo Credit: Assasi Productions, photograph; International Architects Atelier, architect

TRANSPORTATION

Reducing the number of people coming to MU in single-occupant vehicles and, ultimately, the carbon emissions associated with travel will prove to be difficult at MU. Many of the students coming to MU have access to a car in high school and expect to have a car at college. Similarly, increasing enrollment will challenge the carbon reduction goals, and providing for parking is currently seen as an asset for incoming students. Schedules and routes are not well known, and public transportation is not an attractive option for most people at MU. Parking on campus is as low as $18/month.

On the plus side, the city does offer a 50-percent discount to students using public transportation, and the city and the university are working together to offer better transit options for MU's population.

The campus now has four WeCars to rent to students. WeCar provides its members with an inexpensive alternative method of transportation, while decreasing the number of cars on the road. It is expected that each WeCar could replace as many as 20 commuter vehicles. If successful, more WeCars could be added to the MU fleet.

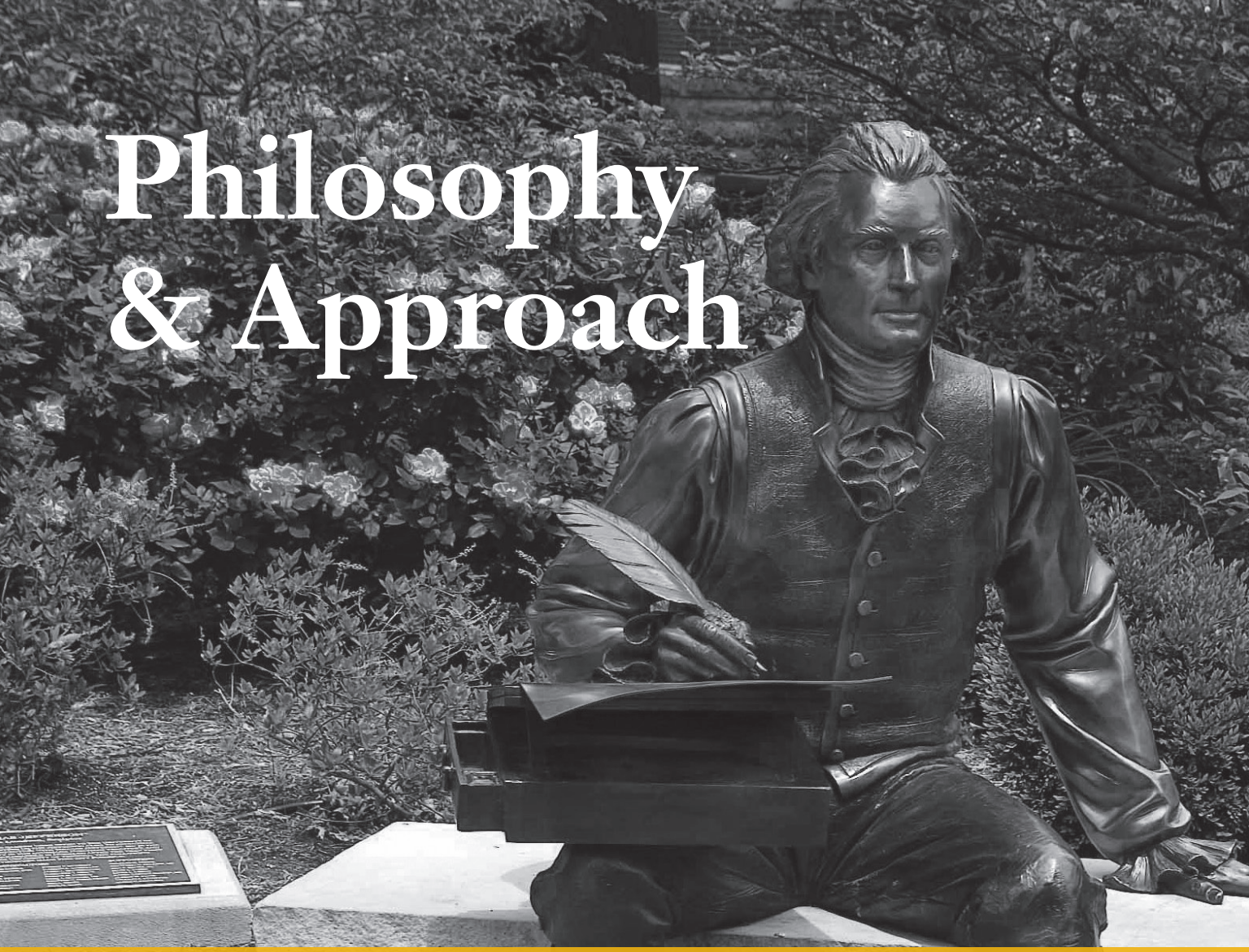
Lastly, there are relatively new off-campus housing developments that run shuttles between the apartments and campus. This could become a good trend to reduce vehicles coming to campus. MU is also in the process of renovating campus housing. Keeping students on campus will decrease emissions due to transportation.

EDUCATION

More than 240 sustainability-related courses have been identified; however, many only modestly address sustainable issues. More advising on sustainability issues is needed to take full advantage of the many environmentally related courses scattered across the departments and colleges. The environmental science major in the School of Natural Resources is clearly a step in the right direction but is focused primarily on environmental sustainability. The environmental studies certificate, through the College of Arts and Science, is directed at the social and economic aspects of sustainability. A broader cross-disciplinary approach of sustainable education on campus must be addressed by the faculty.

With an increasing number of students coming to MU with interest in sustainability, the university has been adding programs with a sustainability focus. Both the environmental studies program and the sustainable agriculture degree program are great examples of the breadth of sustainability offerings on campus. Faculty from Natural Resources, the College of Human Environmental Sciences, Geography, Sustainable Agriculture and the College of Business are meeting regularly to advance sustainability in education. There is a wealth of outreach on campus, much of which is from the unending enthusiasm and talent of the MU students.

Philosophy & Approach



It is important to MU that this document serves as a road map toward carbon neutrality and sustainability. It is meant to be a living document, and at any given time, the document is a snapshot of MU's current state related to climate and ultimately sustainability. In addition, the plan should:

Be Achievable: MU is committed to creating a plan that is achievable and to achieve that neutrality in a responsible manner. All of the initiatives within this report have been vetted carefully.

Focus on Sustainability's Triple Bottom Line: MU believes in the triple bottom line of sustainability – Social Equity, Environmental Stewardship and Economic Responsibility. The actions in this plan will be evaluated with the triple bottom line in mind.

Use 2008 as a Base Year: Although this plan looks back to the year 1990 for historical reference, it uses 2008 as its baseline.

Photo Credit: Mizzou Botanic Garden

Target & Goals

MU is committed to becoming carbon neutral and has set a rolling date to achieve that goal. Since we intend to progress as rapidly as possible, we will not set that date far into the future; rather, we will review progress at the conclusion of every fiscal year and provide a status report to the campus.

The Climate Action Plan's initial phase is five years, from the time of this writing to 2015. Going forward, MU will have a rolling five-year plan that will be reviewed on an annual basis in conjunction with the Campus Master Plan. Like the Campus Master Plan, the Climate Action Plan will be a working tool used to stimulate dialogue and interaction among the many campus groups that might have direct or indirect interest in the development of the campus as it relates to MU's environmental, economic and social footprint. The plan will include areas required by the ACUPCC: energy, transportation, education, research and financing. It will also include other areas of sustainability – water, site selection, waste management, purchasing, building design and construction, and food.

GOALS

Greenhouse Gas Reduction

Realize a 20 percent greenhouse gas reduction in 2015 compared to 2008 baseline.

LEED

Build new structures to LEED specifications.

Alternative & Renewable Energy

Increase the amount of energy provided by renewables and alternative energy.

Energy Conservation

Look at longer payback periods for energy conservation measures.

VARIABLES

As the CAP is updated, the following variables will need to be taken into account:

Population

Population at MU, until now, has been increasing steadily. It is estimated that growth will slow over the next decade and then increase again. The more people on campus, the higher the demand for energy.

Fuel and Energy Prices

MU monitors fuel and energy prices on an hourly basis to minimize costs. As the cost of carbon-emitting fuel increases, so does the desire to use less of those fuels. If climate regulations increase the cost of higher carbon fuels, MU will be able to shift to low carbon emitting energy sources due to its plant's fuel flexibility.

Technology

New technologies are emerging every day. The university will pay close attention to these emerging technologies.

Growth of SF (new buildings)

Any additional square footage on campus will increase the university's emissions unless the space is designed to be Zero Net Energy. The university will be strategic about growth.

Funding

As funding becomes available, MU might be able to reduce carbon emissions at a faster rate.

GSF/Utilization

Optimizing space utilization can affect emissions greatly.

Strategies & Projects

The University of Missouri will expand existing master planning principles to include sustainability and, more specifically, climate action planning. They will provide a rigorous framework for determining where, when and how to locate new facilities and best use existing facilities based on integrated sustainable principles.

Photo Credit: Unknown

Transportation

Obtain More Accurate Transit Data

The first step in addressing emissions due to transportation is to obtain more accurate data. MU will identify where its population lives, when they are coming to and leaving campus, and what mode of transportation they use to get to campus. The campus could obtain some of this data when hiring new employees, issuing parking passes, selling meal plans or registering for classes.

Address Nonmotorized Transportation

The campus will explore options for nonmotorized transportation on campus. Initiatives might include providing bicycle racks in the garages and encouraging students to bring bicycles to campus.

Work with City

The campus needs to use the data collected on the campus population's transportation statistics to work with the city to address campus needs. Synchronizing public transit with campus population needs will be a critical component for increasing ridership.

Sustain Mizzou — Focus on Culture of Sustainability

Sustain Mizzou, one of MU's most active student groups, will be critical to advancing alternative transportation on campus and building a culture of sustainability. Sustain Mizzou has initiated Bike Fest, an annual event aimed at introducing more Mizzou students to biking, encouraging students to use their bikes as commuting vehicles and teaching students some basic repair techniques. The MU Sustainability Office and Student Sustainability plans to open a Bike Resource Center.

Telecenter Network

The Missouri Telecenter network is an opportunity for Mizzou to reduce CO_2 emissions due to transit. Amongst other amenities, the network links campuses and other locations across the state through high-quality interactive video conferencing.

Offsets

To eliminate carbon emissions due to transportation, MU will ultimately need to make significant changes in transportation policy and technology. As the campus' scope 1 and 2 emissions reduce, scope 3 will increase. To reach carbon neutrality, some universities produce more clean energy than they need and retain the carbon credits or purchase carbon offsets.

Energy Efficiency

The first phase of MU's climate action plan targets a 20 percent carbon emissions reduction from the 2008 emissions baseline. As of August 2010, the campus has already achieved close to an 8 percent reduction. The targets are based on the following assumptions:

Fuel Mix & Purchased Power:

- Maintain the same percentage of purchased electric to campus use as FY10.
- Maintain the same percentage of natural gas to solid fuel as FY10.
- Replace coal with biomass as new biomass boiler becomes available, and add more biomass blend in existing boilers.
- Increase natural gas usage over coal and purchased electricity as economics or funding allows.
- Increase renewable usage over coal and purchased electricity as economics or funding allows.

Energy Intensiveness (kBtu/GSF):

- FY10 average building use was 106 kBtu/GSF.
- New buildings coming on line between FY10–FY15 are expected to average 141kBtu/GSF.
- Renovated buildings are expected to average 90 kBtu/GSF.
- Buildings taken offline are expected to average 81 kBtu/GSF.

Weather Normalization (Degree Days):

- Energy use in FY15 assumes "normal" weather (20-year average). We estimate less steam use in FY15 than FY10 because heating degree days in FY10 were higher than normal.
- We estimate more chilled water and electric use in FY15 than FY10 because cooling degree days in FY10 were lower than normal.

Infrastructure Upgrades:

- The university currently is completing a multi-year project to upgrade underground utility infrastructure to improve distribution efficiency.

Energy Conservation:

During the next five years, MU will continue to implement energy conservation strategies including:

- Variable Air Volume (VAV) conversion of central air-handlers in seven to 10 buildings
- VAV conversions on auditorium air-handling units in six to eight buildings
- Convert electric/pneumatic controls to Direct Digital Controls (DDC) on central-air-handling units and fan-coil units in four to six buildings
- Re-lamp one to two buildings with newer technology lighting systems
- Install LED wall packs for outdoor security/architectural lighting on several buildings
- Re-commission HVAC controls in three buildings
- Install occupancy sensors on lighting and lab controls in three buildings
- Increase energy conservation awareness by giving presentations, placing posters and advertisements, and promoting Energy Management's website
- Miscellaneous optimization of DDC controls in various buildings (continuous)

& Supply

Install More Dashboards:

Currently, the University of Missouri Building Dashboard provides information on energy usage to residents of Hatch, Schurz, College Avenue, Dogwood, Galena, Hawthorn, Jones, Lathrop and Laws residence halls in real time. The system is designed to educate students about energy usage and conservation and ultimately to empower residents to reduce their own energy usage over time. In the next five years, the campus will increase the number of dashboards across campus.

Forest Offsets Expectations:

The university owns roughly 1,700 acres of forested land that sequesters approximately three tons of CO_2/acre.

Depending on availability of funding and pricing, the university will consider:

- Switching fuel from coal to gas or preferably biomass;
- Issuing an RFP for wind energy;
- Pursuing renewable energy pilot projects.

IN ADDITION TO THE ABOVE MEASURES MU WILL:

- Require that any new construction on campus will be 25 percent better than ASHRAE 90.1, 2007, and any substantial renovation will perform 15 percent better than ASHRAE 90.1, 2007. MU will require ASHRAE Appendix G energy models for new construction and major renovation to demonstrate compliance.
- Develop requirements for air-barrier testing on all new construction and substantial renovation projects.
- Research the feasibility of installing solar hot-water panels at the MU Power Plant for solar-thermal heating of boiler make-up water. This study will define the scope and design of the project and will determine the appropriate number of panels and system configuration.
- Optimize space. The University of Missouri has seen a 10-year growth in facilities and programs. Campus Facilities – Space Planning & Management was established to gather and manage space information for the MU campus and to help academic divisions best accommodate their teaching, research and support needs. It helps to translate MU's instruction, research and public service programs into physical facility needs. *www.cf.missouri.edu/spm/about/mission.html*
- Work toward setting a target date to achieve carbon neutrality.

ONGOING PLAN

MU will continually revise this Climate Action Plan. As the university updates the plan, it will consider the following issues:

- Implementing additional renewable energy technologies
- Optimizing power plant fuel mix based on price, availability and carbon emissions rates
- Investing in conservation options with longer paybacks and lower returns on investment
- Contining space optimization
- Creating "swing space" to allow more aggressive conservation measures
- Increasing energy-efficiency measures
- Investigating new technologies
- Evaluating building-performance standards
- Increasing power production efficiency where economically feasible
- Implementing end-user accountability

Renewable Energy

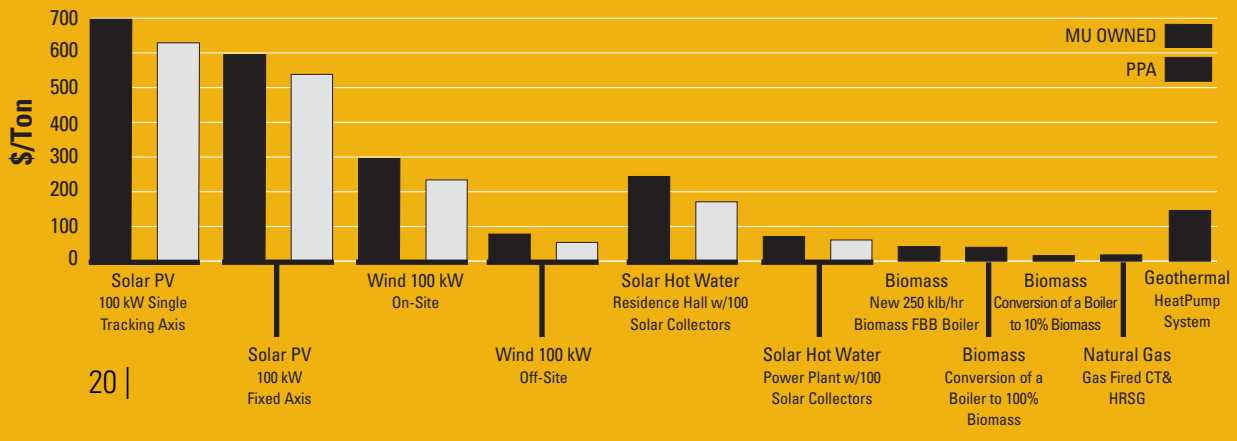
FEASIBILITY STUDY

To help assess future energy investments and address its long-term desire to increase the energy that the campus receives from renewable-energy resources, MU retained Burns & McDonnell Engineering Company (Burns & McDonnell) to perform a Renewable Energy Feasibility Study (Renewable Study) for Energy Management. The additional renewable energy resource added to the MU energy portfolio will help in reducing the carbon footprint of the campus beyond the 20 percent CO_2 reduction target defined for the next five years.

The scope of the renewable study consisted of comparing numerous potential investments by utilizing estimated critical characteristics obtained through limited depth analysis, providing a high-level comparative evaluation of various potential renewable-energy technologies. That renewable study does not involve specific case analyses. The ideal energy portfolio for the campus would consist of multiple and distributed renewable energy assets across the campus in addition to the central plant. This feasibility evaluation did not account for complex interactions among diverse energy assets on the MU energy system. The Renewable Study included an assessment of the potential renewable energy resources for the MU campus through the following activities:

- Characterized MU's current electrical and steam system and determined their baseline cost of producing electricity and steam for use on the campus under its existing generation resource assets
- Conducted a resource assessment customized to MU for the following renewable technologies:
  - Solar-photovoltaic (PV) panels for electricity
  - Solar-thermal panels for heating water
  - Wind Energy, both on-site and off-site
  - Expanded use of biomass at the MU Power Plant
  - Ground-source heat pumps for building heating and cooling
- Investigated the potential of CO_2 capture and sequestration in Missouri
- Evaluated the potential reduction in CO_2 emissions by using more natural gas in place of coal
- Determined the life-cycle costs of the renewable and non-renewable energy technologies
- Determined the impact of implementing each renewable energy technology on the baseline operations and the resulting incremental cost of generating electricity and thermal energy
- Determined the cost to reduce CO_2 emissions for each technology considered
- Identified the most cost-effective renewable and non-renewable energy options for MU to implement to reduce CO_2 emissions

Incremental Cost to Reduce CO_2 Emissions



Study & Results

FEASIBILITY STUDY RESULTS

The renewable study included an evaluation of multiple renewable energy technologies and ownership structures in an effort to identify the best renewable-resource options for MU. The lowest-cost source of thermally and electrically generated renewable energy for MU is from co-firing additional biomass fuel in the existing coal boilers.

RENEWABLE ENERGY RECOMMENDATIONS & STRATEGIES

Based on the results of the analysis completed in the renewable study, it was recommended that MU pursue a more detailed investigation of the following top four technology options to further advance renewable energy generation on campus and reduce the annual CO_2 emissions associated with providing thermal and electrical energy to the MU campus:

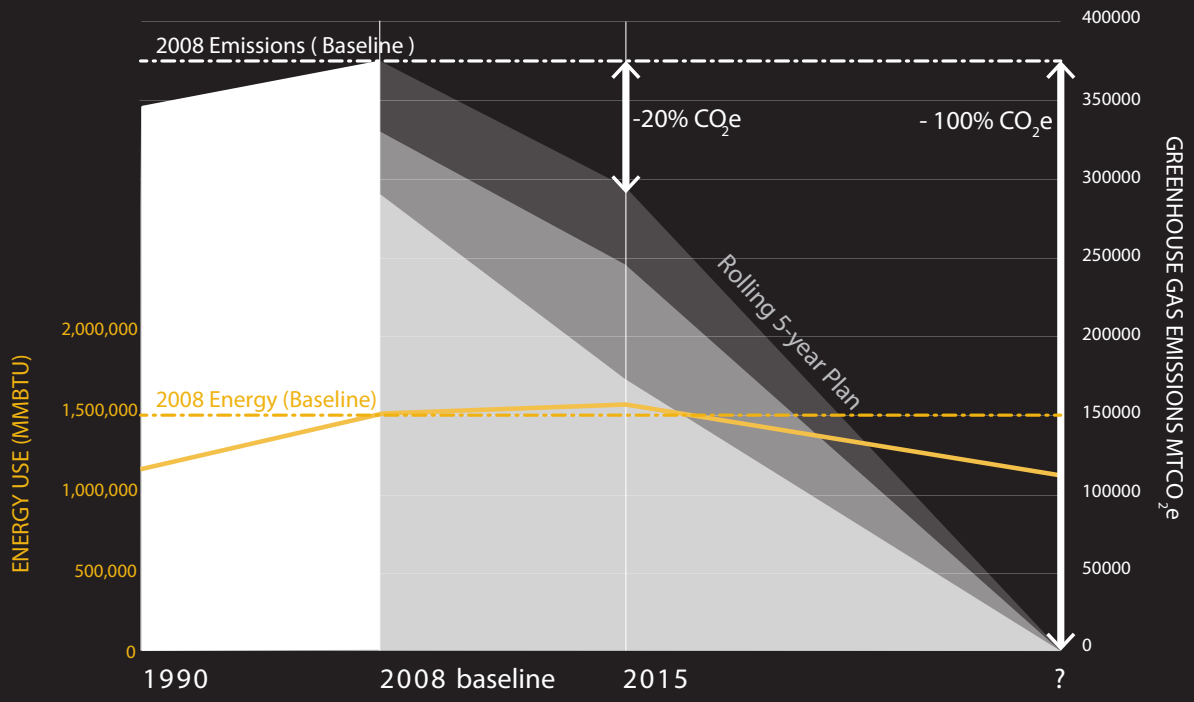
- Burn more Natural Gas at MU Power Plant – Gather additional information and analysis on the capacity of the local infrastructure to deliver natural gas to the MU campus year-round, and determine what backup fuel (if any) is required. Because the MU Power Plant's coal-and gas-fired energy resources are dispatched according to the campus thermal load, electric load and economics, it will also be important to quantify how much natural gas can be used to offset coal and at what price.
- Expanded Biomass Usage at MU Power Plant – As a working research laboratory, further refine and analyze the issues associated with conversion of another coal boiler to burn biomass, and further refine the capital costs. Further analyze market availability limitations of biomass as partners with faculty in the College of Engineering and the College of Agriculture, Food and Natural Resources.
- Off-Site Wind Energy – Further refine wind energy market pricing or develop a wind energy request for proposal to test the market for pricing of wind power.
- Solar Thermal at MU Power Plant – Install solar hot-water panels at the MU Power Plant for solar-thermal heating of boiler make-up water. MU was recently awarded a grant from the Missouri Department of Natural Resources (MDNR) to conduct a detailed feasibility study of installing a solar-thermal system on top of the MU plant. This study will define the scope and design of the project and will determine the appropriate number of panels and system configuration.

In addition, it was also recommended that MU should consider installing the following demonstration scale projects to advance its academic mission regarding sustainability and renewable energy.

- Ground-Source Heat Pump – If MU adds a new building that is not close to the existing utility distribution infrastructure from the MU Power Plant, it should evaluate the economics of a ground-source-heat-pump system for heating and cooling the new building.
- On-Site Wind Energy – MU should consider installing a small-scale wind demonstration project.
- Solar PV – MU should consider installing a small-scale solar-PV demonstration project.

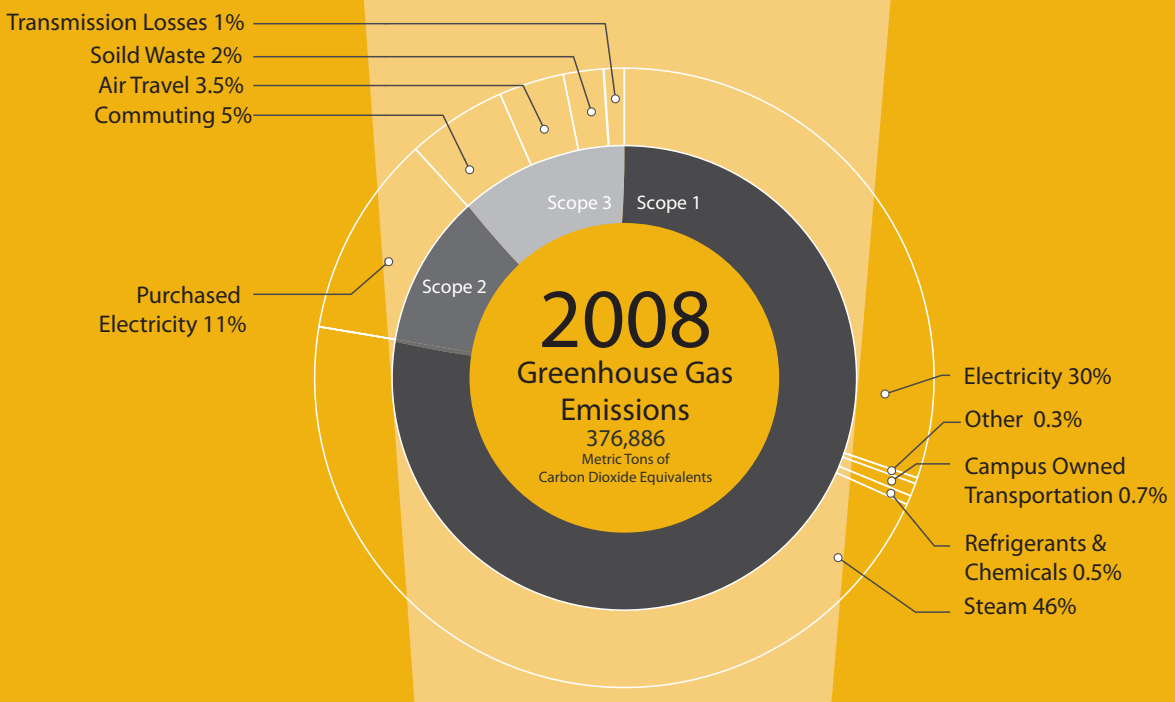
MU Climate Action Plan

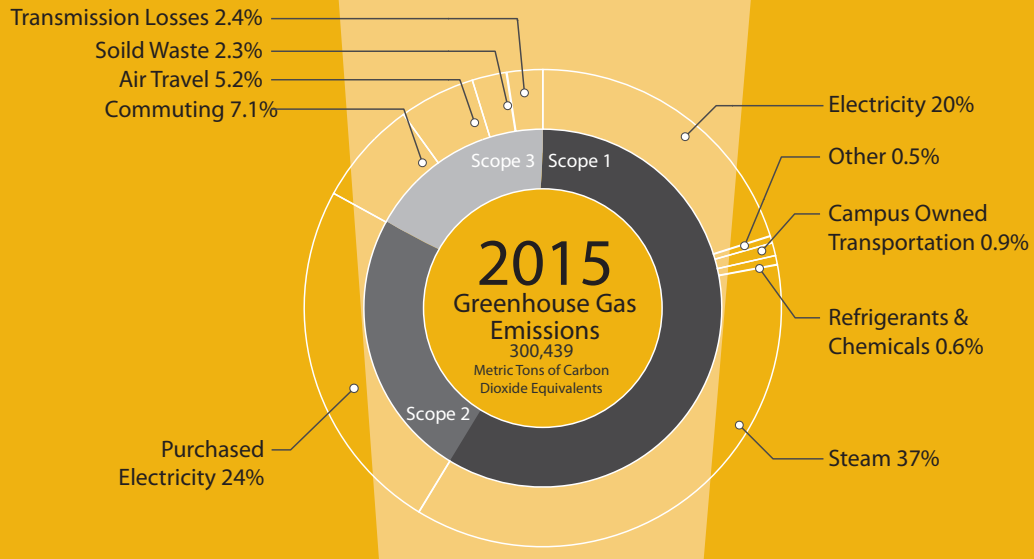
Carbon Reduction Plan



	1990	2008 baseline	2015
GHG ($MTCO_2e$)	349,104	376,886	300,439
Energy (MMBTU)	1,166,219	1,502,841	1,528,584

- Scope 3 CO_2 EMISSIONS
- Scope 2 CO_2 EMISSIONS
- Scope 1 CO_2 EMISSIONS
- TOTAL ENERGY USE





Rolling 5-year Plan to a Carbon-Neutral Goal

Education

The campus recognizes that educating students about sustainability and creating sustainablity-literate future leaders have a greater impact on the world's carbon emissions than the university's emissions themselves. Therefore, education and outreach are critical components to this plan. Formal education in environmentally related topics, issues and skills occurs across the curriculum with relevant coursework offered in at least 40 departments.

Metrics of Success

The critical first step of MU's Education & Outreach Climate Action Plan was to define metrics of success that can be measured. One graduate and two undergraduate researchers, with help from faculty, students and staff across campus, developed a student sustainability survey during the 2009-2010 academic year. MU Student Sustainability, in spring 2010, administered this survey to more than 1,000 Mizzou students. The survey measured different aspects of student knowledge of environmental issues, student engagement in environmentally responsible behaviors, and student attitudes toward sustainability concepts. These results are currently being analyzed by the MU Statistics Department and will be published in early 2011.

The MU Sustainability Office along with MU Student Sustainability will re-issue this survey annually to measure success against the aforementioned metrics over time. This survey will be distributed to a diverse population across campus.

Faculty Seminar
Cross-Disciplinary Approaches

While there is significant sustainability education occurring across campus, there is little sharing amongst faculty across disciplines. The CAP calls to begin this dialogue through a Faculty Seminar Series. The series will give faculty across departments and within departments opportunities to share their work.

Environmental Studies Major & Certificate

Environmental education at MU is loosely coordinated by the environmental studies program, housed in the College of Agriculture, Food and Natural Resources. It currently has one half-time faculty member. Environmental studies provides career and major advising for undecided students and academic advising for students seeking an environmental studies major or the 15-hour certificate in environmental studies. The program compiles the list of environmentally related courses and a list of faculty doing environmental research (missouri.edu/~umcsnresiwww/faculty.html). It publishes a monthly newsletter covering environmental topics, maintains a calendar of local environmental events, helps students find internship opportunities and assists in advising student sustainability groups.

Sustainable Agriculture Degree Program

The sustainable agriculture program at MU is unique because it offers student training in both the production and community aspects of sustainable agriculture. It provides students a strong background in the biological, physical and social sciences and allows students to develop expertise in either integrated crop and livestock farming systems or community food systems. It includes a hands-on component that places students in an internship or international experience in sustainable agriculture. The core curriculum includes courses in plant and animal science, environmental studies, soil science, rural sociology and agricultural economics. Students completing the program pursue careers in a variety of fields.

Photo Credit: Karen Stockman, Reynolds Journalism Institute

Mizzou Advantage

University of Missouri faculty, students and alumni worked together to identify competitive assets that set MU apart from other universities. These assets underlie five dynamic initiatives that collectively are called the Mizzou Advantage:

- Food for the Future
- Media of the Future
- One Health, One Medicine: The Convergence of Human and Animal Health
- Sustainable Energy
- Understanding and Managing Disruptive and Transformational Technologies

A network of faculty members, centers, departments, corporate partners and other universities drives activities related to each competitive asset. MU has a $6 million annual financial plan to increase the impact of these collaborators, whose efforts will result in more grants and opportunities to recruit the most prominent scholars and scientists. Not only will Mizzou Advantage contribute to MU's status in higher education, it will create jobs and improve the quality of life for Missourians.

In response to the rapidly changing environment of the five strengths, MU will develop new educational programs in these five areas to give students a competitive edge in the global marketplace.

Outreach

Environmental Affairs and Sustainability Committee

The Environmental Affairs and Sustainability Committee makes recommendations to the provost on the development of policies for environmental issues and develops formal and informal mechanisms for improved education to enhance environmental awareness.

The MU Sustainability Office's Role

Sustainability on the MU campus is a multi-faceted endeavor, involving academia and administration; students, faculty and staff; and partnerships within and outside the institution. The MU Sustainability Office coordinates these various endeavors, facilitates the development of new initiatives, provides information for campus decision-makers and implements sustainability projects.

STUDENT SUSTAINABLITY GROUPS

MU's students are its greatest asset in terms of sustainability outreach to other students, MU's greater community, and outside the campus boundaries to Columbia and beyond. The Environmental Affairs and Sustainability Committee and the Sustainability Office can barely keep up with the expansion of student activity and enthusiasm for sustainability. Student sustainability groups are diverse on campus. They range from Emerging Green Builders, to Greeks Going Green. Other groups include the Environmental Science Club, MSA Sustainability Committee, Coal Free Mizzou, Solar Decathlon and Weatherization Columbia. Sustain Mizzou, one of MU's most prominent sustainability groups is dedicated to promoting a sustainable way of life at the University through education, cooperation and local action regarding the environment. It serves as an incubator for student ideas. Some of Sustain Mizzou's projects include:

- Notebooks Project – Two hundred notebooks made of used computer paper and cereal boxes were constructed and sold. Since 2008, Sustain Mizzou's notebooks have been available for sale in the MU bookstore. Wider community interests led Sustain Mizzou members to hold a notebook workshop at a local elementary school.
- Stream Team – In the spring of 2008, 425 native tree seedlings were planted along the bank of the Hinkson Creek. Water-quality monitoring events performed the same day discovered the creek to be in fair condition. Sixty hours of volunteer service was recorded. During fall 2008, two litter pickup/water-quality monitoring events were conducted, resulting in a total of 90 volunteer hours, 50 bags of trash, 20 tires and other waste items.
- *Footprint* – *Footprint* is a sustainability magazine with the purpose of teaching the public, especially students, how to live a more sustainable lifestyle. *Footprint* mostly focuses on environmental action through individuals and how they interact with their community.
- Outreach Table – Every Wednesday, Sustain Mizzou hosts a table to educate students about sustainability, provide volunteer opportunities and sell sustainable products such as Sustain Mizzou's notebooks.
- Talk Sustainability – Talk Sustainability was created in fall 2008 to increase our knowledge of sustainability and initiate conversation by recruiting speakers to discuss sustainability/environmental issues before general meetings.
- Recycle Mountain – Educates students on recycling by representing the recyclable materials that are thrown away every day at Mizzou with a mountain of bailed plastic, aluminum and paper.
- Recycle Ink – Sustain Mizzou collaborates with MU General Stores to provide the opportunity at various sites across campus to recycle most ink cartridges.

SUMMER WELCOME

Summer Welcome is a two-day orientation for incoming students. It provides information sessions, introduces concepts of college cultures and helps students navigate campus. It is a great opportunity to reach new students, and to inform them about ways to get involved in sustainability on campus. It is a key component to the overall sustainability outreach efforts. Most student clubs are represented at Summer Welcome, and this presents the perfect forum for environmental clubs to recruit the sustainability leaders of the future. At the 2010 Summer Welcome, Sustain Mizzou had more than 700 people sign up at its booth requesting further information.

Tiger Tailgate

Tiger Tailgate Recycling began when Anheuser-Busch Recycling offered to provide MU with recycling containers and start-up financial support. Volunteers from student organizations serve as the Tiger Tailgating Recycling Team. The students distribute recycling bags, provide recycling information, thank tailgaters for recycling their beverage containers and collect filled recycling bags. MU Campus Facilities personnel then take the bags to roll-off containers provided by the City of Columbia's Public Works Department. The city collects the containers and sorts, weighs and bales the recyclables at its Material Recovery Facility.

Collection rates have increased significantly since the program began, from 11 tons in 2005 to about 24 tons in 2008. *cf.missouri.edu/ls/recycle/tgrtailgate.html*

Mizzou Botanic Garden

Established in August 1999, Mizzou Botanic Garden is dedicated to not only adding seasonal color to the campus, but providing important environmental and health benefits, too. The garden delights campus visitors with its beauty and serves as a fertile academic environment for educators, researchers and students. It is a living museum of thousands of plants, including Plants of Merit, specimens known for their pest resistance, growth characteristics, adaptability to a variety of growing conditions and ease of maintenance.

Trees help to clean the air, curb storm water runoff, sequester carbon and reduce energy costs. Mizzou Botanic Garden counts six state champion trees among its collection of 6,000.

MU's Master Plan, since its inception in 1981, has included planned green space to link sections of campus and provide pedestrian passageways from one end of campus to another. Mizzou plans to preserve these green spaces and natural areas on the campus, as the Climate Action Plan and Master Plan eventually become one plan.

Research

The University of Missouri Center for Sustainable Energy was formed in the spring of 2008 as a collaboration between the College of Agriculture, Food and Natural Resources and the College of Engineering. More than 70 faculty members, from a wide variety of disciplines, are associated with the center. The center focuses on five primary areas: energy policy and management, research, education and training, service, and commercialization. The center utilizes a number of programs already established on the MU campus (e.g., the Food and Agricultural Policy Research Institute) to support activities in the area of energy policy and management. They partner with two-year institutions to develop curriculum to support the growth of jobs in energy industries. In the area of transportation fuels, the center has a variety of ongoing projects. For example, work is under way to utilize novel nanotechnology composites to enhance methane and hydrogen storage. A number of research projects are also focusing on the utilization of biomass for fuel production. Specific projects are focused on enhancing biomass production but also on understanding and reducing any harmful environmental impacts that might arise.

Selective list of research projects

COUNCIL OF RESEARCH ADMINISTRATORS

While a comprehensive coordinated research agenda devoted to sustainability does not currently exist at MU there is indeed significant research going on across the university including Sustainable Energy, Energy Economics and Policy and Energy-related Commercialization & Business Development. Some of the energy specific research areas include:

- Biomass Conversion and Utilization
- Biomass Production and Transport
- Energy Efficiency, Conservation and Management in Agriculture
- Energy Efficiency, Conservation and Management in Business and Industry
- Energy Storage
- Fuel Cells
- Energy Generation
- Geothermal Energy
- Power Harvesting
- Solar Energy
- Steam and Gas Turbines
- Transportation
- Transmission
- Wind Turbines

Moflux Project

The Moflux Project measures oak hickory forests' carbon and water balance. The MU Department of Forestry, along with the Environmental Sciences Division of Oak Ridge National Laboratory and Atmospheric Turbulence and Diffusion of NOAA are collaborating on a research project that measures the carbon and water balance of Missouri's oak-history forests on a large scale. Equipment on a 106-foot tower measures CO_2 , water vapor and meteorological information. The data can be used to estimate the CO_2 and water vapor exchange of up to 250 acres of forest, giving an ecosystem-level answer to when forests areas are sources and sinks of CO_2. *aes.missouri.edu/baskett/research/index.php*
Work stemming from the MoFlux project will help MU better plan for future Campus management strategies as we learn more about carbon flux processes, sources, sinks and related topics.

Photo Credit: CAFNR

Financing

The university recognizes that a key component to sustainability is economics: If an initiative doesn't make financial sense, then it is not sustainable. Unfortunately, at the time of this writing, MU is expecting significant budget cuts in the upcoming fiscal year and therefore faces pressure on each investment. On the positive side, dollars spent on energy are low relative to its peers, and Energy Management does have a budget each year to invest in energy conservation. The university is weighing options to help energy users have a more direct relationship to the dollars spent on energy.

MU practices the triple bottom line of sustainability. To that end, everything accomplished regarding environmental stewardship must make sense from a financial, social and cost standpoint in the near and long terms. To date, MU has been fiscally responsible when it comes to reducing its environmental impact. In 1990, then Chancellor Monroe provided seed money to invest in energy efficiency measures on campus. The campus reinvested efficiency savings into further efficiency savings projects each year. Currently $1.7 million is being reinvested each year into energy conservation measures across campus. Energy

Photo Credit: Mizzou Botanic Garden

conservation efforts since 1990 were calculated to result in a $4.8 million cost savings in 2010. Conservation measures reduce the need for additional energy-producing capacity, lowering long-term investment costs by another $2 million. This total annual cost-avoidance of nearly $6.8 million is equivalent to a $218 annual reduction in tuition per student.

The university has committed funding for various infrastructure improvements across campus including $75 million for a new biomass boiler and fuel-handling system to burn 100 percent biomass.

The campus pursues grants on a regular basis to fund efficiency projects. Most recently MU was awarded a grant to research the feasibility of installing a solar-thermal system on the MU Power Plant.

Students voted in 2009 to impose a $1/year fee on themselves to support one full-time staff member and student workers focused on campus sustainability initiatives.

Going forward the campus intends to continue to invest in reducing its overall environmental footprint.

Other Sustainability

Since 2003, the Environmental Affairs and Sustainability Committee has been documenting the sustainability efforts on campus. In addition, in 2009 the Sustainability Task Force issued a report that outlined a campus sustainability plan. While this initial Climate Action Plan focuses primarily on greenhouse gas emissions reduction, MU would like this plan to evolve to a more comprehensive sustainability plan. The plan would address the following areas:

Purchasing

MU's Procurement department includes Purchasing and Surplus Property. Procurement is responsible for managing policies related to the purchase of all good and services, and facilitates most purchases over $5,000. Choices of which products are purchased are determined by university business units and sourced by Procurement. According to the 2009 Sustainability Task Force, MU purchases more than $65.6 million of goods and services each year. A new electronic purchasing system will help track products that are sustainable. The university recommends MU begin focusing on sustainable purchasing by developing guidelines that define sustainable procurement practices and encourage the campus community to participate.

Water

Campus Facilities uses five deep wells to supply potable water for the main MU campus. Waste water is discharged to and treated by the City of Columbia. Since 1990, due to water conservation measures by Campus Facilities, water use per gross square foot on campus has decreased by 61 percent (Sustainability Task Force Report, 2009). Recently, the MU Power Plant began using recycled waste water from the plant's water treatment system to supplement the plant's cooling water system. The University of Missouri will continue to monitor and make improvements to campus water use (including but not limited to water quality, quantity of use and runoff/storm water processes). The university will require that storm water quality be optimized and quantity be managed through the adoption, implementation, revision and enforcement of the university's Phase II MS4 (Municipal Separate Storm Sewer System) Permit and Storm Water Management Plan (SWMP) as appropriate and that management strategies adapt as understanding of campus water resources improves.

Solid Waste and Recycling

There are currently a number of recycling and waste management programs in place at MU. Most of the existing programs were developed as efforts to save money, to adhere to state regulations and to reduce environmental impact. The current recycling efforts have been provided by the Recycling Committee, the Environmental Affairs and Sustainability Committee, and the coordinator of Solid Waste and Recycling (now sustainability coordinator), along with other campus entities.

Measures

A total of 6,779 tons of solid waste was generated in 2009. In general solid waste is trending downwards while amount of recycling is increasing. In 2010, 25 percent of the waste generated was recycled. Tiger Treasures, indoor beverage container recycling, Tiger Tailgate Recycling, drop-off recycling, sidewalk recycling, and paper, cardboard and newsprint recycling all contribute to the recycling efforts. Recycling saves MU more than $104,000 per year in hauling and disposal costs.

The 2010 Sustainability Task Force Report suggests the campus pursue a zero-waste production goal and proposes an updated MU recycling plan to accomplish this goal.

Landscape

Campus Facilities-Landscape Services department has clear policies on grounds and landscape maintenance. These policies divide the campus into three priority categories, and clearly specify strategies for irrigating, fertilizing and using pesticides. They emphasize the use of native species, spot treating with pesticides and the use of integrated pest management strategies. In 1999, Landscape Services received the Grand Award for Grounds Maintenance Excellence from the Professional Grounds Management Society, its top award. In 2006, Landscape Services was named the America in Bloom Champion-University Class and was recognized for its Urban Forestry Program. Currently MU does not have a comprehensive sustainable landscape master plan; however, it does follow a landscape management plan.

Building Design and Construction

The campus follows state and national codes and constructs its building for long lifetimes. Thus the campus has developed specific standards for issues such as windows, hardware and energy usage. Construction projects are developed with input from all major campus stakeholders. In recent years the campus has instituted a number of sustainable practices including recycling carpet otherwise going to the landfill, specifying low VOC coatings and purchasing green-guard certified furniture.

The campus is supporting the development of the two new health facilities seeking LEED certification. Gwynn Hall, which is part of MU's College of Human Environmental Sciences, is slated for major renovation. MU plans to use the project to test LEED. Many colleges and universities have established standards that all new and major renovated buildings earn a certain LEED rating. If the Gwynn Hall project goes well, MU will likely set a similar standard. In addition MU might look to incorporate sustainability standards further into its campus building standards.

Moving Ahead

TRACKING PROGRESS

Annual Reports Coinciding with Master Plan Updates

The Climate Action Plan will be a living document that is referred to over the course of the year. All major campus decisions impacting the university's carbon footprint will take the CAP into consideration. MU will update the CAP annually informing and being informed by the annual Master Plan updates. The annual update will be presented to the community each spring at the same time as the Master Plan update.

Communications Plan

A summary of the Climate Action Plan will be made available to the community. The summary will be akin to the annual Master Plan update. The complete plan, progress and relevant links will be hosted on the Office of Sustainability's newly designed website.

CONCLUSION

Through comprehensive energy management strategies MU has already made great strides to reduce its carbon footprint. In addition, the current level of activity around sustainable issues both in and outside of the classroom is substantial. This Climate Action Plan is an important step for the university. Achieving carbon neutrality will not be easy. The process will include examining most aspects of the university from the classroom to the garage. In line with the MU's mission and values, this plan sets the university on the right path and provides a framework for a more sustainable future.

Acronyms Key

ACUPCC – American College and University Presidents' Climate Commitment

ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers

BFB – Bubbling Fluidized Bed

CAP – Climate Action Plan

CHP – Combined Heat and Power

CO2 – Carbon Dioxide

DDC – Direct Digital Controls

E&G – Education and General

EPA – Environmental Protection Agency

FTE – Full-Time Equivalent

GHG – Green House Gas

GSF – Gross Square Footage

HVAC – Heating, Ventilating and Air Conditioning

kBtu/GSF – Thousand British Thermal Units per Gross Square Foot

LED – Low-Emitting Diode

LEED – Leadership in Energy and Environmental Design (U.S. Green Building Council Green Building Rating Tool)

MIZZOU – University of Missouri

MMBTU – One Million British Thermal Units

MODNR – Missouri Department of Natural Resources

MTCO2e – Metric Tons of Carbon Dioxide Equivalents

MU – University of Missouri

PPA – Power Purchase Agreement

PV – Photovoltaic

RFP – Request for Proposal

SF – Square Footage

VAV – Variable Air Volume

University of Missouri

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CAMPUS BACKGROUND

1. MU Statement of Values
   http://chancellor.missouri.edu/plansPriorities/values.php

2. MU Mission
   http://www.missouri.edu/about/mission.php

3. Campus Master Plan
   http://www.cf.missouri.edu/masterplan/intro/intro.html

4. Sustainability Policy
   http://sustainability.cf.missouri.edu/policy.html

5. MU School of Natural Resources
   http://www.snr.missouri.edu/

ENERGY

6. Energy Conservation Projects
   http://www.cf.missouri.edu/energy/em_conserve/index.html

EDUCATION AND OUTREACH

7. Environmental Affairs and Sustainability Committee
   http://committees.missouri.edu/environmental-affairs/

8. Sustainability Office
   http://sustainability.cf.missouri.edu/

9. Student Sustainability
   http://studentsustainability.missouri.edu/l

10. Research
    http://chancellor.missouri.edu/plansPriorities/energy-researchers/energy-research.php

REPORTS

11. The Impacts of Campus Activities on the Environment
    Prepared by: University of Missouri Environmental Affairs Committee, April 2003
    http://committees.missouri.edu/environmental-affairs/index.php

12. MU Sustainability Task Force Report, January 2009
    http://sustainability.cf.missouri.edu/resources/taskforce09_final.pdf

This Climate Action Plan was created in collaboration with Sasaki Associates, Inc.