UofL Climate Action Plan

September 2010

UofL Sustainability

Commitment to a Sustainable Future. It's Happening Here.

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Table of Contents

UNIVERSITY OF LOUISVILLE.

The **Courage** to Question Convention.
The **Passion** to Break New Ground.
The **Insight** to Champion Community.
The **Imagination** to Pursue the Undiscovered.
The **Will** to Achieve Greatness.
The **Promise** of a Limitless Future.
The **People** to Bring It to Life.
It's Happening Here.

September 2, 2010

Much public policy conversation in recent years has focused on the "accountability" of the academy. At the University of Louisville, we are accountable: academically accountable, financially accountable and environmentally accountable.

Environmental accountability is an integral part of our 2020 Plan – many important campus and community changing activities are taking place at the University of Louisville from incorporating sustainability concepts into our daily classroom teaching and curriculum to being a leader in developing renewable energy resources and technology to campus and community outreach. That is, at UofL we are not just talking the talk but walking the walk.

Our Sustainability Council was envisioned to pull together faculty, staff and students to ensure that the administration of the University of Louisville was indeed accountable in following through on our commitments, to point out creative new directions for us to take and to comprehensively look at everything we do. The Sustainability Council is a success – it is doing its job.

The Climate Action Plan is more than a plan – it is the roadmap we will follow as we continue to ensure the highest level of accountability at the University of Louisville.

Sincerely,

James R. Ramsey
President

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UNIVERSITY OF
LOUISVILLE.

Office of the Executive Vice President and University Provost

September 15, 2010

It is with great pride that I write to endorse, in principle, the work of the Sustainability Council in its development of the University of Louisville's (UofL's) Climate Action Plan. This Plan represents UofL at its best.

In a spirit of collaboration, the Sustainability Council tackled one of the greatest challenges facing our world today. The Council developed a thoughtful, inclusive and exciting plan to guide UofL toward climate neutrality. Is it ambitious? Absolutely. Is it unreasonable? Not at all. Is it flexible enough to work with over the coming decades? I believe so.

This Plan will position UofL in the top tier of local businesses and national universities working to improve our planet. I am delighted with the foresight and conviction upon which this Plan is based, and, contingent upon consultation and endorsement by the university community as well as adequate financial resources, I look forward to full implementation in the years ahead.

Sincerely,

Shirley C. Willihnganz
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Executive Summary

As a 2008 signatory to the American College & University Presidents' Climate Commitment, the University of Louisville is committed to reducing greenhouse gas (GHG) emissions with the ultimate long-term goal of carbon neutrality. UofL's target goals for university-wide reductions in greenhouse gas emissions from our 2008 benchmark estimate of 192,788 MT eCO2 are:

Our plan for making progress toward climate neutrality is dynamic and multifaceted. We recognize that sustainability demands progress on multiple

Goals	Timeframe	Percent reduction in net GHG emissions	Target maximum net GHG emissions (MT eCO_2)
Short Term	**2010–2020**	**20%**	**154,230**
Mid Term	**2021–2030**	**40%**	**115,673**
Long Term	**2031–2050**	**100%**	**0**

fronts and that lasting change cannot be achieved without coordinated efforts campus-wide. As such, we propose taking a variety of steps to lead UofL down a path toward climate neutrality with a focus on the following initiatives: green purchasing; energy conservation and efficiency; renewable energy; carbon sequestration; master planning; green building design; composting and horticultural practices; behavior change; recycling; transportation; food; and carbon offsets.

A sample of projects from this Climate Action Plan		
Project	**Estimated emissions reduction** (MT eCO_2 per year)	**Progress towards goal** (% reduction in GHG emissions from 2008 baseline)
20% renewable energy by 2020	22,284	11.5%
Implement phase 2 of energy savings performance contract on HSC & Shelby campuses	17,419	9%
Convert from coal to natural gas fuel at Belknap Steam & Chilled Water Plant	4,222	2.2%
Create dedicated bike lanes to connect campus to neighborhoods	3,283	1.7%
Increase fuel efficiency of the university fleet by 15%	136.3	0.7%

The Climate Action Plan outlined here is designed to be a living document that we will continue to revisit and refine as we go through a four decade process of adaptive management on the road to climate neutrality. Engaging students, faculty, researchers, staff and the broader community in this process will be vital to its success and to our broader educational and research mission. This plan is a key element in our sustainability initiatives, and it involves many steps that will help us achieve our strategic goals as well as our climate commitment. It is also the right thing to do in a world of dwindling fossil fuel resources and worsening climate crisis.

Our Climate Commitment

At the University of Louisville (UofL), climate change is not "just another issue." We recognize that it is a symptom of a deep-seated cultural crisis. As a society we must take an honest look in the mirror and realize that in the last 150 years we have developed a debilitating addiction to fossil fuels and the concomitant destruction of natural carbon sinks. Unfettered growth in human population, consumption and technology has led us down this path, but we are beginning to realize that this course is no longer sustainable. The time for reevaluation has come.

The bad news is that we, as a society, have dug ourselves in deep and we can no longer proceed with business-as-usual. The good news is that we, as individuals and institutions, can take action immediately to alter our priorities and reverse course. We are the ones who can turn this ship around – individually in the simple choices we make every day and collectively in the priorities we set about how much energy to consume and of what kind.

Together we must create a society that is less wasteful, powered not by concentrated ancient solar energy buried in the ground, but by the clean, renewable energy that Earth receives every day. While this shift will take money, effort and, yes, some sacrifice, it doesn't have to mean a reduction in human happiness, fulfillment or quality of life. We don't have to live in cold, dark caves. We just have to live better and smarter. Indeed a clean, renewable future is a more joyous, secure, carefree one than the world we confront today. It's time for all of us to step up to the task, roll up our sleeves and get to work on creating a new and joyful post-carbon world.

With this Climate Action Plan, UofL is charting how it will contribute to this brave new world. We recognize that the climate crisis cannot be solved in isolation but that it is the role of institutions like ours to lead the way and to do our part.

UofL exists to create a better tomorrow through education and research. If we do not take action to address the pollution generated and nonrenewable resources consumed by these endeavors, we risk undermining all of that progress. Thus, environmental responsibility and climate neutrality have become a part of our strategic plan and a key component of our mission to create a brighter future for all.

Sustain-agility

This Climate Action Plan is a living document. We recognize that true sustainability is born out of flexibility and responsiveness to changes over time. We cannot predict the changes in technology, political will, economics and ecological conditions that will all shape the pace and nature of our progress toward climate neutrality. We therefore accept that specific strategies, timelines and technologies may need to be altered as time goes on.

UofL is committed to a dynamic, ongoing climate action planning process. Our initial vision and ideas for moving forward are contained herein, but we will continue to revisit them over time. In a spirit of adaptive management we will make every effort to monitor our progress, learn from our successes and failures and revise our plans accordingly. This job will not soon be done and our climate commitment is not something we can ever hope to put behind us. On the contrary, this commitment is something that will continue to guide us and shape our decisions across the long arc of time.

Background & Institutional Data

Though many individuals on campus had been pursuing various environmental projects for years, UofL made a formal, institutional commitment to sustainability on Aug. 1, 2008, when President James R. Ramsey took the bold step of signing the American College & University Presidents' Climate Commitment (ACUPCC).

As a further indication of the university's commitment to climate neutrality and a broader social, economic and environmental responsibility, Provost Shirley Willihnganz established UofL's Sustainability Council that same year. Comprised of representatives from a wide spectrum of university departments along with administrators and students, the council aims to do the following:

- Oversee the work of three committees on sustainability initiatives (operations; education & research; and administration, finance & outreach)
- Develop and review policies to recommend for implementation to the president and provost
- Set metrics and provide oversight to measure progress using the categories in the Association for the Advancement of Sustainability in Higher Education (AASHE) Sustainability Tracking, Assessment and Rating System (STARS) and in other areas deemed important to the university
- Serve as a clearinghouse of information and an organizational hub for university activities related to sustainable practices
- Encourage faculty, staff and students to become involved in sustainability efforts at all levels
- Publicize sustainability initiatives internally and externally to create momentum for substantial change

One year later, the university further solidified its commitment to sustainability by creating a regular full-time professional and administrative staff position devoted exclusively to the effort. Dr. Justin Mog began work as UofL's first-ever assistant to the provost for sustainability initiatives on Aug. 17, 2009.

Today at UofL the purchasing department and food vendors have begun using more locally sourced, recycled and renewable materials. Faculty members from many disciplines are offering classes that focus on various aspects of the sustainability puzzle. Our researchers are conducting investigations to help further advance renewable energy and energy efficiency technologies and to protect land and waterways through better policy, planning and technology.

The University of Louisville is doing a lot, but can, and will, do more. A vital goal built into our strategic plan for 2020 is to be "creative and responsible stewards" of resources. For the university, that stewardship means making a commitment to sustainability and efficiency and to tracking our progress according to the widely accepted standards of the Association for the Advancement of Sustainability in Higher Education (AASHE). This Climate Action Plan is the next logical step in that process.

Institutional Data

Founded by decree of city council on April 3, 1837, with roots stretching back to 1798, the University of Louisville is today a premier metropolitan research university with two campuses in downtown Louisville and one on the urban fringe. UofL is a state supported institution located in Kentucky's largest metropolitan area. It was a municipally supported public institution for many decades prior to joining the statewide university system in 1970.

The university has three campuses. The 287-acre Belknap campus is three miles from downtown Louisville and houses seven of the university's 11 colleges and schools. The Health Sciences Center is situated in downtown Louisville's medical complex and houses the university's health related programs and the University of Louisville Hospital. The 243-acre Shelby campus is located in eastern Jefferson County.

Today, under the leadership of its seventeenth president, James Ramsey, UofL has become known for its exceptional teaching, research, service to the community and the advancement of educational opportunity for all citizens. With a total fall 2010 enrollment of 21,863 students and a growing number of full-time and residential students, UofL's academic programs continue to attract students from every state and from countries all over the world.

	Employees (excluding instruction/research assistants)			Students				Total Campus Population	Operating Budget
	Full Time	Part Time	Total	Full Time	Part Time	Total	Full-time Equivalent		
2006	4,678	1,086	5,764	15,643	6,117	21,760	16,246	27,524	$697.8 m
2007	4,830	1,119	5,949	15,804	6,037	21,841	16,483	27,790	$769.3 m
2008	4,993	1,145	6,138	16,061	5,628	21,689	17,214	27,827	$867.4 m

A Growing University

Employing over 6,100 people and operating with a budget approaching $1 billion, UofL is a major economic force in the community, lending even greater import to its policies with respect to environmental stewardship.

The university owns and maintains a fleet of 194 road vehicles in addition to a number of pieces of heavy machinery used for grounds maintenance (backhoes, tractors, etc.). The physical plant is responsible for maintaining the majority of these, as well as over 115 buildings and 660 acres of land on all three campuses. The physical plant also operates and maintains a 13,800-volt electricity distribution system at the Health Sciences Center and Belknap Campus, as well as the Belknap central steam and chilled water plant with coal and natural gas powered boilers for heating and electric driven chillers with 10,575 tons of chilling capacity for air conditioning.

Our Carbon Footprint

In 2009, UofL made its first attempt to comprehensively estimate the total greenhouse gas emissions resulting from our operations. The resulting Baseline Inventory of Greenhouse Gas Emissions (2006–2008) was submitted to the American College & University Presidents' Climate Commitment (ACUPCC) on Sept. 15, 2009, and is available to the public online at: acupcc.aashe.org/ghg/121/?id=121.

The report found that for fiscal years 2006 through 2008, UofL produced annual average net emissions of 197,506 metric tons of carbon dioxide equivalent[1] (MT eCO2) from all sources. The following tables summarize UofL's greenhouse gas (GHG) emissions estimates.

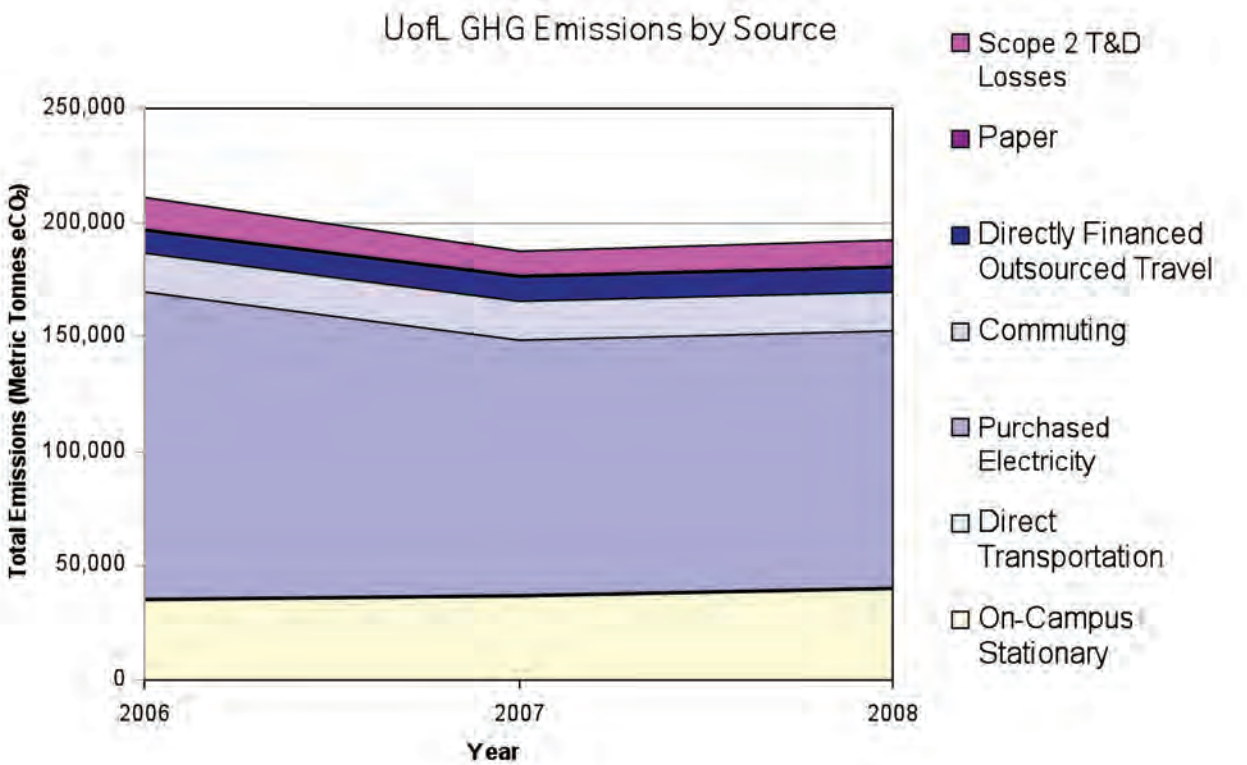
Fiscal Year	Heating Degree Days	Cooling Degree Days
2006	4,222	1,340
2007	4,379	1,288
2008	4,373	1,233

Year	Net Emissions (MT eCO_2)	[2]Emissions per 1,000 sq. ft. (MT eCO_2)	Emissions per Student (MT eCO_2)	Emissions per Full-Time Equivalent Student (MT eCO_2)	Emissions per Capita (All Students + Staff) (MT eCO_2)
2006	211,296	30.2	9.7	13.0	7.7
2007	188,433	26.9	8.6	11.4	6.8
2008	192,788	27.5	8.9	8.9	6.9
Average	**197,506**	**28.2**	**9.1**	**11.9**	**7.1**

	Scope 1 Emissions Sources		Scope 2 Emissions Sources	Scope 3 Emissions Sources				Sequestration	TOTAL
Fiscal Year	Stationary Combustion	Mobile Combustion	Purchased Electricity	Commuting	Air Travel	Solid Waste	Paper Purchasing	Due to composting	Net Emissions
	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2
2006	34,544	858	134,485	16,763	10,078	614	666.9	(14)	**211,296.1**
2007	36,688	942	110,943	17,231	10,418	654	598.4	(14)	**188,433.2**
2008	39,878	981	111,420	17,633	10,604	627	640.6	(14)	**192,788.5**

[1] Carbon dioxide equivalent is the concentration of CO2 that would cause the same level of radiative forcing (or heat-trapping potential) as a given type and concentration of some other greenhouse gas, such as methane (a much more potent greenhouse gas).

[2] Based on an estimated 7 million square feet of space in university-owned buildings.

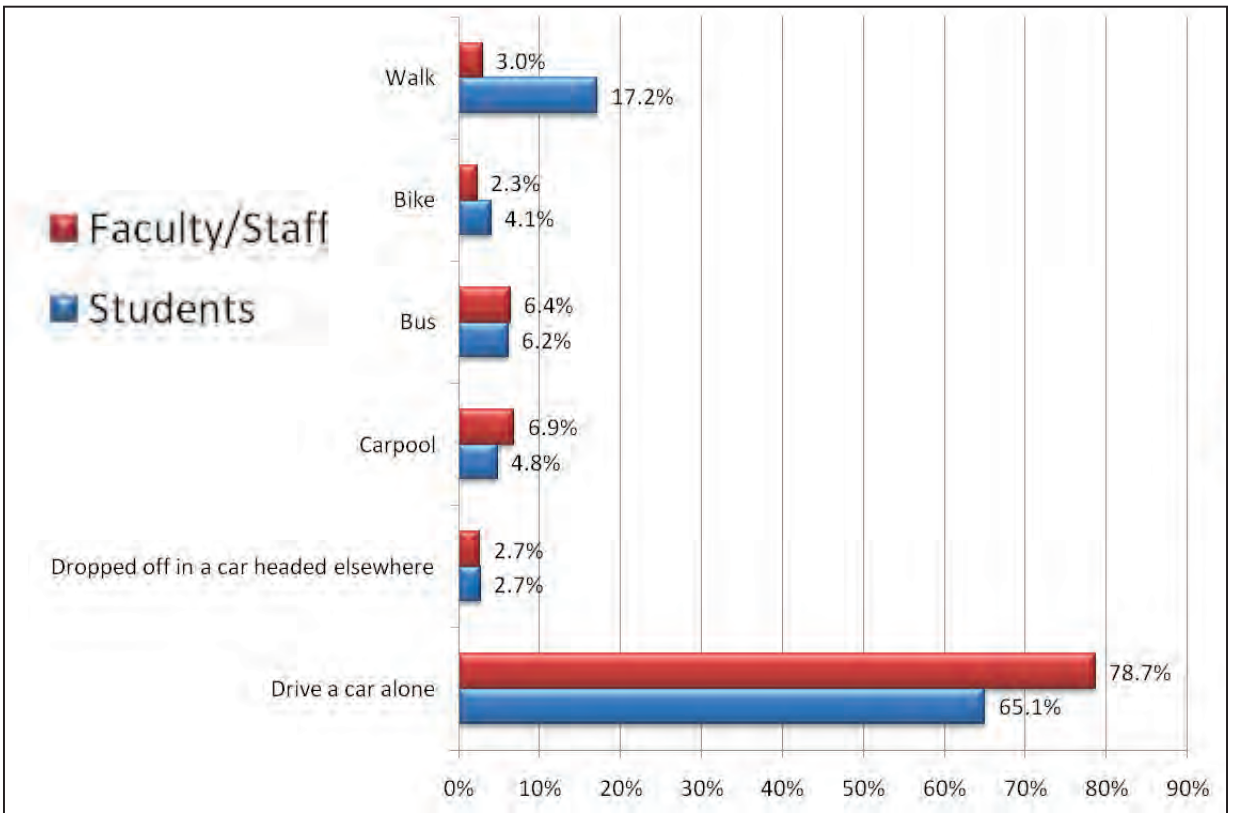


The data suggested that, by far, the largest portion of the university's carbon footprint (58 percent) could be attributed to scope 2 emissions produced from purchased electricity generated primarily from coal. The next largest portion of UofL's carbon footprint is derived from its scope 1 stationary combustion emissions (21percent) resulting from the burning of fossil fuels to heat campus buildings. The university's Health Sciences Center was found to generate roughly 41 percent of the combined scope 1 and 2 emissions.

Scope 3 indirect emissions were found to be the smallest percentage of overall emissions. Most of these emissions were transportation related. While the percentage of the total emissions derived from the university's 194 fleet vehicles was found to be very small (0.005 percent), commuting to campus and university-related air travel represented a sizable fraction (9 percent and 5.5 percent respectively).

Getting a handle on emissions from transportation will be vital as UofL has traditionally been primarily a commuter school, with only about 9 percent of students living on campus. Recent efforts to expand student housing on and around our campuses has nearly tripled that percentage, yet a March 2010 survey found that 65 percent of UofL students and 79 percent of employees still drive alone as their primary means of getting to campus.

Belknap's steam & chilled water plant is transitioning away from coal to 100 percent natural gas by 2015.



Results from a March 2010 survey of the UofL community indicate that most people commute to campus by driving. Commuting represents nine percent of our carbon footprint.

Even though the university's population, budget and land holdings grew over this three-year period our net GHG emissions did not grow in proportion. This indicated that the efforts we implemented to limit the university's environmental impact were trending in the right direction.

This baseline inventory included utilities data for 115 buildings owned by the university on all three campuses, which together comprise nearly 7 million square feet of building space on 660 acres of land. The data encompassed all of the university's academic, health science, medical, dental, athletic, dormitories, research and office buildings and grounds.

Several buildings that are associated with the university but not owned or operated by UofL were not included in the report. Examples of these include fraternity and sorority houses, dormitories operated by third parties, the University Hospital and leased spaces off-campus.

Estimated emissions were calculated using the Clean Air-Cool Planet® Campus Carbon Calculator v6.1 software utilizing annual facility data. The calculator was used for university data collection, storage and conversion into a common greenhouse gas emission unit, metric tons of carbon dioxide equivalent (MT eCO2). In the conversion process, the calculator uses scientifically based factors for specific activities leading to GHG emissions (e.g., commuter miles traveled, tons of waste disposed, gallons of fuel burned, etc.).

Our Greenhouse Gas Emissions Reduction Plan

UofL is committed to reducing greenhouse gas emissions, with the ultimate long-term goal of carbon neutrality. UofL's target goals for university-wide reductions in greenhouse gas emissions from our 2008 benchmark estimate of 192,788 MT eCO2 are as follows:

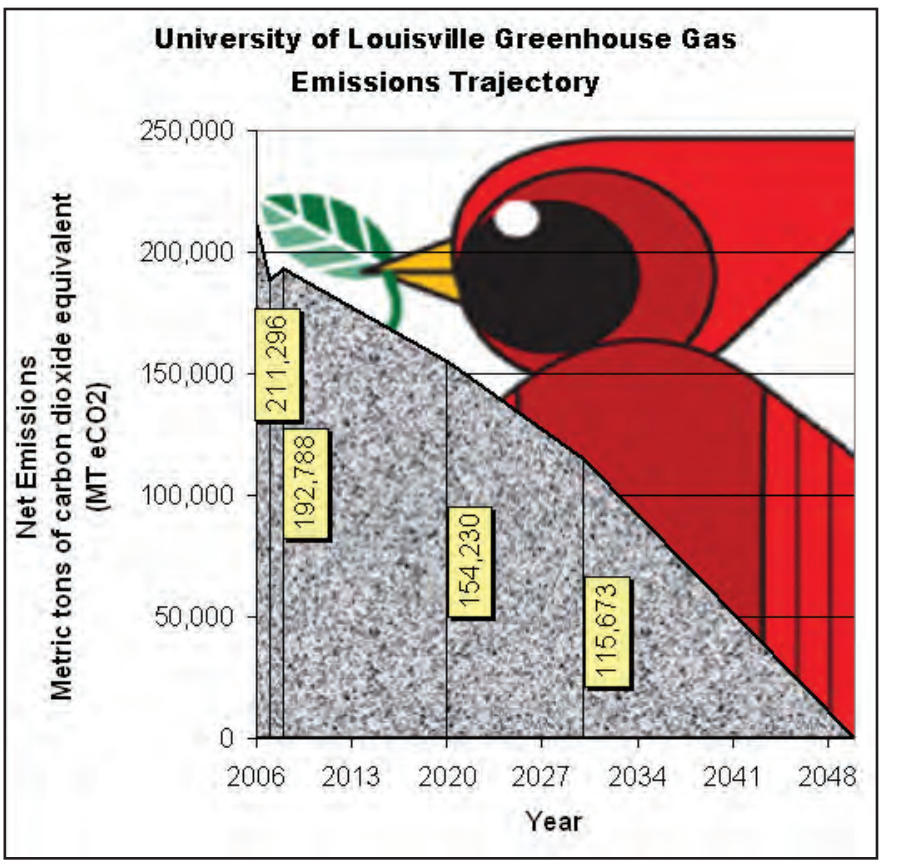
- 20 percent reduction by 2020
- 40 percent reduction by 2030
- 100 percent reduction (or climate neutrality) by 2050

Goals	Timeframe	Percent reduction in net GHG emissions	Target maximum net GHG emissions (MT eCO_2)
Short Term	**2010–2020**	**20%**	**154,230**
Mid Term	**2021–2030**	**40%**	**115,673**
Long Term	**2031–2050**	**100%**	**0**

Our plan for achieving these goals is divided into goals and strategies for three specific time frames, summarized below:

This Climate Action Plan addresses current and future initiatives in the following areas:

- Green purchasing
- Energy conservation and efficiency
- Renewable energy
- Carbon sequestration
- Master planning
- Green building design
- Composting and horticultural practices
- Behavior change: Green Team pilot program
- Behavior change: university-wide
- Recycling
- Transportation
- Food
- Carbon offsets



A. Green Purchasing

UofL is committed to the stewardship of the environment and to reducing the university's generation of waste and dependence on nonrenewable energy. To reflect that commitment, UofL adopted a green purchasing policy to guide procurement decisions university-wide.

The goal of this policy is to reduce the adverse environmental impact of our purchasing decisions by buying goods and services from manufacturers and vendors who share our commitment to the environment. Green purchasing is the method wherein environmental and social considerations are evaluated along with the price, availability and performance criteria that colleges and universities use to make purchasing decisions.

Green purchasing is also known as environmentally preferred purchasing (EPP), green procurement, affirmative procurement, eco-procurement and environmentally responsible purchasing. In all cases, the goal is to provide the university with necessary goods and services at reasonable cost while minimizing negative environmental and social impacts.

Green purchasing attempts to identify and reduce environmental impact and to maximize resource efficiency.

A.1. Current Green Purchasing Policies and Practices

UofL's green purchasing policy[3] is very broad and encompasses many areas of concern in this Climate Action Plan. The policy covers the following topics and the more pertinent sections are discussed later in this report:

- Energy
- Water
- Toxins and pollutions
- Bio-based products
- Forest conservation
- Recycling
- Packaging
- Green building
- Landscaping
- Food

Residents of west Louisville in the Rubbertown area are acutely aware of the environmental and social impacts of consumer product manufacturing.

Paper

A request for proposals was completed in 2010 and, after careful review in conjunction with the Partnership for a Green City agencies, the university signed a new contract with a vendor to provide photocopier and printer paper with a minimum of 30 percent post-consumer recycled content.

Computers

Currently all desktop and notebook computers and monitors purchased by UofL must meet a minimum of Electronic Product Environmental Assessment Tool (EPEAT) bronze with additional consideration given to products that have earned silver or gold.

Energy Star

The university currently requires all designated energy-using products to be Energy Star certified. Since the requirements for earning and maintaining this certification are constantly being reviewed and increased, this will continually allow us to purchase items that minimally meet these requirements, reducing our energy consumption for appliances.

Cleaning Materials

Most cleaning materials purchased by the university are Green Seal Certified.

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[3] Purchasing policy 31.00, available online at: louisville.edu/purchasing/sustainability/greenpolicy.html.

A.2. Green Purchasing Goals

- Increase the post-consumer recycled content for paper purchased by UofL from the current 30 percent to 50–100 percent by 2013 (short term).
- Consider an increase to an EPEAT silver minimum standard for computers and monitors purchased by UofL (short term).
- Develop a policy regarding the use of personal refrigerators in residence halls and offices with the goal of reducing the number of refrigerators by 20 percent by 2015. See Behavior Modification Section of this report (short term).
- Include sustainable packing practices language in vendor contract renewals (short term).

B. Energy Conservation and Efficiency

The majority of Belknap Campus' utilities are served by a central steam and chilled water plant with a 13,800 volt electricity distribution system. The Health Sciences Center is served by a central steam and chilled water plant, which operates in partnership with other hospitals in the medical complex. The university currently purchases all of its electricity[4] and natural gas from the local utility, Louisville Gas & Electric Co.

According to our 2008 baseline estimates, nearly 80 percent of UofL's GHG emissions are produced through the burning of coal and natural gas. The largest portion of the university's carbon footprint, roughly 58 percent of the total, can be attributed to emissions at the local utility to generate electricity for the university. This electricity is produced from the burning of fossil fuel (coal) and represents a significant opportunity for reducing the university's carbon footprint by reducing the use of this purchased electricity.

The next largest portion of the carbon footprint, roughly 21 percent, is generated on campus from the burning of coal and natural gas for building heating.

B.1. Current Energy Efficiency & Conservation Initiatives

The university is taking a wide variety of steps toward energy conservation, reducing its overall consumption of fossil fuels and peak demand for electricity. These measures will have a significant impact on reducing UofL's overall carbon footprint.

Hundreds of improvement measures have either been implemented over the past few years or are in progress through an energy savings performance contract (ESCO) in conjunction with Siemens Corp. Energy Group. The university's contract began with energy audits of Belknap Campus in 2008 and includes more than $21.7 million in capital improvements that are guaranteed to save more than $2.3 million annually in energy costs.

Funding was secured by the university through a commercial lending institution at favorable rates, and the annual savings guaranteed by the ESCO over thirteen and a half years.

The implementation of the first phase of this project is currently under way on Belknap campus and includes 69 buildings with the following specific improvements:

- Lighting upgrades totaling nearly $4.6 million to replace more than 40,000 incandescent and older fluorescent lamps with state-of-the-art high efficiency bulbs and ballasts, which is expected to reduce electricity consumption by 11,200 megawatt hours per year and save the university more than $635,000 annually.
- Replacing more than 130 large motors with high efficiency units to reduce electricity consumption by an estimated 1,100 megawatt hours per year, saving nearly $60,000 annually.
- Upgrading heating and ventilation systems, totaling $5.6 million with an estimated savings of $460,000 annually, including the replacement of large air handling units in the chemistry and law school buildings and major upgrades to systems in Davidson Hall and the Humanities Building.
- Building control upgrades totaling $5.7 million with estimated savings of $844,000/year.

In July 2010, UofL sent an old coal-fired boiler to a nearby recycling facility to make room for a more efficient natural gas boiler at the Belknap steam and chilled water plant.

- Water conservation measures totaling $1.4 million with estimated annual savings of $224,000 through the installation of low-flow shower heads and flush valves.
- Upgrading energy management systems, installing electricity sub meters and chilled water meters to measure energy conservation and providing verification of savings.

The effect of these energy efficiency projects is estimated to reduce the overall carbon footprint of the university by more than 20,000 metric tons GHG per year or roughly 10 percent of the university's total footprint, starting in fiscal year 2011. This translates to an annual equivalent impact of removing approximately 4,600 cars from the road, planting 177 acres of trees or not burning 133 railcar loads of coal each year.

[4] Except for the small fraction of electricity produced by our pilot solar installations.

The university presently uses coal as the primary energy source for our steam heating boilers on the Belknap Campus and Health Sciences Center. Plans are under way, however, to convert to a natural gas fuel source for Belknap. Work has already begun on replacing older, less-efficient coal-fired boilers. The full conversion to natural gas is scheduled to be completed by 2015.

The estimated impact from converting the coal boiler to natural gas is an increase in natural gas consumption of 95,000 MMBtu and a reduction in coal usage of 4,800 short tons per year. Such a conversion would lead to an estimated annual reduction in GHG emissions of 4,222 MT eCO2 (a 2.2 percent reduction from the 2008 baseline).[5]

Project	Estimated emissions reduction (MT eCO_2 per year)	Progress towards goal (% reduction in GHG emissions from 2008 baseline)
Convert from coal to natural gas fuel at Belknap steam and chilled water plant.	4,222	2.2%

B.2. Energy Conservation Policies

UofL has recently drafted and adopted a campus energy policy to set university-wide standards and expectations related to energy use. The policy states, "The University of Louisville, in an effort to establish and maintain practical thermal environments, appropriate illumination levels, sustainable energy consumption and environmentally compliant buildings and facilities, will endeavor to design and function in a manner to satisfy the requirements of the present while preserving resources for future generations. Consistent with this goal, the university will dedicate efforts to efficiently manage and reduce the consumption of energy, water and utility costs in a conduct that is responsible and consistent with providing an optimal campus community environment."

The policy includes the following general guidelines for all campus buildings:

Lighting Levels

The Illuminating Engineering Society of North America's (IESNA) luminance selection procedure shall be used for establishing target lighting levels throughout all facilities. Specific lighting intensities shall conform with the IESNA requirements along with consideration for influences of glare, task complexity, surface reflectivity and user age addressed with this procedure:

Target Lighting Levels	
Classrooms	35–60 foot-candles
Offices and Conference Rooms	30–40 foot-candles
Reception Areas and Lounges	30–40 foot-candles
Corridors	10–20 foot-candles
Kitchens	45–55 foot-candles
Cafeterias	20–30 foot-candles
General Space	20 foot-candles

Space Temperatures

ASHRAE guidelines shall be used for ventilation requirements. The following minimum and maximum room temperatures shall be maintained to the extent reasonably possible, except for areas with approved special needs:

Target Indoor Temperatures		
During Heating Season	Occupied Hours	66–72 °F
	Unoccupied Hours	55–65 °F
During Cooling Season	Occupied Hours	74–78 °F
	Unoccupied Hours	78–85 °F

Many of these standards and guidelines from the energy policy already have been implemented as part of the building controls upgrades mentioned previously. The policy will be implemented across the university after the performance contracting process has been substantially completed.

[5] Emissions reduction estimates throughout this document were calculated using the Clean Air-Cool Planet® Campus Carbon Calculator v6.1.

The Department of Public Safety, in collaboration with the Sustainability Council, has also crafted a policy for use of space heaters designed to set guidelines for what types of space heaters are approved for use on campus and under what circumstances. One objective is to minimize the use of these inefficient means of conditioning spaces. The policy specifies, in part:

- Space heaters pose serious fire and electrical hazards and are not efficient from an energy use standpoint; therefore, the use of space heaters at the university is strongly discouraged.
- If individuals feel that a space heater is needed to achieve and maintain acceptable levels of warmth in their work space, please contact Work Control at 852-6245 or louisville.edu/physicalplant/forms/non_chargeable_request and a room temperature adjustment will be conducted.
- Room temperatures while occupied shall be maintained between 66–72oF during colder days and between 55–65oF while unoccupied. In the event room temperatures cannot be adjusted following a physical plant temperature adjustment, temporary use of an approved space heater may be allowed.
- Space heater users are required to comply with this policy effective Sept. 1, 2010.
- Heaters may not produce more than 1500 watts of heat or require more than 120 volts or 12.5 amps power to operate.
- Heaters must be turned off and unplugged from the outlet daily to conserve energy.
- Personal space heaters are not allowed for use in residence halls, Greek housing facilities or other sleeping areas at UofL.

B.3. Energy Efficiency & Conservation Goals

The first phase of the energy savings performance contract focused only on Belknap Campus. The second phase began in the spring of 2010 with an energy audit of the Health Sciences Center and Shelby Campus.

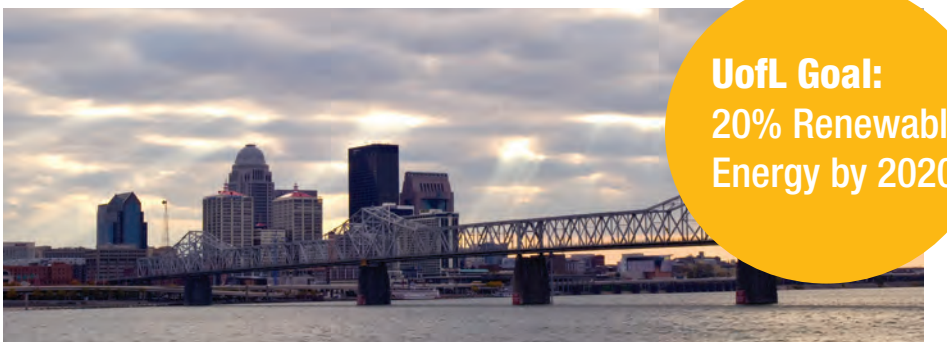
Initial findings indicate that this proposed second phase could generate up to another $2 million in annual energy savings, depending on the final scope of improvement measures to be included. Additional engineering studies are needed to determine the feasibility of these measures. These studies are planned for later in 2010 to determine the final project cost and savings estimates. Implementation of the second phase is projected for 2011.

Preliminary estimates indicate potential savings of roughly 13 million kWh of electricity, about 100,000 MMBtu of steam heat, and about 19,000 MMBtu of natural gas. If these estimates are accurate, implementation of the second phase of performance contracting would yield an annual reduction of 17,419 MT eCO2, or a 9 percent reduction in GHG emissions from our 2008 baseline.

Project	Estimated emissions reduction (MT eCO_2 per year)	Progress towards goal (% reduction in GHG emissions from 2008 baseline)
Implement phase 2 of energy savings performance contract on HSC & Shelby campuses.	17,419	9%

Recommendations:

- Finalize phase 2 of performance contracting and implement improvements to identified inefficiencies at Health Sciences Center and Shelby Campus (short term)
- Consider funding through university resources priority energy savings projects that were not included in the performance contracts (short term)
- Convert the final Belknap coal boiler to a natural gas fuel source by 2015. Cost for one boiler is estimated currently at $4 million (short term)
- Issue the campus energy policy to the university community and take the necessary steps to fully implement the policy university-wide (short term)
- Issue the policy for use of space heaters to the university community and take the necessary steps to fully implement the policy university-wide (short term)



UofL Goal:
20% Renewable Energy by 2020

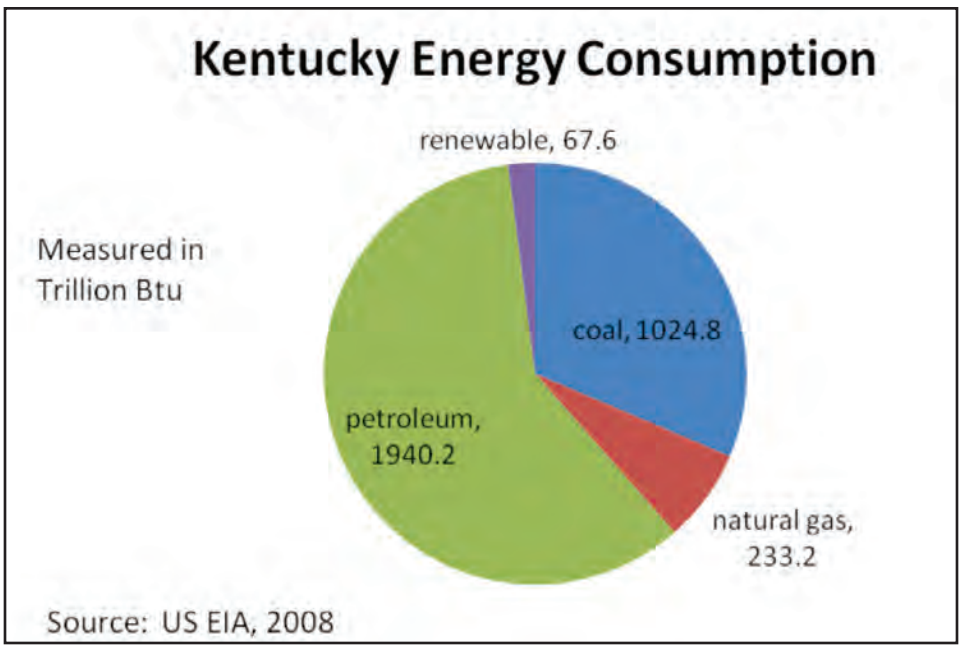
C. Renewable Energy

The University of Louisville is one of the largest energy users in the commonwealth, requiring more than 145,858,511 kWh of electricity and 2,209,374 CCF (100 cubic feet) of natural gas annually (2009). The university's goal is to obtain 20 percent of its energy from renewable resources by 2020 and to become carbon neutral by 2050. The later goal can only be met by eliminating the university's dependence on fossil fuels.

Project	Estimated emissions reduction (MT eCO_2 per year)	Progress towards goal (% reduction in GHG emissions from 2008 baseline)
20% renewable energy by 2020	22,284	11.5%

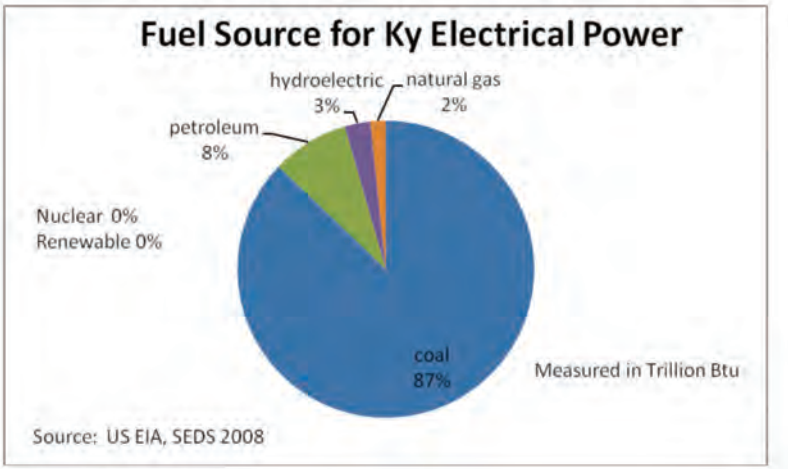
Approximately 58 percent of the greenhouse gases emitted by the university come from purchased electricity. The most cost-effective means of reducing these emissions is through conservation, which is being aggressively pursued through the energy savings performance contract (described above) to reduce energy demands by 33 percent. Even with this reduction in total energy use, the university will need to transition from a high dependency on coal[6] to carbon-free renewable energy such as solar, wind, biomass, geothermal and hydropower.

Kentucky is the third largest coal-producing state. (Wyoming is first and West Virginia second.) Kentucky accounts for roughly one-tenth of total U.S. coal production and nearly one-fourth of U.S. coal production east of the Mississippi River. With Kentucky's historic reliance on coal-fired base load generation, the state has enjoyed some of the lowest electricity rates in the country. Our low rates have allowed energy-intensive industries to flourish in the state.



[6] The local utility obtains 98 percent of its energy from coal-fired power plants producing 2.02 pounds of CO2e per kWh.

Low rates have also encouraged Kentuckians to become some of the greatest consumers of electricity in the country. Kentucky's per capita consumption of residential electricity is among the highest in the United States. In May 2008, a Brookings Institute report identified Louisville as having the fifth highest per capita carbon footprint in the United States (Lexington, Ky., was first). The Brookings report primarily implicated coal-fired electricity generation for the high carbon footprint.



Clean and renewable energy is derived from sources that can be naturally replenished, such as solar and wind, and do not take destructive mining practices to produce. In addition, renewable energy has added social benefits compared to fossil fuels, such as lowering dependence on foreign nations for resources, providing local jobs and stable pricing.

Of course, no power generation is completely without an embedded carbon footprint. The life cycle GHG emissions for solar photovoltaic (PV) power, for example, depends on the manufacturing process, type of PV, the source of electricity used in the manufacture of the PV module, efficiency of the unit and the insolation rate where the module is installed (the higher the insolation rate, the lower the emissions per kWh generated). Studies have shown that the U.S. average is 24–32 g/kWh. The production of polycrystalline silicon is the most energy-consuming stage of the silicon module's life cycle; it accounts for 45 percent of the total primary energy required in production. Fortunately, the trend is toward lower embedded emissions for newer PV modules.

The greenhouse gas emissions from a biomass-to-methane system are also difficult to calculate. To do so you must include the transportation of waste, fugitive emissions from the process to distill waste products into ethanol, energy input into the distillation process, conversion losses to produce electricity (30 percent) and releases from the combustion of methane. Methane is a potent greenhouse gas, and it releases carbon dioxide during combustion. Assuming complete combustion of methane, 230 g/kWh is released. If we added the other factors of transporting waste material, distillation requirements, incomplete combustion and fugitive losses, the amount of greenhouse gas emissions could equal or exceed that from coal combustion (915 g/kWh).

Current state and federal policies are being crafted that could significantly change the renewable energy sector and UofL's ability to participate. These include renewable energy tax credits and financial incentives, energy portfolio requirements, renewable energy tariffs, cap and trade systems and other approaches designed to reduce the amount of carbon being released into the atmosphere.

Researchers installed a dual-tracking solar PV array on the roof of Sackett Hall at the J.B. Speed School of Engineering.

C.1. Current Renewable Energy Initiatives

The university uses purchased electricity and natural gas as its primary sources of energy. The Belknap Campus steam and chilled water plant previously used up to 5,000 tons of coal annually to heat the campus. The university is phasing out the use of coal by replacing one of its coal-fired boilers with a $3 million natural gas boiler. Natural gas will be used as the primary fuel, with coal used as a backup fuel until the second coal-fired boiler is replaced by 2015. We estimate that the net effect of switching Belknap steam production from coal to natural gas would reduce our Scope 1 GHG emissions by approximately 2,538 metric tons per year (based on a three-year average). This represents a 1.3 percent reduction in the University's entire carbon footprint, or 7 percent of the entire University's Scope 1 emissions and roughly 15 percent of Belknap's Scope 1 emissions.

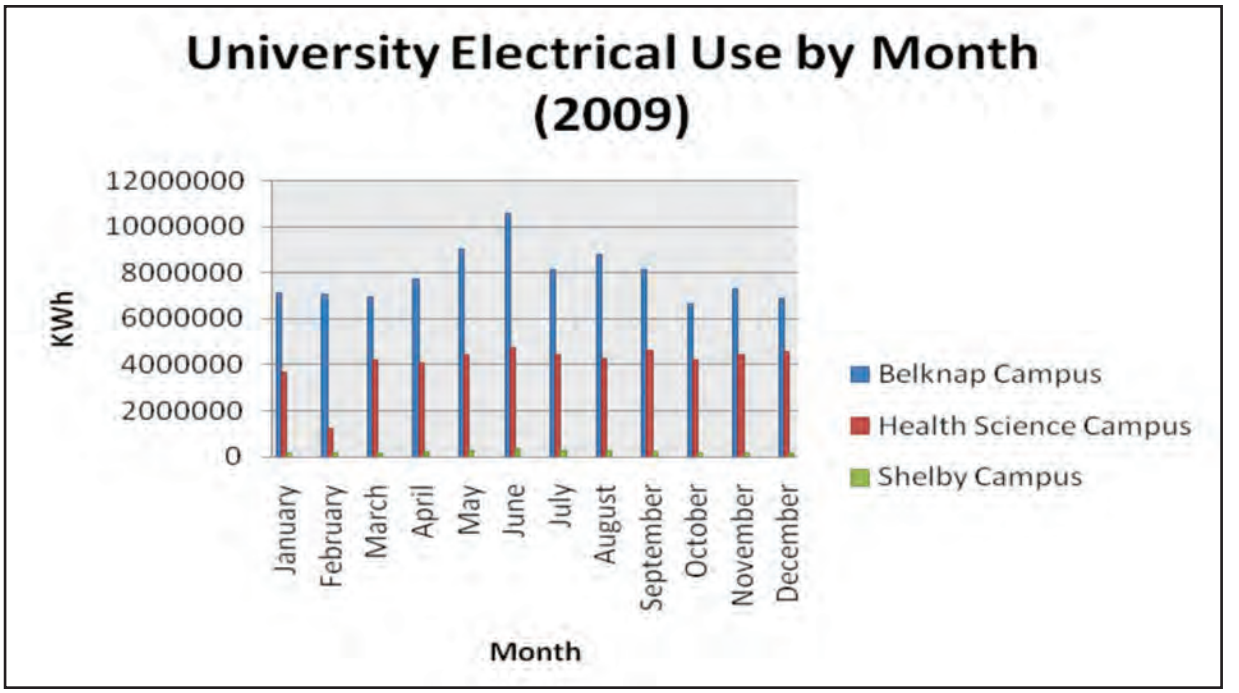
UofL has installed a number of pilot renewable energy systems on campus to generate onsite energy, including:

- 50.4 kW solar PV array at the Predictive Medicine Laboratory
- 2 kW solar PV and 56-square-foot solar hot water collectors at Sackett Hall
- 28-square-foot collector and heat pipe for warming classroom space at Burhans Hall
- 80-square-foot solar hot water collector at Burhans Hall
- Solar light shelves at the Translational Research Building

Burhans Hall on Shelby campus now enjoys water heated passively by the sun.

While these facilities are producing energy from renewable resources, their combined capacity is less than one percent of the university's energy demand. Electrical energy used on campus should be the primary target for reducing our carbon footprint through a move from fossil fuels to renewable energy sources.

Electricity use on each of the three campuses is shown in the chart below. Demand at the Health Sciences Center and Shelby Campus remain fairly constant through the year, while peak demands on Belknap Campus occur during the warmer months of the year (May–September) even though there are far fewer students and faculty on campus over the summer. This suggests that there are opportunities to reduce energy demand through better management of air conditioning systems to avoid cooling unoccupied spaces.



C.2. Renewable Energy Options

In 2009, UofL contracted CannonDesign and Staggs and Fisher Consulting Engineers to prepare a report on renewable energy options for the university. The report was presented Aug. 11, 2009, and is summarized on the following page.

Using the report as a guide, the university is exploring several options involving partnerships with private firms to secure renewable energy. These include:

1. **Biomass Gasification:** Working in partnership with Parallel Products, the university is exploring using waste products (spirits, wine, beer, sugar beverages, cosmetics) to produce methane. Parallel Products is paid to take these wastes and destroy them. Currently they distill and ferment the wastes to produce 5.5 million gallons of ethanol annually. The byproduct of the fermentation and distillation process plus other waste streams (such as dairy wastes) could be shipped via rail 1.5 miles to Belknap Campus to be placed in a 1.5 million gallon digester to produce biogas (methane). The biogas could then be combusted to generate electricity and/or to heat buildings. The proposed project could provide 15–20 percent of the electrical power used by the university. The total estimated cost of the project is $8-9 million.

Biodiesel, like that produced from waste dining services oil at UofL, is another example of renewable biomass energy.

2. **Solar**: Working in partnership with Earthwell Inc., the university is exploring the potential of a power purchase agreement to provide the capital needed to install solar arrays across campus. A third party financial group would provide the necessary capital to purchase and install solar photovoltaic and solar thermal systems to meet a portion of the university's energy demands. They would receive all federal and state tax breaks (currently 30 percent from the federal government) and could sell the Renewable Energy Credits. Earthwell Inc. would be responsible for the installation and maintenance of the systems. UofL would lease the systems and pay back the capital cost by paying for energy produced at a rate comparable to that currently being paid to the local electrical and gas provider. Once the capital is repaid, the ownership of the systems would transfer to the university.

3. **Low-Impact Hydroelectric**: Working in partnership with Hydro 7, the university is exploring the potential for a low-impact hydroelectric project. Hydro 7 recently completed the rebuilding of a hydroelectric station at lock 7 on the Kentucky River. The 2 MW project produced over 9,000 MWh of energy last year (6 percent of the university's total energy demand). They hold Federal Energy Regulatory Commission (FERC) preliminary permits for locks 12 and 14 on the Kentucky River, which would have similar generating capacities as lock 7. However, they have already entered into a partnership with a Kentucky electric cooperative for these two projects. UofL will monitor the situation and, in the event that the partnership is unable to complete one or both of these projects, could explore viable opportunities to enter into the partnership. Hydro 7 is also studying the feasibility of a third location at an existing dam in Southern Indiana. This is an earthen dam owned and operated by the U.S. Army Corps of Engineers. The project would siphon water over the top of the dam down to a turbine, thus not impacting the integrity of the earth dam. This project is contingent upon obtaining Corps of Engineer approval in addition to FERC approval (projected to take 8–10 years).

4. **Wind**: Working in partnership with Hydro 7, the university is exploring the potential of constructing a wind energy project. Based on new wind resource maps with measurements at 75 meters, rather than the older 50 meter hub height, the project would investigate the feasibility of installing a 100-meter tower and a 1.5 MW turbine. New tower designs allow the modular construction of higher towers. Using proven technology of mid-size turbines in combination with the newly available towers, this option could put the turbines in wind flows double that at ground and 50 meter heights. Potentially wind energy could provide 3–5 percent of the university's energy demand.

5. **Landfill Gas**: UofL is exploring a potential partnership with Horizon LFG, which owns the landfill gas at the Outer Loop Landfill operated by Waste Management Inc. The Outer Loop Landfill generates 5,500 standard cubic feet per minute (scfm), and this is expected to rise to as much as 8,000 scfm in the next few years. There is adequate gas to meet the university's 20 percent goal. The gas could be utilized in several ways:

    - To produce electricity using a turbine or internal combustion engine
    - Piping it to Belknap Campus to burn at the steam and chilled water plant
    - Piping it to the university and produce electricity using a turbine or internal combustion engine
    - Piping it to UofL and produce electricity and use waste heat to cogenerate steam for heating buildings

Piping the gas to campus could be accomplished along the I-65 corridor or a railroad corridor that passes next to the landfill and by UofL's steam and chilled water plant. The cost of the pipe alone could be $2–$7 million. This option is similar to the parallel product proposal; however, in addition to the capital costs (generators, electric connections, pipe, etc.) the university would be required to pay for the landfill gas itself. For this reason, it is viewed as a less-desirable, long-term possibility.

Renewable Energy Options for the University of Louisville

Technology	Description	Feasibility	Cost to Meet 20% Goal	Notes
Hydrokinetics	Provide electricity from kinetic energy of the Ohio River. Does not require a dam, rather it uses small submerged turbines..	Ohio River flow is 5 fps, at low end of performance envelope. Would produce 1–20 kW per turbine, or 1% of goal..	$210 million	Feasibility being reinvestigated.
Wind	Harnesses the energy in the movement of wind to produce electricity.	Kentucky's wind resources may be inadequate (<4 m/s at 50 m). Small turbines may be possible at specific locations.	$200 million	Recent wind studies shows that at 75–100 m hub height, there are sufficient wind energy resources in Kentucky.
Geothermal	Drilling deep (3–10km) injection and production wells, injecting water to fracture rock and extract heated water.	Enhanced Geothermal Systems have not been tested in Kentucky, and there is insufficient geologic data to support this option	$100 million +	Using earth as a heat sink could enhance cooling and heating of individual or clusters of buildings.
Incremental or Low Impact Hydroelectric	Installation of hydroelectric generators on existing dams, often use flow of river rather than stored water.	There are a large number of existing dams with no hydroelectric capacity in the immediate vicinity of the university.	$150–400 million	Obtaining FERC permit for a project would require 5–10 year lead time.
Landfill Gas	Collect and use methane produced at a landfill to burn in place of natural gas or as a fuel for a turbine or internal combustion engine to produce electricity.	The largest landfill in the state is 5.5 miles south of the campus, collects its methane and already pipes 30% of it to General Electric. The rest is currently wasted (flared).	$15 million	If the gas was piped to campus, a cogeneration configuration could produce electricity and steam for campus heating. Landfill is currently installing a digester to increase gas production.
Solar	Could generate electricity (photovoltaic or Sterling engine) or hot water (thermal) directly from the sun. Hot water could be used domestically or to generate steam through concentrating mirrors.	To meet 20% goal, would require installation of 24.4 MV photovoltaic capacity covering 56 acres, or 600 solar dishes with Sterling engines.	$9.1 million for a project limited to the Belknap parking garage and SAC ($7/watt)	Would be best to be part of the overall 20% rather than the sole means of meeting UofL's goal of 20% renewable energy. Would likely generate <5% of energy demand.
Biomass Gasification	Places organic material into a low-oxygen container to produce methane gas. Gas can be burned directly or used to produce electricity.	Requires a sufficient stream of organic material (e.g., dedicated crops, agricultural wastes, wood and forest residue, animal and clean urban wastes) within 50 miles.	$8–25 million	With cogeneration, waste heat could be used to provide steam for campus-wide heating.

C.3. Renewable Energy Goals

Short Term — 2010–2015

UofL Goal: 5% Renewable Energy by 2015

- Goal: 5 percent energy from renewable sources
- Enter into a power purchase agreement to install solar systems on campus. Integrate these systems into solar energy research projects at UofL's Conn Center for Renewable Energy Research and Environmental Stewardship, as well as educational opportunities for students.
- Create a public-private partnership to design and construct a biomass digester. Determine whether it would be best to combust the biogas in the central steam and chilled water plant on campus or to generate electricity with the biogas. The second coal-fired boiler on Belknap Campus will be required to be modified by 2015 in accordance with the university's air quality permit. Investigate the feasibility of using biogas for the second boiler. If an economic and engineering feasibility study shows that the better approach is to use the biogas to generate electricity, UofL will explore the feasibility of combined cogeneration to use the waste heat from the generation process.
- Assess the feasibility of combusting landfill gas in the second boiler at the steam and chilled water plant.

Mid Term — 2016–2020

UofL Goal: 20% Renewable Energy by 2020

- Goal: 20 percent energy from renewable sources.
- Enter into a partnership to develop a low-impact hydroelectric project.
- Conduct wind energy tests to determine the feasibility of using wind energy on campus.

Long Term — 2021–2050

UofL Goal: 100% Renewable Energy by 2050

- Goal: 100 percent energy from renewable sources.
- Explore the feasibility of using geothermal energy to heat/cool buildings on campus, especially as we grow the square footage of campus buildings.
- Explore the feasibility of constructing campus buildings with natural cooling and heating capabilities (such as passive solar, solar heat tubes and earthen berms) to minimize or eliminate the need for central heating or cooling systems.
- Assess the potential of using biogas and fuel cells to generate electricity.
- Assess the potential of using bacteria and organic material (solid waste, wood waste, etc.) to generate hydrogen. Hydrogen could be used for space heating, electric generation and mobile propulsion.

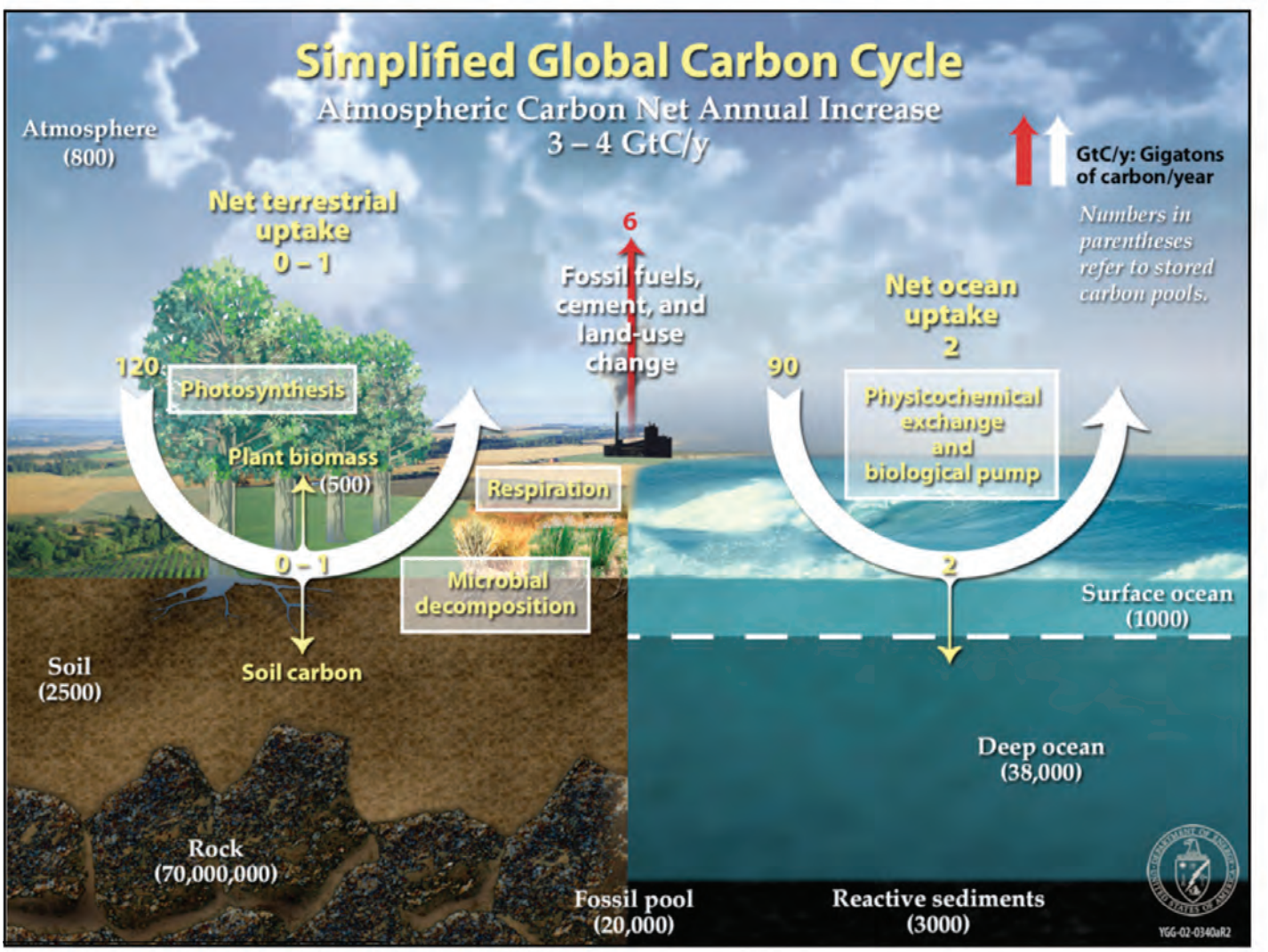
An experimental passive solar heat tube for warming classroom space is being studied at Burhans Hall on Shelby Campus.

D. Carbon Sequestration

One of the most promising ways to reduce the accumulation of greenhouse gases in the atmosphere is through carbon sequestration. As the illustration below shows, the global carbon cycle's natural sequestration (i.e., plant photosynthesis and storage, soil carbon and photosynthesis in the oceans) remove 3–4 gigatons[7] of carbon from the atmosphere annually.

Though it is only a trace gas (<0.03 percent of the atmosphere by volume), the concentration of carbon dioxide (CO2) is increasing at a rate of 1.9 parts per million (ppm) annually. Over the last 160 years, the concentration of carbon dioxide in the atmosphere has increased 37 percent (concentration from 1850 back 400,000 years was 280 ppm, today it is over 391 ppm). Approximately 6 gigatons of carbon dioxide are released through anthropologic activities, including fossil fuel combustion, cement manufacturing and land use changes that destroy forests, farms and other carbon sinks. This results in an increase of 2,–3 gigatons of carbon dioxide annually.

Carbon sequestration is the process by which carbon dioxide sinks (natural and artificial) remove CO2 from the atmosphere. The largest carbon dioxide sinks are in rock formations, oceans, soils, peat bogs, permafrost and living plants. Artificial sinks include direct injections of CO2 into geologic formations, oceans and environments for plant uptake.



[7] A gigaton is 1 billion tons.

The university has the ability to sequester carbon biologically on its various campuses and research properties including Belknap (345 acres), Shelby (233 acres), Health Sciences Center (62 acres), Ohio River Environmental Station (2 acres) and the Horner Bird and Wildlife Sanctuary (200 acres). There are a number of reasons for assessing and managing these 842 acres for biological sequestration, including:

1. Measuring biological carbon sequestration on campus lands can inform or bolster wise, sustainable campus land management policies (e.g., campus tree management, mowing policies, use of native species);

2. Provides new educational or research opportunities (e.g., to understand the carbon cycle and biological sequestration, and to research means of maximizing sequestration); and

3. Reduce impact of the university on climate change.

While the first two are important and sufficient reasons to conduct an assessment of the biological sequestration potential of all university managed lands, the third reason—to reflect an offset to our overall carbon footprint—gets into rather uncertain territory. At most, the impact will be minor from a global perspective. At this point, the American College & University Presidents' Climate Commitment (ACUPCC) does not formally recognize carbon sequestration in calculating greenhouse gas offsets except from composting.

Carbon inventories were designed for national oversight, not at an institutional level. Institutional GHG inventories report carbon dioxide, methane and other annual GHG emissions because these additions continue to destabilize the already-unbalanced current atmospheric carbon equation. The institutional GHG inventory is not meant to be an inventory of all existing institutional carbon exchange, but rather a snapshot of the ways in which institutional activities are further altering the equation of global atmospheric carbon exchange in any given year.

If we understand that entity-level carbon inventories are meant more as a policy tool to reduce the problematic overabundance of GHGs in the atmosphere rather than to scientifically catalog what carbon exists where, the role biological sequestration will play in our inventory reports should become clearer. This is why, while it would not be accurate in this context to report as an offset the carbon sequestered from existing trees, you could potentially count an addition to those trees, or even a change in management practices that resulted in a sustained increase in the uptake of carbon, as an offset to your emissions (assuming it met other offset criteria).

D.1. Current Carbon Sequestration Initiatives

Forty five percent of the dry mass of a tree comes from carbon, and every pound of carbon in a tree equals 1.65 pounds of carbon dioxide kept out of the atmosphere. The university has initiated but not completed an inventory of the trees on campus. The inventory includes data on:

- Species type
- Location (GIS)
- Diameter at breast height (dbh)
- Wood density
- Height
- Condition of the crown

UofL trees sequester carbon while providing beauty, shade and soil stabilization.

There are an estimated 2,400 trees on Belknap Campus alone, which accounts for the majority of trees on the three campuses, but the Horner Bird and Wildlife Sanctuary has a far greater number of trees. The inventory will be completed on the three campuses using faculty and staff from the Department of Biology, Kentucky Institute for the Environment and Sustainable Development, Center for GIS in the Department of Geography & Geosciences and Physical Plant. Students from the Urban Wildlife Research Laboratory and selected classes will be used to complete the inventory, along with practicing foresters from Metropolitan Louisville government, Kentucky Division of Forestry and private foresters. Reductions in atmospheric carbon dioxide are achieved directly through sequestration and indirectly through emission reductions from energy savings derived from trees shading buildings and keeping them cool.

There are a number of models to calculate the sequestration of trees in an urban setting including: Center for Urban Forest Research Carbon Calculator and Urban Forest Effects Model (USFS); CITYgreen (American Forests); Clean Air-Cool Planet; Form EIA-1605 Voluntary Reporting of Greenhouse Gases Program (US EIA); and others. A decision will be made by the inventory team on which model to use for Louisville.

The inventory will also be used as part of the university's recognition from the Arbor Foundation as a Tree Campus USA participant. This well-regarded registry requires an annual submittal by the university to demonstrate compliance with the program's five standards:

- Campus Tree Advisory Committee — Establish a committee comprised of students, faculty, Physical Plant and members of the community with a stake in campus trees to provide advise and guidance.

- Campus Tree Care Plan — Have a clear policy and guidance for planting, maintaining and removing trees. The plan also provides education to the campus community, citizens, contractors and consultants about the importance of the campus forest and the protection and maintenance of trees as part of the growth and land development process.

- Campus Tree Program with Dedicated Annual Expenditures — The program has allocated finances for the campus tree program. It is suggested, but not mandatory, that campuses work toward an annual expenditure of $3 per full-time enrolled student.

- Arbor Day Observance — Hold an Arbor Day observance on the campus or in conjunction with the community where the campus is located. This provides a golden opportunity to educate the campus community to the benefits of the trees on their campus property and in the community.

- Service Learning Project — Engage the student population with service learning projects related to trees.

UofL is organizing to apply for Tree Campus USA status by the end of 2010.

D.2. Carbon Sequestration Goals

Carbon sequestration programs must be developed to meet ACUPCC protocols. The university's program will include:

1. A new policy to systematically replace all dead, wind damaged and removed trees with enough new trees to replace the annual carbon sequestration during the last year, plus match stored carbon within 10 years. Projects to remove trees should include within the budget sufficient funds to plant and maintain the number of needed trees necessary to sustain the campus carbon sequestration rate. The inventory will be used to identify the annual carbon sequestration rate and the total stored carbon for each tree. Trees may be planted on any land owned by the university or within the surrounding community.

2. From the inventory of trees, those that have particular significance due to their size, historic value, unique species and other specific attribute of significance should be identified and protected. Individual trees so identified would require a written determination by the university president that its removal is essential and unavoidable.

Young trees in UofL's Freedom Park will provide decades of environmental services.

3. Managing the campus trees to increase carbon density through selective tree replacement and management. Trees of greater density and size have the ability to store carbon for longer periods of time, and by replacing trees with greater densities the capacity to store carbon can be enhanced.

4. A new program will be established to reduce the release of greenhouse gases from trees upon their removal. Stored carbon in a tree is released back into the atmosphere once the wood is burned or allowed to decompose. To prolong the retention of the carbon, the university will explore the feasibility of milling trees in excess of 16 inches dbh into lumber, land filling or burying logs and slash, chipping and incorporating the chips into soil as an amendment and/or creating log piles to prolong decomposition and to create wildlife habitat. These approaches would prolong the storage of greenhouse gases. Milling trees would provide local economic benefits as well.

5. Biochar is charcoal produced from the slow pyrolysis of organic biomass such as wastes from forestry, clean urban wood waste and residential yard wastes. Pyrolysis is a thermo-chemical reaction where biomass is heated in the absence of oxygen and can use concentrated solar energy as the source of energy. The pyrolysis process that creates biochar also creates gaseous byproducts, commonly referred to as syngas (or synthetic gas), which can be used as a fuel source for the generation of heat or electricity. The production of biochar has been proposed as an effective method for long-term capture and sequestration of carbon in the earth. The entire process is considered a carbon sink, as it returns carbon captured during the photosynthesis of biomass growth to the soil for long-term sequestration in the form of biochar. Biochar is also a valuable soil amendment. A feasibility analysis would determine if a small-scale biochar pyrolysis process would be useful to dispose of campus yard wastes, wood pallets, food waste and removed trees and tree branches to produce syngas and biochar.

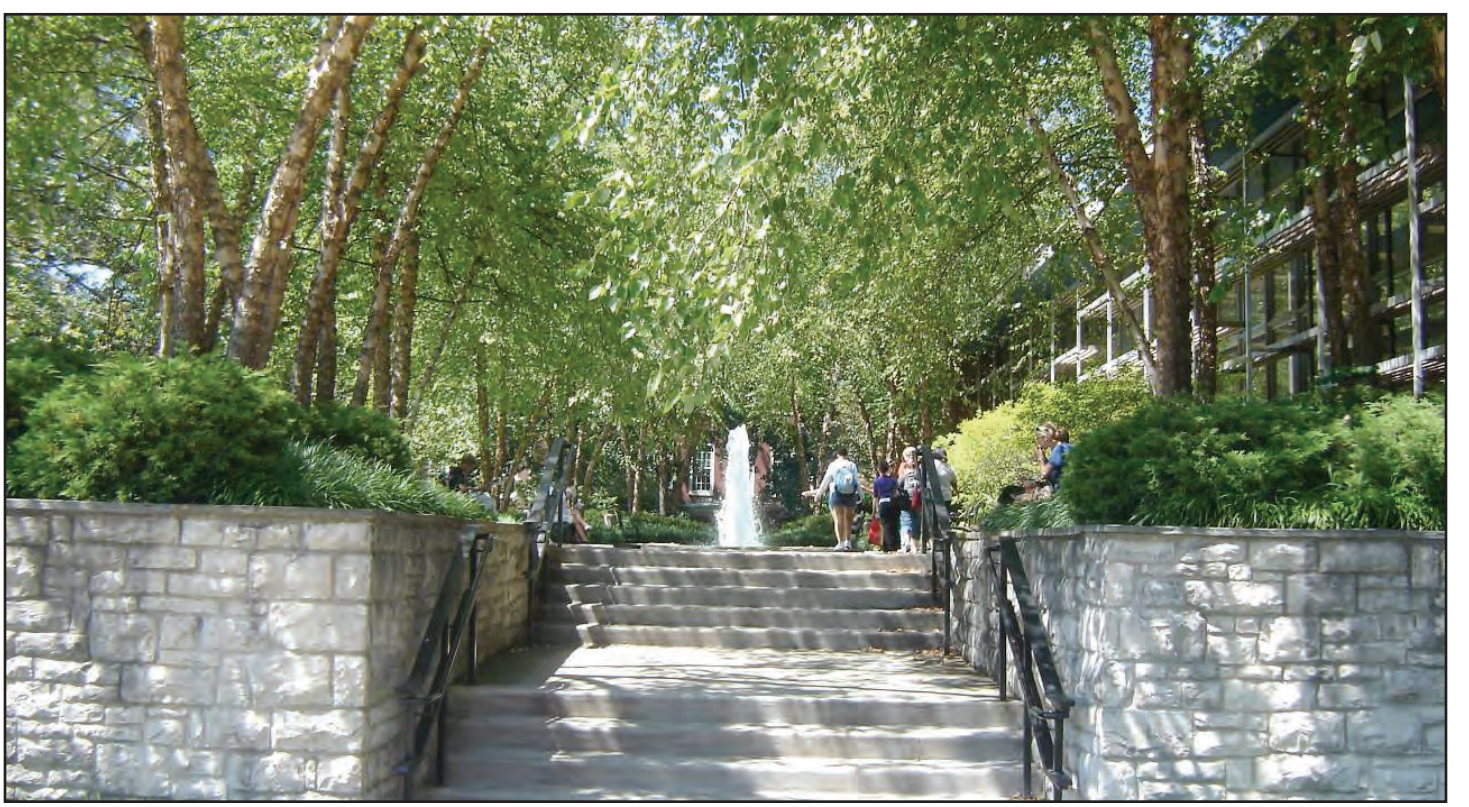
6. Establish an annual tree giveaway program to provide suitable urban seedlings to students, faculty, staff and members of the surrounding community. Prior to, or during the giveaway program, education programs on the benefits of trees, tree species and how to select a site, plant and maintain a tree would be offered.

7. UofL is currently preparing a self-guided tour of campus trees to enhance educational opportunities about the diversity and value of trees. Belknap Campus has a wide variety of trees that are mostly unknown to the campus population. The trees present boundless educational opportunities that eed to be leveraged through publicity about the new campus tree tour and incorporation into the curricula and research agendas.

8. UofL's 200-acre Horner Bird and Wildlife Sanctuary includes open fields and forested areas. Regionally appropriate forest sequestration rates can be used to calculate the sequestration potential of this tract of land. Open fields currently provide a variety of wildlife habitats. A forest management plan should be developed with assistance from the Kentucky Division of Forestry and Fish and Wildlife Service to determine how the resources at the sanctuary could be enhanced. Afforestation is the process of converting idle pasture or cropland to forest land by planting and actively managing the land to grow mature trees. The goal of afforestation projects is to enhance carbon sequestration by allocating lands away from cropland and pasture that may have lower carbon storage capacity to forest cover that has higher carbon storage potential. Research is ongoing in the carbon storage capacity of different types of land uses. However, afforestation is an accepted carbon offset strategy in carbon trading institutions such as the Chicago Climate Exchange (CCX) Clean Development Mechanism under the Kyoto Protocol.

At the suggestion of the Sustainability Council, UofL's Student Activities Board gave away 200 free native tree seedlings (red bud and red oak) during the 2010 Earth Day celebration.

Collectively these programs would allow UofL to meet the ACUPCC's standards and to take credit for carbon sequestered by trees on university property.



E. Master Planning

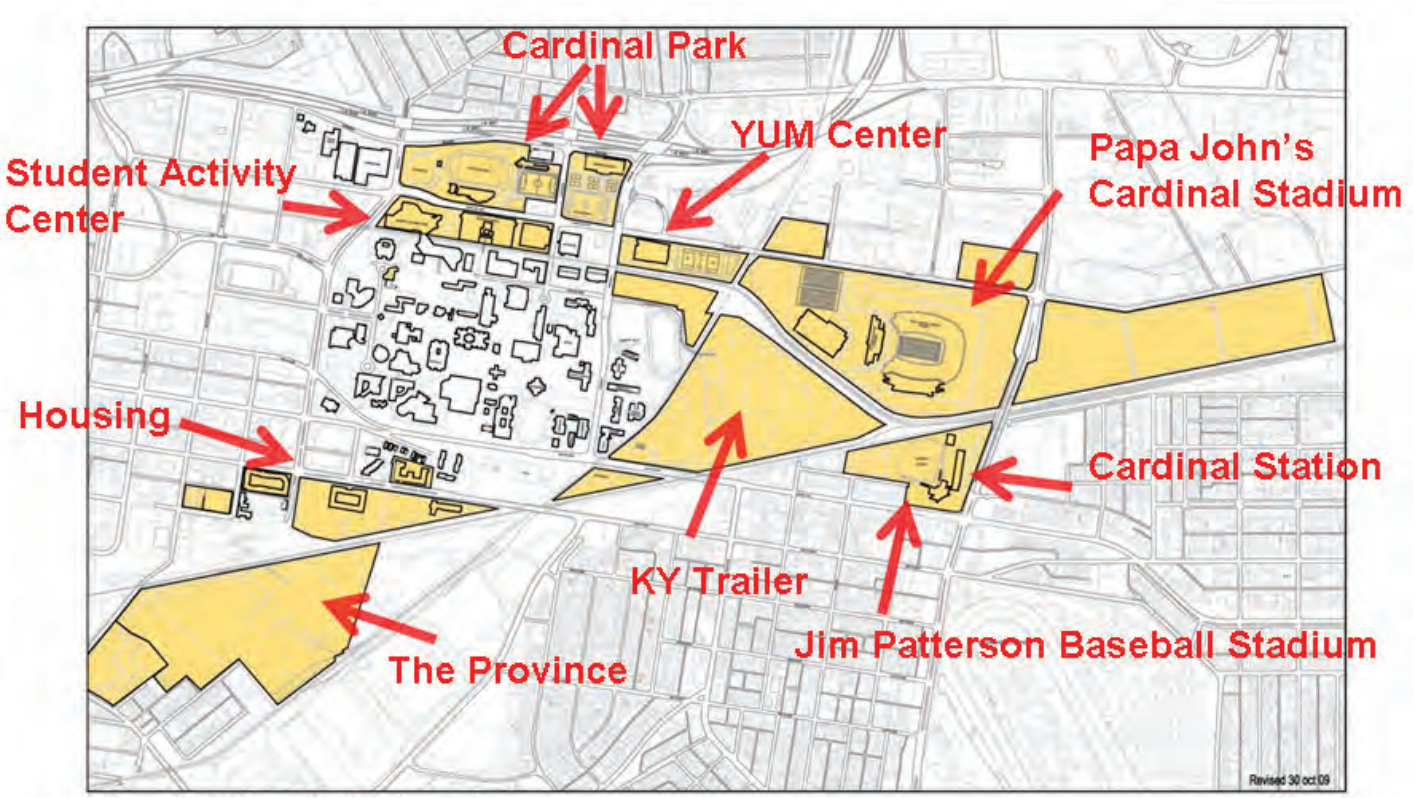
UofL has formally committed to sustainability, defining opportunities for implementation of a wide range of recommendations that demonstrate the university's commitment to become a leader in both responsible growth and stewardship. While fostering a culture of sustainability that involves input from students, staff, faculty and community members, the university aims to continually improve and reduce the institution's overall impact on the environment. It is the university's intention to achieve dynamic growth while demonstrating a commitment to sustainability.

E.1. Past Master Planning Initiatives

The university undertook Belknap Campus and Health Sciences Center master planning efforts in 1975, 1985 and 1993. The most notable sustainability efforts as a result of these plans were in the area of brownfield redevelopment.

Belknap Campus:
After an extensive planning process, brownfields adjacent to and within campus are on their way to becoming an environmentally and socially sustainable community. It is and has been the university's intention to achieve dynamic growth while demonstrating a commitment to sustainability through brownfield reclamation, responsible construction, energy management practices and recycling programs. The university has expanded into areas adjacent to the university and continued to remain a very walkable campus through brownfield reclamation.

In addition to UofL's own brownfield reclamation projects, the university also works directly with partners to responsibly redevelop brownfields adjacent to campus as demonstrated in the recent Province development, which reclaimed land for a major housing property near campus. This has enabled many more of our students to walk and bike to campus. In total, UofL has been involved in the remediation and reclamation of over 200 acres of brownfields in Louisville. One notable project, UofL's Papa John's Cardinal Stadium, received the 1999 Phoenix Award Grand Prize for its use of innovative solutions to redevelop brownfield sites.

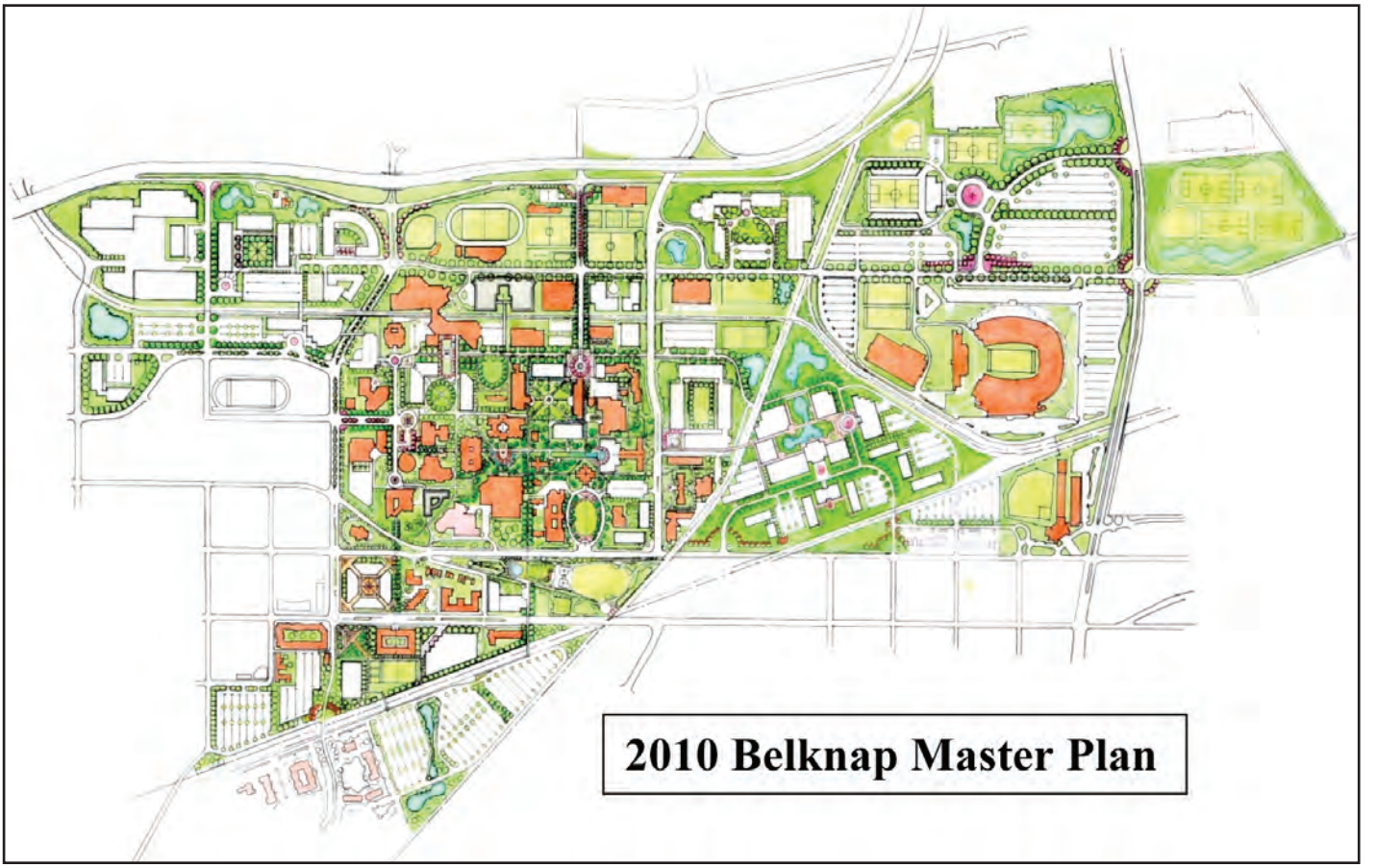


Brownfield Areas, UofL Belknap Campus

E.2. Current Master Planning Initiatives

The 2010 Belknap Campus master plan provides an ambitious and visionary template for future developments. The commonwealth of Kentucky has projected significant growth for the institution and the Belknap master plan targets an increase of 3.03 million additional gross square feet (gsf) of building space. This calls for more than doubling the current amount of space on campus (2.48 million gsf) to approximately 5.5 million gsf. More than 140 land acres will be needed to achieve this target.

While challenging, the projected growth provides exciting opportunities for significant sustainable campus improvements including more brownfield reclamation. The vision is for a greener Belknap campus, with improved accessibility, appropriately located mission-focused buildings, well-organized and generous open spaces, and improved water infiltration. The result will create a comprehensive and distinctive living, working and learning community. The challenge is to achieve this level of growth while reducing our net environmental impact.



E.3. Master Planning Goals

The sustainability portion of the Belknap master plan includes very specific recommendations that need to be implemented as the campus grows. The master plan sustainability report is organized into five areas: energy and climate, buildings, land use and grounds, storm/surface water, and transportation and parking. These were chosen because of their direct relationship to the land use recommendations, their potential positive environmental impact and the opportunity for early implementation. Many of the specific goals of the master plan are discussed in other sections of this document.

Recommendations

The following master plan recommendations will help us achieve our goal of climate neutrality:

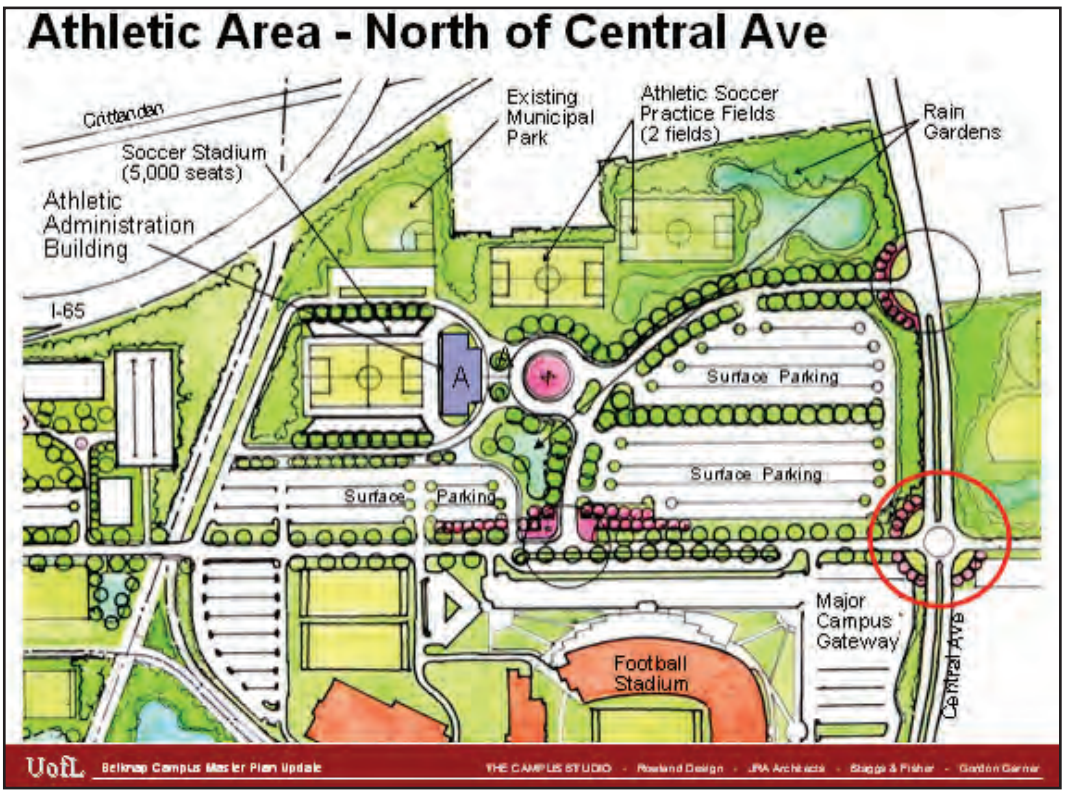
Energy and Climate

- Institute long-term alternative energy initiatives and implement conservation measures needed to achieve carbon reduction goals. (long term)

- Use onsite renewable energy sources. Address future steam loads by adding biofuel boilers. When replacing one of the two multifuel boilers at Belknap's Steam & Chilled Water Plant (likely to occur no sooner than five years from now), evaluation of biofuel as an energy source will be revisited. Additionally, as future campus growth extends into areas not readily served from the current central plant, biofuel should be evaluated along with other viable alternate energy options. (mid term)

- Create a campus that consumes less energy, even as the campus expands by constructing more energy efficient buildings. (short – long term)

- Develop the campus as a model of green planning and innovation. Create demonstration facilities that support sustainability research and technologies such as solar energy panels and wind turbines. Selectively use proposed green space buffers and storm water management areas to test and demonstrate best practices for infiltration and storm water management and other environmental services such as shading to reduce heat island effects. (short – long term)



- Use variable volume heating ventilation and air conditioning (HVAC) systems in new construction and renovations rather than constant volume systems, as they require substantially less power. Some new and existing buildings may be better served by independent HVAC systems such as geothermal. (short term)

- Design chilled water systems for new and remodeled buildings with a 16□F temperature rise (instead of current 10□F) to reduce demand and enable the campus chillers to run more efficiently. Replace the existing R-22 chiller refrigerant with an environmentally friendly refrigerant to reduce green-house gas emissions. (mid term)

- Use the central chilled water plant when practical for increasing cooling efficiencies rather than standalone building chillers at remote sites. (short term)

Buildings

- Renovate existing buildings before infilling with new facilities. Initiate construction in the new campus areas (north, south, east and west campus) only as a last resort. (short term)

- Retain existing buildings that have the potential to meet future space and sustainability targets. Remove those facilities that do not make efficient use of space. (long term)

- Build at a greater density (slightly taller buildings with larger footprints) to optimize energy efficiencies and space utilization. (short term)

- Use underground space (basements) creatively to obtain energy efficiency benefits and to achieve a compact campus, preserving important vistas and open spaces and allowing for the creation of major pedestrian corridors and linkages between key campus areas. (mid term)

- Roofs should be assessed for contributions to the heat island effect. When choosing new construction roofing and when reroofing older buildings, white roofs and green roofs that reduce heat buildup and air conditioning loads should be considered. Some buildings may allow storm water retention through green roofs. (short term)

- Use condensate drainage from building air conditioning systems for use in landscape irrigation and water features rather than treated city water. (short term)

Land Use Patterns

- Extend the collegiate setting into potential acquisition areas. (short term)

- Remediate and reuse contaminated sites for buildings, parking, storm water management, recreational uses, open space and plantings, and infrastructure improvements. (mid term)

- Coordinate land uses to discourage sprawl and minimize hard surfacing to create a walkable campus and reasonable infrastructure costs. (mid term)

- Coordinate walkways, bikeways, open space and the road network. Create a continuous open space network. (mid term)

- Achieve building densities consistent with the existing character of the campus as conveyed by the relationship of open green space and buildings. (mid term)

Grounds

- Eliminate existing hard surfaces if not needed. (short term)

- Prepare natural resource inventories for vegetation, water quality, etc., to assist with indigenous plants, land- and water-scaping. Use and protect native plant species and avoid using exotic or invasive species. This reduces the need for irrigation and power landscaping equipment, which are a source of greenhouse gas emissions. (mid term)

- Create additional open space areas to screen and buffer undesirable views; add accent plantings and signage to emphasize major entries and arrivals; and plant street and walkway trees to shade and visually enclose important corridors. (mid term)

- Use tall canopy trees to define the edge of campus and to line walks and major roads, thereby creating shade. Project a park-like image via the development of an expanded urban forest. Formalize the campus tree inventory into a campus tree management plan. Work with metro government and the Kentucky Department of Transportation for tree planting improvements in nearby public rights of way. (short term)

Belknap Campus features a park-like atmosphere with some of the oldest trees in the neighborhood.

- Use new lighting technologies such as LED, solar and cutoff illuminates, which direct the light downward onto the walk surface thereby minimizing light pollution and energy inefficiencies. Develop a comprehensive lighting plan. (short term)

- Budget 15 percent of building cost for site treatments and grounds-related sustainability enhancements. This percentage is higher than historic levels, but is supported by university commitments and new state laws and regulations. (short term)

Transportation and Parking

- Implement traffic demand management strategies that encourage carpooling by providing preferential parking opportunities. (mid term)

- Use shuttle buses to transport commuters from major near-campus parking areas. This currently includes connections to the stadium area, but should also include shuttle service from off-campus housing locations, park-and-ride lots along interstate roadways and the major surface lots proposed west of the CSX railroad tracks (Exxon and Allied Drum property). (mid term)

- Work with the regional mass transit agency to coordinate campus accessibility and transit utilization. Work with the TARC city bus system to implement a strategy that employs alternative fuels, such as hybrid diesel, and electric batteries as fuel sources. These are quieter, reduce fuel consumption by 30 percent, and lower maintenance costs by 30–50 percent. (mid term)

- Improve campus shuttle service for faculty and staff needing to travel within the campus, as the campus expands. (short term)

- Consider increasing the cost of parking permits and (continue to) provide free transit rides. (mid term)

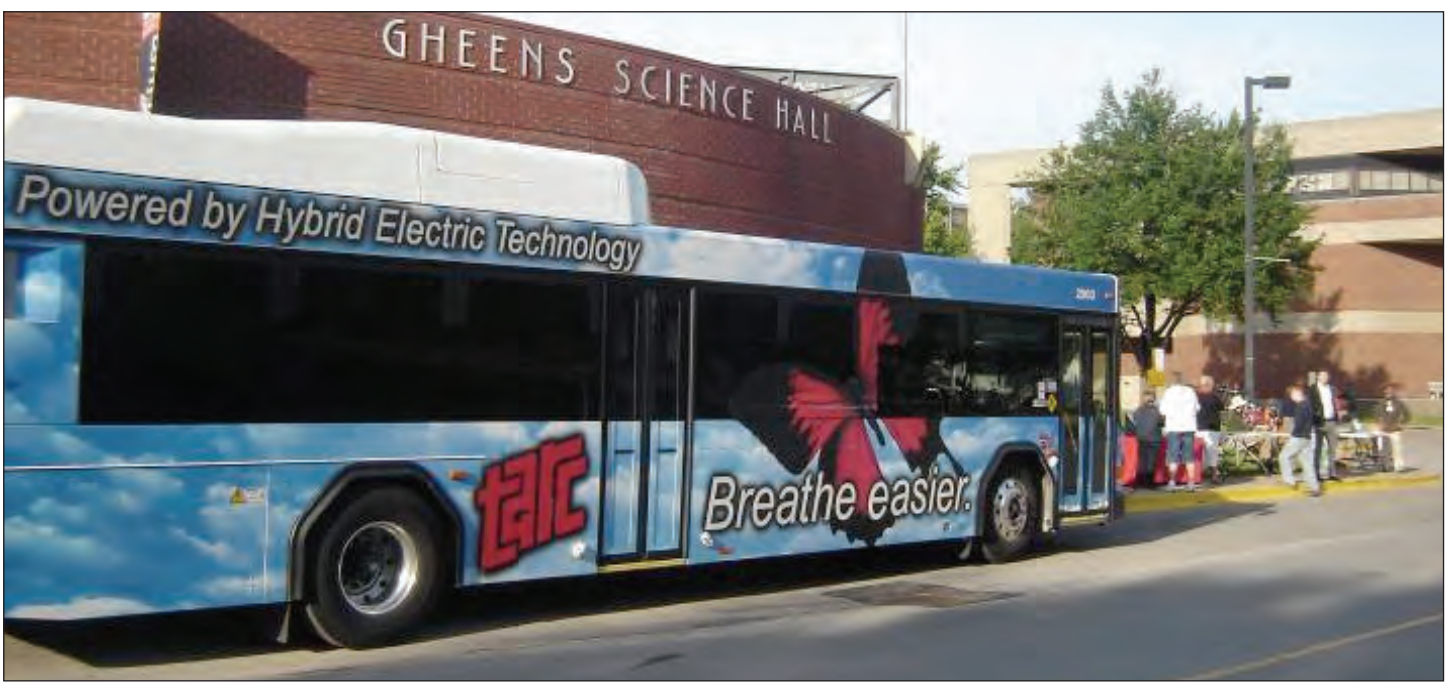
- Design and create bicycle routes to facilitate accessing the campus regionally, when traveling from perimeter shuttle lots and moving within the campus. City and university representatives need to jointly define area routes. Make a coordinated effort to provide a campus bike path system and bicycle storage facilities. (mid term)

- Configure the campus to encourage and support pedestrian movement by offering efficient and safe pedestrian walks that lead to the campus and connect primary campus destinations. (short term)

- Provide university support and incentives for faculty and staff to move into houses close to campus so they can walk rather than drive. (mid term)

- Replace large surface parking lots with more concentrated parking garages. (mid term)

By undertaking a master plan approach guided by sustainability and related green initiatives, UofL is among a select group of higher education institutions redefining a new way of doing business and tackling many of the complex needs of a modern university campus.



TARC is expanding its fleet of hybrid buses and its service to UofL campuses.

F. Green Building Design

F.1. Current Standards and Policies

Pursuant to KRS 56.770-784 and the recently filed administrative regulations, 200 KAR 6:070 High Performance Building Standards, construction and major renovation projects must adhere to new criteria in the design and construction of such projects.

This new criteria is based on the Leadership in Energy & Environmental Design (LEED) Green Building Rating System for New Construction and Major Renovation 2009 standards, as adopted by the U.S. Green Building Council.

The LEED standard required will vary depending on budgeted project size. Projects considered "major renovations" are those where the budget exceeds half the insured value of the building being renovated.

This variable standard is applied as follows:

- All new construction and major renovation building projects in the amount of $25 million or more shall be designed, built and submitted for certification to achieve LEED Silver level or higher.
- All new construction and major renovation building projects budgeted between $5 million and $25 million shall be designed, built and submitted for certification to achieve LEED Certified level or higher.
- All new construction and major renovation building projects greater than $5 million in budget shall additionally achieve a minimum of seven points for new and for existing buildings under the LEED Energy and Atmosphere Credit 1 – Optimize Energy Performance.
- All new construction and major renovation building projects budgeted between $600,000 and $5 million shall be designed and built using the LEED rating system as guidance.

The university has also adopted a green purchasing policy that addresses this as follows:

- Green purchasing concepts shall be integrated into architectural designs, final construction documents and into the final construction of all UofL buildings, renovations of property or facilities owned by UofL.
- All new campus construction as well as large renovation projects will target the U.S. Green Building Council's LEED Silver standard or equivalent. This policy covers all building types as well as building components.

UofL is designing and constructing buildings that reflect our commitment to sustainability.

F.2. Current Green Building Initiatives

The LEED Green Building Rating System encourages and accelerates global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria. The following buildings on all three UofL campuses have already been designed to achieve LEED certification through a wide variety of performance measures such as energy efficiency, water reuse, access to alternative transportation, construction waste recycling and the use of locally sourced and recycled-content materials:

- Center for Predictive Medicine – scheduled for completion in 2010

- Clinical & Translational Research Building – certified in 2010 by USGBC as LEED Gold for new construction. One of the largest LEED Gold research buildings in the country (288,000 square feet).
- Dental School Renovation – estimated to be completed by fall 2011.
- Duthie Center Renovation – certified in July 2010 by USGBC as a LEED Gold renovation.

Clinical & Translational Research building at the Health Sciences Center.

F.3. Green Building Goals

- The university should continue to strive, when financially feasible, to build to a minimum of LEED Silver for all future construction and major renovation projects. (short term)

G. Composting & Horticultural Pratices

The university's composting initiative has been significantly scaled up in recent years, initially due to the abundance of material resulting from tree damage caused by Hurricane Ike in 2008 and the ice storm in early 2009. In July 2010, UofL began its first trial of onsite food waste composting as well.

G.1. Current Initiatives in Composting & Horticultural Practices

Composting

The university composts selected yard wastes for use as mulch in landscape beds throughout Belknap Campus. These items are tub ground once or twice per year in an effort to decrease their size and combine the materials. They are then put into piles based on age and turned regularly to aerate the materials. Irrigation for the operation is supplied only by rainfall. After the items have decomposed to a satisfactory state, they are utilized on campus as mulch/compost or given to the university community.

On-campus mulch/compost piles.

From 2003–2009 UofL diverted more than 1.55 million pounds of yard wastes from the landfill by converting them to useful organic mulch and compost. In recent years, UofL has been composting an average of 37 short tons of material per year, leading to the sequestration of 14 MT eCO2 (metric tons of carbon dioxide equivalent released to the atmosphere each year annually).

In 2010, the university took steps to begin a pilot program for food waste composting and vermiculture on Belknap Campus. Food waste has historically accounted for a significant portion of the waste that is sent to the landfill, especially by weight. This waste is now reimagined as a resource and plans are being developed to capture as much food waste as practicable for composting onsite in conjunction with our existing yard waste composting operations. This will reduce the scope 3 greenhouse gas emissions associated with transporting and land filling our food waste while producing a rich organic fertilizer that could be used to maintain campus grounds instead of petroleum-based inorganic fertilizers. (short term)

An on-campus food waste composting project is just beginning.

Landscaping

Native trees, shrubs and grasses are specified for landscape plantings. When non-natives are utilized, they are selected for their resistance to insects and disease. Non-native plants must be hardy in planting zones 6–7 (the type that thrive on our campus) to best ensure they will thrive with minimal maintenance. This reduces the need for irrigation and power landscaping equipment (a source of greenhouse gas emissions).

Turf grasses

Fescues are selected that grow best in the various sun/shade levels around campus. Specific cultivars are selected based on data collected for the National Turf grass Evaluation Program (NTEP) by the University of Kentucky at Spindletop Farm in Lexington, Ky. Only varieties that score highly in this program are used in the lawns on campus. This reduces the need for irrigation, fertilizers and power landscaping equipment, which all contribute to greenhouse gas emissions.

A micro-clover lawn area was planted on the west side of Miller Information Technology Center (MITC) in fall 2009 to study its feasibility as a lawn area. Micro-clover releases nitrogen into the air, which fertilizes the grass and helps maintain its healthy appearance. Along with requiring much less fertilization, micro-clover also needs less mowing than traditional lawn grasses. The area next to MITC is only mowed about once per month. Similarly, the Center for Predictive Medicine has a newly planted native grass mix that needs to be mowed just twice each year.

UofL's micro-clover lawn is an experiment in lower maintenance.

Mowing and Trimming

Lawn clippings are always returned to the soil for nourishment to reduce fertilizer needs. Mowing heights have been raised to the upper end of recommended levels to ensure a deeper-rooted, healthier turf grass and less use of lawn equipment. All push mowers have been converted to operate on cleaner-burning propane fuels.

G.2. Composting & Horticultural Practice Goals

- Continue utilizing the green waste from campus grounds maintenance to produce a useful product through composting. The university should install a permeable concrete pad to increase the efficiency of turning the mulch piles to aerate them. Cost estimate: $60,000 one-time expense. (short term)

- Continue and expand the program for food waste composting and vermiculture on Belknap Campus and consider opportunities to expand the diversion of organic matter from the landfill and to engage researchers, staff and students in the efforts. Labor costs to turn compost piles: $4,000 continuing annual requirement (CAR). (short term)

- Explore efficiencies to be gained from larger propane-powered lawn equipment and propane conversion of four-cycle string trimmers and hedge trimmers. (short term)

- Install two rain gardens by 2011 and implement a plan to mitigate storm water runoff. (short term for plan, mid term for implementation)

- To save both water and the energy required to pump it, a central irrigation control system is being considered for Belknap Campus. This control system will irrigate based on real-time soil moisture data as well as evapotranspiration data. Currently the environmental conditions are monitored and our 18 automatic irrigation controllers at Belknap are manually based on weather data. Central irrigation control can reduce water consumption by as much as 30 percent. (short term)

H. Behavior Change: Green Team Pilot Program

Awareness is a key factor in gaining support from the campus community to achieve the goal of energy conservation and greenhouse gas reduction. The university has and continues to develop programs to educate our community on the importance of sustainability in their jobs and lives.

Historically, no single person or office has been responsible for managing energy use at UofL. The university does not have meters on most buildings and must rely on master meters to determine aggregate energy consumption. Energy costs are not evident to managers since it is accounted as an indirect cost. Faculty, staff and students generally receive no information on the amount of energy they consume and therefore have little motivation to use energy efficiently. We are beginning to seek ways to turn these trends around.

H.1. Recent Green Team Initiatives

Beginning in 2007, the College of Arts and Sciences (A&S) "Green Team" developed and began to pilot a "12 by 12" energy conservation plan aimed at reducing energy use by 12 percent in 2012 from a 2006 baseline. To meet this goal, A&S Green Team members embraced and applied a multistage transtheoretical model of social and cultural change with a longstanding history of promoting behavior change in the health field. The model integrates key constructs from other theories of behavior change and incorporates a process model describing how individuals can move from having literally no awareness of their poor behavior to acquiring sufficient knowledge to make positive behavior changes. The central organizing construct of the model involves five stages of change, which refer to a progression individuals typically move through when either giving up unhealthy behaviors or adopting new, healthy ones:

1. **Pre-contemplation** — is the stage in which people are not intending to take action in the foreseeable future, usually measured as the next six months. The goal for these individuals is to increase awareness of the extent and impacts of energy use.

2. **Contemplation** — is the stage in which people are intending to change their energy use patterns in the next six months. They are more aware of the pros of changing but are also acutely aware of the cons. The goal for these individuals is providing information on actions that they can take that will make a difference.

3. **Preparation** — is the stage in which people are intending to take action in the immediate future, usually measured as the next month. These individuals need to be empowered to reduce energy use.

4. **Action** — is the stage in which people have made specific overt modifications in their lifestyles within the past six months to use energy more efficiently. The goal for these individuals is to provide support and feedback on the impact of their action.

5. **Maintenance** — is the stage in which people must be diligent not to relapse back to old, wasteful behaviors. Kentucky's cheap energy has meant that energy efficiency is a low financial priority. Kentucky is ranked #6 among the nation's states in per capita energy consumption and continuous reinforcement on the need to use energy efficiently will be required to prevent people lapsing to inefficient habits.

The university has started a coordinated social and cultural campaign to change behavior to address each of these stages. A preliminary survey would assist in determining with greater certainty just how many students, faculty and staff are at the various levels of behavior to better focus and prioritize programs. An important feature of the transtheoretical model is that interventions are specifically tailored to each stage of awareness or change.

H.2. Behavioral Change (Green Team Pilot) Goals

The recommendations below are to be piloted by the A&S Green Team, with the hopes of being fully implemented university-wide. The university community will get the benefit of many of the recommendations regarding things such as communications as they are being implemented by A&S.

Pre-contemplation stage programs

1. **A&S departmental awareness** — Fully pilot this energy conservation plan in the College of Arts and Sciences. Departmental chairs should be made aware of the plan's goals and provisions. This should be conducted through college departmental chair meetings with the dean. Chairs should be informed of plan goals, solicited for ideas to improve the plan, and their support should be secured to assure success.

2. **Incorporating the plan into the classroom** — Encourage faculty to incorporate elements of the energy conservation plan into existing curricula of offered classes. Faculty across A&S should be encouraged to identify ways to incorporate energy use and conservation into class curricula.

3. **Faculty and student organizational awareness** — Discuss the plan's goals and provisions with the Faculty Senate, Student Government Association, and Housing and Residential Life program. The goal is to make these university-wide organizations aware of the plan's goals and provisions and to solicit their input into the final plan.

4. **Implement awareness campaign** — Develop and implement an awareness campaign on energy. The logo for the campaign could be, "When not in use, turn off the juice," to reflect that the campaign is focused on meeting this goal by changing faculty, staff and student energy use behavior, primarily to turn off lights and equipment when they are not being used. The campaign should focus on three points:

   I. **Fiscal** — What is the university paying for energy?

   II. **Environmental** — What are the direct (air and water pollution) and indirect (coal mining, natural gas exploration and drilling) impacts of energy use?

   III. **Public health** — What are the public health impacts of energy use?

The campaign should be conducted through print media like the Cardinal student newspaper and posters/banners in buildings. It should also be conducted verbally through public service announcements at athletic events, and electronically on the university website, monitor boards in A&S buildings and e-mail communications such as UofL Today. This will serve as a constant reminder to faculty, staff and students that unnecessary energy use has a consequence and that the goal of the university is to reduce its energy use while providing feedback on progress made to date toward that goal. Other elements of the plan that are already in effect include:

a. **Light plate stickers** — The university printed and pasted a sticker reminding everyone to turn off lights when they leave a room. Priority was given to personal offices and rooms.

b. **Student and new employee orientation** — New members of the campus community are informed about the university energy policy and given a brief overview of the university's energy reduction goals during student and new employee orientations. The presentation includes a variety of practical tips for reducing energy use.

Contemplative Stage Programs

1. **University-wide education** — The university community already receives a weekly green tip through UofL Today. More could be done to engage the community, including creating a column in the Cardinal and on the UofL website to allow students and employees to ask a question on energy to learn more about ways to reduce energy use. A fact sheet on energy use and energy costs per piece of equipment should be developed and made available to help make informed decisions on equipment purchases.

2. **Organizational unit assessments** — Create an electronic spreadsheet and ask organizational units to calculate the amount of energy they consume. The spreadsheet would provide information to encourage the unit to reduce its overall energy use. The assessment would also provide a context for the group to under stand the impacts of its energy use.

Members of the campus community are encouraged to commit to at least three green actions through the Cards Go Green! Pledge at public events such as Earth Day and Campus Sustainability Day.

3. **Competitions** — Conduct staged events to promote awareness of energy using competition between organizational units (including residence halls and other local student housing) and games to increase participation.

4. **Individual education programs** — Continue gathering signatures on the "Cards Go Green! Pledge," which lists actions individuals can take to reduce their energy use and environmental impact. The goal is to provide information to those in the contemplative stage on actions they can take that will make a difference. Information on ways to reduce energy use should be added to the university website.

5. **Energy self assessments** — Create an electronic spreadsheet, accessible through the web, that individuals can use to calculate their personal energy use and provide information on actions that they can take to reduce that energy use.

Preparation Stage Programs

1. **Appoint an Energy Conservation Team** — This A&S team should be provided clear roles and authority to implement the plan. The energy manager must have authority to implement changes and enforce structural changes and psychological initiatives approved by the energy team. This plan will be piloted in A&S to identify problems and measure the impact and effectiveness of programs developed. Upon successful implementation of the pilot program, the energy conservation plan should be expanded university-wide.

2. **Benchmark** — Compare UofL's per capita energy use against peer benchmark universities. The report will be published annually.

3. **Survey of energy use** — Conduct a survey (executed by the energy team) to obtain information on energy use within the college.

4. **Establish benchmarks** — Develop energy-use benchmarks to measure any energy reductions realized. The benchmarks may include metered energy usage, calculated energy usage and/or energy use behavioral changes.

5. **Organizational unit and building competitions** — Hold competitions between organizational units and/or buildings within A&S for recognition as the most energy efficient unit. To become eligible each unit would complete specified steps such as:

    a) Replace all personal refrigerators with departmental Energy Star refrigerators (representing up to a 50 percent savings over other refrigerators).

    b) Program all personal computers to hibernate when idle, and program all printers and copiers to default to double-sided printing.

    c) Remove all personal space heaters.

Once eligible, the organizational units could then describe other actions they have taken as a group to become more energy efficient and educated. The energy team will select those units that have reduced their energy consumption by the greatest percent. The recognition will be determined by the dean.

A similar competition should be established for students living on campus in residence halls. Some of these buildings have electric meters that allow direct measurement of energy reductions. Students will be provided education materials and technical assistance, and each hall will establish its own energy-reduction goals. The winning hall will be provided recognition and a reward determined by the Housing director.

Action Stage Programs

1. **E-Corps** — Establish a corps of students within A&S to assist in implementing energy conservation projects. The corps would be composed of 8–10 work-study students under the supervision of the university energy manager. As an example, the corps could take light readings in individual offices and, working with the employee, determine if offices are excessively lighted. They could provide educational programs on energy use and actions that could be taken to reduce energy use. They could check energy usage for specific pieces of electronic equipment.

2. **Restrict use of selected electronics** — Implement requirements within A&S to eliminate the following electronic products:

    a) **Personal refrigerators** — should be replaced to the extent possible by offering college units new Energy Star refrigerators if the entire unit eliminates five or more small (and energy inefficient) refrigerators.

    b) **Personal space heaters** — are both energy intensive and a safety problem. Heaters should banned for office use unless employees contact Physical Plant and document that the building HVAC system is not capable of meeting heating and cooling policies adopted by the university. The program will be phased in over a one-year period.

3. **IT support staff** — Instruct IT support staff in all A&S departments to set all existing and new computers to hibernate after 15 minutes of inactivity, to use a black rather than blue background and to program printers to default to double-sided.

4. **Building zone contacts** — Instruct all building zone contacts in A&S to instruct all cleaning and security staff to turn off lights when they are done cleaning.

5. **Green models** — Create model residence hall rooms, offices, labs and classrooms that incorporate energy efficient lighting and electronic equipment, to show what environmentally sustainable rooms would look like.

6. **Empowering employees and students** — Encourage employees and students to suggest ways the college can reduce energy use. The person could be rewarded through a recognition program and also monetarily from an employee suggestion pool, with the amount based on how much their idea is estimated to save the university.

The A&S Green Team sponsored a 2009 project for interior design students to create a model green residence hall room. The result features bamboo flooring, ceiling fans and extensive day lighting.

Maintenance Stage Programs

1. **Annual report** — The energy team should prepare an annual report on energy usage to provide feedback to employees and students on the impact of the programs described previously.

2. **Feedback** — Provide continuous feedback on energy reductions achieved. Although most residence halls are sub-metered, many of the buildings housing A&S departments are not individually metered. Feedback on Belknap Campus energy efficiencies measured at master meters and calculated energy efficiencies based on changes made within the college should be reported to departments and housing units on a monthly basis. The calculated energy efficiencies will be based on measured efficiencies for specific actions, e.g., changing light bulbs, programming computers to hibernate, eliminating or replacing refrigerators, etc.

3. **Continual education and engagement** — To avoid people slipping back into previous behavior patterns, a program for continually educating and making individuals aware of the consequence of energy use should be developed and implemented.

All of these recommendations are of a short-term nature in regard to the pilot project. Hopefully, many of them would be moved to institution-wide projects in late short term and into mid term.

UofL's Sustainability Council seeks to continually educate and engage the community through regular events such as Campus Sustainability Day.

I. Behavior Change: University-wide

The university has done many things to promote behavior change that are described throughout this report. Many more things can be easily promoted through policy change or simply through effective communications with the campus community.

I.1. Behavior Change (university-wide) Goals

Building dashboards — Consider purchasing systems to provide information to specific building occupants on energy use within their building. This would assist with competitions and challenges between buildings. If occupants can see how much energy their and other buildings are using, they will have much more motivation to conserve. (short term)

Computers — Regularly remind employees and reinforce with Tier I staff to mitigate the impact of an estimated 15,000 computers in use at the university through the processes listed below. National estimates indicate that most PCs are not being used most of the time they are switched on. In addition, 30 – 40 percent of all PCs are left on overnight and on weekends. (short term)

- Turn off PCs, monitors, printers, scanners and copiers every night and on weekends. Turning off a computer helps reduce heat stress and wear on the system.
- Look for efficient Energy Star models when purchasing PCs, monitors, printers, fax machines and copiers.
- Enable the sleep settings on computer monitors. Screen savers do not save energy but sleep settings do.
- Purchase smart surge protectors that detect when the computer is shut off and automatically turns off all peripherals. (73 percent energy reduction)
- Purchase surge protectors with motion detectors to turn off the computer when no one is around.
- If appropriate, use ink-jet printers, which consume 95 percent less energy than laser printers. Similarly, laptops use 90 percent less energy than desktop computers.
- Only buy a monitor as large as needed; a 17-inch monitor uses 40 percent more energy than a 14-inch one. Also, the higher the resolution, the more energy needed.
- Use flat screen monitors, as they consume only 20 percent of the energy used by CRT monitors.
- Wait until ready to use a PC before turning it on and do not turn on the printer until ready to print. Even idle equipment consumes energy.
- Turn off computers if they are not going to be used for more than 15 minutes. The surge of power used by a CPU to boot up is far less than the energy used by the unit when left on for over 3 minutes.
- Try to schedule computer-related activities to do all at once, keeping the computer off at other times.
- Use a printer that can print double-sided documents. When making copies, use double-sided copying. Set default settings to double-sided.
- Turn off surge protectors for computers, printers, faxes, battery chargers, televisions and stereos with remotes to avoid phantom energy consumption.
- Turn off the backlight on laptops.

Lighting — Remind employees of the recommendations listed below on a regular basis. Lighting is the most prevalent use of energy on campus. Many campus users turn on multiple lights, whether it is needed or not. Often luminance levels in offices exceed recommended lighting levels. (short term)

- When repainting office spaces, always choose a white or off-white color to maximize wall reflectivity and the efficient use of lighting. Lighter room colors significantly reduce lighting needs.
- Turn off lights when a room will be empty for 15 minutes.
- Don't turn on lights when there is adequate natural sunlight.
- Use task lights to reduce use of overhead lights.

Effective use of daylight can eliminate the need for artificial lighting and improve moods. The Clinical & Translational Research building was designed with this in mind.

Refrigerators and vending machines — Refrigeration is one of the most energy intensive consumers of electricity both in the home and at the university. A soft drink dispenser uses approximately $140 of energy annually. Refrigerated vending machines, water faucet chillers, cold storage rooms, ice machines, refrigerators and freezers are large energy users. Currently about 30 percent of the university's soft drink machines have vending misers attached. The following suggestions should be enforced by departmental managers and the purchasing department when possible. (short term)

- Upgrade all refrigerators to more energy efficient Energy Star models.
- Utilize common departmental refrigerators rather than personal refrigerators. Consider a policy to not allow the use of personal refrigerators.
- Work with vending machine vendors to negotiate installation of vending misers on all machines.

Building temperatures — It is common to find inefficient personal space heaters and fans being used around campus. In many cases this is due to inadequate controls at the individual office that are not thermostatically controlled, but rather controlled by a fan on the radiator. Employees should be reminded regularly of the following suggestions:

- Keep windows closed in buildings that are being air conditioned or heated to prevent loss of conditioned air.
- Encourage employees to dress in layers to stay comfortable. This saves energy and reduces the chance of conflict with others who share the space. Thermostats should be kept within the ranges in the campus energy policy.

Laboratories — Research laboratories have strict air exchange requirements, making them energy-intensive to heat and cool. Laboratory employees need to be made conscious of this fact and regularly reminded of the following suggestions:

- Fully lower fume hood sashes when not in use to prevent loss of conditioned air within the building.
- Turn off equipment when not in use. This includes everything from bio-safety cabinet fume hoods to hot plates, lights and computers.
- Shut hallway doors as much as possible. This is a safety measure and it helps balance the air system in a laboratory.
- Wait until you have a full load before operating automatic glassware washers.
- Keep refrigerator and freezer coils clean and doors properly sealed.
- Consolidate contents of refrigerators or freezers – a full appliance is more efficient. Turn off any empty, unused appliances after consolidation.

Laboratories in the Clinical & Translational Research building are designed with efficiency and employee wellness in mind.

J. Recycling Programs

J.1. Current Recycling Initiatives

UofL has an aggressive landfill diversion program to minimize landfill waste and its associated carbon footprint. The university has been recycling since 1991, beginning with a program focused on sorted office paper, cardboard, coal ash and tires. Items such as newspapers, magazines, catalogs, plastic bottles and aluminum were not collected for recycling until 2010.

2003–2009 UofL Recycling Statistics		
	Gals.	Lbs.
Coal Ash		5, 299,440
Mixed Office Paper		2,648,480
Cardboard		3,391,085
Scrap Metal, White Goods		1,479,844
Compost		1,551,000
Batteries, Lamps, Ballasts		108,728
Electronic Scrap		126,712
Aluminum		52,113
Tires		8,070
Rendering oil	8,900	
Petroleum Products, Antifreeze	12,543	

Single Stream Recycling

In 2009, a request for proposals (RFP) was written to solicit a vendor who could accept all recyclable items in a single stream method. Single stream recycling is the term used for a system in which all recyclable items can be mixed together during the collection stage and then sorted off-site. Education, training and support by the potential vendor were a large part of the RFP. From the two firms that submitted proposals QRS Inc. was chosen.

In this system, every office, classroom and common area has a container for mixed recyclables. Custodial staff are responsible for collecting the materials and placing them into the recycling dumpster. An 8-yard, single stream recycling dumpster is placed by each garbage dumpster. Recycling dumpsters are emptied according to a schedule that is dictated by how often they are full. This may be daily in some cases and every two weeks in others. The recycling truck then takes the items to the nearby mixed recycling facility where items are sorted through a combination of automation and manpower. Recyclables are then bundled by commodity and sold to processors.

Garbage Reduction Program/Mini-Bin

Coupled with the new single stream recycling initiative is a waste reduction program featuring a desk-top garbage can called a mini-bin. The lidded mini-bin holds about 1 quart. It has a slogan on the side that reads, "This is all the GARBAGE I make!" The smaller desk-top can is for any item that cannot be recycled in the single stream system, the idea being that most items that were considered trash now can be recycled. The small size of the mini-bin causes one to think about what they are trying to dispose of and whether the item is recyclable.

In the new program, each individual is responsible for emptying his or her mini-bin container while recyclables are collected by the janitorial staff – reversing the former disincentive of the old system to recycle. The university is in the process of replacing all larger desk-side trashcans with the mini-bin. This system is being rolled out across all three campuses throughout 2010.

Electronics

Old but working computer equipment is mostly repurposed throughout the university or passed to university affiliates such as the Family Scholar House or No Child Left Behind. Students are encouraged to donate their used cell phones and computers through the university's e-waste recycling programs. Additionally, annual swap shops and Earth Day events reinforce campus recycling.

Any PCs not meeting requirements of the repurposing will be recycled through UofL's new contract with GES, a nearby zero-landfill, zero-export e-waste recycling facility that focuses on reuse possibilities.

UofL's iTech Xpress has partnered with Verizon Wireless to be a campus collection center for Verizon's HopeLine project. Through HopeLine, cell phones donated at the iTech Xpress collection center are refurbished and given to those in need. Those phones without value are recycled in an environmentally friendly manner.

Chemical Redistribution Program

The best method for chemical waste minimization in laboratories and clinical areas is up-to-date inventory control. Product substitution with a nontoxic or less hazardous chemical should also be considered. Chemical purchases can often be reduced by sharing chemicals between laboratories. Departments are encouraged to exchange chemicals whenever possible.

Not all the chemicals picked up by the Department of Environmental Health and Safety (DEHS) are a waste. In some cases, these chemicals can be used by someone else at the university. DEHS supports a redistribution program called "Chem Cycle," which provides a double cost savings for the university. It not only decreases the amount of new chemicals purchased, but eliminates the need for expensive disposal.

Construction Waste

The LEED guidelines UofL has adopted for all of its construction and major renovation projects provide detailed guidance for the recycling of waste materials at construction sites. It is the university's intention to keep as much construction waste out of the landfill as is feasible.

Materials Exchange

The Department of Purchasing, Surplus Division maintains both a physical surplus swap shop on campus and a website that allows authenticated campus users to post items they no longer need for anyone else who could use the products for official university use. The possibility of utilizing this site for the purpose of making available packaging materials received during the course of deliveries is being explored. The intent of the materials exchange is to increase the reuse of items and to divert the goods from the landfill or recycling stream.

J.2. Proposed Recycling Recommendations

- Continue to implement and promote the single stream recycling and mini-bin garbage reduction programs in all buildings university-wide. (short term)
- Convert outdoor garbage bins along campus walkways to recycling bins. (short term)
- Expand the number of Big Belly solar trash compactors in high-traffic areas to reduce the number of collections required. (short term)
- Establish a system for campus exchange and reuse of packaging materials. (short term)

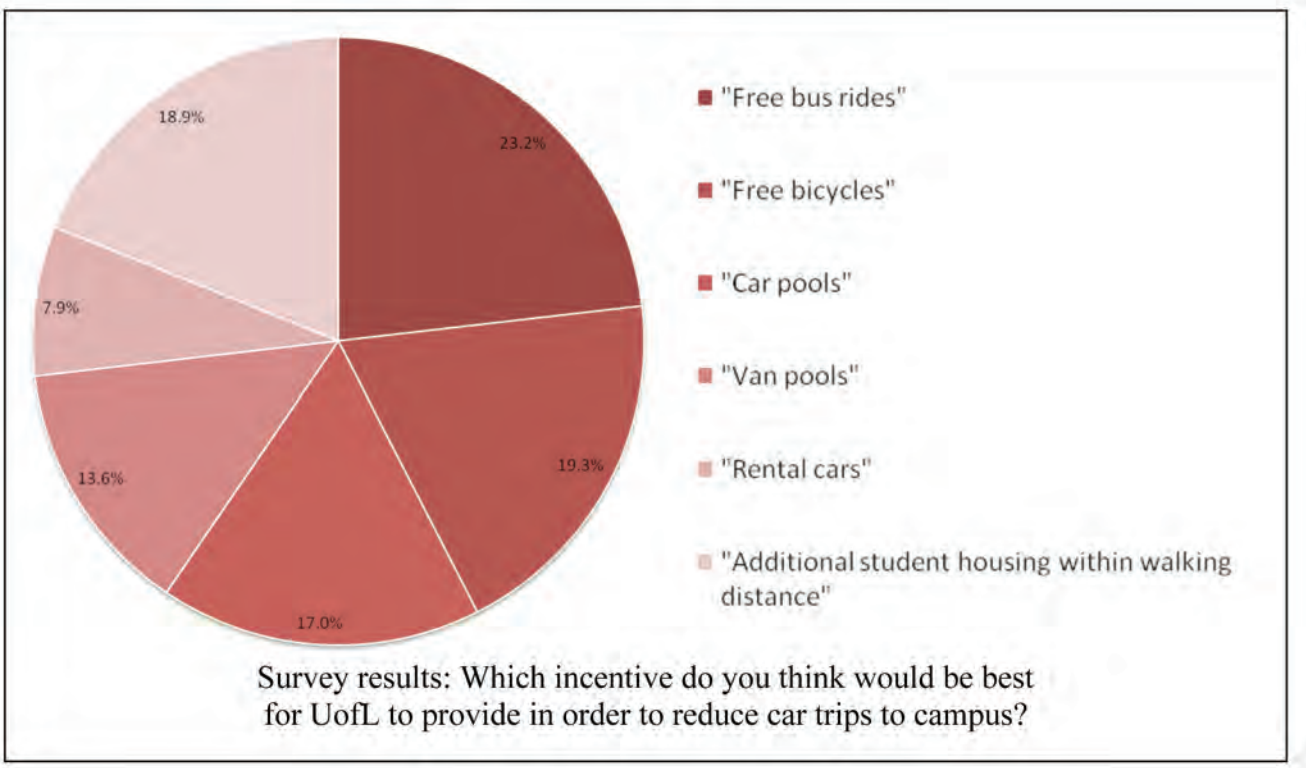
J.3. Estimated Costs to Implement Single Stream and Garbage Reduction Programs

Mini-bins	$11,000 estimate one time, $800 CAR
Promotional materials	$2,000 estimate CAR
QRS service	$38,000 estimate CAR
Indoor/outdoor recycling containers	$30,000 estimate one time, $2,000 CAR

K. Transportation

Transportation is responsible for 14.5 percent of the university's greenhouse gas emissions, primarily from commuters (9 percent), airplane travel (4.5 percent) and a minute fraction from the university's fleet of approximately 200 vehicles (0.005 percent). A March 2010 survey found that 78.7 percent of university employees and 65.1 percent of students primarily commute to the university in a car alone[8].

This prevalence to single-occupant automobiles is a major contributor to the university's greenhouse gas emissions, but it also offers an opportunity to reduce our environmental impact while increasing the health and wellness of our campus community and the livability of our campus neighborhood. The survey results also suggested that the university community has a considerable willingness to explore transportation alternatives, especially if particular incentives are provided.



In addition to reducing pollution, a shift to shared transportation, walking and biking would also improve public health, increase transportation efficiency, provide environmental benefits, strengthen the local economy and improve the quality of life. The cost of owning and operating a car is estimated at $8,000 annually. The elimination of this expense by walking, biking, or taking a free bus would allow UofL students to spend more money in the local economy.

Car and van pooling would proportionately reduce pollution and fossil fuel consumption while reducing traffic congestion and demand for parking on campus. The university has more than 14 acres of campus dedicated to parking. There are 7,000 Purple, 819 Red, 1,525 Green and 1,600 Yellow parking spaces on the Belknap Campus. HSC campus has two large parking garages, a 1,400-space garage and a recently completed 1,700-space garage.

Parking concerns are reflected in the draft Belknap master plan, which projects the need for 3–4 additional parking garages over the next 20 years. The cost of constructing the recently completed parking garage on the HSC campus was $36 million, or approximately $21,000 per space. The annual debt payment for the garage is $2 million over 20 years, or $1,175 per space per year. Additional operating funds will have to be sunk into maintaining, staffing and lighting the parking deck. While cheaper, surface lots consume more land and contribute more to storm water runoff problems and heat island effects. The estimated cost of constructing a surface lot is approximately $2,000 per space.

[8] Conducted by the Sustainability Council in collaboration with Institutional Research and urban planning graduate students in an advanced research class taught by John Gilderbloom. We can be fairly confident in the accuracy of these results, given that the response rate overall was 21.1 percent (faculty/staff 31.3 percent; students 10.9 percent) and the sample size was 24 percent of all university employees, 2.3 percent of all full-time students.

K.1. Current Transportation Initiatives

The university is already implementing a variety of programs designed to reduce the number of vehicle miles driven to campus. UofL encourages its students and employees to leave their cars at home by requiring drivers to purchase annual parking permits and by restricting parking for first-, second- and third-year students who may only park off campus in designated areas and take the shuttle to and from campus.

The university promotes transportation alternatives and provides information on car-free ways of getting to campus through its "Commute Green" website, information kiosks around campus and transportation alternatives fairs, the first of which was held in May 2010.

May 2010 video:
http://www.youtube.com/univoflouisville#p/u/1/Z2YUPpW76ew

Bus

In 2009, UofL began fueling its campus shuttle with biodiesel generated by engineering students on campus from dining hall waste vegetable oil.

Since 1999, UofL has contracted with Metro Louisville's Transit Authority of River City (TARC) to provide free service (with a UofL ID card) to all university employees and students. The service is available for unlimited trips throughout the metropolitan area. Six separate bus routes and a loop shuttle route serve Belknap Campus; another six routes serve the Health Sciences Center while one route serves Shelby Campus.

This service also provides multimodal opportunities through the TARC Bikes-on-Board program. All TARC buses and shuttles are bike rack-equipped. It takes less than 10 seconds to load a bike.

University Parking partners with UofL's Speed School of Engineering in a biodiesel initiative to convert used cooking oil provided by campus dining facilities into biodiesel fuel. The biodiesel, produced by students, is used in a 5–20 percent blend to power a university-owned campus shuttle bus.

Bicycling

The university is creating a master bicycle plan and currently implementing a plan to add new bike racks on all three campuses in high priority locations during fall 2010. UofL has established a partnership with a local non-profit organization, Bicycling for Louisville, to provide classes about using the bicycle for transportation. Classroom discussion and on-bike training are included in the program. We are exploring ways to make these classes available for credit to students on a regular basis by including them in the course catalog under the Department of Health & Sport Sciences' Physical Activity Program.

Bicycling to campus is also promoted through participation in Bike To Work Month each May, through transportation alternative fairs hosted on campus, and through campus health and wellness programs including Get Healthy Now and Campus Health Promotion. The Sustainability Council also helped fund the printing of new city bike maps, which are being distributed on campus. A car-free trip to UofL's Gray St. Farmers' Market was organized for Welcome Week 2010 with guided trips on bike or bus.

Bikes On Board — Racks are available on all city buses.

The potential gains to be made from getting more UofL students, faculty and staff on bikes are enormous and relate to personal health and wellness as well as our carbon footprint.

UofL President Ramsey led a Bike to Work Day ride in May 2010.

Incentives for Fuel-Efficient Vehicles

The university has begun rewarding the use of "fuel efficient vehicles" with parking incentives. The Conn Center for Renewable Energy Research and Environmental Stewardship has six preferred spaces dedicated for "fuel efficient vehicles." Examples of qualifying vehicles include hybrid, diesel or flex fuel vehicles, which are designed to run on gasoline or any blend of up to 85 percent ethanol (E85).

UofL reserves priority parking for fuel efficient vehicles.

K.2. Transportation Goals

Walking

Short term goals:

- Conduct walkability studies on a one-mile perimeter around campuses. Walkability studies are designed to identify barriers to walking, address safety concerns associated with walking, review street crossings for safety concerns, and to develop circulation patterns between campus and the surrounding community. Collaborate with the Mayor's Healthy Hometown Movement (MHHM), which is aimed at promoting healthy lifestyles and has conducted similar walkability studies across the metropolitan area.

- Work with private developers constructing rental and other properties that cater to university employees and students to develop walking paths and sidewalks to campus.

- Work with the Louisville Metro Public Health and Wellness Department to build community infrastructure to encourage biking and walking. The university is a partner with the department on a $7.9 million grant (U.S. Health Service, Communities Putting Prevention To Work) to address obesity in Louisville. As part of the grant the department is constructing signs with directions and distance (measured in minutes) to key locations. Locate signs within the community showing the direction and distance to the Belknap and Health Sciences Center campuses.

- Prepare campus circulation plans to design a holistic network of sidewalks, paths and open spaces that promote and support walking.

Professor Keith Lyle promotes the physical and mental benefits of walking to campus.

Mid term goals:

- The Belknap master plan calls for a doubling of square footage from existing buildings, the construction of new residence halls on campus and an expansion of campus. The internal walkability study proposed above could be used as a framework to guide this expansion. As the university expands its on-campus residency infrastructure, the percentage of commuting students will decrease.

Bicycling

Converting single-passenger car commuters into bike commuters would reduce on a 1:1 basis the amount of greenhouse gases released by each commuter. In addition, bicycling would provide considerable health, wellness and community benefits, just as walking does.

The Sustainability Council's March 2010 transportation alternatives survey revealed that a sizable percentage of the campus population might consider bicycling to campus if better facilities were made available. The most important facility identified by respondents was dedicated bike lanes radiating out from campus to connect directly to neighborhoods.

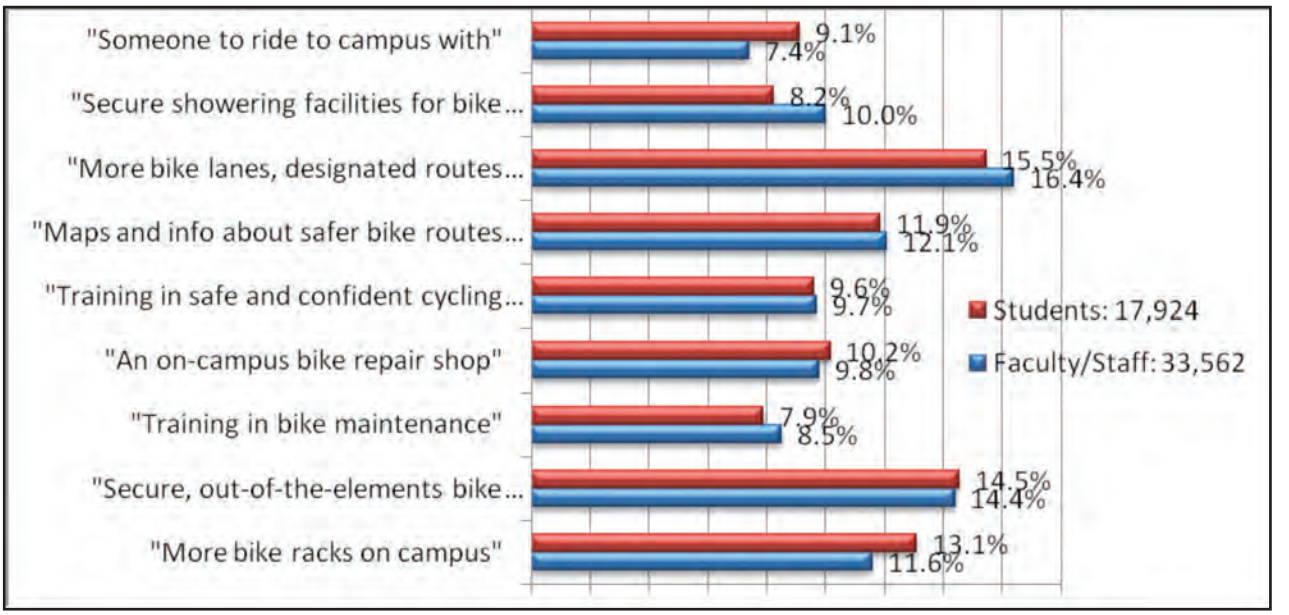
As the table of survey data below suggests, such facilities for bikes could lead to a 32,524 reduction in vehicle miles traveled per day by the campus community. Over a year, this would add up to more than 8 million deferred miles of driving, equivalent to an annual emissions reduction of 3,283 MT eCO2 (1.7 percent reduction from 2008 baseline).

Commute time to campus	# of commuters in each time range, based on survey statistics	Percent who agree that a dedicated bike lane would make them more likely to bike to campus	Number who agree that a bike lane would make them more likely to bike to campus	Percentage who drive car alone to campus	Reduction in number of cars driven to campus if ONLY these drivers, who expressed interest, ride bike instead of driving alone	Conservatively estimated round trip vehicle miles traveled (VMT) to campus per single occupant auto	Estimated reduced miles traveled to campus, in roundtrip VMT/day, by single occupant drivers who would bike instead of driving
10 min./less	5,500	75%	4,125	18%	742	2	1,484
11-20 min.	8,900	66%	5,874	31%	1,820	6	10,920
21-30 min.	8,100	54%	4,374	32%	1,400	10	14,000
31-40 min.	3,300	46%	1,518	13%	197	20	3,940
41-60 min.	1,600	48%	768	6%	46	30	1,380
60+ min.	375	53%	199	1%	20	40	800
TOTAL							32,524

Survey respondents identified a number of factors that would influence their decision to bicycle to campus, the predominant factors being designated bike routes and secure out-of-element storage areas for their bikes while on campus:

Project	Estimated emissions reduction (MT eCO_2 per year)	Progress towards goal (% reduction in GHG emissions from 2008 baseline)
Create dedicated bike lanes to connect campus to neighborhoods.	3,283	1.7%

Survey Results: Factors that would motivate people to bike to campus



Short term goals:

- The university will work to reduce the number of private vehicles commuting to and from campus by continuing to develop a free bike program that would provide a new bicycle and helmet to any student or employee who agrees not to obtain a campus parking permit for at least two years[9].
- Coordinate with the Get Healthy Now program to allow participants in the free bike program to partially qualify for reduced health insurance costs.
- The university will continue work with Metro Louisville transportation planners and the Bike Louisville program to review and improve commuter routes to campus and traffic-calming measures around campus. Bicycle traffic patterns on campus will be assessed for needed improvements.
- Introduce "UofL Bikes" way finding signage for cyclists to designate safer routes within a one-mile radius of campus.
- Identify space on or adjacent to campus for a bicycle repair shop, either through contracting with a private bicycle store, using work-study students to operate the shop or a hybrid of the two. In addition, every residence hall should be provided a bicycle pump and basic tool kit to be stored at the front desk for use by anyone with a UofL ID.
- Consider significantly expanding the bike patrol for UofL parking and police officers to reduce fuel costs and our carbon footprint while improving employee health.

Other Transportation Programs

Short term goals:

- Create a UofL-specific electronic ride board to encourage ride sharing to locations outside the metropolitan area. A common concern is that giving up a car would mean that students would be unable to make trips to their homes or other locations. A ride share board would help ameliorate this concern if program participants had a viable option to travel outside of the TARC service area. Most of Kentucky is not serviced by any public transportation system.

[9] To implement this program, UofL could work with bicycle manufacturers directly to acquire up to 500 bicycles at wholesale prices for distribution annually. The bikes could be cardinal red, labeled as University of Louisville bicycles with the UofL logo, and be suitable for urban transit. Initially, we have identified manufacturers who could provide bicycles for $250–$350 each. The estimated cost of the program would be $150,000–$175,000 annually. Funds for the program could be secured by a surcharge of $6–$9 per parking permit. The surcharge would be collected annually to continue the program. Bikes not given away could be sold at retail cost to UofL alumni and visitors and students, faculty or staff who want a UofL bike but are not willing to forgo their parking permits. Departments would be encouraged to purchase the bicycles for internal campus travel, as well. Participants would also have the option of receiving a voucher to select their own bike from a local shop.

- Create a UofL database to match university employees and students to form carpools for regular commuting to campus. A system specific to UofL would be utilized more than a regional system[10] since all of the users would be looking to share a ride to campus.

- Provide incentives to carpool such as reduced parking permit prices, shared permits, preferred parking, university recognition, etc.

- Work with the Kentuckiana Regional Planning and Development Agency to establish dedicated vanpools to campus for those commuting from outside the Louisville metro area. UofL could also provide incentives to these vanpools such as preferred parking, subsidized fuel costs, etc. If vans are unavailable from the regional agency, UofL should consider purchasing vans as needed.

- Purchase fuel-efficient models as university fleet vehicles are replaced. Require that new vehicles have fuel efficiencies at least 15 percent better than their predecessors. By 2020 we will increase the efficiency of 60 percent of our fleet by 15 percent. By 2025 our entire fleet will be at least 15 percent more fuel efficient. A 15 percent increase in fuel efficiency for the university fleet would mean an annual reduction of 13,907 gallons of gasoline and 1,209 gallons of diesel. This translates to an annual reduction of 136.3 MT eCO2 (a 0.7 percent reduction from 2008 baseline).

Project	Estimated emissions reduction (MT eCO_2 per year)	Progress towards goal (% reduction in GHG emissions from 2008 baseline)
Increase fuel efficiency of the university fleet by 15%.	136.3	0.7%

- Consider implementing preferred parking for fuel-efficient cars in all parking garages.

- Encourage more use of flexible schedules and telecommuting for employees whenever possible.

- Implement automatic vehicle identification (AVI) technology in all university garages and a no idling on campus policy to reduce carbon emissions and improve air quality.

- Consider whether a car-share program providing small, fuel-efficient vehicles could be used effectively on campus.

Mid term goals:

- Work with state and local officials to provide new mass transit systems such as light rail, people movers or other systems to efficiently transport UofL employees and students to campus from within the Louisville metro area and from nearby cities.

- Reassess the need for additional parking garages as the university grows.

[10] UofL currently encourages carpool-matching through such a regional system at: tickettoride.org.

Airline Travel

The university supports extensive travel for both employees and students for a variety of educational, research and exchange purposes. Airline travel is one of the fastest growing sources of greenhouse gas emissions worldwide. Ground transportation releases greenhouse gases low in the atmosphere where the air density is high and there is vegetation to absorb some of the carbon dioxide. Jet airplanes, however, not only burn many times as much fuel per passenger mile (see chart), but they also release exhaust gases in the fragile and rarefied region of the stratosphere where the air density is only one percent of that at ground level. In addition to carbon dioxide, planes release other greenhouse gases such as water vapor and nitrogen dioxide that form contrails and cirrus clouds, which also trap solar radiation and add to global warming.

Fuel Consumption Comparisons per Passenger Mile

Vehicle	Fuel consumption rate	Fuel consumption rating/passenger mile compared to a bus *
Public Bus	4.54 gal/mi	1
Private automobile	25 mi/gal	3
Boeing 747–200	7.75 gal/mi	7.9

* Ratio of fuel consumption/passenger mile of vehicle and bus, under assumption of 80 percent occupancy, typical in commercial airplanes & buses

Short term goals:

- Develop a system to track the means used by all employees, students and others (guests, potential employees, etc.) whose travel is funded by the university.
- Establish a policy through which either travel expenses for destinations within 250 miles would only be reimbursed for ground transportation or a requirement that all air travel reimbursement requests include information on the distance traveled and the amount of greenhouse gases produced[11]. The information would be used to remind travelers whether the trip is essential or if it could be conducted via ground transportation, telecommunication or videoconferencing. Incentives could also be built into travel reimbursement policies for expenses incurred by rail, bus or carpooling.
- Establish a carbon off-set policy to require airline travelers to pay an off-set calculated by the university. Travel requests would require a transfer of funds to a university account to be used to further reduce greenhouse gas emissions[12].

Mid term goals:

- Further develop telecommunication and videoconferencing opportunities at the university to reduce travel demands.

Long term goals:

- Work with state and national transportation officials to further reduce car dependency by developing new public transportation modes providing service to Louisville and surrounding cities such as high speed rail and intercity buses and trains.

[11] There are a number of easy web-based sites to calculate both the distance and greenhouse gases produced per passenger for flights anywhere in the world (e.g., carbonplanet.com/shop/offsets?offset_type=Flight)

[12] As an example, a roundtrip flight from Louisville to Washington, D.C., is 1,520 km and would produce 0.6 tons eCO2 per passenger. The current market value of an off-set for this trip would be $15.

L. Food

Recognizing the wholly unsustainable carbon footprint associated with the average U.S. meal (which travels some 1,500 miles from farm to plate) and the need to support a thriving local food economy, UofL is getting serious about food. We are taking a multifaceted approach to address the unsustainability in our food system that spans the spectrum from teaching students how to grow food in our new campus garden and cooking workshops through the Basic Pantry program, to increasing local food access through a farmers' market, Community Supported Agriculture (CSA) programs, our convenience store and, of course, our food service.

UofL currently contracts with Sodexo to operate all of the on-campus food venues. Since 2009, Sodexo and the university have worked cooperatively to increase the availability and consumption of local, organic, fair trade and vegetarian foods; to promote the use of reusable drink containers; and to move toward 100 percent trayless dining with no disposable tableware.

L.1. Current Food Related Initiatives

Trayless Dining

Fall 2010 marked the opening of a newly constructed residential dining facility with several dining options contained in an all-you-care-to-eat venue. This new facility is 100 percent trayless and provides a test facility for the possibility of eliminating all trays throughout campus. The aim is to reduce food waste and the resources required to sanitize trays.

The new Trayless Westside Dining facility opened in August, 2010.

Community Supported Agriculture (CSA)

UofL launched a CSA program in 2009 to give the campus community the opportunity to subscribe to local farms for a basket of fresh produce to be delivered to them on campus each week. The program began with a CSA fair that allowed farmers an opportunity to market their CSA directly to faculty, staff and students. After a successful first year involving a bit of a learning curve, the university hosted a CSA training session for farmers to share ideas and the results of a survey of UofL CSA shareholders. The event was held on campus over the winter in conjunction with the University of Kentucky Extension program to provide local farmers with information about organic production, schedules, harvest and post-harvest issues, pricing, promotion, marketing and dealing directly with consumers. On April 1, 2010, the university held its second annual CSA fair to facilitate farmer-consumer connections for the growing season, which featured new CSA share options designed especially for students.

Gray Street Farmers' Market

In spring 2009, the weekly Gray Street Farmers Market opened at the Health Sciences Center with nearly two dozen local vendors coming to an area of the city that has been identified as a "food desert." The market has been a huge success and is now in its second season, having added more weeks (May – October), more product variety and an EBT/debit machine to accept food stamps.

Gray Street Farmers' Market

Basic Pantry

Sodexo and Campus Health Services have formed a partnership to create a "Basic Pantry" program designed to give students the information and resources necessary to cook for themselves. Campus Health Promotion creates a bi-weekly recipe that can be easily made in the campus residence facilities and Sodexo stocks the ingredients at the campus convenience store. In addition, Sodexo occasionally provides students with cooking demonstrations to educate them on how to prepare a healthy meal. The goal of this program is not only to get our students to eat healthy, but to get them to purchase food close to where they live and to eat close to home.

Conveniently Kentucky Proud

In spring 2010 Sodexo relocated the campus convenience store to a larger location and added a full line of organic and local food options, including a section of fresh produce and Kentucky Proud products that proved to be very popular. Sodexo is also stocking a line of products from United Natural Foods Inc. that include a wide variety of organic, vegetarian and gluten-free items.

In spring 2010 the UofL Bookstore also opened an in-store Kentucky Proud section. It spotlights the quality products produced in our state and makes consumers aware of the positive effects of buying local.

Local, fresh and organic foods are featured in the newly expanded Cardinal's Nest convenience store.

Cooking Oil to Biodiesel

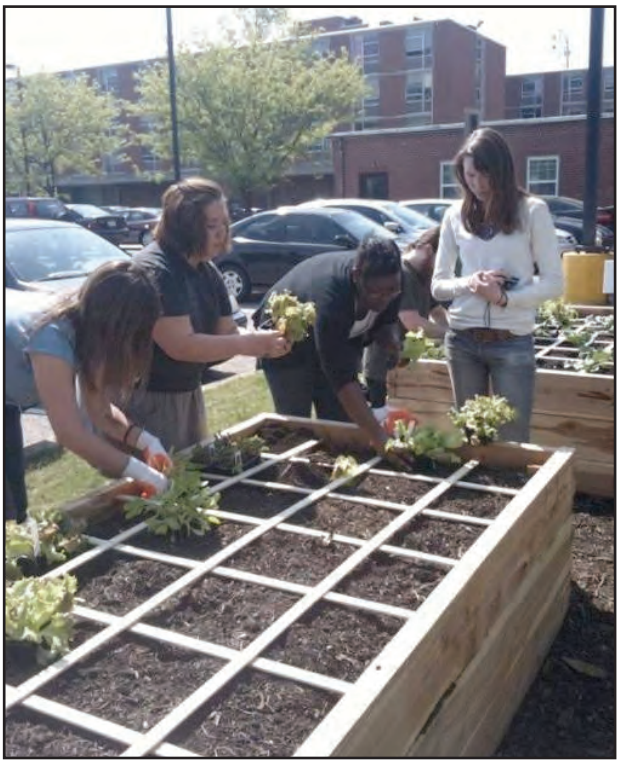
In Fall 2009, Sodexo began supplying its used cooking oil from campus dining facilities to UofL's Speed School of Engineering for conversion into biodiesel by faculty and students. This biodiesel is then used to fuel the campus shuttle buses.

Food Waste Composting

Initial food waste composting efforts began in 2009, with the collection of campus coffee grounds by a local composting and urban agriculture project known as Breaking New Grounds. In 2010, these efforts expanded as Sodexo began collecting kitchen wastes for food waste composting on campus.

Campus Garden

There exists a structural imbalance in our U.S. diet between the items on our plate that have been grown on local lands and those imported from a thousand or more miles away. As a plan of action, we can choose to grow our own food as a community to derail some of the inevitable challenges we face as humans—from climate change and a need to sequester carbon to malnutrition to supporting a local economy.



Using intensive, organic, square-foot gardening techniques, students participate in the first planting at UofL's new Garden Commons on April 12, 2010.

In collaboration with the local nonprofit Louisville Grows, UofL is planting the seed to discuss and explore the possibilities of creating food independence. The Garden Commons at the Cultural Center is the first community garden of its kind at the university. It provides an edible and educational landscape in which to actively promote a more sustainable food network.

The Garden Commons is currently supported by Louisville Grows, the Cultural Center, UofL's Sustainability Council and more than a dozen campus and city organizations. The enthusiasm and hands-on engagement of UofL students, faculty and staff as well as members of the greater community have and will continue to make this initiative a success.

The garden is comprised of four raised beds crafted from cedar wood by YouthBuild, a job training program for at-risk youth. The beds are used for organically growing vegetables, fruits and herbs.

With the contention that education and food security are indivisible, UofL charged Louisville Grows with organizing a series of educational workshops to discuss topics of food policy, gardening basics, harvesting, distribution plans and more. Through networking and synergy, Louisville Grows has created not only momentum for the Garden Commons in terms of gaining in-kind donations of plants and materials, but has brought local experts in urban agriculture to present their knowledge at the workshops. To date, three workshops have been successfully implemented. Open to the public, they were well attended.

Through education and demonstration it is hoped that our students will start growing their food close to home and develop this into a life long habit. The environment will be enhanced through carbon sequestration and less greenhouse gas emissions from transporting food over great distances.

L.2. Campus Garden Goals

We are actively working to expand and improve the campus garden initiative by implementing the following in the coming months and years:

- Develop and implement methods for rainwater harvesting and reuse to save resources and reduce the threat from stormwater runoff. (short term)
- Implement a demonstration composting area as a complement to UofL's overall food waste composting initiative. (short term)
- Implement a growing plan that minimizes pest and weed control without chemicals. (short term)
- Continue to expand web outreach with the purpose of educating and engaging more garden project support and more locally grown food. (short term)
- Support the newly formed registered student organization for students to retain sustained leadership of the project. (short term)
- Implement greater event marketing, including outreach to new students during Welcome Week. (short term)
- Develop additional workshops and an "Outdoor Lecture Series" on sustainable food practices through the continued welcoming of campus and community agricultural advocates. (short term)

- Organize equitable distribution plans for harvested produce. (short term)
- Organize volunteer appreciation events. (short term)
- Organize citywide events where UofL students present solutions based on what they have learned through the Garden Commons on how Louisville can more effectively promote healthy eating and environmental consciousness through growing our own food as a community and supporting our local farmers. (short term)

L.3. Other Food Related Goals

- Implement 100 percent trayless dining by 2014. (short term)
- Support Sodexo's collection and delivery of food wastes for composting, potentially expanding into post-consumer collection and scrape stations. (short term)
- Convene a meeting of the caterers the university did business with during this past fiscal year to discuss our goal to offer more local food products on campus. Develop a 'local foods' designation on UofL's website for those caterers that desire to participate and will carry local food menu items. (short term)
- Develop and post on appropriate websites a database that lists the submission dates for RFPs for supplying food products such as meats, milk, etc., so that with advance knowledge more local producers may be able to compete for these contracts and they will be awarded to multiple food vendors. (short term)
- Increase student, staff and faculty awareness of local food issues by hosting classes and information session visits in the residence halls, Red Barn, Student Activities Center and University Club. (short term)
- Involve the Food Service Advisory Group to identify ways to increase our campus use of locally grown food products. Make local food initiatives a standing agenda item. (short term)
- Develop a formal program to introduce the University Club's membership to locally grown food products. Activities to be considered include tasting parties, Kentucky alcoholic beverages added to the bar's drink list, menu selections based on local food products, etc. Since some existing contracts may prohibit these ideas this should be considered as new contracts are negotiated. (short term)
- Add a Fall CSA Fair to our current format so that when signup time comes in the spring, potential program participants will be better informed. (mid term)
- Work with Sodexo to create a full-time position to be the lead contact on sustainability issues, including local foods. COSTS: $50,000 CAR (short term)
- Explore the feasibility of purchasing products grown at Kentucky State University, especially through its aquaculture program, to be used in our campus dining facilities. (short term)

- Collaborate with the Kentucky Department of Agriculture to identify training needs of local farmers with the intent of UofL being able to provide training. For example, Good Agricultural Practice (GAP) certification is required to meet Sodexo's health and safety requirements, but it is currently cost prohibitive for many small farmers. If UofL could offer this training, it would allow more local farmers to become certified. COSTS: Approximately $10,000 CAR. (mid term)
- Review the possibility of establishing a Farmers' Market on Belknap Campus similar to the Gray Street Farmers' Market at the Health Sciences Center. A Belknap market would ideally be managed jointly with our Community Supported Agriculture (CSA) program on Belknap campus. (short term)

M. Carbon Offsets

Several universities, corporations and other institutions have chosen to become carbon neutral in the short term by purchasing carbon offsets. A carbon offset is a credit that offsets the purchaser's greenhouse gas emissions by funding an off-site greenhouse gas reduction project. Carbon offsets can be classified into four general types: energy efficiency projects, renewable energy projects, biological sequestration and technological/geological sequestration. A wide variety of organizations currently offer carbon offsets.

A **Renewable Energy Certificate** (REC) is a type of carbon offset. In order to be a credible carbon offset, the fee for the offset must be the "difference maker," meaning that the price paid must actually help the project occur and it couldn't happen without additional financing. Foreseeing the need to regulate this new market, the ACUPCC created a "Voluntary Carbon Offset Protocol" that determined that universities should purchase high quality offsets that are:

- **Real** — the project results in actual greenhouse gas reductions or that carbon from the atmosphere is being sequestered.
- **Additional** — the project must be "in addition" to what would have occurred anyway or as a matter of "business as usual."
- **Transparent** — project details are known to the institution and communicated to the stakeholders in a transparent way to ensure validity and further the goal of education on climate disruption and sustainability.
- **Measurable** — project results are scientifically measurable.
- **Permanent** — once trees die or are cut down, that act not only ends any future carbon sequestration by those trees but may also undo and release back into the atmosphere the carbon that was biologically sequestered by those trees in previous years, thus undoing the offsets that you previously counted. The "permanence" requirement is to prevent that circumstance from occurring.
- **Verifiable** — sequestration must be verifiable by an independent third party using established criteria.
- **Synchronous** — the greenhouse gases sequestered must be near the same time that greenhouse gases are being emitted.
- **Account for leakage** — the sequestration project does not result in any direct or indirect emissions of greenhouse gases.
- **Registered** — projects are tracked by a well-regarded registry.
- **Not double-counted** — sequestration cannot be counted as an offset for any other project.
- **Retired** — credits are retired before they can be counted as offsets by the institution.

M. 1. Carbon Offset Goals

- Purchasing carbon offsets will probably be necessary in the long term for carbon emissions that cannot be affordably or practicably reduced on campus. This step should be utilized only as a last resort and after full analysis. (long term)
- Guidelines for the purchase of offsets will be created through community-wide involvement and peer institutions. (long term)

Financing Options

As a responsible institution with a long-term social mission, it is our duty to invest in a cleaner, post-carbon future so that the students we teach today will not inherit a heavy environmental debt tomorrow.

While the university is identifying many ways of reducing our carbon footprint that will also save us money, some of these strategies require considerable up-front capital investments that may take many years to pay off through savings. Other steps toward climate neutrality may require an increase in operating costs for the university as the current economics of doing business-as-usual allows for the externalization of many costs to the environment and to society.

Figuring out how to afford to do everything we'd like to do is a great challenge in the face of constrained resources and given our desire to keep a high-caliber UofL education affordable and accessible to those in need. The current recession darkens the view even further and it is harder to justify new energy projects in a state with an abundance of coal and some of the lowest electric utility rates in the nation.[13] It is imperative, however, that we take a long-term view in planning for climate neutrality. Thus, our strategy has been to prioritize projects that will bring the greatest emissions reduction return on our investment while seeking creative strategies for financing.

Below is a summary of some of the options we have been exploring:

Performance Contracting

As a prelude to financing strategies which may be employed even more in the future, UofL has been funding many of its recent energy efficiency projects through an energy savings performance contract (ESCO) in conjunction with Siemens Corporation Energy Group. The university's contract began with energy audits of Belknap campus in 2008 and includes over $21.7 million in capital improvements that are guaranteed to save more than $2.3 million annually in energy costs. The implementation of the first phase of this project is currently underway on Belknap Campus and includes 69 buildings.

Funding was secured by the university through a commercial lending institution at favorable rates, and the annual savings were guaranteed by the ESCO over 13.5 years. The first phase of the energy savings performance contract focused only on Belknap Campus. The second phase began in the spring of 2010 with an energy audit of the Health Sciences Center and Shelby Campus.

Initial findings indicate that this proposed second phase could generate up to another $2 million in annual energy savings, depending upon the final scope of improvement measures to be included. Additional engineering studies are needed to determine the feasibility of these measures. These studies are planned for later in 2010 to determine the final project cost and savings estimates. Implementation of the second phase is projected for 2011.

Looking forward, the university is considering similar financial arrangements for other projects, potentially including power purchasing agreements for renewable energy. One option, for example, may be for the university to lease a photovoltaic array installed on campus from a solar power company that would front the capital costs, while UofL would pay annual leasing fees to match our current expenses on the amount of electricity generated. Such an arrangement would allow us to begin powering the university with the sun without having to take on a new debt burden or increasing our annual operating expenses.

Major Renovation Projects and New Construction

Other building-by-building opportunities exist for investing in efficiency, and possibly even renewable energy, in a more traditional manner through major renovation and new construction projects that must now be designed to LEED specifications in accordance with state law. In these cases, the costs associated with reducing the carbon footprint of a building is simply built into the budget of the entire project and the investment is ensured by the force of state law.

[13] The U.S. Energy Information Administration reports that in May 2010, the average retail price of electricity across all sectors in Kentucky was just 6.5 cents/kWh. Only Wyoming had lower rates. eia.doe.gov/cneaf/electricity/epm/table5_6_a.html

Renewable Energy Certificates (RECs) ('Green Tags')

To ultimately achieve climate neutrality, the university can either build renewable energy capacity or buy Renewable Energy Certificates (RECs) to offset the climate impacts of the non-renewable energy we currently use. RECs represent the 'environmental attribute' associated with renewable power and are intended to provide a financing mechanism to expand renewable electricity generating capacity.

The Louisville Gas and Electric Company offers a Green Energy program for $5 per 'block' of 300 kWh of electricity generated by renewable means. To meet the university's goal of 20 percent of its energy use (29,171,702 kWh), UofL would need to purchase 97,239 blocks of Green Energy credits at a cost of $486,195 annually. Other national REC markets would cost 0.5 to 5.6¢ per kWh or $145,858 to $1,633,615 annually[14].

The quality and price of RECs can vary according to the type or resource, generation location and third party certifications. At these levels of cost, it becomes economically feasible to construct a capital project capable of producing the renewable energy necessary to meet the 20 percent goal. If UofL were to produce 20 percent of its energy from solar power, the university could sell the associated RECs for $325/1000 kWh or $9,480,803 (June 2010 prices on SRECTrade).

While the purchase of RECs would theoretically contribute to 'reducing' UofL's carbon footprint, it would not actually change the amount of fossil fuel energy consumed by the university. And while the sale of RECs could assist in financing the construction of new renewable energy systems and contribute toward meeting the university's goal of 20 percent renewable energy by 2020, it would not reduce the amount of greenhouse gases being emitted globally. With their sale, the university would take on the contribution of greenhouse gas emissions that would be released by the buyer. This juxtaposition of competing goals will have to be decided on a case-by-case basis to determine the most appropriate course of action.

Though the U.S. carbon market is still nascent and voluntary at this point, there is a growing global market and it may only be a matter of time until the country participates in that market fully. It is not unreasonable, therefore, to imagine that UofL could eventually find funding for its renewable energy projects through the sale of RECs.

In this scenario, an entity with a desire or requirement to limit its own greenhouse gas emissions could purchase RECs created by renewable power generating capacity at UofL to offset its needs. While such a scheme provides funding for these projects, the drawback is that it 'absolves' others from reducing their own GHG emissions, thereby contributing less to the solution of this global problem.

Energy Savings Certificates (ESCs) or Energy Efficiency Credits (EECs) ('White Tags')

Similarly, there is an emerging market for Energy Savings Certificates (ESCs) or Energy Efficiency Credits (EECs) in which one entity is able to offset its own GHG emissions by purchasing credits from another entity that has permanently reduced its emissions through energy efficiency measures. As UofL is making great strides in efficiency, we may be able to raise funds through the sale of such credits but, again, the global benefits would be undermined.

[14] See US DOE Green Power Markets table: apps3.eere.energy.gov/greenpower/markets/certificates.shtml?page=1

Student Green Fee

Many colleges and universities are experimenting with new student fees designed to provide consistent revenue for investments in campus sustainability projects. Such student 'green' fees can take a variety of forms and rates. They can be mandatory or voluntary, approved by the student body through referendum or imposed by the administration, and managed exclusively by students, the administration, or some combination thereof.

At UofL, we are beginning to explore the idea of a student green fee, less as a means to generate significant revenue and more as a means to further engage students in our sustainability initiatives. As such, we would ideally like to see a student green fee created, approved and managed by the students themselves. The Sustainability Council is currently exploring this idea with UofL's Student Government Association, which would have the authority to institute a small student fee to create a student-managed fund for campus sustainability projects. These projects could potentially include efforts to reduce GHG emissions through behavior change, renewable energy, energy-efficiency, and alternative fuel and transportation initiatives.

External Support

Another funding source UofL is currently exploring is the creation of an Alumni Green Fund through which the university's many alumni would have the opportunity to donate directly to campus sustainability initiatives. Other schools have had success using such a fund to further engage alumni in investing in a green future for their alma mater. Alumni are more likely to donate when they see the real benefits of their contributions through projects that not only enhance the university, but contribute to the solution of pressing societal problems like global climate change.

UofL also has the opportunity to fund its efforts for GHG emissions reduction through corporate sponsorships or grants from foundations, government agencies and non-profit organizations. These institutions' funding of green initiatives continue to expand along with society's awareness of the environmental challenges we face.

Parking Fees

Increasing parking fees in a targeted manner would not only provide an incentive for students, faculty and staff to drive less, but would provide new revenues for projects designed to reduce emissions, especially those relating to transportation. Parking permit fees could be increased across the board and the university could consider creating more parking spaces (especially those in higher demand areas) which are available on a pay-per-use basis so that members of the university community could commit to reducing the number of times they drive to campus without having to decide whether or not to invest in a parking permit.

The new funds could be invested in:

- Bicycles to get students and employees out of their cars, as part of a bikeshare program by giving free bicycle to anyone willing to forgo a parking permit for at least two years.

- Programs to encourage members of the university community to live within easy walking or biking distance from campus. UofL is currently involved in a massive expansion of student housing close to campus and financial incentives could be provided to faculty and staff to encourage them to live closer to campus as well.

- Carshare programs to provide convenient, affordable short-term car rental options for people on campus so that they can give up their own cars while still meeting occasional needs for driving.

In 2010, UofL staff and students began test-riding various models for a potential program to offer free bikes to anyone willing to forego a campus parking permit for at least two years.

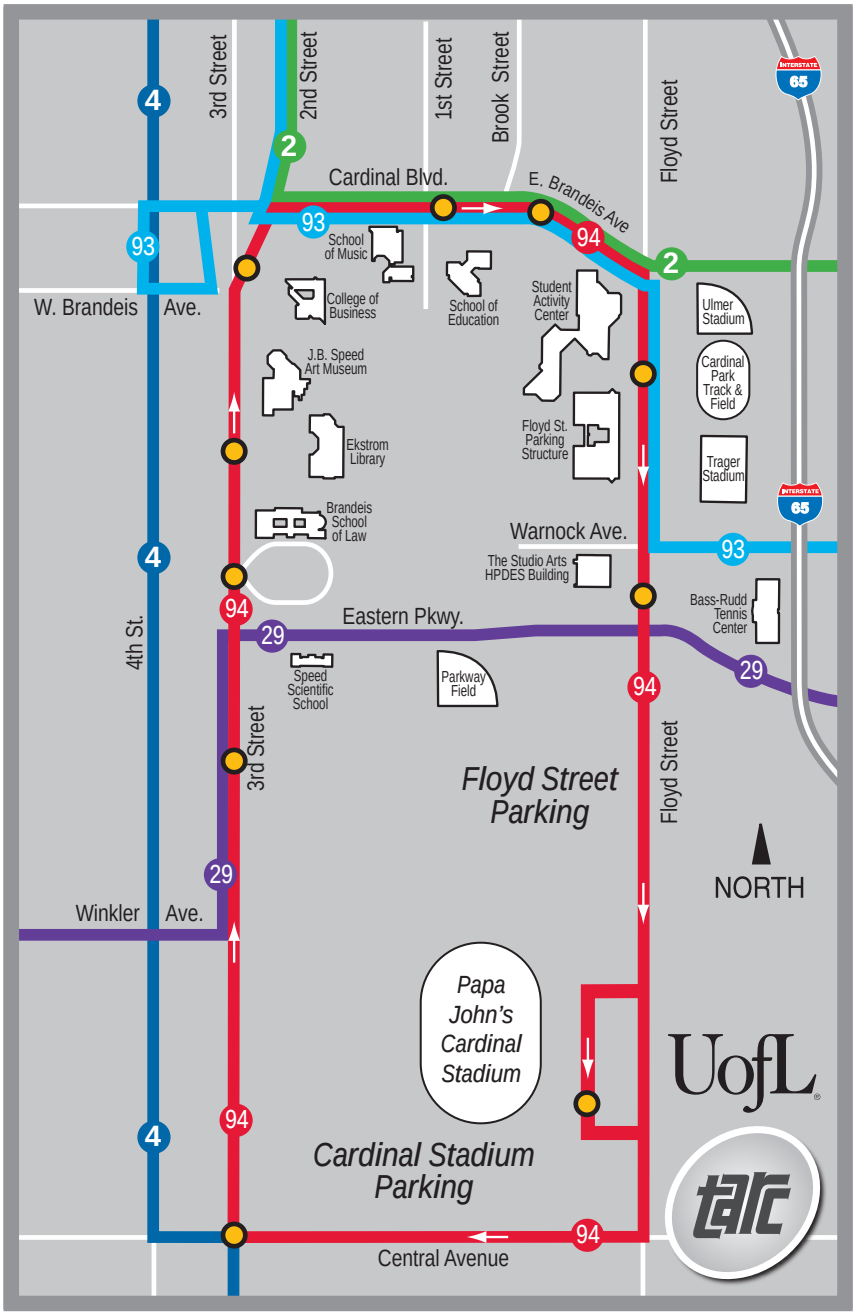
- Carpool and vanpool matching services for students, faculty and staff to reduce total vehicle miles traveled by the campus community.

- Expanding the services available through our free ride program with the Transit Authority of River City (TARC) to include more bus routes and/or more frequent service on routes. For instance, UofL is currently in discussions with TARC to create a frequent shuttle service in 2011 between the two main campuses (Belknap and Health Sciences).

TARC Routes Serving University of Louisville

Your UofL Cardinal Card just became MORE valuable!
With a current UofL Cardinal Card, you can ride anywhere, anytime on TARC at no cost to you. Just show the bus driver your card and you can access many areas of Louisville for employment, shopping and entertainment.

94 **Cardinal Shuttle** circulates campus from 6:40 a.m. to 9:30 p.m. (7:53 p.m. on Fridays) when UofL is in full session. However, there are many other routes that pass through campus for your convenience.



Other Routes Serving UofL

2 Second Street
Service to:
Louisville International Airport
Downtown Louisville
UPS Worldport
Kentucky Expo Center

4 Fourth Street
Service to:
Downtown Louisville
Central Park
Old Louisville
Churchill Downs
Technology Park
Iroquois Park
UPS Employment Center

29 Eastern Parkway
Service to:
Cherokee Park
St. Matthews
Mall St. Matthews
Oxmoor Center
The Highlands
Baptist Theological Seminary
Presbyterian Seminary
Shively

93 UPS/UofL/JCC Shuttle
Service to:
Jefferson Technical College
Louisville International Airport
UPS Heavy Freight

Stops for connecting routes

www.ridetarc.org • (502) 585-1234 • TTY (502) 213-3240

UofL works with the Transit Authority of River City (TARC) to develop UofL-specific promotional materials.

Implementation Structure and Tracking Progress

As noted earlier, this Climate Action Plan is intended to be a living document. We recognize that true sustainability is born out of flexibility and responsiveness to changes over time. We cannot predict the changes in technology, political will, economics, and ecological conditions that will shape the pace and nature of our progress toward climate neutrality. We therefore accept that specific strategies, timelines and technologies may need to be altered as time goes on.

The University of Louisville is committed to a dynamic, on-going climate action planning process. Over time, we will continue to revisit the initial vision, goals, strategies, and targets contained within this document. In a spirit of adaptive management we will make every effort to monitor our progress, learn from our successes and failures, and revise our plans accordingly.

UofL already has several structures in place that will facilitate implementation of the Climate Action Plan as well as our ability to track progress over time.

Key structures include the university-wide Sustainability Council as well as its three associated committees (Operations; Administration, Finance, and Outreach; and Education and Research) and their respective subcommittees. The assistant to the provost for sustainability initiatives is also intimately involved with the development and oversight of sustainability projects and programs across our campuses. As part of their work, these groups and individuals develop plans and policies for campus sustainability as well as monitor progress, report accomplishments and assess areas needing improvement.

The Sustainability Council keeps the campus community and the public updated on progress.

Working together, the council, associated committees and the assistant to the provost for sustainability initiatives compile both monthly and annual progress reports, with an eye towards a variety of internal and external measures of sustainability progress (most notably STARS and the Sustainable Endowments Institute's report card). Much like the climate action planning process itself, this reporting involves coordination of and information from a wide variety of players in campus sustainability. Having these groups and individuals in place provides the cornerstone for our ability to implement the Climate Action Plan as well as periodically track our progress.

We will use structures already in place to facilitate our tracking of progress. In particular, each year in our annual report at the end of the fiscal year we will assess progress, detail steps for the upcoming year and note any areas needing revision or adjustment. Further, reassessment of our greenhouse gas emissions and associated reporting to ACUPCC every other year will ensure that progress is assessed and that any necessary adjustments (due either to inadequate progress toward targets or development of new strategies to better facilitate goal accomplishment) are made to keep our progress toward climate neutrality and the intermediate targets on track. If necessary, such assessments also will allow the university to revise goals as needed.

Communication, Education and Engagement

UofL's Office of Communications and Marketing has aggressively supported campus sustainability efforts since Provost Shirley Willihnganz formed the university's first Sustainability Council in mid-2008.

A full-time communications professional in that office regularly covers monthly meetings of both the Sustainability Council and its operations committee to stay abreast of the committee's activities and programs. The office has also identified this professional to all of UofL's schools and colleges as someone who can assess and evaluate communication opportunities and offer support as warranted.

One of the first tasks undertaken by Communications and Marketing was to design an original graphic to help brand campus sustainability initiatives and to unify the great diversity of efforts taking place campus-wide. The graphic has since appeared on organic cotton T-shirts and reusable cloth bags, posters, websites, UofL planners and advertisements, providing a readily recognizable image for sustainability activities on campus.

Office writers gather information for stories about campus sustainability on a weekly basis. These stories, along with weekly 'green tips,' go out to the campus-wide community via a daily e-mail news service called *UofL Today* and typically also appear on the university's main internal web page. Photos and short videos regularly accompany these stories and appear on university Flickr and youtube sites. Green tips are also shared through a variety of internal communications channels, including the UofL Alumni newsletter (*UofL Connection*), *Campus Health News* and updates from our employee wellness program, Get Healthy Now.

The students, faculty and staff involved in sustainability initiatives around campus are invited to author a monthly column, *UofL Green Scene*, which is distributed internally via *UofL Today* and to the broader community through *GreenList Louisville*, a bi-monthly print and online guide to sustainable living (see: greenlistlouisville.com/).

The communications office also regularly places stories about UofL's sustainability efforts in external news media. These placements have appeared in the Louisville *Courier-Journal*, *Business First* of Louisville, all four Louisville commercial television stations and on local public radio. The office also frequently inserts information about UofL's sustainability efforts into talking points written for the university president and provost for various speaking engagements. Recent topics include UofL's initiatives related to:

- Single-stream recycling program
- Model green dorm room
- Participation in STARS, Earth Hour and Bioneers
- LEED-certified campus buildings
- Comprehensive energy-saving contract
- Various efforts by student groups (e.g. movies sponsored by GRASS)
- The university's rankings in the SEI report card, Cool Schools list, etc.
- Community Supported Agriculture and farmers' markets on campus
- Partnership for a Green City

A special effort has been made to position UofL's new assistant to the provost for sustainability initiatives, Dr. Justin Mog, as a quotable source in the external news media. A communications office promotion led *Velocity,* a youth-oriented weekly publication of the *Courier-Journal*, to include Mog in a lengthy profile of Louisville's 2010 "Generation Next – 10 up-and-coming Louisvillians under 40." Quotes from Mog show up regularly in local print and broadcast media on topics ranging from climate change to recycling.

The communications office will continue supporting UofL's sustainability efforts in the years ahead, especially through story opportunities related to our progress in implementing this Climate Action Plan.

Looking ahead, the communications office is exploring the possibility of the *University of Louisville* hosting the international conference of the Society of Environmental Journalists in 2014. That project is still in the talking stages, but if it moves forward it could create a worldwide platform for UofL's sustainability experts to share behavior-changing information about the climate crisis and steps all of us can take to reduce greenhouse gas emissions.

Education, Research and Public Engagement to advance climate action

UofL not only has the ability to change the impact of campus operations, but we also serve as a role model to inspire others to take similar action. The university has already taken a number of key steps that demonstrate its leadership role including:

- Construction of three LEED Gold buildings
- $22 million energy performance contract to reduce energy demands on Belknap campus
- Implementation of a single-stream recycling program to reduce landfill rates
- Installation of solar energy projects, including the largest array in Kentucky
- Implementation of an energy behavioral change pilot program
- Establishing a university garden and working to increase the amount of local foods available on campus (through CSAs, farmers markets, and UofL food services).

A university is a model laboratory for society; the changes and strategies made on campus can be adapted to other institutions. An integral part of climate action planning is sharing news and information to help others succeed in climate neutrality. Community outreach can be conducted through student volunteerism, events and information sharing.

Climate change education and sustainability are also essential academic topics for today's generation of college students and could be integrated into UofL's curriculum more broadly. The university has implemented a Green Threads program to encourage faculty to create new courses or to integrate sustainability themes into existing curricula. Now in its second year, more than 22 faculty members have created four new courses and have integrated sustainability into their existing courses. New courses have also been developed in renewable energy, climate change, health issues associated with climate change and energy conservation.

Community outreach to the university and the broader Louisville community on climate change has been achieved through public forums and conferences. UofL has supported campus–and community-wide conferences on climate change, with noted national authors and academicians. Each year for the past 20 years, the University has hosted an Environmental Youth Summit to bring high school students to campus to discuss environmental issues. The last three have focused on climate change with students conducting service learning projects on how to measure energy use, carbon sequestration rates, waste generation and transportation demands at their schools and what they can do to reduce greenhouse gases.

UofL's progress in sustainability has a rich, collaborative history. In 1992, the university established the **Kentucky Institute for the Environment and Sustainable Development (KIESD)**, with the mission "to provide multidisciplinary research and applied scholarship, teaching and educational outreach, and public service on issues of the environment, its protection, and sustainable development at the local, state, national and international levels."

KIESD has achieved these goals through the work of a variety of centers focused on different aspects of sustainability, including:

- The Center for Environmental Education
- The Center for Environmental Engineering
- The Center for Environmental and Occupational Health Sciences
- The Environmental Cardiology Center (Public Health)
- The Center for Environmental Policy and Management
- The Environmental Finance Center (EPA Region IV)
- The Center for Environmental Science
- The Center for Land Use and Environmental Responsibility
- The Center for Sustainable Urban Neighborhoods
- The Kentucky Pollution Prevention Center

More information is available online at: louisville.edu/kiesd.

Based at the UofL's J.B. Speed School of Engineering, the Kentucky Pollution Prevention Center (KPPC) runs programs state-wide designed to help private organizations reduce their carbon footprint. KPPC helps businesses, industries and other organizations develop environmentally sustainable, cost-saving solutions for improved efficiency. Since 1994, the center has provided free, non-regulatory waste assessments to nearly 500 Kentucky businesses with total savings reaching nearly $6 million. More information is available online at: louisville.edu/kppc/.

In August 2004, the university teamed up with local schools and the city to manage environmental resources better through the Partnership for a Green City. As the first of its kind in the country, the partnership represents a collaborative effort to improve environmental education, health and management by combining the resources of Louisville's three largest public entities: UofL, the Jefferson County Public School system and Louisville Metro Government.

In total, the partner agencies employ some 26,000 people, enroll 120,000 students, and own more than 500 buildings, 7,000 vehicles and 25,000 acres of land. Through the coordination of efforts and cooperation, the partnership has been able to realize real results that will have long-term impact on the health, education and well-being of our citizens while also improving and institutionalizing environmental practices within the organizations themselves.

Through the Partnership for a Green City the university has installed renewable energy systems on campus, at public schools and within the city. The Partnership has been active in promoting energy reductions through programs such as Kilowatt Crackdown, use of biofuels, education and produced a Climate Action Plan for the city. Both UofL and Metro Louisville have signed commitments to reduce their greenhouse gas emissions.

In December 2006, the partnership formed a Climate Change Committee that commissioned a Climate Action Plan. Part of the plan was to develop an inventory of the community's GHG emissions based on 2006 data. This initial effort, in which the university participated, laid the groundwork for UofL to produce its own comprehensive baseline inventory in 2009. More information about the Partnership for a Green City can be found online at: **partnershipforagreencity.org**.

More recently, in late 2008, UofL engineering and business alumnus Henry (Hank) Conn and his wife, Rebecca, pledged more than $20 million to J.B. Speed School of Engineering to support the development of a renewable energy center at UofL, which had been developing several strengths necessary for building such a center. Specifically, the university and the Speed School had established the Institute for Advanced Materials and Renewable Energy and invested resources to build capabilities for advanced materials research toward renewable energy and energy efficient technologies. The Conn's pledge allowed the University to refine their efforts toward a larger endeavor completely focused on advancing renewable energy and energy efficiency research for both Kentucky and the nation. This center, with a new and expanded mission, was thereafter named the "Conn Center for Renewable Energy Research" in Hank and Becky's honor.

UofL's Conn Center is engaging students in renewable energy R&D. Shawn Crowe, a chemical engineering graduate student from Shelbyville, KY, examines the rain runoff-powered system that his team built for a summer 2010 course. The project applies hydroelectricity to power five LED lights.

In early 2009, Kentucky Gov. Steve Beshear announced that the state would enter into a memorandum of agreement with UofL for the Conn Center to carry out aspects of the mission of the state-created Center for Renewable Energy Research and Environmental Stewardship (CRERES). The Kentucky General Assembly created CRERES in 2008 through House Bill 2 to promote partnerships among Kentucky's post-secondary education institutions, private industries and non-profit organizations to actively pursue federal research and development resources that are dedicated to renewable energy. CRERES' efforts are based on the seven-point energy plan issued in 2007 by the Governor's Office of Energy Policy (now DEDI).

The Conn Center's mission is to perform research and development on practical, economical and potentially commercializable renewable energy and energy efficiency technologies and resources. UofL has the expertise to conduct research and develop technologies for solar energy conversion, energy storage, biofuels and biomass conversions, energy efficiency and conservation, and advanced energy materials. These explorations occur via the Conn Center in conjunction with UofL and other university faculty members as well as energy industry partners.

As we look ahead toward a post-carbon future, UofL will seek to continue deepening our engagement with the issue of climate change by harnessing the power of these existing research centers and partnerships and by taking the following steps:

Short Term

- Develop a faculty incentive grant program to provide mini-grants for faculty who revise or enhance course curricula to incorporate practicum or other community-based learning opportunities for students pertaining to climate change and sustainability.
- Develop an academic community engagement course assistant award program that would fund and support graduate or undergraduate students coursework in the community focused on climate change and sustainability.
- Provide seed funds for faculty who engage in community-based participatory research focused on climate change and sustainability.
- Make climate change and sustainability a strategic priority of the Community Engagement Steering Council.
- Develop a university Community Academic Partnership Assistance program that would provide faculty with funds to advance university community partnerships necessary for student academic learning experiences tied to climate change and sustainability.
- Establish with the School of Arts and Sciences an undergraduate, interdisciplinary degree in Sustainability. Classes for the degree would be taught in multiple departments within the school.
- Create a USGBC student group with a focus on Leadership in Energy and Environmental Design (LEED). The group would work with campus architects to conduct research and assist in promoting sustainable technologies in new and remodeled campus buildings. In collaboration with the Office of Planning, Design and Construction, service learning projects will be identified for student research projects. One of the goals of the group would be to create classes to prepare for student LEED certification.
- UofL's Sustainability Council will work to increase academic collaboration on the topic of climate change. The Council will continue to invite speakers to campus for public lectures and forums.
- Many of the activities mentioned above would be open to the public and student internships are often with local groups. Information will also be shared with the University's Partnership for a Green City and with the Community Engagement Steering Committee.

Mid Term

- The American College & University Presidents' Climate Commitment calls for educating all students about climate change. The short-term goals call for increasing voluntary offerings, while building institutional capacity on climate change issues. Deliberation by faculty about making "climate neutrality and sustainability a part of the curriculum and other educational experiences for all students" should occur by 2020. In terms of undergraduate students, this would occur through the regular academic venues. There are many options for covering the basics of climate change and other environmental issues, including internships, service learning, international travel and course work, all of which could include some practical activity designed to further sustainability on campus, in the surrounding community or in the world. Faculty may also choose to incorporate examples, texts and theory about climate change into various majors and courses.
- Academic research topics relevant to climate change mitigation and adaptation will be expanded above 2010 levels. This goal will be accelerated with additional external grant support.

UofL's Sustainability Council participates each year in the National Climate Change Teach-In.

Conclusion

At UofL, we recognize that we are standing at a crossroads. We could choose to continue down the well-travelled path of fossil-fuel reliance and unbridled energy consumption, but we are beginning to realize that this is a dead-end street filled with disastrous consequences for both people and planet. Instead, with this plan we are making the choice to step away from the familiar path and to chart a new course toward a clean, renewable future based on the values of conservation, stewardship and sustainability.

To achieve the ambitious goals outlined in this Climate Action Plan, the Sustainability Council and its committees will continue their diligent efforts to integrate sustainability into everything that we do at UofL from what we teach and research, to how we invest our funds and treat our community, to how we conduct our business and operate our facilities. As a member of the Association for the Advancement of Sustainability in Higher Education (AASHE), we are committed to measuring our progress through the Sustainability Tracking, Assessment and Rating System (STARS). Continuing to improve our STARS score is part of our strategic plan.

The University of Louisville has begun its journey toward climate neutrality. We have a great deal of work and struggle ahead, but we face those challenges with a vigor born out of excitement about the prospects ahead and a confidence instilled by the number of people and institutions who walk together with us down this new path.