UNIVERSITY OF LOUISVILLE

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BASELINE INVENTORY OF GREENHOUSE GAS EMISSIONS 2006 – 2008

UNIVERSITY OF LOUISVILLE

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ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

This report summarizes the estimated greenhouse gas (GHG) emissions for the University of Louisville (UofL) for the fiscal years 2006 through 2008.

The summary results estimate greenhouse gas emissions resulting from the activities of over 27,500 (full- and part-time) students, faculty and staff at all three of the university's campuses, including the Belknap, Health Science and Shelby campuses.

This inventory provides a baseline for tracking GHG emissions and for developing future strategies to reduce such emissions. ***Due to variations in methodologies, scales and contextual settings, this report is not intended to be used for comparison to other higher education institutions nor for any regulatory requirements.***

BACKGROUND

On August 1st, 2008, University of Louisville President, James R. Ramsey, took the bold step of signing the American College & University Presidents' Climate Commitment. This pledge expresses UofL's long-term commitment to sustainability and a move toward climate neutrality. Within a year of signing the commitment the university agreed to document current greenhouse gas emissions from university facilities and operations. This report describes our best effort to produce such a baseline of data.

The enclosed findings are estimates only, based on an admittedly unrefined system of data gathering. The university will continue to strive in the coming years to improve data collection methods and to better track emissions. The reported data baseline allows the university to begin planning steps towards carbon footprint reduction and ultimately climate neutrality.

METHODOLOGY

The baseline inventory and the data summarized herein includes utilities data for 115 buildings on all three campuses which are owned by the university comprising of nearly seven million square feet of space on 660 acres of land. The data encompasses all the university's academic, health science, medical, dental, athletic, dormitories, research, and office buildings and grounds.

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

GHG emissions are typically broken down into three categories and defined as scope 1, 2 or 3 emissions. All three categories are included in this report.

Scope 1 emissions refer to those occurring from sources owned or controlled by the university. These consist of direct operations on campus that produce greenhouse gases, such as on-site fuel consumed (i.e. natural gas burned for heat and fuel consumed by campus fleet vehicles).

Scope 2 emissions refer to those produced off-site by the electric utility as part of the generation process. The university purchases electricity from Louisville Gas & Electric, which has coal-powered generating stations located on the Ohio River.

Scope 3 refers to other indirect emissions generated off-site by commuter travel, business travel and waste transported to landfills. These emissions, although not produced directly on campus, are a result or consequence of university activities.

The university's emissions were calculated using the Clean Air-Cool Planet® Campus Carbon Calculator v6.1 software utilizing collected facility data.

Emissions not reported because levels were considered to be *de minimus* include nitrous oxides used in the medical and research facilities, perflurocarbons used in eye surgeries and MRIs, sulfur hexafluorides used in ultrasound imaging, and hydrofluorocarbons from campus refrigeration systems.

FINDINGS & RECOMMENDATIONS

For fiscal years 2006 through 2008, the University of Louisville produced an annual average net emissions of **197,506 metric tons** of carbon dioxide equivalent (MT eCO_2) from all sources (scopes 1, 2, and 3).

Year	Net Emissions (MT eCO_2)	Emissions per 1000 sq. ft. (MT eCO_2)[1]	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**

The largest portion of the university's carbon footprint (58%) can be attributed to scope 2 emissions produced from purchased electricity generated from coal. The next largest portion of UofL's carbon footprint is derived from its scope 1 stationary combustion emissions (21%). The university's Health Sciences Campus generates 41% of the combined scope 1 and 2 emissions.

[1] Based on an estimated seven million sq. feet of space in University-owned buildings.

Scope 3 indirect emissions are the smallest percentage of overall emissions. While the percentage of the total emissions derived from the university's 194 fleet vehicles is small (0.005%), commuting to campus and university-related air travel represent a sizable fraction (9% and 5.5% respectively).

Though the university's population, budget and land holdings have grown over this three year period the net GHG emissions have not grown in proportion. This indicates the efforts implemented to limit the university's environmental impact are trending in the right direction. The university is committed to greater energy conservation and plans to remain vigilant in pursuing ways to reduce the identified carbon footprint.

Recommendations to reduce the university's carbon footprint include:

- Seek to produce more of our own electricity on campus from renewable sources such as the demonstration photovoltaic array on the roof of our Speed School of Engineering.

- Use our power as a major customer of LG&E to push the utility to invest more in renewable energy production.

- Conduct locally-relevant research on renewable energy technologies and share the findings with the utilities and industries to help speed the transition from fossil fuels.

- Implement energy efficiency initiatives on Belknap campus resulting from our new performance contract with Siemens Corp. and conduct an energy audit of the Health Sciences Center campus in FY10.

- Pursue improved efficiency in the way the university heats and cools buildings. Possibilities include everything from extensive efficiency retrofits to installing programmable thermostats to encouraging more moderate heating and cooling expectations among those who use our buildings.

- Increase the use of lower impact modes to commute to campus, by:
    - Providing free or discounted loaner bicycles, helmets and bike route maps.
    - Increasing the number of bicycling education classes to help riders and drivers safely share the road.
    - Working with the Metro government to improve bicycle and pedestrian infrastructure around its campuses, and seek partnerships with businesses to open a bicycle shop on or adjacent to each campus.
    - Installing showers in campus office buildings for those who wish to bike to work.
    - Increasing the amount of bicycle parking with racks placed convenient distances from building entrances.
    - Publicizing the "Commute Green" web site and targeting communications regarding online resources for green commuters such as: the TARC trip planner (www.ridetarc.org), carpool organizers (tickettoride.org), and safe

bicycle route finders (www.ridethecity.com/louisville).

- Reduce university-related air travel by using technologies like video-conferencing to minimize the need for long-distance travel; and encourage employees and students to consider bus, train and carpool travel for medium-distance trips (including those booked through the University's contracted travel agent).

DATA LIMITATIONS

It should be stressed that these findings are *estimates* of GHG emissions, not actual measurements. The accuracy of these estimates is limited by the quality and extent of the data gathered. Actual emissions are likely to vary from the calculated estimates.

Limitations to the data used in this survey include:

- Fuel consumption figures were based on an average price per gallon.
- Emissions for leased off-campus spaces and private residence hall spaces not owned by UofL were not included.
- Fugitive emissions from laboratory animals used in medical research could not be accounted for.
- TARC data provided per bus ride not including transfers. To control for transfer inflation the transfers per trip were estimated based on an assumed average of 1.5 rides for each commute.
- Air miles booked on behalf of the university but not using the university's contracted travel agent could not be directly accounted for. Instead, the university estimated based on a historic average of 51% of university air trips booked through contract a prorated miles traveled for the additional 49%.
- Miles commuted by car to campus were estimated based on the assumption that those who bought parking permits were driving an average round-trip distance from their home zip code at a rate of five times per week for employees and three times per week for students controlling for time-off and times between semesters.
- The Athletics department's transportation fuel usage, fertilizer applications and emissions resulting from Athletic events (other than utilities usage) were not incorporated into this report due to its separate budget and accounting system.

BACKGROUND

Though many individuals on campus had been pursuing various environmental projects for years, the University of Louisville made a formal, institutional commitment to sustainability in 2008. On August 1st, 2008, President James R. Ramsey took the bold step of signing the American College & University Presidents' Climate Commitment.

As a further indication of the university's commitment to climate neutrality and a broader social and environmental responsibility, Provost Shirley Willinghanz established the 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 and in other areas deemed important to the University;
- Serve as a clearinghouse of information and organizational hub for university activities related to sustainable practices;
- Encourage faculty, staff and students to become involved in sustainability efforts at all levels; and to
- Publicize sustainability initiatives internally and externally in order to create momentum for substantial change.

One year later, the university further solidified its commitment to sustainability by creating a new, regular full-time professional and administrative staff position devoted exclusively to the effort. The university's first-ever Assistant to the Provost for Sustainability Initiatives began work on August 17th, 2009.

UofL's environmental progress has a rich, collaborative history. In 1992, the University of Louisville 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

Based at the University of Louisville 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.

In August 2004, the university teamed 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 three of Louisville's largest public entities: the University of Louisville, the Jefferson County Public Schools, 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.

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 the comprehensive benchmark report detailed here.

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 develop renewable forms of energy and are developing pilot devices that will let our technology operate more efficiently and save our land and waterways.

The University of Louisville is doing a lot, but can, and will, do more. One of the goals of the 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 standards from the Association for the Advancement of Sustainability in Higher Education (AASHE). It all begins with this baseline survey of our greenhouse gas emissions.

INSTITUTIONAL DATA

Founded by decree of city council on April 3rd, 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.

Now in 2009, under the leadership of its seventeenth president, James R. Ramsey, the University of Louisville has become known especially for teaching, research, and service to its community and the advancement of educational opportunity for all citizens thereof. With a total enrollment of nearly 22,000, 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.

A Growing University

	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

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 central steam and chilled water plant on the Belknap campus and a 13,800-volt distribution system at the Health Sciences Center and Belknap campuses.

Fiscal Year	Heating Degree Days	Cooling Degree Days
	#	#
2006	4222.00	1340.00
2007	4379.00	1288.00
2008	4373.00	1233.00

METHODOLOGY

The Office of the Vice President of Business Affairs, in conjunction with the department of Physical Plant Operations and University Planning, Design and Construction began the process of developing a baseline inventory of the University of Louisville's GHG emissions in July 2008. Strategies for gathering the necessary data were developed and the key staff members responsible were identified. It wasn't until September 2009 that a complete picture of the university's annual emissions took shape.

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 eCO_2). 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.). These conversion factors have been modified as more is learned about the global warming effects of various greenhouse gases.

The default emissions coefficients supplied in the Clean Air-Cool Planet® Campus Carbon Calculator were used in preparing this report. The version of the Carbon Calculator we employed uses a global warming potential (GWP) factor from the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). GWP is the ratio of the degree of warming to the atmosphere that would result from the emission of one unit of a given GHG compared to one unit of carbon dioxide over a specified time period. This is used to convert emissions of other GHGs into units of carbon dioxide equivalents (CO_2e).

In calculating our carbon footprint, the university used rough, upper-bound estimates to designate as *de minimis* (or materially insignificant) small emissions sources that collectively comprised less than 5% of the university's total GHG emissions. Some emissions considered *de minimus* for this report include nitrous oxides used in the medical and research facilities, perflurocarbons used in eye surgeries and MRIs, sulfur hexafluorides used in ultrasound imaging, and hydrofluorocarbons from campus refrigeration systems. While emissions from these sources were excluded from this inventory, the university recognizes the very real contribution to global warming that these emissions make. It is the intention of the university to continue to seek ways to minimize all GHG emissions, whether they are closely tracked and reported or not.

Other limitations to the collected data include:

- Calculations to determine total fuel consumed in university vehicles was based on an average price per gallon. Total fuel consumption figures include fuel used to power equipment in addition to fleet vehicles.
- Wastewater volume is not measured, nor is freshwater input as the water utility does not provide the university with annualized gallon data. In the future, gallons of water consumed by the university could be calculated based on average costs, but currently there is no central repository for the information and the university receives some 150 different water bills each month.

- The university recognizes that its true carbon footprint includes emissions from facilities that it does not own (such as private residence halls and leased off-campus space), however it is difficult for the university to track or control these emissions.
- While the university houses no farm animals, it is responsible for laboratory animals used in medical research. Fugitive emissions from these animals (e.g. releases of methane produced as part of normal digestive processes) could not be monitored.
- The TARC bus service tracks each leg of any trip taken by university-affiliated customers, and not rides taken on transfers. Thus, the university estimated an average of 1.5 rides for each trip reported in order to control for transfers inflation.
- Miles commuted by car to campus are not directly tracked. Instead, the university calculated those who bought parking permits were driving an average round-trip distance from their home zip code at a rate of five times per week for employees and three times per week for students, controlling for time-off and semester breaks.
- Air miles booked on behalf of the university but not using the university's contracted travel agent could not be directly accounted for. Instead, the university estimated based on a historic average of 51% of university air trips booked through contract a prorated miles traveled for the additional 49%.
- The Athletics department has a separate budget from the University Budget. The department was unable to report travel statistics. Based on this neither the budget nor the emissions are included in the calculations. Furthermore, the university was not able to include an accounting of emissions resulting from Athletic events, other than utilities consumed. Unlike other expenses, Athletics department utilities are paid out of the University's general funds and are therefore reflected in this survey. In future years, the university intends to include all of the Athletics department's emissions in our GHG reporting, but unable to reliably do so in time for this report.

Upon completion, the baseline greenhouse gas inventory report was presented to a panel of university reviewers prior to submission.

FINDINGS & RECOMMENDATIONS

The following table summarizes the GHG emissions estimates produced by this survey for the University of Louisville:

	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**

The largest portion of the university's carbon footprint (58%[2]) can be attributed to scope 2 emissions produced from purchased electricity. As this electricity is produced from the burning of fossil fuel (coal), a vital part of our strategy for reducing our carbon footprint must be a reduction in the use of this purchased electricity. This can be achieved through a multi-pronged approach involving:

1. Renewable Energy: The university could seek to produce more of our own electricity on campus from renewable sources such as the demonstration photovoltaic array on the roof of our Speed School of Engineering. The university can also use our power as a major customer of LG&E to push the utility to invest more in renewable energy production. Conducting locally-relevant research on renewable energy technologies and sharing the findings with the utilities and industries would also speed the transition from fossil fuels.

2. Energy Conservation: The 'greenest' energy is that which is not wasted. The university is taking a wide variety of steps toward reducing its overall and peak demand for electricity. UofL is implementing hundreds of energy saving measures through a performance contract with Siemens Corp. This process will invest over twenty million dollars in lighting upgrades, high efficiency motors, improved temperature controls and water conservation measures on Belknap Campus. Plans are underway to conduct and energy audit of the Health Sciences Center campus in FY10.

   The university's College of Arts & Sciences Green Team recently conducted office energy audits. In all 700 individual offices of the College of Arts & Sciences were reviewed and staff were provided with comparative data about their energy use. The intention is to drive behavior changes and identify areas where demand could be reduced through better insulation and more efficient equipment. This audit process could be extended to every school and college at

[2] Percentages based on 2008 data.

the university to further raise awareness and identify priority facilities for energy retrofits.

The next largest portion of UofL's carbon footprint is derived from its scope 1 stationary combustion emissions (21%). These are primarily produced from our coal-burning central steam and chilled water plant used for warming and cooling buildings on the Belknap campus. These emissions could be reduced through improved efficiency in the way we heat and cool buildings. Possibilities include everything from extensive efficiency retrofits to installing programmable thermostats to encouraging more moderate heating and cooling expectations among those who use our buildings.

For scope 3 emission, while the percentage of our total emissions from the university's 194 fleet vehicles is small (0.005%), commuting to campus and university-related air travel represent a sizable fraction (9% and 5.5% respectively). UofL has traditionally been a commuter campus, with just 9% of students living on campus in recent years. Between 2006 and 2008 the number of students reached 22%, more than doubling the historic average of residential students. The university's strategic plan sets a goal of 32% of students living on campus by 2020. This should continue to reduce the number of miles students drive to campus on aggregate.

Fiscal Year	Scope 3 Emissions Sources					Scope 2 Transportation & Distribution Losses
	Faculty / Staff Commuting	Student Commuting	Directly Financed Air Travel	Solid Waste	Paper Purchasing	
	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2	MT eCO_2
2006	10,177.0	6,585.7	10,078.1	614.4	666.9	13,300.7
2007	10,645.5	6,585.7	10,418.2	654.0	598.4	10,972.4
2008	11,047.6	6,585.7	10,604.3	627.0	640.6	11,019.5

All students and staff are discouraged to drive through required parking permit fees on campus. They are encouraged to get to campus via public transit (with unlimited free rides on the TARC system for anyone with a UofL identification card) and/or walking and bicycling (encouraged through the 'Get Healthy Now' campus wellness program and the installation of more bike racks in recent years). Much more could be done to raise awareness of and promote these alternatives along with carpooling.

The university could provide free or discounted loaner bicycles, helmets and bike route maps. It could increase the number of bicycling education classes to help riders and drivers safely share the road. UofL could work with the Metro government to improve bicycle and pedestrian infrastructure around its campuses, and seek partnerships with businesses to open a bicycle shop on or adjacent to each campus. Showers could be installed in campus office buildings for those who wish to bike to work. The amount of bicycle parking could be increased with racks placed convenient distances from building entrances. Finally, as we've started with our "Commute Green" webpage, the university could further publicize and target communications to online resources for green commuters such as: the TARC trip planner (www.ridetarc.org), carpool organizers (tickettoride.org), and safe bicycle route finders (www.ridethecity.com/louisville).

Air travel is highly polluting, though not always necessary. The university is increasingly using technologies like video-conferencing to reduce the need for long-distance travel. Further reductions in the number of air miles traveled could be achieved if employees and students were encouraged to consider bus, train and carpool travel for medium-distance trips. The university's contracted travel agent could be advised to make these lower-impact options available when appropriate.

CONCLUSION

With this baseline report, the University of Louisville is proud to have made the first attempt to comprehensively document its total greenhouse gas emissions. It is not a flawless report or a complete and precise accounting. These numbers are estimates. The university recognizes the need to further refine our techniques for gathering this data and is developing strategies to do so.

It is important to note that as the university continues to capture a more complete picture of university-affiliated emissions, the net *reported* emissions numbers may rise in future years even if our *actual* emissions stabilize or decline.

The university very much expects the trend in actual emissions to improve as it will be making significant improvements in energy efficiency throughout the institution in coming years. With President Ramsey's commitment to achieve climate neutrality and the day-to-day work of the Sustainability Council, the Assistant to the Provost for Sustainability Initiatives, and numerous individual staff, faculty, researchers and students across our campuses, the University of Louisville is bound for a brighter, greener future.

UofL's mission is to teach the next generation and research solutions to our pressing problems. In striving for climate neutrality as an institution, the University of Louisville is leading by example and providing our students and employees vital lessons in stewardship and responsibility.