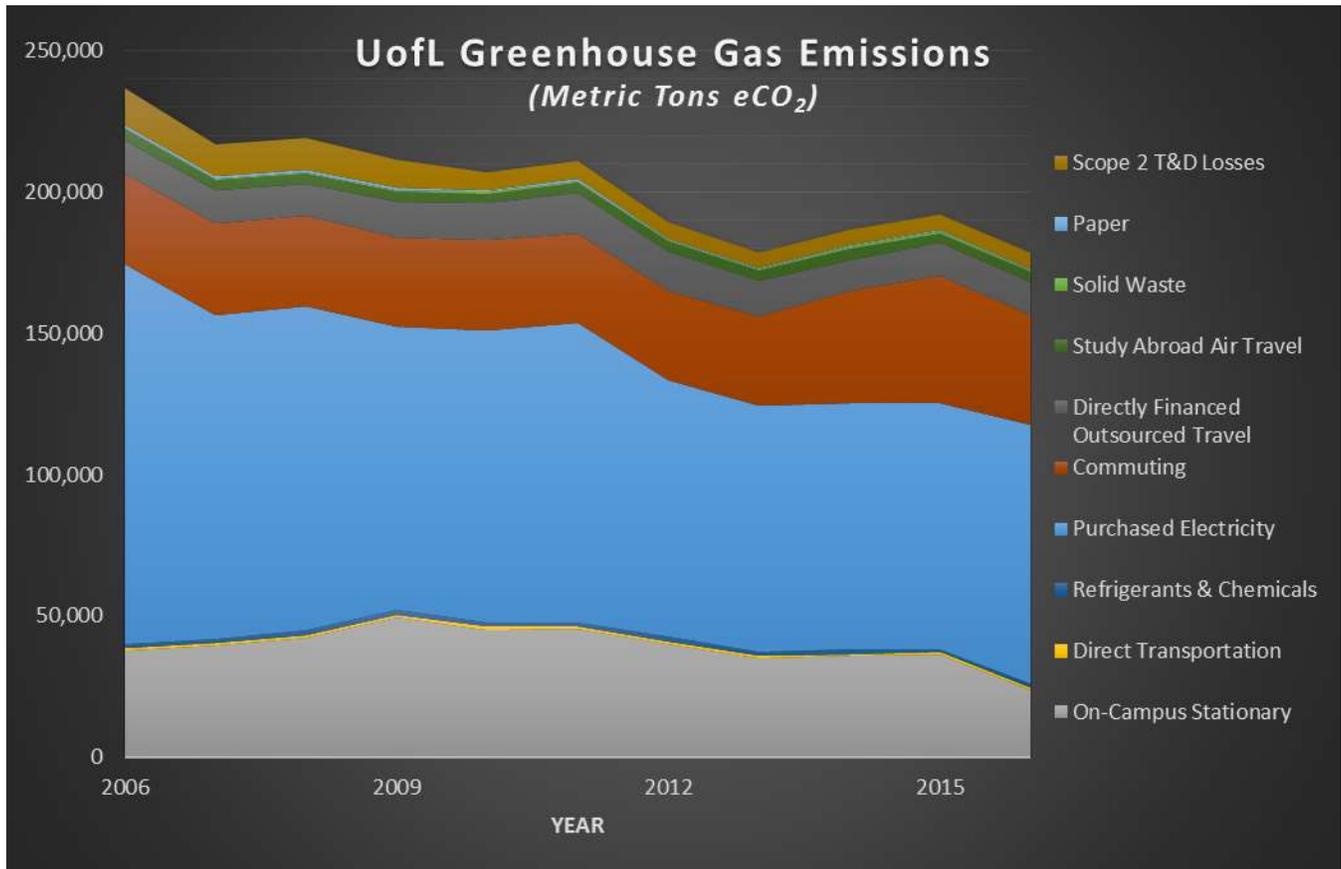


UNIVERSITY OF LOUISVILLE

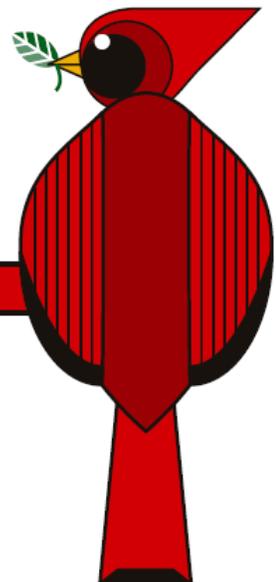


GREENHOUSE GAS EMISSIONS INVENTORY 2006 - 2016



U^{of}L Sustainability

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



louisville.edu/sustainability

ACKNOWLEDGEMENTS

Report Prepared By:

Project Coordination, Narrative, Data Collection & Analysis:

Justin Mog, PhD

Assistant to the Provost for Sustainability Initiatives

Lead Data Manager:

Steven Sizemore, AICP

Graduate Research Assistant, Urban & Public Affairs

The preparers of this report would like to acknowledge the work of all of those who aided in the development of this document, including but not limited to:

Mary Alexander-Conte, Director, Disbursement Services, Finance
Brian Barnes, Director, EcoReps Program & Composting Operations
Russ Barnett, Director, Kentucky Institute for the Environment & Sustainable Development
Shari Barrow, Senior Analyst, Institutional Research
Aaron Boggs, Assistant Director, Physical Plant Maintenance and Renovations
Brad Bohannon, Business Rental Sales Manager, Enterprise
David Heard, Vice President, University Travel, [Anthony Travel](#)
Glen Todd, Director of HSC Physical Plant Maintenance, Facilities
Kenneth Dietz, Director of University Planning, Design & Construction
Robert Goldstein, Vice Provost, Institutional Research
Virginia Hosono, Associate Director, Office of Study Abroad and International Travel
Paul Hoza, Chemical Regulatory Specialist, Dept. of Environmental Health & Safety
George Kirwan, Assistant Director of Engineering, Physical Plant
Curtis Monroe, Assistant Director of Purchasing/Materials Management
Peggy Moore, Space Coordinator, University Planning, Design & Construction
Kerry Schmidt, Director of Finance & Operations, Provost Units
David Simpson, Chair & Professor of Urban & Public Affairs, Chair of Sustainability Council
Robin Stewart, Assistant Director, Contract Administration & Procurement Services
Dennis Sullivan, Assistant Director, Dept. of Environmental Health & Safety
Frances Woodson, Lead ERP Systems Analyst, Performance Improvement & Business Analytics

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Report Prepared For:

Carbon Commitment (formerly American College & University Presidents' Climate Commitment)

Date of Submission:

April 2017



University of Louisville Greenhouse Gas Emissions Inventory 2006 – 2016

EXECUTIVE SUMMARY

Thanks to sustained investment of resources and attention over the last six years, the University of Louisville's efforts to implement our [Climate Action Plan](#) have continued to pay dividends and reap rewards for the university, our region, and our common global future. Despite a troubling reversal of progress documented in last year's inventory, UofL has managed to stay on track and continue reducing waste, inefficiency, and emissions across campus. This report documents the progress we have made in reducing our greenhouse gas (GHG) emissions, even as we continue to grow as a university.

From 2006 to 2016, we estimate that UofL's net carbon emissions have been reduced nearly 25% from 236,101 to 177,704 metric tons.

We have also documented that UofL is well on its way to achieving our first milestone goal of a 20% reduction in emissions from our 2008 baseline by 2020. In 2016, we stood at an 18.69% reduction from the 2008 baseline.

A key finding of this inventory is that UofL's emissions continue to DECLINE overall, despite an increase documented from 2013 to 2015. UofL has since reversed this trend. In 2016, the university was able to achieve an overall reduction of 7.2% in carbon emissions from 2015.

By continuing to invest in efficiency and behavior change, we are proud to announce that in 2016, we reversed those trends and began reducing emissions once again. This was a vital investment for the sake of our students' futures, and, indeed, for our common future on this one shared planet.

While this reduction is important and laudable, we certainly cannot rest on our laurels. We must remain vigilant, committed, and willing to invest resources in order maintain our progress and to ensure a sustained effort toward our ultimate goal of climate neutrality by 2050. ***We must continue to invest in emissions reduction, to innovate solutions that work in our unique urban setting, and to prioritize efficiency, behavior change, transportation alternatives and renewable energy.***

The most important steps that UofL needs to take in the near-term are:

1. **Reduce driving through a Transportation Demand Management Plan** that invests in and incentivizes alternatives, caps parking, & transitions UofL from highly subsidized annual permits to market-rate, pay-per-use parking.
2. **Invest in large-scale renewable energy, behavior change, and energy efficiency** measures beyond the scope of the existing performance contract.
3. **Explore carbon offsetting and sequestration solutions** that would benefit our campus, community, and region.

This inventory represents UofL's on-going effort to track GHG emissions for the purpose of developing and refining strategies to reduce the pollution that results from our activities. ***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.***

You will find herein a summary of the estimated GHGs for which UofL was responsible during the years 2006 through 2016. This is the fourth inventory update since our baseline GHG inventory, submitted in 2009. It follows the release of UofL's [Greenhouse Gas Emissions Inventory for 2006-2015](#), in January 2016.

This inventory provides an estimate of greenhouse gas emissions resulting from the activities of some 30,579 people who share our campus as students, faculty and staff, as well as the operation of nearly 8.5 million square feet of buildings on all three of the university's campuses, including the Belknap, Health Sciences Center, and Shelby campuses.

BACKGROUND

On August 1st, 2008, former 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, which persists across administrations. The University remains true to this commitment, having determined a baseline inventory of greenhouse gas emissions in 2009 and having developed a comprehensive [Climate Action Plan](#) in 2010. This Plan acts as a living document for UofL and serves as roadmap to achieve net climate neutrality by 2050, with interim goals for emissions reduction along the way.

The enclosed findings are estimates only, based on an admittedly imperfect system of data gathering. We continue to refine our carbon accounting methodology each year, and this reporting represents a significant step forward in the comprehensiveness and accuracy of our data gathering and estimation. With this report, the University continues to more accurately track our emissions.

The major improvement to this reporting is the inclusion of all UofL Athletics air travel data which had been unavailable for previous reports. We have accurate data for 2016 and 2015, with back estimates for prior years.

METHODOLOGY

GHG emissions are typically broken down into three categories and defined as scope 1 (on-campus sources), scope 2 (off-campus sources), and scope 3 (indirect sources). All three categories are included in this report.

The data summarized herein includes utilities data for some 120 buildings on all three campuses which are owned by the University, comprising approximately 8,498,067 gross square feet of building 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, residence halls operated by third parties, the University Hospital, and off-campus leased space.

The report also tracks emissions from some of the behaviors of our total campus population of 30,579 students, faculty and staff. The transportation choices of this community have been particularly impactful on our collective carbon emissions. Our most recent [fall 2015 UofL Transportation Alternatives survey](#) uncovered a disturbing increase in driving alone to campus (especially amongst employees). We've also seen an increase in the use of highly-polluting air travel to conduct university business. These shifts in the wrong direction may be in large part due to a precipitous drop in fuel prices, but these market conditions only ***increase the need for UofL to be proactive and strategic in our efforts to change transportation behaviors.***

The University's emissions were estimated using the UNH (formerly Clean Air-Cool Planet®) Campus Carbon Calculator v8.0.

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

Emissions not reported due to the lack of accurate, attainable data or trends on which to base projected estimates include wastewater and purchased steam and chilled water from the shared Louisville Metro Steam & Chilled Water Plant, an independent, non-profit entity that supplies steam and chilled water to the entire downtown hospital and medical center, including our Health Sciences Center.

FINDINGS & RECOMMENDATIONS

For years 2006 through 2016 our revised estimates suggest that the University of Louisville produced annual average net emissions of 201, 794 metric tons of carbon dioxide equivalent (MT CO₂e) from all sources. Despite a brief two-year period of regression between 2013 and 2015, our net emissions for 2016 appear to have regained its previous downward trend, both in absolute terms and relative to growth in the size of the University.

From 2006 to 2016, we estimate that UofL's net carbon emissions have been reduced nearly 25% from 236,101 to 177,704 metric tons.

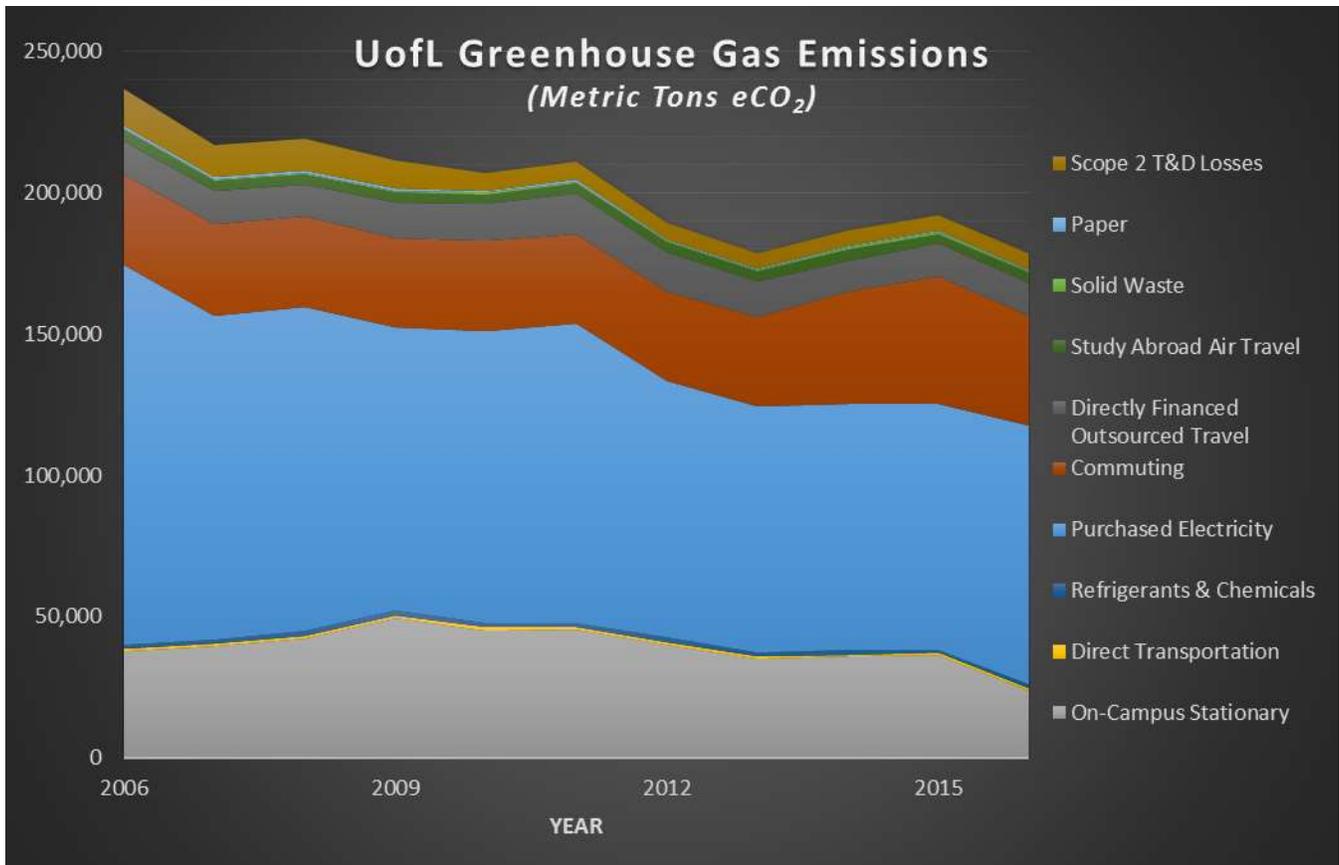
We have also documented that UofL is well on its way to achieving our first milestone goal of a 20% reduction in emissions from our 2008 baseline by 2020. In 2016, we stood at an 18.69% reduction from the 2008 baseline.

A key finding of this inventory is that UofL’s emissions continue to DECLINE overall, despite an increase documented from 2013 to 2015. UofL has since reversed this trend. In 2016, the university was able to achieve an overall reduction of 7.2% in carbon emissions from 2015.

While this reduction is important and laudable, we certainly cannot rest on our laurels. We must remain vigilant and committed in order maintain the current trend and to ensure a sustained effort toward our ultimate goal of climate neutrality by 2050. We must continue to invest in emissions reduction, to innovate solutions that work in our unique urban setting, and to prioritize efficiency, behavior change, transportation alternatives and renewable energy.

The increases we saw in emissions from 2013-2015 were ***not solely attributable to the continued growth of our university*** in terms of budget, employees, students, land, and building space. It was particularly troubling to note increases across the board in terms of emissions per student, per capita, per square foot of building space, and per dollar of operating budget.

By continuing to invest in efficiency and behavior change, we are proud to announce that in 2016, we reversed those trends and began reducing emissions once again. This was a vital investment for the sake of our students’ futures, and, indeed, for our common future on this one shared planet.



Trends

As we noted in our 2013 and 2015 GHG inventories, **UofL has made disproportionately good progress in reducing electricity and on-campus stationary fuel consumption compared to a notable lack of progress reducing emissions from transportation sources** (commuting, university financed air travel, and study abroad air travel).

In August 2012, the UofL Sustainability Council aggressively expanded the diversity and scope of [transportation initiatives](#) available on campus, and our work has gained national recognition. In addition to offering students and employees free access to the entire Louisville transit system, UofL now also offers a [car-share system](#), [bike-share](#) program, ride-sharing through our new [Cardinal Directions](#) online platform, and our extremely popular and nationally-recognized [Earn-A-Bike program](#) through which students and employees willing to give up their right to a UofL parking permit for at least two years can earn a \$400 bike shop voucher.

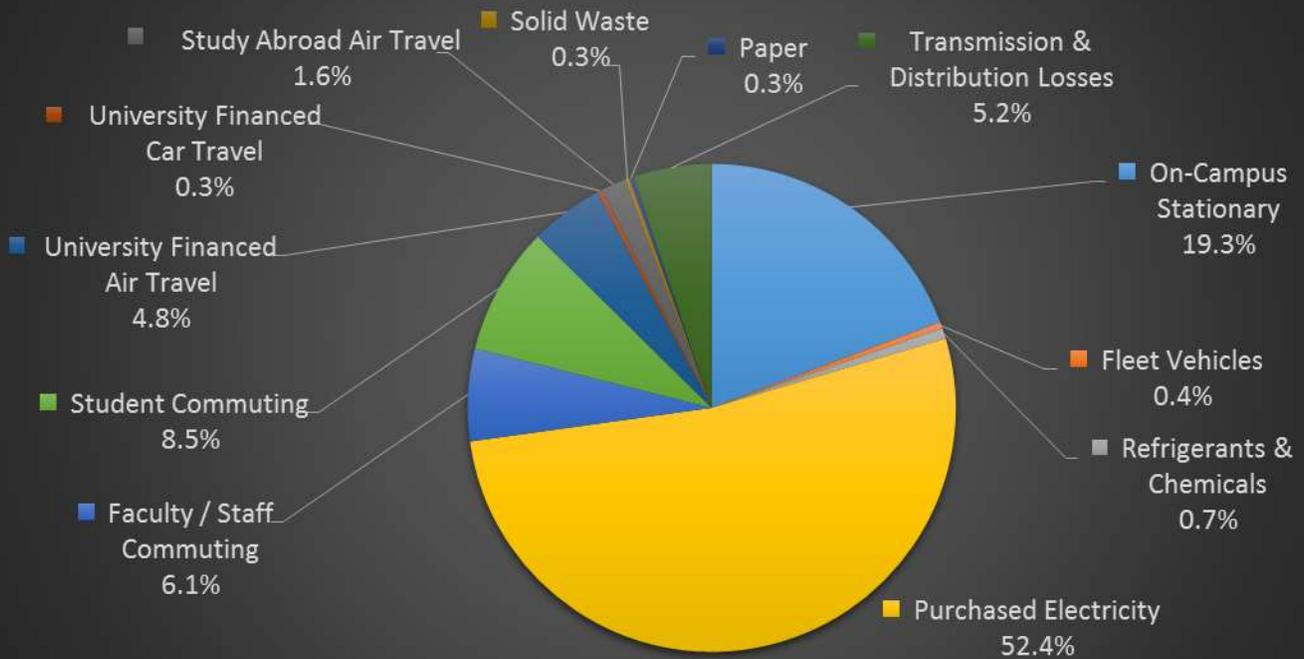
The only significant transportation alternative we have failed to launch are [vanpools](#) due to a lack of a critical mass of willing participants commuting from the same location on the same schedule. We also have not been successful in setting-up intercity bus service from UofL's main Belknap campus. In 2013-14, we worked with [Miller Trailways](#) to try to launch a new Campus Connector service to offer direct daily departures to Frankfort and Lexington from Belknap campus. Despite UofL's willingness, the University of Kentucky did not provide a welcoming solution on the other end of the Connector. In 2014, we also worked with [BreakShuttle](#) to try to establish a charter bus option for UofL students traveling over major academic breaks, but the service never materialized.

Despite our overall progress in offering a wide variety of transportation alternatives, our fall 2015 survey revealed that many UofL commuters have reverted to prior bad habits of driving alone and choosing to live far from campus. More student housing has opened around campus, so student commute numbers are better, but **employee commuters are not doing their part to reduce emissions**, traffic congestion, and parking pressures associated with driving to campus.

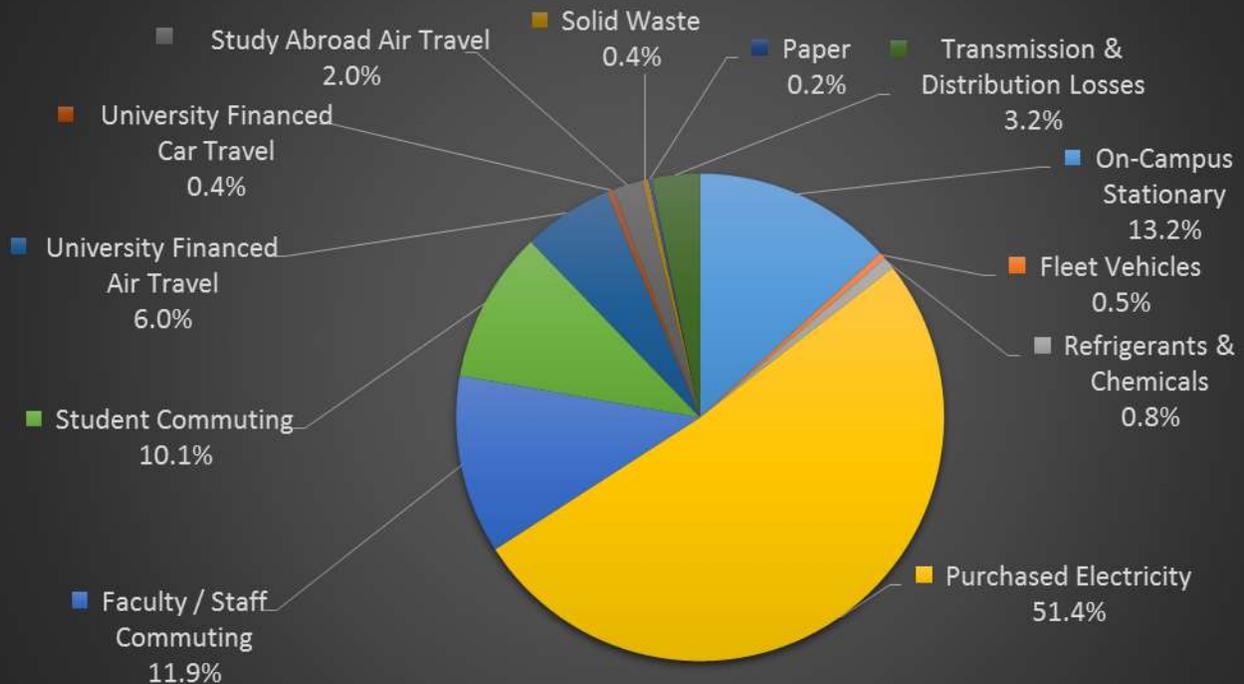
To reverse this trend, ***UofL needs to develop and implement a strategic, comprehensive Transportation Demand Management Plan which will provide not only ease of access to alternatives and incentives for using them, but more importantly, UofL needs to begin implementing DISINCENTIVES to driving alone.*** An overabundance of parking combined with a system of annual rather than as-needed parking permits, parking costs well below market-rate, and a pervasive culture of driving makes it extremely difficult to for alternative modes to gain traction amongst our campus population.

The university's 2017 budget crisis offers a prime opportunity to reconsider parking fees a to rationalize our parking structure so that people can pay market-rate prices for parking when the need it rather than purchasing an annual permit that makes daily driving the norm.

UofL Greenhouse Gas Emissions by Source (2008)

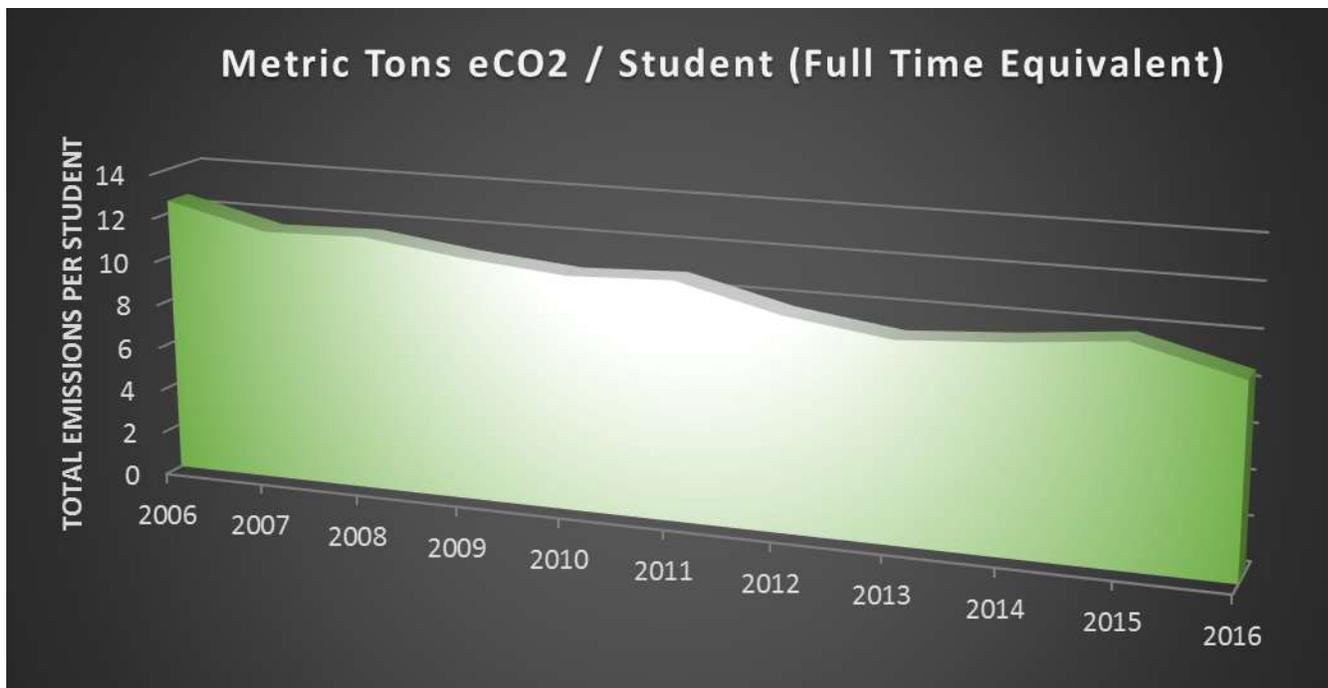


UofL Greenhouse Gas Emissions by Source (2016)

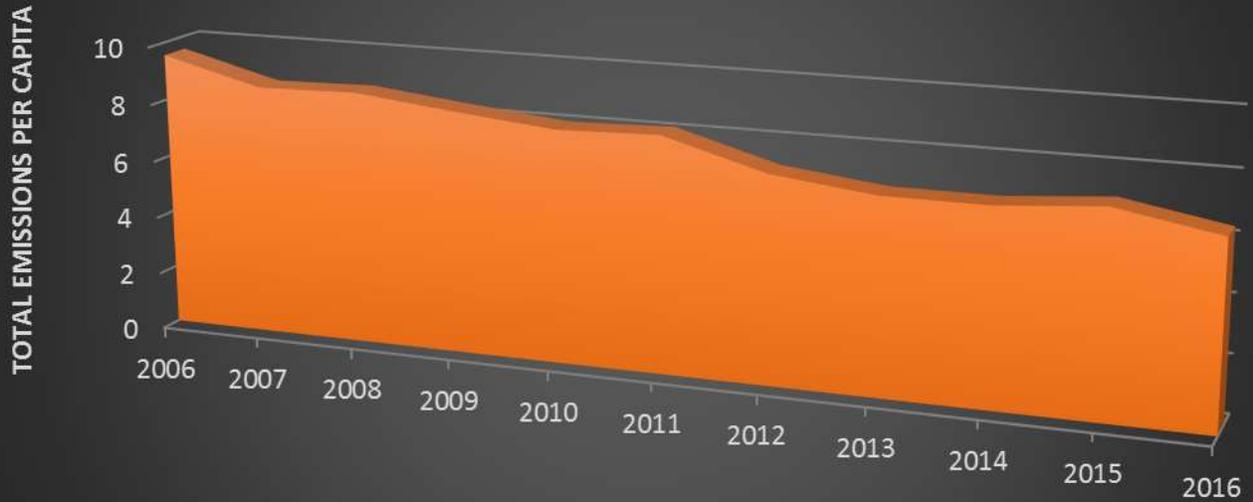


The University's population, budget and land holdings have continuously grown over this period. Despite the growth, our net GHG emissions had not grown in proportion, and, in fact, has been on an overall downward trajectory, despite the 2013-15 increase. This is the case both in absolute and relative terms.

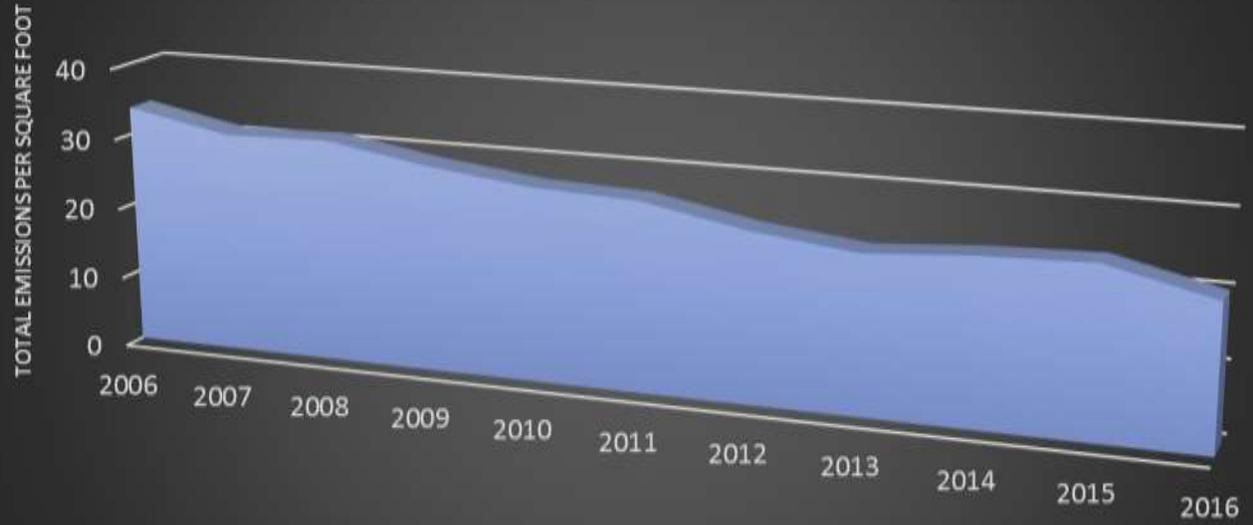
Year	Net Emissions	Per Student	Per Capita (Students + Faculty + Staff)	Per Sq. Ft. of Building Space	Per Annual Operating Budget	Per Number of Heating Degree Days	Per Number of Cooling Degree Days
	MT CO ₂ e	MT CO ₂ e / FTE Student	MT CO ₂ e / Person	kg CO ₂ e / ft ²	g CO ₂ e/ \$	MT CO ₂ e / HDD	MT CO ₂ e / CDD
2006	236,101	14.9	8.5	33.8	350.0	56.1	176.7
2007	216,171	13.5	7.8	31.0	298.4	49.5	168.3
2008	218,540	13.6	7.8	31.3	273.1	50.2	187.5
2009	210,661	12.9	7.5	28.9	248.8	45.2	207.0
2010	206,490	12.3	7.2	27.1	245.5	43.4	133.1
2011	210,300	12.4	7.3	26.6	200.9	45.4	162.2
2012	188,358	11.1	6.5	23.8	180.2	51.0	127.3
2013	177,973	10.3	6.1	22.1	171.2	38.9	159.4
2014	185,945	10.7	6.1	23.3	180.0	37.5	161.3
2015	191,491	11.2	6.3	23.5	191.1	38.9	155.2
2016	177,704	10.2	5.8	20.5	144.8	40.7	144.1
Average	201,794	12	7	27	234	46	164



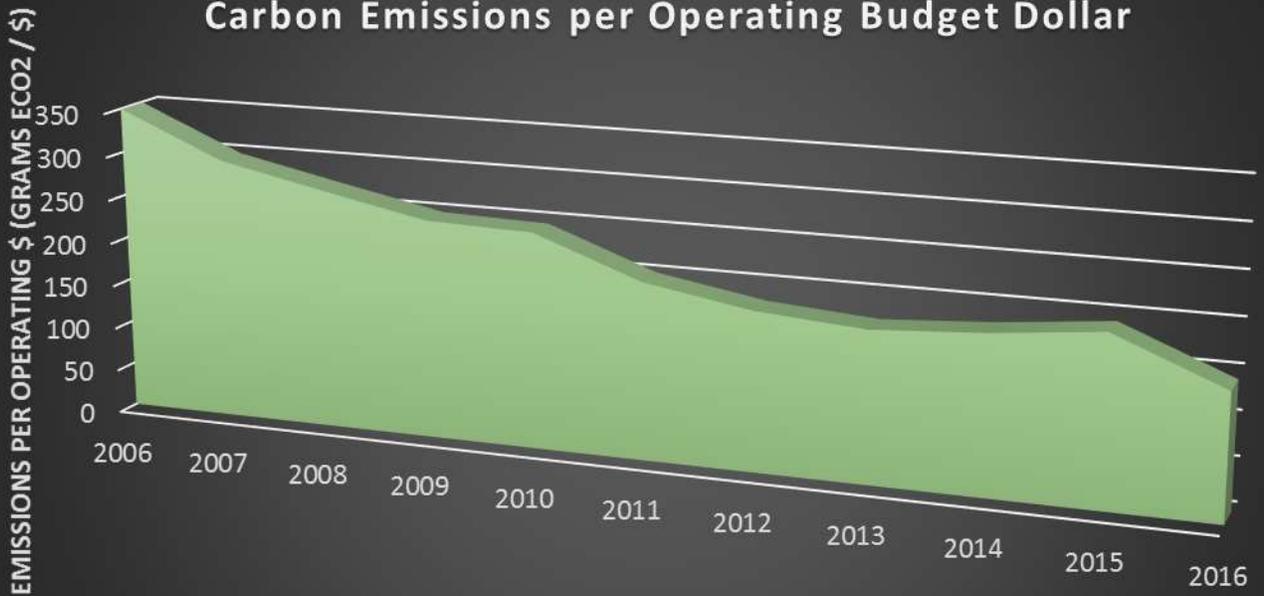
Metric Tons eCO2 per capita (Students+Faculty+Staff)



kg eCO2 / Square Foot Building Space



Carbon Emissions per Operating Budget Dollar



The overall trends reflect the fact that the University has been committed to greater energy conservation and has invested considerably in improving building efficiency through a [performance contract with Siemens](#). This nearly \$50 million project, involving 88 buildings (6.2 million square feet) on all three UofL campuses is projected to directly save the university \$4.4 million every year and to reduce our annual carbon dioxide emissions alone by over 46,000 tons (the equivalent of removing 7,690 cars from the road). With these improvements, UofL expects to reduce its utility bill by over \$12,000 per day.

In June 2015, we launched a [third phase](#) to invest an additional \$5.4M in improvements in lighting, heating, electrical systems, water conservation and other areas. Through this effort, we have made additional improvements which are expected to lead to another \$457,600 in annual cost savings. Cardinal Sports Park, Ekstrom Library, J.B. Speed, Strickler, Shumaker, and Sackett halls on Belknap Campus were all among buildings receiving improvements during the third phase, along with the Research Tower and Baxter I, Baxter II and Medical-Dental research buildings at HSC.

As can be seen in this report, these efforts have already produced documented results. As one example for which we have documented savings, in FY 2011-12, Belknap Campus reduced fuel use 48%, electricity use 27%, and water use 31%. Efficiency-minded campus users have helped us exceed our engineers' expectations. They had predicted fuel use to decline nearly 40% and electricity use to drop at least 20% annually. This represented a large step for UofL in emissions reduction, but it was only the first of many laid out in our [Climate Action Plan](#).

UofL's goal is to achieve climate neutrality by 2050. We are well on our way, but we need to step up our efforts and accelerate progress to achieve that goal. Current rates of reduction will not get us there by 2050, and failure to do so is dangerous for the institution and our planetary future.

Our plan for making progress toward climate neutrality is dynamic and multifaceted. We recognize that sustainability demands progress on multiple fronts and that lasting change cannot be achieved without coordinated, university-wide efforts. As such, we will be taking a variety of steps to lead UofL down a path toward climate neutrality.

DATA LIMITATIONS

It must 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:

- **Purchased Steam & Chilled Water:**
UofL's Health Sciences Center does rely on purchased steam (in FY15 it was 209,517.98 MMBtu) and purchased chilled water (in FY15 it was 235,715.79 MMBtu) from the shared Louisville Metro Steam & Chilled Water Plant, an independent, non-profit entity

adjacent to HSC that supplies steam and chilled water to the entire downtown hospital and medical center. We are not reporting these numbers directly as part of our scope 2 emissions, however, because we have no way of knowing what the fuel mix was and because we have no other historical data to compare to. Each year, we do, however, report as scope 1 steam coal emissions an estimate of UofL's portion of the total coal burned at the shared Louisville Metro Steam & Chilled Water Plant. We report these numbers instead of MMBtu of purchased steam and chilled water because it is impossible for us to know what the complete fuel mix is at that Plant. We know that coal is not the only fuel source, but we cannot access records to give us a complete accounting. UofL recognizes this flaw in our GHG accounting. We are not able to report UofL's portion of the natural gas, electricity, or other fuel sources consumed at the Louisville Metro Steam & Chilled Water Plant. This is not an insignificant source of carbon emissions, but we have no way of tracking it.

- **Facilities UofL Does Not Own:**

The University recognizes that its true carbon footprint includes emissions from facilities that it does not own (such as private residence halls, leased off-campus space, or which are owned by separate affiliated entities such as the UofL Hospital and UofL Foundation). These emissions are not included in our reporting, however, as it is not possible for the University to track or control these emissions. We chose to focus our inventories on facilities we have direct control over.

- **Wastewater:**

UofL's 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. We recognize that scope 3 emissions from the University's sewage are not insignificant and would like to find a way to include these figures in future reports.

- **Athletics Travel & Events:**

The Athletics department has a separate budget from the University and operates with considerable autonomy. This has limited our access in the past to complete data about Athletics travel. For the first time, in this report, however, we were able to collect travel data from the department for years 2015 and 2016. This data was not broken down by employees vs. students, but we broke it out based on an assumption that student athletes made up 80% of the travelers. In order to generate a rough estimate Athletics air travel for previous years, we took the average between 2015 and 2016 (3,718,008 student athlete miles and 929,502 athletics staff miles) and applied it to all previous years. We were not able to include an accounting of emissions resulting from on-campus Athletics events (such as fan travel), other than the utilities consumed (as these are paid out of general funds).

- **Air Travel:**

a) Air miles booked on behalf of the University but not using the University's contracted

travel agent could not be directly accounted for. Instead, we have estimated this additional mileage based on a 2015 calculation that 68% of University air travel expenses are booked through contract and prorated miles traveled for the additional 32% accordingly.

b) We were unable to receive any non-Athletics travel data for the first half of 2016 from our former non-Athletics travel agent, PanAm, so we simply doubled the non-Athletics mileage from Anthony to estimate the annualized total.

c) The travel data we receive is not divided by students vs. employees, so we have to estimate the split based on a rough assumption that students account for 9% of all non-Athletic travel, as has been the case historically.

d) The air miles for Study Abroad trips not booked through UofL travel agents have to be estimated for each leg of each flight using airmilescalculator.com. For a small percentage of these trips, the exact itineraries between home and destination cities was not known and had to be assumed. Study Abroad data prior to 2011 is not available and had to be roughly estimated based on trend.

- **Rental Car Mileage:**

While we were able to get very detailed and accurate data for rental car mileage booked through our primary contractor, Enterprise/National, unfortunately, we were not able to get non-Enterprise/national rental car mileage data from either of the travel agents we contracted with in 2016. Instead, we calculated a rough estimate of rental car mileage booked through our travel agents based on a simple proportion using 2015 travel agent air vs. car miles and known 2016 travel agent air miles. Rental car mileage data prior to 2013 is incomplete, so we simply use a very rough estimate assuming minimal change.

- **Personal Mileage Reimbursements:**

Prior to 2016, Personal Mileage Reimbursements had been handled via thousands of paper travel vouchers. We have always lacked the staff time necessary to go back through all those paper records to come up with an estimate of total annual mileage. As promised in our last report, however, UofL has gotten a better handle on personal mileage as we transitioned to digital travel vouchers in 2016. New to this year's report is the inclusion of UofL's total calendar year 2016 personal vehicle mileage reimbursements. This data includes all of the following types of travel: In-State Travel (219,756 mi); Out-of-State Travel (106,726 mi); Student Travel (10,350 mi); Prospect Travel (7356 mi); International Travel (1817 mi); Other Non-Employee Travel (1032 mi); Employee Recruitment (435 mi); Coach Recruitment (115 mi); and Student Recruitment (21 mi). With no actual data for previous years, we have done the best we could to estimate annual personal mileage reimbursements for 2006-2015 based on each year's total campus population multiplied by the per capita mileage in 2016 = 347,608 miles / 30,579 people = 11.36753981490565 miles/person.

- **De Minimus Emissions:**

In calculating our carbon footprint, the University used rough, upper-bound estimates to designate as *de minimus* (or materially insignificant) 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, perfluorocarbons used in eye surgeries and MRIs, sulfur hexafluorides used in ultrasound imaging, and fugitive emissions from laboratory animals used in medical research.

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, former 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, former Provost Shirley Willihnganz established the university-wide Sustainability Council that same year. Comprised of representatives from a broad spectrum of University departments along with administrators and students, the Council aims to do the following:

- Oversee the work of four committees on sustainability initiatives (Operations; Education & Research; Planning & Administration; and our new Engagement committee);
- 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 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 full-time professional and administrative staff position devoted exclusively to the effort. UofL hired its first-ever Assistant to the Provost for Sustainability Initiatives in August 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.

In August 2004, the University teamed with the biggest public institutions in Louisville 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 four largest public entities: the University of Louisville, the Jefferson County Public Schools, Louisville Metro Government, and now Jefferson Community & Technical College.

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 University to develop its own Climate Action Plan.

Today at UofL, the purchasing department and food vendors are 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 is doing a lot, but can, and will, do more. One of the goals of UofL's strategic plan for 2020 is to be "creative and responsible stewards" of resources. For the University, part of that stewardship means making a commitment to sustainability and efficiency; and to tracking our progress through STARS. As a Charter Participant in STARS back in 2011, UofL was the first school in the region -- and the 10th in the nation -- to achieve a STARS rating. To this day, we continue to have the highest STARS rating in Kentucky, a [STARS Gold rating \(65.19%\)](#) earned in February 2016. This represented a 6.9 point increase from our February 2013 [STARS Silver rating \(58.29%\)](#), and a significant improvement from our first rating in January 2011 of [STARS Silver \(50.11%\)](#).



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.

The University of Louisville is committed to teaching, research, and service to its community and the advancement of educational opportunity for all citizens thereof. With a total enrollment of 22,640, 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

Year	Employees			Students			Total Campus Population	Operating Budget (adjusted for inflation 2005 \$)
	Faculty	Staff	Total	Full Time	Part Time	Total		
2006	2,074	3,875	5,949	15,804	6,037	21,841	27,790	\$6.76 m
2007	2,130	4,008	6,138	16,061	5,628	21,689	27,827	\$7.26 m
2008	2,124	4,050	6,174	16,027	5,734	21,761	27,935	\$8.02 m
2009	2,125	3,961	6,086	16,377	5,654	22,031	28,117	\$8.49 m
2010	2,188	4,087	6,275	16,818	5,472	22,290	28,565	\$8.44 m
2011	2,309	4,103	6,412	16,924	5,325	22,249	28,661	\$1.051 b
2012	2,316	4,585	6,901	16,963	5,330	22,293	29,194	\$1.050 b
2013	2,381	4,356	6,737	17,198	5,331	22,529	29,266	\$1.044 b
2014	2,383	5,333	7,716	17,317	5,282	22,599	30,315	\$1.037 b
2015	2,401	5,461	7,862	17,125	5,242	22,367	30,229	\$1.006 b
2016	2,439	5,500	7,939	17,406	5,234	22,640	30,579	\$.999 b

Now employing 7,939 people and operating with a budget of \$1.229 billion (2016 dollars), 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 roughly 200 road vehicles in addition to a number of pieces of heavy machinery used for grounds maintenance (backhoes, tractors, etc.). Physical Plant is responsible for maintaining the majority of these, as well as over 115 buildings (8,498,067 gross square feet) and 660 acres of land on all three campuses. 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.

METHODOLOGY

The university's Assistant to the Provost for Sustainability Initiatives served as the primary contact, author, and data compiler and analyst for this report. The data was gathered from across the university by collaborators with the university-wide Sustainability Council, in conjunction with the following units:

- Office of Institutional Research
- Office of the Vice President of Business Affairs,
- Department of Physical Plant Operations
- Department of Environmental Health and Safety,
- University Planning, Design and Construction.
- Office of Study Abroad and International Travel
- Contract Administration & Procurement Services

Faculty and graduate students in the Department of Urban & Public Affairs took a lead role in developing the commuter survey and analyzing the data. Commuting data was gathered September 15th to October 15th of 2015. Strategies for gathering the necessary data had been developed five years prior for UofL's baseline emissions inventory.

GHG emissions are typically broken down into three categories and defined as scope 1 (on-campus sources), scope 2 (off-campus sources), and scope 3 (indirect sources). 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.

Estimated emissions were estimated using the **UNH (formerly Clean Air-Cool Planet®) Campus Carbon Calculator v8.0** 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 CO₂e). 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

Year	Heating Degree Days	Cooling Degree Days
2006	4222	1340
2007	4379	1288
2008	4370	1169
2009	4671	1021
2010	4773	1556
2011	4646	1301
2012	3712	1486
2013	4599	1301
2014	4970	1486
2015	4934	1121
2016	4386	1157

have been modified as more is learned about the global warming effects of various greenhouse gases.

The default emissions coefficients supplied in the UNH Campus Carbon Calculator v8.0 were used in preparing this report. The version of the Carbon Calculator we employed uses a global warming potential (GWP) factor from the Fourth 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 (CO₂e).

In calculating our carbon footprint, the University used rough, upper-bound estimates to designate as *de minimus* (or materially insignificant) 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 our medical and research facilities, perfluorocarbons used in eye surgeries and MRIs, sulfur hexafluorides used in ultrasound imaging, and fugitive emissions from laboratory animals used in medical research. 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.

FINDINGS & RECOMMENDATIONS

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

Year	Carbon Emissions													Offsets		NET
	On-Campus Stationary	Fleet Vehicles	Refrigerants	Fertilizer	Purchased Electricity	Faculty/Staff Commuting	Student Commuting	University Financed Car Travel	University Financed Air Travel	Study Abroad Air Travel	Solid Waste	Paper	Transmission & Distribution Losses	Sequestration due to composting & trees	Green Energy Certificates	Net Emissions
	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2	MT eCO2
2006	37,770	811	1,561	8	134,394	12,943	19,229	757	10,841	3,784	678	676	13,292	(641)	0	236,101
2007	39,457	895	1,561	8	114,293	13,430	19,391	761	10,723	3,663	721	607	11,304	(641)	0	216,171
2008	42,267	927	1,561	8	114,784	13,443	18,563	758	10,630	3,548	691	650	11,352	(641)	0	218,540
2009	49,471	1,009	1,561	8	100,142	13,246	18,602	758	11,832	3,373	822	574	9,904	(642)	0	210,661
2010	44,858	1,246	1,561	8	103,474	13,502	18,447	761	12,218	3,308	804	559	6,395	(650)	0	206,490
2011	45,339	876	1,561	8	105,988	13,190	18,542	761	13,642	3,264	748	579	6,551	(749)	0	210,300
2012	40,087	866	1,561	8	90,648	13,590	18,435	764	13,087	3,409	596	503	5,603	(671)	(127)	188,358
2013	34,894	829	1,561	8	87,228	12,781	18,640	773	11,800	3,521	769	515	5,391	(736)	0	177,973
2014	35,704	844	1,561	9	87,364	17,547	21,747	870	10,220	4,028	815	499	5,400	(661)	0	185,945
2015	36,513	858	605	5	87,499	20,991	23,978	846	10,787	3,309	856	492	5,408	(651)	(7)	191,491
2016	23,565	844	1,434	8	91,672	21,152	17,928	773	10,652	3,532	741	400	5,666	(663)	0	177,704

Electricity:

By far, the largest component of the University’s carbon footprint (51.4%) can be attributed to scope 2 emissions produced from purchased electricity. Since the electricity available from the grid in Louisville is produced almost exclusively from the burning of coal and natural gas, 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:** In order to reduce emissions and hedge against energy market risk, the University must seek to produce more of our own electricity from renewable sources. Unfortunately, we are making very slow progress towards our initial goal of 20% renewable energy by 2020. **Investing in a large-scale renewable energy project**, in addition to smaller-scale installations on individual buildings, is essential to achieving this goal. The University is conducting locally-relevant research on renewable energy technologies and sharing the findings with the utilities and industries to help speed the transition away from fossil fuels. The university itself represents an important opportunity to use the campus as a living laboratory for renewable solutions.
2. **Energy Conservation:** The 'greenest' energy is that which is not wasted or needed in the first place. The University is taking a wide variety of steps toward reducing its overall and peak demand for electricity. UofL has implemented significant energy saving measures through a performance contract with Siemens Corporation, including lighting upgrades, high efficiency motors, building envelope improvements, water conservation measures, and improved HVAC systems and temperature controls on all three UofL campuses. As this contract enters its final phases, we must pursue other opportunities for conservation that fall beyond the scope of our performance contract.
3. **Behavior Change:** A key component of our [Climate Action Plan](#) is to implement strategies for changing the campus culture and individual behaviors associated with energy use. This effort began in 2008, when UofL's College of Arts & Sciences Green Team conducted energy audits in all 700 individual offices of the College and employees were provided with comparative data about their energy use. Now sustainability and energy conservation are woven into all new student and new employee orientation programs at UofL. New members of our community are encouraged to sign a "Cards Go Green!" pledge to reduce their contribution to UofL's environmental impact by selecting individual actions they will take to reduce consumption and waste. Weekly green tips in campus publications help reinforce this message regularly, and the Sustainability Council launched an [EcoReps](#) program designed to move faculty, staff & students beyond talk to action for a more sustainable UofL. We provide basic training & resources, service opportunities, and leadership opportunities as a point-person & peer-to-peer advocate for sustainability.

Transportation:

Though harder for a university to directly control, scope 3 emissions from university-related transportation represent a sizable portion of our overall carbon footprint. While fleet vehicles account for a minor 0.5% of emissions, **22% of our emissions are from commuting** alone. Another 8.4% of our emissions are from air travel and car trips. Taken together, **transportation accounts for nearly 31% of UofL's carbon footprint.**

Despite our overall progress in offering a wide variety of transportation alternatives, our fall 2015 transportation survey revealed that many UofL commuters have reverted to prior bad habits of driving alone and choosing to live far from campus. More student housing has opened

around campus, so student commute numbers are better, but **employee commuters are not doing their part to reduce emissions**, traffic congestion, and parking pressures associated with driving to campus.

To reverse this trend, ***UofL needs to develop and implement a strategic, comprehensive Transportation Demand Management Plan which will provide not only ease of access to alternatives and incentives for using them, but more importantly, UofL needs to begin implementing DISINCENTIVES to driving to campus alone.*** A series of unaddressed factors make it extremely difficult to for alternative modes to gain traction amongst our campus population:

- An overabundance of parking and no plan for capping the number of spaces on campus;
- A system of annual rather than as-needed parking permits;
- Parking costs well below market-rate and free or subsidized parking for some; and
- A pervasive culture of driving.

The university's 2017 budget crisis offers a prime opportunity to reconsider parking fees and to rationalize our parking structure so that people can pay market-rate prices for parking when the need it rather than purchasing an annual permit that makes daily driving the norm.

Carbon Offsets:

Over the last decade, the University has been able to offset its emissions by 0.3% through on-campus carbon sequestration. This is the result of the increased planting and preservation and of over 2500 trees on Belknap campus and at UofL's mostly forested 200-acre [Horner Conservation Property](#) (also referred to as the Moore Observatory). The University also composts organic wastes from grounds maintenance and began composting food wastes from campus dining facilities in July 2010. We estimate that these practices sequester nearly as much carbon as is released due to the solid waste UofL sends to the landfill.

Carbon offsetting must ultimately be a part of our solution to achieve climate neutrality. In 2015, UofL's Law School took the step of becoming the first unit on campus to voluntarily offset travel carbon emissions via the Appalachian Carbon Partnership (MACED). Through a simple "flat tax" of \$1 per trip invested in protecting small landholder forests in Appalachia, the Law School was able to pioneer the practice of offsetting carbon from university travel. Following the discontinuation of the Appalachian Carbon Partnership in 2016, we are currently exploring new opportunities for offsetting carbon emissions through projects that benefit our region.

CONCLUSION

With this update to our greenhouse gas emissions inventory, the University of Louisville is proud to uphold its climate commitment and to continue tracking and reducing its emissions. While we recognize that these numbers are merely estimates and not a complete and precise accounting, we remain focused on the primary purpose of this effort – to continue developing and refining strategies to **reduce** our emissions, as laid out in our [Climate Action Plan](#). The University recognizes the need to further refine our techniques for gathering more and better data about our climate impact and we continue working on strategies to do so.

We expect the trend in overall emissions to continue its downward trajectory as we continue to make significant investments in energy efficiency, alternative transportation, behavior change, waste minimization, and renewable energy across the institution. With the university'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.

We invite you to learn more about our sustainability initiatives and get involved through our [UofL Sustainability website](http://louisville.edu/sustainability): <http://louisville.edu/sustainability>.