

# **University of Kentucky Emissions Reduction Plan**

*Reduce campus emissions to 25 percent below 2010 levels by 2025*

Prepared by the Emissions Reduction Plan Task Force of the President's Sustainability Advisory  
Committee

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# University of Kentucky Emissions Reduction Plan

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### Emissions Reduction Plan Task Force Members:

Jeff Zumwalt, Director, Utilities and Energy Management  
Andrea Smith, Air Quality Compliance Manager, Environmental Management  
Bob Kjelland, Director, Environmental Management  
Britney Ragland, Energy Engineer, Utilities and Energy Management  
Tyler Hill, student member, spring 2017  
John Garlasco, student member, spring 2017  
Ryan Lark, student member, fall 2017 & spring 2018  
Taylor Renfro, student member, fall 2017 & spring 2018  
Paul Vincelli, faculty member, College of Agriculture, Food and Environment  
George Wagner, faculty member, College of Agriculture, Food and Environment  
Alice Turkington, faculty member, College of Arts and Sciences  
Shane Tedder, Campus Sustainability Coordinator

## Our commitment to reducing greenhouse gas emissions

On December 15, 2016, President Capilouto signed the University of Kentucky's first greenhouse gas emissions reduction commitment. In announcing this commitment, President Capilouto noted,

*"We are, above all else, a learning institution. This new commitment will catalyze not only concrete, strategic actions that will improve our environment, but also a thoughtful approach to how these issues can help further our educational and scholarly missions."*

Universities are uniquely positioned to spearhead the research, innovations, and cultural shifts necessary to address human-induced climate change. As the Commonwealth's flagship university, the University of Kentucky will serve as a leader by implementing strategies that lower greenhouse gas emissions while enhancing campus operations and reducing energy costs.

The University is committed to modeling and implementing strategies that reduce greenhouse gas emissions and promote a healthy and ecologically sustainable society. UK will reduce campus emissions by employing new technologies, conserving energy, reducing waste, and encouraging campus participation. These strategies will be integrated as high-impact, hands-on components of teaching, research, and service.

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**The University is committed to reducing campus greenhouse gas emissions to 25 percent below 2010 levels by 2025.**

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The University has a long-term objective of achieving carbon neutrality. To achieve meaningful and measurable progress, the University is committed to reducing campus greenhouse gas emissions to 25 percent below 2010 levels by 2025.

The student organization UK Greenthumb and the President's Sustainability Advisory Committee (PSAC) have been key to developing the foundational documents and campus support needed to make this commitment. In the spring of 2016, PSAC and students from UK Greenthumb initiated a collaborative effort to draft the University's emissions reduction commitment. Following the President's adoption of the commitment, the PSAC assembled a task force of students, staff, and faculty to develop this plan.

## Institutional boundaries

### *Sources of emissions*

This plan, and all future reports, will include annual emissions from eight distinct sources of campus emissions. These sources are listed below and **Appendix A** provides the emissions quantification methodology for each source. These eight sources do not include every source of campus emissions; however, they do represent the vast majority of campus carbon footprint. **Table 1** provides the University's inventory of emissions from these sources for fiscal years<sup>1</sup> 2010 through 2017. Selected sources were excluded based on a combination of these four criteria: 1) the source is outside of the physical boundary described below; 2) historic data on the source are unavailable or unreliable; 3) the estimated emissions from the source are negligible<sup>2</sup> and/or; 4) tracking and reporting on the source is difficult or unreliable. **Appendix B** provides additional details on excluded sources.

This plan uses the emission categories, known as scopes, established by the International Greenhouse Protocol Standard (<http://www.ghgprotocol.org/>). These standards organize emissions sources into three levels based on the degree of control and influence an entity has over the source and quantity of the emissions. The standard unit of measure is a metric ton of carbon dioxide equivalent<sup>3</sup> (mtCO<sub>2</sub>e).

*Scope 1* - Entity controls the amount and source of the processes and products producing the emissions

- Coal and natural gas burned in equipment owned and operated by UK and partners in housing and dining
- Fuel used in campus-owned vehicles

*Scope 2* - Entity controls the amount but not the source of the processes and products producing the emissions

- Purchased electricity

*Scope 3* - Entity controls neither the amount nor the source of the processes and products producing the emissions

- Commuting activities of students, staff, and faculty
- Student air travel for Education Abroad
- Directly financed air travel
- Solid waste sent to landfills
- Wastewater treatment

### *Physical boundaries*

This plan, and future reports, will include emissions from the sources listed above that originate from the main campus in downtown Lexington, Kentucky. This includes the operations of UK HealthCare, UK Athletics, and the facilities operated by UK's partners in student housing and campus dining services.

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<sup>1</sup> The University's fiscal year is July 1-June 30. Example: Fiscal year 2017 runs from July, 1 2016-June 30, 2017.

<sup>2</sup> Based on finding from the 2014 Greenhouse Gas Emissions Inventory and Mitigation Strategy Assessment Report.

<sup>3</sup> <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>

<b>Table 1: Campus emissions inventory 2010-2017</b>									
See Appendix A for calculation methodologies									
<b>Calculated Emissions (mtCO<sub>2</sub>e)</b>	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	
<b>Emissions for Scope 1: Direct Emissions</b>									
Coal for UK Heating Plants	77,373	82,627	61,996	39,152	24,694	25,306	21,858	21,125	
Natural Gas for UK Campus	38,807	44,440	48,927	68,916	79,802	79,343	72,314	70,518	
Gasoline for Fleet Transportation	1,783	1,811	1,772	1,781	1,777	1,773	1,693	1,791	
Diesel for Fleet Transportation	733	739	762	790	777	727	656	564	
<b>Emissions for Scope 2: Purchased Utilities</b>									
Electricity for UK Campus	323,484	338,356	348,201	337,394	352,141	348,737	362,381	372,139	
<b>Emissions for Scope 3: Indirect Emissions</b>									
Air Travel: Business	3,549	3,809	3,837	4,080	4,323	4,566	4,781	5,534	
Air Travel: Education Abroad	485	987	1,373	1,341	1,704	1,811	1,762	1,798	
Campus Commuting: Employees	21,800	23,064	22,978	23,348	23,479	24,587	23,591	25,681	
Campus Commuting: Students	5,154	5,318	4,887	4,921	4,838	4,417	3,951	4,116	
Landfill Waste	30,430	31,388	26,387	24,276	24,475	24,881	15,200	2,582	
Wastewater	320	334	301	310	312	309	301	302	
Scope 1 subtotal	118,696	129,616	113,457	110,639	107,049	107,149	96,521	93,999	
Scope 2 subtotal	323,484	338,356	348,201	337,394	352,141	348,737	362,381	372,139	
Scope 3 subtotal	61,738	64,899	59,762	58,276	59,132	60,572	49,586	40,013	
<b>Total Emissions</b>	<b>503,918</b>	<b>532,872</b>	<b>521,420</b>	<b>506,309</b>	<b>518,322</b>	<b>516,458</b>	<b>508,488</b>	<b>506,150</b>	

## Quantifying the reduction target

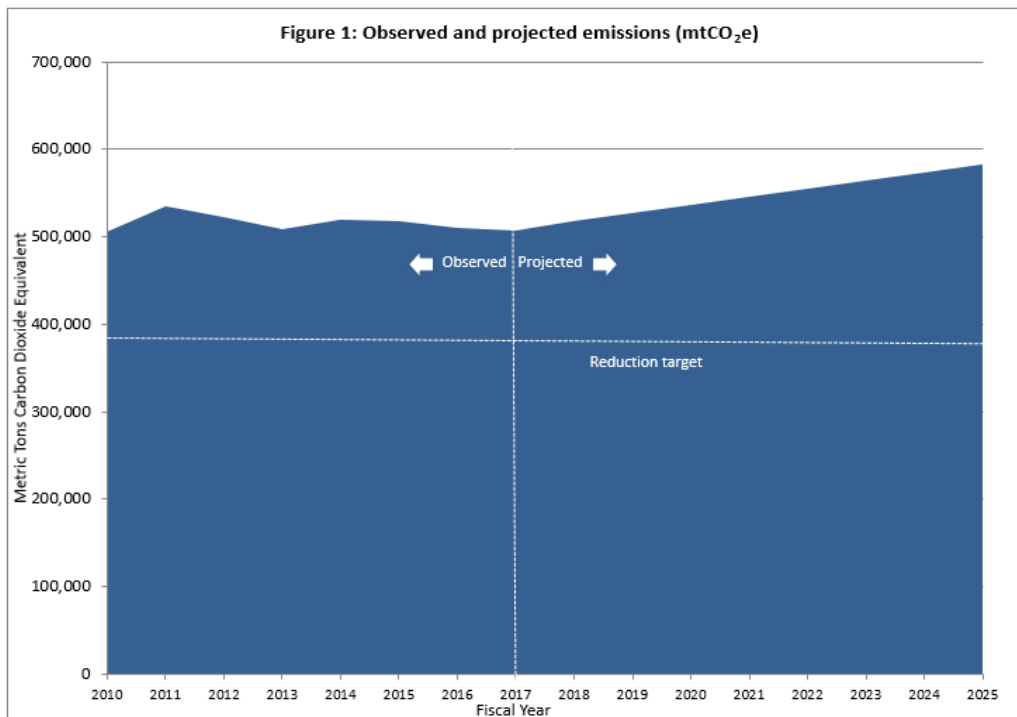
The University's emission reduction target is 25 percent below 2010 levels by 2025. Campus emissions in 2010 totaled 505,736 mtCO<sub>2</sub>e based on the sources and methodologies included in this plan. Twenty-five percent of this is 126,434 mtCO<sub>2</sub>e. Therefore, the University's commitment is to reduce or offset the annual emissions of the main campus in Lexington to no more than 379,302 mtCO<sub>2</sub>e by the end of fiscal year 2025.

Considering the growth UK has experienced since 2010, and the growth projected for the next eight years, achieving this reduction will represent a nearly 50 percent drop in the University's emissions per gross square foot of building space (mtCO<sub>2</sub>e/gsf). This will result in a decrease from the observed 0.0295 mtCO<sub>2</sub>e/gsf in 2010 to the targeted 0.0161 mtCO<sub>2</sub>e/gsf in 2025.

## Projecting future growth

Developing a set of emissions reduction strategies sufficient to achieve this commitment required making assumptions about projected growth and its impact on campus emissions. The growth projections used in this plan are based on student enrollment during the period 2010-2016. During that time, enrollment of full-time equivalent (FTE) students<sup>4</sup> increased by an average of 2.09 percent annually. Projected increases for all emissions sources in this plan are a function of that growth rate.

**Figure 1** projects the emissions of the campus assuming none of the reduction strategies contained in this plan are implemented and that the emissions intensity of key activities (i.e. steam production and electricity generation) are static across time<sup>5</sup>. This growth projection is referenced in this plan as the business-as-usual scenario.



<sup>4</sup> Integrated Postsecondary Education Data System (IPEDS) method – UK Interactive Fact Book – Student Data – FTE Enrollment.

<sup>5</sup> Both of these assumptions err on the side of over estimating future emissions. This conservative approach was chosen to ensure that reduction strategies allow the University to hit its target, even in worst case scenarios.

## Emissions reduction strategies

The University will pursue the 25 percent reduction target with a two-phased approach. The reduction strategies for Phase 1 will cover fiscal years 2018 through 2021, and focus on energy conservation and efficiency, waste reduction, and transportation opportunities. Detailed reduction projections for these strategies are provided in **Table 2** and **Figure 2**. See **Appendix C** for the methods used to estimate the emissions reduction potential for Phase 1 strategies. Phase 2 strategies will cover fiscal years 2022 through 2025 and build on the reductions achieved during Phase 1.

### Phase 1 Strategies (FY2018-2021)

#### 1. Energy Conservation and Efficiency

- 1.1 Optimize building performance for energy efficiency
- 1.2 Renovate and upgrade buildings for energy efficiency
- 1.3 Optimize electricity used for lighting through equipment upgrades
- 1.4 Improve the efficiency of baseload chilled water production
- 1.5 Optimize steam distribution systems

#### 2. Waste Reduction

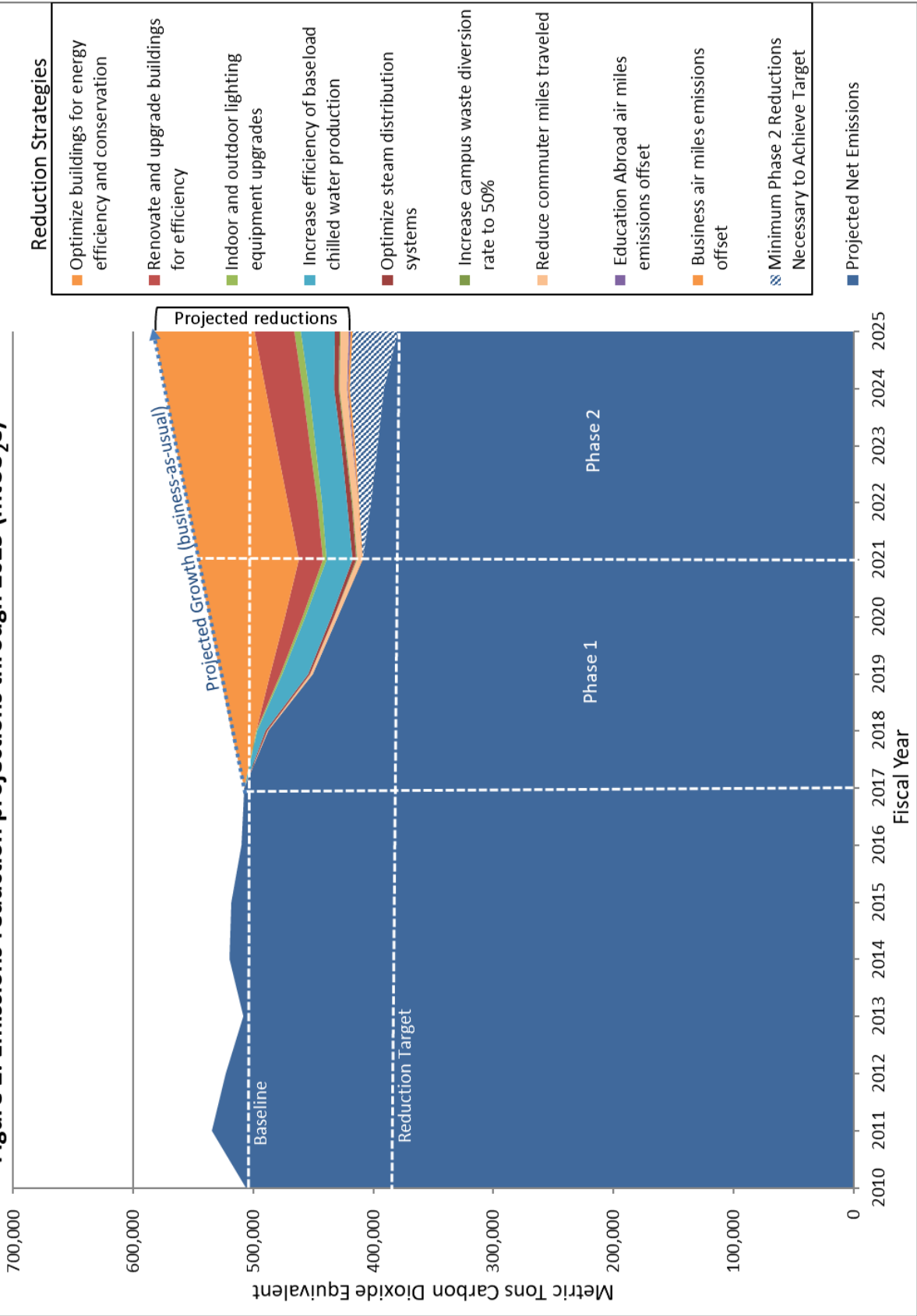
- 2.1 Increase campus waste diversion rate to 50 percent

#### 3. Transportation

- 3.1 Launch and promote alternative transportation programs and policies
- 3.2 Work with campus and community partners to develop a service learning-focused effort to offset 50 percent of the annual emissions associated with Education Abroad air miles by 2025
- 3.3 Work with campus and community partners to develop a service learning-focused effort to offset 25 percent of the annual emissions associated with University business air miles by 2025

Fiscal Years	Table 2: Phase 1 emissions reduction projections (mtCO <sub>2</sub> e)										
	Projected Net Emissions	Optimize buildings for energy efficiency and conservation	Renovate and upgrade buildings for efficiency	Indoor and outdoor lighting equipment upgrades	Increase efficiency of baseload chilled water production	Optimize steam distribution systems	Increase campus waste diversion rate to 50%	Reduce commuter miles traveled	Education Abroad air miles emissions offset	Business air miles emissions offset	Business-As-Usual Emissions
2018	485,992	20,898	0	770	7,064	861	0	842	0	0	516,427
2019	449,114	41,795	8,359	1,540	21,191	1,722	179	1,685	0	0	525,584
2020	427,643	62,693	15,046	2,310	21,191	2,582	365	2,527	159	241	534,757
2021	407,504	83,590	20,396	3,080	21,191	3,443	557	3,369	326	490	543,946
2022	410,186	83,590	24,676	3,850	21,191	3,443	758	4,212	499	747	553,151
2023	413,718	83,590	28,100	4,620	21,191	3,443	965	5,054	679	1,012	562,372
2024	418,124	83,590	30,839	5,390	21,191	3,443	984	5,896	866	1,286	571,610
2025	416,015	83,590	33,030	6,160	28,255	3,443	1,003	6,739	1,061	1,569	580,864

**Figure 2: Emissions reduction projections through 2025 (mtCO<sub>2</sub>e)**





## **Potential Phase 2 Strategies (FY2022-2025)**

The reduction strategies proposed for Phase 1 will significantly reduce the emissions of the campus. However, these strategies alone are not projected to be sufficient for hitting the 25 percent reduction target (see **Figure 2**). Closing the gap between Phase 1 reductions and the University's 2025 target will be accomplished through a second round of reduction strategies. A detailed plan for Phase 2 strategies will be developed in the fall of 2020 by a task force appointed by the President's Sustainability Advisory Committee. In anticipation of that effort, this plan considered a range of potential strategies that could be implemented during Phase 2. Brief overviews of three of these possible strategies are included below.

### **1. Combined Heat and Power Generation**

Combined heat and power (CHP) can offer a number of benefits compared to conventional electricity and thermal energy production, including:

- CHP requires less fuel to produce a given energy output and avoids transmission and distribution losses that occur when electricity travels over power lines.
- Because less fuel is burned to produce each unit of energy output and because transmission and distribution losses are avoided, CHP reduces emissions of greenhouse gases and other air pollutants.
- CHP can save facilities considerable money on energy bills due to high efficiency, and can provide a hedge against electricity cost increases.
- Unreliable electricity service represents a quantifiable business, safety and health risk for some companies and organizations. CHP is an on-site generation resource and can be designed to support continued operations in the event of a disaster or grid disruption by continuing to provide reliable electricity.

There are a number of challenges relative to CHP at UK. Primary among these are costs and the logistics of fuel delivery to the potential facility. Combined heat and power was evaluated in the UK Utilities Master Plan and continued efforts to explore the feasibility of this initiative are being led by UK's Utilities and Energy Management Division.

### **2. Renewable Power Purchase Agreement**

A renewable power purchase agreement (rPPA) is a financial agreement where a developer arranges for the design, permitting, financing, and installation of a renewable energy system at a defined location. The developer sells the power generated to the host customer at a fixed rate that is typically lower than the local utility's retail rate. This lower electricity price serves to offset the customer's purchase of electricity from the grid while the developer receives the income from these sales of electricity as well as any tax credits and other incentives generated from the system. PPAs typically range from 10 to 25 years and the developer remains responsible for the operation and maintenance of the system for the duration of the agreement. At the end of the PPA contract term, a customer may be able to extend the PPA, have the developer remove the system or choose to buy the renewable energy system from the developer. More information about rPPAs is available at [www.seia.org/research-resources/solar-power-purchase-agreements](http://www.seia.org/research-resources/solar-power-purchase-agreements).

### **3. Kentucky Utilities Green Energy Program**

The Kentucky Utilities Green Energy program uses monetary contributions from customers to purchase Renewable Energy Certificates (RECs). One REC represents the property rights to the environmental, social, and other non-power benefits of 1,000 kilowatt-hours (kWh.) of renewable electricity. RECs purchased by the program are sourced from renewable power generator in Kentucky and bordering states. More information about RECs is available at <https://lge-ku.com/environment/green-energy-program/how-green-energy-program-works>.

#### **Reporting**

The Office of Sustainability will coordinate and produce annual reports summarizing progress toward the University's emissions reduction commitment. Progress reports will be available in the fall of each year for the years 2018-2025.

## **Appendices**

- A. Methodology for calculating campus emissions
- B. Evaluation of excluded emissions sources
- C. Phase 1 Strategies and reduction methodologies

## Appendix A: Methodology for calculating campus emissions

There are several heat-trapping gases that are by-products of the activities of the University included in this plan. Each of these has been converted to a carbon dioxide equivalent for the purposes of this report. Metric tons of carbon dioxide equivalent (mtCO<sub>2</sub>e) is the standard unit of measure for campus emissions.

### Stationary Combustion for Steam Production

The University owns and operates 14 primary boilers that produce the steam needed to heat campus facilities and meet campus hot water needs. Ten of the boilers are fueled by natural gas and four are fueled by coal. The University operates these 14 boilers in compliance with regulations and permits provided by the Kentucky Division of Air Quality and the United States Environmental Protection Agency (USEPA). The emissions factors for these two fuels are:

- Coal combustion is tracked by the number of short tons (2000 lbs.) burned. Each short ton of coal burned releases 2.47664 mtCO<sub>2</sub>e.
- Natural gas combustion is tracked by British thermal units (Btu) and one million BTUS (MMBtu) releases .054431643 mtCO<sub>2</sub>e.

### University-Owned Vehicles

The University owns and operates a large fleet of automobiles, service vehicles, buses, heavy equipment, and golf service carts. These vehicles run on a variety of fuels including gasoline, diesel, bio-diesel, and electric batteries. The emissions factors provided by the University of New Hampshire's Sustainability Indicator Management and Analysis Platform (SIMAP) are used to convert the fuel use of these vehicles to mtCO<sub>2</sub>e.

### Purchased Electricity

Purchased electricity is the largest single source of UK's GHG emissions. UK purchases all of its electricity from Kentucky Utilities (KU). The resulting emissions are considered Scope 2 because UK has control over the amount consumed, but not over the method used to produce the electricity.

KU has a current grid mix composed of 94.62 percent coal, 5.01 percent natural gas, and 0.37 percent renewable sources. The average heat rate is approximately 10,270 British thermal units (Btu) per kilowatt hour (kWh) for Kentucky power generation and grid loss is approximately 5.82 percent. The USEPA has established CO<sub>2</sub>e emission rates of 210 pounds of CO<sub>2</sub>e per million Btu (MMBtu) produced for coal and 120 lb./MMBtu for natural gas. Based on those rates and using the calculations below, the emissions factor for the electricity purchased by UK is 0.001007 mtCO<sub>2</sub>e/kWh.

- Coal:  $10,270 \text{ Btu/kWh} \times 210 \text{ lb./MMBtu} \times 0.9462 \div 1,000,000 = 2.04 \text{ lb. CO}_2\text{e/kWh}$  plus
- Natural gas:  $10,270 \text{ Btu/kWh} \times 120 \text{ lb./MMBtu} \times 0.0501 \div 1,000,000 = 0.06 \text{ lb. CO}_2\text{e/kWh}$
- Subtotal: 2.10 lb. CO<sub>2</sub>e/kWh or 0.00095255 mtCO<sub>2</sub>e /kWh
- Grid loss: 5.82 percent of 2.10 lb. CO<sub>2</sub>e/kWh = 0.12 lb./kWh
- Total: 2.10 lb./kWh + 0.12 lb./kWh = 2.22 lb. CO<sub>2</sub>e/kWh or 0.001007 mtCO<sub>2</sub>e /kWh

## Directly Financed Air Travel and Education Abroad Travel

The total air miles traveled by the UK community for business and Education Abroad purposes is tracked by two offices. The UK Education Abroad Office tracks the student air miles traveled for education abroad opportunities and UK Travel Services tracks all university-funded travel for staff and faculty. This report uses the emissions factors developed by the USEPA for short-, medium- and long-haul flights to convert the air miles traveled into emissions equivalents ([https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors\\_2014.pdf](https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf)).

## Commuting Activities of Students, Faculty, and Staff

Travel to, from, and around campus for daily activities generates a tremendous number of vehicle miles traveled (VMT) with corresponding emissions impacts, congestion, air quality issues, and safety concerns. Calculating the emissions that result from the vehicles driven to, from and around campus by employees and students is challenging due to the number of variables at play.

Employee commuter emissions are calculated using these figures, assumptions, and estimates:

- The number of employee permits sold for a given fiscal year
- The average employee makes five, round-trip commutes between home and campus per week
- The average employee works 48 weeks per year
- The average round-trip commute distance is estimated to be 15.9 miles based on survey data collected by UK Transportation Services from 2,604 employees
- All of these trips are made in vehicles that use unleaded gasoline and that the average fuel economy for these vehicles is 20.79 miles per gallon based on National Highway Traffic Safety Administration (NHTSA) data
- An emissions factor of 0.009795 mtCO<sub>2</sub>e /gallon of gasoline from USEPA data (<https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>).

Employee emissions calculation (mtCO<sub>2</sub>e) = {[Permits sold x 5 (trips) x 48 (weeks) x 15.9 (miles)]/20.79 (mpg)} x .009795 (mtCO<sub>2</sub>e per gallon)

Student commuter emissions are calculated using the following figures, assumptions, and estimates:

- The number of commuter permits (C permit) sold for a given fiscal year
- The assumption that the average student makes four round trip commutes between home and campus per week
- The assumption that the average student is on campus 34 weeks per year
- The average round-trip commute distance is estimated to be 7.66 miles based survey data collected by UK Transportation Services from 1,010 students
- The assumption that all of these trips are made in vehicles that use unleaded gasoline and that the average fuel economy for these vehicles is 20.79 miles per gallon based on NHTSA data for model years 1982-2011 and

- An emissions factor of 0.009795 mtCO<sub>2</sub>e /gallon of gasoline from USEPA data (<https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>).

Student commute emissions calculation: {[Permits sold x 4 (trips) x 34 (weeks) x 7.66 (miles)]/20.79 (mpg)} x .009795 (mtCO<sub>2</sub>e per gallon) = mtCO<sub>2</sub>e per year.

### **Landfilled Waste**

When placed in a landfill municipal solid waste (MSW) generates methane, a very potent greenhouse gas. There are also greenhouse gas emissions associated with the transport of the waste. This report uses the methodology developed for the University of New Hampshire's Sustainability Indicator Management and Analysis Platform (SIMAP) to convert tons of landfilled waste to carbon dioxide equivalent. Emissions factors for landfilled MSW vary widely depending on the presence and/or type of landfill gas recovery system in use at the landfill in question.

The landfill receiving the University's solid waste had very limited, if any, methane recovery or flaring until late 2015. In late 2015, a system for recovering landfill gas for power generation was activated in partnership with Toyota Motor Manufacturing of Kentucky. This significantly impacted the emissions associated with the University's solid waste. For FY2010-FY2015, this document uses the emissions factor of 3.1 mtCO<sub>2</sub>e /short ton of MSW based on the SIMAP emissions factor for solid waste with no methane recovery or flaring. For FY2016, this document uses the factor above for half the year and the SIMAP emissions factor for solid waste with methane recovery and flaring of 0.31 mtCO<sub>2</sub>e /short ton of MSW for the other half. Starting in FY2017 and projecting forward, this document uses the 0.31 mtCO<sub>2</sub>e/short ton of MSW. Additional information is available at <https://sustainableunh.unh.edu/calculator>.

### **Wastewater**

Lexington's wastewater treatment process generates methane as a by-product. Due to methane capture and storage technologies installed at the treatment plant, the emissions from wastewater are quite low relative to the volume of water processed. The methodology from the University of New Hampshire's Sustainability Indicator Management and Analysis Platform (SIMAP) is used to convert the gallons of wastewater to carbon dioxide equivalent.

## Appendix B: Evaluation of excluded emissions sources

Source of emissions	Description	Reason(s) excluded
Refrigerants	Fugitive emissions from refrigerants used in cooling equipment	Historic data on the source are unavailable or unreliable and the estimated emissions from the source are negligible
Agriculture - Fertilizer	N <sub>2</sub> O emissions from fertilizer use	Estimated emissions from the source are negligible
Agriculture - Livestock	CH <sub>4</sub> emissions from animals	UK owns livestock, however, they are managed on lands outside the physical boundary for this plan
Purchased Goods and Service, including capital goods	Extraction, production, and transportation of goods and services purchased or acquired by the reporting company in the reporting year	Difficult to track and quantify and estimated emissions from the source are negligible
Fuel and Energy related activities	Extraction, production and transportation of fuels and energy purchased or acquired by the reporting company in the reporting year	Not available
Upstream Transportation and Distribution	Transportation and distribution of products purchased by the reporting company in the reporting year between a company's tier 1 suppliers and its own operations	Not available
Upstream leased assets	Operation of assets leased by the reporting company (lessee) in the reporting year and not included in scope 1 and scope 2 – reported by lessee	Not available
Downstream transportation and distribution	Transportation and distribution of products sold by the reporting company in the reporting year between the reporting company's operations and the end consumer	Not available
Processing of sold products	Processing of intermediate products sold in the reporting year by downstream companies	Not available
Use of sold products	End use of goods and services sold by the reporting company in the reporting year	Not available
End of life treatment of sold products	Waste disposal and treatment of products sold by the reporting company (in the reporting year) at the end of their life	Not available
Downstream leased assets	Operation of assets owned by the reporting company (lessor) and leased to other entities in the reporting year, not included in scope 1 and scope 2 – reported by lessor	Not available
Franchises	Operation of franchises in the reporting year, not included in scope 1 and scope 2 – reported by franchisor	Not available
Investments	Operation of investments (including equity and debt investments and project finance) in the reporting year, not included in scope 1 or scope 2	Tracking and reporting on the source is difficult or unreliable

## Appendix C: Phase 1 strategies and reduction methodologies

### 1. Energy Conservation and Efficiency

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- 1.1 Optimize building performance for energy efficiency to reduce emissions by 93,132 mtCO<sub>2</sub>e.  
**Methodology:** Through a contract with a private partner, energy specialists will review, monitor, and make recommendations regarding the performance of all campus buildings with a goal achieving a nearly 20 percent reduction in campus energy consumption.
- 1.2 Renovate and upgrade buildings for energy efficiency to reduce emissions by 36,329 mtCO<sub>2</sub>e by FY2025.  
**Methodology:** Each year 10 buildings will be targeted for equipment upgrades from a list of buildings prioritized by their documented energy consumption. The goal will be a 20 percent reduction in energy consumption for each building as a result of the upgrade. The potential reductions in successive years are estimated to be 80 percent of the previous year's reduction.
- 1.3 Optimize electricity used for lighting to reduce emissions by 6080 mtCO<sub>2</sub>e by 2025.  
**Methodology:** UK purchased 354,394,077 kWh of electricity in FY2016. Nationally, lighting is estimated to account for 17 percent of electricity consumption on University campuses ([https://www.mge.com/saving-energy/business/bea/article\\_detail.htm?nid=2390](https://www.mge.com/saving-energy/business/bea/article_detail.htm?nid=2390)). Using that number, we estimate that 60,246,993 kWh was used by campus lighting systems in FY2016. The target for this strategy is a 10 percent reduction in electricity consumption by campus lighting by the end of FY2025. Ten percent of the estimated 2016 lighting consumption is 6,024,699 kWh. Using the established methodology for calculating emissions from the Kentucky Utilities grid mix (0.0010091 mtCO<sub>2</sub>e /kWh), the annual emissions reduction from this strategy in FY2025 would be 6,080 mtCO<sub>2</sub>e. Progress toward this goal will be incremental, with an estimated year one reduction of 760 mtCO<sub>2</sub>e.
- 1.4 Add four new campus chillers by 2025 for more efficient baseload chilled water production to reduce emissions by 27,466 mtCO<sub>2</sub>e.  
**Methodology:** The four new chillers will be used for baseload chilled water production, with existing chillers being kept in ready state for peak demand days. Utilities and Energy Management staff estimate that each new chiller will reduce annual emissions by 6,867 mtCO<sub>2</sub>e through more efficient use of electricity.
- 1.5 Optimize utility plants and distribution systems to reduce emissions by 46,000 mtCO<sub>2</sub>e by FY2025.  
**Methodology:** By repairing leaks, upgrading valves and other components of campus steam delivery infrastructure, this strategy is targeting a five percent reduction in annual steam consumption.



## 2. **Waste Reduction**

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- 2.1 Increase campus diversion rate to 50 percent to reduce annual emissions by 10,030 mtCO<sub>2</sub>e by 2025.

**Methodology:** At current diversion rates and projected campus growth, landfilled waste is projected to be 9,707 tons in 2025. Each short ton of material sent to the landfill generates an estimated 0.31 mtCO<sub>2</sub>e. Increasing the diversion rate from 25 percent (FY2017) to 50 percent diversion rate by 2025 through recycling, composting, redesign and reuse will divert an *additional* estimated 3,236 tons of material from the landfill in 2025.

## 3. **Transportation**

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- 3.1 Launch and promote alternative transportation programs and policies that increase the convenience, efficiency, safety, and cost-benefits of commuting choices other than driving alone to decrease annual emissions by 25 percent of 2010 levels yearly by 2025.

**Methodology:** 2010 Commuter emissions were estimated to be 26,954 mtCO<sub>2</sub>e using methodology described above. 25 percent of this is 6,739 mtCO<sub>2</sub>e. We project a steady ramp up alternative transportation programs across the 8 performance years, with annual net emission reductions of 842 mtCO<sub>2</sub>e.

- 3.2 Work with campus and community partners to develop a service learning-focused effort to offset the emissions associated with University business and student Education Abroad air miles.