UNIVERSITY OF
ARKANSAS
Office for Sustainability

University of Arkansas
Climate Action Plan – 2018

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Abbreviations

ACUPCC	American College and University Presidents Climate Commitment
AEP	American Electric Power, the parent company of SWEPCO
ASG	Associated Student Government, the student legislative body of the university
ESPC	Energy Savings Performance Contract
FTE	Combined Full-time Equivalent of student, staff and faculty
GHG	Greenhouse gas
GSF	Gross square feet; building space as measured by exterior building dimensions
KPI	Key Performance Indicator
MTCDE	Metric tons of carbon dioxide equivalent; a measure of the impact of a greenhouse gas
SWEPCO	Southwestern Power Electric Company, the provider of electricity to the University

Executive Summary

In 2007, the University of Arkansas became the first higher education institution in the state and among the first 100 in the nation to commit to the American College and University Presidents' Climate Commitment. Since this commitment, the University has made huge strides in reducing its greenhouse gas emissions with an ultimate goal of reaching zero emissions by 2040. The Office for Sustainability (OFS) and the University of Arkansas Sustainability Council (UASC) were created to help guide the University toward carbon neutrality through the creation and implementation of The UA Climate Action Plan.

With the first implementation of a Climate Action Plan, the University of Arkansas created a set of goals to become a leader in active stewardship of the environment.

- **Short Term:** Mitigate Metric Tons of Carbon Dioxide Equivalent (MTCDE) to 2005 levels by 2014
- **Medium Term:** Return to 1990 emission levels (125,000 MTCDE) by 2021
- **Long Term:** Become net carbon neutral by 2040

Since becoming a charter signatory the University of Arkansas has reduced its resource consumption and GHG emissions despite tremendous growth in campus population and size. In FY2017, the student population at the University of Arkansas increased by 17%. During the same period, the University of Arkansas emitted approximately 119,500 MTCDE, a 25% reduction from the 158,700 MTCDE emitted just six years ago in FY2011

The results of the first full year of measurement and verification (FY 2012) of the Energy Savings and Performance Contracts (ESPC) indicated energy cost avoidance for the University of Arkansas exceeded the anticipated campus-wide energy savings by 24% or $879,000. The total cost avoidance was $4.55 million for the fiscal year. Most importantly, the Energy Savings Performance Contracts helped the University of Arkansas **achieve the entirety of its short-term GHG mitigation goals**, demonstrating that sustainability initiatives can simultaneously be financially, socially and environmentally beneficial.

With all short-term goals completed, The University of Arkansas's next milestone was to reach 1990 GHG emission levels of 125,000 MTCDE by 2021. This was achieved in 2017, four years early, chiefly thanks to the implementation of the Combined Heat and Power

System which drastically reduced emissions from purchased electricity by providing local, efficient electric power and thermal energy to the University.

This leaves the University with the challenging yet attainable goal of achieving complete carbon neutrality by 2040. This goal will be realized through a combination of projects across the University. Current and potential projects and their impacts are outlined at the end of this document. They represent an aggressive and innovative path towards carbon neutrality.

Achieving the bold goal of carbon neutrality will require high energy efficiency levels, a significant reduction of energy consumption and more sustainable commuter transportation options. Investments by the University of Arkansas in energy efficiency infrastructure have already significantly reduced the UA's carbon footprint, but there is still room for improvement.

Additionally, despite emission reduction strategies undertaken by the University, the campus will inevitably produce emissions. Long term solutions for reaching carbon neutrality by 2040 depend heavily on **Carbon Sequestration.** This document will investigate potential carbon sequestration projects for the University of Arkansas and what their long-term impacts could be.

Implementing this plan will require participation from all levels of the campus and surrounding NWA community, as well as available financing. The University of Arkansas academic and political infrastructure has demonstrated a commitment to sustainability. Only through the integration of all relevant systems and continued dedication from stakeholders can the 2040 goal of neutrality be achieved.

This document reflects the University of Arkansas's commitment and goals, identifies projects to reduce carbon emissions, and establishes a clear path towards implementation. There are several campus plans and manuals that can provide more context for University sustainability systems such as the Facility Management's Transportation Master Plan and the Campus Landscape Design Manual. The Climate Action Plan is a living document and will not be completed until carbon neutrality is achieved.

Introduction

The University of Arkansas, the state's flagship university, resides on 345 picturesque acres overlooking the Ozark Mountains. For nearly 150 years, it has been at the center of higher education in the state of Arkansas and recently has moved to the center of higher education in the nation.

Never in the history of the University has its students and faculty been more academically accomplished, its facilities more sophisticated, or its research efforts more inclusive. All indicators of academic success are at record highs and climbing. The University's 27,000 students come from every county in Arkansas and some 100 nations, and study within over 200 academic programs. Through the integration of teaching, research, and service, the University of Arkansas is taking its place among the nation's great universities.

With pride and commitment to responsible leadership, the University of Arkansas's flagship campus in Fayetteville, under the leadership of then Chancellor John A. White, became a charter signatory of the American College and University Presidents Climate Commitment (ACUPCC) in 2007. ACUPCC provides a common framework and support for its hundreds of signatory America's colleges and universities in their pursuit of carbon neutrality. The ACUPCC requires signatories to complete greenhouse gas inventories, set target dates and milestones, take immediate steps to mitigate GHG emissions and integrate sustainability into their curriculum. It also requires its signatories create an publicly available climate action plan, biannual campus emission inventory, and incremental progress reports.

The Office for Sustainability was formed in 2007 to carry out the requirements of the ACUPCC. Its initial actions included the formation of a campus-wide Sustainability Council. The Office for Sustainability brought together these dedicated campus constituents to create a democratic and comprehensive plan towards carbon neutrality. The mission of the Council was and continues to be providing critical leadership through expertise and representation; they are the backbone of the University of Arkansas sustainability strategy.

The Sustainability Council, comprised of faculty, staff, students and representatives from the Fayetteville community, seeks to support the University of Arkansas' environmental stewardship mission. They do this through a framework of the four systems identified below, with workgroups focused on each of these four systems.

- **Built Systems** explores sustainability initiatives focused on structures across the University of Arkansas system, including classrooms, laboratories, and offices.
- **Natural Systems** explores sustainability initiatives for ecosystem services provided by non-human focused systems across the University of Arkansas system.
- **Managed Systems** explores sustainability initiatives in human-focused endeavors, including agriculture and business.
- **Social Systems** explores sustainability initiatives within and between social communities across the University of Arkansas system.

An additional **Academic workgroup** is focused on developing the undergraduate and graduate degree programs in sustainability.

The University of Arkansas Office for Sustainability employs a sustainability framework that evaluates continuous improvement processes through key performance indicators. The framework is an interactive process of defining, implementing, and measuring projects to reduce the University of Arkansas's carbon footprint and overall environmental impact (Figure 1). This document provides an inventory of the University of Arkansas's greenhouse gas emissions, a summary of progress made to date, and a proposed strategy for achieving the next emission targets.

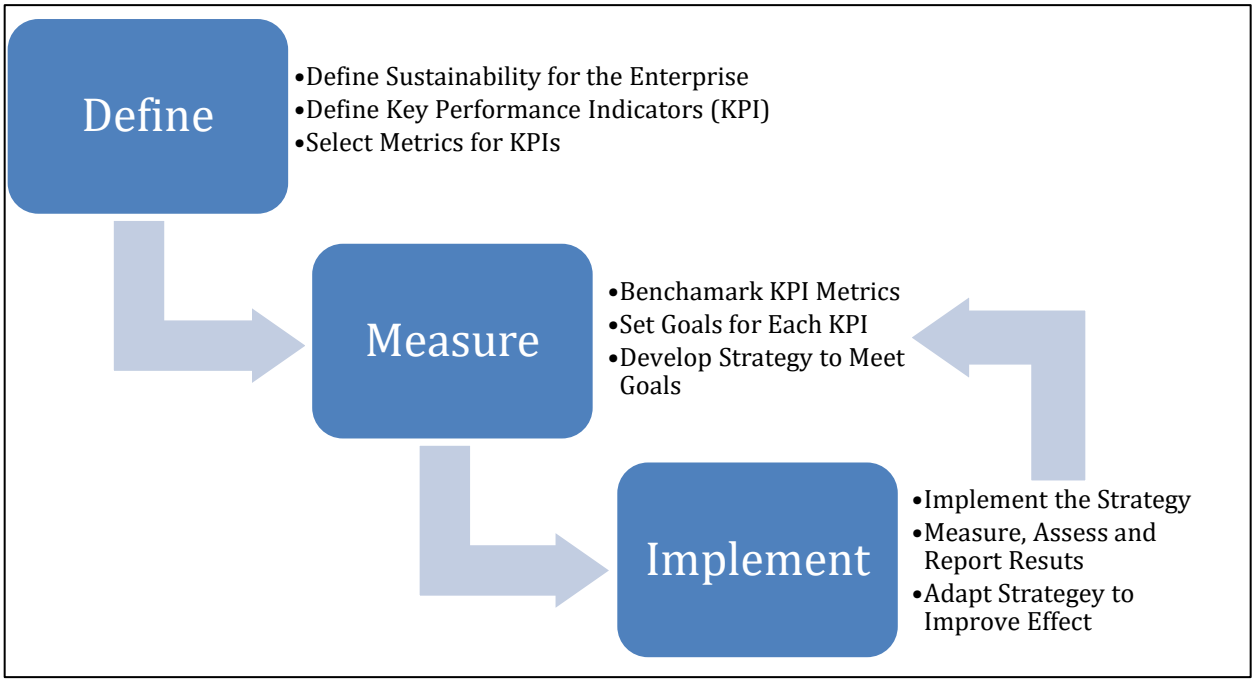

Figure 1: University of Arkansas OFS iterative improvement framework.

Part I: Current and Historical Emission Levels by Scope

Measuring Emissions:

Greenhouse gases (GHG) are any gases whose absorption of solar radiation contribute to the global greenhouse effect, including carbon dioxide, methane, ozone, and fluorocarbons. The greenhouse effect, a natural phenomenon, occurs as these gases reflect solar radiation, trapping it within the Earth's atmosphere. While this phenomenon is crucial to creating the livable temperature of the Earth's surface, the increased levels of GHG in the atmosphere caused human activities over the past two centuries has led to a magnification of this effect, increasing overall global temperature averages and driving climate change. The GHG analysis presented in this document is the product of working with Sightlines[1], a consulting firm which helps educational institutions manage their facilities investments. Sightlines aggregates campus utility consumption and calculates emissions using Clean-Air, Cool Planet and the ACUPCC standard for analyzing GHG impact. [2]

This document will relate all emissions in terms of Metric Tons of Carbon Dioxide Equivalents (MTCDE). Emissions that are not specifically carbon dioxide but contribute to the overall greenhouse effect will be converted into carbon dioxide equivalents using the conversions provided by version nine of the University of New Hampshire Campus Carbon Calculator.[3] Since emissions are extremely difficult to measure directly, assumptions are made regarding University emissions. These emission factors are also provided by the University of New Hampshire's Campus Carbon Calculator.

How Emissions Are Categorized:

Greenhouse gas emissions are the leading contributing agents to climate change and are generated from several sources. (Houghton, Harvey, Intergovernmental Panel on Climate Change, Intergovernmental Panel on Climate Change, & Working Group I, 1997) All greenhouse gasses occur naturally; however, the greenhouse gas emissions discussed here are from anthropogenic sources.

Emissions are categorized into three broad scopes as defined by the Greenhouse Gas Protocol[4]. Scope 1 emissions are emissions resulting from sources that are directly owned or controlled by the reporting entity. Scope 2 emissions are indirect emissions resulting from the purchase of electricity. Scope 3 emissions are indirect emissions resulting from

[1] For more information on sightlines, visit: www.sightlines.com
[2] For more information on Clean-Air, Cool-planet visit: http://www.adaptationclearinghouse.org/organizations/clean-air-cool-planet-ca-cp.html
[3] For more information on the University of New Hampshire Sustainability Institute visit: http://www.sustainableunh.unh.edu
[4] For more information on GHG Protocol, visit http://www.ghgprotocol.org/calculation-tools

University activities as well as transmission and distribution (T&D) losses from Scope 2 emissions.

Historic Emissions by Scope:

Table 1 shows historic emissions by the University of Arkansas from 2002 to 2017. All values are shown in Tons of Carbon Dioxide Equivalents.

Year	Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	Total Emisions
2002	31,103	81,357	34,033	146,493
2003	33,184	80,842	33,489	147,514
2004	28,495	89,107	33,982	151,585
2005	32,446	91,060	34,773	158,279
2006	27,748	96,786	33,724	158,259
2007	28,357	85,257	31,980	145,594
2008	30,655	90,244	33,251	154,150
2009	31,089	92,309	31,846	155,244
2010	31,583	88,704	24,498	144,785
2011	41,960	92,484	24,327	158,771
2012	27,068	85,474	26,689	139,231
2013	29,152	83,829	25,270	138,251
2014	34,831	91,120	27,889	153,839
2015	29,919	95,903	27,061	152,883
2016	32,609	67,244	30,411	130,263
2017	39,386	52,496	27,620	119,501

Table 1. University of Arkansas MTCDE emissions data, 2002-2017.

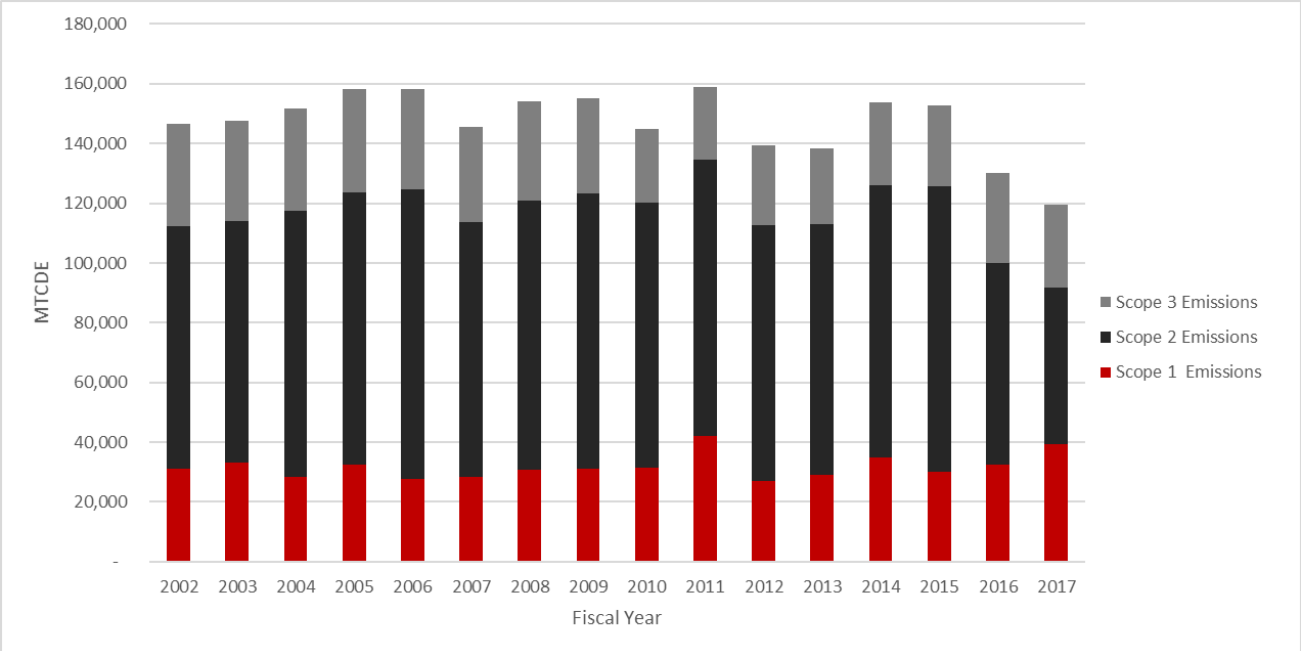

Figure 2: Graphical representation of Arkansas greenhouse gas emissions data, 2002-2017.

Current Emissions Analysis FY2017:

Current Emissions for FY2017 show a dramatic decrease in Scope 2 emissions from the previous year. This is thanks to the Combined Heating and Power system (CHP) being operational for the full year, which drastically reduced the amount of purchased electricity required by the U of A. It should be noted, however, that the CHP also increased Scope 1 emissions, but by a smaller amount than the decrease in Scope 2 emissions. This increase in Scope 1 emissions is created by natural gas being burned in the CHP system.

Despite reductions in FY2016 and FY2017 from the CHP, Scope 2 emissions still make up 43% of the University's emissions. The CHP is currently at capacity, so additional needs for electricity will come at the expense of an increase in Scope 2 emissions. Scope 1 and Scope 3 emissions comprise 32% and 25% of University emissions respectively.

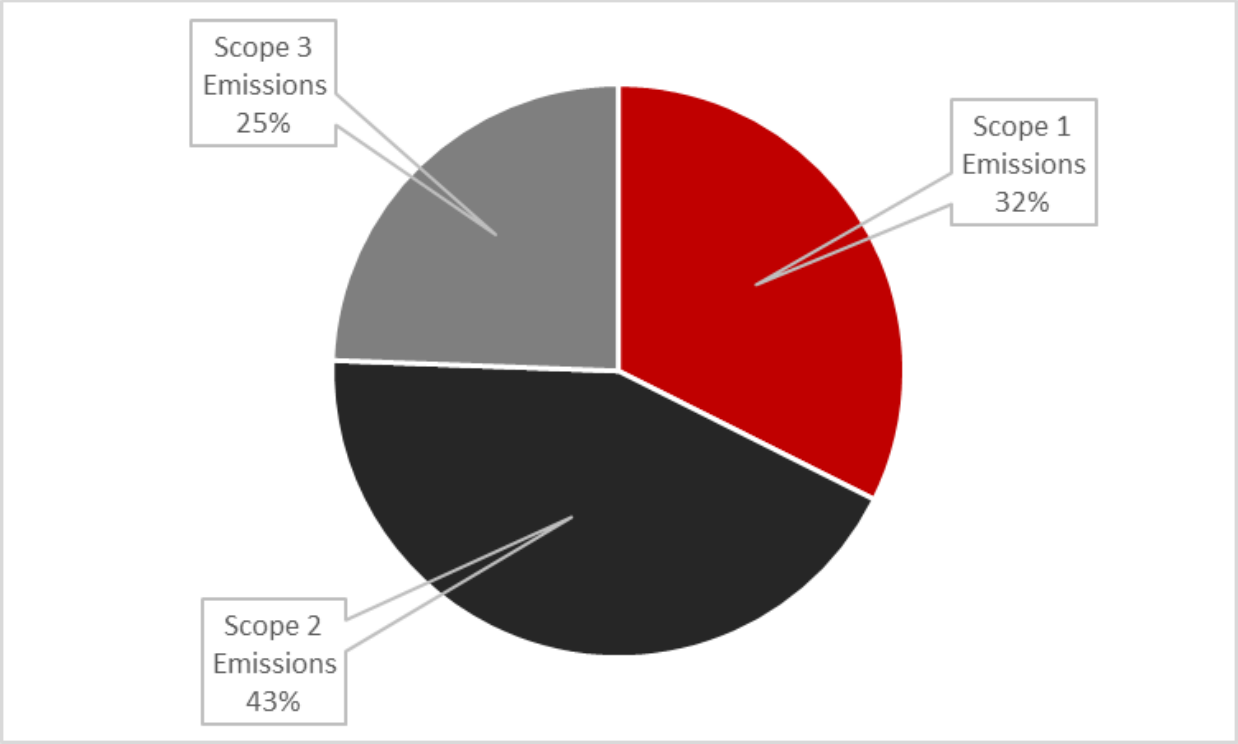

Figure 3: University of Arkansas emissions breakdown by scope for FY2017.

Scope 1 Emissions Analysis FY2017:

As outlined previously in this document, Scope 1 emissions are direct GHG emissions from sources that are owned or controlled by the University of Arkansas. Scope 1 can include emissions from fossil fuels burned on site, emissions from entity-leased vehicles, and other direct sources.

Stationary combustion is anything used to produce electricity, steam, heat, or power using equipment in a fixed location, while mobile combustion includes fuels used in university-owned vehicles. This encompasses fugitive sources of gases or vapors that are the product

of leaks and other unintended releases as well. In addition to the campus fleet of buses that run every day, vehicles for faculty and staff transportation and maintenance utility vehicles are included in this percentage. This number is expected to drop as the University continues to invest in low emissions vehicles and high efficiency utility operations.

A breakdown of Scope 1 emissions can be found below. The largest portion of Scope 1 Emissions are Co-Gen Electricity and Co-Gen Steam at 35% and 28% of total Scope 1 emissions respectively. These categories are projected to remain fairly constant.

The category with the most room for improvement is On-Campus Stationary which made up 25% of Scope 1 Emissions and 8% of total emissions for FY2017. This should be the main focus in Scope 1 reduction efforts as Co-Gen Steam and Co-Gen Electricity reduce Scope 2 emissions and are therefore offset. Similarly, Direct Transportation offsets Scope 3 emissions. Consequently, the University of Arkansas Scope 1 reduction strategy should target On-Campus Stationary related emissions.

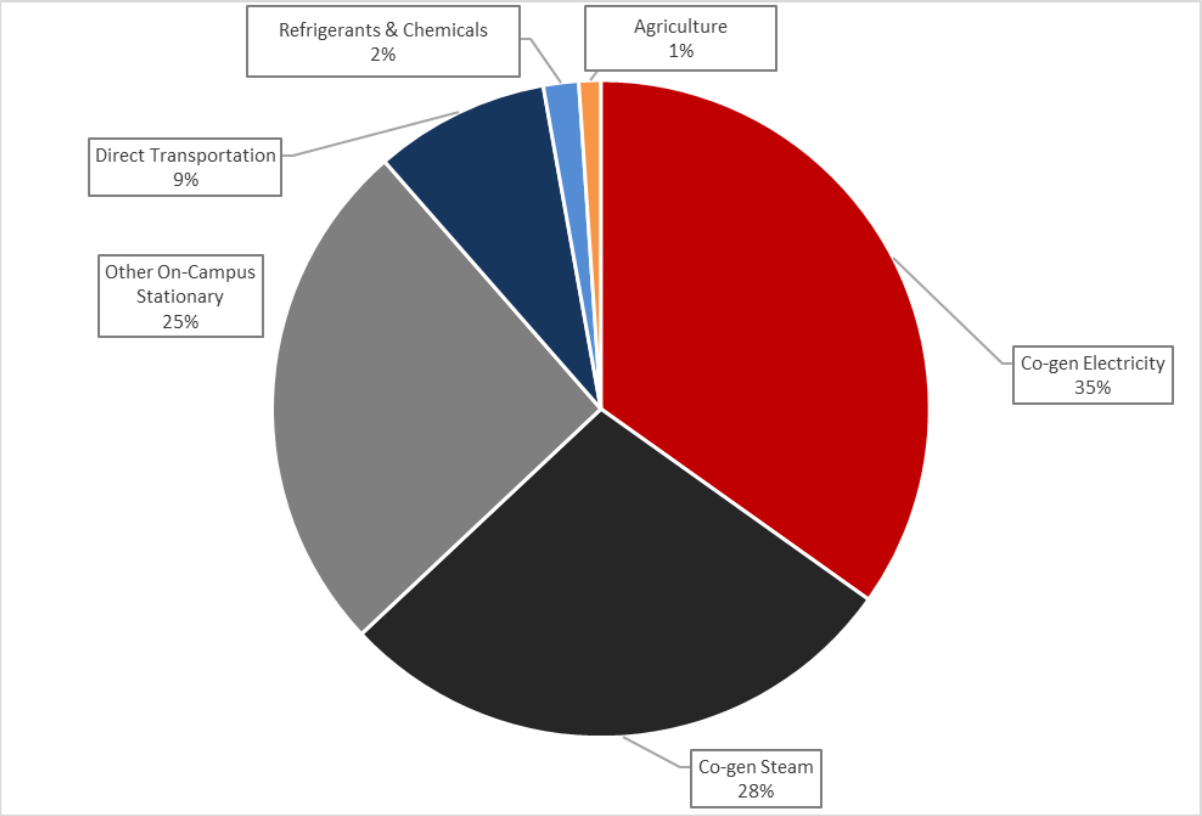

Figure 4: University of Arkansas Scope 1 emissions breakdown for FY2017.

Scope 2 Emissions Analysis FY2017:

Scope 2 emissions are indirect GHG emissions resulting from the generation of electricity from off-site sources purchased by the entity. Scope 2 makes up the largest portion of GHG

emissions emitted by the University of Arkansas, but also represents the most opportunity in mitigating emission levels.

Scope 2 emissions constituted 44% of the Green House Gas Equivalents emitted by the University for FY 2017, a ratio projected to grow moving forward. Scope 2 emissions are unique from other categories in that they can be entirely mitigated with the purchase of carbon credits by the University. This mitigation strategy will be further explained later in this document.

Scope 3 Emissions Analysis FY2017:

These are indirect GHG emissions from sources not owned or directly controlled by the University but related to University activities. This would include emissions from student and faculty commuting, study abroad travel, faculty travel, etc. Scope 3 GHG emission sources currently required for federal GHG reporting also include less intuitive emissions, such as those resulting from transmission and distribution (T&D) losses associated with purchased electricity, contracted solid waste disposal, and contracted wastewater treatment.

Most categories of Scope 3 emissions are calculated using University data. All emission categories associated with commuting were made using data from the 2015 University of Arkansas Campus Transportation Plan. This plan outlines commuting modes, average length of commute, and number of trips for students, faculty, and staff. Commuting makes up a combined 39% of Scope 3 emissions and 9% of total emissions, representing massive

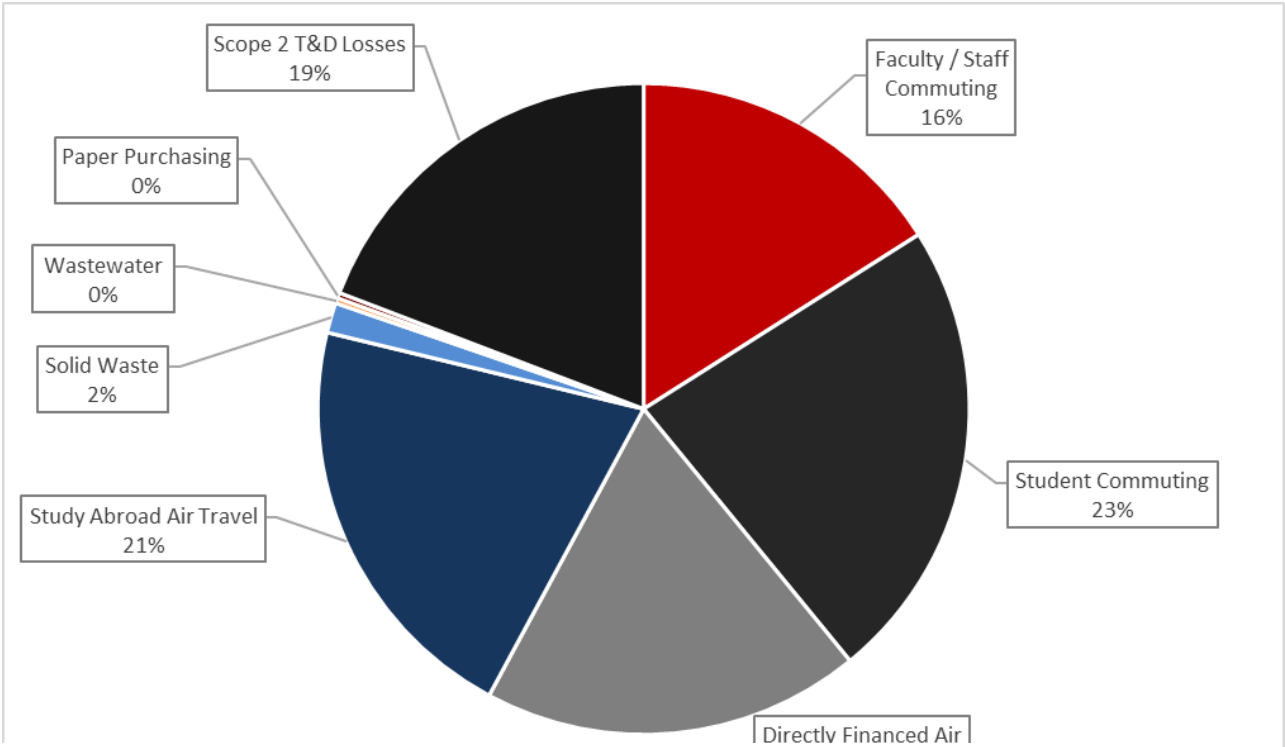

Figure 5: University of Arkansas Scope 3 emissions analysis for FY2017.

opportunity for improvement. Only 22% of students and 14% of faculty commute using carbon neutral forms of transportation (walking and biking), a percentage that will likely increase with greater infrastructure and awareness.

Directly financed air travel and study abroad travel are unlikely to decrease without the implementation of carbon offset programs outlined later in this document. Solid waste could be cut in half with adequate execution of the University of Arkansas Zero Waste Goals.[5] Scope 2 T&D losses can be mitigated with greater energy efficiency; however, they will not reach zero without the purchase of carbon offsets.

Energy Consumption

Figure 6 gives a comprehensive breakdown of current energy consumption over the last seven years. Electricity consumption has historically accounted for the majority of energy consumption; however, the amount of demanded electricity has decreased sharply with the CHP System.

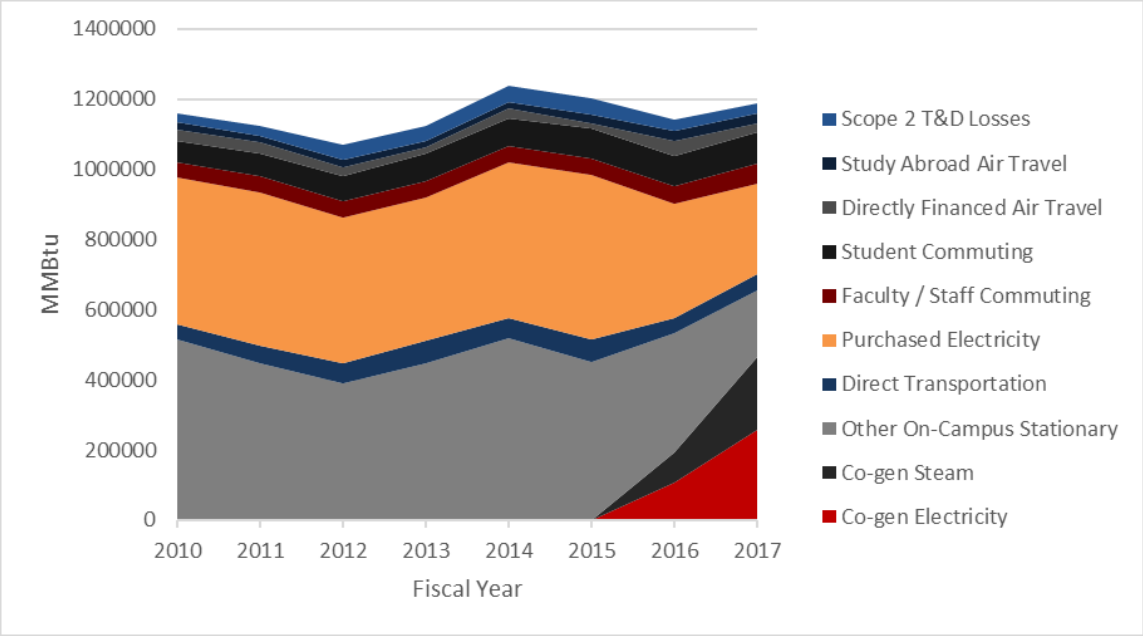

Figure 6: Total University of Arkansas energy use by sector (MMBtu).

While figure 6 shows total energy, consumption has historically had a general upward trend and is projected to continue to gradually increase, it should also be noted the context in which this increase has occurred. When accounting for the growth in student population, the University has demonstrated a consistent reduction in energy usage. Figure 7 highlights this reduction in energy consumption, displaying a reduction of nearly 20% in MMBtu per student from 2010 to 2017.

[5] For more information on the University of Arkansas Zero Waste Goals see: https://sustainability.uark.edu/about/zero-waste.php

This reduction can be attributed to the implementation of the Energy Savings Performance Contracts in 2009, which helped to renovate electrical systems in existing buildings. The University also completed a multi-year energy conservation project in the summer of 2011 which directly affected 80 campus buildings and over 5.2 million gross square feet of educational, housing, athletics, and other auxiliary space[6].

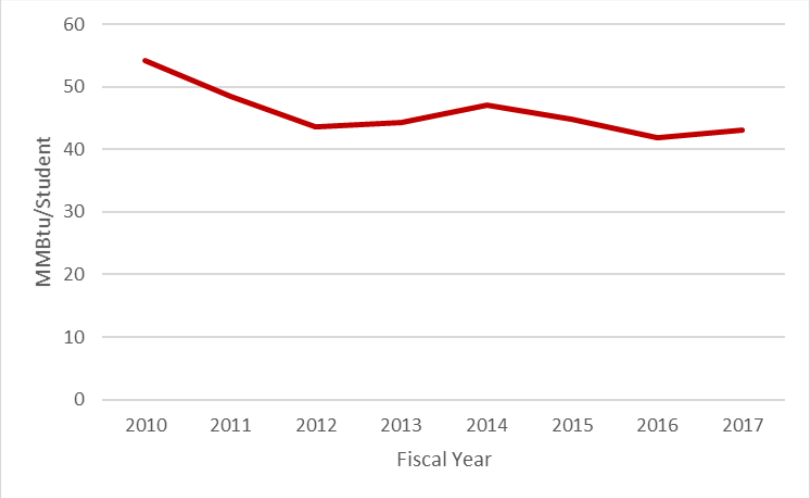

Figure 7. University Energy Consumption per Student (MMBtu).

University Emissions per Student:

Though the decrease in University emissions may seem modest in magnitude, when accounting for the increase in the population of the University of Arkansas the decreases in emissions are quite significant. In FY2002, the University emitted roughly 9.6 MTCDE per student. In FY2017, the University emitted roughly 4.4 MTCDE a 54% decrease.

[6] Facilities Management's Strategic Energy Plan will include more measures related to ESPCs and energy efficiency. More can be found here: http://fama.uark.edu/files/StrategicEnergyPlan.pdf

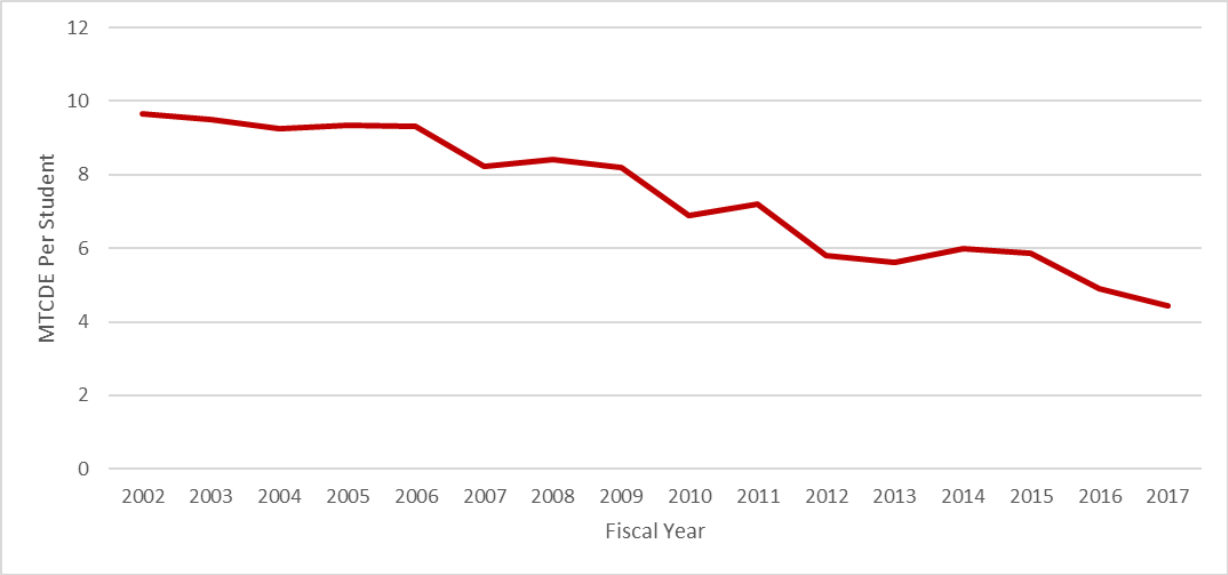

Figure 8. University Emissions per Student (MTCDE).

Emissions per Square Foot of Building Space:

The decrease in University emissions is also apparent when controlling for the actual size of the campus. The University of Arkansas has grown significantly over the past decade and a half with roughly 6,271,894 square feet of building space in FY2002 and 8,671,341 square feet of building space in FY2017. During this time, the University experienced a 42% decrease in emissions per square foot of building space, as shown in Figure 9.

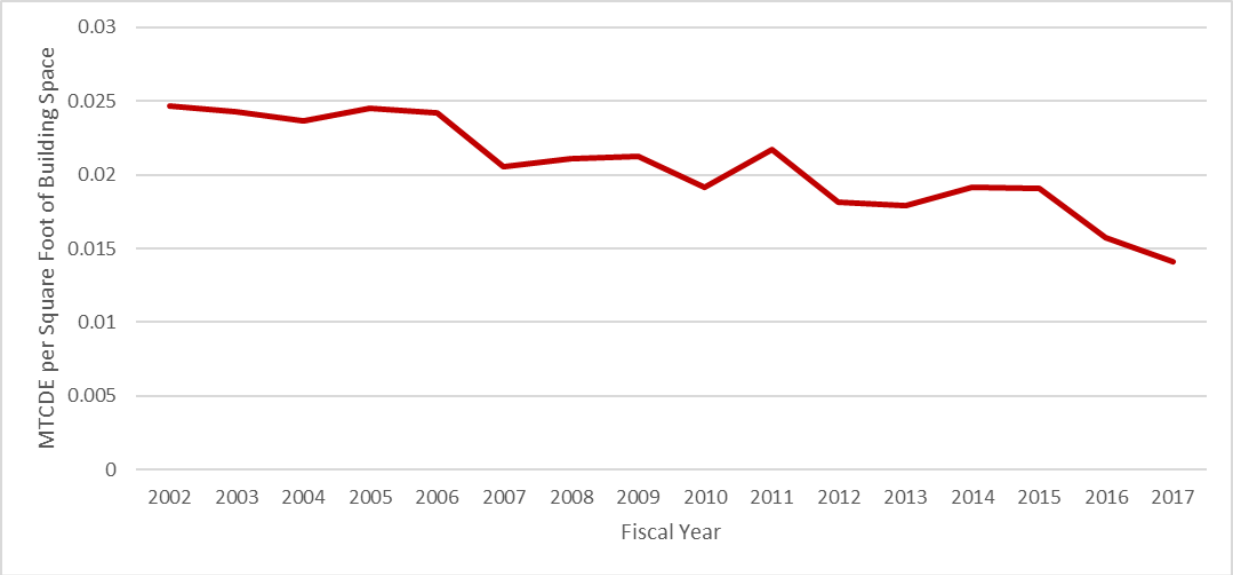

Figure 9. University Emissions per Square Foot of Building Space (MTCDE).

Part II: Emissions Projections

Emissions Projections Overview:

The projections in this section hold all parameters associated with University of Arkansas activity constant and assume business as usual. The following section projects University emissions by scope and category up until FY2040 using historical data attained by the Office for Sustainability.

The projections used in this analysis span across approximately 30 different categories, all of which contribute either directly or indirectly to University emissions. A higher resolution approach in projection emissions is possible, however, it is impractical due to inadequate data.

Types of Projections Used

The projections for each specific category can take one of four forms outlined below. Projections are never allowed to be less than zero, regardless of the projection used.

Linear Projections: Linear projections find the slope of all available data points for a specific category. The slope of the data indicates the projected growth rate and is assumed to remain constant moving forward. Categories that show a relatively consistent historic growth rates year over year will be projected using this methodology.

Normalization by Students: The historical ratio of a given emission category per University of Arkansas student is calculated as well as the average of this ratio. Using this average, the ratio of emission factor to student population is projected to remain constant, and the factor is considered to increase proportionally to the student body. Factors that have a high correlation to student population will be projected using this methodology.

Normalization by Building Space: This methodology is identical to the previous methodology, using building space in lieu of student population. Factors that have a high correlation to building space will be projected using this methodology.

Constant Growth Rates: Constant growth rates assume a consistent growth rate year over year for certain emission factors. For factors that should be held constant, a 0% growth rate is applied.

Key Institutional Assumptions:

Institutional assumptions are extremely sensitive since they directly affect the rate of change predicted for future emissions. The methodology for projecting institutional data is detailed below.

Student Population: Since the University has experienced tremendous growth over the past decade, a linear or constant projection could not be used since such growth is

unsustainable. Therefore, a student population cap was placed at 35,000 students. This cap is estimated to begin in FY2027 with a constant growth leading up to 2027.

Faculty & Staff: Faculty and staff projections use the normalization by students methodology as outlined above. The average ratio over the past fifteen years of faculty to students is 0.05 and 0.14 for students to staff. The number of faculty and staff is calculated by taking the projected student population for a given year and multiplying it by the corresponding ratio.

Total Building Space: Total building space uses the normalization by student methodology from the last three years of historical data. The ratio of students to square feet of building space is calculated as 310.76 and is assumed to remain constant moving forward.

Scope 1 Assumptions

Natural Gas: Natural gas consumption at the University of Arkansas is highly correlated with increases in building space, therefore the normalization by building space projection methodology was chosen. The Combined Heat and Power system that went into effect halfway through FY2016 decreased the amount of natural gas the University consumed below the historic average, thus the ratio of natural gas to building space for FY2017 was selected as the ratio for future projections.

On Campus Stationary Electric and Steam Output: This emission factor is a function of the projected electricity the Combined Heat and Power system will produce, as this system falls under the Scope 1 emissions category. This projection assumes that the CHP system was at full capacity for FY2016 and therefore will remain constant for all years going forward.

Gasoline Fleet: This document assumes a constant growth rate of 2% for the University's gasoline fleet.

Diesel Feet: This document assumes a constant growth rate of 2% for the University's diesel fleet.

E85 Fleet: The University's E85 fleet is assumed to maintain a constant consumption at 2017 levels.

Refrigerants & Chemicals: As shown in figure 10, emissions due to refrigerants and chemicals are extremely volatile and therefore difficult to project assuming constant growth rates or ratio levels. For this reason, this projection took the average of the last five years of data and assumed a constant level of emission based on this average.

Agricultural Sources: The same projection methodology regarding refrigerants and chemicals was used for agricultural sources. Both categories make up a small percentage of the total of Scope 1 emissions, therefore any error in projections is negligible.

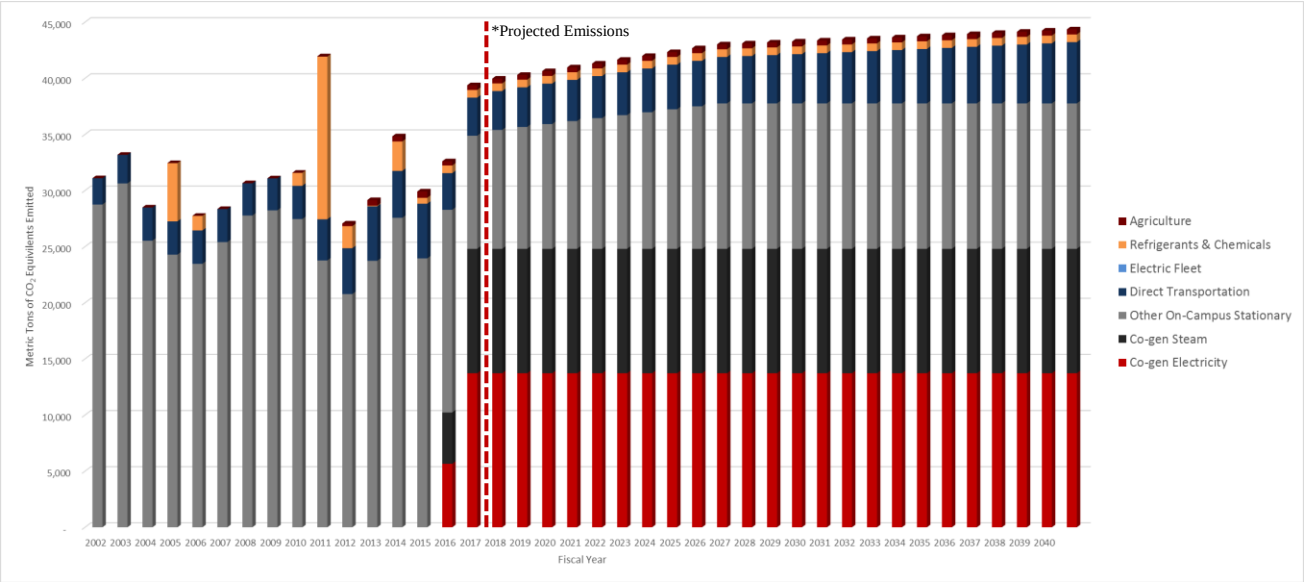

Figure 10. University of Arkansas Scope 1 Emission Projections (MTCDE).

A sharp increase in Scope 1 emissions from 2014 to 2016 on its surface should be a cause for concern; however, this increase in Scope 1 emissions caused a far greater decrease in Scope 2 emissions which will be further explored in the next section. This sharp increase is not projected to continue. In fact, Scope 1 emissions exhibit a relatively small growth rate of roughly 0.2% from FY2018 to FY2040.

Scope 2 Assumptions and Results

Purchased Electricity: Purchased electricity experienced a sharp drop from 2015 to 2017, however this decreasing trend in Scope 2 emissions will reverse in FY2018. In fact, Scope 2 emissions are the fastest growing emissions category at the University because of all future increases in electricity demand will be represented as Scope 2 emissions. Scope 2 emissions from the last 15 years of data are projected using a linear approximation. Electricity demanded by the University is projected to increase 537,178 Kwh year over year, translating into an increase of approximately 375 MTCDE every year.

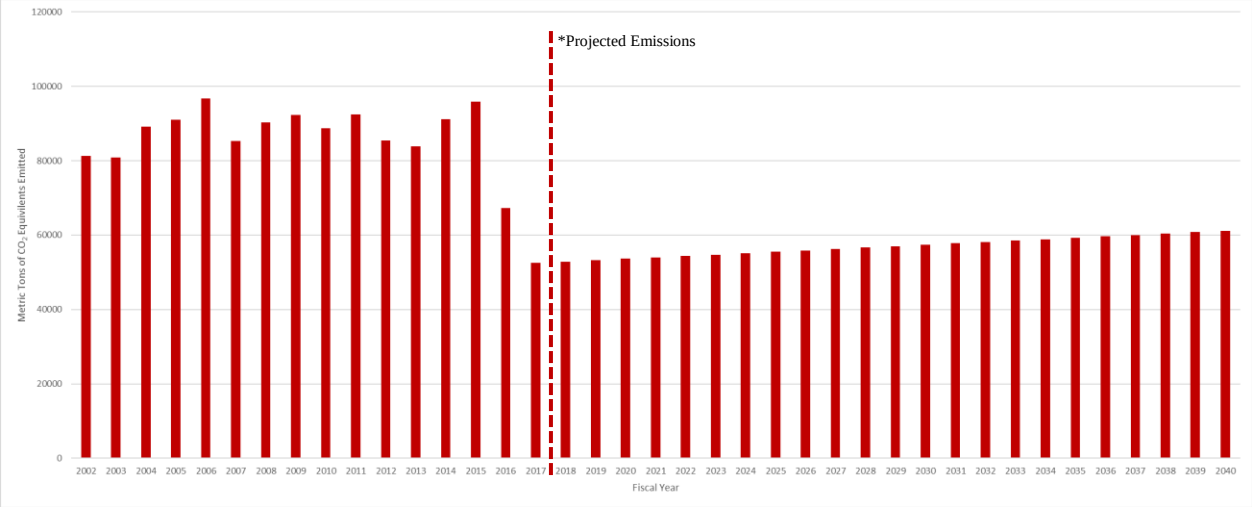

Figure 11. University of Arkansas Scope 2 Emission Projections (MTCDE).

Scope 3 Assumptions and Results

Faculty & Staff Commuting: Faculty and Staff commuting is projected using the normalization by student method using the last 15 years of historical data. Commuting modes and distances for faculty and staff are assumed to remain unchanged.

Student Commuting: Student commuting normalized by student population growth holding modes of transportation and average distance constant.

Directly Financed Air Travel: Directly financed air travel is normalized by student population growth using the last 15 years of data.

Study Abroad Travel: Study abroad travel is normalized by student population growth using the last 15 years of data.

Solid Waste: *A*ll solid waste at the University of Arkansas is deposited into EcoVista Landfill in Springdale, Arkansas. This landfill installed a "gas to energy" collection system in FY2011, which captures methane released from the landfill and uses this as energy. This reduces the amount of emissions resulting from solid waste. Solid waste is projected to increase by 2% year over year moving forward.

Waste Water: Emissions due to waste water are projected using a linear regression over the last fifteen years of data.

Paper Purchasing: Factors effecting emissions from paper purchasing employ either a linear methodology or are normalized by student population growth depending on the factor and how well the data fits with the corresponding methodology.

Scope 2 T&D Losses: Scope 2 T&D losses are directly correlated with purchased electricity; no projection methodology was used for this category.

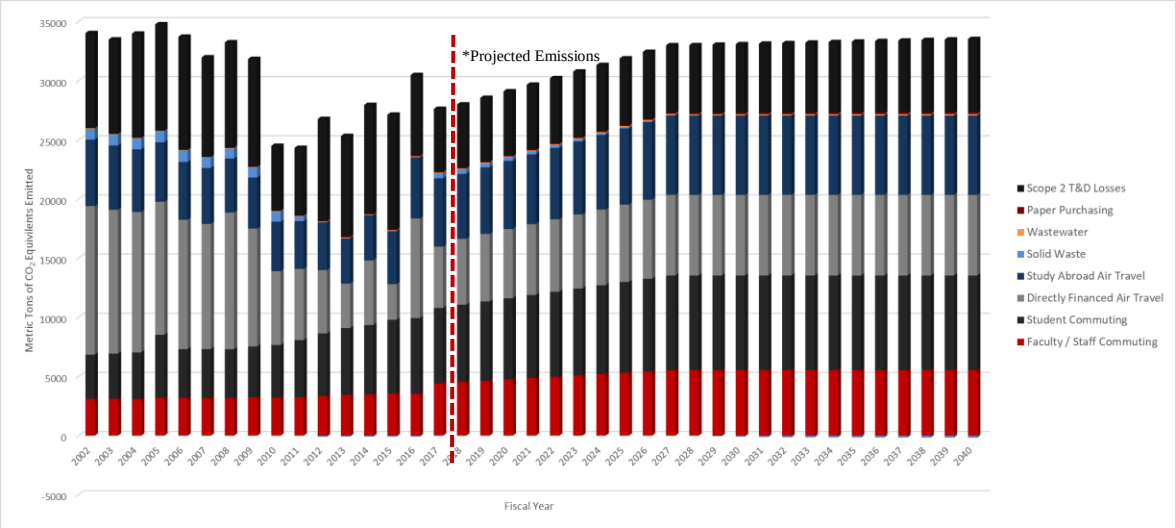

Figure 12. University of Arkansas Scope 3 Emission Projections (MTCDE).

Total Emissions Projections

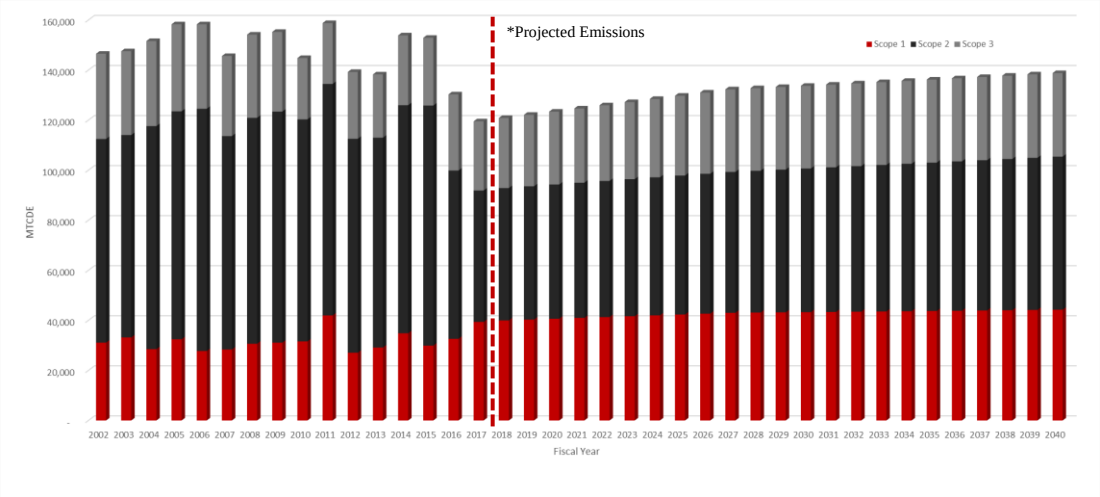

Figure 13. Total Emissions Projections (MTCDE).

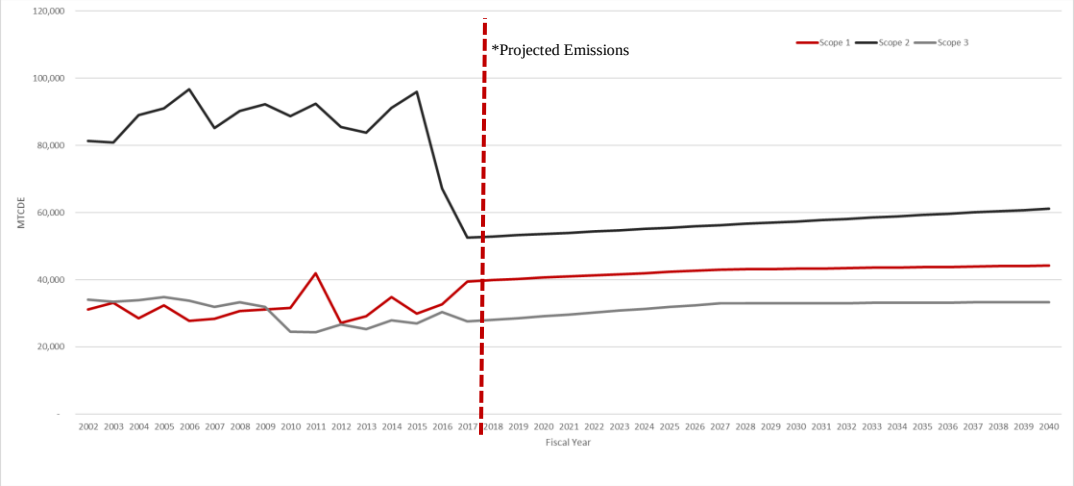

Figure 14. Total Emissions Projections (MTCDE).

As eluded to in Figure 13, the University will continue to experience gradual increases in emission levels if it does not aggressively pursue GHG mitigation strategies. If general trends continue with no mitigation actions taken, the University will emit approximately 138,500 MTCDE in FY2040, which is well above its long-term carbon neutrality goals.

The issue of growing emissions is consistent among each scope at the University of Arkansas and shows that achieving carbon neutrality will require consistent commitment from a broad spectrum of stakeholders. To reduce the University of Arkansas's environmental footprint, aggressive mitigation strategies will be required across a broad spectrum of University activities.

Part III: Achieving Short and Medium Term Mitigation Goals

As outlined previously, the University of Arkansas committed to three target emission levels with different time frames by signing the Presidents Climate Commitment:

- **Short Term Target:** Mitigate Metric Tons of Carbon Dioxide Equivalent (MTCDE) to 2005 levels by 2014
- **Medium Term Target:** Return to 1990 emission levels (125,000 MTCDE) by 2021
- **Long Term Target:** Become completely carbon neutral by 2040

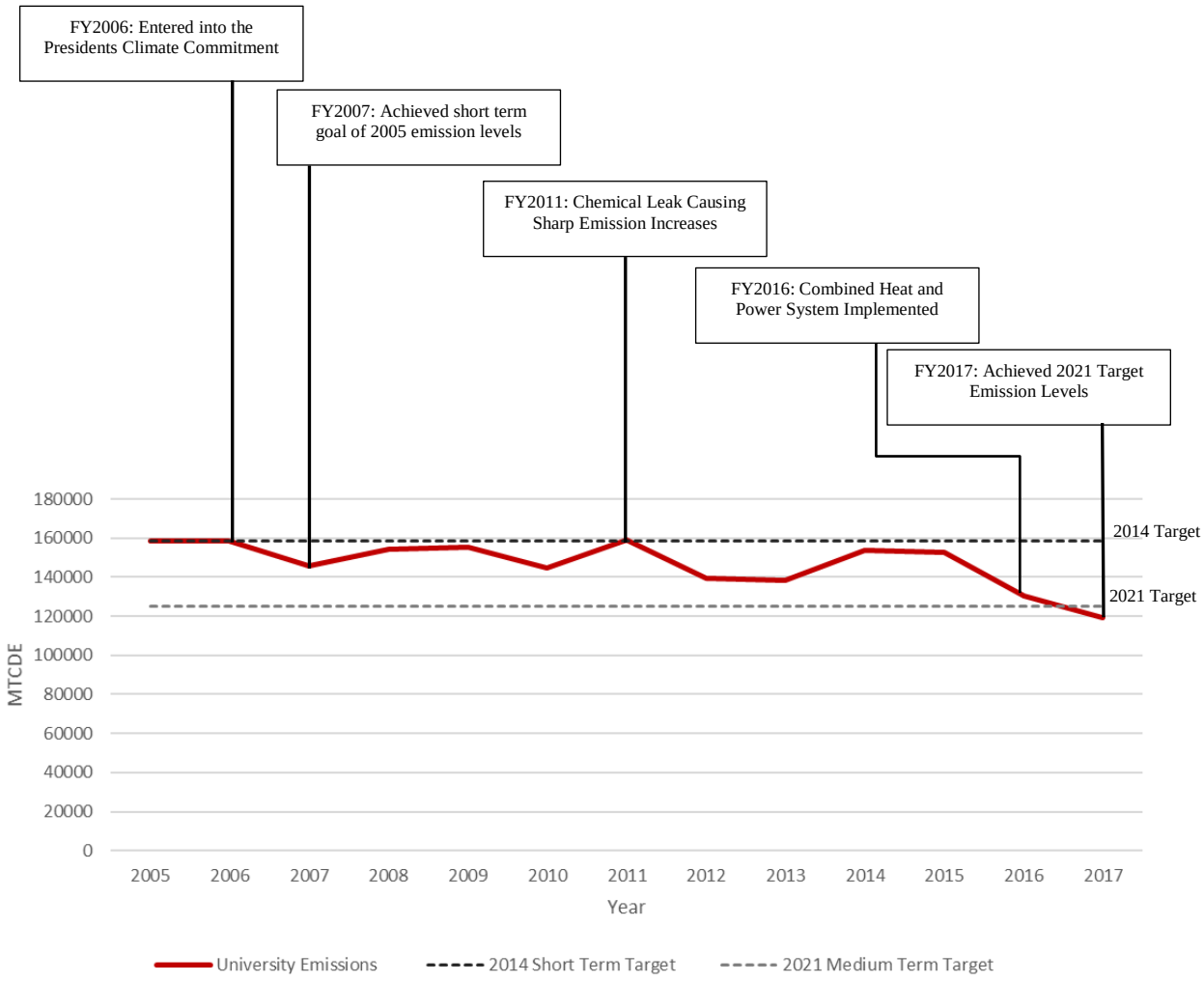

Figure 15. Total Emissions Levels Relative to Targets (MTCDE).

As outlined in Figure 15, the University achieved both its short-term and long-term emission goals long before the corresponding, self-imposed deadlines. The University met its short term 2014 emissions target just a year after signing the Presidents Climate Commitment seven year early in FY2007. In FY2017, the University met its 2021 emissions target, dropping below 1990 emission levels. While these accomplishments are impressive, the University of Arkansas still has a long way to go before it can achieve complete carbon neutrality and fulfil its 2040 target emissions level.

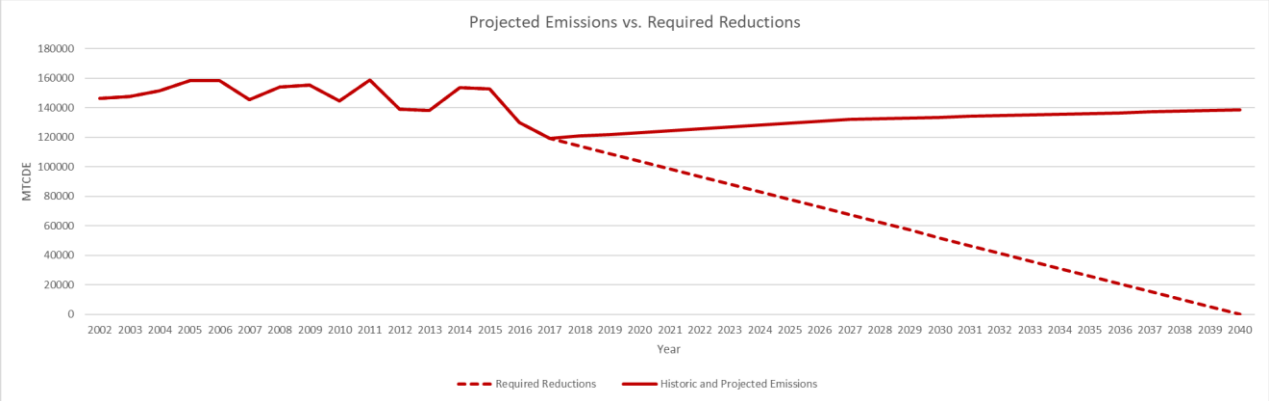

Figure 16. Projected Emissions vs Required Reductions to Meet 2040 Target (MTCDE).

With all things held constant and no pursuit of mitigation strategies, the University will increase its emissions by approximately 750 MTCDE every year, slightly below a 1% increase in current emissions for FY2017. The required amount of decrease in University emissions to achieve its 2040 goal of carbon neutrality is approximately a 5,200 MTCDE reduction, a 4% decrease, every year until 2040. The University of Arkansas will not reach its ultimate goal of carbon neutrality by continuing the status quo; its achievement will require aggressive mitigation strategies.

Part IV: Achieving Neutrality and Implementation of Projects

Combined Heat and Power System:

A Combined Heat and Power system (CHP) is vastly more efficient than other traditional means of producing electricity. In a CHP, fossil fuels are used to make electricity through traditional means; however, the exhaust heat of this process is recaptured and used to heat system water. This ultimately reduces the electricity needed by the University for day to day activities.

The CHP was operational for half of FY2016, and the University immediately saw a decrease in emissions. While the CHP system may increase Scope 1 emissions, it reduces Scope 2 emissions substantially. The diverted GHG from this system will total approximately 35,000 MTCDE.

Wind Catcher Program:

The University of Arkansas could potentially eliminate all of Scope 2 emissions and reduce its total carbon footprint by 44% by purchasing Renewable Energy Contracts (RECs) through the Wind Catcher Program. The Wind Catcher project is a wind farm that will be constructed in the panhandle of Oklahoma, spanning 300,000 acres. It will be the largest wind turbine project in North America to date.

The University of Arkansas would purchase Renewable Energy Credits (RECs) at a low marginal cost and a 10-year fixed price. These RECs would eliminate all University emissions from Scope 2 sources and could reduce the University's carbon footprint by more than any other program to date.

This could completely change emission reduction strategies undertaken by the University of Arkansas as the complete reduction of Scope 2 emissions would put greater importance on Scope 1 and Scope 3 mitigation strategies. The Wind Catcher program could cumulatively mitigate nearly 1.1 million MTCDE by 2040 and would be a massive step towards the University of Arkansas's 2040 emissions target.

Projected Emission Reductions from Existing Programs:

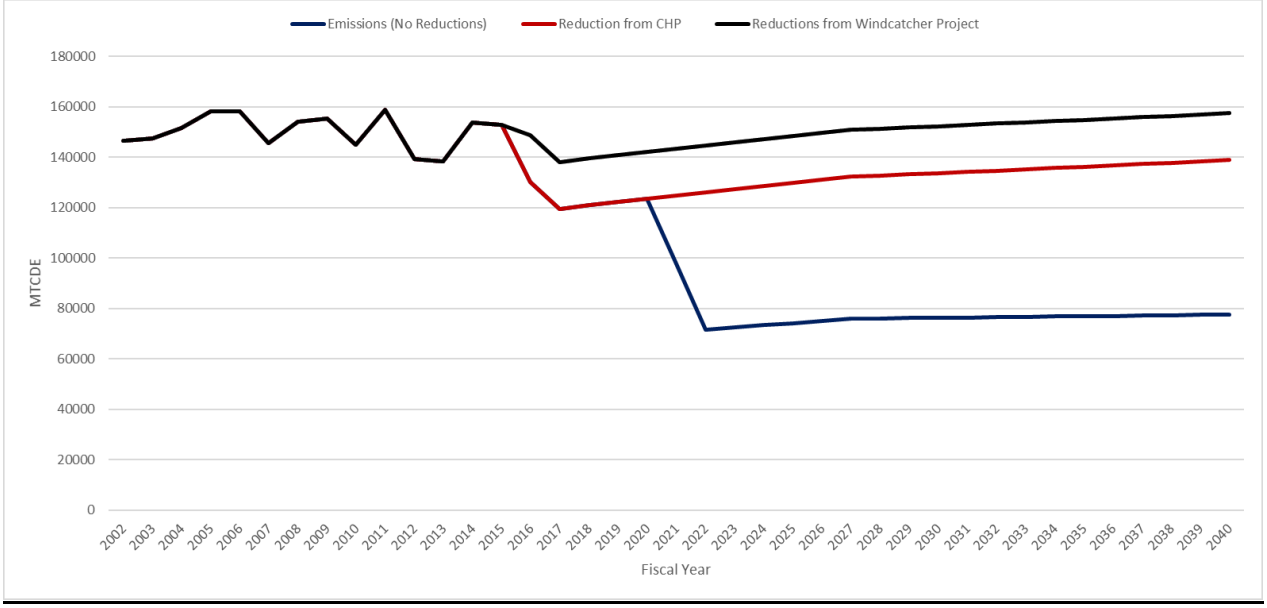

Figure 18. Mitigation Program Effects on University Emissions (MTCDE).

FY2025 Emissions Breakdown:

With current reduction strategies taking full effect after FY2021, a comprehensive analysis of UA emissions at this point in time must take place to outline strategies to further decrease the University's carbon footprint. With the complete mitigation of all Scope 2 emissions, new strategies and programs must be implemented to abate the remainder of the University's carbon footprint. At 2025, Scope 2 emissions will be zero, Scope 1 emissions are projected to total approximately 42,000 MTCDE, and Scope 3 emissions are projected to total approximately 32,000 MTCDE.

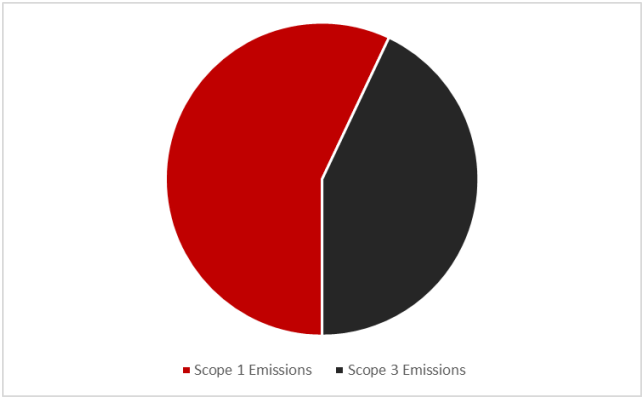

Figure 19. Projected U of A 2025 Emissions Breakdown by Scope.

The challenges associated with reducing Scope 1 and Scope 3 emissions are substantial, but with a strong commitment from the University of Arkansas administration, faculty, and students, these emissions can be successfully mitigated and the University of Arkansas can achieve carbon neutrality.

Green Revolving Fund Update:

The Green Revolving Fund (GRF) provides financing for implementing energy efficient, sustainable and cost-savings projects. These savings are tracked and used to replenish the fund or help finance additional projects. The Green Revolving Fund's primary goal is to engage students, faculty, staff, and donors toward the University's vision of becoming a global leader in sustainability education, research, innovation, and campus facilities.[7] Projects that have been implemented by the Green Revolving Fund are outlined below.

Billingsly Music Building Lighting:

Total Cost: $21,295.66 **Annual ROI: 21.3%**

Lifetime CO2e Abated: 842.5 MT **Lifetime ROI: 255.3%**

The retrofitting of Billingsly Music Hall with LED lights was a GRF project proposed by UA students. They demonstrated that using energy efficient LED bulbs was economically viable. LEDs use significantly less energy than traditional bulbs, and savings generated by their use will have a payback period of 3.5 years and a ROI of 21%. This project was spearheaded by the Office for Sustainability and Campus Planning and Design. They tested three different LED bulbs to select the option with the best color, light quality, and compatibility with building design. Over the lifetime of the installation, at least 800 MTCDE will be abated.

University Theater Lighting:

Total Cost: $7,780.85 **Annual ROI: 6.3%**

Lifetime CO2e Abated: 152 MT **Lifetime ROI: 75.4%**

This project was nearly identical to that of the retrofitting of Billingsly Music Hall. The project has a payback period of 6.8 years and an ROI of 6.3 %.

Grounds Crew Goes Green:

Total Cost: $11,027.30 **Annual ROI: 18.2%**

Lifetime CO2e Abated: 70.6 MT **Lifetime ROI: 91.0%**

The Grounds Crew Goes Green (GRF) program is designed to convert University leaf blowers and lawn trimmers, which normally operate with two-stroke gasoline engines and emit more pollution than a standard car, to electric powered units. These electric powered leaf blowers and trimmers are not only more environmentally friendly than their diesel counterparts, they are more economical. The Grounds Crew Goes Green has a payback of roughly 3 years and an ROI of 18.2% while abating over 70 MTCDE over the life of the project.

[7] For more information on the Green Revolving Fund visit: https://sustainability.uark.edu/get-involved/green-revolving-fund.php

Part V: Further Areas of Reduction to Achieve Carbon Neutrality

Scope 1 Mitigation Strategies:

Co-gen Electricity and Steam: Emissions from electricity and steam produced on campus by the Combined Heating and Power system are necessary as the CHP reduces emissions resulting from purchased electricity and has positive economic impacts for the University. This is an important example of an emission factor that cannot be reasonably mitigated and therefore must be offset by carbon sequestration.

Direct Transportation: Transportation from University owned vehicles accounts for roughly 3,500 MTCDE a year. Switching University fleet vehicles and busses to electric, hybrid, or Compressed Natural Gas (CNG) would drastically reduce these emissions. The Office for Sustainability is currently conducting a feasibility study to analyze the economic and environmental costs associated with retrofitting the University's transportation system.

On-Campus Stationary: By continuing to retrofit HVAC systems the University can drastically reduce its emissions from on-campus stationary systems. By continuing to increase the amount of buildings on campus that are LEED certified, the University can continue to reduce its carbon footprint in this category.

Scope 3 Mitigation Strategies:

Alternative transportation: Direct transportation by University of Arkansas students, staff, and faculty contributes significantly to the University's Scope 3 emissions. Increased infrastructure for modes of transportation that are carbon neutral not only contribute to the reduction of University emissions but also add to the overall community by incentivizing student health and increasing the attractiveness of the UA campus.

Current emissions from commuting are roughly 3,000 MTCDE for FY2017 and are projected to increase as the student population at the University rises. Currently only 2% of students commute to campus by bike, indicating a lack of bicycle infrastructure on campus. By increasing the percentage of students that either ride their bike or walk as a primary mode of transportation, the University can mitigate the emissions resulting from this category. However, these emissions will never be reduced to zero as 100% carbon free transportation is impossible for a campus of this size. Therefore, this emission category will also rely on carbon sequestration as increases in carbon neutral student commuting reaches a ceiling.

Carbon Offset Policies: Carbon offset schemes allow individuals and companies to balance out their own carbon footprint by investing in environmental projects locally or around the world. These projects are designed to reduce carbon emissions either by eliminating future emissions or by sequestering emissions.

Carbon offset policies pursued by the University will mainly focus on Scope 3 Emission factors such as directly financed air travel, study abroad air travel, and paper purchasing. These three categories make up roughly 9% of University emissions in FY2017 and will make up 17% in FY2021 once all Scope 2 Emissions are mitigated.

This amplifies the need to pursue carbon offset policies to diminish Scope 3 emissions. The goal of offsetting Scope 3 travel emissions and paper purchasing will be two-fold. First, buying carbon offsets would counteract negative environmental effects caused by the activity. Second, it would incentivize stake-holders to avoid or reduce that certain activity, since the purchaser will want to avoid the extra cost of the offset. Working in tandem, these two effects would produce significant reductions in Scope 3 University emissions.

Carbon Sequestration:

Carbon neutrality is a realistic goal for the University of Arkansas by 2040 so long as it is approached from a systems perspective. Long-term management of atmospheric carbon will require massive reductions in emissions through adoption of efficient consumption technologies and alternative power-generation technologies. Design processes such as net-zero energy buildings and technologies such as gasification from food-waste can significantly reduce the use of petrochemical fuel sources and will reinforce the leadership role of the University of Arkansas in global sustainability.

The University of Arkansas will unavoidably create emissions. Therefore, active sequestration of GHG, particularly CO_2, must be part of the overall strategy for the University of Arkansas to move to carbon neutrality. Carbon sequestration can be achieved using a number of strategies, including purchasing carbon credits from GHG brokers.

Part VI: Overview of Current UA Sustainability Systems

Sustainability Curriculum

In 2011, the University of Arkansas began offering the interdisciplinary Foundations of Sustainability undergraduate minor. Requirements for the minor include the gateway course SUST 1103 Foundations of Sustainability, the follow-up course SUST 2103 Applications of Sustainability, three electives, and a capstone experience. In the first two courses, students are introduced to fundamental concepts and practices of sustainability organized within four interdisciplinary systems areas: natural, social, built, and managed. Both courses also include a community service component. Students select electives from an extensive list of approved courses from all undergraduate colleges and schools at the University. Electives are determined to include significant sustainability content (tier 1) or to cover background or prerequisite knowledge (tier 2) by the Sustainability Curriculum Steering Committee. At least 6 of the 9 elective credits must be from tier 1 courses. These give students the opportunity to tailor their learning to the subjects that are of the greatest interest to them. Students are ultimately expected to incorporate knowledge gained from coursework into a capstone experience, which is an open-ended requirement that can be satisfied through an internship, research project, or service project. Students spend a semester planning and executing their projects under the supervision of faculty mentors, after which they articulate their experience and its connections to sustainability principles in the form of a written report and poster presentation.

Enrollment in the sustainability minor has grown steadily since its inception, and the list of elective courses has also grown, reflecting an increasing level of engagement from both students and faculty campus-wide. Students involved in the minor are being given the tools to become informed and motivated agents for furthering the University's sustainability goals.

The University has also implemented a graduate certificate in the sustainability program, which is targeted at graduate students in other programs who would like to add sustainability competencies to their program, as well as professionals within the workforce who wish to obtain a sustainability credential. The certificate consists of 15 credit hours, met through one required course, WCOB 5023 Sustainability in Business, and four elective courses identified by the Sustainability Curriculum Steering Committee.

In 2013, a proposal was submitted for the launch of an undergraduate Bachelor of Science in Sustainability program. The proposed major is built upon the minor, most notably with the addition of a strong emphasis on sustainability metrics and research methods. Similarly, there is a goal of developing a master's sustainability program in the future based upon the graduate certificate.

The University is also in the process of developing the University of Arkansas Resiliency Center (UARC). The purpose of the UARC is to inspire current generations to better understand the interconnectedness of economic, social, and environmental systems. The interdisciplinary Resiliency Center proposes to coordinate graduate-level education, undergraduate sustainability coursework, research at all levels, and active outreach programs in sustainable food, water, community, and landscape systems.

The UARC will help the Office for Sustainability build on its success in engaging students in sustainability focused research activities. The Office for Sustainability currently supports 10-15 undergraduate students who focus on sustainability research and projects that engage with a wide range of University systems.

Stakeholder Engagement and Education

Students:

Of any stakeholder groups discussed in this document, students have perhaps the greatest range of opportunities to become involved and bring the University closer to the completion of its sustainability goals. Students may pursue sustainability through curriculum, research, active engagement, informing policy, personal choices, and peer leadership.

Registered Student Organizations (RSOs) play a key role in developing new project initiatives. Razorback Food Recovery works to reduce food waste in dining halls. Net Impact works towards connecting students with professionals in sustainability and advocating for various environmental issues on campus. The Cycling Club advocates for greater bicycle infrastructure on campus. These are just a few of the sustainability focused RSO's on campus, and they will play an incredibly active role in achieving carbon neutrality.

The Associated Student Government (ASG), responsible for communicating student concerns to the university administration, has appointed a Sustainability Director to its cabinet who will also serve as a student representative of the UA Sustainability Council. Residents' Interhall Congress similarly elected a sustainability director for UA Residence Halls. This individual works with the Office for Sustainability, ASG, and other entities to enact projects and educational campaigns in University of Arkansas dormitories.

Because of their unique ability to impact outcomes across all metrics, more students are needed to become actively involved in sustainability initiatives. Students are encouraged to use the Office for Sustainability as a launching point for engagement and research.

University Administration:

The support of the University administration is crucial to the success of this plan. By becoming a charter signatory of the ACUPCC and forming the advisory body of the Sustainability Council, the UA administration has shown a high level of commitment to the sustainability of this institution. Ongoing support will be sought in the form of approval for future initiatives.

Projects that require funding from fees will require approval from relevant campus committees, the University System President, and the Board of Trustees.

The chancellor's executive committee, consisting of the Chancellor, Provost, Vice Chancellors, and Vice Provosts, considers policy proposals from the Sustainability Council, as well as other campus committees. The executive committee recognizes the strategies in this plan as an appropriate direction for the UA campus and endorses this plan as a means for meeting the responsibilities outlined by the American College and University Presidents Climate Commitment.

Faculty:

At an institution of higher learning, the role of faculty members in implementing this plan rests both on their impact as educators and their contribution as researchers. Faculty members have played a valuable part in mobilizing students by equipping them with the knowledge, skills, and motivation to engage with sustainability issues in meaningful ways. By mentoring engaged students, faculty members provide crucial guidance. Furthermore, in research conducted across all disciplines, faculty members continue to contribute knowledge that is crucial to developing campus key performance indicators by which the University's success can be judged. This research also establishes an institutional reputation for innovation and leadership in an emerging field of study.

Beyond research, faculty can explore opportunities to develop more courses with core sustainability components. Due to the interdisciplinary nature of the subject, all departments could conceivably address sustainability in their disciplines through course offerings, thereby reaching students in all programs and contributing to the diversity of both stakeholders and curricular offerings simultaneously.

Staff:

As the largest group of employees on campus, staff members have substantial influence on the University's management of resources. Staff members are already working to create a culture of sustainability within the buildings they work. As the primary and most consistent occupants of many academic and administrative buildings, staff set the norms for behaviors in these spaces.

Green initiatives often fall within the purview of staff. The Staff Senate is an important entity for communicating staff concerns with the administration. For example, the Social Systems workgroup is exploring a project called HEAL, Home Energy Affordability Loans. Home owning employees use HEAL loans for home energy efficiency improvement projects. The loans are offered through a local bank with low interest rates and their employers pay for participation in the program as an enhanced employee benefit. Employers around the nation, including L'Oreal, USA, Arlington Hotel, Friendship Community Care, Hendrix College, and Century Industries, Inc., now offer the program.

There are many ways for staff to become proactive in helping the University achieve its carbon goals. They can bring the buildings in which they work significantly closer to zero waste by ensuring that the quad recycling system is in place in every office and classroom. They can also help to reduce energy consumption in some of the highest consuming buildings by spreading awareness of the need to power down electronic equipment when not in use.

Campus and Public:

As the broadest stakeholder group, the campus and Fayetteville community is a key base for ideas, participation, and support. All members of the community can engage by spreading awareness, adopting sustainable behaviors on an individual level, and voicing support for ongoing projects.

On occasion, the University of Arkansas Sustainability Council actively solicits the input of community stakeholders. For example, in January of 2014, the University of Arkansas Sustainability Council held a Town Hall meeting to discuss additions to this update of the Climate Action Plan.

The Fayetteville Town and Gown Committee, formed in July 2012, is a venue where University and city officials can come together and address issues common to university towns. The Fayetteville Town and Gown includes seven city administration appointees, seven University of Arkansas appointees, and seven community members and city council representatives. This committee is an ideal body for communication of community input regarding this plan. Interested parties are also encouraged to contact the Office for Sustainability to share ideas, concerns, and information relevant to the goals and projects set forth here.

What is most impressive is the City of Fayetteville's recently adopted Energy Action Plan. This Energy Action Plan outlines the city's goals and benchmarks for energy independence, improved public health, resilient local businesses, energy efficient homes, a collective

understanding of climate change, and a culture of innovation. The City of Fayetteville has outlined the following goals in this plan.

Energy Supply:

- Achieve 100% local government clean energy by 2030
- Achieve 50% community-wide clean energy by 2030
- Achieve 1005 community-wide clean energy by 2050

Transportation:

- Reduce per capital vehicle miles traveled to 2010 levels by 2030
- Achieve 25% bike/walk/transit mode share by 2030

Waste:

- Achieve 40% total waste diversion from the landfill by 2027

Buildings:

- Complete periodic feasibility analyses of building energy code updates
- Achieve 3% annual reduction in overall energy usage in buildings
- Improve the health distribution, coverage, and effectiveness of Fayetteville's urban forest

Conclusion:

The University of Arkansas has achieved both its short-term and mid-term goals years before their respective deadlines. In the decade after the 2007 University of Arkansas American College and University Presidents' Climate Commitment, enrollment increased by 52% and building space increased by 23%, but emissions still decreased by 27%. That respectable progress can be largely attributed to energy savings performance contracts, a combined heat and power system, and LEED Silver standards for all new buildings and renovations. These initiatives were all cost effective solutions to reducing emissions while improving the experience of campus users.

With the expected SWEPCO Wind Catcher project to come to fruition in 2020, the University of Arkansas hopes to mitigate all of Scope 2 emissions from its carbon footprint, nearly 44% of its current emission levels. At that point, the University would have approximately 74,000 MTCDE to mitigate through energy efficiency projects, procurement policies, commuter incentives, and carbon sequestration projects. Emission reduction and associated strategies will continue to be an iterative process. University staff will continue to review progress made and identify emerging opportunities annually.

The University of Arkansas has made significant strides in reducing its environmental impact, but this is not a cause for complacency. The University still has a long way to go to honor the commitment it made in 2007 to achieve carbon neutrality by 2040. While campus population and building space are expected to plateau, new technologies and sequestration opportunities will hopefully arise. The University of Arkansas plans to reach carbon neutrality through widely accepted best practices.

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