Eastern Kentucky University:
Climate Action & Resiliency Plan

February 9, 2017

Prepared by:

Eastern Kentucky University's
Office of Sustainability

Letter from the President

June 14, 2016

My signing of the Second Nature Climate Commitment in 2015 galvanized our resolve at Eastern Kentucky University to develop a plan for achieving carbon neutrality. It was a proud day for our campus community, but as I noted at the time, our actions speak louder than our words. Developing this Climate Action Plan is the first step in putting our commitment into action. EKU has long taken a pro-active approach toward reducing its environmental footprint – while preparing and encouraging our students to become good environmental stewards.

Our approach has encompassed, in part, the use of energy-efficient technologies and the construction of high-performance, sustainable buildings; a reduction of vehicular emissions through ridesharing and improving the walkability and "bikeability" across campus; diversion of as much waste as possible from landfills; "green" purchasing policies; greater use of local and organic foods in campus cafeterias; and ongoing educational campaigns.

Sustainability is sometimes defined too narrowly or wrongly viewed through a lens of political partisanship. The truth is that rethinking and retraining to accommodate sustainable behaviors is more than just an environmental win; oftentimes it simply makes good fiscal sense. (How else do you explain why more than half of Fortune 500 companies have committed to sustainability as one of their core values?)

Given the budgetary challenges we now face in public higher education, it is more important than ever that we meet our current resource needs without hindering the ability of future generations to do the same. But this is about far more than just our careful stewardship of the public trust or even our own future as a learning community. Institutions of higher learning have a supreme calling to be visionaries, to model smart, forward-thinking sustainable solutions to all of society's long-term needs, and to engage all their constituencies in the process. At Eastern Kentucky University, that is exactly what we will continue to do.

Sincerely,

Michael Benson
President
Eastern Kentucky University

MICHAEL T. BENSON
PRESIDENT

Acknowledgements

The development of this Climate Action & Resiliency Plan for Eastern Kentucky University (EKU) is attributable directly to the vision of University President Michael T. Benson. Without his support and understanding of the importance of addressing this issue for the future prosperity of EKU and the planet, this report and the ongoing effort behind it would not exist. Additionally, this report and EKU's progress toward reducing its climate impact would not have been possible without the dedication of the following individuals:

EKU Climate Advisory Committee

Patrick W. McKee – Sustainability Manager, Office of Sustainability

William T. Rhodes – Assistant Director, Facilities Services, Environmental Compliance & Energy Management

Paul Gannoe – Associate VP, Facility Services & Capital Planning

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William Keaton – Assistant Director, Student Life

Jennifer Koslow – Assistant Professor of Plant Ecology, Dept. of Biological Sciences

Shannon Gibson – Student Sustainability Coordinator, Office of Sustainability

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Brittney Kenney – Administrator, EKU Card Services

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Jennifer White – Study Abroad Coordinator, Center for International Education

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Randy Wilson – Program Coordinator, Facilities Services

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Chad Powers – Farm Manager, EKU Meadowbrook Farms

Justin Mckinney – Director, EKU Meadowbrook Farms

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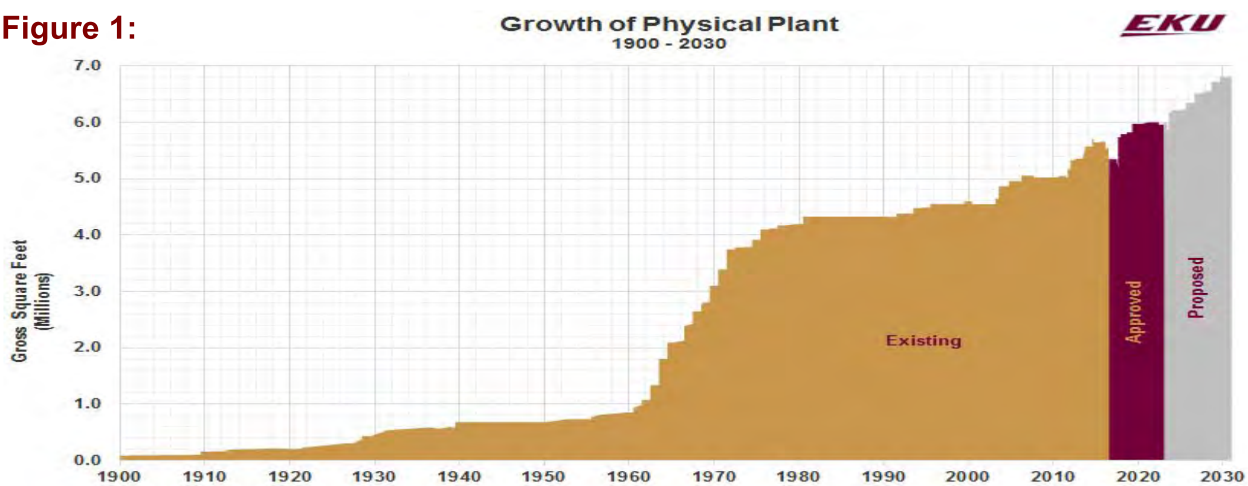
CHAPTER 1: INTRODUCTION

1.1 Eastern Kentucky University (EKU)

Eastern Kentucky University is a regional, coeducational, public institution of higher education offering general and liberal arts programs, pre-professional and professional preparation in education and various other fields at both the undergraduate and graduate levels. Located in Richmond, Kentucky, EKU has a distinguished record of more than a century of educational service to the Commonwealth. The University is both a residential and commuter campus. The majority of EKU's students are from Kentucky and surrounding states, with the remainder coming from across the United States and abroad.

Founded in 1906, EKU initially utilized the buildings of an older university—called Central University—whose original structures dated back to 1874. From its founding to the late 1950s, EKU's facilities grew steadily, peaking at 1 million square feet. Then between 1960 and the early 1970s, the campus experienced a building boom that nearly quadrupled its size in the span of only a decade. Since this building boom, the campus has once again grown steadily, reaching approximately 5.4 million square feet by Fiscal Year (FY) 2016 (July 1st 2015 – June 30th 2016).

Figure 1:



Between FY2016 and FY2024, EKU's building square footage is projected to increase to 6 million square feet. Given the energy intensity of buildings (40% of all energy consumed in the U.S. comes from buildings[1]), this increase in square footage will in turn increase EKU's overall climate impact unless it takes proactive steps to reduce its greenhouse gas (GHG) emissions (referred to interchangeably as equivalent carbon dioxide (CO_2e) or carbon dioxide (CO_2) emissions in this report). Energy efficiency upgrades to campus buildings and infrastructure not only reduce emissions, but can also save the University money. In the fall semester of FY2016, the University had 10,740 full-time students (approx. 4,600 living on campus), 1,707 part-time students, 687 full-time faculty, 510 part-time faculty, 1,553 full-time staff, and

[1] Source of reference: Website - http://www.eia.gov/tools/faqs/faq.cfm?id=86&t=1, EIA, Accessed September 2016

626 part-time staff, for a weighted campus user (WCU) load of 12,312.[2] WCU is a useful metric representing faculty, staff, and students' full- time equivalency related to their usage of buildings and other campus resources. During the fall and spring semesters, roughly 40% of full-time students live on campus throughout the week and return home on weekends, leaving the campus relatively unoccupied on Saturdays and Sundays. During the summer months, EKU hosts a much smaller number of campus users. In the summer of FY2016, EKU had 412 full-time students, 3,155 part-time students, 390 full-time faculty, 92 part-time faculty, 1,532 full-time staff and 581 part-time staff for a WCU of 3,669. Over the summer months, 39% of EKU's WCU figure is comprised of staff alone; this percentage drops to just 12% during the normal academic year.

1.2 Potential Impacts of Climate Change

Institutions and scientific groups throughout the world study climate change and its underlying science. The central international entity that studies climate science on behalf of the world's governments is the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC boasts nearly universal participation from UN member states and is widely recognized as the most credible source of climate data.[3]

One of the UNFCCC's most important roles is the administration of the Intergovernmental Panel on Climate Change (IPCC), which prepares and releases comprehensive reports documenting the state of worldwide climate science. To date there have been five reports released: in 1990, 1996, 2001, 2007, and most recently 2014. These reports are prepared in collaboration with "more than 450 lead authors" and "more than 800 contributing authors."[4] An additional "2,500 experts reviewed the draft documents" from countries all over the world.[4] These reports are over 3,000 pages in length and are considered the most comprehensive appraisal of climate science available. Overall, their development entails a lengthy process that is highly transparent and technically rigorous. These IPCC reports attempt to synthesize all available information on the existing trends of climate science and potential future impacts on the world's societies, natural environments, and economies. The following section of this report briefly describes the current state of Earth's climate as informed by credible sources—including the IPCC's recent Fifth Assessment Report (AR5) and the U.S. National Aeronautics & Space Administration (NASA). This section will distinguish between what is known, what is currently happening, and what could potentially happen regarding climate change.

[2] Weighted campus user (WCU) is a term that refers to average carrying capacity of the campus at any given time throughout the academic year. It is useful in evaluating the intensity impact on campus buildings and services. WCU is calculated (Full Time On-Campus + 0.75 * (Full Time Off Campus Students + Full-time Faculty + Full-Time Staff) + 0.5 * (Part-Time Students + Part-Time Faculty + Part-Time Staff)

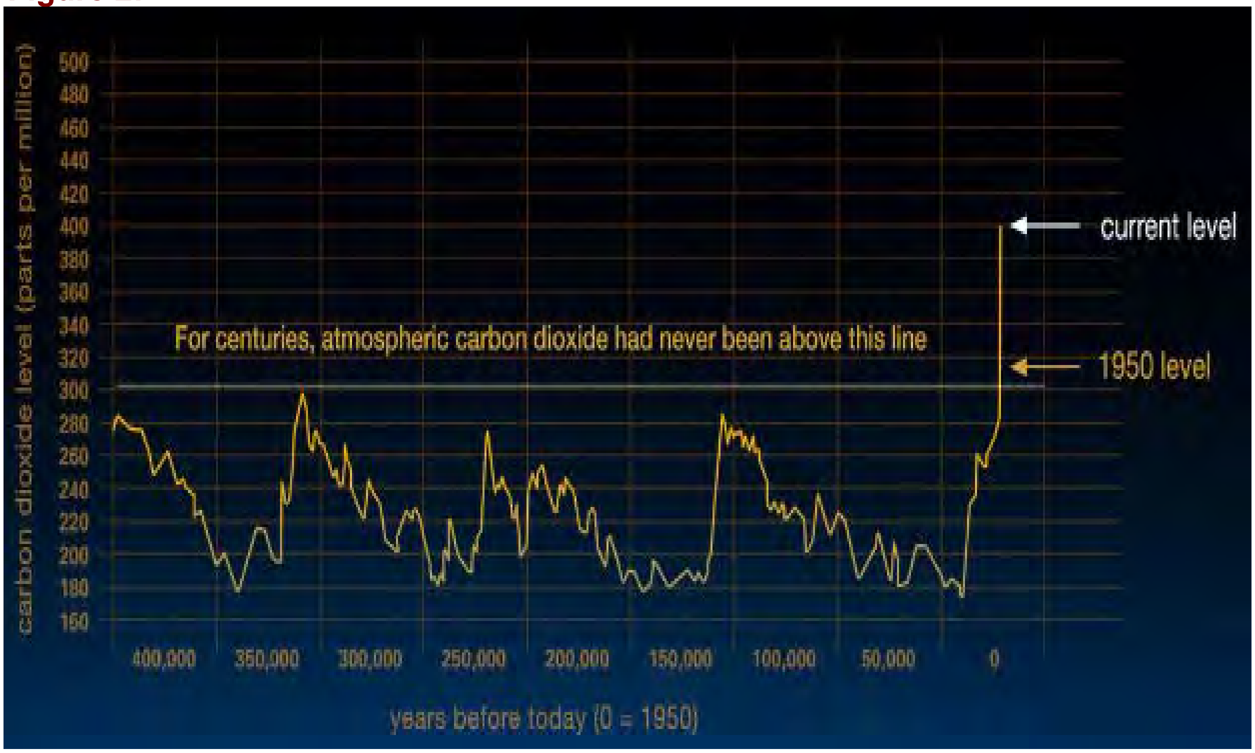
[3] Source of Reference: IPCC, 2014: Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Page 30.

[4] Source of Reference: http://www.ucsusa.org/global_warming/science_and_impacts/science/ipcc-backgrounder.html#.WAAVEvkrK00. October 2016.

What is Known

Through intensive study of the Earth's present and historic atmosphere, NASA has compiled a trend line interpolation of the concentrations of parts per million (PPM) of carbon dioxide (CO_2) in the atmosphere over the last 400,000 years.[5]

Figure 2:



Selecting the 1950 concentrations as a baseline and high-water mark, Figure 2 depicts that CO_2 concentrations in the last decade have climbed to unprecedented levels —currently topping out at over 400 PPM (with 300 PPM being the natural upper limit historically). It is undisputed that CO_2 is a heat-trapping, or "greenhouse gas (GHG)," and that higher concentrations in the atmosphere naturally will trap more heat. The IPCC reports that "human influence on the climate system is clear."[6] Furthermore, as the above chart illustrates, "recent anthropogenic emissions of greenhouse gases are the highest in history."[6] Given the basic scientific principle of heat-trapping gasses, and the extraordinarily high concentrations of CO_2 currently in the atmosphere, global climate cycles appear to be experiencing the impact of such trapped heat. As the IPPC reports:

> *Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.*[7]

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[5] Source of Figure: Website - http://climate.nasa.gov/evidence/, NASA, Accessed August 2016
[6] Source of Reference: IPCC, 2014 Synthesis Report. Page 2.
[7] Source of Reference: IPCC, 2014 Synthesis Report. Page 4.

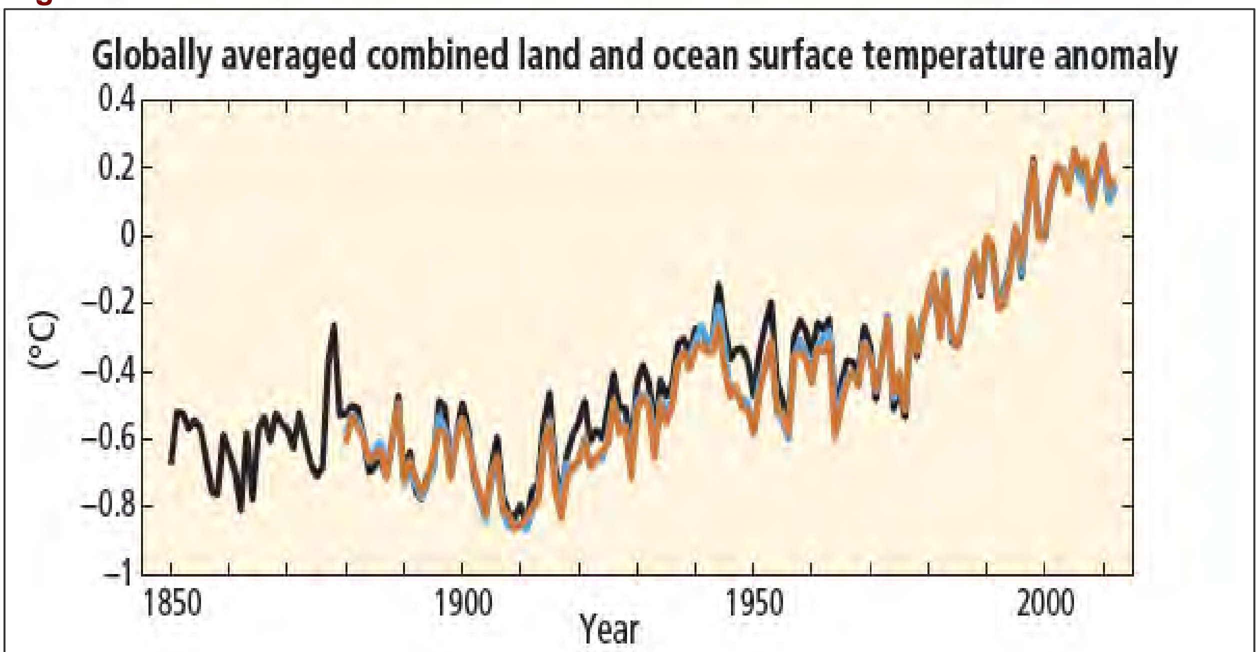
What is Currently Happening

Earth’s landmasses, plants, animals, oceans and atmosphere represent a complex interaction of natural forces. Through most of recorded history, humanity considered these global resources to be infinite and largely outside of human control or influence. Only recently (since the industrial revolution in the 1800s) have human activities reached a scale in which they can have a measurable impact on the natural carrying capacities of the planet. Over the last century, humans have been directly responsible for dramatic increases in extinction rates of a number of plant and animal species, large-scale deforestation, regional water shortages, sweeping contamination of land and water resources, rises in air pollution, and a reduction in natural resource capacities.[8] This impact also includes Earth's climate and interrelated systems. The 5th IPCC report states that:

> *In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate.[9] […] Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.[10]*

Figure 3 illustrates the change in some of these temperature-related measures from 1850 to the present.

Figure 3:



So how much additional CO_2 has the human race put into the atmosphere? The U.S. Department of Energy has estimated that over 374 billion metric tons of carbon dioxide equivalent ($MTCO_2e$) have been released globally between 1751 and 2011.[11] These

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[8] Source of Reference: Robertson, M. (2014). Sustainability principles and practice. Page 6. Abingdon, Oxon: Routledge.

[9] Source of Reference: IPCC, 2014 Synthesis Report. Page 6.

[10] Source of Reference: IPCC, 2014 Synthesis Report. Page 2.

[11] Source of Reference: Oak Ridge National Laboratory, U.S. Department of Energy

sources of emissions include CO_2 from fossil fuel combustion via stationary energy generation and automobiles, methane from agricultural practices and landfills, refrigerant chemical releases, and various other climate-impacting sources tied to our modern way of life. Figure 4 outlines the current sources of emissions from various sectors of our global economy.

Figure 4:

Greenhouse Gas Emissions by Economic Sectors

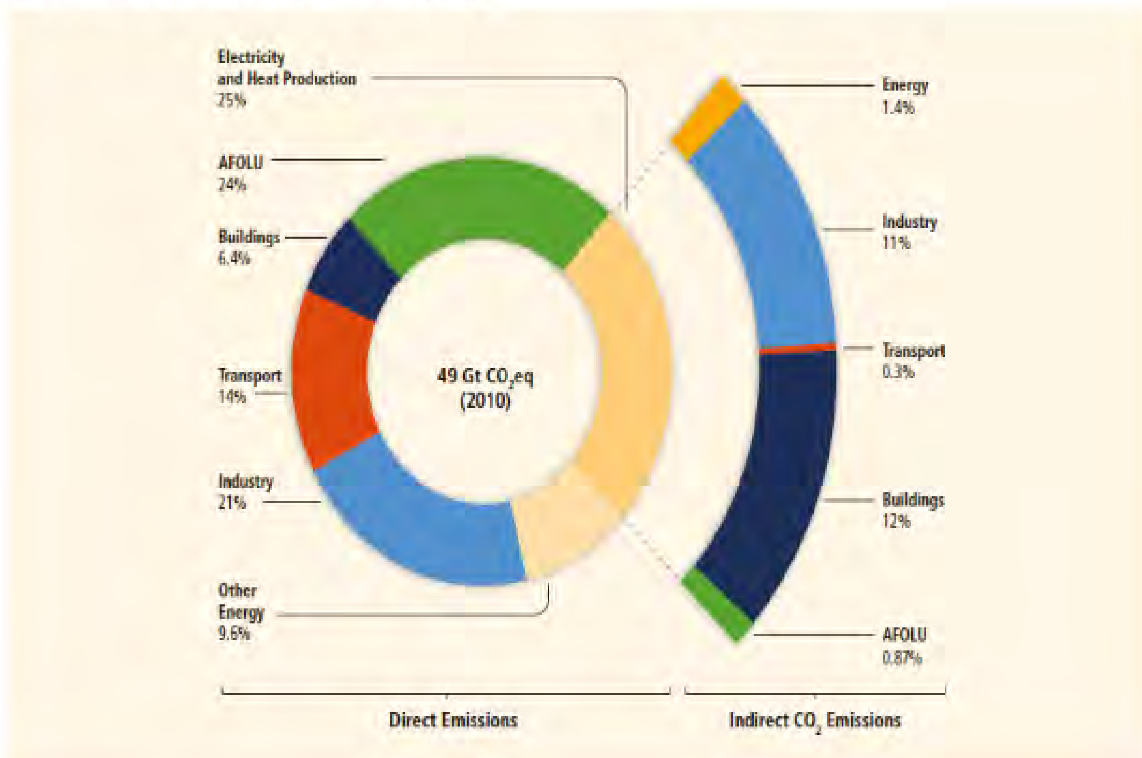


Figure SPM.2 | Total anthropogenic GHG emissions ($GtCO_2eq/yr$) by economic sectors. Inner circle shows direct GHG emission shares (in % of total anthropogenic GHG emissions) of five economic sectors in 2010. Pull-out shows how indirect CO_2 emission shares (in % of total anthropogenic GHG emissions) from electricity and heat production are attributed to sectors of final energy use. 'Other Energy' refers to all GHG emission sources in the energy sector as defined in Annex II other than electricity and heat production [A.II.9.1]. The emissions data from Agriculture, Forestry and Other Land Use (AFOLU) includes land-based CO_2 emissions from forest fires, peat fires and peat decay that approximate to net CO_2 flux from the Forestry and Other Land Use (FOLU) sub-sector as described in Chapter 11 of this report. Emissions are converted into CO_2-equivalents based on GWP_{100}[6] from the IPCC Second Assessment Report. Sector definitions are provided in Annex II.9. [Figure 1.3a, Figure TS.3 upper panel]

Figure 4 also shows that when it comes to direct (point of origin) emissions, electricity and heat production account for the largest portion of global emissions (25%), agriculture, forestry and other land use (AFOLU) account for the second-largest portion (24%), and industry the third-largest portion (21%). Buildings, transportation, and other energy sources all combine to make up the remaining portion (30%).[12] Indirect emissions are secondary uses of generated energy and heat; these come primarily from buildings and industry, with a small percentage coming from transportation, energy, and AFOLU sectors. The measured accounts of the ecological, social, and economic impacts that are occurring have led scientists to forecast reasonable outcomes if current conditions continue.

[12] Source of Chart: IPCC, Climate Change 2014 Mitigation of Climate Change, Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Page 9

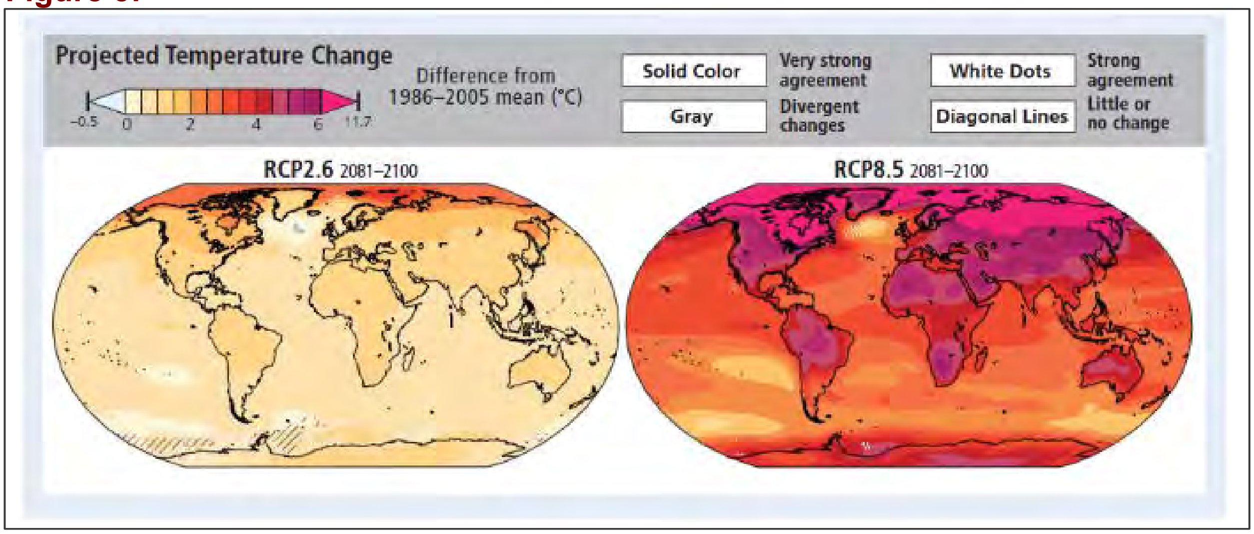
Potential Impacts of Climate Change

The scientific community is predominantly in agreement about increasing CO_2 concentrations, their growing influence on climate, and the rise in global average temperature. In fact, a recent survey of climate scientists states:

> *"The consensus that humans are causing recent global warming is shared by 90%–100% of publishing climate scientists according to six independent studies by co-authors of this paper. Those results are consistent with the 97% consensus reported by Cook et al (Environ. Res. Lett. 8 024024) based on 11,944 abstracts of research papers, of which 4,014 took a position on the cause of recent global warming."*[13]

The question of how these changes might manifest in the world and impact people is a far more contentious discussion among scientists and within the general population. For example, the following chart (Figure 5) from the 5th IPCC report shows two different projected scenarios of global temperature change. The image on the left represents the hypothetical "best-case" scenario, and the one on the right, the hypothetical "worst-case" scenario.[14]

Figure 5:



Taking into account existing CO_2 concentrations, the "best-case" scenario projects a rise of one to two degrees Celsius globally, with higher temperatures in the polar region by 2100.[14] Many scientists consider this to be within the safe upper limit for global temperature increases.[15] The "worst-case" scenario depicts global temperature increases in the four to six degree range.[15] Many believe this higher temperature range would lead to cataclysmic changes in our planet's natural systems that would constitute a direct threat to our species' long-term survival.[16] The 5th IPCC report states:

> *There are multiple mitigation pathways that are likely to limit warming to below 2°C relative to pre-industrial levels. These pathways would require substantial emissions reductions over the next few decades and near zero emissions of CO_2 and other long-lived greenhouse gases by the end of the*

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[13] Source of quote: *"Consensus on consensus: a synthesis of consensus estimates on human-caused global Warming"* http://iopscience.iop.org/article/10.1088/1748-9326/11/4/048002/pdf, Abstract Text
[14] Source of graphic: IPCC, A-B report Page 10.
[15] Source Reference: IPCC, 2014 Synthesis Report. Page 20.
[16] Source Reference: IPCC, 2014 Synthesis Report. Page 16.

century. Implementing such reductions poses substantial technological, economic, social and institutional challenges, which increase with delays in additional mitigation and if key technologies are not available. Limiting warming to lower or higher levels involves similar challenges but on different timescales.[17]

The IPCC and other scientific groups utilize complex climate models to predict the potential rise in temperature in the coming decades, and to understand the effects of actual and hypothetical mitigation efforts. All of these models contain uncertainties that could dramatically alter the outcomes and level of effort required to keep global temperature increases below two degrees Celsius (3.6 degrees Fahrenheit). Several unanswered questions remain within these models, for example:

1. What is the cumulative GHG emissions mankind will put into the atmosphere?
2. What positive or negative interactions between natural systems exist, but are currently unknown between the atmosphere, oceans, and land typologies?
3. What is the history and future of solar cycles and the sun's dynamic impact on climate?
4. What is the natural impact of the terrestrial carbon cycle (i.e. volcanos, oceans, forest fires, etc.) which is outside human control, but can be the source of significant contributions to GHG concentrations in the atmosphere?
5. Will it be possible in the future to extract GHGs from the atmosphere through technological advents or through biological management?
6. Is there a carbon concentration tipping point for "runaway climate change" that could be precipitated from methane releases by arctic permafrost melt and encapsulated peat bogs, or by summer ice losses in the North Pole (leading to additional absorption of heat by darker oceans underneath)?[18]

Despite numerous uncertainties, the IPCC states that:

Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.[19] *[…] Effective decision-making to limit climate change and its effects can be informed by a wide range of analytical approaches for evaluating expected risks and benefits, recognizing the importance of governance, ethical dimensions, equity, value judgments, economic assessments and diverse perceptions and responses to risk and uncertainty.*[20]

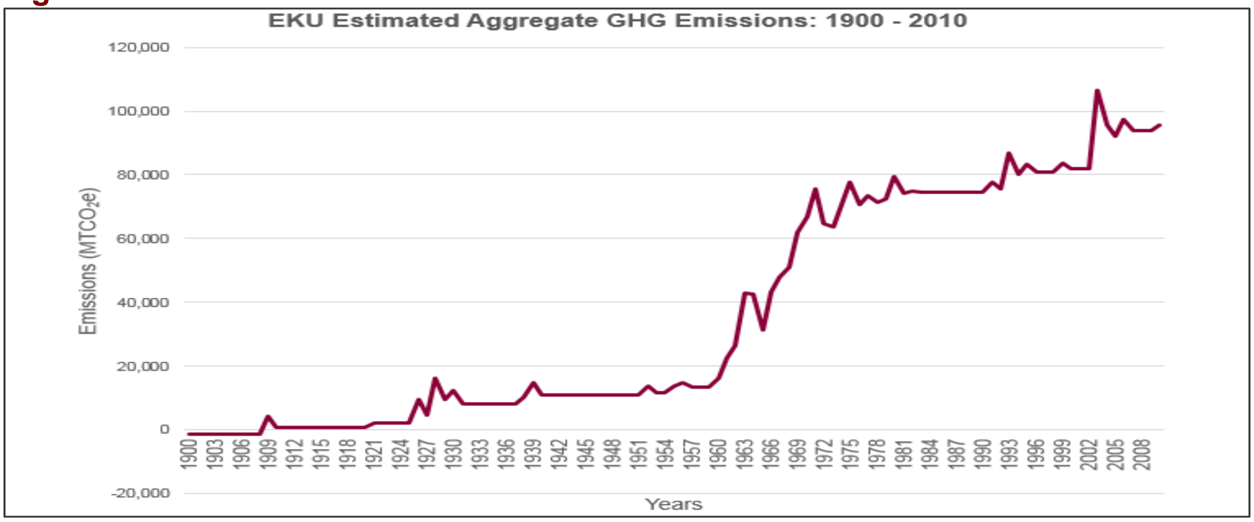
The IPCC clearly believes that society will need to undertake some level of coordinated global action to address the increase of CO_2 concentrations in the atmosphere and to mitigate any future negative outcomes of climate change. These mitigation actions will have both positive and negative impacts on existing economic drivers and structures of human civilization. Striking the proper balance in the face of uncertainty is the key challenge to global climate action. The next section will evaluate EKU's impact on the larger context of climate change and solutions for mitigating EKU's carbon contribution in accordance with the Second Nature Climate Commitment.

[17] Source Reference: IPCC, 2014 Synthesis Report. Page 20.
[18] Source Reference: The Arctic Institute, Climate Change, Arctic Security, and Methane Risks. 2016.
[19] Source Reference: IPCC, 2014 Synthesis Report. Page 8.
[20] Source Reference: IPCC, 2014 Synthesis Report. Page 17.

1.3 EKU's Global Climate Impact

Utilizing the historical analysis of EKU's campus building square footage, it is feasible to estimate the University's cumulative carbon debt (as distinct from its annual carbon deficit). A high-level analysis, including consideration of the embodied emissions associated with the construction of new buildings, concluded that EKU has emitted as much as 4 million cumulative $MTCO_2e$ into the atmosphere over its 115-year history. According to these estimates, EKU is responsible for approximately 0.001% of the total human CO_2e emissions globally over this time period (Figure 6).

Figure 6:



Looking at the magnitude of this calculation, it seems daunting that EKU could begin to address its historic carbon debt in a meaningful way; however, as an institution of higher learning, EKU has the potential to have a disproportionate positive impact on the climate change discussion and on mitigating actions in Kentucky and the broader community. This outsized influence is attributable to the University's commitment to educating students and preparing them to become informed environmental stewards and decision makers in their careers and personal lives. Additionally, University sponsored research and outreach could help advance the topics of sustainability and GHG mitigation solutions. These efforts are consistent with EKU's central mission of education.

An in-depth review of EKU's current energy infrastructure and emissions profile leads to an important discovery: reducing GHG emissions can serve as a net economic benefit to the University. EKU can save money, improve its infrastructure, while at the same time mitigate its carbon emissions. Given the apparent benefits of mitigation, EKU's President Dr. Michael Benson has committed the University to strategically reduce its annual, as well as historic, impact on the planet's atmospheric carbon concentrations. [21]

[21] For more information on these issues, please see the following websites and reports from federal and international agencies:

1.4 Campus Climate Resiliency/Adaptation Planning

Beyond mitigating its own climate impact, EKU must also prepare for a changing climate in the coming decades. Due to the historically unprecedented concentrations of CO_2 in the atmosphere, there is broad scientific consensus that some degree of climate change will occur regardless of future mitigation efforts. Ironically, some regions may experience perceived benefits in the short-term (i.e. longer growing seasons, more rainfall, and new crop species options), while overall impacts will be far more negative. EKU must be prepared to adapt itself to both the positive and negative consequences that a changing climate presents, and to plan for what could be much more extreme changes in the future. As stated in the 5th IPCC report:

> *Adaptation options exist in all sectors, but their context for implementation and potential to reduce climate-related risks differs across sectors and regions. Some adaptation responses involve significant co-benefits, synergies and trade-offs. Increasing climate change will increase challenges for many adaptation options.*[22]

As decided in the previous IPCC global map, the Midwest/Southeast's weather is projected to become hotter with longer summers. This could have a direct impact on EKU's heating and cooling costs, with more cooling days required. An increase in overall temperature could encourage invasive species migration (such as disease-bearing mosquitoes) to move north from the Southern United States. Changes in growing seasons could also affect Kentucky's agricultural production, with some crop yields increasing and some decreasing, while others becoming newly viable in this region. Given today's close interconnection of global economies, impacts elsewhere could also be felt locally. Beyond these short-term changes, long-term climate change could eventually lead to large shifts in Kentucky's economy, quality of life, and culture.

Building resiliency on EKU's campus is a process of hardening campus infrastructures and interdependencies to uncertain environmental stresses, while also expanding existing community education programs to cover the societal and economic challenges that climate change could pose to the University and region. This could include modifying EKU's electrical supply grid and heating and cooling infrastructure to be more localized, renewable, and under the direct control of the University.

The development of campus resiliency represents an opportunity for EKU to get ahead of the conversation and start preparing students and the broader community for the predicted social, economic, and environmental challenges associated with climate change.[23]

- Intergovernmental Panel on Climate Change (IPCC): The 2014 5th Assessment Report of The Intergovernmental Panel on Climate Change - http://www.ipcc.ch/report/ar5/
- Environmental Protection Agency (EPA): A Student's Guide to Global Climate Change - https://www3.epa.gov/climatechange/kids/index.html
- National Aeronautics & Space Administration (NASA): Global Climate Change: Vital Signs of the Planet - http://climate.nasa.gov/

[22] IPCC, 2014 Synthesis Report. Page 26.
[23] The following resources from national and regional sources can provide more information:

1.5 EKU's Climate Commitment

Colleges and universities are increasingly becoming the focus for sustainability education, demonstration, and leadership. According to *The Princeton Review* (a top ranking higher education publication) being a "green college" is becoming an important selling point to incoming freshmen across the country. Each year, the publication ranks the top schools for sustainability in the nation. In 2015, four of the top 353 "green schools" were located within the state of Kentucky.[24] These schools were: The University of Louisville (UofL), Northern Kentucky University (NKU), Berea College, and Western Kentucky University (WKU).

Along with EKU, several other schools in the state also have active sustainability commitments and have, or are developing, carbon footprint assessments: including Western Kentucky University (WKU), University of Kentucky (UK), Transylvania University, and Morehead State University.[25]

On October 20, 2015 EKU President Michael Benson signed the Second Nature Climate Commitment.[26] This was influenced in part by EKU's student sustainability organization "Green Crew." Second Nature is a national nonprofit organization that provides a framework and parameters for the self-reporting of GHG emissions by colleges and universities. Under the terms of this commitment, EKU is required to develop its first comprehensive carbon footprint assessment and climate action plan. Since 2006, over 679 U.S. universities and colleges have committed to developing their own institutional carbon footprint assessment and climate action plans. These institutions represent over 41% of all U.S. higher education students.[27] In total, 60% of these institutions have submitted carbon footprints, demonstrating reductions totaling 3,759,878 $MTCO_2e$, or 21% of total annual emissions from these schools.[28]

Specifically, the Second Nature Climate Commitment requires that EKU quantify its GHG emissions annually and prepare a climate action plan every 5 years, detailing the strategies EKU will use to reduce emissions and establishing goals toward carbon neutrality. EKU also has an opportunity to work with

- Western Kentucky University (WKU) Kentucky Climate Center: Interactive Website & Resources - http://www.kyclimate.org/index.html
- The National Climate Assessment (NCA): 2014 Climate Change Impacts in the United States: Chapter 17 Southeast & the Caribbean - http://nca2014.globalchange.gov/
- Environmental Protection Agency (EPA): 2016 Climate & Health Resource: Kentucky - https://www3.epa.gov/climatechange/kids/index.html

[24] Source of Reference: Website - http://www.princetonreview.com/college-rankings?rankings=green-colleges, The Princeton Review, Accessed August 2016 and Green Guide - http://az589735.vo.msecnd.net/pdf/greenguide2015.pdf, The Princeton Review, Accessed August 2016

[25] Note: Neighboring "green schools" outside Kentucky include: Miami University, Ohio State University (OSU), Ohio University (OU), University of Tenn Knoxville (UT), University of Dayton, University of Cincinnati (UC), and Antioch College.

[26] Source of reference: http://secondnature.org/, Note: this commitment is formerly known as the American College & University Presidents' [ACUPCC] Climate Commitment

[27] Source of Reference: http://annualreport.secondnature.org/2014/

[28] Source of Reference: http://annualreport.secondnature.org/2014/

other Kentucky public universities to directly engage this topic and to drive the conversation in the field of higher education and beyond. Given Kentucky's heavy reliance on coal, it is reasonable that a reduction in the prominence of fossil fuels in America's energy infrastructure would profoundly affect the state's economy and employment trends—especially in Eastern Kentucky. As a result, EKU is well positioned to take a leadership role in climate change education, modeling positive change, and helping Appalachia deal with the economic impacts of shifting away from coal.

Going forward, EKU should consider the ultimate strategic, tactical, and operational goals of mitigating its emissions. Scientifically accepted estimates suggest that developed countries need to reduce their annual carbon emissions output by 25–40% by 2020, and 80–95% by 2050 (based on 1990s levels) to avoid the most catastrophic impacts of climate change.[29] This will only be possible through a drastic shift away from the burning of fossil fuels. Many of the technologies, practices, and procedures required for this shift will be outside of EKU's direct control. For instance, EKU does not have a voice in encouraging Kentucky and Midwestern/Southeastern utilities to move away from fossil fuels; these utilities are legally required by their regulatory system to provide power at the lowest cost possible. Government rules could change this however, by requiring utilities to recognize and incur costs for carbon emissions. Such regulatory changes would have a major impact on both the electricity portion of EKU's carbon footprint (its largest carbon emission source by far) and the University's utility budget. EKU is particularly susceptible to these regulatory costs, as Kentucky Utilities (KU) has one of the highest proportions of coal-produced electricity in the country.

What EKU can control is the amount of electricity it consumes and its direct usage of fossil fuels through its central heat plant. Reductions in these two areas can mitigate both a portion of the University's carbon footprint, and the risk of increased costs due to utility-level changes and environmental upgrades. The University can also educate campus users and the region on the consequences of increasing CO_2 concentrations and strategies for reducing carbon output in their personal lives.

When developing reduction goals, there are at least two ways EKU should evaluate its progress: through absolute goals and intensity-based targets. Absolute goals target a total percentage consumption reduction by a certain date (i.e. 30% reduction of electricity consumption by 2030). Intensity-based goals relate directly to the service mission of the entity or institution. For EKU, this mission is education; as such, an intensity goal would link emissions reduction to service indicators related to education—namely $MTCO_2e$ per campus user or $MTCO_2e$ per building gross square foot. While constructing buildings and housing students isn't the University's central mission, EKU needs buildings and plays host to a community of people on its campus to fulfill its larger service mission to the state and region.

[29] Source Reference: 4th IPCC Report, http://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch13-ens13-3-3-3.html. Accessed October 2016.

CHAPTER 2: GREENHOUSE GAS EMISSIONS

EKU used the Microsoft® Excel-based Campus Carbon Calculator (CCC), along with information provided by EKU staff, to develop the EKU-specific carbon footprint analysis summarized in this report. In 2001, the nonprofit organization Clean Air Cool Planet (CA-CP) and the University of New Hampshire partnered to develop the CCC as a carbon-calculating tool specifically tailored to colleges and universities. Since its development, the calculator has been used by "more than 90% of the U.S. colleges and universities that publicly report their emissions."[30] This free carbon calculator is widely accepted as the national standard for higher education carbon accounting. In 2014, CA-CP was absorbed by the University of New Hampshire, as was the administration of the Excel-based calculator and CarbonMAP (a new online version).

After comparing the Excel-based and online versions, EKU chose to use the Excel version 6.9 of the CCC to maximize the customization of the tool for the University's current and future carbon tracking. Nearly all of Second Nature's signatories have used this comprehensive and rigorous modeling tool. EKU customized the calculator to track its carbon footprint from FY2011–FY2020. The University used the calculator to develop its baseline analysis in the spring of 2016. With light revisions, this analysis supplied the basis for this report. EKU will continue to use this tool on an annual basis to track its progress. All of EKU's carbon emissions information in this report through 2020 originated from the CCC.

The CCC uses three broad categories to organize emission sources. These categories are generally accepted in the international carbon measurement and verification community, as codified in the "Greenhouse Gas Protocol."[31] This protocol "is the most widely used international accounting tool for government and business leaders to understand, quantify, and manage greenhouse gas emissions."[31] The following categories organize emission sources by the degree of control EKU administration has over them.

- **Scope 1 Controlled Sources:** This category represents emission sources directly controlled by EKU's administration, including fuel used in the central heat plant, fleet vehicles, and agricultural sources.

- **Scope 2 Partially Controlled Sources:** This category represents emission sources partially controlled by EKU's administration through consumption (indirect emissions). Purchased electricity is the only source relevant to EKU in this category. Ultimately, electricity consumption on campus is within EKU's administrative control, but its fuel source and associated emissions are the purview of Kentucky Utilities (KU).

- **Scope 3 Minimally Controlled Sources:** This category represents emission sources not controlled by EKU's administration due to extremely diffuse users. This includes emissions due to staff/student flights, commuting, solid waste decay, wastewater treatment, and paper use. Campus users control the quantity and intensity of use and

[30] Source of Reference: https://sustainableunh.unh.edu/calculator. October 2016.
[31] Source of Reference: http://www.ghgprotocol.org/calculation-tools/faq. October 2016.

thus the equivalent emissions tied to these sources; however, without the University's operation there would be no equivalent emissions.

Together these three categories of emissions make up the total gross $MTCO_2e$ attributable to the University in any given year—known as its total carbon footprint. In addition to these three categories, carbon sequestration (the active absorption of gaseous carbon from the atmosphere in ways that would not be possible without the existence of the University) represents an unofficial 4th category to be considered. This can help offset the first three scopes.

- **Scope 4 Carbon Sequestration:** This category relates to features of EKU's campus that actively remove CO_2 from the atmosphere, beyond that of pasture land. These features include different land types (i.e. forests, fields, and green spaces) owned and managed by the University. Assessing these features has a twofold benefit; first, it can help mitigate EKU's carbon footprint, and second, it can assign additional value to the management and expansion of these carbon-negative land features for years to come.

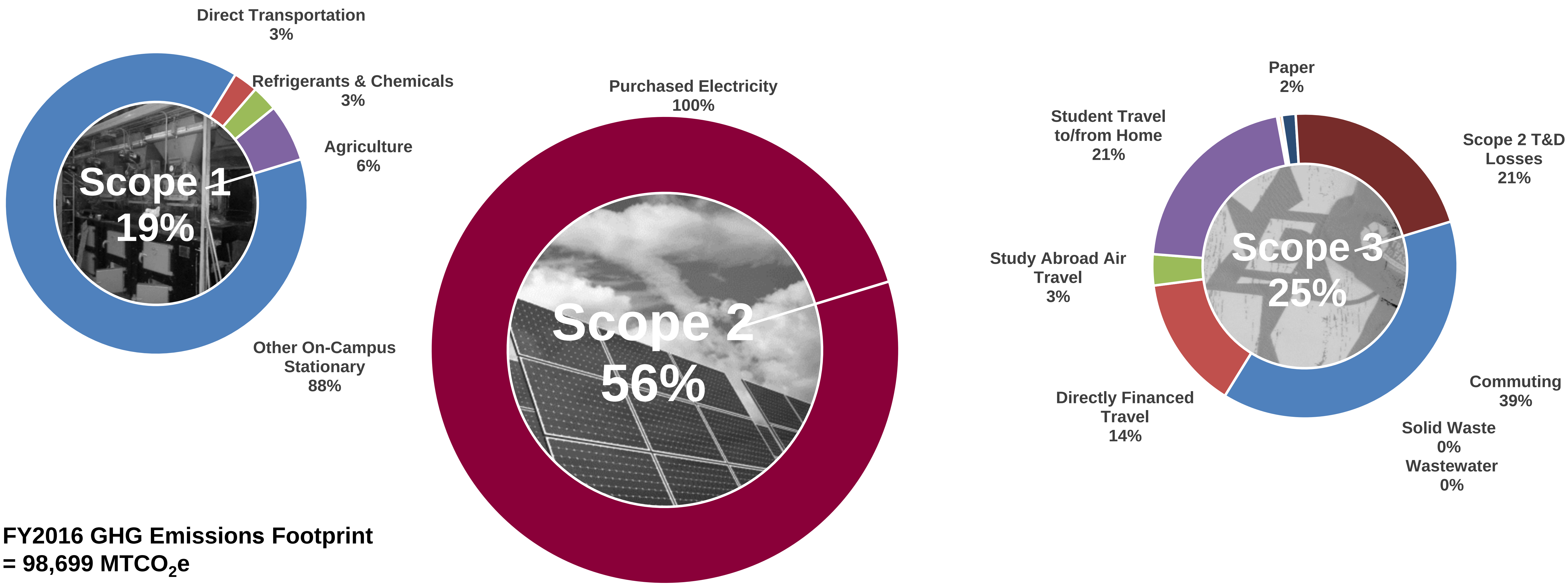
For accounting purposes, carbon sequestration is considered a "negative" source of emissions which can be subtracted from the total Scope 1, 2, and 3 gross emissions. The net emissions captured in these categories makes up the University's carbon emissions baseline and annual carbon footprint. When evaluating carbon emissions, it is important to determine the economics of mitigating them. Depending on the source of the emissions, the cost of reducing them can vary greatly. Some mitigation strategies (especially those related to electricity or fuel consumption) can save the University money while reducing emissions. These win-win investments should be the first place a University administration looks to reduce emissions. Carbon-sequestering features like campus green spaces and University-owned farm and forest lands, can also serve as valuable mitigating assets.

2.1 EKU's Baseline & Footprint FY2011 – 2014 & FY2016

The official GHG emissions baseline for EKU spans from FY2011 to FY2014. This multi-year baseline approach ensures that any anomalies (such as irregularly hot summers or colder winters) are evened out, allowing for a more accurate trend-line. An accurate trend-line is important because it provides the basis of the climate model and goal setting—much as a golfer's handicap is the basis on which he or she scores their game. Accuracy up front ensures that future years' calculations will effectively assess whether EKU's GHG emissions are increasing or decreasing, and whether the University's goals are being reached. Figures 7 and 8 depict the GHG emissions for EKU's baseline by fiscal year and scope category.[32]

[32] Note: The numbers presented in this report are represented as unrounded integers from the output of the CCC Excel model with EKU customizations. It should be understood by the reader that these are estimates only, and are only as precise and accurate as the assumptions used. These assumptions and their sources are detailed in the CCC calculator, outputs of which are included in the appendices of this report. Thus, the precision of the numbers show in this report are presented to show that they are exact model outputs and NOT to represent that these numbers are known with high precision or accuracy.

Figure 7:



FY2016 GHG Emissions Footprint = 98,699 $MTCO_2e$

Figure 8:

EKU Annual Carbon Footprint Report Table

Category		FY2011	FY2012	FY2013	FY2014	Base Year	FY2015		FY2016		FY2017	FY2018	FY2019	FY2020
		$MTCO_2e$	$MTCO_2e$	$MTCO_2e$	$MTCO_2e$	$MTCO_2e$	$MTCO_2e$	+/-	$MTCO_2e$	+/-	$MTCO_2e$	$MTCO_2e$	$MTCO_2e$	$MTCO_2e$
Scope 1	Other On-Campus Stationary	20,031	21,248	20,387	21,723	20,847	19,672	(1,175)	17,691	(3,157)	0	0	0	0
	Direct Transportation	566	545	613	531	564	512	(51)	521	(42)	0	0	0	0
	Refrigerants & Chemicals	865	874	755	759	813	270	(544)	550	(263)	0	0	0	0
	Agriculture	890	1,104	1,073	1,293	1,090	1,235	145	1,229	139	0	0	0	0
Scope 2	Purchased Electricity	63,682	66,991	64,707	66,643	65,506	65,817	312	59,753	(5,753)	0	0	0	0
Scope 3	Commuting	11,257	11,068	10,901	10,473	10,925	10,690	(235)	10,710	(215)	0	0	0	0
	Directly Financed Travel	3,673	3,690	3,667	3,546	3,644	3,609	(35)	3,938	294	0	0	0	0
	Study Abroad Air Travel	800	765	748	546	715	925	211	917	202	0	0	0	0
	Student Travel to/from Home	6,303	6,027	5,888	5,700	5,980	5,839	(140)	5,788	(192)	0	0	0	0
	Solid Waste	(54)	(53)	(52)	(50)	(52)	(50)	2	(50)	3	0	0	0	0
	Wastewater	84	97	58	78	79	83	4	88	9	0	0	0	0
	Paper	449	437	427	415	432	416	(16)	411	(21)	0	0	0	0
	Scope 2 T&D Losses	6,298	6,625	6,400	6,591	6,479	6,509	31	5,910	(569)	0	0	0	0
Total Gross Emissions ($MTCO_2e$)		114,844	119,419	115,572	118,250	117,021	115,529	(1,493)	107,455	(9,566)	0	0	0	0
Total Sequestered ($MTCO_2e$)		(8,756)	(8,756)	(8,756)	(8,756)	(8,756)	(8,756)	0	(8,756)	0	0	0	0	0
Total Net Emissions ($MTCO_2e$)		106,088	110,663	106,816	109,493	108,265	106,772	(1,493)	98,699	(9,566)	0	0	0	0
Scope Totals		FY2011	FY2012	FY2013	FY2014	Base Year	FY2015		FY2016		FY2017	FY2018	FY2019	FY2020
		$MTCO_2e$	$MTCO_2e$	$MTCO_2e$	$MTCO_2e$	$MTCO_2e$	$MTCO_2e$	+/-	$MTCO_2e$	+/-	$MTCO_2e$	$MTCO_2e$	$MTCO_2e$	$MTCO_2e$
Scope 1		22,352	23,771	22,828	24,307	23,315	21,689	(1,626)	19,991	(3,324)	0	0	0	0
Scope 2		63,682	66,991	64,707	66,643	65,506	65,817	312	59,753	(5,753)	0	0	0	0
Scope 3		28,809	28,657	28,037	27,299	28,201	28,022	(179)	27,712	(489)	0	0	0	0

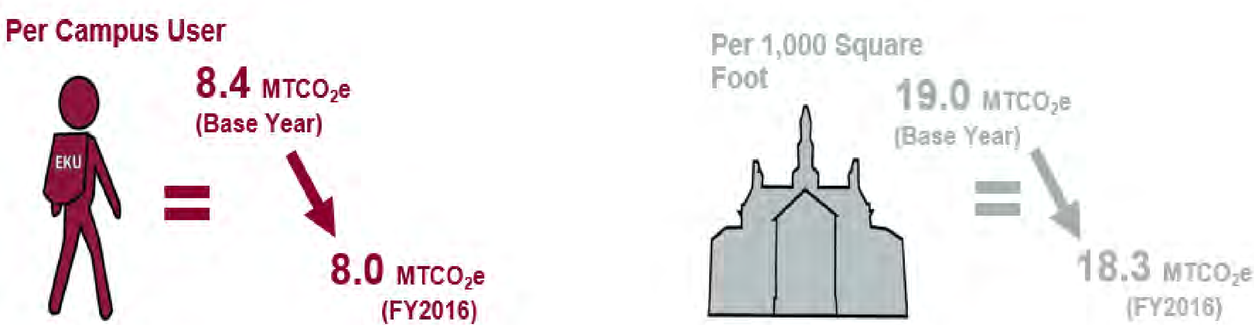
(light grey box)	Carbon Footprint Base Years
(dark grey box)	Averaged 4 Year Baseline

Based on the CCC's output, as represented in Figure 8, EKU's annual emissions range from a net 106,088 MTCO$_2$e in FY2011 to 109,493 in FY2014.[33] The average annual trend for these four years is 108,265 MTCO$_2$e, with a 2% margin of error. Thus, the University will use 108,265 as its baseline to assess progress going forward. Between the baseline and FY2016, the footprint decreased by 9,566 MTCO$_2$e, a reduction of 9.7%. This change shows a dramatic departure from the University's established baseline. The following chart examines the FY2016 footprint in more depth, as well as the relative proportion of emissions associated with each source category.

EKU's entire carbon footprint in FY2016 was a gross 107,455 MTCO$_2$e, with carbon sequestration offsetting 8,756 MTCO$_2$e. This equals a total net footprint of 98,699 MTCO$_2$e. In FY2016 Scope 2 emissions were the largest source of emissions, representing a majority of 56% of total gross emissions. Scope 3 was the second largest impact, representing 25% of total emissions, with student commuting and electricity transmission losses being the largest subcategories. Scope 1 represented just under 20% of the total footprint. On-campus stationary emissions from EKU's central heat plant dominated Scope 1. Combined, these annual carbon emissions are comparable to the annual GHG emissions of approximately 10,000 U.S. residential homes or 20,000 passenger vehicles.

Beyond gross total emissions, this footprint can be further analyzed in terms of intensity based on the number of students served or square footage of building space occupied. With its baseline average of 12,953 WCU, the baseline intensity usage represents 8.4 MtCO$_2$e/WCU. With its baseline average of 5,695,895 gross square feet (GSF) of buildings, these emissions amount to 19.0 MTCO$_2$e/GSF. In FY2016, carbon emissions per campus user decreased to 8.0 MtCO$_2$e/WCU, while carbon emissions per building square foot shifted down to 18.3 MTCO$_2$e/1,000 GSF. This change is due to a slight decrease in campus users, a slight decrease in gross square footage, and a large reduction in carbon emissions attributed to KU's 11% shift from coal to natural gas (which emits less CO_2 when combusted than coal) for electricity generation that occurred between FY2015 and FY2016.

Figure 9:



[33] Note: Numbers in the report are shown with color-coded boxes that tie them back to the source data from the table.

CHAPTER 3: GHG EMISSIONS MITIGATION STRATEGIES

EKU's Climate Action & Resiliency Plan seeks to establish specific goals for gross emissions reduction and intensity targets. EKU staff considered a number of mitigation strategies in the development of a more refined portfolio of implementable options. Figure 10 lists all of the strategies considered:

Figure 10: **EKU Carbon Mitigation Strategies**

Scope #	Emission Source	#	Strategy Name	Quantification		
				Reduction Potential (1 Low - 10 High Scale)	Relative Capital Cost (1 Low - 10 High Scale)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)
Scope 1 Emissions	On-Campus Stationary Sources	1.1	Centralized/Decentralized Geothermal	4	7	-7
		1.2	Fuel Modulation	5	1	7
		1.3	Fuel Switch - Coal to Natural Gas	6	10	8
		1.4	Fuel Switch - Coal to Biomass	8	10	5
		1.5	Efficiency Upgrades - Central Plant	5	5	-6
		1.6	New ESPC Contract - Central Plant	5	1	-9
		1.7	Decentralized Solar Thermal	3	5	-6
		1.8	Steam/ Condensate Water Conservation Strategies	2	2	-4
		1.9	New Building Energy Efficiency Policy Guidelines - Steam Savings	3	6	-6
		1.10	Steam/ Chill Water Efficiency Projects - EKU Campus Buildings	2	6	-7
	Direct Transportation Sources	1.11	Anti-idling Policy Staff Vehicles	1	1	1
		1.12	Increase Biofuel, Ethanol, Hybrid, Fuel Efficiency or Electric Vehicles & Fuel Options	1	5	-5
	Refrigerants	1.13	Replace Refrigerants with Low/No GWP Refrigerants	1	2	1
		1.14	Catalogue Refrigerant Use by Unit on an Ongoing Basis and Evaluate Replacement Based on Leaks	1	3	-4
	Agricultural Sources	1.15	Use Organic Fertilizers	1	1	1
		1.16	Utilize Low Tillage & Alternative Low Fertilizer Agricultural Practices	1	1	1
		1.17	Switch to Grass Over Grain Feed for Cattle/ Farm Animals	1	1	1
Scope #	Emission Source	#	Strategy Name	Quantification		
				Reduction Potential (1 Low - 10 High Scale)	Relative Cost (1 Low - 10 High Scale)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)
Scope 2 Emissions	Purchased Electricity	2.1	Electricity Conservation Strategies - EKU Campus Buildings	5	2	-5
		2.2	Summer Building Electricity Reduction Plan	4	1	-8
		2.3	New Building Energy Efficiency Policy Guidelines - Electricity Savings	4	6	-7
		2.4	Electricity Efficiency Projects - EKU Campus Buildings	5	5	-6
		2.5	New ESPC Contract - EKU Campus Buildings	5	1	-6
		2.6	Onsite PV Solar	3	6	-5
		2.7	Renewable Energy Hedges	10	1	-6

One accepted method for ranking mitigation strategies is to take a practical economic approach and evaluate their impact on a dollar-invested basis. The accepted metric outlined by the CCC, for measuring this impact is MTCO2e per year / $ invested.

Analyses showed many strategies would result in an implementation cost, while others created savings through reduced energy use. The current market price of high-quality carbon offsets is $7 to $12 per metric ton[34], it is therefore not justified to implement strategies that cost more than $12 per $MTCO_2e$ (unless it is a required infrastructural upgrade and has additional benefits beyond GHG emissions mitigation). This maximum cost threshold immediately reduced the original list of 42 strategies down to 17 that are truly viable based on competitive economics.

Figure 11:

Scope #	Emission Source	#	Strategy Name	Quantification		
				Reduction Potential (1 Low - 10 High Scale)	Relative Cost (1 Low - 10 High Scale)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)
Scope 3 Emissions	Commuting	3.1	Incentivize Bus Riding, Walking & Biking Through Various Policies	1	1	2
		3.2	Incentivize on Campus or Near Campus Residence for Students, Faculty & Staff	1	2	3
	Directly Financed Outsourced Travel	3.3	Promote Virtual Meetings as Alternative to Travel	1	2	3
		3.4	Offset Directly Financed Travel	2	1	3
		3.5	Increase Carpool and Mass Transportation for Directly Financed Travel	1	1	2
	Study Abroad	3.6	Offset Study Abroad Flights	2	1	2
	Student Travel to/From Home	3.7	Offset Student Flights to/from Home	2	1	2
		3.8	Encourage Carpool and Mass Transportation to/from Home	1	1	2
	Solid Waste	3.9	Increase Campus Recycling	2	1	2
		3.10	Explore the Viability with Richmond of Installing Biogas Collection/ Power Generation Package on Landfills	3	1	1
	Wastewater	3.11	Reduce Water Consumption	2	4	-6
		3.12	Explore the Viability with Richmond of Installing Biogas Collection/ Power Generation Package on Sewer Treatment Plants	3	1	1
	Paper	3.13	Paper Recycling	1	1	3
		3.14	Purchase Policy to Buy Higher Percentage Recycled Content	1	1	1
		3.15	Increase Paperless Office Policies & Encourage Best Practices	1	1	1
Scope #	Emission Source	#	Strategy Name	Quantification		
				Reduction Potential (1 Low - 10 High Scale)	Relative Cost (1 Low - 10 High Scale)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)
Scope 4	Offsets	4.1	RECs	10	1	3
		4.2	Carbon Offsets	10	3	7

Besides these strategies (Figure 11), an analysis of five additional "idealistic" approaches provides a sense of comparatively inefficient means of reductions. EKU staff playfully dubbed these five strategies "Barbie Dream House" strategies, in that they represent an unattainable ideal, but should be compared to more practical strategies to help give a thorough understanding of mitigation possibilities. These are shown in the following table:

[34] Transparency of the standard used to develop the offset, the source type of the offset, the rigor of the methodology used to calculate the reduction potential of the offset all have a huge impact on the overall quality of a given carbon offset. This quality is difficult to define, but is generally evaluated by its price in the carbon offset marketplaces.

Figure 12: Barbie Dream House (BDH) Mitigation Strategy Analysis*

Name	Scope	Net Present Value/Total Cost**	Reduction of Carbon Footprint (avg)	Total Tons That are Being Targeted (avg)	$MTCO_2e$ Reduced by Campus User (avg)	$MTCO_2e$ Reduced by 1,000 GSF (avg)
100% REC purchase offset of 2015 Scope 2 CO_2e Emissions	Purchase enough RECs annually to cover all campus electricity consumption	$3,064,524	55.4%	70,511	5.9	9.4
100% Electricity Offset Onsite Solar or Solar Array Installation	Install enough onsite and/or offsite solar PV to cover all campus electricity consumption	$39,116,713	55.4%	70,511	5.9	9.4
Switch 100% from Coal to Natural Gas	Switch central plant fully from coal to natural gas	$9,373,349	4.2%	5,499	0.5	0.7
Switch 100% Coal to Biomass	Switch central plant coal completely to biomass	$17,200,231	11.78%	15,276	1.3	2.0
Close Central Plant & Convert Entire Campus to Geothermal	Stop using natural gas and coal and switch completely to decentralized geothermal heat pump for all buildings	$51,431,458	57.7%	74,775	6.3	10.0

*These are high level analyses and should only be used as rough estimates.
**Over 20 year timeframe/payback

Figure 12 shows that these individual strategies could each reduce campus emissions from as little as 4.2% to as high as 57.7%, but all at extremely high costs. The 100% renewable energy certificate (REC) purchase option would be impractical, because energy efficiency and conservation initiatives could make up a sizable portion of those electricity reductions with savings instead of ongoing costs. A 100% solar (PV) installation would take up 200 acres of land, which would essentially require the collection of all sunlight from an area the size of the current Richmond campus and cost $100 million upfront to implement. Additionally, this approach would likely require upgrades to the larger utility system that EKU would be required to pay to support the increased generation capacity into the regulated utility system.

Switching from coal to natural gas or biomass is both an attractive project but is surprisingly costly with little meaningful impact. Either project option requires high up-front costs and dramatic alterations of existing campus infrastructure (which is currently in good operating condition), while also carrying an ongoing incremental fuel cost. The closure of the central heat plant and switch to 100% geothermal energy would involve a huge initial capital outlay, and there is question that enough green-space or suitable paved areas for installing the geothermal system even exists on campus.

An analysis of the "Barbie Dream House" scenarios concludes that their implementation is impractical due to the incredibly costly and inefficient nature of the strategies compared with the viable alternative of purchasing carbon offsets. From a review of the larger list of potential mitigation strategies by cost per $MTCO_2e$, magnitude of GHG emissions reduction impact, and cost savings, the University selected the following eleven strategies to develop its mitigation strategy portfolio (Figure 13). The subsequent one-page write-ups (Pgs. 27-37) explore these strategies in depth.

Figure 13: EKU Carbon Mitigation Strategies

Scope #	Emission Source	#	Strategy Name	Quantification						Dollar/MTCO$_2$e (over 20 years)	
				Reduction Potential (1 Low - 10 High Scale)	Relative Capital Cost (1 Low - 10 High Scale)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)	Estimated Capital Cost (Conservative)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)	Estimated MTCO$_2$E Reduced (Conservative)		
Scope 1 Emissions	On-Campus Stationary Sources	1.01	Centralized/Decentralized Geothermal	4	7	-7	$2,500,000	-$2,500,000	1,639	$0	*
		1.06	New ESPC Contract - Central Plant	5	1	-9	$7,500	-$5,000,000	3,279	-$1,523	*
		1.10	Steam/ Chill Water Efficiency Projects - EKU Campus Buildings	2	6	-7	$1,000,000	-$2,500,000	410	-$3,660	*
Scope #	Emission Source	#	Strategy Name	Quantification						Dollar/MTCO2e (over 20 years)	
				Reduction Potential (1 Low - 10 High Scale)	Relative Cost (1 Low - 10 High Scale)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)	Estimated Capital Cost (Conservative)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)	Estimated MTCO$_2$E Reduced (Conservative)		
Scope 2 Emissions	Purchased Electricity	2.01	Electricity Conservation Strategies - EKU Campus Buildings	5	2	-5	$50,000	-$500,000	3,279	-$137	*
		2.02	Summer Building Electricity Reduction Plan	4	1	-8	$7,500	-$5,000,000	1,639	-$3,045	*
		2.03	New Building Energy Efficiency Policy Guidelines - Electricity Savings	4	6	-7	$1,000,000	-$2,500,000	1,639	-$915	*
		2.05	New ESPC Contract - EKU Campus Buildings	5	1	-6	$7,500	-$1,000,000	3,279	-$303	*
		2.07	Renewable Energy Hedges	10	1	-6	$7,500	-$1,000,000	27,324	-$36	*
Scope #	Emission Source	#	Strategy Name	Quantification						Dollar/MTCO2e (over 20 years)	
				Reduction Potential (1 Low - 10 High Scale)	Relative Cost (1 Low - 10 High Scale)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)	Estimated Capital Cost (Conservative)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)	Estimated MTCO$_2$E Reduced (Conservative)		
	Wastewater	3.11	Reduce Water Consumption	2	4	-6	$250,000	-$1,000,000	410	-$1,830	*
Scope #	Emission Source	#	Strategy Name	Quantification						Dollar/MTCO2e (over 20 years)	
				Reduction Potential (1 Low - 10 High Scale)	Relative Cost (1 Low - 10 High Scale)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)	Estimated Capital Cost (Conservative)	Relative Ongoing 20-year Cost/Savings (+10 cost | 0 Neutral | -10 High svgs)	Estimated MTCO$_2$E Reduced (Conservative)		
Scope 4	Offsets	4.01	RECs	10	1	3	$7,500	$125,000	27,324	$5	*
		4.02	Carbon Offsets	10	3	7	$125,000	$2,500,000	27,324	$140	*

Figure 14: EKU Emissions Reduction/Financial Analysis: Portfollio of Strategies

Fiscal Years	Total Net Emissions (Scope 1, 2, 3 & 4)	Mitigation Scenarios ($MTCO_2e$ Reduced/ Net Cost)									
		Scope 1		Scope 2		Scope 3		Scope 4		Total	
		Annual $MTCO_2e$	Aggregate Cost ($)	Annual $MTCO_2e$	Aggregate Cost ($)	Annual $MTCO_2e$	Aggregate Cost ($)	Annual $MTCO_2e$	Aggregate Cost ($)	Annual $MTCO_2e$	Aggregate Cost ($)
2011	106,088	EXISTING BASELINE									
2012	110,663										
2013	106,816										
2014	109,493										
2015	106,772										
2016	98,699										
2017	18,873	5,045	$4,621,626	16,513	5,972,983	2	267,670	59,254	381,756	80,813	11,244,036
2018	17,388	6,028	$4,606,369	16,820	5,376,899	2	234,691	60,445	742,079	83,295	10,960,038
2019	16,687	6,988	$4,568,460	16,964	4,745,961	2	201,049	61,050	1,106,005	85,003	10,621,475
2020	15,959	7,977	$4,507,103	17,109	4,079,361	2	166,730	61,660	1,473,571	86,748	10,226,765
2021	15,204	8,995	$4,421,468	17,257	3,376,270	2	131,722	62,277	1,844,812	88,530	9,774,272
2022	14,422	10,043	$4,310,697	17,406	2,635,836	2	96,010	62,900	2,219,766	90,350	9,262,308
2023	13,610	11,122	$4,173,894	17,556	1,857,185	2	59,580	63,529	2,598,469	92,209	8,689,127
2024	12,770	12,233	$4,010,130	17,709	1,039,417	2	22,418	64,164	2,980,959	94,108	8,052,925
2025	11,898	13,377	$3,818,442	17,863	181,610	2	-15,491	64,805	3,367,275	96,048	7,351,835
2026	10,996	14,555	$3,597,824	18,020	-717,185	2	-54,162	65,454	3,757,453	98,030	6,583,929
2027	10,060	15,768	$3,347,233	18,178	-1,657,944	2	-93,611	66,108	4,151,533	100,055	5,747,211
2028	9,091	17,016	$3,065,585	18,338	-2,641,670	2	-133,852	66,769	4,549,554	102,125	4,839,618
2029	8,088	18,302	$2,751,752	18,500	-3,669,392	2	-174,902	67,437	4,951,555	104,241	3,859,013
2030	7,049	19,626	$2,404,560	18,664	-4,742,172	2	-216,777	68,111	5,357,576	106,403	2,803,188
2031	5,973	20,989	$2,022,789	18,830	-5,861,099	2	-259,494	68,792	5,767,658	108,614	1,669,853
2032	4,859	22,393	$1,605,169	18,998	-7,027,297	2	-303,069	69,480	6,181,840	110,873	456,642
2033	3,706	23,838	$1,150,378	19,168	-8,241,919	2	-347,520	70,175	6,600,164	113,184	-838,898
2034	2,513	25,327	$657,043	19,340	-9,506,155	2	-392,865	70,877	7,022,671	115,546	-2,219,306
2035	1,278	26,859	$123,732	19,515	-10,821,228	2	-439,121	71,586	7,449,403	117,962	-3,687,214
2036	0	28,437	-$451,046	19,691	-12,188,398	2	-486,307	72,301	7,880,403	120,432	-5,245,348

3.1 Portfolio of Mitigation Strategies & Analysis

The following section captures the specific goals for gross emissions and intensity targets agreed by consensus of EKU stakeholders to meet the requirements of the Second Nature Climate Commitment. The eleven strategies detailed on Pg. 24 were selected from the larger list of mitigations strategies as being the most feasible to implement. This portfolio of viable strategies helped inform the specific goals developed in this report. Cost-effectiveness was a major factor in choosing strategies. The following one-page analyses examine each mitigation strategy in depth, detailing the following:

- **Project Scope:** Defines what is and what is not included in the mitigation strategy.
- **Capital Costs:** Details the initial and ongoing capital costs required to pay for the mitigation strategy, including number of years of implementation and total life of the investment.
- **Operation & Maintenance Costs:** Evaluates the financial impacts associated with the strategy after the initial capital investment and implementation period. Each strategy includes unique types of costs and savings.
- **GHG Emissions Mitigation:** Quantifies GHG emissions mitigation as a percent of the source of emissions in $MTCO_2e$. It also looks at intensity reductions related to campus users and square footage of buildings.
- **Project Economics:** Summarizes the project economics, and analyzes payback, net present value, internal rate of return (IRR), and dollar per ton reduction.
- **Reduction vs. Cost:** Charts the costs or savings and GHG emissions reduction over the life of the investment.
- **Conclusions:** Qualifies the risks and benefits of implementing the strategy.

These detailed analyses provide a high-level consideration of the factors required for practical implementation of each strategy. A specific engineering review of scope and cost near the time of implementation would provide an even higher level of insight. This portfolio of mitigation strategies, if comprehensively implemented, would have a significant impact on reducing EKU's GHG emissions toward carbon neutrality.[35]

[35] Note: For simplicity, this study modeled all capital being spent in Year Zero and all implementation strategies as being implemented on Year One. This is the best means of creating a best-case strategy for mitigation where the costs and benefits of each proposed strategy can be compared and weighted.

EKU Carbon Mitigation Strategy

1.01 Centralized/Decentralized Geothermal

Project Scope Up-front cost **Moderate** Ongoing cost/savings **Savings** Included? **Yes**

This mitigation strategy evaluates the GHG emission savings potential associated with developing geothermal in a few strategic places around campus, new buildings and the end of steam service lines as replacement for upgraded or new HVAC capacity. To add savings, this concept could be extended to a project to upgrade the existing buildings south of the bypass, but this is not considered in the current scope.

Capital Costs

There is a moderate ongoing annual capital cost associated with implementing the geothermal heat pump strategy. This represents the incremental cost for installing geothermal wells in place of installing cooling tower capacity of $0.11 per sq. ft, and this is assumed for 50% of new square footage added.

Capital Costs:		Base		Option
Annual Cost FY2018-19:	$	303,947	$	-
Annual Cost FY2036-37:	$	532,973	$	-
Total Capital Cost:	$	8,167,174		

Number of years implementation: 20.0

Operating & Maintenance Costs

There is an ongoing annual net savings for the strategy based on HVAC savings.

Ongoing Costs (+) or Savings (-) Factors:	
Percentage of New GSF Feet Added with Geothermal:	50%
$MTCO_2e$ per GSF for Traditional HVAC:	0.010
Capital Cost per Ton of Traditional HVAC:	$2,000
Annual Operational Cost per Ton of Geo:	$148
Annual Operational Cost per Ton of Traditional HVAC:	$248

Ongoing Annual Costs/Savings	
Annual Cost/Savings FY2017-18:	($20,263)
Total Cumulative Cost/Savings:	**($20,263)**

Note: these savings are total cost savings all taken in 2017 dollars.

Mitigation

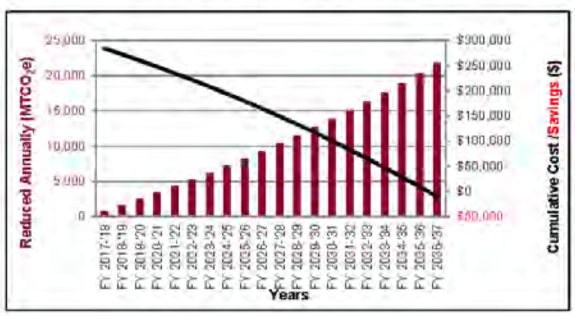
The emissions reduced by this strategy would be electricity consumption associated with Scope 2 emissions. However, this ongoing savings is invested back into an equivalent percentage of the projects for the next year.

Reduction of Carbon Footprint (avg):	9.4%
Total $MTCO_2e$ Being Targeted (avg):	10,370

$MTCO_2e$ Reduced by Campus User (avg):	-0.8
$MTCO_2e$ Reduced by 1,000 GSF (avg):	-1.4

Project Economics

Invested Capital	$8,167,174	dollars
Ongoing Cost/Savings	($20,263)	dollars
Total Cumulative Cost	$2,982,183	2017 dollars
Payback Period	N/A	years
Net Present Value	N/A	2017 dollars
Internal Rate of Return	N/A	IRR
Annual Tons of CO_2e	10,370	Avg. tons
Dollars per Ton Rdctn	$14.38	$/ton



Conclusions

This strategy would reduce a portion of EKU's scope 1 & 2 emissions associated with new and existing building HVAC operations. Furthermore, we have assumed a very modest portion of the total campus square footages are converted to geothermal, and this could be further improved by adding additional geothermal projects. Finally, the payback shown is much more modest than sould be assumed, because this scope only studies 20 years of cash flows, but has capital invested each and every year of the 20 years -- as such, the systems installed in year 19 have all their capital represented, but only receive one year of savings in the calculations.

Moore Ventures, LLC

NOTE: *all estimates are feasibility stage and require further detailed engineering*

Carbon Sustainability Plan
1-page Scope Review

EKU Carbon Mitigation Strategy

1.06 New ESPC Contract - Central Plant

Project Scope Up-front cost **Moderate** Ongoing cost/savings **Savings** Included? **Yes**

This mitigation strategy evaluates the GHG emission savings potential associated with implementing documented efficiency upgrades of EKU's Central Plant through a performance contract. These include installing a boiler economizer on the coal fire boilers, controlling continuous boiler blow-down by conductivity, and using a heat exchanger on waste blow-down to capture waste heat.

Capital Costs

These capital upgrades will have a low capital cost, but will yield large benefits in ongoing savings to the plant. Capital cost is for a non-condensing stack economizer, piping, and for heat exchangers and controls. These costs are presumed to be grouped into an ESPC contract.

Capital Costs:	Base
Economizer Project & Soot Blower	$ 575,000
Blowdown Heat Exchanger & Piping	$ 50,000
Blow-down Conductivity Monitoring	$ 45,000
Controls Upgrades to optimize the above	$ 95,000
Total Capital Cost:	$ 765,000

Number of years implementation: 1.5

Operating & Maintenance Costs

There is an ongoing annual savings for the strategy based on natural gas reductions at the central heat plant, and coal savings due to increased efficiency at the heat plant by capturing waste heat.

Ongoing Costs (+) or Savings (-) Factors:	
Percentage of Natural Gas Reduced:	0.50%
Percentage of Coal Reduced:	6.00%
ESPC Annual Repayment Time Period:	8
ESPC Repayment % Profit (Cost of ESPC Money):	45%

Ongoing Annual Costs/Savings	
Natural Gas Annual Savings	($3,050)
Coal Annual Savings	($36,229)
Increased maintenance	$7,500
Total Cumulative Cost/Savings:	**($31,779)**

Note: these savings are total cost savings all taken in 2017 dollars.

Mitigation

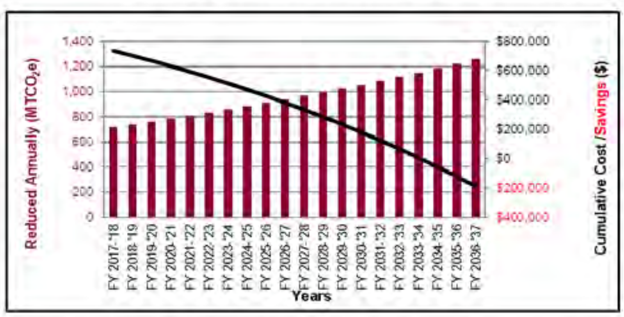
The emissions reduced by this strategy would be natural gas and coal consumption associated with Scope 1 emissions, based on reduced coal and natural gas consumption.

Reduction of Carbon Footprint (avg):	0.9%
Total $MTCO_2e$ Being Targeted (avg):	963

$MTCO_2e$ Reduced by Campus User (avg):	-0.07
$MTCO_2e$ Reduced by 1,000 GSF (avg):	-0.1

Project Economics

Invested Capital	$765,000	dollars
Cumulative Total Savings	($31,779)	dollars
Total Cumulative Cost	($187,047)	2017 dollars
Payback Period	13	years
Net Present Value	($187,047)	2017 dollars
Internal Rate of Return	1.9%	IRR
Annual Tons of CO_2e	963	Avg. tons
Dollars per Ton Rdctn	($9.72)	$/ton



Conclusions

This strategy would reduce a small portion of EKU's scope 1 coal and natural gas emissions associated with central plant efficiency upgrades. While it constitutes a small portion of the overall upgrades and reductions needed, it is still a valuable part of the mitigation plan, because the reductions in coal usage are so consequential for the GHG emissions.

Moore Ventures, LLC

NOTE: *all estimates are feasibility stage and require further detailed engineering*

EKU Carbon Mitigation Strategy

1.10 Steam/ Chill Water Eff Proj - EKU Campus Bldgs

Project Scope Up-front cost **Large** Ongoing cost/savings **Savings** Included? **Yes**

This mitigation strategy evaluates the GHG emission savings potential associated with steam conservation upgrades of EKU's buildings to reduce demand, including: HVAC setbacks, minimize building air changes, behavior change, and hot water conservation. While the Siemens ESCO contract from 2007 tackled many of these, we believe further work in building automation and readdressing set-backs (particularly those that are bypassed) is possible. Additionally, installing occupancy sensors for local heat pumps and air handlers may provide additional savings.

Capital Costs

There is a moderate capital cost associated with implementing the conservation strategies that will reduce steam usage. This includes occupancy sensors for local air handling and thermostats, improved building controls, and building automation work with set-backs, in conjunction with administrative decisions about building use.

Capital Costs:	Base
Replace or re-glaze worst windows	$ 850,000
Replace oldest natural gas boilers	$ 750,000
Install BMS enabled thermostats & valves on heat exchanges	$ 2,000,000
Building steam meters	$ 250,000
Total Capital Cost:	$ 3,850,000

Number of years implementation: 1.0

Operating & Maintenance Costs

There is an ongoing annual savings for the strategy based on electricity savings from decreased running of chillers and energy wheels. Savings primarily comes from reduced campus steam usage.

Ongoing Costs (+) or Savings (-) Factors:	
Percentage of Electricity Reduced by Project:	3%
Percentage of Natural Gas Reduced:	15%
Percentage of Coal Reduced:	5%

Ongoing Annual Costs/Savings	
Annual Cost/Savings FY2017-18:	($245,278)
Total Cumulative Cost/Savings:	**($245,278)**

Mitigation

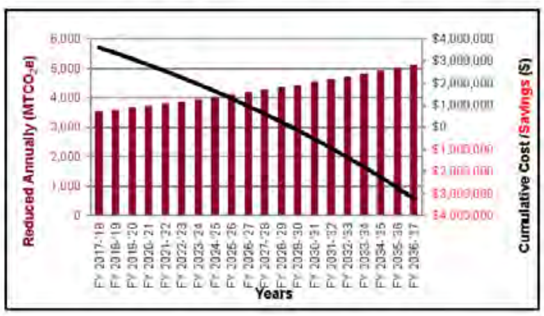
The emissions reduced by this strategy would be electricity consumption associated with the generation of chill water and Scope 2 emissions

Reduction of Carbon Footprint (avg):	3.9%
Total $MTCO_2e$ Being Targeted (avg):	4,260

$MTCO_2e$ Reduced by Campus User (avg):	-0.3
$MTCO_2e$ Reduced by 1,000 GSF (avg):	-0.6

Project Economics

Invested Capital	$3,850,000	dollars
Ongoing Cost/Savings	($245,278)	dollars
Total Cumulative Cost	($3,246,181)	2017 dollars
Payback Period	12	years
Net Present Value	($3,246,181)	2017 dollars
Internal Rate of Return	5.8%	IRR
Annual Tons of CO_2e	4,260	Avg. tons
Dollars per Ton Rdctn	($38.10)	$/ton



Conclusions

This strategy would reduce a portion of EKU's scope 2 electricity emissions associated with chill water efficiency in the central plant.

Moore Ventures, LLC

NOTE: all estimates are feasibility stage and require further detailed engineering

Carbon Sustainability Plan
1-page Scope Review

EKU Carbon Mitigation Strategy

2.01 Elec Conserve Strategies - EKU Campus Bldgs

Project Scope Up-front cost **Large** Ongoing cost/savings **Savings** Included? **Yes**

This mitigation strategy evaluates the GHG emission savings potential associated with implementing documented conservation strategies in EKU's campus buildings focused on electricity. These projects would include: lighting occupancy sensors, HVAC setbacks, removing portable space heaters, and reduced/increased cooling operating temperature levels, etc.

Capital Costs

There is a moderate capital cost to implement conservation strategies that will be focused on reducing electricity in buildings with intense summer usage. This includes occupancy sensors for lighting, local air handling units, and thermostats, improved building controls, and building automation work with set-backs, in conjunction with administrative decisions about building use.

Capital Costs:	Base	Option
Additional occupancy sensors & T-Stats		$ 1,500,000
Controls Updates and set-back work		$ 500,000
Other capital cost		$ 250,000
Total Capital Cost:		$ 2,250,000

Number of years implementation: 1.0

Operating & Maintenance Costs

There is an ongoing annual savings for the strategy based on electricity savings in the highest electricity usage buildings where this project should be focused.

Ongoing Costs (+) or Savings (-) Factors:	
Percentage of Electricity Reduced by Project:	5.0%

Ongoing Annual Costs/Savings	
Annual Cost/Savings FY2017-18:	($195,973)
Additional Annual Cost Maintain Setbacks:	$10,000
Ongoing Cost/Savings:	**($195,973)**

Mitigation

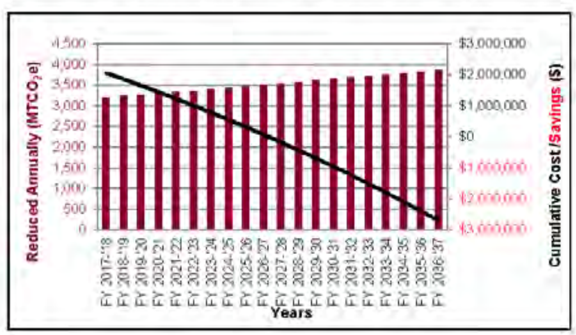
The emissions reduced by this strategy would be electricity consumption associated with Scope 2 emissions

Reduction of Carbon Footprint (avg):	3.2%
Total $MTCO_2e$ Being Targeted (avg):	3,526

$MTCO_2e$ Reduced by Campus User (avg):	-0.3
$MTCO_2e$ Reduced by 1,000 GSF (avg):	-0.5

Project Economics

Invested Capital	$2,250,000	dollars
Ongoing Cost/Savings	($195,973)	dollars
Total Cumulative Cost	($2,703,157)	2017 dollars
Payback Period	9	years
Net Present Value	($2,703,157)	2017 dollars
Internal Rate of Return	8%	IRR
Annual Tons of CO_2e	3,526	Avg. tons
Dollars per Ton Rdctn	($38.34)	$/ton



Conclusions

This strategy would reduce a portion of EKU's scope 2 electricity emissions associated with existing building conservation. It would reduce the electricity consumption and should be taken in conjunction with the Summer Set-Back, which is a thorough implementation of summer conservation on top of what is assumed here.

Moore Ventures, LLC

NOTE: *all estimates are feasibility stage and require further detailed engineering*

EKU Carbon Mitigation Strategy

2.02 Summer Building Electricity Reduction Plan

Project Scope Up-front cost **Small** Ongoing cost/savings **Savings** Included? **Yes**

This mitigation strategy evaluates the GHG emission savings potential associated with the documented summer building consolidation and shut-down plan outlined in the 2014 EKU Energy Infrastructure Investment and Master Energy Plan. The project would be for EKU to consolidate summer services into as few buildings as possible, and then to shut-down a large amount of the campus square footage during the summer cooling months - see EKU Energy Infrastructure Investment & Master Plan for details

Capital Costs

There is a small capital cost associated with implementing the new summer building efficiency policy. This is confined to implementation internal to EKU, materials publishing, assistance moving offices, etc.

Capital Costs:	Base	Option
Internal Implementation	$ 35,000	$ -
Total Capital Cost:	$ 35,000	

Number of years implementation: Variable

The project would likely start by further consolidating campus housing and shutting down a half-dozen buildings, then move to academic buildings.

Operating & Maintenance Costs

There is ongoing savings for the strategy based on electricity reduction, which is estimated at $200000 per year, based on about 1/3 of the summer cooling peak for the non-Fall/Spring Semester months.

Ongoing Costs (+) or Savings (-) Factors:

Projected Annual Electricity Cost Savings (EKU Energy Infrastructure Investment & Master Plan, Page 23)*:	$200,000

*Conservative estimate based on $100,000 reduced per month for 2 months

Ongoing Annual Costs/Savings

Annual Cost/Savings FY2017-18:	($211,095)
Ongoing Cost/Savings:	**($211,095)**

Mitigation

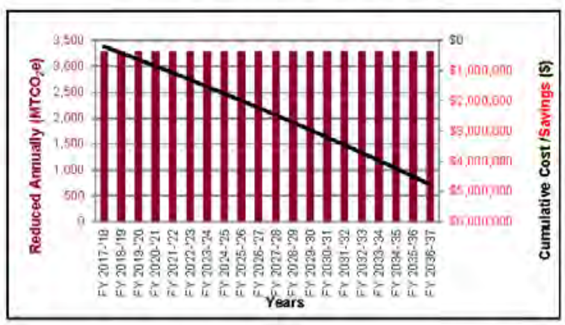
The emissions reduced by this strategy would be electricity consumption associated with Scope 2 emissions.

Reduction of Carbon Footprint (avg):	3.0%
Total $MTCO_2e$ Being Targeted (avg):	3,282

$MTCO_2e$ Reduced by Campus User (avg):	-0.2
$MTCO_2e$ Reduced by 1,000 GSF (avg):	-0.4

Project Economics

Invested Capital	$35,000	dollars
Ongoing Cost/Savings	($211,095)	dollars
Total Cumulative Cost	($4,741,946)	2017 dollars
Payback Period	0.2	years
Net Present Value	($4,741,946)	2017 dollars
Internal Rate of Return	604.4%	IRR
Annual Tons of CO_2e	3,282	Avg. tons
Dollars per Ton Rdctn	($72.24)	$/ton



Conclusions

This strategy would be fairly easy to implement from a cost standpoint, and would reduce a sizeable portion of EKU's scope 2 electricity emissions associated with new building and large scale renovations. The capital costs should all be internal to the University using existing resources and labor, with few if any real external capital costs. However, this will require a rethinking of summer operations, could result in substantial staff and faculty push-back, and would require real leadership on the part of administration. Those things being understood, the potential for cost and GHG savings is large.

Moore Ventures, LLC

NOTE: all estimates are feasibility stage and require further detailed engineering

Carbon Sustainability Plan
1-page Scope Review

EKU Carbon Mitigation Strategy

2.03 New Bldg EE Policy Guidelines - Elec Savings

Project Scope Up-front cost **None** Ongoing cost/savings **Savings** Included? **Yes**

This project implements a Building Efficiency Specification on all future construction or renovation projects. The additional specifications require engineers and architects to design to a higher reasonably feasible energy efficiency standard, and to provide commissioning documentation that the building operates to that higher standard.

Capital Costs

Because EKU now controls and manages it's own projects, implementation of this policy would be managed in-house by EKU project managers. There will be a small up-front capital expense to develop specification language that will require the efficiency improvements. Additional capital outlays will be on a per project basis, and may cost $1 per Square Foot of new construction.

Capital Costs:	Base	Option
Specification Development	$50,000	$ -
Total up-front Capital Cost:	$50,000	
Additional Cost per GSF for Policy:		$1.50
Number of years implementation:		20.0

Operating & Maintenance Costs

There is an ongoing annual savings for the strategy based on electricity, natural gas and coal, which grows each year as new buildings are built and/or reovations occur.

Ongoing Costs (+) or Savings (-) Factors:	
Average Percentage Savings from Utility	15%
Incremental Maintenance Cost for High Eff. Bldgs. per 100k sq.'	$2,500
Projected Percent Increase of GSF Annually:	3%
New square feet added in 1st year:	162,105

Note: This is taken in combination with Geothermal (1.01), thus the reduction is lower than might be expected compared with conventional construction.

Ongoing Annual Costs/Savings	
First Year Energy Savings:	($23,301)
First year incremental capital cost:	$243,158
Incremental Maintenance per Square Foot:	$4,053
Ongoing Cost/Savings:	**$223,909**

Mitigation

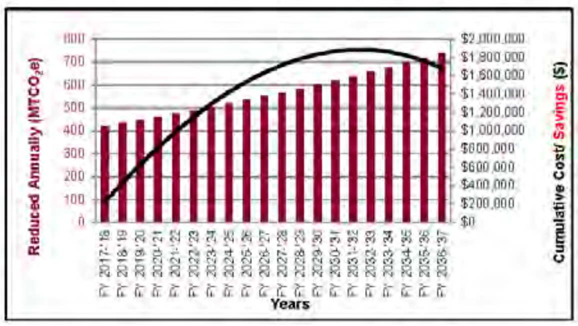
The emissions reduced by this strategy would be electricity consumption associated with Scope 2 emissions and natural gas Scope 1 Emissions

Reduction of Carbon Footprint (avg):	0.5%
Total $MTCO_2e$ Being Targeted (avg):	567

$MTCO_2e$ Reduced by Campus User (avg):	-0.04
$MTCO_2e$ Reduced by 1,000 GSF (avg):	-0.08

Project Economics

Invested Capital	$50,000	dollars
Ongoing Cost/Savings	$223,909	dollars
Total Cumulative Cost	$1,734,926	2017 dollars
Payback Period	N/A	years
Net Present Value	N/A	2017 dollars
Internal Rate of Return	N/A	IRR
Annual Tons of CO_2e	567	Avg. tons
Dollars per Ton Rdctn	$153.08	$/ton



Conclusions

This strategy would be fairly easy to implement and would reduce a good portion of EKU's Scope 2 electricity emissions associated with new building and large scale renovations. Over time, as more of the campus is renovated and the building stock turns over, the entire campus would become more efficient. Finally, the payback shown is much more modest than should be assumed, because this scope only studies 20 years of cash flows, but has capital invested each and every year of the 20 years -- as such, the systems installed in year 19 have all their capital represented, but only receive one year of savings though they can be expected to contribute savings for many more years.

Moore Ventures, LLC

NOTE: *all estimates are feasibility stage and require further detailed engineering*

EKU Carbon Mitigation Strategy

2.05 New ESPC Contract - EKU Campus Buildings

Project Scope Up-front cost **None** Ongoing cost/savings **Savings** Included? **Yes**

This mitigation strategy evaluates the GHG emission savings potential associated with implementing documented efficiency upgrades of EKU's campus buildings through another performance contract, this contract would include: lighting upgrades, HVAC upgrades, water flow upgrades, variable speed drives on pumps and motors, EnergyStar appliances, efficient equipment, and thermal envelope upgrades

Capital Costs

There is a small capital cost associated with implementing the new summer building efficiency policy.

Capital Costs:	Base
Replace lighting with LED's	$ 1,500,000
Replace oldest chillers w/ high SEER	$ 1,250,000
Replace oldest WSHP w/ high SEER	$ 1,500,000
Total Capital Cost:	$ 4,250,000
Number of years implementation:	8.0

Operating & Maintenance Costs

There is an ongoing annual savings for the strategy based on Scope 1 coal and gas savings from the efficiency gains, plus Scope 2 electricity savings from reductions in HVAC and in lighting.

Ongoing Costs (+) or Savings (-) Factors:	
Percentage of Electricity Reduced by Project:	15%
ESPC Annual Repayment Time Period:	8.0
ESPC Repayment % Profit (Cost of ESPC Money):	45%

Ongoing Annual Costs/Savings	
Annual Cost/Savings FY2017-18:	$3,871,142
Ongoing Cost/Savings:	**$3,871,142**

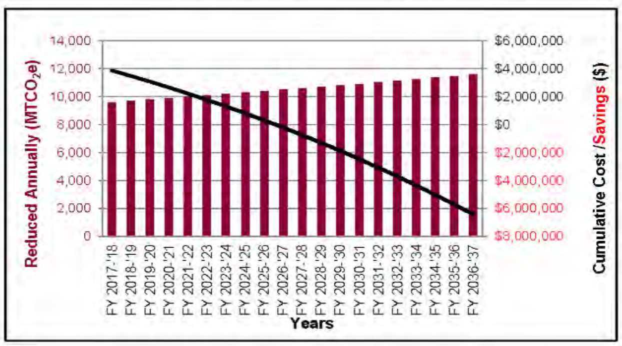
Mitigation

The emissions reduced by this strategy would be electricity consumption associated with Scope 2 emissions

Reduction of Carbon Footprint (avg):	9.6%	$MTCO_2e$ Reduced by Campus User (avg):	-0.8
Total $MTCO_2e$ Being Targeted (avg):	10,577	$MTCO_2e$ Reduced by 1,000 GSF (avg):	-1.4

Project Economics

Invested Capital	$4,250,000	dollars
Ongoing Cost/Savings	$3,871,142	dollars
Total Cumulative Cost	(6,428,221)	2017 dollars
Payback Period	9	years
Net Present Value	(6,428,221)	2017 dollars
Internal Rate of Return	9.6%	IRR
Annual Tons of CO_2e	10,577	Avg. tons
Dollars per Ton Rdctn	($30.39)	$/ton



Conclusions

This strategy would reduce a portion of EKU's scope 2 electricity emissions associated with existing building efficiency. In addition to reducing the cost of electricity consumption and mitigating emissions, this strategy would also reduce maintenance and operational dependability.

Moore Ventures, LLC

NOTE: *all estimates are feasibility stage and require further detailed engineering*

Carbon Sustainability Plan
1-page Scope Review

EKU Carbon Mitigation Strategy

2.07 Renewable Energy Hedges

Project Scope Up-front cost **Small** Ongoing cost/savings **Savings** Included? **Yes**

This mitigation strategy evaluates the GHG emission savings potential associated with entering into a long-term renewable energy hedge agreement with a large scale developer. This agreement would allow EKU to diversify a percentage of its electricity costs outside of the fossil fuel market and at a low price point, while also getting the green attributes of the associated clean power being generated

Capital Costs

There is a low initial administrative cost for developing the hedge contract with provider, beyond this the additional costs/savings are all ongoing.

Capital Costs:	Base	Option
Initial Contract Development (Administration Staff Time):	$ -	$ -
Outside Legal Cost:	$ -	
Total Capital Cost:	$ -	

Number of years implementation:	1.0
Life of the investment*:	20.0

*Utilizing the proposed contract, the life of project would be 20 years

This Strategy Could be Explored Further as a Potential Collaborative Effort With Other KY State Universities

Operating & Maintenance Costs

There is an ongoing annual cost/savings for the hedge contract that varies based on the comparative price of KU electricity per kWh. In the early years, there is a cost of the hedge over KU's electricity rates -- however, in the out-years when inflation in the cost of KU electricity has compounded to exceed the cost of the fixed-price hedge, EKU reaps savings.

Ongoing Costs (+) or Savings (-) Factors:	
Assumed Increase in Electricity Consumption:	0.0%
Price of Hedge ($/kWhs):	$0.000
Annual Increase in the Cost of KU Electricity (over inflation):	0.0%
Percentage of Scope 2 Electricity Mitigated by RECs*:	0%

*Please note, this is in absence of any other energy saving strategy and would therefore not be appropriate to take above [illegible]0%

Ongoing Annual Costs/Savings	
Annual Cost/Savings FY2017-18:	$0
Ongoing Cost/Savings:	**$0**

Mitigation

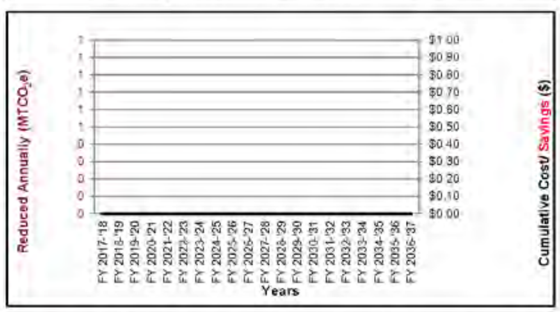
The emissions reduced by this strategy would be electricity consumption associated with Scope 2 emissions

Reduction of Carbon Footprint (avg):	0.0%
Total $MTCO_2e$ Being Targeted (avg):	0

$MTCO_2e$ Reduced by Campus User (avg):	0.0
$MTCO_2e$ Reduced by 1,000 GSF (avg):	0.0

Project Economics

Invested Capital	$0	dollars
First-Year Cost/Savings	$0	dollars
Total Cumulative Cost	$0	2017 dollars
Payback Period	N/A	years
Net Present Value	N/A	2017 dollars
Internal Rate of Return	N/A	IRR
Annual Tons of CO_2e	0	Avg. tons
Dollars per Ton Rdctn	$0.00	$/ton



Conclusions

This strategy would be fairly easy to implement and would reduced a l_rge portion of EKU's scope 2 emissions. Due to the ongoing annual costs, it is suggested that this strategy be undertaken with care and other electricity reducing strategies with paybacks should be implemented first. NOTE: Due to the complex nature of this type of strategy, this mitigation strategy was unable to be analyzed. It has been included because it is important that EKU staff look deeper at this option and get quotes from national vendors to see if this is feasible. It has the potential to be a big opportunity for EKU's carbon footprint mitigation if feasible.

Moore Ventures, LLC

NOTE: *all estimates are feasibility stage and require further detailed engineering*

EKU Carbon Mitigation Strategy

3.11 Reduce Water Consumption

Project Scope Up-front cost **Small** Ongoing cost/savings **Savings** Included? **Yes**

This mitigation strategy evaluates the GHG emission savings potential associated with the implementation of water conservation strategies in campus buildings to reduce water consumption. This scope would focus on common water fixtures found throughout campus, including: toilets, sinks and showers. This scope does not include water conservation associated with steam supply or condensate returns to the Central Heat Plant. This steam plant water consumption, represents approximately 80% of annual water consumption on campus.

Capital Costs

There is a low initial capital cost for implementing the water conservation projects across campus. Inventoried by outside vendor and installed by EKU facilities staff members.

Capital Costs:	Base	Option
Contract Development	$ 300,000	$ -
Total Capital Cost:	$ 300,000	

Number of years implementation:	1.0
Life of the investment*:	20.0

Operating & Maintenance Costs

There is an ongoing annual savings for the strategy based on reduction of water and sewer utility cost savings.

Ongoing Costs (+) or Savings (-) Factors:	
Projected Percent Increase of Wastewater Unit Cost Annually:	1%
Percentage of Water/Sewer Reduced by Project*:	2%

*This represents 10% of the 20% that is not related to the central heat plant's operation

Ongoing Annual Costs/Savings	
Annual Cost/Savings FY2017-18:	($32,330)
Ongoing Cost/Savings:	**($32,330)**

Mitigation

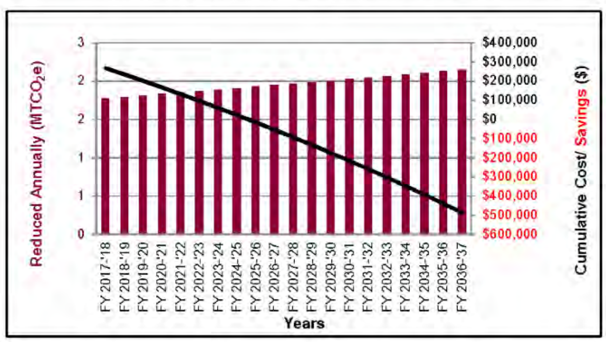
The emissions reduced by this strategy would be water/ waste water usage associated with Scope 3 emissions. The emissions at these water treatment plants are avoided by the reduction of EKU's consumption.

Reduction of Carbon Footprint (avg):	0.002%
Total $MTCO_2e$ Being Targeted (avg):	2.0

$MTCO_2e$ Reduced by Campus User (avg):	-0.0001
$MTCO_2e$ Reduced by 1,000 GSF (avg):	-0.0003

Project Economics

Invested Capital	$300,000	dollars
Ongoing Cost/Savings	($32,330)	dollars
Total Cumulative Cost	($486,307)	2017 dollars
Payback Period	8	years
Net Present Value	($486,307)	2017 dollars
Internal Rate of Return	10.7%	IRR
Annual Tons of CO_2e	2.0	Avg. tons
Dollars per Ton Rdctn	($12,416.71)	$/ton



Conclusions

This strategy would be fairly easy to implement and would reduce a tiny portion of EKU's scope 3 emissions. The economic value in this project is the moderate cumulative savings over the life of the project. EKU could substantially reduce Scope 3 emissions by undertaking a massive condensate return pipe replacement project; a project that would also improve Scope 1 emissions by improving heat plant overall efficiency. However, this project is not economically feasible at this time due to extremely high capital cost in the multi millions of dollars.

Moore Ventures, LLC

NOTE: *all estimates are feasibility stage and require further detailed engineering*

Carbon Sustainability Plan
1-page Scope Review

EKU Carbon Mitigation Strategy

4.01 Renewable Energy Credits (RECs)

Project Scope Up-front cost **Small** Ongoing cost/savings **Cost** Included? **Yes**

This mitigation strategy evaluates the GHG emission savings potential associated with EKU purchasing Renewable Energy Credits (RECs) annually from Kentucky utility (KU) to reduce carbon footprint associated with Scope 2 emissions electricity consumption. It is envisioned this would involve a 20 year purchase contract with KU, that locks in the current rate per REC; KU in turn uses that ongoing revenue stream to fund purchases of renewable power from sources such as the Lost Creek Wind Farm in Missouri, or to fund local projects such as E. W. Brown Solar farm or the newly proposed 4 MW Shelby County interstate community solar farm project.

Capital Costs

There is a low initial administrative cost for developing the REC contract with KU. Beyond this upfront cost, the additional costs are all in the additional charges added to the EKU Utility bill by KU.

Capital Costs:	Base	Option
Contract Development	$ 10,000	$ -
Total Capital Cost:	$ 10,000	

Number of years implementation: 1.0
Life of the investment*: 20.0

*Utilizing the proposed contract, the life of project would be 20 years

Operating & Maintenance Costs

There is an ongoing annual cost for the purchase of the RECs.

Ongoing Costs (+) or Savings (-) Factors:	
Increase in Electricity Consumption:	1%
Cost per REC Block*:	$13.00
MWhs per Block**:	6.26
Cost per REC MWH:	$2.08
Percentage of Electricity Mitigated Annually:	60%

Reflected on KU website for $13 Block Large Commercial/Industrial

Ongoing Annual Costs/Savings	
Annual Cost/Savings FY2017-18:	$93,506
Ongoing Cost/Savings:	**$93,506**

**KU historical data on kWh/block shows an average of 6.26, however at the time of this report, the purchasing power had increased to over 10 kWh

Mitigation

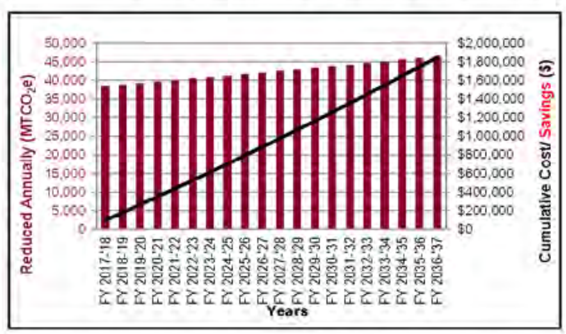
The emissions reduced by this strategy would be related to electricity consumption associated with Scope 2 emissions

Reduction of Carbon Footprint (avg):	38.4%
Total $MTCO_2e$ Being Targeted (avg):	42,307

$MTCO_2e$ Reduced by Campus User (avg):	-3.1
$MTCO_2e$ Reduced by 1,000 GSF (avg):	-5.7

Project Economics

Invested Capital	$10,000	dollars
Ongoing Cost/Savings	$93,506	dollars
Total Cumulative Cost	$1,858,714	2017 dollars
Payback Period	N/A	years
Net Present Value	N/A	2017 dollars
Internal Rate of Return	N/A	IRR
Annual Tons of CO_2e	42,307	Avg. tons
Dollars per Ton Rdctn	$2.20	$/ton



Conclusions

This strategy would be fairly easy to implement and would reduced a large portion of EKU's scope 2 emissions. Due to the ongoing annual costs, it is suggested that this strategy be undertaken with care and other electricity reducing strategies with paybacks should be implemented first. Due to the ongoing annual costs, it is suggested that this strategy be undertaken in conjunction with other strategies that have positive payback, such that the basket of mitigation strategies has a neutral to positive economic impact, long-term.

Moore Ventures, LLC
NOTE: *all estimates are feasibility stage and require further detailed engineering*

EKU Carbon Mitigation Strategy

4.02 Carbon Offsets

Project Scope Up-front cost **Small** Ongoing cost/savings **Cost** Included? **Yes**

This mitigation strategy evaluates the GHG emission savings potential associated with EKU purchasing carbon Offsets annually to reduce the campus' gross carbon footprint. It is recommended that medium quality offsets are purchased for this strategy. The quality of carbon offsets are dependent on the transparency of the standard used to develop the offset, the source type of the offset, the rigor of the methodology used to calculate the reduction potential of the offset. This quality is difficult to define by the marketplace price.

Capital Costs

There is a low initial administrative cost for developing the offset offtake contract with developer, beyond this the additional costs are all ongoing.

Capital Costs:	Base	Option
Contract Development	$ 5,000	$ -
Total Capital Cost:	$ 5,000	

Number of years implementation: 1.0
Life of the investment*: 20.0

*Utilizing the proposed contract, the life of project would be 20 years

Operating & Maintenance Costs

There is an ongoing annual cost for the purchase of the carbon offsets. The assumption is that a flat rate contract with no built-in escalator.

Ongoing Costs (+) or Savings (-) Factors:	
Cost of Medium Quality Offset*:	$13.12
Percentage of Carbon Footprint to be Mitigated by Offsets:	21%

*Terrapass Quote November 2016

Ongoing Annual Costs/Savings	
Annual Cost/Savings FY2017-18:	$273,250
Ongoing Cost/Savings:	**$273,250**

Mitigation

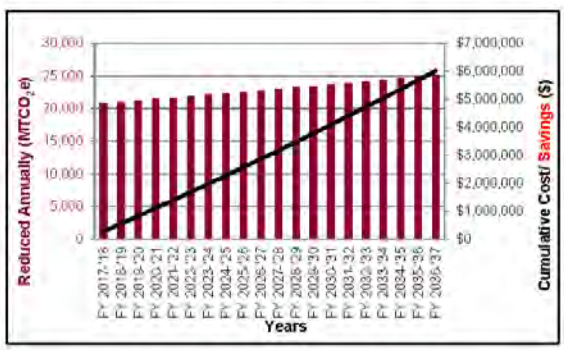
The carbon offsets purchased are non-specific to an EKU Scope of Emissions -- they instead come off the bottom-line carbon emissions after all other mitigations are taken into account.

Reduction of Carbon Footprint (avg):	20.9%
Total $MTCO_2e$ Being Targeted (avg):	22,929

$MTCO_2e$ Reduced by Campus User (avg):	-1.7
$MTCO_2e$ Reduced by 1,000 GSF (avg):	-3.1

Project Economics

Invested Capital	$5,000	dollars
Ongoing Cost/Savings	$273,250	dollars
Total Cumulative Cost	$6,021,689	2017 dollars
Payback Period	N/A	years
Net Present Value	N/A	2017 dollars
Internal Rate of Return	N/A	IRR
Annual Tons of CO_2e	22,929	Avg. tons
Dollars per Ton Rdctn	$13.13	$/ton



Conclusions

This strategy would be fairly easy to implement and would reduce the remaining portion of EKU's emissions. Due to the ongoing annual costs, it is suggested that this strategy be undertaken in conjunction with other strategies that have positive payback, such that the basket of mitigation strategies has a neutral to positive economic impact, long-term.

Figure 15: EKU Mitigation Strategy Reduction Chart: FY 2016 - 2036

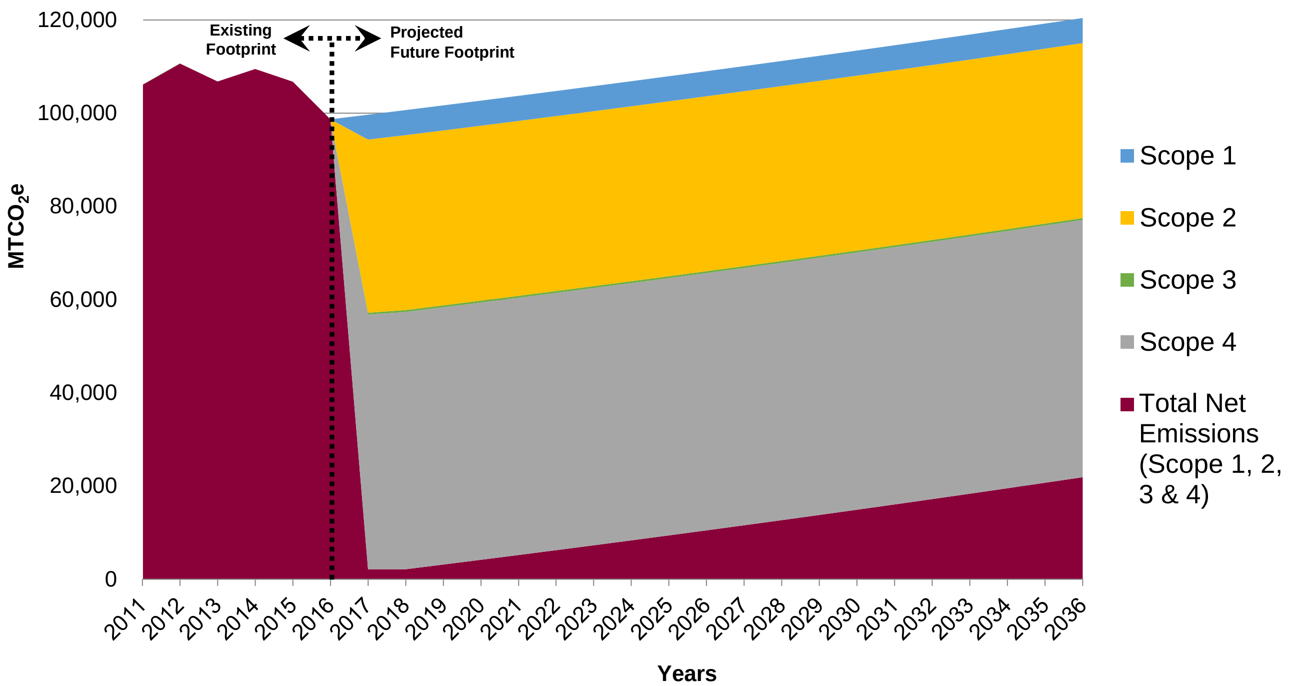
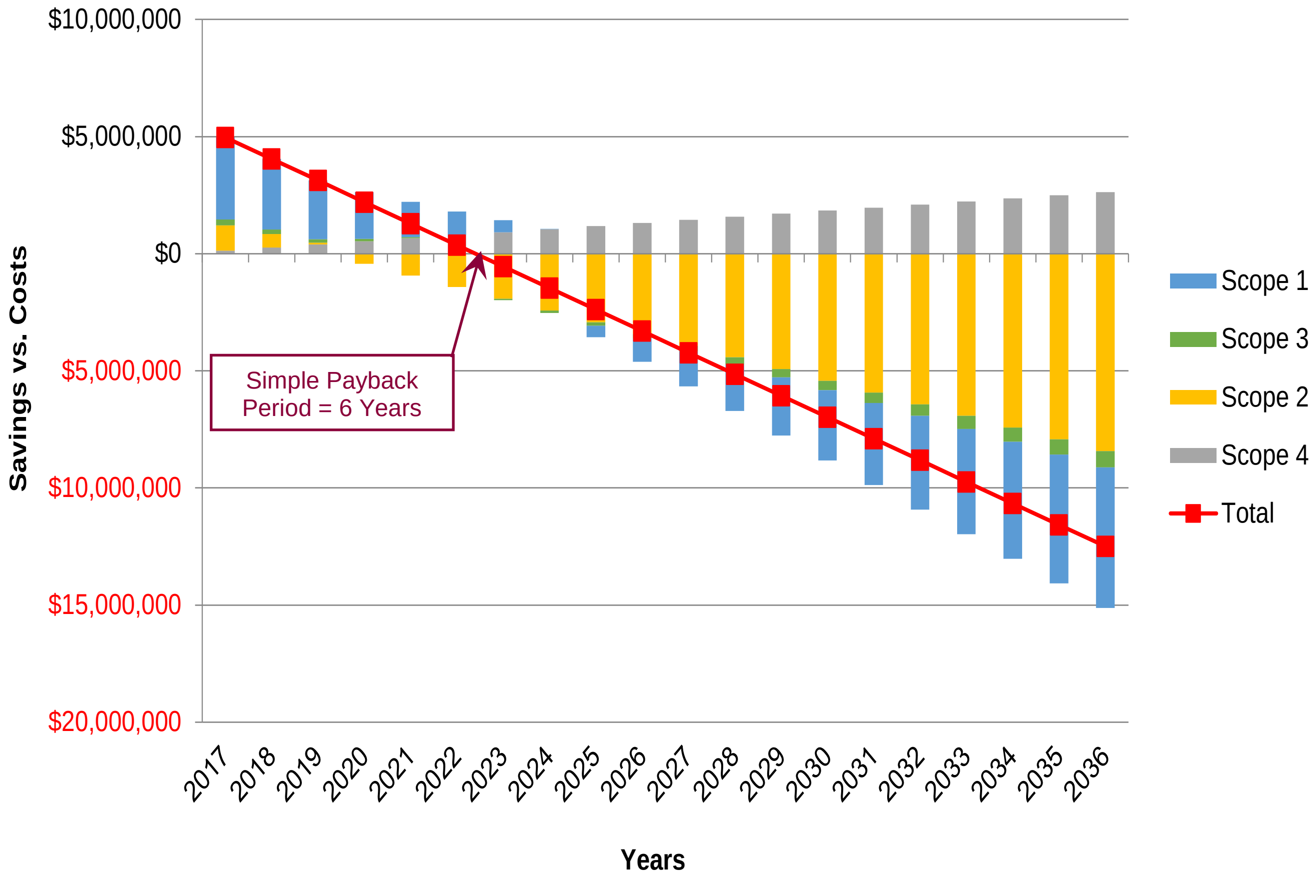


Figure 15 depicts the cumulative strategies taking EKU to carbon neutrality in the first year of implementation. While it may be unrealistic to assume that EKU will implement all of these strategies in a single year, it is a working assumption to evaluate the potential of the short list of mitigation strategies. Based on projected campus square footage growth, the University's footprint would presumptively start to grow again in the coming years, without implementation of further mitigation strategies, as new buildings come on-line. The adoption of green building standards, installation of geothermal heating/cooling systems on all new buildings, increased use of renewable energy and renewable energy certificate (REC) purchases, and continued energy efficiency upgrades in existing buildings would further reduce (and possibly mitigate completely) this projected emissions growth. Figure 16 shows the aggregate capital investment, ongoing costs, and savings associated with the mitigation strategies.

Figure 16: EKU Overall Financial Visualization



This financial analysis considers cumulative costs and savings over the lifetime of the investment (20 years) from the mitigation strategies, both unrelated to implementation and fully implemented. The above chart demonstrates that, if EKU were to implement all these strategies in the first year, the initial cost would be $7.5 million, but would have a 9-year return on investment (ROI). After 20 years, this initial investment would provide an estimated $12 million savings, resulting in a $4.5 million net return. The emissions and financial charts are further refined in the next chapter with input on operational goals from EKU's Office of Sustainability and Division of Facilities Services.

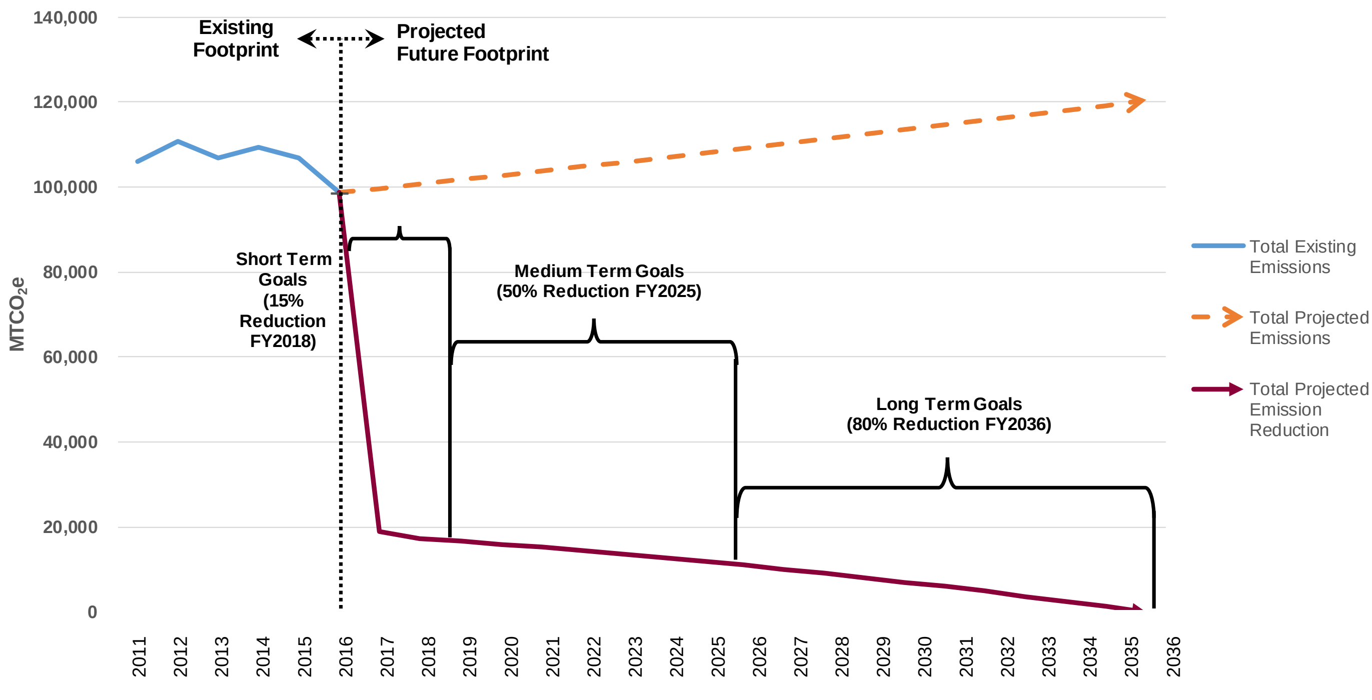
CHAPTER 4: GHG EMISSIONS REDUCTION GOALS

As previously discussed, there are two principle approaches to setting GHG emissions reduction goals: 1) an absolute emissions reduction target (i.e. 30% reduction by 2030), and 2) an intensity approach, which reduces emissions based on an existing factor (i.e. $MTCO_2e$ per student or $MTCO_2e$ per gross building square foot). EKU staff members determined the time-frame and cost requirement for implementation based on the mitigation strategies analyzed in the previous chapter. The next two sections will look at the established goals within both approaches for EKU.

4.1 Absolute Reduction Target

Without immediate action, EKU's carbon footprint is projected to grow from the existing baseline (FY2011–FY 2014) of 108,265 $MTCO_2e$ to 120,432 $MTCO_2e$ by FY2036. This represents an estimated increase of nearly 10% in EKU's overall GHG emissions footprint. Through stakeholder meetings and examination of the portfolio of evaluated mitigation strategies, EKU has determined a method by which it seeks to reduce its GHG emission footprint annually towards zero by FY2036 (Figure 17).

Figure 17: EKU Absolute Reduction Goal Chart: FY 2016 - 2036



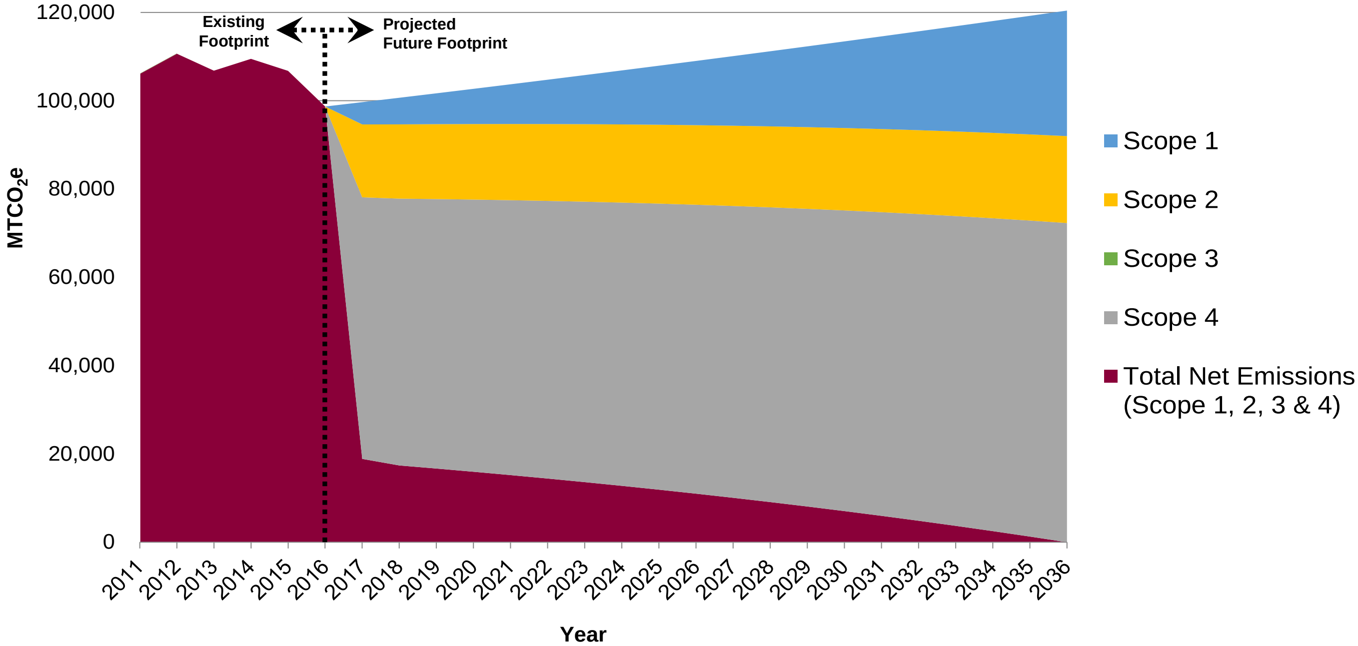
These specific goals focus on absolute emissions reduction in the short (FY2017–FY2018), medium (FY2025), and long term (FY2036). The details of these emission reductions and their associated mitigation strategies are broken down in Figure 18.

Figure 18:

#	Strategy Name	Net Present Value/Total Cost	Internal Rate of Return	Total Tons That are Being Targeted (avg)
1.01	Centralized/Decentralized Geothermal	$2,982,183	N/A	10,370
1.06	New ESPC Contract - Central Plant	($187,047)	1.9%	963
1.10	Steam/ Chill Water Efficiency Projects - EKU Campus Buildings	($3,246,181)	5.8%	4,260
2.01	Electricity Conservation Strategies - EKU Campus Buildings	($2,703,157)	8.2%	3,526
2.02	Summer Building Electricity Reduction Plan	($4,741,946)	604.4%	3,282
2.03	New Building Energy Efficiency Policy Guidelines - Electricity Savings	$1,734,926	N/A	567
2.05	New ESPC Contract - EKU Campus Buildings	($6,428,221)	9.6%	10,577
2.07	Renewable Energy Hedges	$0	N/A	0
3.11	Reduce Water Consumption	($486,307)	10.7%	2
4.01	RECs	$1,858,714	N/A	42,307
4.02	Carbon Offsets	$6,021,689	N/A	22,929
Total		**($5,195,348)**	**N/A**	**98,781**

The following chart (Figure 19) reflects EKU's absolute target of reducing 84% of its emissions by FY2018, 89% by FY2025 and 100% by FY2036. These reduction impacts are estimates, and would be further refined as the full scope and timing of the mitigation strategies are finalized.

Figure 19: EKU Mitigation Strategy Reduction Chart: FY 2016 - 2036



4.2 Intensity-Based Reduction Target

Beyond absolute goal setting, it is also important to view progress through the lens of intensity-based reductions. The intensity factors are associated with the main service mission of EKU, namely serving a student population with essential facilities for educational purposes. The best intensity targets to measure this mission are $MTCO_2e$ per campus user and $MTCO_2e$ per 1,000 square foot of building space. Tracking these two intensity targets would ensure recognition of emission reductions achieved, even as the campus grows to maximize its mission (and the absolute annual footprint grows with it). In this case, an increase in absolute emissions, due to the requirement of more resources for a growing student body, would mean that the University is expanding the impact of its mission. The table below (Figure 19) shows how intensity-based emissions reduction targets overlay absolute reduction goals:

Figure 20: Other Regional Universities

Reporting Year	School Name	Net Emissions ($MTCO_2e$)	$MTCO_2e$/ Student	$MTCO_2e$/ 1,000 GSF
2014	Northern Kentucky University (NKU)	59,667	4.92	24.8
2015	University of Louisville (UofL)	198,909	10.59	24.3
2014	University of Cincinnati (UC)	280,025	10.10	19.1
2015	Ohio University	167,537	7.88	20.8
2015	University of Tennessee, Knoxville (UT)	211,878	8.94	13.7

Figure 21:

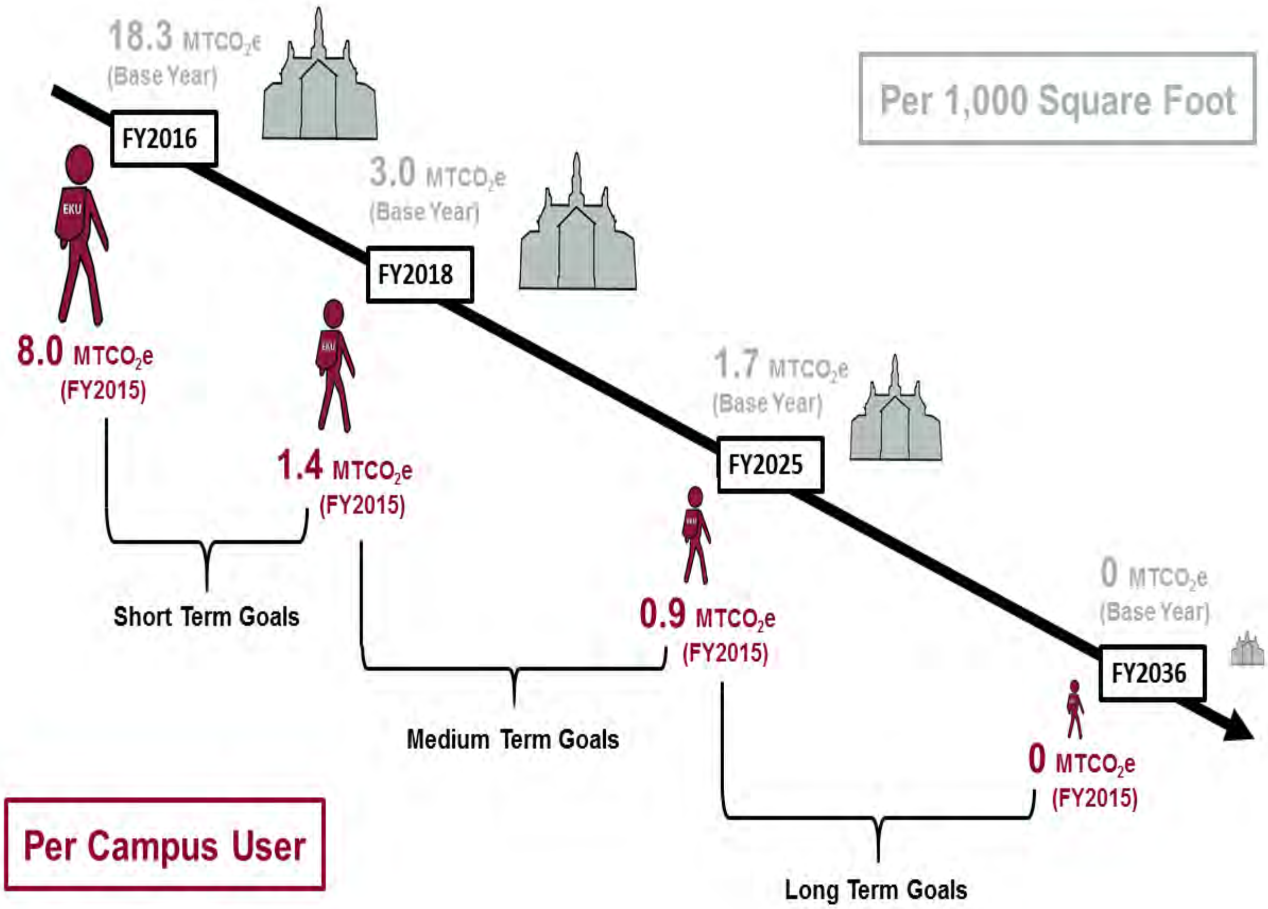
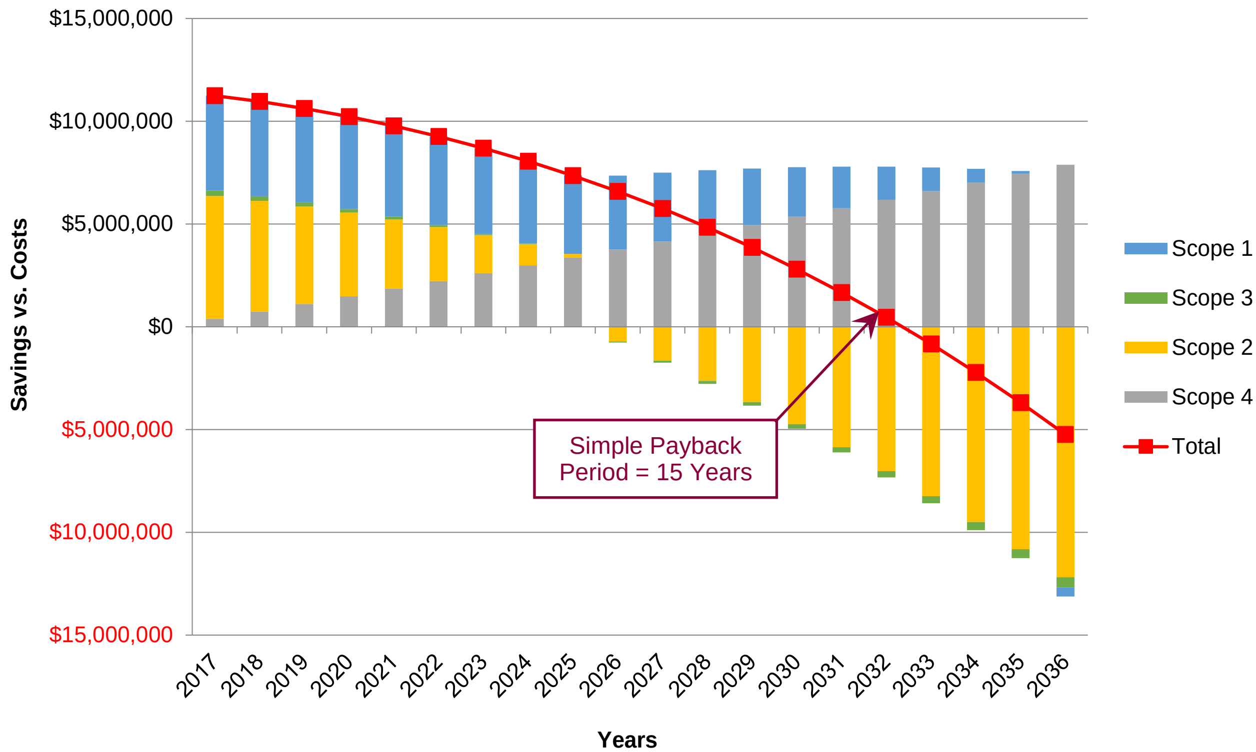


Figure 21 illustrates, from FY2016 to FY2036, a projected reduction in emissions per campus user from 8.0 $MTCO_2e$ to 0 $MTCO_2e$, and a projected reduction in emissions per 1,000 square foot from 18.3 $MTCO_2e$ to 0 $MTCO_2e$. This represents more than 100% reduction in overall intensity, which corresponds with the absolute targets in the previous sub-section. These absolute and intensity based emissions reduction goals rely on feasible technological upgrades to the campus and a focus on implementation costs and savings associated with the identified mitigation strategies.

4.3 Cost of Reduction

To achieve any goals related to reducing EKU's annual GHG emissions deficit, it is crucial to have a plan for funding these reductions—recognizing both capital costs and potential energy savings. Figure 22 demonstrates the estimated aggregate costs and savings associated with these goals.

Figure 22: EKU Overall Financial Visualization



With a total initial investment of $11.2 million, EKU could meet its goal of achieving carbon neutrality by 2036. This investment would pay back over the term of 15 years, and would then go on to earn an additional $5.2 million for the University in savings. A bond or other University funding source could potentially supply this money. Once it was repaid, EKU could reinvest the savings to achieve additional sustainability goals. In addition, a high percentage of these investments would be in campus infrastructure and policies which would have additional operational benefits beyond the GHG reductions and financial ROI demonstrated in this report.

The goals outlined in this chapter would lay the foundation for EKU to engage in reducing its annual GHG emissions deficit. With today's technologies, EKU could implement the strategies identified in this report in a cost-effective manner. Given the pace of technological innovation, these strategies should be reassessed at least every five years to incorporate the latest technologies. Advances or cost shifts in renewable energy technologies, fossil fuels, distributed generation, hydrogen fuel cells, low emissions transportation options, and electric utility fuel sources could profoundly affect the "best path forward" for EKU to reduce its annual emissions deficit. Beyond its annual carbon deficit, EKU wishes to consider ways of alleviating its long-term GHG emissions debt (See Chapter 1). If the planet continues to exceed identified safe concentrations of CO_2 in the atmosphere, government regulations or pressure from the University community could preemptively force action by the University.

CHAPTER 5: CONCLUSION & NEXT STEPS

Implementing the emissions reduction and resiliency goals outlined in this document will represent a significant series of trials for the EKU community. The main challenges inherent in implementing the mitigation strategies are financing and screening the strategies through key departmental stakeholders. Beyond this, achieving a wider consensus on the urgency of President Benson's strategic climate goals is also necessary. The University's Climate Advisory Committee established the following list of goals to help meet the requirements outlined in the Second Nature Climate Commitment.

5.1 Short, Medium, & Long Term Goals

Implementation for FY2017 – FY2018 (Short Term)

1. **Disseminate & Promote Goals of Comprehensive Climate Action Plan to Campus Community:**
   - Publish Climate Action Plan both in print and digitally.
   - Implement climate action education campaign:
     a. Train key stakeholders in the fundamentals of the Climate Action Plan.
     b. Deliver Climate Action Plan presentation to classes, faculty, and University leadership.
     c. Present Climate Action Plan at Kentucky-based events and organization meetings.
     d. Attend national higher education events and present goals and strategies within Climate Action Plan.
   - Submit plan to Second Nature to satisfy Climate Commitment requirements.

2. **Implement 2.02 Summer Building Electricity Reduction Plan (FY2017 – FY2018):**
   - Adjust summer classroom and office occupancy levels and hours for savings as outlined in the 2015 EKU Energy Infrastructure Investment & Master Plan. This will require a large change in campus use, expectations and culture during the summer months. The steps include:

     a. Consolidate summer activities in residence halls.
     b. Consolidate summer class activities into occupied buildings.
     c. Arrange remote work for faculty.
     d. Modify set-back schedules to match building occupancy.

3. **Prepare Financing & Implementation Plan for implementing Carbon Reduction Opportunities (CROs):**
   - Form Committee to evaluate, further develop, and oversee the implementation of the targeted CROs outlined in this plan.
   - Establish green revolving fund and explore the dedication of a portion of energy savings for implementing carbon reduction opportunities (CROs).
   - Evaluate third-party energy savings performance contract (ESPC) and bond options for financing select CROs.

4. **Implement 1.01 Centralized/Decentralized Geothermal**
    - Incorporate geothermal for all new construction and major building upgrades or remodels in place of cooling towers.

5. **Implement 1.10 Steam/Chill Water Efficiency Projects – EKU Campus Buildings**
    - Empower EKU Facilities Services with resources to develop, plan, and implement efficiency projects.
    - Provide adequate funding and staffing for EKU Facilities Services to better manage energy and to make needed repairs and ongoing upgrades.

6. **Implement 2.01 Electricity Conservation Strategies – EKU Campus Buildings**
    - Empower EKU Facilities Services with resources to develop, plan and implement energy efficiency projects.
    - Initiate peak demand shaving initiative with EnerNOC and KU and recommit funds from savings to support other energy efficiency projects.
    - Undertake comprehensive LED retrofit of campus buildings.

7. **Implement 3.11 Reduce Water Consumption**
    - Work with EKU Facilities Services to develop water cost savings and implementation plan.

8. **Implement 4.01 Renewable Energy Credits (RECs)**
    - Sign contract with KU to purchase RECs on the order of 50% of campus electricity usage at a locked-in rate for an extended term.

9. **Implement 1.06 New ESPC Contract – Central Plant**
    - Select performance contract company to propose and implement upgrades to EKU's Central Heat Plant (given the overall existing infrastructure and efficiency of the plant, it is not recommended that it be fully decommissioned for alternative decentralized heating and cooling options).

10. **Implement 2.03 Efficiency Standards for Building & Construction Projects – Build to LEED Silver Standards**
    - Work with key stakeholders to establish efficiency baselines for all new construction projects and large-scale remodels.

Goals for FY2019 – 2025 (Medium Term)

11. Further Evaluate 2.07 Large Scale Renewable Energy Power Purchase Agreement (PPA) or Energy Hedge

- Potentially commit to investment or hedge mechanism for 50% of electricity footprint.

12. Start Training Students to be Climate Leaders Through Curriculum Update & Community Training Classes

- Work with academic departments to get a holistic dissemination of climate facts and action opportunities through relevant disciplines at EKU.
- Develop Climate Leader Certification.

13. Update Climate Action Plan

- Reevaluate mitigation strategies and new technologies/processes – adjust climate goals as needed.

Goals for FY2026 – 2036 (Long Term)

14. Update Climate Action Plan

- Reevaluate Mitigation Strategies and New Technologies/Processes to achieve carbon neutrality.

The implementation of these mitigation goals will require new University policies, increased stakeholder engagement, and administrative leadership. Success will also require support and action from the entire University community. The next section provides examples of how individuals can get involved in this effort.

5.2 How to Get Involved

Implementing EKU's Climate Action Plan requires the active engagement of the entire University community. University Leadership, faculty, staff and students all share in the responsibility of reducing EKU's carbon footprint. We must work together to lead by example, and meet our collective duty to advance the global conversation around climate change. Below are some helpful suggestions for how to get involved, no matter what your role at EKU.

Students

Students can make their voices heard and make an impact on campus by joining EKU's Student Government Association (SGA) or the Green Crew student sustainability organization. Students are also encouraged to participate in any number of Office of Sustainability sponsored events held on campus throughout the year. Find out more about Green Crew by visiting: facebook.com/EKUGreenCrew/

Faculty

From incorporating climate-related content into curricula, to advising students and University leadership on climate-conscious decision making, to pursuing climate research and grant opportunities, EKU's faculty members are critical leaders in driving the University to carbon neutrality. Interested faculty members can join or attend monthly meetings of the Responsible Environmental Stewardship Committee (RESC) or become part of EKU's Sustainability Network. To learn more about the RESC visit: sustainability.eku.edu/about-us

Staff/Administration

Staff and administration have countless opportunities to help mitigate the University's carbon footprint and other environmental impacts. Staff and administrators are encouraged to identify key areas of EKU's Sustainability Strategic Plan, in which they have the ability to impact in their role at EKU, and contact the Office of Sustainability to express interest in joining the Sustainability Network. All employees are highly encouraged to participate in sustainability related events on campus.

For more information, visit EKU's sustainability website at:
http://sustainability.eku.edu/

Follow us on social media!

facebook.com/EKUsustainability

twitter.com/Sustainable_EKU

instagram.com/sustainable_eku

For direct inquiries, contact:
Patrick W. McKee
Sustainability Manager
859.622.8798
patrick.mckee@eku.edu

Appendix A: Professional Qualifications of Plan Developers

Moore Ventures, LLC: Jonathan J. Moore, P.E., CEA

Jonathan Moore is an engineer with long experience in power generation, process control and energy projects. He has a BS in Electrical Engineering and an MENG from UofL's Speed Scientific school of Engineering, as well as an MBA. He began his career in power plant operation and in the corporate engineering group of a large Midwestern electric utility, gaining a diverse experience in power plant design and operation.

Jonathan has passed the Professional Engineer licensing exam in three disciplines: Electrical, Mechanical and Control engineering, and he is a licensed professional engineer in around a dozen states. Jonathan has also achieved the Certified Energy Auditor (CAE) certification by the Association of Energy engineers, and he is a member of several related professional organizations.

After nearly a decade in the power utility industry, Jonathan founded a consulting company focused on power and related industries. The successful company specializes in retrofit engineering for Power and Process plants including small turnkey Engineer, Procure & Construct (EPC) projects. He has been involved in multiple projects in the biomass power sector, including the successful conversion of a coal-fired power plant to biomass and tire-derived fuel, and early stage work on development on over a dozen development projects. Jonathan has more recently provided extensive support on new construction hydroelectric projects, including directing the building of the generators for the first new construction hydroelectric plant east of the Mississippi in 3 decades. As well as work on the new low head horizontal units along the Ohio River. Jonathan also consults internationally through USAID in support of improvement in the energy sectors in the developing world. His engineering work includes:

- EKU Heat Plant Control Updates (O.E.);
- EKU Campus-wide Energy Improvements & MACT Review (O.E.);
- USAID/USEA mission to Kosovo to review nation’s two lignite-fired power plants, (Consult);
- Manufacturing Facility Electrical Review (O.E.);
- EPC Contractor Support of FEED estimating and engineering for 50+ MW biomass development plant (C.E.);
- LFUCG WWTP Pump Station Strainer Control (E.P.C.);
- Eastern Kentucky University Fly ash Capital Upgrades (O.E.);
- USAID/USEA mission to Albania;
- Utility Plant Switchgear Review and Remanufactured Bkr. Supply (E.P.);
- LFUCG WWTP Non-Potable Water Controls (E.P.C.); and
- Utility Plant Switchgear Retrofit Project (E.P.C.).

Interdependent Energies, LLC: Jason Delambre, CEM

Jason is a Carbon and Sustainable Energy Consultant who works with clients to maximize profitability through effective utilization of natural resources and the development of groundbreaking energy efficiency and greenhouse gas emission reduction solutions.

Throughout his career, Jason has developed an extensive knowledge of architecture, construction, urban planning, energy, university sustainability development, and greenhouse gas emission reduction. Jason's undergraduate education was in Architecture and History, and he holds a Master's Degree in Environmental and Energy Planning from the University of Cincinnati. Jason has also achieved the Certified Energy Manager (CEM) certification by the Association of Energy engineers. From this education background and professional experience, Jason has developed a unique vision of the greenhouse gas reduction strategies and energy efficiency synergies possible through innovative business, infrastructural, financial, policy, and community organizing strategies.

His climate planning and sustainability work to date includes:

- Climate Action Plan Consultant for Transylvania University;
- Developed University Climate Action Plan for University of Cincinnati (UC);
- Climate Action Plan Consultant for Western Kentucky University (WKU);
- Developed University of Kentucky (UK) Greenhouse Gas Emissions Inventory and Mitigation Strategy Assessment Report;
- Carbon Footprint Consultant for Berea College;
- Co-authored Strategic Rebuilding Plan Writer for West Liberty, Kentucky;
- Co-authored the Energy Infrastructure Investment & Master Plan for Eastern Kentucky University (EKU);
- Co-authored City of Berea's Energy Savings Plan;
- Co-authored an in-depth Carbon Lifecycle Study for a National Utility Company with Jonathan Moore and Moore Ventures, LLC;
- Developed Berea College Utility Savings Implementation Report;
- Assisted in the Development of Private College California Climate Action Registry Forest Development Project;
- Co-authored Comprehensive Renewable Energy Assessment for Harvard University;
- GHG Emission Assessment South Carolina Department of Education's School Bus Fleet; and
- Project Manager of Greenhouse Gas Emission Assessment of the 2008 Democratic National Convention.