UNC CHARLOTTE

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Climate Action Plan 2012

[1] Image courtesy of National Geographic http://science.nationalgeographic.com/science/photos/climate/

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Glossary

Carbon Neutrality: "*Carbon neutral means that – through a transparent process of calculating emissions, reducing those emissions and offsetting residual emissions – net carbon emissions equal zero*." (2009 Department of Energy and Climate Change[2])

Carbon Dioxide Equivalent: "*There are six main greenhouse gases that cause climate change limited by the Kyoto protocol. Each gas has a different global warming potential. For simplicity of reporting, the mass of each gas emitted is commonly translated into CO2e so that the total impact from relevant emissions sources of all Kyoto greenhouse gases can be summed to one figure*."(2009 Department of Energy and Climate Change[3])

***"Green development** is a land use planning concept that includes consideration of community-wide or regional environmental implications of development, as well as site-specific green building concepts. This includes city planning, environmental planning, architecture, landscape architecture and community building."* (Wikipedia 2012)[4]

Internal Rate of Return (IRR): "*The discount rate often used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero. Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project. As such, IRR can be used to rank several prospective projects a firm is considering. Assuming all other factors are equal among the various projects, the project with the highest IRR would probably be considered the best and undertaken first."* (Investopedia 2012)[5]

Net Present Value: "*The difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of an investment or project. NPV analysis is sensitive to the reliability of future cash inflows that an investment or project will yield."* (Investopedia 2012[6])

Emissions Scopes:

Scopes 1: Emissions from sources owned or operated by UNC Charlotte

Scope 2: Emissions resulting from generated electricity purchased by UNC Charlotte

Scope 3: Emissions form sources not owned or directly controlled by UNC Charlotte

Transmission & Distribution (T&D) Losses: Energy dissipated in the conductors and equipment used for transmission, transformation, sub- transmission and distribution of power.[7]

[2] Department of Energy and Climate Change 2009:Guidance on Carbon Neutrality
[3] Department of Energy and Climate Change 2009:Guidance on Carbon Neutrality
[4] Wikipedia accessed 6/11/2012 http://en.wikipedia.org/wiki/Green_development
[5] Invetopedia accessed 6/12/2012 http://www.investopedia.com/terms/n/npv.asp#axzz1xbDxj7py
[6] Invetopedia accessed 6/12/2012 http://www.investopedia.com/terms/n/npv.asp#axzz1xbDxj7py
[7] http://www.teriin.org/upfiles//pub/papers/ft33.pdf

Executive Summary

In October 2009, Philip Dubois, Chancellor of UNC Charlotte, signed the American College and University Presidents' Climate Commitment (ACUPCC) making a commitment to strive to become greenhouse gas (GHG) neutral. This significant commitment signaled the start of a series of actions that needed to be completed by the University. The first of these was to undertake a campus wide greenhouse gas inventory. The first UNC Charlotte greenhouse gas inventory was completed in 2010. The inventory was conducted by quantifying emissions from all six internationally recognized greenhouse gasses.

The second major deliverable has been to develop a Climate Action Plan detailing the steps the University may take to reduce its greenhouse gas emission and identifying a date for achieving climate neutrality.

More than a list of identified actions, the Climate Action Plan as the name suggests will serve as a decision support tool to be utilized by the University to plan, fund and implement greenhouse gas mitigation strategies and communicate those strategies to achieve the ultimate goal of greenhouse gas neutrality.

The 2010 greenhouse gas inventory identified that UNC Charlotte directly and indirectly was responsible for an annual emissions of 120,500 metric tonnes of carbon dioxide equivalent and if no action is taken this would rise to 250,000 metric tonnes of carbon dioxide equivalent by 2050.

The Climate Action Plan (CAP) was developed by establishing five task forces in the areas of energy, purchasing, curriculum, transportation and communications. Each task force had representation of faculty, staff, students and members of the community. The initial undertaking of each task force was to identify greenhouse gas mitigation strategies to reduce source emissions. Once the task forces had completed this action a further quantitative assessment of the identified mitigation strategies was completed, to estimate the GHG reduction potential and cost or benefits of the selected strategies.

The following milestones have been recommended by the CAP task forces for achieving climate neutrality, based on suggested mitigation strategies.

Date	Goal Reduction over 2009 Baseline
2020	20%
2030	40%
2040	60%
2050	100%

Funding will need to be secured to implement the greenhouse gas mitigation projects identified in this CAP. Some projects such as the performance contract, petroleum displacement, shuttle extensions and green development are already funded as ongoing projects. For other projects new streams of funding will have to be identified and applied.

Achieving the intent of the CAP means the implementation of mechanisms to track progress of the various mitigation strategies in a large decentralized institution. Various indicators have been established, most of which are currently used by the institution and have established data gathering procedures and processes.

As we go forward with this process it is important that we;

- Celebrate successes
- Excite campus community
- Engage campus community
- Engage research/education
- Be accountable for the success of the CAP
- Aim for continuous improvement

The journey to climate neutrality begins with the adoption of this plan and the implementation of the mitigation strategies throughout the institution. A primary objective of the initial CAP is simplicity in order to achieve implementation. It is understood that the mitigation strategies presented here do not achieve climate neutrality, but rather set the course for the University to embark on this path.

Introduction: Why a Climate Action Plan?

Climate change is a threat that deserves to be part of any risk management strategy. Indeed climate change resulting from increased atmospheric concentrations of carbon dioxide, methane and nitrous oxide from anthropogenic sources is resulting in observed changes.

> *"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC 2007).*

Many international, national and local organizations recognize the risk of climate change and are adopting strategies to mitigate its impact and developing adaptation strategies to plan for the future consequences of climate change.

The University of North Carolina at Charlotte faces three potential sources of risk that may be mitigated by the development and implementation of this climate action plan. These are:

- Cost of future energy: Depending on various scenarios Duke Energy estimates that rate changes relative to current rates may increase anywhere from 7-31% by 2020.
- Cost of Carbon: Although less politically acceptable than in 2008, some form of carbon tax is likely in the future.
- Reputational Risk: As the impacts of climate change become more evident the expectation on institutions to act responsibly toward this issue will grow. These expectations will be especially strong with the population demographic looking to enter higher education.

By signing the American College and University's Climate Commitment (ACUPCC) in October 2009, UNC Charlotte recognized its contribution to climate change and has made a voluntary commitment to understand and quantify its greenhouse gas emissions. This Climate Action Plan (CAP) delineates UNC Charlotte's strategies to manage and mitigate greenhouse gas emissions, and to prioritize the risks posed by climate change.

The vision is to develop a CAP that successfully transitions the university to achieving climate neutrality, as it continues to deliver on the core functions of education, research and outreach. More specifically, the mission of the CAP is to identify the most effective short, medium and long term strategies for reducing emissions and to spell out the costs and benefits of reducing those emissions. The CAP will serve as a decision support tool to be utilized by the University to plan, fund and implement greenhouse gas mitigation strategies to achieve the ultimate goal of greenhouse gas neutrality by 2050.

This CAP will review the findings of the first campus greenhouse gas inventory, the baseline from which the University will measure future performance, and will then present a suite of mitigation strategies that begin the journey toward climate neutrality. The CAP is designed as an evolving document, meant to be updated as new technologies, regulations, carbon pricing and energy pricing develop.

This CAP is also a communications and engagement tool, informing the campus and external community of the efforts being undertaken by the University to achieve this voluntary obligation.

The CAP is not intended to work in isolation, but to support, inform and guide current and future strategic plans leading to the successful implementation of greenhouse gas reduction programs at UNC Charlotte.

2010 Green House Gas Inventory Review

In October 2009, Philip Dubois, Chancellor of UNC Charlotte, signed the American College and University Presidents' Climate Commitment to become greenhouse gas (GHG) neutral. Signing ACUPCC committed UNC Charlotte to undertake a number of steps — one being to undertake a campus wide greenhouse gas inventory. The first UNC Charlotte greenhouse gas inventory was completed in 2010. The inventory was conducted by quantifying emissions in three categories known as scopes. Emissions from all six internationally recognized greenhouse gasses are quantified in this assessment.

- Scope 1: Direct emissions from sources owned by UNC Charlotte.
- Scope 2: Indirect emissions from purchased electricity.
- Scope 3: indirect emissions from commuting, air travel and waste disposal.

The 2010 inventory Summary

- Scope 1: 20,511 metric tons of CO_2e
- Scope 2: 65,686 metric tons of CO_2e
- Scope 3: 34,279 metric tons of CO_2e

Table 1: Emissions by Scope and Source

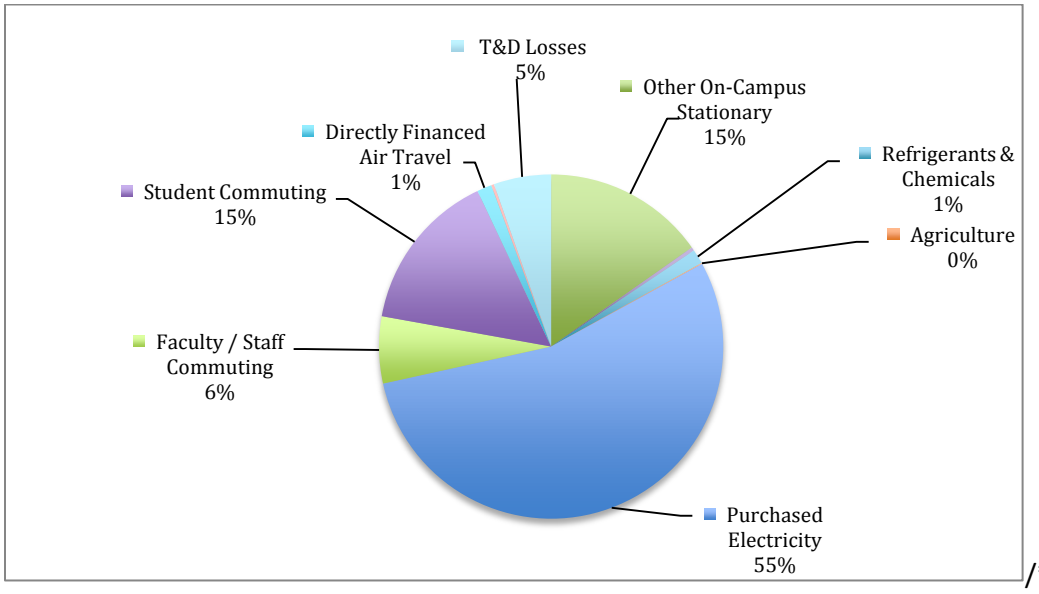
Scope	Source	MT of CO_2e	% of Total Emissions
Scope 1	Natural Gas & Fuel Oils	18,360.20	15.24%
	University fleet	392.50	0.33%
	Refrigerants & Fertilizers	1,758.30	1.46%
Scope 2	Purchased Electricity	65,686.00	54.52%
Scope 3	Faculty & Staff commuting	7,566.10	6.28%
	Student Commuting	18,236.70	15.14%
	Air Travel	1,678.60	1.39%
	Solid Waste	302.10	0.25%
	Transmission &Distribution losses	6,496.40	5.39%
Offsets	Composting	(2.00)	0.00%
Totals		120,474.90	100%

Scopes 2 and 3 account for the majority of campus emissions and will be the focus areas for developing greenhouse gas mitigation strategies.

The above sources and quantities of emissions were arrived at by using the Clean Air Cool Planet Campus Carbon Calculator[8] and represent fiscal year 2009-2010.

[8] http://www.cleanair-coolplanet.org/toolkit/inv-calculator.php

Graph 1: Emissions by Source



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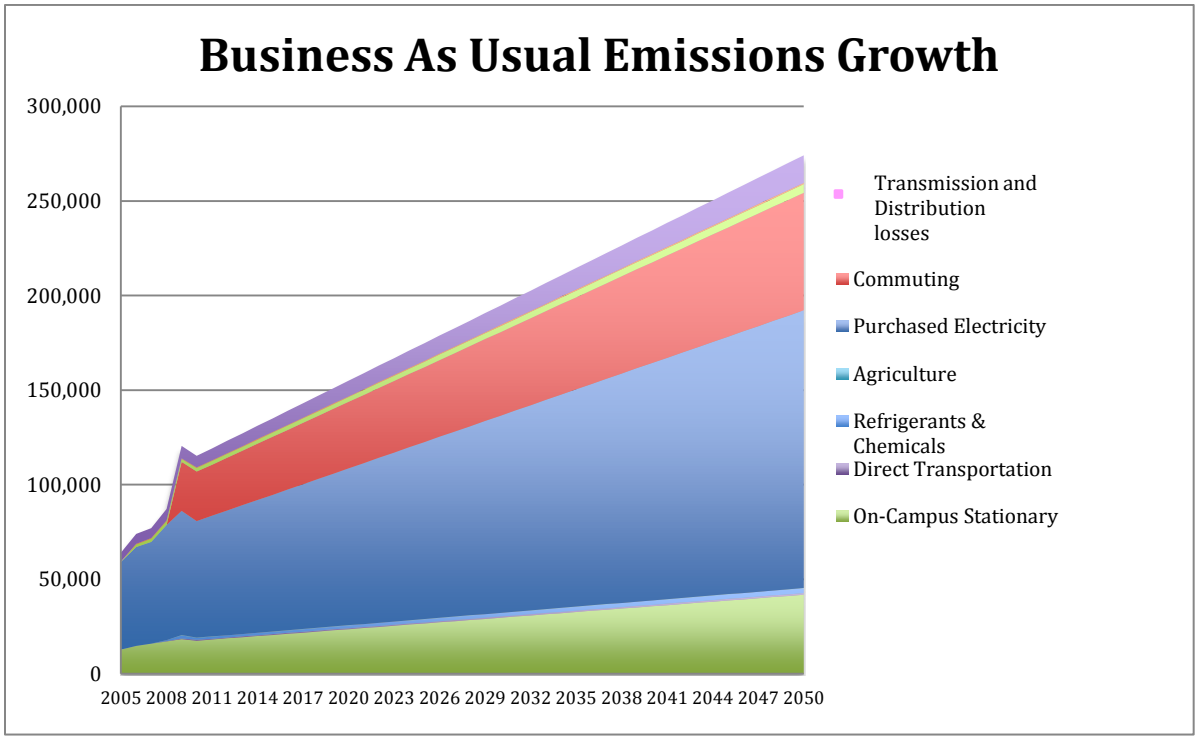
However, this is not the full story. If no action is taken, as the University grows, it will continue to emit GHGs at an increasing rate for years into the future. Thus, to develop meaningful mitigation strategies, future emission quantities must be calculated based on campus growth estimates, if no efforts are made to reduce emissions. This is known as the "business as usual" approach. It is anticipated that if the University takes no action, emissions in the year 2050 may rise above 250,000+ metric tons of CO_2e annually, representing a 52% increase over the 2009 baseline year.

Graph 2: Business as Usual Emissions Growth



The Challenge of the CAP process is to develop mitigation strategies that will enable the University to achieve climate neutrality by the target date of 2050, by reducing GHG emissions effectively, efficiently, and realistically over time.

CAP Development process:

The Climate Action Plan (CAP) was developed by establishing task forces in the areas of energy, purchasing, curriculum and transportation. These areas were chosen as they are the primary sources of campus emissions. Each task force had representation of faculty, staff, students and members of the community. A communications task force was also established to inform the campus community about progress of the CAP.

The initial undertaking of each task force was to identify key focus areas, based on the greenhouse gas inventory. Once the task force identified the key focus areas, or "emission buckets", they began to identify greenhouse gas mitigation strategies to reduce source emission in each of the buckets. The task forces developed an initial list of 111 possible mitigation strategies. Each task force was asked to qualitatively assess the strategies by ranking them from low (1) to high (6) in the areas listed below:

- Payback benefit
- Emissions reduction potential
- Education opportunities
- Exponential benefit
- Initial costs
- Ease of monitoring
- Implementation time frame
- Implementation feasibility
- Operational impact
- Community engagement potential

The aim of this qualitative evaluation was to identify the most suitable strategies to undertake a further assessment to determine GHG reduction potential. The qualitative assessment refined the potential strategies from 111 to 54. Of the 54 strategies recommended by the task forces, 15 could not be quantified and have instead been listed as supporting best management practices, and 12 strategies were collapsed into single groups as together they were deemed more effective in reducing emissions. Thirty GHG mitigation strategies were then subjected to a more enhanced quantitative assessment.

The aim of the quantitative assessment was to estimate the GHG reduction potential, cost or benefit of the selected strategies. The results of this effort are shown on the abatement curve on page 21 of this document.

The final deliverable of the CAP is to outline the mitigation strategies that will begin the journey to the goal of climate neutrality. The 30 strategies have been grouped into wedges and further divided into near term and long term actions. Based on the emissions potential of the selected strategies, interim milestones and carbon reduction targets leading toward the final goal of climate neutrality by a date of 2050 have been established.

Climate Neutrality

The journey to climate neutrality begins with the adoption of this plan and the implementation of the mitigation strategies throughout the institution. A primary objective of the initial CAP is simplicity in order to achieve implementation. It is understood that the mitigation strategies presented here do not achieve climate neutrality, but rather set the course for the university to embark on this path. That being said, it is anticipated that this CAP will be reviewed every two years to determine the implementation and impact of greenhouse gas reduction strategies, and to research and establish new strategies intended to achieve the future milestones outlined in this plan.

The mitigation strategies identified fall into six focus areas, or wedges. Within each of these wedges are near term and long term actions. Near tem actions are to be undertaken within the next eight years, while long term actions are based on 2020 – 2050 time frames.

Table 2: Reduction Wedges

Wedges	Programs
Transportation	Incentivize faculty, staff and students to reduce vehicle use by attaching a premium to parking, providing alternate transport options and alternative working strategies
	Continue conversion of campus fleet to alternative fuel and electric vehicles
Green Development	Focus on reducing energy use intensity based on the AIA Architecture 2030 Challenge
	Advocate for local higher density mixed use development
Behavior Change/Energy Conservation	Implement energy conservation programs
	Implement education programs to promote behavior change on how people use energy
Renewables	Transition to using renewables; especially solar hot water, geothermal and solar PV
Waste Management	Continue the focus on recycling and composting
Offsets	Use of creative offset programs

Milestones and Targets

The following milestones have been recommended by the CAP task forces for achieving climate neutrality, based on suggested mitigation strategies and future goals.

Date	Goal Reduction over 2009 Baseline
2020	20%
2030	40%
2040	60%
2050	100%

Near Term Projects

Near term projects are those that may be implemented by the year 2020, which represent the majority of projects in this initial CAP. These are focused on energy conservation, transportation, and high performance building development.

These strategies have been selected as appropriate near term actions based on existing programs, infrastructure, ease of implementation and cost per tonne $CO2_e$ reduction, shown on the abatement

curve graph 9. In addition, legislative requirements such as the required energy savings under North Carolina Senate SESSION LAW 2007-546 SENATE BILL 668 have been incorporated into relevant categories such as green development.

The near term mitigation projects represent an emission reduction of 17% over business as usual emissions. A description of each of the mitigation strategies is presented in the appendix 2 of this document. Of the near term strategies; energy conservation and green development present the greatest opportunity to reduce emissions, followed closely by behavioral change programs.

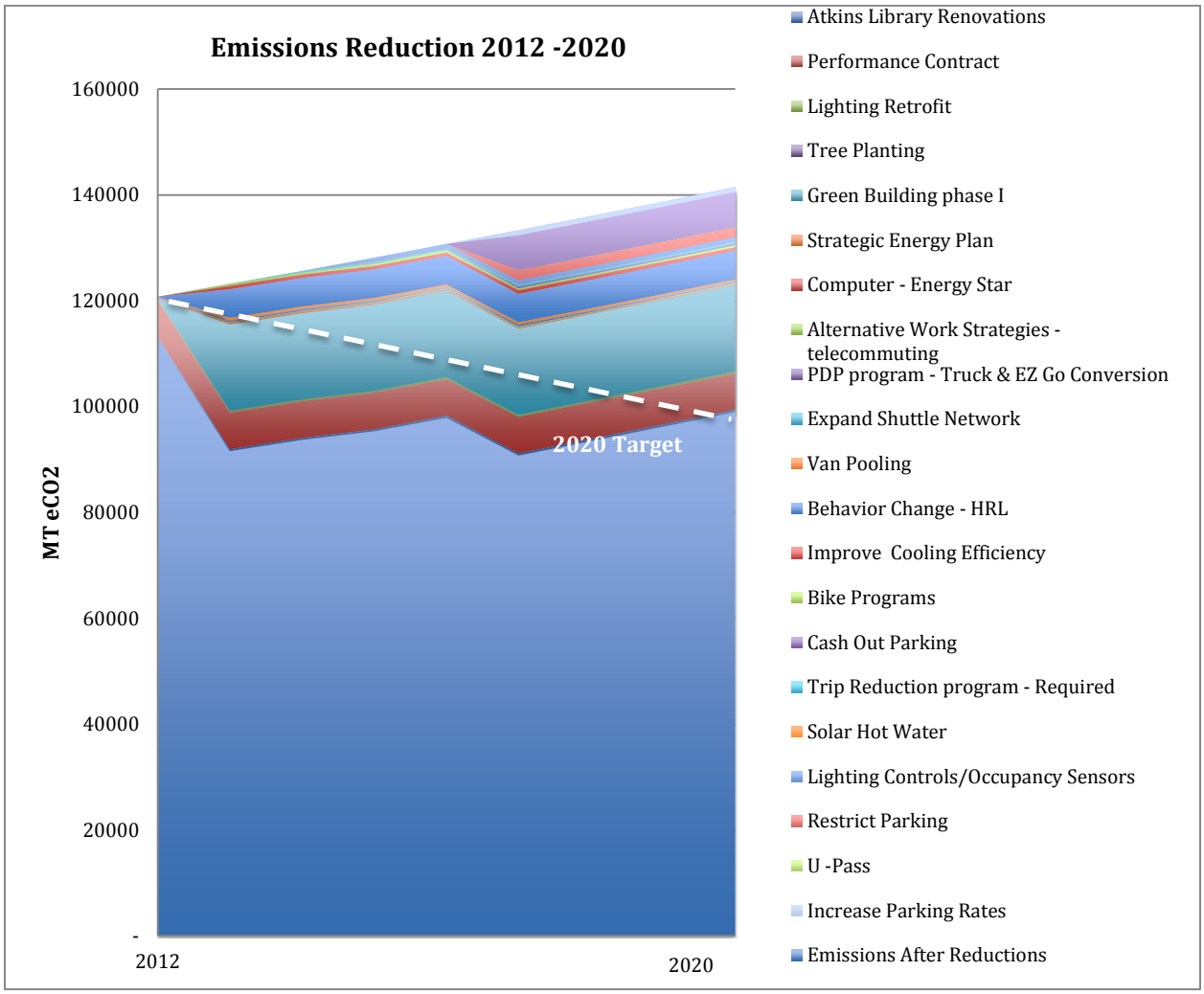
Table 3: Strategies and Wedge Category

	Strategy/Wedge	Transportation	Green Development	Energy Conservation	Renewables	Waste Management	Offsets
1	Atkins Library Renovations			X			
2	Performance Contract			X			
3	Lighting Retrofit			X			
4	Tree Planting		X	X			
5	Green Building Phase I	X	X	X	X	X	
6	Strategic Energy Plan			X	X		
7	Computer Energy Star			X			
8	Alternative Work Strategies	X	X	X			
9	Petroleum Displacement Program	X		X			
10	Expand Bus/Shuttle Network	X					
11	Van Pooling	X					
12	Behavior Change	X		X		X	
13	Improve Cooling Efficiency			X			
14	Bike programs	X					
15	Cash Out Parking	X					
16	Trip Reduction Program	X					
17	Solar Hot Water		X	X	X		
18	Lighting Occupancy Controls			X			
19	Restrict Parking	X					
20	Universal Pass	X					
21	Performance Contract II			X	X		
22	Duke Energy Green Grid			X	X		
23	Solar Photovoltaic I			X	X		
24	Geo Thermal HVAC			X	X		
25	Carbon offsets/Green power Purchasing						X
26	Green Building Phase II	X	X	X	X	X	
27	Land Use Higher Density	X					
28	Green Mortgages	X					
29	Solar Photovoltaic II		X		X		
30	Parking fees	X					

The tables in appendix 1 identifies the estimated $MTCO_{2e}$ reductions of the near term and long strategies identified in this Climate Action Plan.

Graph 3: Near Term Reductions 2012 - 2020

Graph 3 below, shows the estimated emission reductions that may be obtained from the near term greenhouse gas mitigation strategies over the 2009 baseline year. This represents a 20% reduction target. Implementing a green building program for new construction and renovation, followed by estimate energy savings from the performance contract and staff/student behavior changes generate the greatest potential emission reductions.



Long Term Projects

Long Term Projects are those designed to be implemented from 2020 to 2030. Although a new suite of mitigation strategies will be implemented after 2020, greenhouse gas reductions from mitigation strategies implemented prior to 2020 will still be accrued depending on the length of the initial mitigation strategies.

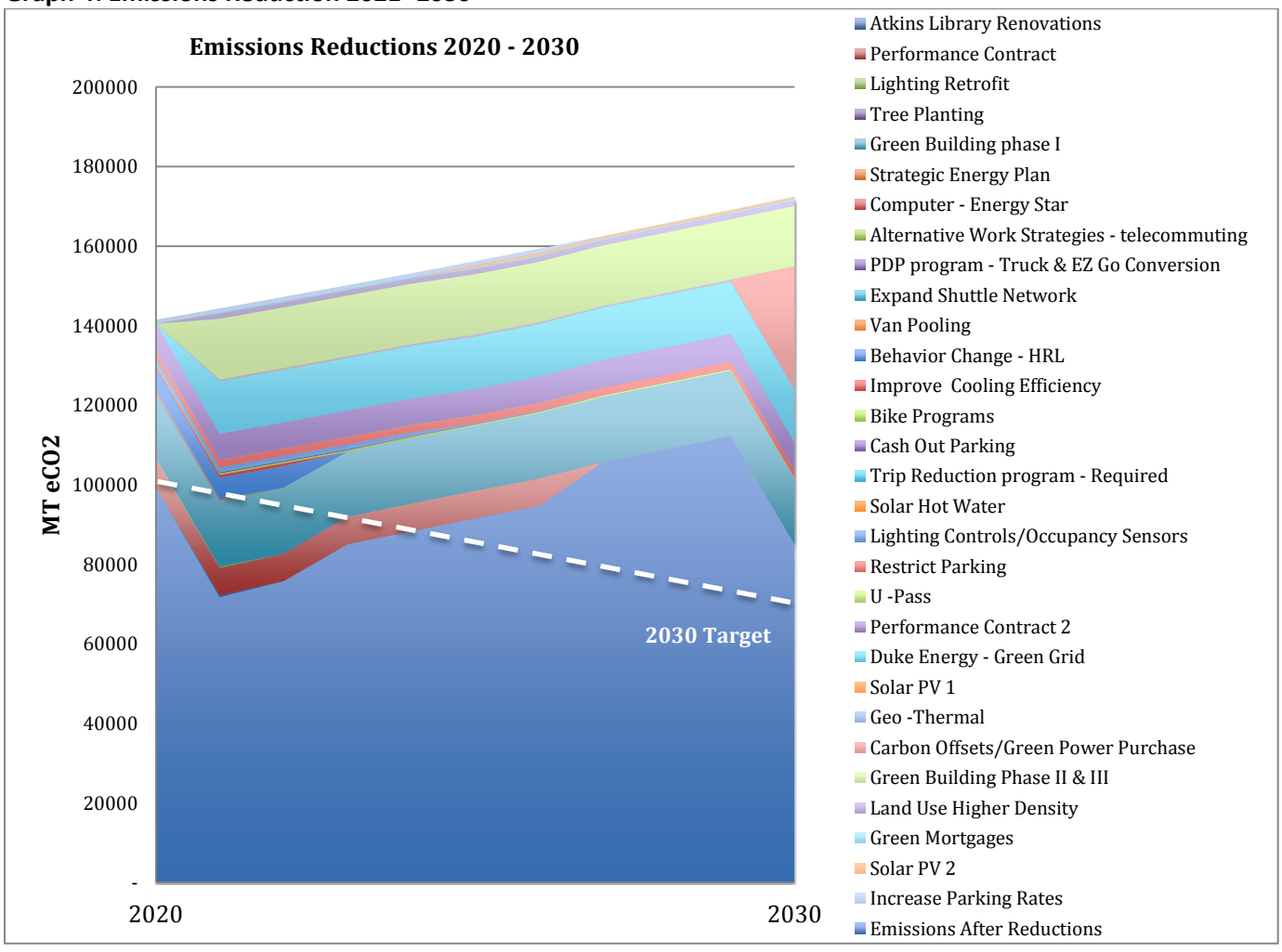
The specific long term mitigation strategies and their potential emissions are far less accurate than the near term strategies discussed above. However, the CAP is intended to show the key focus area that will have to be addressed to reduce emissions further to achieve the intended milestones established.

Table 4: Long Term Strategies

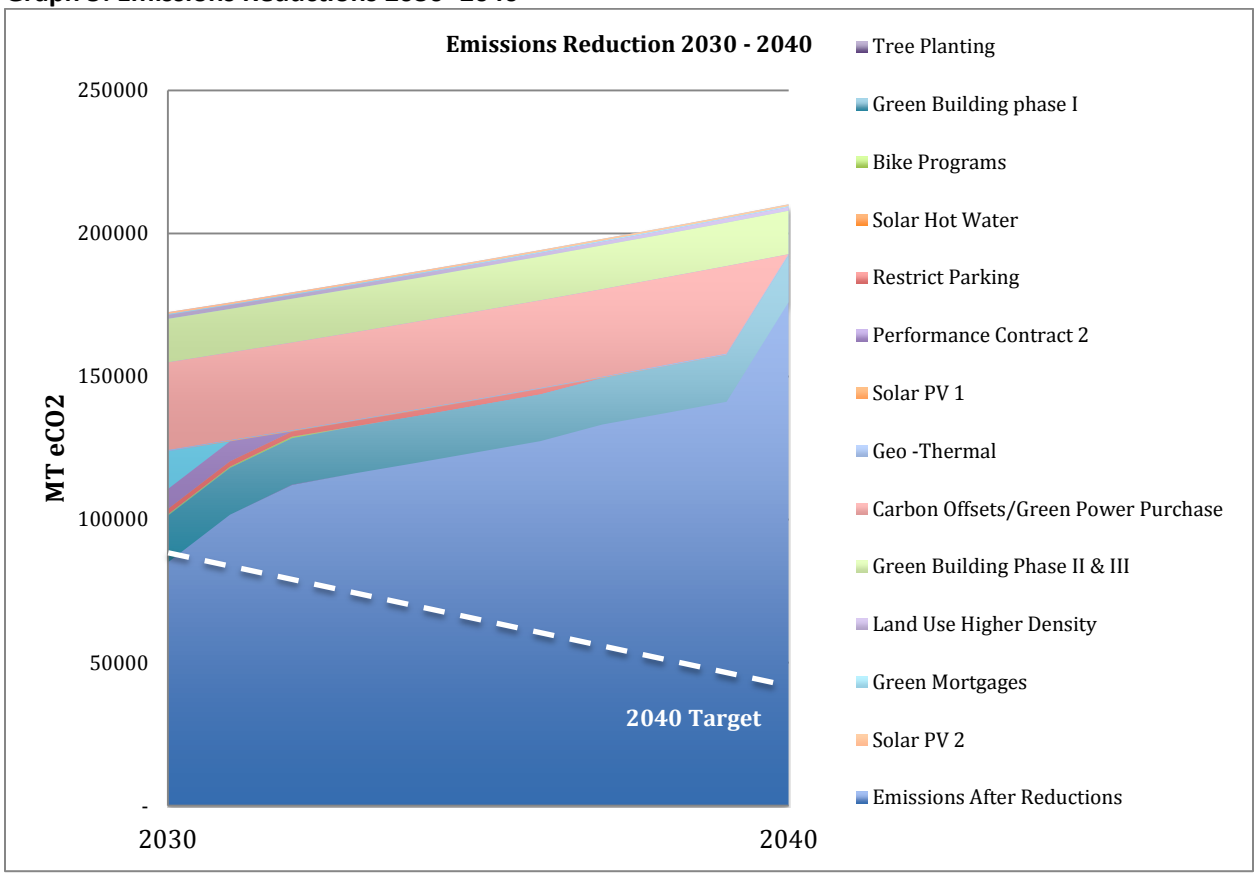
Strategy	Transportation	Green Development	Energy Conservation	Renewables	Waste Management	Offsets
Solar PV		X	X	X		
Geo – Thermal HVAC		X	X	X		
Green Building		X	X	X	X	
Land Use Higher Density	X	X				
Green Mortgages	X	X				
Offsets						X
New Technologies	X	X	X	X	X	X

The following graphs shows the potential emission reductions based on the suggested milestones and climate neutrality date of 2050.

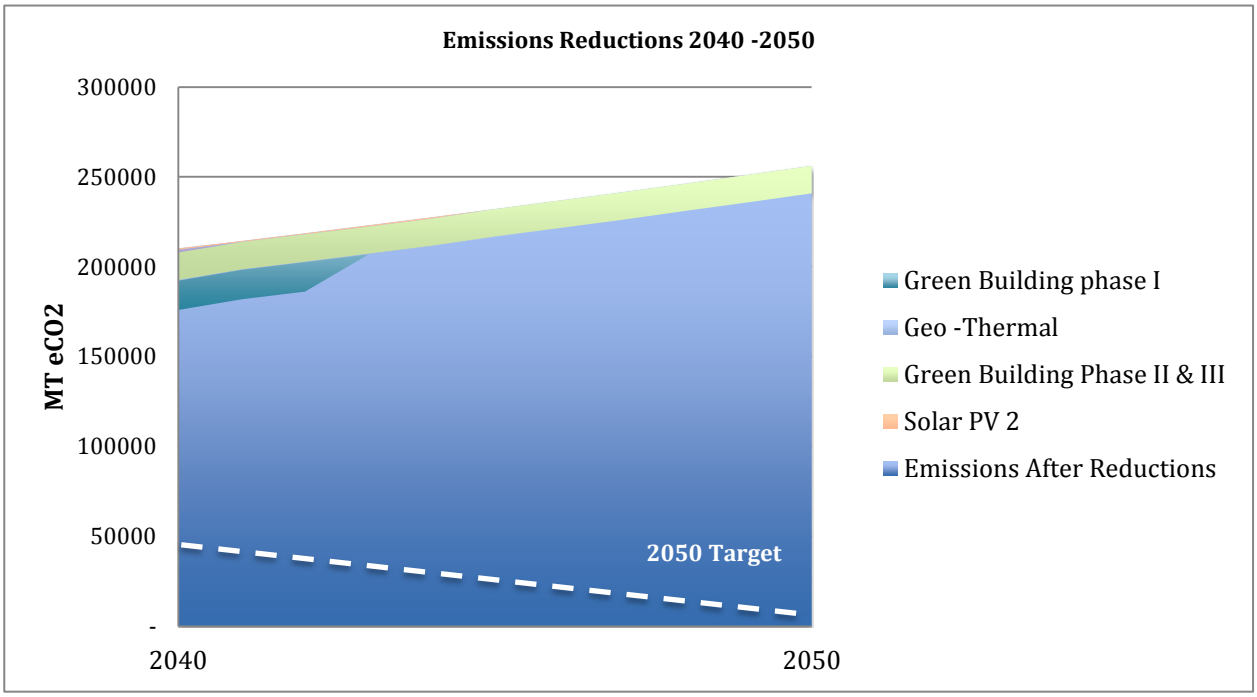
Graph 4: Emissions Reduction 2021 -2030



Graph 5: Emissions Reductions 2030 -2040

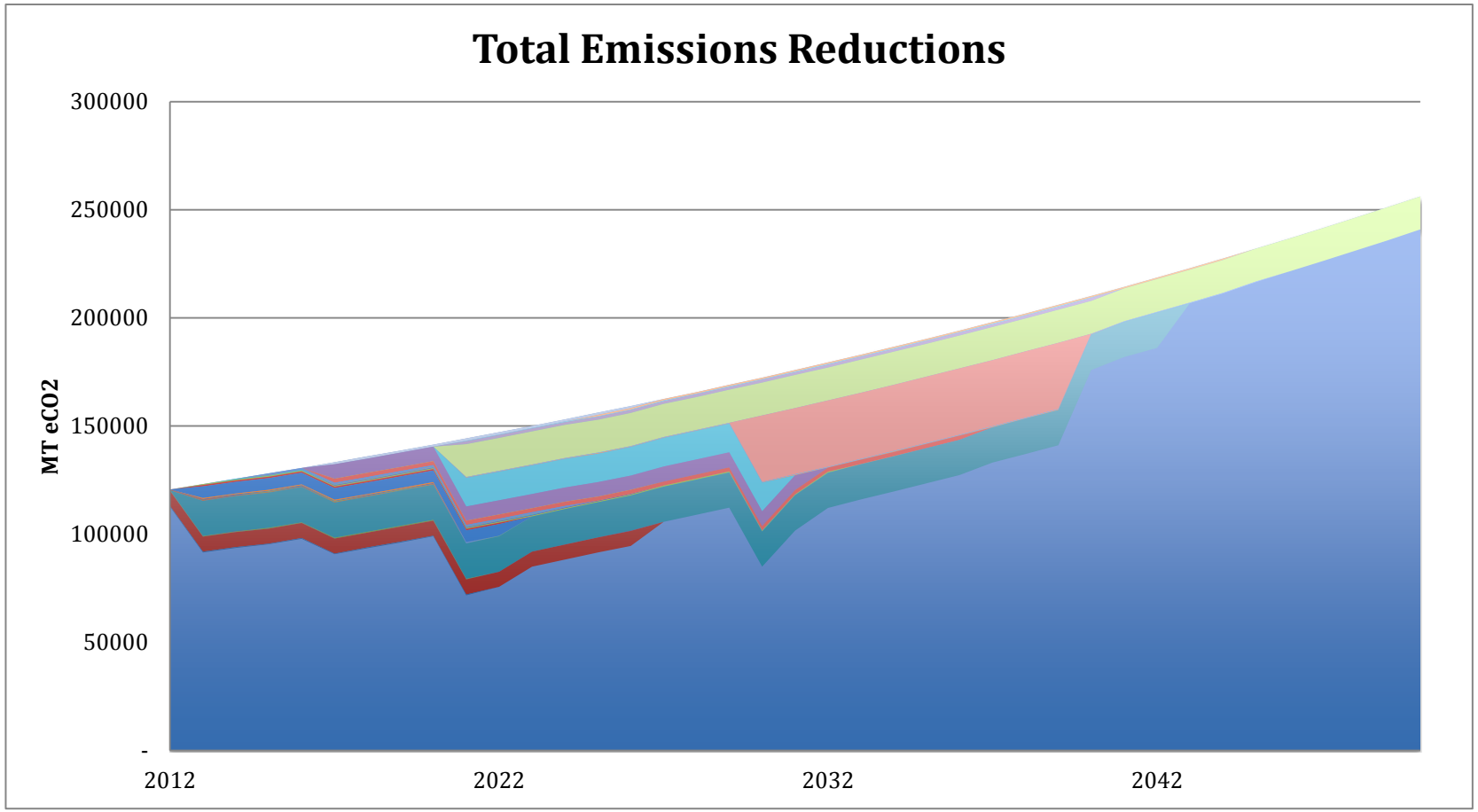


Graph 6: Reduction 2040 – 2050

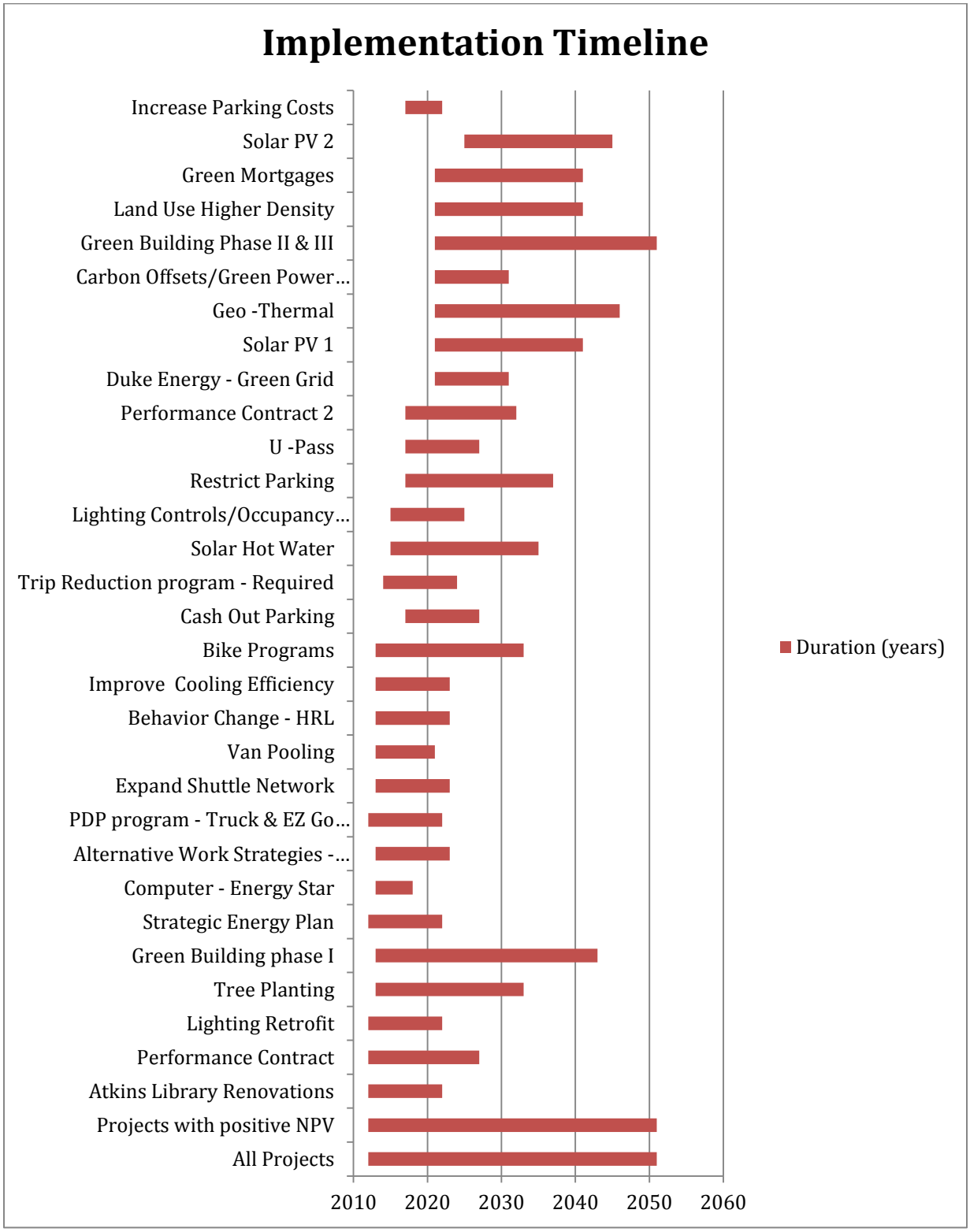


The resulting emissions reductions from the mitigation strategies presented in this initial CAP potentially reduce emissions significantly over a business as usual scenario up to the year 2030 and is a challenging goal for the university to achieve.

Graph 7: Total Emissions Reductions



Graph 8: Implementation Timeline



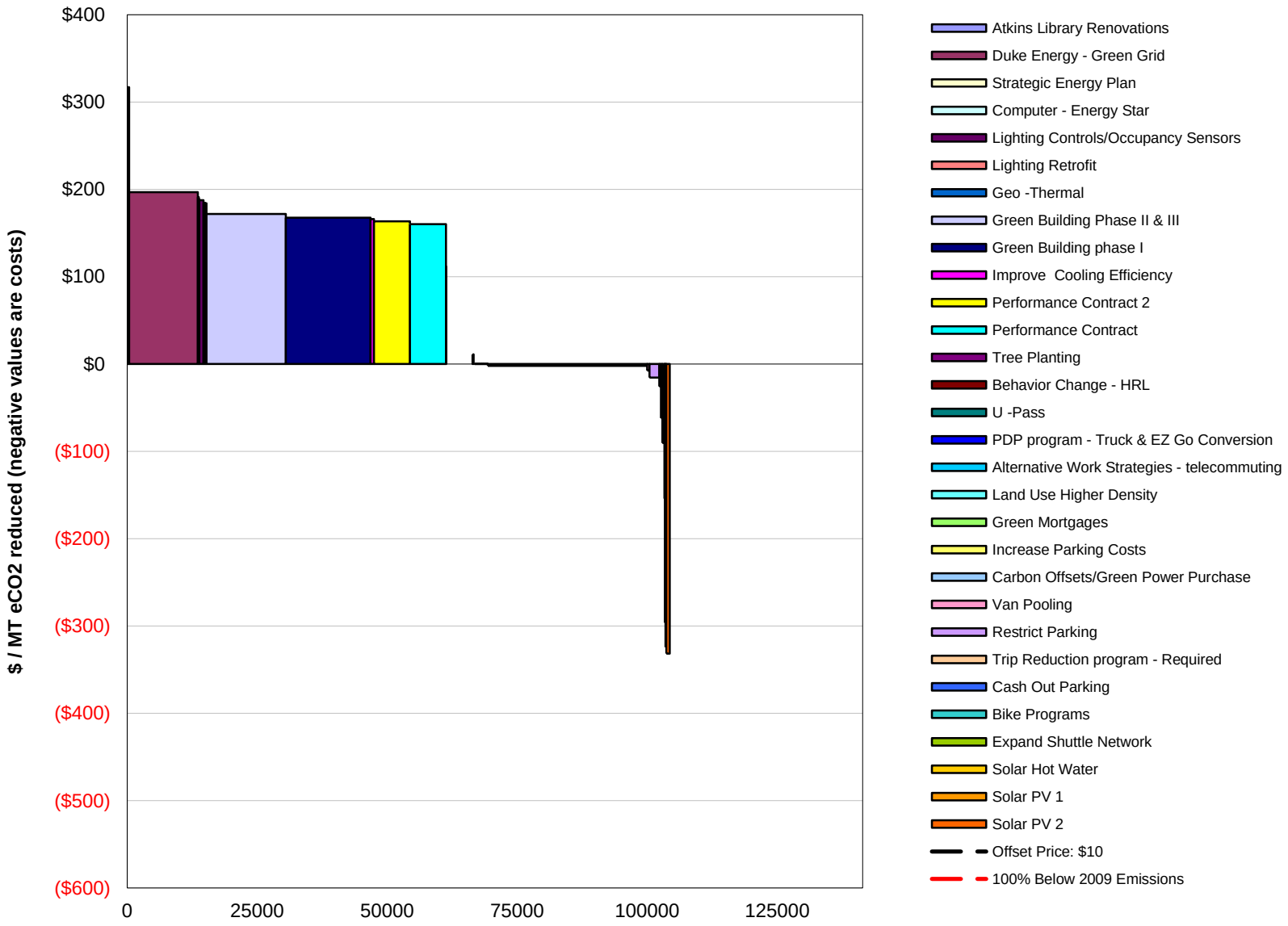
Financial Analysis of the Climate Action Plan

To assist in the decision making process, a financial analysis has been completed of the 22 near term mitigation projects and eight long term mitigation projects. This financial analysis focused on determining the Internal Rate of Return (IRR), Net Present Value (NPV), and discounted pay back terms of the selected projects. Table 5 details this financial analysis.

Graph 9 shows the abatement curve identifying the potential cost or savings per metric tonne of carbon savings and the quantity of carbon reduction per strategy.

Project Name	Start Year	Duration (years)	Units	Total Capital Cost	Total Capital Cost Including Incentives	Average Discounted Annual Cash Flow	NPV	IRR	Discounted Payback Time (years)	Annual Reductions (MTeCO2)	Total Lifetime Reductions (MTeCO2)	% of Start Year Emissions	% of End Year Emissions	Discounted Cost per Reduction	Rank
Atkins Library Renovations	2012	10	1	-	$469,000	$107,372	$1,181,092	-	0.00	(372.7)	(3,726.8)	0.30%	0.25%	$316.92	1
Performance Contract	2012	15	1	-	-	$1,039,558	$16,632,924	-	0.00	(6,926.2)	(103,892.5)	5.62%	4.26%	$160.10	12
Lighting Retrofit	2012	10	1	($20,932)	($20,932)	$53,527	$588,796	290.12%	0.34	(319.1)	(3,191.1)	0.26%	0.22%	$184.51	6
Tree Planting	2013	20	300	($52,500)	($52,500)	$3,372	$70,819	9.85%	8.68	(31.7)	(633.6)	0.03%	0.02%	$111.78	13
Green Building phase I	2013	30	1	($7,208,499)	($7,208,499)	$2,641,689	$81,892,351	39.17%	2.58	(16,296.6)	(488,899.3)	12.97%	7.31%	$167.50	9
Strategic Energy Plan	2012	10	1	-	-	$32,468	$357,145	-	0.00	(186.9)	(1,869.1)	0.15%	0.13%	$191.07	3
Computer - Energy Star	2013	5	1000	-	-	$16,366	$98,195	-	0.00	(104.0)	(520.2)	0.08%	0.08%	$188.77	4
Alternative Work Strategies -	2013	10	1	-	-	$0	$0	-	0.00	(166.2)	(1,661.8)	0.13%	0.11%	$0.00	17
PDP program - Truck & EZ Go Conversion	2012	10	197	($458,336)	($458,336)	$2,106	$23,170	0.91%	9.53	(210.6)	(2,106.3)	0.17%	0.14%	$11.00	16
Expand Shuttle Network	2013	10	1	($424,019)	($424,019)	($38,547)	($424,019)	-	N/A	(113.2)	(1,131.6)	0.09%	0.08%	($374.71)	30
Van Pooling	2013	8	182	($26,936)	($26,936)	($2,993)	($26,936)	-	N/A	(444.3)	(3,554.7)	0.35%	0.31%	($7.58)	22
Behavior Change - HRL	2013	10	19	($221,008)	($221,008)	$544,712	$5,991,831	274.74%	0.36	(5,383.9)	(53,839.3)	4.29%	3.59%	$111.29	14
Improve Cooling Efficiency	2013	10	1	($146,574)	($146,574)	$98,380	$1,082,183	82.32%	1.21	(652.2)	(6,521.9)	0.52%	0.43%	$165.93	10
Bike Programs	2013	20	1	($58,164)	($58,164)	($33,791)	($709,604)	-	N/A	(391.9)	(7,838.1)	0.31%	0.21%	($90.53)	26
Cash Out Parking	2017	10	1	($172,748)	($172,748)	($15,704)	($172,748)	-	N/A	(278.7)	(2,786.7)	0.20%	0.17%	($61.99)	25
Trip Reduction program - Required	2014	10	1	($23,265)	($23,265)	($7,402)	($81,425)	-	N/A	(316.3)	(3,163.4)	0.25%	0.21%	($25.74)	24
Solar Hot Water	2015	20	8	($744,504)	($744,504)	($25,400)	($533,390)		N/A	(90.0)	(1,799.7)	0.07%	0.05%	($296.37)	27
Lighting Controls/Occupancy	2015	10	1	($44,873)	($44,873)	$136,021	$1,496,236	333.88%	0.30	(797.9)	(7,978.6)	0.61%	0.51%	$187.53	5
Restrict Parking	2017	20	2537	($588,584)	($588,584)	($28,028)	($588,584)	-	N/A	(1,887.1)	(37,741.0)	1.39%	0.95%	($15.60)	23
U -Pass	2017	10	1	($232,658)	($232,658)	($21,151)	($232,658)	-	N/A	311.6	3,116.0			$74.67	15
Performance Contract 2	2017	15	1	-	-	$1,060,665	$16,970,634	-	0.00	(6,926.2)	(103,892.5)	5.09%	3.86%	$163.35	11
Duke Energy - Green Grid	2021	10	1	-	-	$2,363,544	$25,998,980	-	0.00	(13,215.7)	(132,157.4)	8.98%	7.52%	$196.73	2
Solar PV 1	2021	20	1	($1,712,995)	($1,712,995)	($50,474)	($1,059,956)		N/A	(163.4)	(3,268.6)	0.11%	0.08%	($324.29)	28
Geo -Thermal	2021	25	1	($113,881)	($113,881)	$46,507	$1,209,179	45.20%	2.22	(262.8)	(6,571.2)	0.18%	0.11%	$184.01	7
Carbon Offsets/Green Power Purchase	2021	10	1	($665,426)	($665,426)	($60,493)	($665,426)	-	N/A	(30,640.0)	(306,400.0)	20.82%	17.42%	($2.17)	21
Green Building Phase II & III	2021	30	1	($7,208,449)	($7,208,449)	$2,535,027	$78,585,843	37.93%	2.65	(15,251.2)	(457,535.2)	10.36%	5.84%	$171.76	8
Land Use Higher Density	2021	20	1	-	-	$2,328,271	$0	-	0.00	(1,279.5)	(25,590.0)	0.87%	0.60%	$0.00	18
Green Mortgages	2021	20	1	-	-	$0	$0	-	0.00	(310.1)	(6,202.5)	0.21%	0.14%	$0.00	19
Solar PV 2	2025	20	4	($6,979,740)	($6,979,740)	($206,529)	($4,337,108)		N/A	(653.8)	(13,075.5)	0.41%	0.28%	($331.70)	29
Increase Parking Rates	2017	10	1	-	-	$0	$0	-	0.00	(978.0)	(9,780.0)	0.72%	0.60%	$0.00	20

Graph 9: Project Abatement Curve



Climate Action Plan Funding

Funding will need to be secured for the mitigation projects identified in this CAP for implementation to occur. Some projects such as the performance contract, petroleum displacement, shuttle extensions and green development are already funded as ongoing projects. For other projects new streams of funding will have to be identified and applied.

This CAP however does not stand in isolation to other planning initiatives ongoing at UNC Charlotte, where there are other plans and initiatives for which this Climate Action Plan may be used as support. These synergistic opportunities may present some internal funding opportunities for the development and implementation of this CAP.

Synergies

- Institutional Plan
- Master Plan
- Circulation and Transport Plans
- Student recruitment
- Academic Plans
- Business Plans
- Strategic Energy Plans

Funding may be secured from the following sources

- Energy Savings
- Revolving Fund
- Capital and Operating Funds

Education

Upon signing the ACUPCC, institutions are required to complete a number of actions, including addressing climate actions in education and research. The ACUPCC states:

> *Within two years of signing this document, develop an institutional action plan for becoming climate neutral, which will include:*
>
> - *Actions to make climate neutrality and sustainability a part of the curriculum and other educational experience for all students.*
> - *Actions to expand research or other efforts necessary to achieve climate neutrality*

Currently there are plans to develop an Environmental Science Major/Minor focused on environmental and sustainability issues. There are also a large number of courses on offer that have a number of components of sustainability within them. These being subjects such as pollution prevention (air, land and water), sustainable development, environmental management and business, environmental economics, ecology, design for environment, sustainable production and consumption, social justice, human welfare, functions of earth's natural systems, human activity and environmental sustainability, urban planning, building performances, and sustainable materials.

In addition to the above, the Sustainability Committee Strategic Plan has proposed actions to develop a more visible, coherent and intentional approach to formal and informal sustainability education on campus, as well as a need for opportunities to learn how to translate knowledge into action.

The goals of the strategic plan are:

- Create a formal sustainability curriculum.
- Develop strategies to educate the campus about sustainability and its implications for the individual and the community, and offer tools and resources to enable the translation of campus knowledge into action.
- Create a robust program to improve campus understanding of sustainability at regional, national, and global scales.

Informal education consists of those events which educate the public about sustainability, such as Earth Day, Student Green competitions, along with promotional activities, campus publications, and websites promoting sustainability on campus. Examples of campus programs are:

- Earth Day, Campus Sustainability Day, Graduate Public Health Week, environmentally themed movies, the Take It or Leave It tour, informational tables at various events, and the Recyclemania competition.
- Earth Club Meetings – a student led organization promoting and enhancing sustainability at UNC Charlotte and within the local community.
- Charlotte Green Initiative Meetings - the student led group that manages the student green fee dedicated toward funding student initiated on-campus sustainability projects.
- UNCC Recycling and Keep Charlotte Green program, which includes websites, posters, stickers, 49 ways to "keep charlotte green", flyers, banners, and brochures.
- Sustainability Newsletter (quarterly)

Future revisions of the CAP will also present opportunities for student learning by providing opportunities for research projects on climate change mitigation strategies.

Research

UNC Charlotte is privileged to have extensive research opportunities guided by the many centers and institutes on campus that benefit the local community. These centers should be able to assist in future versions of the CAP by integrating research findings in transportation, conservation, green development and renewable technologies that may be applied at the University.

- The Center for Applied Geographic Information Sciences. A project example is ozone modeling so emission control strategies within Mecklenburg County may be compared to provide decision support for air quality planning initiatives.
- Infrastructure Design Environmental and Sustainability (IDEAS) Center has recently been established to hasten the shift from unsustainable infrastructure, housing, and technology design to practices more attuned to the challenges of the 21st century. The IDEAS Center strives to promote a region-wide climate of cooperation to advance its goals. A recent project example: UNC Charlotte, together with Charlotte Mecklenburg Utilities, Central Piedmont Community College and the Centralina Council of Governments, recently was awarded a Green Business Fund Grant presented by Gov. Bev Perdue. The $85,000 grant, along with a $99,850 grant from the Biofuels Center of North Carolina, will aid in the study and development of a highly integrated biodiesel production facility for Charlotte Mecklenburg Utilities. The regional partnership will cultivate an oil seed crop on five acres of land owned by Charlotte Mecklenburg Utilities and irrigated with reclaimed water to produce biodiesel fuel.
- The Daylighting and Energy Performance Laboratory is an applied research unit of the School of Architecture at the University of North Carolina at Charlotte's Center for Integrated Building Design Research.
- The Energy Production and Infrastructure Center (EPIC) at UNC Charlotte was formed in response to the need to supply highly trained engineers qualified to meet the demands of the energy industry – through traditional and continuing education, and provide sustainable support for the Carolina energy industry by increasing capacity and support for applied research. EPIC is a highly collaborative industry/education partnership that produces a technical workforce, and advancements in technology for the global energy industry, while supporting the Carolinas' multi-state economic and energy security.

Outreach

There are numerous opportunities for the University to engage with the local area about the CAP by educating community members about what the University is doing regarding climate change, as well as developing partnerships with other communities and institutions to work on climate mitigation initiatives.

The extensive UNC Charlotte volunteer services programs may also engage in climate education and GHG offset opportunities such as community tree planting events to maintain and extend the tree canopy of Charlotte-Mecklenburg.

There are specialized offices at UNC Charlotte such as the Environmental Assistance Office (EAO), developed to increase effective and sustainable pollution prevention practices in the region and to provide UNC Charlotte students with out-of-classroom practical learning opportunities. The EAO specializes in bringing governmental agencies and businesses together with talented UNC Charlotte students and faculty to address environmental issues.

There will also be opportunities presented through the College of Education to partner with local teachers and schools to bring lessons related to climate action planning to regional K – 12 classrooms. In addition, the College of Education has begun implementing sustainability curriculum materials in its preparation of K-12 teachers.

Tracking Progress

Achieving the intent of the CAP means the implementation of mechanisms to track progress of the various mitigation strategies in a large decentralized institution. Various indicators have been established, most of which are currently used by the institution and have established data gathering procedures and processes.

Indicator	Data Tracking	Wedge
Lbs. per annum recycled	Reduction of waste to landfill	Waste management
Kbtu/Gsf	Energy intensity	Energy Conservation/Green Development
Gal Gsf	Water use	Energy Conservation/Green Development
Petrol gal Per Annum	Petroleum displacement	Energy Efficiency
Parking Permits	Vehicle Miles Travelled	Transport
Compost lbs. per annum	Reduction of MSW	Offsets/Waste Management
Energy Starr Equipment	Purchases	Energy Conservation
Number of campus departments with CAP addressed in strategic plans	Project implementation	All
Number of climate change/sustainability courses offered	Education	Behavior Change
Number of climate sustainability research projects	Research	Energy Efficiency/behavior Change
Student engaged in climate action efforts	Engagement	Behavior Change

Conclusion

UNC Charlotte has made steady progress in sustainability efforts. Institutional structures such as the Sustainability Committee have been established to guide and support sustainability efforts. The support of the administration and senior management in academic and non-academic departments continues to have a positive effect on campus sustainability. This support empowers those sustainability champions on campus to run with sustainability initiatives.

Student groups such as the Earth Club and the Charlotte Green Initiative continue to grow in confidence and bring the student voice to campus sustainability initiatives, while Facilities Management, Housing Residence Life and Auxiliary Services have been at the forefront in implementing sustainability initiatives.

The success had to date provides a solid foundation for the hard work ahead need to implement the mitigation initiatives discussed in this CAP as we strive to meet the goal of greenhouse gas neutrality by 2050.

As we go forward with this process it is important that we;

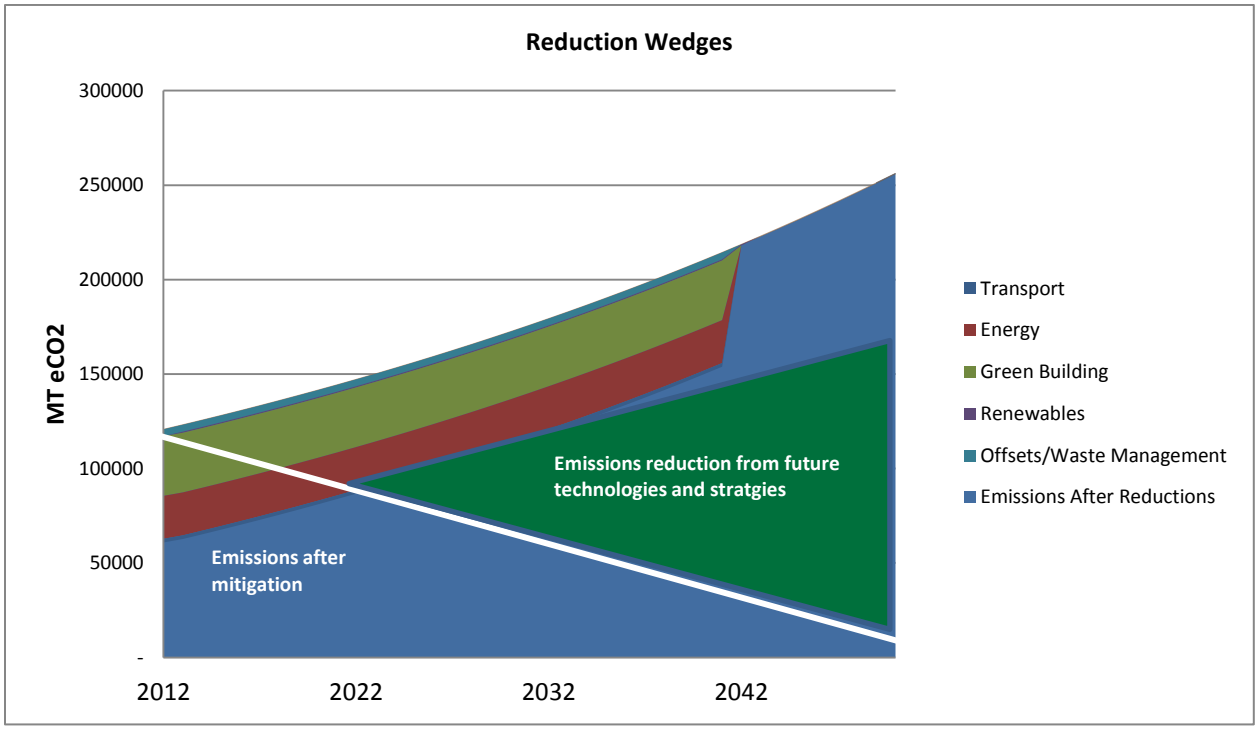
- Celebrate successes
- Excite campus community
- Engage campus community
- Engage research/education
- Be accountable for the success of the CAP
- Aim for continuous improvement

The resulting emissions reductions from the mitigation strategies presented in this initial CAP potentially reduce emissions significantly over a business as usual scenario up to the year 2030 and is a challenging goal for the university to achieve.

The world in 2030 will look very different than today. New and emerging technologies and may hasten the shift of power companies to using more renewables for energy generation. New and emerging technologies will also have a major impact on campus eco-efficiency programs. Together these changes as well as consumer/student attitudes to sustainability will have a profound impact on campus emissions. However, the University can position itself to take advantage of future technologies and consumer sentiment by adopting strategies that:

- Support the implementation of renewable energy generation
- Adopting aggressive building efficient metrics
- Awareness raising and educating staff, faculty and students on energy and water conservation
- Continually improving eco-efficient and eco-effective practices on campus

Graph 10: Reduction Wedges



Appendices

Appendix 1: Mitigation strategies and estimated Reductions in $MTCO_{2e}$

2012 – 2020 Emissions Reduction Potential (tonnes $MTCO_{2e}$)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Emissions Pre Mitigation	120,747	123,160	125,621	128,131	130,691	133,303	135,967	138,684	141,456
Atkins Library Renovations	373	373	373	373	373	373	373	373	373
Performance Contract	6,926	6,926	6,926	6,926	6,926	6,926	6,926	6,926	6,926
Lighting Retrofit	319	319	319	319	319	319	319	319	319
Tree Planting		32	32	32	32	32	32	32	32
Green Building phase I		16,297	16,297	16,297	16,297	16,297	16,297	16,297	16,297
Strategic Energy Plan	187	187	187	187	187	187	187	187	187
Computer - Energy Star		104	104	104	104	104			
Alternative Work Strategies - telecommuting		166	166	166	166	166	166	166	166
Petroleum Displacement Program - Truck & EZ Go Conversion	211	211	211	211	211	211	211	211	211
Expand Shuttle Network		113	113	113	113	113	113	113	113
Van Pooling		444	444	444	444	444	444	444	444
Behavior Change - HRL		5,384	5,384	5,384	5,384	5,384	5,384	5,384	5,384
Improve Cooling Efficiency		652	652	652	652	652	652	652	652
Bike Programs		392	392	392	392	392	392	392	392
Cash Out Parking						279	279	279	279
Trip Reduction program - Required			316	316	316	316	316	316	316
Solar Hot Water				90	90	90	90	90	90
Lighting Controls/Occupancy Sensors				798	798	798	798	798	798
Restrict Parking						1,887	1,887	1,887	1,887
Universal Pass						312	312	312	312
Performance Contract 2						6,926	6,926	6,926	6,926
Increase Parking Rates						978	978	978	978
All Projects	8,015	31,600	31,916	32,804	32,804	42,562	42,458	42,458	42,458
Total Emissions After Mitigation	112,731	91,560	93,705	95,327	97,888	90,741	93,509	96,226	98,998

Emissions Reduction Potential Long Term Strategies 2021 – 2030 (tonnes MTCO2e)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total Emissions Pre Mitigation	144,283	147,166	150,107	153,107	156,168	159,289	162,472	165,720	169,032	172,410
Atkins Library Renovations	373									
Performance Contract	6,926	6,926	6,926	6,926	6,926	6,926				
Lighting Retrofit	319									
Tree Planting	32	32	32	32	32	32	32	32	32	32
Green Building phase I	16,297	16,297	16,297	16,297	16,297	16,297	16,297	16,297	16,297	16,297
Strategic Energy Plan	187									
Alternative Work Strategies - telecommuting	166	166								
Petroleum Displacement Program - Truck & EZ Go Conversion	211									
Expand Shuttle Network	113	113								
Behavior Change - HRL	5,384	5,384								
Improve Cooling Efficiency	652	652								
Bike Programs	392	392	392	392	392	392	392	392	392	392
Cash Out Parking	279	279	279	279	279	279				
Trip Reduction program - Required	316	316	316							
Solar Hot Water	90	90	90	90	90	90	90	90	90	90
Lighting Controls/Occupancy Sensors	798	798	798	798						
Restrict Parking	1,887	1,887	1,887	1,887	1,887	1,887	1,887	1,887	1,887	1,887
Universal Pass	312	312	312	312	312	312				
Performance Contract 2	6,926	6,926	6,926	6,926	6,926	6,926	6,926	6,926	6,926	6,926
Duke Energy - Green Grid	13,216	13,216	13,216	13,216	13,216	13,216	13,216	13,216	13,216	13,216
Solar Photovoltaic I	163	163	163	163	163	163	163	163	163	163
Geo –Thermal HVAC	263	263	263	263	263	263	263	263	263	263
Carbon Offsets/Green Power Purchase										30,640
Green Building Phase II & III	15,251	15,251	15,251	15,251	15,251	15,251	15,251	15,251	15,251	15,251
Land Use Higher Density	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279
Green Mortgages	310	310	310	310	310	310	310	310	310	310
Solar Photovoltaic II					654	654	654	654	654	654
Increase Parking Rates	978	978	978	978	978	978				
All Projects	72,496	71,407	65,092	64,775	64,631	64,631	56,760	56,760	56,760	87,400

Total Emissions After Mitigation	71,786	75,759	85,016	88,332	91,536	94,657	105,712	108,960	112,272	85,010

Emissions Reduction Potential Long Term Strategies 2030 – 2040 (tonnes MT CO2e)

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Total Emissions Pre Mitigation	175,857	179,372	182,957	186,614	190,344	194,149	198,030	201,988	206,026	210,144
Tree Planting	32	32								
Green Building phase I	16,297	16,297	16,297	16,297	16,297	16,297	16,297	16,297	16,297	16,297
Bike Programs	392	392								
Solar Hot Water	90	90	90	90						
Restrict Parking	1,887	1,887	1,887	1,887	1,887	1,887				
Performance Contract 2	6,926									
Solar Photovoltaic I	163	163	163	163	163	163	163	163	163	163
Geo –Thermal HVAC	263	263	263	263	263	263	263	263	263	263
Carbon Offsets/Green Power Purchase	30,640	30,640	30,640	30,640	30,640	30,640	30,640	30,640	30,640	
Green Building Phase II & III	15,251	15,251	15,251	15,251	15,251	15,251	15,251	15,251	15,251	15,251
Land Use Higher Density	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279
Green Mortgages	310	310	310	310	310	310	310	310	310	310
Solar Photovoltaic II	654	654	654	654	654	654	654	654	654	654
All Projects	74,184	67,258	66,835	66,835	66,745	66,745	64,857	64,857	64,857	34,217
Total Emissions After Mitigation	101,672	112,113	116,122	119,779	123,599	127,404	133,172	137,131	141,168	175,927

Emissions Reduction Potential Long Term Strategies 2040 – 2050 (tonnes $MTCO_{2e}$)

	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Total Emissions Pre Mitigation	214,345	218,630	223,000	227,458	232,005	236,643	241,374	246,199	251,121	256,141
Green Building phase I	16,297	16,297								
Geo –Thermal HVAC	263	263	263	263	263					
Green Building Phase II & III	15,251	15,251	15,251	15,251	15,251	15,251	15,251	15,251	15,251	15,251
Solar PV 2	654	654	654	654						
All Projects	32,464	32,464	16,168	16,168	15,514	15,251	15,251	15,251	15,251	15,251
Total Emissions After Mitigation	181,880	186,165	206,832	211,290	216,491	221,392	226,122	230,948	235,870	240,890

Appendix 2: Mitigation Strategies Descriptions

Transport Mitigation Strategies

Introduction

Faculty, staff and student commuting account for 21% (25,802.8 $MTeCO_2$) of all UNC Charlotte greenhouse gas (GHG) emissions each year. Reducing emissions from transportation is difficult, as doing so requires modal shift, behavior shift, fuel mix transition, land planning, transport infrastructure development and parking management.

Through the Climate Action Plan process, involving faculty, students and staff, a number of mitigation strategies have been analyzed to determine their efficacy in reducing UNC Charlotte greenhouse gas emissions. This analysis is presented below.

A brief description of each mitigation strategy is given along with a goal(s) related to that strategy with estimated GHG reduction potential, cost/benefit potential and implementation duration. In addition to the mitigation strategy analysis a number of best management practices supporting the strategy are identified.

The mitigation strategies selected will potentially reduce annual emissions by 6642.0 $MTeCO_2$, or 25% of transport associated emissions, and 5.5% of total emissions. Project lifetime GHG reductions from these strategies may be approximately 97,562.0 $MTeCO_2$.

This Climate Action Plan may be used in support of a number of other UNC Charlotte strategic plans and initiatives.

Synergies

- **Parking Plans**
- **Master Plan**
- **Circulation Plan + Shuttle Service**
- **Student recruitment**
- **Regional zoning**
- **Light Rail**

Petroleum Displacement Program – Truck and EZ Go conversion program:

Objective: The aim of this program is to eliminate/reduce the use of gasoline and diesel in the campus fleet by replacing these fuels with E10, E85 and cart electrification. This is not a new program, but rather an extension of the petroleum displacement program managed by the campus fleet manager.

Goal: Reduce petroleum use by 85% by 2027.

Capital Cost: $458,336
Annual $MTeCO_2$ savings: 210 (0.17%)

Program duration: 10 years
Start Date: 2012
IRR: 0.9%
NPV: $-384,790

Assumptions
For low speed vehicles and truck conversions the following methodology is used:

- Determined average miles travelled from fuelling records
- Used EPA mpg averages
- Determined annual fuel use
- Determined marginal difference of fuel types (E85, electric, Biodiesel against BAU)
- CO_2 savings calculated from fuel use difference.

The following best management practices will support this strategy:

- Motor fleet vehicles should also be AFV/HEV/LSV. Develop policy stating that: a) vehicle selection types will be outlined by all departments; b) these will then be reviewed by FM and c) appropriate products that will then be provided for department selection. Benefit: reduces the growing number of odd and unique vehicles taxing the Motor Fleet repair teams.
- Proper AFV/HEV/LSV maintenance: Building and storage expansion needs of Motor Pool repair site and Staff must be examined, with monies earmarked to expand space.
- Create central distribution center for campus deliveries, with building deliveries provided by AFV/HEV/LSV. Recommend a Central Distribution location for large delivery vehicles nearer perimeter of campus to keep them off of infrastructure roads. Vendors will be required to secure (in partnership with Materials Management) facility; have smaller AFV, HEV, or LSV delivery systems and adhere to Campus LSV policies. A "warehouse" built by vendor/distributors could have refrigeration facilities for product normally delivered more often; dry goods storage; event storage; UPS and FedEx secure drop site for LSV distribution; Receiving and Stores operations and more.
- Routing study for all campus fleet corridors.
- Vendor use AFV/HEV/LSV on service corridors: All vendors should use AFVs vehicles, and use efficient traffic pathways around campus. Also, rather than making separate visits to campus for each service call, trips should be consolidated as much as possible.
- Encourage ride sharing for FM staff to reduce number of vehicles in use.
- Install plug-ins for electric vehicles in garages and surface lots.
- Look at LSV PATS program and do outreach to vendor/manufacturer to create campus specific LSV Shuttles with environmental features; automatic ADA lifts (in some); onboard LCD information systems, and more.

Land use/location higher density

Objective: Support and advocate for higher density/mixed use planning around the University to integrate land use and transport strategies. High density mixed use development may provide more local student employment opportunities, and reduce VMT to source goods and services, while providing greater population density for public transport.

Goal: Support and advocate for mixed use, higher density development to reduce vehicle miles travelled

Capital Cost: N/A
Annual $MTeCO_2$ savings: 1,278 (.89%)
Program duration: 20 years
Start Date: 2020
IRR: N/A
NPV: N/A

Emissions reduction based on reduced VMTs. An estimated 5% reduction of total VMT from commuters is used based on CAPCOA literature review.

Supporting best management practices:

- Increase close-in employment for students: Encourage more businesses in close proximity to campus, and those businesses to employ our students so they don't have to commute far (or be able to walk/bike/shuttle) for employment. Increase number of students who could be near campus for an employment base.
- Increase food/retail options on and near campus: Expand food on campus (keep people here at lunch time); Encourage Master Plan concept of boundary property partnership development with quality restaurants, fuel stations (accessed from both Street and Campus side), and entertainment stores like GameStop, or video stores (perhaps satellite branches of Best Buy, etc.), bike and scooter stores, sporting goods for walking shoes and products.

Trip reduction programs – Mandatory Faculty/Staff

Objective: Develop upon existing programs provided by PaTS to develop coordinated efforts to reduce the use of single occupancy vehicles and increase modal shift to other transportation options. To be effective, this should be a mandatory program geared toward faculty and staff.

Goal: Develop a mandatory trip reduction program by 2014

A mandatory trip reduction program may encompass any of the following strategies (CAPCOA & VTPI)

- Rideshare Matching.
- Parking Management and Parking Pricing.
- Alternative Scheduling (Flextime and Compressed Work Weeks).
- TDM Marketing and Promotion.
- Guaranteed Ride Home.
- Walking and Cycling Encouragement.
- Walking and Cycling Improvements.
- Bicycle Parking and Changing Facilities.
- Transit Encouragement programs.
- Provide Wayfinding and Multi-Modal Navigation Tools which provide guidance on how to reach a worksite by walking, cycling and transit.
- Worksite amenities such as on-site childcare, restaurants and shops, to reduce the need to drive for errands.
- Company travel reimbursement policies that reimburse bicycle or transit mileage for business trips when these modes are comparable in speed to driving, rather than only reimbursing automobile mileage.

- Company vehicles, to eliminate the need for employees to drive to work in order to have their cars for business travel.
- Proximate Commuting, which allows employees to shift to worksites that are closest to their home (for employers who have multiple work locations, such as banks and other large organizations).
- Special Event Transport Management, for example, to provide special employee travel services during special events, peak shopping periods, roadway construction projects or emergencies.
- Worksite locations that reflect Location-Efficient Development principles.

Capital Cost: $23,265
Annual $MTeCO_2$ savings: 316 (.23%)
Program duration: 10 years
Start Date: 2014
IRR: N/A
NPV: $-81,425

Mitigation Method:
% VMT Reduction = A * B * C
Where:
A = % shift in vehicle mode share of commute trips
B = % employees eligible
C = Adjustment from vehicle mode share to commute VMT
Detail:
A: 21% reduction in vehicle mode share based on 20% employees only being eligible

Supporting Best Management practices

- Develop sidewalks/bike paths into and within campus to discourage car use. Create campus access, making it easier for walking, biking, etc., to reduce personal vehicle use. Also create a car-free zone throughout center campus.
- Encourage/facilitate car-pooling. Develop carpooling website to coordinate carpooling with advertisement. Also, look into providing free rides to those who carpool in cases of emergency. Other campuses have done this, and it is not used very often, but accommodates faculty/staff/students who think they need more flexibility in case of emergency, late night, etc.

Alternative Work Strategies

Objective: Encourage the implementation of alternative working arrangements to reduce the need to faculty and staff to commute to campus on a daily basis.

Goal: Establish teleworking policy by 2013

Capital Cost: $0
Marginal Costs: $
Annual $MTeCO_2$ savings: 166 (.13%)
Program duration: 10 years
Start Date: 2013

Parking Management/Supply

One to five year strategies

The VPTI states that traditionally "*convenient and affordable parking are considered a sign of welcome*". This convenient and affordable parking in association with planning decisions has encouraged the growth of VMT.

Objective: Transition parking from convenient and affordable, to parking that is used efficiently, supports TDM and public transport initiatives by restricting parking availability, and price parking accordingly to encourage modal shift and reduce VMT single car occupancy.

Cash Out Parking

Objective: To financial incentivize faculty, staff and students to forgo parking on campus by providing a cash payment equivalent to parking permit.

Goal: Achieve participation rates of 90 faculty/staff and 900 students within ten years.

Moving Cooler Technical Appendices indicate that reimbursing "cash-out" participants $1/day can reduce GHG between 0.44% and 2.07% and reduce commuting VMT between 3.0% and 7.7%. The reduction in GHG varies based on how extensive the implementation of the program is. The reduction in commuting VMT differs for type of urban area. Percent Change in Commuting VMT use 3.7%

Capital Cost: $172,748
Marginal operating Cost $
Annual $MTeCO_2$ savings: 278 (.22%)
Program duration: 10 years
Start Date: 2017
IRR: N/A
NPV: $-172,748

Restrict Parking

Objective: Use circulation master plan goal to establish goal to reduce the provision of parking per student. Enrollment figures are currently used to project future parking demand. The ratio of parking spaces to student enrollment should be used to set a goal for reducing parking demand. Fewer parking spaces provided per student translate into greater use of more sustainable alternative modes of transportation. With the cost savings gained by not building large parking decks, it will be possible to significantly improve bicycle, pedestrian and transit facilities and programs at UNC Charlotte. UNC Charlotte should establish the following goals for reducing the provision of parking:

Goal: Year Parking Ratio Goal 2015: 1 parking space per 2 students = reducing current capacity by 2537 spaces.

Therefore, using the following formula to get VMT reduction: 2537 x trips per week x weeks per year x miles per trip = VMT

Capital Cost: $588,584
Annual $MTeCO_2$ savings: 1,887 (1.39%)
Program duration: 20 years
Start Date: 2017
IRR: N/A
NPV $: -588,584

Five Year + Strategies

Increase parking rates

Objective: Use price point increases to reduce demand for parking decals. It would also be necessary to implement a residential parking decal system to prevent non-resident students from parking on surrounding streets. This change will enhance shifting of mode share away from motor vehicles to more sustainable modes such as walking, bicycling, and taking transit.

Goal: Increase parking permit to $900.00 annually

Use CAPCOA formula where a $3.00 daily charge reduces VMT by 5.4%
% VMT reduction = Percentage reduction in VMT commute x percentage employees subject to priced parking

Capital Cost: $0
Annual $MTeCO_2$ savings: 978 (.67%)
Program duration: 10 years
Start Date: 2017
IRR: N/A
NPV: 0

The following BMP should be in place to support the parking program

- TDM program should be in place.
- Develop biking/walking infrastructure to support restrictive parking
- For freshmen, satellite lot parking only, with bus/shuttle access to campus. Also, residential students could be restricted to satellite lots as much of the time their car merely sits in a lot. The issue is that students may have jobs out of campus area to which they must drive.
- Institute a transit fee, added to tuition bill.
- Parking spot availability data at campus entrances and online to reduce time/emissions in search for parking
- All visitor parking to be in close proximity of campus shuttle
- Develop Contractor area in conjunction with Central Distribution. Possible rental of electric shuttles for moving staff to projects along with rental flatbeds. Cost to be included in projects

for vehicles, services, and replacement. Contract cost should go down as site work impact is greatly reduced due to volume contractor damage. Contractor and subcontractors have containers on site for storage of tools and some materials. Designed into Civil phase for access and use. Campus Architect coordination needed.

Transport Options:

Reducing VMT by single occupancy vehicle must be supported by a comprehensive TDM program, as well as increasing public/semipublic transport options. Three such options discussed below are recommended by the Task force; U-Pass, Vanpool and Expanded Shuttle

One to five year strategies

U Pass program – free or subsidized transport

Objective: Provide subsidized/free transport on CATS, RR, Light Rail and Coach Services to encourage students, faculty and staff to use alternate transport options.

Goal: Establish U-pass program by 2017

Assumptions – monthly bus pass rate of $46.00 – same as senior citizen pass = daily transit subsidy of approximately $1.50. This is to be funded by university.

According to CAPCOA, in a suburban setting a transit subsidy of $1.50 would reduce VMT by 10.9%.

Capital Cost: $232,658
Annual $MTeCO_2$ savings:-311
Program duration: 10 years
Start Date: 2017
IRR: 0
NPV: 0

Vanpool

Objective: Develop a campus van pool program, work with specialist providers and CATS to establish program.

Goal: Have at least 200 (+/-) faculty and staff enrolled in a van pool program by 2017

Assumptions
CAPCOA medium implemented van pool % mode shift x 89 percent employees available (% using car to commute) x .67 mode shift = percent VMT reduction
VMT reduction = percentage of employees participating
= number of vans needed
$1250 cost per month to operate

Capital Cost: $26,936
Annual $MTeCO_2$ savings: 444.3 (.34%)
Program duration: 8 years
Start Date: 2013
IRR: N/A
NPV: $-26,936

Expanded shuttle service

Objective: Provide students who live within a one-mile radius of campus an alternate form of transportation.

Goal: Service all student apartment complexes within one-mile radius of campus by 2013

Capital Cost: $174,493
Marginal Costs: TBD
Annual MTeCO2 savings: 113 (.09%)
Program duration: 10 years
Start Date: 2012
IRR: N/A
NPV: $-15,863

Bike programs

Public Bike Systems (PBS, also called Bike Sharing and Community Bike Programs) provide convenient rental bicycles intended for short (less than 5 kilometer), utilitarian urban trips. A typical Public Bike System consists of a fleet of bicycles, a network of automated stations (also called points) where bikes are stored, and bike redistribution and maintenance programs. Bikes may be rented at one station and returned to another. Stations with automated self-serve docking systems that accommodate 5-20 bikes are located at major destinations and transportation centers, spaced about 300m apart. Use is free or inexpensive for short periods (typically first 30 minutes). This allows urban residents and visitors to bicycle without needing to purchase, store and maintain a bike. PBS is most efficient when bikes are shared by many users each day; some systems average as many as twelve daily users per bike.

- Place at apartments
- Place at halls
- Shops

Objective: provide an infrastructure that encourages biking on campus

Goal: Have at least 5% of students use bikes for transit on and into campus by 2017.

Literature reviewed suggested that a bike sharing program as part of an overall bike program may result in a 4% VMT reduction. The following assumptions were used:
4% of VMT x 48% for students
4% of VMT x 12% for faculty and staff

48% student live within 5 miles of campus and 12% of staff/faculty live within 12 miles of campus. Literature review suggests that most successful bike share programs are utilized where cycling distances do not exceed 5 miles.
Overall bike program may consist of: VPTI reference

- Bike promotion programs
- Bicycle lanes, paths and bridges
- Effective bicycle signage and traffic signal improvements
- Connectivity between transit and cycling
- Bicycle parking and storage
- Facilities for cyclists
- Bike share program
- Mapping and educational materials

The following BMPs should be associated with a campus biking program to ensure most uptake:

- Adequate bike parking in all parts of campus: Provide more inverted U bike racks, install perpendicular to surrounding infrastructure, and cover them. Remove and replace ladder racks with inverted U bike racks. Need study on suitable locations.
- Increase usage of hidden bike parking: Provide signage to underutilized bike racks to increase usage
- Mandatory bike registration: Work with police and PaTS to administer a mandatory bike registration program
- Bike website: Add dedicated bike page to PaTS' website. UNCC Cyclists need a website to host discussions and post useful resources.
- Shared pedestrian/bike pathways: Provide separated pedestrian bike paths on congested sidewalks. The lowest cost method would be to paint the paths and provide signage. Enforcement would be a challenge but needed to make the process work effectively.
- Public bike repair stations: Several locations to provide bicyclists (both mountain and road) with location to keep their bike properly pumped and repair any minor issues.
- Bike education workshops: These involve presentations on bike related issues, such as how to repair a flat tire, how to ride alongside an automobile, what to do when involved in an accident, etc. Can be administered by UNCC Cyclists, Charlotte Area Bicycle Alliance, Charlotte DOT, NC DOT, League of American Bicyclists, etc.
- Bike sharing system: Bike sharing system consists of several check out/in stations with several bikes to travel across campus.
- Bike Master Plan: Circulation Master Plan has limited, outdated (published in 2007) bike planning so there is need for bike master plan.
- Bike Pedestrian Coordinator: Bicycle/pedestrian coordinator is needed to listen to bicycle/pedestrian related concerns and develop plans for how to resolve them.
- Sharrows on roads: ALL roads into campus that are not wide enough to install bike lanes should have sharrows installed until widening for bike lanes can occur.

Capital Cost: $58,164
Annual MTeCO2 savings: 391 (.31%)
Program duration: 20 years
Start Date: 2013
IRR: 0
NPV: $-33,791

Green Mortgages

Objective: 85% of faculty and staff live a distance of greater than 5 miles from campus, with 14% living a distance great than 13 miles from campus. Offering green mortgages to bring these faculty and staff closer to campus to reduce VMT.

Goal: 100 green mortgages should be offered. UNCC to work with banks and credit unions to get a reduced mortgage rate for such personnel.

Annual MTeCO2 savings: 310 (.21%)
Program duration: 20 years
Start Date: 2020

Energy – Mitigation Strategies

Overview

Energy use on campus, both direct and purchased, account for 60% (86,197 MT_eCO_2) of all UNC Charlotte greenhouse gas emissions. A large percentage of these emissions are on account of our purchased energy, where we have no control over generation source. Thus emissions reduction strategies are focused on behavioral changes, efficiency, on site generation, building design and use of innovative technologies.

A brief description of each mitigation strategy is given along with a goal(s) related to that strategy with estimated GHG reduction potential, cost/benefit potential and implementation duration. In addition to the mitigation strategy analysis a number of best management practices supporting the strategy are identified.

The mitigation strategies selected will potentially reduce annual emissions by 2025 of 99,864 MT_eCO_2 or 82% of 2009 baseline total emissions. Project life time GHG reductions from these strategies maybe approximately 1,727,565 MT_eCO_2

Improve Cooling Efficiency

Objective: Achieve a 10% reduction of electricity use via increasing efficiency of cooling units starting in 2013.

Goal: Employ technologies to achieve 10% savings related to cooling capacity by 2013

Capital Cost: $146,574
Marginal Costs: $2000
Annual MTeCO2 savings: 652 (.52%)
Program duration: 10 years
Start Date: 2013
IRR: 83%

NPV: $1,102,183

Atkins Library Renovations

Objective: Update heating and ventilation and air conditioning controls.

Goal: Complete upgrade by December 2011

Capital Cost: $0
Marginal Costs: $0
Grants: $469,000
Annual MTeCO2 savings: 372 (.29%)
Program duration: 25 years
Start Date: 2011
IRR: 0
NPV: $2,292,463

Performance Contract

Objective: Use CAP to support implementation of performance contract.

Goal: N/A

Capital Cost: $0
Marginal Costs: $0
Grants: $0
Annual MTeCO2 savings: 6,926 (5.62%)
Program duration: 15 years
Start Date: 2012
IRR: 0
NPV: $16,632,924

Lighting Retrofit

Objective: Increase efficiency by replacing existing fixtures with those that may provide a 30% efficiency gain. The following calculations are based on retrofitting 300,000 feet of existing space with more efficient fixtures.

Goal: Complete available retrofit of 300,000 feet of space by 2013.

Capital Cost: $20,932
Marginal Costs: $0
Grants: $0
Annual MTeCO2 savings: 319 (0.26%)
Program duration: 10 years
Start Date: 2012

IRR: 290%
NPV: $588,796

Lighting Controls Occupancy Sensors

Objective: Use technology such as occupancy sensors adjusting to room utilization, day-lighting parameters to reduce need of lighting.

Goal: Install occupancy sensors in all campus space designated as office space by 2015.

Assumptions: It is assumed that sensors will be places in all campus offices (642,933 sqft) achieving a 35% electricity savings.

Capital Cost: $44,873
Marginal Costs: $0
Grants: $0
Annual MTeCO2 savings: 798 (0.61%)
Program duration: 10 years
Start Date: 2015
IRR: 333%
NPV: $1,496,236

Shading/Tree Planting

Objective: Utilize the design process to install green roofs and vegetative walls to increase energy efficient of existing and new buildings.
Goal: Develop tree planting program for 300 trees designed for maximum thermal load reduction to existing campus building by 2012.

Capital Cost: $52,200
Marginal Costs: $0
Grants: $0
Annual MTeCO2 savings: 31 (.03%)
Program duration: 20 years
Start Date: 2012
IRR: 9.91%
NPV: $70,812

Assuming that a mature tree has an annual energy savings of 200kwh and that each tree has a purchase/plant cost of $150.00. *Source CAPPA V1.5*

Green Buildings Phase I

Objective: Enhance current green building practices, based on LEED, high performance buildings to meet the 2030 challenge by 2050:

To accomplish this, Architecture 2030 issued The 2030 Challenge asking the global architecture and building community to adopt the following targets:

- *All new buildings, developments and major renovations shall be designed to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 60% below the regional (or country) average for that building type.*

- *At a minimum, an equal amount of existing building area shall be renovated annually to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 60% of the regional (or country) average for that building type.*

- *The fossil fuel reduction standard for all new buildings and major renovations shall be increased to:*
  - *70% in 2015*
  - *80% in 2020*
  - *90% in 2025*
  - *Carbon-neutral in 2030 (using no fossil fuel GHG emitting energy to operate). These targets may be accomplished by implementing innovative sustainable design strategies, generating on-site renewable power and/or purchasing (20% maximum) renewable energy.*

Goal: Establish site energy utilization indices (kBtu/gsf) in design and construction process by end of 2012.

Marginal Capital Cost: $7,208,499
Marginal Operating Costs: $0
Grants: $0
Annual MTeCO2 savings: 16,296 (13.23%)
Program duration: 30 years
Start Date: 2012
IRR: N/A
NPV: $81,601.890

Strategic Energy Plan

Objective: Incorporate the energy savings of the annual strategic energy plan into the Climate Action Plan.

Goal: Support implementation of strategic energy plan.

Marginal Capital Cost: $0 (2012 Plan)
Marginal Operating Costs: $0
Grants: $0

Annual MTeCO2 savings: 187 (.015%)
Program duration: 10 years
Start Date: 2012
IRR: N/A
NPV: $354,145

Computer Energy Star Savings:

Objective: As part of the scheduled IT replacement program computers are upgraded to most efficient models.

Goal: Update 1000 computers by end of 3 year replacement cycle beginning 2012.

Assumption one energy star computer has annual energy savings of 201kwh

Marginal Capital Cost: $0 (2012 Plan)
Marginal Operating Costs: $0
Grants: $0
Annual MTeCO2 savings: 104 (.08%)
Program duration: 5 years
Start Date: 2012
IRR: N/A
NPV: $98,124

Behavioral Change Programs

Objective: Develop behavioral change programs resulting in the more efficient use of appliances, lighting, heating and cooling systems leading to a reducing in energy demand.

Goal: Implement program in all 19 halls of residence starting Fall semester 2013.

Program should target the following behaviors and have some feedback mechanism:

- Reducing hot water use in showers
- Thermostat control
- Efficient laundry practices
- Turning off appliances
- Residence Hall Competitions
- Rack Dryers

An assumption of a 10% reduction in energy use in halls is assumed.

Marginal Capital Cost: $221,008
Marginal Operating Costs: $0
Grants: $0
Annual MTeCO2 savings: 5,383 (4.1%)
Program duration: 10 years
Start Date: 2013

IRR: 274%
NPV: $599,831

Green Building and Renovations Phase II & III

Objective: Enhance current green building practices, based on LEED, high performance buildings to meet the 2030 challenge by 2050:

To accomplish this, Architecture 2030 issued The 2030 Challenge asking the global architecture and building community to adopt the following targets:

- *All new buildings, developments and major renovations shall be designed to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 60% below the regional (or country) average for that building type.*
- *At a minimum, an equal amount of existing building area shall be renovated annually to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 60% of the regional (or country) average for that building type.*
- *The fossil fuel reduction standard for all new buildings and major renovations shall be increased to:*
  - *70% in 2015*
  - *80% in 2020*
  - *90% in 2025*
  - *Carbon-neutral in 2030 (using no fossil fuel GHG emitting energy to operate).*
    These targets may be accomplished by implementing innovative sustainable design strategies, generating on-site renewable power and/or purchasing (20% maximum) renewable energy.

Goal: Establish site energy utilization indices (kBtu/gsf) in design and construction process by end of 2012.

Marginal Capital Cost: $7,208,499
Marginal Operating Costs: $0
Grants: $0
Annual MTeCO2 savings: 15,251 (10.36%)
Program duration: 30 years
Start Date: 2021
IRR: N/A
NPV: $78,585,843

Solar Hot Water

Objective: The objective is to begin the transition to the use of renewable energy technologies to provide localized energy production for heating hot water used in halls of residence and catering venues.

Goal: Install eight solar hot water systems on campus by 2015

Assumption 800 ft^2 Solar Hot Water Systems placed in the following locations for a total of 8 systems.

Sandford, Moore, Holshauser and Scott Halls
Student Union
South Village Catering
Prospector Catering
Hawthorne

Marginal Capital Cost: $744,504
Marginal Operating Costs: $0
Grants: $0
Annual MTeCO2 savings: 90 (.07%)
Program duration: 20 years
Start Date: 2015
IRR: n/a
NPV: $-533,390

Performance Contract Phase II

Objective: Use CAP to support implementation of performance contract.

Annual MTeCO2 savings: 6,926 (5.09%)
Program duration: 15 years
Start Date: 2017
IRR: 0
NPV: $16,970,634

Duke Energy – Green Grid

Duke Energy Carolinas has projected the carbon intensity of generated electricity through implementing the following actions:

- *"The retirement of 1.650 MWs of un-scrubbed coal and 500MWs of old fleet combustion turbines.*
- *Instillation of Cliffside Unit 6, Buck and Dan River Combined Cycle Units, nuclear uprates and combustion turbines*
- *Instillation of Lee Nuclear Station with the first unit on line in 2021 and second on line in 2023*
- *Impacts of save a watt and NC renewable energy requirements applied to entire service territory*." (source Duke Energy Carolinas)

It is estimated that these upgrades will reduce campus emissions by 13,000 MT_eCO_2 annually starting in 2020.

Solar PV

Objective: Transitions to using renewable sources of energy through installing solar PV systems on campus.

Goal: Install Solar PV 1 250kw PV system on campus by 2020.

Marginal Capital Cost: $1,712,995
Marginal Operating Costs: $0
Annual MTeCO2 savings: 163 (.11%)
Program duration: 20 years
Start Date: 2020
IRR: n/a
NPV: $-1,061,837

Geo-Thermal

Objective: As part of the renewable energy mix the use of Geo-thermal technology should investigated for deployment on campus.

Goal: install Geo Thermal unit son campus by 2020

Marginal Capital Cost: $113,881
Marginal Operating Costs: $0
Grants: $0
Annual MTeCO2 savings: 263 (.18%)
Program duration: 20 years
Start Date: 2020
IRR: 45%
NPV: $-1,205,335

Solar PV phase II

Objective: Transitions to using renewable sources of energy through installing solar PV systems on campus.

Goal: Install Solar PV 4 250kw PV system on campus by 2025.

Marginal Capital Cost: $9,979,740
Marginal Operating Costs: $0
Grants: $0
Annual MTeCO2 savings: 654 (.41%)
Program duration: 20 years
Start Date: 2025
IRR: n/a
NPV: $-6,979,740