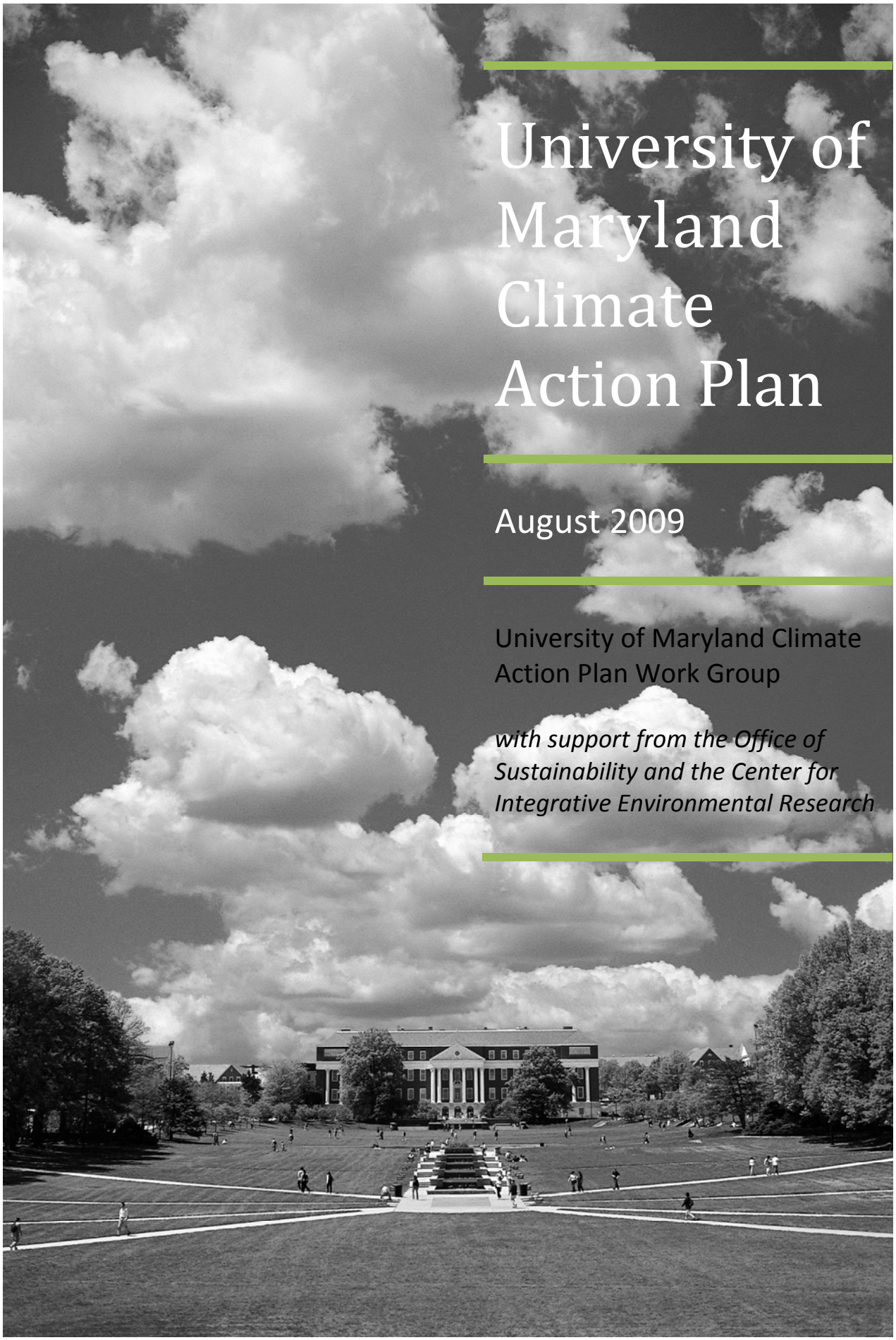

University of Maryland Climate Action Plan

August 2009

University of Maryland Climate Action Plan Work Group

with support from the Office of Sustainability and the Center for Integrative Environmental Research

August 2009

University of Maryland
Climate Action Plan

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EXECUTIVE SUMMARY

Commitment to Climate Action and Carbon Neutrality

The University of Maryland recognizes the exigency of climate change and the important role that it can play as an institution of higher learning in finding mitigation strategies to address this global challenge. As a signatory to the American College and University Presidents Climate Commitment (Presidents Climate Commitment), the University has demonstrated its commitment to addressing the issue of climate change and agreed to reduce and ultimately neutralize its greenhouse gas emissions. Carbon neutrality is defined as reducing greenhouse gas (GHG) emissions as much as possible and offsetting any remaining emissions so that net emissions to the atmosphere are zero. For additional background on climate change that motivated the University's participation in the Presidents Climate Commitment, see *Carbon Footprint of the University of Maryland, College Park: An Inventory of Greenhouse Gas Emissions (2002-2007)*.[1] While the University's actions cannot materially affect global geochemical cycles, the institution recognizes that it is responsible as a global citizen to diminish its emissions and in the process of doing so will improve its efficiency and influence its students, faculty, and staff. As part of the Presidents Climate Commitment, the University also agreed to increase research on climate change and expand the educational curriculum focused on sustainability.

The University of Maryland's Climate Action Plan (CAP) is a 40-year strategic plan for how the campus will become carbon neutral by 2050. Because of the long-term nature of the plan and the uncertainties surrounding the needed institutional, technological, and behavior changes, the plan will continue to be updated and evolve. The plan builds upon the vision and core principles for sustainability laid out in the 2001 Facilities Master Plan, the 2005 Environmental Stewardship Guidelines, and the 2008 Strategic Plan and details how the campus will reduce its GHG emissions through diverse strategies. The University has agreed to submit a Climate Action Plan to Presidents Climate Commitment organizers by September 2009, and following submission of this document, conduct greenhouse gas inventory updates every two years and milestone reporting in off years.

Campus Greenhouse Gas Inventory

In 2008, the University published a detailed inventory of its GHG emissions from FY 2002 through FY 2007. The inventory scope included emissions associated with electricity and steam consumption, fuel use, commuting, air travel, the University fleet, Shuttle-UM buses, agricultural releases, solid waste management, and fugitive refrigerant releases. In Fiscal Year (FY) 2005, the University emitted approximately 321,000 metric tons of carbon dioxide equivalents, roughly the same amount of carbon dioxide annually emitted by 54,600 cars[2] or sequestered by 96,500 acres of Maryland forest[3]. The major sources of emissions were electricity consumption, transportation, and steam use (for heating and air conditioning campus buildings). FY 2005 is used as the baseline year for the plan. The next GHG inventory will be released in Fall 2009.

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[1] http://www.cier.umd.edu/UMD_GHG_FullRpt_FY02-07.pdf.

[2] Assuming a car traveled 15,000 miles/year * 0.045 gallons/mile * 0.00871 $MTCO_2e$/gallon = 5.88 $MT\text{-}CO_2e$/year.

[3] Assuming an acre of mature trees absorbs 3.33 $MT\text{-}CO_2e$ per year (Duke University).

Climate Action Plan Development Process

Since December 2007, more than 50 students, faculty, and staff representing 35 different schools, departments, and offices have worked to devise emission reduction strategies as part of the Climate Action Plan Work Group. In addition to being focused on strategies related to the major sources of emissions, the group also explored how to integrate sustainability and climate change-related learning and problem solving into teaching and research.

No single strategy will allow the University to become carbon neutral. Instead, the University needs a diverse portfolio of strategies – including operational, technical, educational, behavioral, and financial approaches. A number of GHG reduction strategies are already being implemented, promoting greater partnership among campus departments. An important early outcome of this process is the new relationships that have already been developed and the information sharing and collaborations that are emerging from the Work Group. Cooperation and collaboration are essential in implementing a comprehensive Climate Action Plan and meeting the complex challenges of carbon neutrality.

Key Assumptions

The University is committed to being a leader in sustainability – nationally, within the State of Maryland, and within higher education. This is a natural role for a leading public research institution. Given the fundamental role that energy plays in every aspect of campus life, technical and behavioral expertise is needed to reduce energy use and determine new ways to operate. Reductions are needed from the three campus sectors that contribute the vast majority of the emissions – Power/Operations, Transportation, and Solid Waste. Fortunately, many good efforts that will contribute to emission reductions are already taking place on campus. However, the scope of the challenge to become carbon neutral necessitates a paradigm shift in how the campus operates and does business. New thinking is needed to challenge long held assumptions, policies, and practices.

The campus is charting new territory. Many of the strategies in this document are best estimates about what might be possible in the milestone years leading up to 2050. As new markets, technologies, and regulatory programs emerge, the plan must be periodically revised. Thus, the Climate Action Plan will be a living document and campus progress must be measured to guide future actions.

There are a number of policy barriers that can discourage the campus and other universities from investing in low carbon infrastructure. These include how the campus energy budget is financed through the State of Maryland (see page 24) and prescriptions in the Energy Policy Act of 2005 that govern the types of alternatively fueled vehicles that state fleets may purchase. Such barriers will need to be removed if the University is going to have the ability to aggressively invest in energy efficiency and conservation and new transportation technologies. Successfully promoting the advancement and deployment of new technologies will require leadership in the policy realm.

The profound challenges of climate change represent a tremendous opportunity for an institution with expertise in diverse disciplines that can devise strategies to address the problems posed by a warming planet. The campus will need to be aggressive, within the bounds of current budget restrictions, to effectively leverage that expertise over the near term. The campus is working toward a goal of carbon neutrality by 2050, but clear progress needs to be made much sooner.

Juxtaposed with the environmental challenges are profound economic issues that are constricting state and University resources. There is tremendous uncertainty in the future of energy prices which makes the benefit cost analysis of energy saving technologies exceedingly difficult. These factors will influence

how quickly the campus can work to reduce its carbon footprint where strategies are capital intensive or require extensive staff support.

It is assumed that the campus will continue to grow in its energy usage beyond the FY 2005 baseline, despite best energy efficiency and conservation efforts. Every effort should be made to use existing facilities more efficiently, but it is understood that growth will take place. This growth will need to be powered by 100 percent renewable energy, most likely procured from off-campus sources, so that the benefits of campus hard work to reduce emissions through energy efficiency, conservation, and behavior change are not eroded by new energy demand.

And finally, in keeping with the spirit of the Presidents Climate Commitment, this plan is not solely about strategies and actions with measureable emission reduction benefits. Part of this plan is about integrating sustainability into the lifeblood of the institution – teaching, research, and service. Efforts to educate and incentivize research will likely have strong paybacks, but they will not be quantifiable using the same calculus used to evaluate energy efficiency or renewable energy applications.

Findings

The Climate Action Plan Work Group has identified over 40 strategies, which if fully implemented, would enable the campus to achieve its goal of carbon neutrality by 2050. The Work Group and support staff have carefully articulated these strategies with the best available information, but in many cases there is great uncertainty about what will be possible ten to forty years in the future. Because of this, periodic updates to the Climate Action Plan are vital to the success of the effort and will afford much greater precision as more distant milestones come onto the horizon. Figure A. below shows how the articulated strategies would contribute to carbon neutrality by 2050, if all strategies, including carbon offsets for each sector's emissions which cannot be otherwise reduced, were implemented. The dashed line shows the University's emission reduction goals over time. In the graph, the right X-axis is flipped to show progress over time toward carbon neutrality (net emissions to the atmosphere are zero).

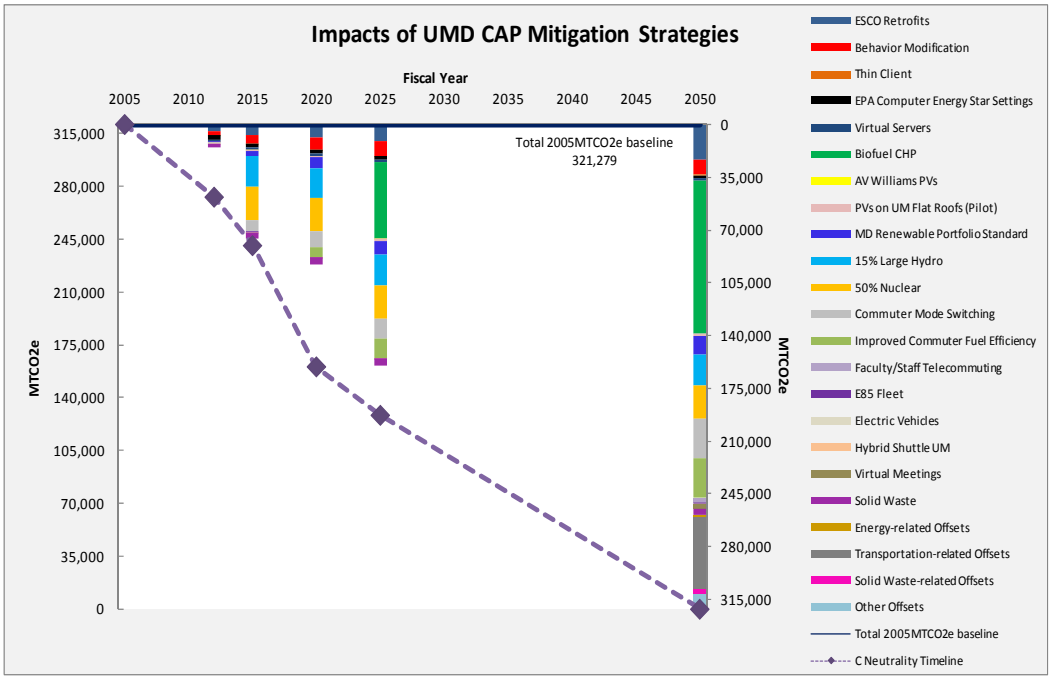

Figure A. Impacts of University of Maryland CAP Mitigation Strategies

The plan provides details about how the three campus emission "sectors" (Power/Operations, Transportation, and Solid Waste) will deliver emission reductions between 2010 and 2050. In early years, the campus is challenged to meet its milestones in some cases, and the currently envisioned strategies fall a bit short of the target. This demonstrates that updates to the plan will have to be ambitious and the campus will have to be innovative to meet these milestones.

As the biggest contributor, power and operations (60 percent of 2005 emissions) provides a host of strategies, which if implemented fully, would neutralize campus emissions from energy by 2050. It should be noted that given the unknowns associated with on-campus renewable energy applications, should these not prove viable, key targets would not be met and other approaches would be needed.

As the second largest contributor, campus transportation (34 percent of 2005 emissions) has a challenging task because much of these emissions are outside of direct University control. The University cannot control who drives to campus, their gas mileage, or how campus personnel travel for official campus business. What the University can control is the provision of options – low carbon commuting options such as Shuttle-UM, vanpools, and designated bicycle lanes on campus as well as air and ground travel alternatives such as convenient, reliable options for video conferencing.

Solid waste emissions are small (2 percent of 2005 emissions) and given the near-term ambitious waste diversion goals that have been suggested for the campus, this "sector" would outperform expectations, potentially reducing emissions more than 2.5 times the overall campus GHG reduction goal by 2015. Plans for further solid waste diversion post 2015 will need to be established.

And finally, there are "other" sources of emissions (from agriculture, refrigerants, and stationary sources) that together accounted for 3 percent of campus emissions in 2005. These emissions were not addressed in this plan given their relatively minor contribution, but they must be addressed in the future so that the campus can attain neutrality. If these emissions cannot be lowered, the plan assumes that carbon offsets would need to be purchased in 2050 to reach the campus' carbon neutrality goal.

<u>Priority Strategies for Near-term Implementation</u>

There are a number of strategies and policies that need to be implemented within the next 3 years if the campus is going to make strong progress toward carbon neutrality. The near-term priority strategies include:

Administrative Policies – Make progress on the following policies that are critical hurdles to campus efforts to reduce emissions

- Strategy 2.1 - Seek state support for "carbon neutral" new buildings through increased energy efficiency; renewable energy applications on site; and renewable energy procurement.
- Strategy 10.0 - Recognize repayment of internal loans to fund capital improvements for energy efficiency and conservation measures.
- Strategy 11.0 - Educate lawmakers about the need for state policy that supports additional capital investment for high performing, energy efficient buildings (life cycle costing).

Power and Operations

- Strategy 1.0 - Existing building retrofits, including Energy Performance Contracts (EPCs) for energy intensive buildings.
- Strategy 2.0 - Seek state support for carbon neutral new buildings through energy efficiency, renewable applications, and renewable energy procurement.

- Strategy 3.0 - Provide incentives to departmental energy users to conserve energy.
- Strategy 4.1 - Conduct a feasibility study for a biofuel powered combined heat and power plant.
- Strategy 7.0 - Procure off-site renewable energy to offset campus growth.
- Strategies 8.1 to 8.3 - Work with Office of Information Technology (OIT) and departmental IT staff to promote low-carbon computing through the promotion of hardware solutions (Thin Client and virtual servers) and behavior change (computer power settings).

Transportation

- Strategies 1.1 to 1.6 - Expand the provision of low-carbon commuting options and increase commuter utilization of these modes including Shuttle-UM, vanpools, carpools, biking, etc.
- Strategy 4.0 - Explore how video conferencing facilities could be better promoted and used as substitutes for certain types of campus business travel.
- Strategy 7.2 - Procure 12 all electric vehicles and scale up purchases as technology is tested and proven for campus needs.
- Strategy 9.0 - Explore how local sources of carbon offsets might be developed to address transportation-related emissions that the University cannot otherwise reduce.

Solid Waste

- Strategy 1.0 - Develop a campus-wide waste reduction, recycling, and composting plan by 2010 that increases the diversion of solid waste from landfills to meet the goals for the CAP.

Education and Research

- Strategy 1.1 - Make education- and research-related resources that relate to climate change, energy efficiency, and economic and environmental sustainability available to the campus.
- Strategy 2.4 A - Integrate themes of sustainability throughout various disciplines via the "Chesapeake Project," a faculty workshop designed with the Center for Teaching Excellence.
- Strategy 3.0 B - Actively consider sustainability and climate-related research and education programs (including scholarships and fellowships) in the portfolio of solicitations for donor support and alumni giving.

<u>Next Steps</u>

As the plan is implemented, the more than 40 strategies will need to be prioritized, resourced, and assigned to appropriate campus champions for further action. In many ways, one of the most important outcomes from the Climate Action Plan process has been the relationships that have been established that will foster new "low-carbon" collaborations across campus – both to implement CAP strategies and to devise approaches that have not even been conceived of yet. This human capital will be vital to the campus' success in attaining carbon neutrality and becoming a model for a green university.

The Vice President for Administrative Affairs has recommended that the President form a University Sustainability Council that would be responsible for monitoring campus progress and overseeing future updates and revisions of the Climate Action Plan. The Council would consist of senior administrators and select faculty, staff, and students, and would be supported by the Office of Sustainability. The Council would make recommendations regarding a new Campus Green Fund and would seek funding from appropriate sources to support priority climate mitigation and sustainability strategies.

CHAPTER 1. INTRODUCTION

I. BACKGROUND

The University of Maryland recognizes the exigency of climate change and the important role that it can play as an institution of higher learning in finding mitigation strategies to address this global challenge. Climate change presents a number of anticipated risks such as a rise in temperature, more extreme weather events, greater variations in annual precipitation, health impacts from extreme weather events and disease migration, and sea level rise. While the University's actions cannot materially affect global geochemical cycles, the institution recognizes that it is responsible as a global citizen to diminish its emissions and in the process of doing so will improve its efficiency and influence its students, faculty, and staff. For additional background on climate change see *Carbon Footprint of the University of Maryland, College Park: An Inventory of Greenhouse Gas Emissions (2002-2007)*.[4] For details on potential impacts in Maryland, see the Maryland Commission on Climate Change's *Comprehensive Assessment of Climate Change Impacts in Maryland,* July 2008.[5]

In 2007 President Mote signed the American College and University Presidents Climate Commitment (Presidents Climate Commitment), a coalition of colleges and universities concerned about the impacts of global warming and dedicated to reducing their institutions' greenhouse gas emissions. As a charter signatory, the University of Maryland demonstrated its commitment to addressing the issue of climate change and agreed to reduce and ultimately neutralize its greenhouse gas emissions. The ultimate goal is to operate a "carbon neutral" campus. Carbon neutrality is defined as reducing greenhouse gas emissions as much as possible and offsetting any remaining emissions so that net emissions to the atmosphere are zero.[6] As a signatory, the University agreed to increase research on climate change and expand the educational curriculum focused on sustainability. More than 640 presidents have signed the Presidents Climate Commitment and all 13 University System of Maryland institutions are participating.

The University's participation in the Presidents Climate Commitment builds upon prior campus work on sustainability and environmental stewardship, most notably in the 2001-2020 Facilities Master Plan and the 2008 Strategic Plan. These documents call for a holistic vision for how the institution operates within the region and local landscape and distinguishes itself as a recognized leader as it transforms the campus through its infrastructure, teaching, research, and service.

Facilities Master Plan

The planning committee of the 2001-2020 Facilities Master Plan established four principles to guide future development:

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[4] http://www.cier.umd.edu/UMD_GHG_FullRpt_FY02-07.pdf.

[5] http://www.mde.state.md.us/assets/document/Air/ClimateChange/Chapter2.pdf.

[6] As examples, a carbon neutral building is one that reduces energy use through energy efficiency and conservation, generates energy from renewable sources on-site, and/or purchases renewable energy. If there are operations that cannot be conducted using renewable energy sources (e.g., business travel) those activities would be offset in some way. A carbon neutral event would make use of energy efficient meeting facilities, public transportation options, low carbon catering options, and the purchase of offsets for emissions that could not otherwise be reduced.

1. Plan the built and natural environment in a way that preserves the beauty of the campus and protects the environment;
2. Reduce the number of automobiles on campus and eliminate vehicular congestion to the extent possible while promoting unimpeded pedestrian movement across the campus;
3. Reinforce the campus' role as a good neighbor in the larger community by the careful development of sites on the campus periphery or in outlying areas that link to the community; and
4. Preserve the architectural heritage of the campus and enhance it through open spaces, gathering places, vistas of green lawn and trees, and groupings of buildings that promote a sense of community.

The Facilities Master Plan notes that "these principles will determine how space is used at the University as demands for buildings and facilities increases." The connections to climate action are obvious through the transformation to a more pedestrian-friendly campus that allows unimpeded access for lower carbon transportation options such as shuttle buses, bicycles, commuter carpools, and regional mass transit. There will likely be numerous co-benefits such as creating a more appealing campus and broader community in which to live and work.

2008 Strategic Plan

The 10-year campus Strategic Plan firmly establishes sustainability as part of the mission of the institution and provides a vision for how the campus will develop sustainable practices that can be replicated at other sites. Through teaching, research, service, and the responsible use of natural resources, the University of Maryland "will be… a model for the sustainability of its environment." Steps taken toward carbon neutrality are part and parcel of that vision as are efforts to integrate sustainability into every aspect of campus operations, including the curriculum and research.

Need for a Paradigm Shift

It is important to note that full implementation of any plan to achieve carbon neutrality is going to require a fundamental rethinking of how the campus operates and does business. The use of energy and the resulting generation of carbon emissions is a ubiquitous process throughout the campus and wider society. Identifying approaches to conducting campus business in a low carbon way is a steep learning curve and there are a myriad of contributing factors and considerations, many of which the campus is only beginning to recognize and understand. Given market uncertainty, aggressively controlling energy consumption by implementing low carbon alternatives in the near term will help the University be competitive and nimble in the future, when prices may be more volatile and/or regulatory pressures may force climate action under tighter timelines and prescriptions.

Greenhouse Gas Inventory

As part of the Presidents Climate Commitment, each institution must conduct an inventory of its greenhouse gas emissions to determine the baseline from which progress will be measured. In June 2008, the University released its first inventory of campus greenhouse gas emissions. The report, entitled, *Carbon Footprint of the University of Maryland, College Park: An Inventory of Greenhouse Gas Emissions (2002-2007),* was prepared by the Center for Integrative Environmental Research (CIER) in coordination with the Office of Sustainability. The College Park campus and two of its larger satellite programs (the Maryland Fire and Rescue Institute and the Maryland Agricultural Experiment Station farms) were selected as the focus of the inventory, comprising 394 buildings and 13.2 million square feet of building space.

The inventory scope included emissions associated with electricity and steam consumption, fuel use, commuting, air travel, the University fleet, Shuttle-UM buses, agricultural releases, solid waste management, and fugitive refrigerant releases. In Fiscal Year (FY) 2005, the University emitted approximately 321,000 metric tons of carbon dioxide equivalents, roughly the same amount of carbon dioxide annually emitted by 54,600 cars[7] or sequestered by 96,500 acres of Maryland forest[8]. The major sources of emissions were electricity consumption, transportation, and steam use (for heating and air conditioning campus buildings).

Although the *Inventory of Greenhouse Gas Emissions* contains campus data through FY 2007, FY 2005 has been chosen as the campus baseline year because prior State of Maryland energy reduction requirements used FY 2005 as a baseline year. The emissions data are fairly consistent over the study period, with only modest differences among the most recent years covered by the inventory.

Table 1. Contribution of Major Emission Sources, FY 2002 – FY 2007

Major Emission Sources	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Purchased Electricity	48%	47%	25%	22%	21%	21%
UM CHP Plant	15%	16%	38%	38%	40%	41%
Transportation	32%	32%	31%	34%	34%	33%
Solid Waste	2%	2%	3%	2%	2%	2%
*Other Sources**	3%	3%	3%	3%	3%	3%
Total Emissions - $MTCO_2e$	311,212	323,501	319,869	321,279	319,073	312,953

*Agriculture, Refrigeration, Stationary sources Baseline Year

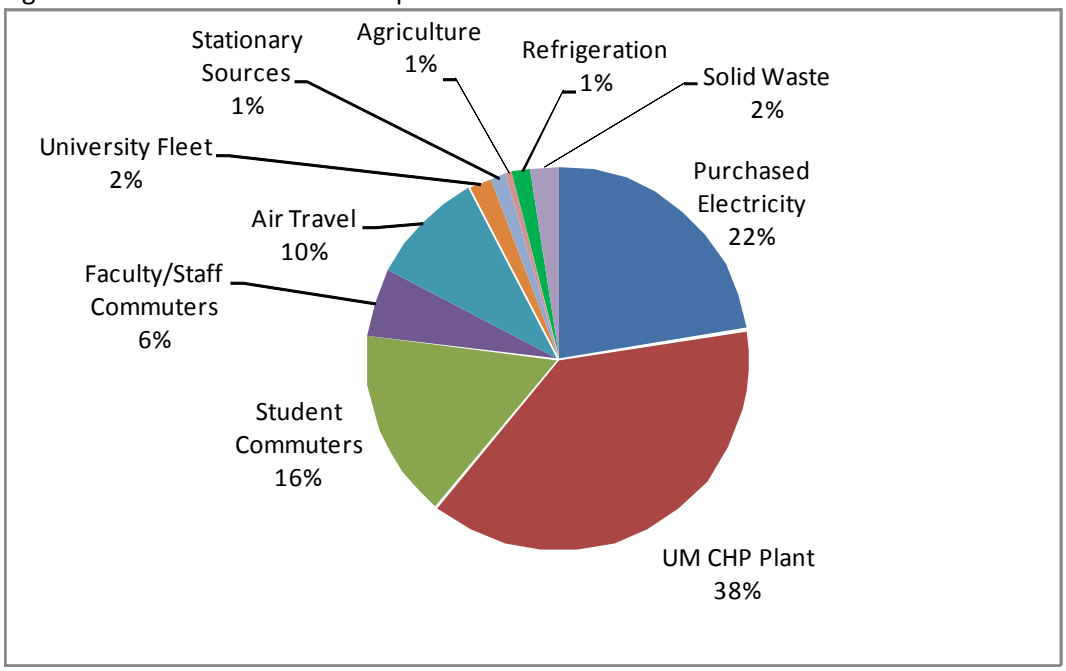
Baseline Emissions (FY 2005)

Figure 1 below provides detail on the major sources of campus emissions. The UM CHP Plant is the on-campus combined heat and power plant (CHP) that came on line in 2004. It burns natural gas, and on a limited basis, No. 2 fuel oil, to produce electricity and steam (for heating and limited air conditioning). Prior to the CHP plant, the campus only produced steam with oil-fired boilers. Transportation includes the daily commuting of the campus community (students, faculty, and staff), business air travel, and the University fleet including Shuttle-UM buses. "Other sources" includes the emissions associated with solid waste, refrigeration, and small stationary sources (e.g., emergency generators) as well as emissions associated with University farms and experiment stations (less than one percent).

It should be noted that the current inventory does not include emissions associated with land use and land use changes, and therefore the Climate Action Plan (CAP) does not address these issues. The Presidents Climate Commitment directs that participating institutions must "ensure that reductions from forest lands are real, lasting, and 'additional.'" To count against baseline emissions, land management activities have to be "additional" meaning that they otherwise would not have occurred. A student project was conducted in 2008 to quantify the carbon sequestration from current land management practices. This information will be included in the forthcoming *FY 2008 Inventory of Greenhouse Gas Emissions* and may be incorporated as appropriate in future Climate Action Plans.

[7] Assuming a car traveled 15,000 miles/year * 0.045 gallons/mile * 0.00871 $MTCO_2e$/gallon = 5.88 MT-CO_2e/year.
[8] Assuming an acre of mature trees absorbs 3.33 MT-CO_2e per year (Duke University).

Figure 1. Sources of FY 2005 Campus GHG Emissions



Total emissions over the 2002-2007 study period decreased slightly, despite campus growth, due to the installation of a combined heat and power plant, which began operating in FY 2004, and greater on- and near-campus student housing. This recent history demonstrates the return on investment for energy efficiency projects and strategies such as increased student housing and alternative modes of transportation. As this plan will highlight, there are many important co-benefits of "lower" carbon investments including reduced labor costs; improved quality of life for students, faculty, and staff; and a more vibrant campus community as community members choose to live in closer proximity to campus.

Now that the scope and sources of emissions are well understood, the campus is responding with targeted strategies to reduce them.

Climate Action Plan Development Process

Since December 2007, more than 50 students, faculty, and staff representing 35 different schools, departments, and offices have worked to devise emission reduction strategies as part of the Climate Action Plan Work Group. In addition to being focused on the major sources of emissions, the group also explored how campus education and research activities can contribute to or benefit from the pursuit of carbon emission reductions. As part of its discussions, it worked to understand how these core functions can assist in the path to carbon neutrality, be it through helping to create more carbon conscious members of the University community or via the development of cutting edge renewable energy technologies. For a list of CAP Work Group members, see Appendix II.

The strategies identified in this document represent the consensus of the Climate Action Plan Work Group and have been presented and discussed in various forums on campus including the Sustainability Speaker Series and other departmental forums within the University. The list of proposed options is neither comprehensive nor final and is subject to revisions over the years to come. Adoption and implementation of the individual strategies will be subject to the normal decision making processes of the University.

No one strategy will allow the University to become carbon neutral. Instead, the University needs a diverse portfolio of strategies – including operational, technical, educational, behavioral, and financial approaches. Many disciplines hold the expertise necessary to address this complex problem and fortunately, as a major research institution, the University has both the depth and breadth to accomplish the necessary technical innovations, as well as bring about institutional and behavioral changes. A number of GHG reduction strategies are already being implemented, promoting greater partnership among campus departments. An important outcome of this process is the new relationships that have been developed and the information sharing and collaborations that are emerging from the Work Group. Cooperation and collaboration are essential in implementing a comprehensive Climate Action Plan and meeting the complex challenges of carbon neutrality.

Presidents Climate Commitment Milestones

The following milestones are part of the Presidents Climate Commitment:

1. Within one year of signing this document, complete a comprehensive inventory of all greenhouse gas emissions (including emissions from electricity, heating, commuting, and air travel) and update the inventory every other year thereafter – *Completed July 2008*
    - *The University will conduct inventories for FY 2008 and calendar year 2009 to refine the methodology and track progress.*
2. Within two years (by September 2009), develop an institutional action plan for becoming climate neutral, which will include:
    - A target date for achieving climate neutrality as soon as possible.
    - Interim targets for goals and actions that will lead to climate neutrality.
    - 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.
    - Mechanisms for tracking progress on goals and actions.
3. Initiate two or more tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed. *In May 2007, the University selected three from the Presidents Climate Commitment's list that are now part of its sustainability portfolio[9]:*
    - *Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED[10] Silver standard or equivalent.*
    - *Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.*
    - *Participate in the Waste Minimization component of the national Recycle Mania competition, and adopt 3 or more associated measures to reduce waste.*
4. Make the action plan, inventory, and periodic progress reports publicly available by providing them to the Association for the Advancement of Sustainability in Higher Education (AASHE) for posting and dissemination.

[9] The list also included an Energy Star Procurement Policy, Air Travel Offsets, Green Power Production or Purchasing, and Climate Friendly Investing. This plan includes the first three actions later in the document.

[10] Leadership in Energy and Environmental Design.

II. APPROACH

In devising strategies for greenhouse gas emission reductions, the Climate Action Plan Work Group has taken a pragmatic, common sense approach. There was agreement from the outset that the University needed to set ambitious, yet realistic targets for emission reductions and that the campus valued hard work and innovative approaches for these reductions over "buying one's way out" through carbon offset purchases. This value is in line with the Presidents Climate Commitment methodology that directs campuses to invest in energy efficiency and conservation measures before considering carbon offset purchases for the remaining emissions. Consensus also emerged that the University should set targets for efficiency improvements and greenhouse gas emission reduction that are at least as ambitious as those set by the State of Maryland, confirming the University's leadership role within the state.

A Living Document with a 40 Year Time Horizon

The Climate Action Plan Work Group met over the course of calendar year 2008 and early 2009 to better understand campus conditions and challenges and set feasible emission reduction and programmatic goals and targets that will lead to verifiable outcomes. Although the group included senior leadership and broad campus expertise across a range of disciplines and administrative units, it was and continues to be challenging to forecast what would be achievable over the different milestone periods, particularly for strategies such as transportation and energy conservation that will likely be affected by new technologies, regulatory programs, evolving markets, and the collective behaviors of present and future members of the campus community. Given the complexity of its task, the Work Group made assumptions and devised strategies with the understanding that this long-term strategic plan of more than 40 years would need to be periodically revisited and updated to reflect changing internal and external circumstances. While it has worked diligently to draft strategies that are technically, administratively, and politically feasible , the implementation of this plan will be an iterative process of trial and error, carefully monitoring progress, and actively revising strategies and programs going forward. The Climate Action Plan is a living document that will need to be updated regularly to build upon successes and a rapidly changing nation that is now focusing on climate change and the broader issue of sustainability.

Grappling with Uncertainty

It is important to note that the Climate Action Plan is being finalized in a time of considerable financial uncertainly for the campus, the state, and the nation. Over the course of the planning process, the economy has entered into a recession. The price of energy has decreased, making a number of strategies within the plan less financially attractive, both to campus decision makers and members of the campus community. There is also regulatory uncertainty with a new national administration and questions about how federal support through the economic stimulus and new federal budget priorities and programs might assist states and higher education on their path to carbon neutrality.

While the need for clean and affordable energy and greenhouse gas reductions is unchanged, the financial crisis places additional pressures on-campus resources. Members appreciate these challenges but also see unprecedented opportunities for leadership on climate issues, particularly because efforts such as energy conservation and efficiency investments will benefit both the environment and the University's bottom line. The Work Group acknowledges the conundrum of climate action in a time of economic recession but believes it is important to set institutional sights high in order to challenge campus stakeholders to commit to this issue and devise innovative approaches to address this complex problem.

This plan lays out a long-term vision for a carbon neutral campus. Work Group discussions have been tempered by the economic recession, but the plan has largely been articulated without specific consideration of current financial challenges. Rather, the Work Group views this document as an essential input into decision making processes (financial and otherwise) that go beyond the mandate for the group.

The Need for Life Cycle Thinking

On a number of occasions, the Work Group discussed the importance of incorporating life cycle thinking into campus decision making. From an economic standpoint, this includes determining the full cost of ownership for buildings and equipment – the operating costs (e.g., energy usage, maintenance, etc.) plus the upfront capital costs – and factoring this broader perspective into design, construction, and procurement decisions. It also includes considering the environmental and social impacts of land use and procurement decisions, such as energy, water, and chemical use; air and water emissions; solid waste contributions, etc. and social impacts across the product's life cycle from cradle (extraction/ materials harvesting) to grave (end of useful life) or return to cradle (reuse and recycling). While it is understood that campus decision makers cannot conduct life cycle inventories for every product and service, Work Group members stressed the importance of incorporating life cycle thinking as part of the campus ethic to help the University move toward carbon neutrality and sustainability.

Human Resource Implications

Given the operational, technical, and behavioral changes needed to reach carbon neutrality, University faculty and staff need to be educated about the issue and motivated to develop low carbon ways of doing business. A number of initiatives are underway or planned that can support employee education and action. The Division of Student Affairs Environment Committee shares best practices across departments and Division managers include sustainability goals in staff members' annual Performance Review and Development Process (PRD) evaluations. These structures will enable Student Affairs to reduce the emissions associated with their operations and activities and could serve as a model for other campus units. The Office of Sustainability is also planning an education and behavior change program to help campus departments assess their carbon footprint and make meaningful changes.

Going forward, every employee needs to consider the carbon implications of their decisions and actions, both on the job and as they commute to campus. Administrative policies, human resource training, and outreach by campus units will help University employees excel at operating a low carbon campus. In addition, the CAP calls for the creation of key positions in information technology, transportation, and energy conservation to provide critical analysis and outreach in support of carbon neutrality. In some cases, these positions may pay for themselves through the energy savings they generate across campus.

Opportunities for Leadership through State and Federal Policy Change

In addition to the challenges posed by the current economic recession, the Climate Action Plan Work Group has uncovered a number of additional barriers in the University's path to carbon neutrality. The greatest hurdle is a lack of incentives for University investment in energy efficiency. As a state institution, the campus energy budget is established based on prior annual expenses. If the campus reduces its energy use by investing in energy efficiency or conservation measures, subsequent energy budgets will reflect this reduction. There needs to be a mechanism for recognizing the repayment of internal loans to fund capital investments for energy efficiency and conservation measures. Without such a mechanism, the University is stymied in its ability to make these vitally important and fiscally responsible investments. Such a change would benefit the entire University System of Maryland and assist these institutions in their path to carbon neutrality.

Another element of this is how capital projects are funded. Per the life cycle discussion above, campus decision makers should be able to make a case to the state for additional capital to construct high performing, energy efficient buildings. Currently there is a small premium for green building construction and design but this is too small to make the radical leap forward that is needed and possible. The University could lead this call for the incorporation of "full cost accounting" into state construction finance.

The campus could also lead by informing policy makers about how the Energy Policy Act of 1992 and 2005 limits states in making fleet procurement choices that reduce greenhouse gas emissions. The Act requires that 75 percent of "covered" University fleet purchases (non-emergency vehicles weighing less than 8,500 pounds) be "alternatively fueled vehicles[11]" but it does not require fleets to have the fueling infrastructure (so they end up burning conventional gasoline and diesel) and it does not include the full range of lower-carbon options on the market. As an example, hybrid electric vehicles are not considered to be alternatively fueled, making it difficult for the University to procure them. University and state fleets need greater flexibility to comply with the Act and emerging technologies should be readily included to help promising models gain market share.

By informing lawmakers at the state and federal levels about the adverse consequences of particular rules and regulations, the University can help shape the broader context within which it embarks on carbon neutrality. As changes to rules and regulations that stand in the way of carbon neutrality are made, the University not only will begin to improve the playing field for itself but for others in the state and nation as well.

Campus Growth

It is understood that the campus will continue to grow; the question is how the campus will expand and improve given its commitment to carbon neutrality. Energy usage has been relatively stable over the period of the *Inventory of Greenhouse Gas Emissions (FY 2002-2007)*, but this is in part due to enhancements such as the combined heat and power plant and other energy efficiency and conservation efforts which countered the effects of campus growth during this time. While economic conditions may slow campus growth in the near term, growth will occur as the University enhances its facilities, including the construction of additional residence halls, state of the art laboratories, and data centers.

Climate Action Plan Work Group members discussed how there are inherent conflicts between growth and carbon neutrality. The campus needs to tackle these issues directly, giving careful consideration to what is truly needed in terms of new facilities, where on campus they should be built, and how this can be accomplished within the framework of carbon neutrality and a green campus. One outcome of these discussions was the recommendation that the University seek state support to make all new buildings carbon neutral (See Chapter 2, Action 2.1.) Members also suggested the importance of setting campus goals that harmonize the Climate Action Plan with the Facilities Master Plan and the Strategic Plan. Further study is indicated to address this vital issue.

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[11] Methanol, ethanol, and other alcohols; blends of 85% or more of alcohol with gasoline; natural gas and liquid fuels domestically produced from natural gas; Liquefied petroleum gas (propane); coal-derived liquid fuels; hydrogen; electricity; biodiesel (B100); and fuels (other than alcohol) derived from biological materials. Source: U.S. Department of Energy, Energy Efficiency and Renewable Energy.

Given the size of FY 2005 baseline emissions that must be reduced, the campus' commitment to carbon neutrality necessitates that post 2010 growth rely on 100 percent renewable energy so that the carbon footprint of the University does not grow along with the size of the physical campus. It should be noted that only growth in electricity demand has been considered in this plan. It does not include growth in steam (for heating) or transportation- or solid waste-related emissions, due to time limitations on the development of this plan and a lack of projections upon which to base growth scenarios. As forecasts are available, subsequent versions of the Climate Action Plan should consider the implications of campus population growth in terms of the full range of campus emissions.

The plan assumes growth of 2 percent in campus electricity demand from 2010 forward (over a FY 2005 baseline) and quantifies the cost of procuring renewable energy for this increased demand:

- By 2015 – an increase of 12.5 percent over FY 2005 baseline
- By 2020 – an increase of 24.0 percent over FY 2005 baseline
- By 2025 – an increase of 37.0 percent over FY 2005 baseline
- By 2050 – an increase of 125.0 percent over FY 2005 baseline

Figure 2 shows a scenario for the emissions associated with energy growth (solid line) compared with the emission reductions called for in this plan (dashed line). This underscores that campus growth in energy demand will drive a wedge between the goal of carbon neutrality and what can be achieved with the strategies laid out in this document. Energy efficiency and conservation remain essential strategies, but to achieve carbon neutrality will require generation or purchase of renewable energy to meet the electricity demand associated with campus growth.

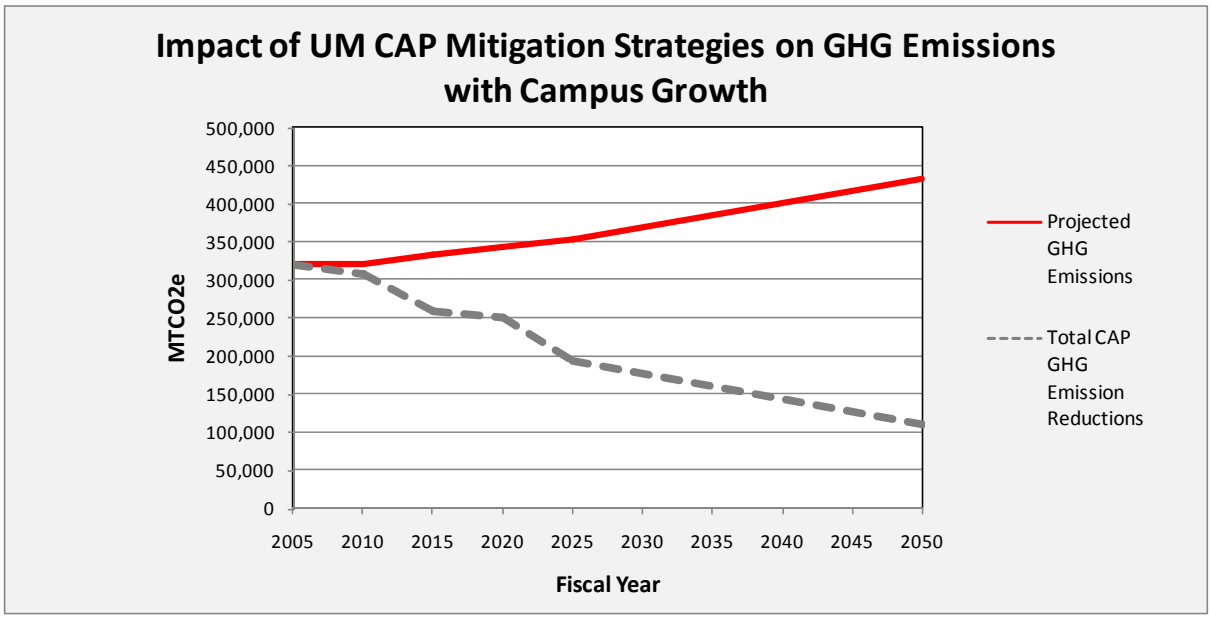

Figure 2. Impact of Energy Demand Growth on the Path to Carbon Neutrality

Timelines for Becoming Carbon Neutral

Recognizing the importance for the institution of providing climate-related leadership and action within the State of Maryland and the University System of Maryland, the Climate Action Plan Work Group agreed on 2050 as the goal year for the campus to become carbon neutral. A number of Work Group members voiced the need for this deadline to be one of last resort and the University should work to reach carbon neutrality well in advance of 2050 in order to make a lasting contribution to efforts that help prevent further environmental degradation and impacts on human populations. Student members, in particular, agreed with accelerating the emission reduction timeline. Interim goals have been laid out as well, in order to better track progress. These are listed in Table 2 below. It should be noted that the reductions listed in Table 2 are against FY 2005 baseline emissions, not growth in addition to the baseline.

Table 2. University of Maryland and State of Maryland GHG Reduction Goals

Fiscal Year	GHG Emissions (MTCO2e)	UM Reduction Goals	State of Maryland Goals
2005 (baseline)	321,279	N/A	N/A
2010	289,151	N/A	N/A
2012	273,087	15% below 2005 levels	10% below 2006 levels
2015	240,959	25% below 2005 levels	15% below 2006 levels
2020	160,640	50% below 2005 levels	25%-50% below 2006 levels
2025	128,512	60% below 2005 levels	N/A
2050	0	100% below 2005 levels	90% below 2006 levels

Again, it should be noted that some near-term goals may be more difficult to achieve, given budgetary constraints, but it is also possible that a cost conscious climate may foster efficiency improvements that result in cost savings and decrease the University's overall GHG emissions.

The plan includes dozens of strategies for completion by 2015, 2020, and 2025. It was difficult to forecast strategies more than 15 years into the future due to unknowns such as technological advances, new regulation, and whether more near-term strategies (e.g., behavior modification strategies around alternative transportation and energy conservation) will have borne fruit. As a result, most of the strategies in this plan have near-term horizons (e.g., 2010 through 2025) and 2050 has been chosen as the neutrality date with those uncertainties in mind. Future revisions to the plan should include targets for 2030, 2035, 2040, and 2045 as strategies appropriate for these milestones come into view. Additionally, the neutrality date may be achievable prior to 2050 pending successful implementation of near-term goals and the development of technological advances that enable low carbon operations (e.g., cost competitive plug in electric vehicles for fleet and commuting activities.) External factors such as regional public transportation projects (e.g., the "Purple Line") will also affect the University's trajectory towards carbon neutrality.

The Presidents Climate Commitment requires each sector – Power/Operations, Transportation, Solid Waste, and "Other" (agriculture, refrigerants, and stationary sources) – to reduce emissions to zero or to offset any emissions that cannot otherwise be reduced. This means that every sector has to be an active participant and partner. For example, the campus cannot offset transportation emissions by buying renewable energy. The purchase of renewable energy must be used to address power and operations-related emissions. Carbon offsets, however, can be used across sectors. For example, transportation emissions could be offset by investing in a fuel switching project off campus (converting a facility from

coal to natural gas to lower emissions through improved efficiency as the campus did with its own plant in 2002). In keeping with the aspirations of being a leader, the University would need to give priority to carbon off-sets that help transform – within the region, state or nation – the technologies, behaviors, institutions and infrastructures that determine carbon emissions. Ideally, the choice of projects focuses on opportunities "close to home", demonstrating that the University practices what it preaches, and presents a clear tie-in with the research and education missions of the University. Subsequent chapters of this plan discuss both of these priorities in more detail.

Collective Impact of Emission Reduction Strategies

The graphs below provide a visual summation of the collective impact of the University's emission reduction strategies if all strategies in the plan were fully implemented. These include a generic category of investments in carbon offsets for campus emissions, which functions as a placeholder for strategies that are required for carbon neutrality. From the vantage point of 2009, it is impossible to tell exactly what will be feasible in future years, so the recommended size of these offsets is highly speculative. The dashed lines show the University's emission reduction goals from Table 2 above. In the following figures, the right X-axis is flipped to show progress over time toward carbon neutrality (net emissions to the atmosphere are zero).

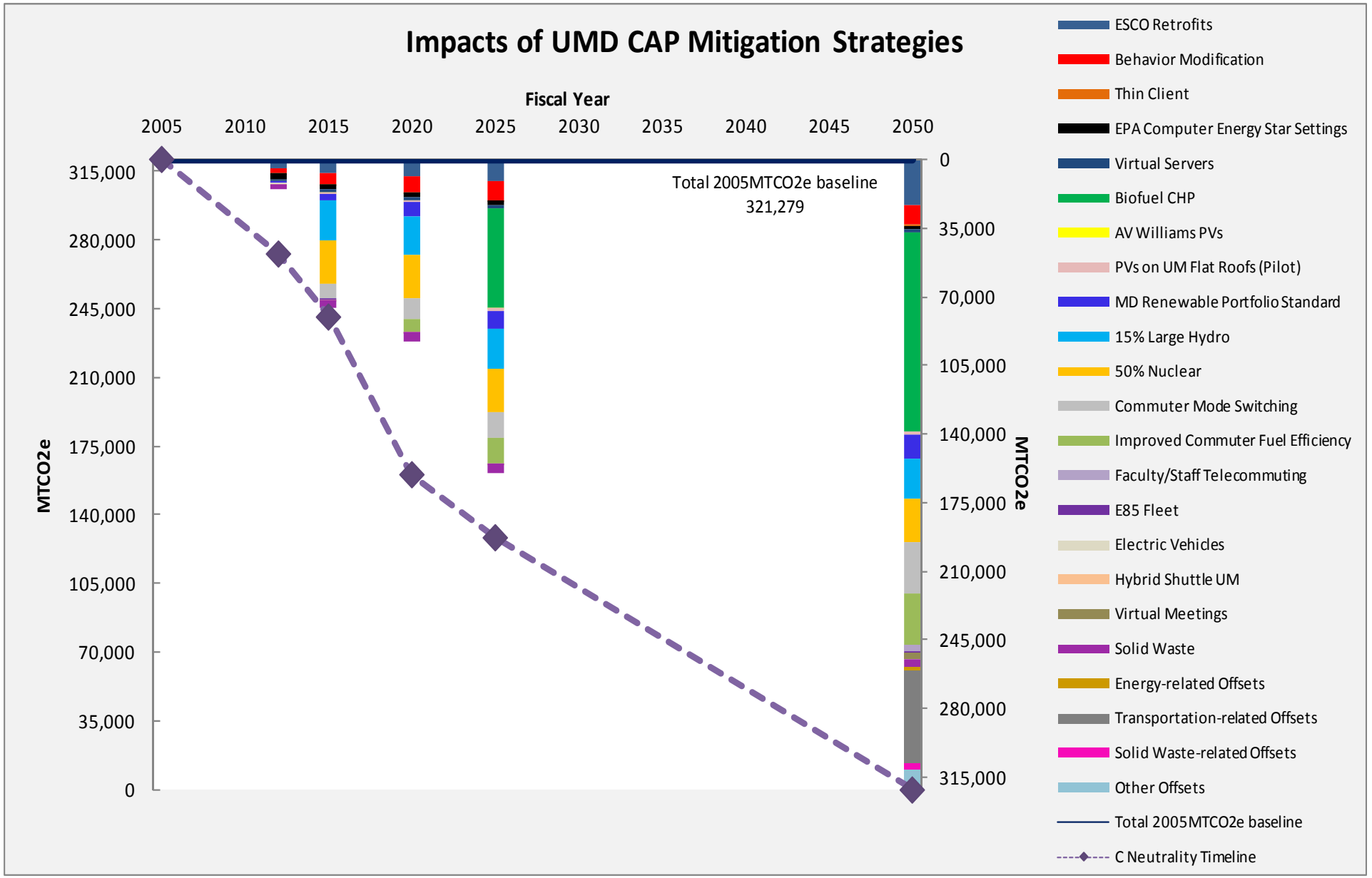

Figure 3. Impacts of University of Maryland CAP Mitigation Strategies

Because the University's emissions are primarily energy- (power and operations) and transportation-related, Figures 4 and 5 below show the cumulative effect of these sector strategies over time (assuming all outlined strategies were successfully implemented as drafted).

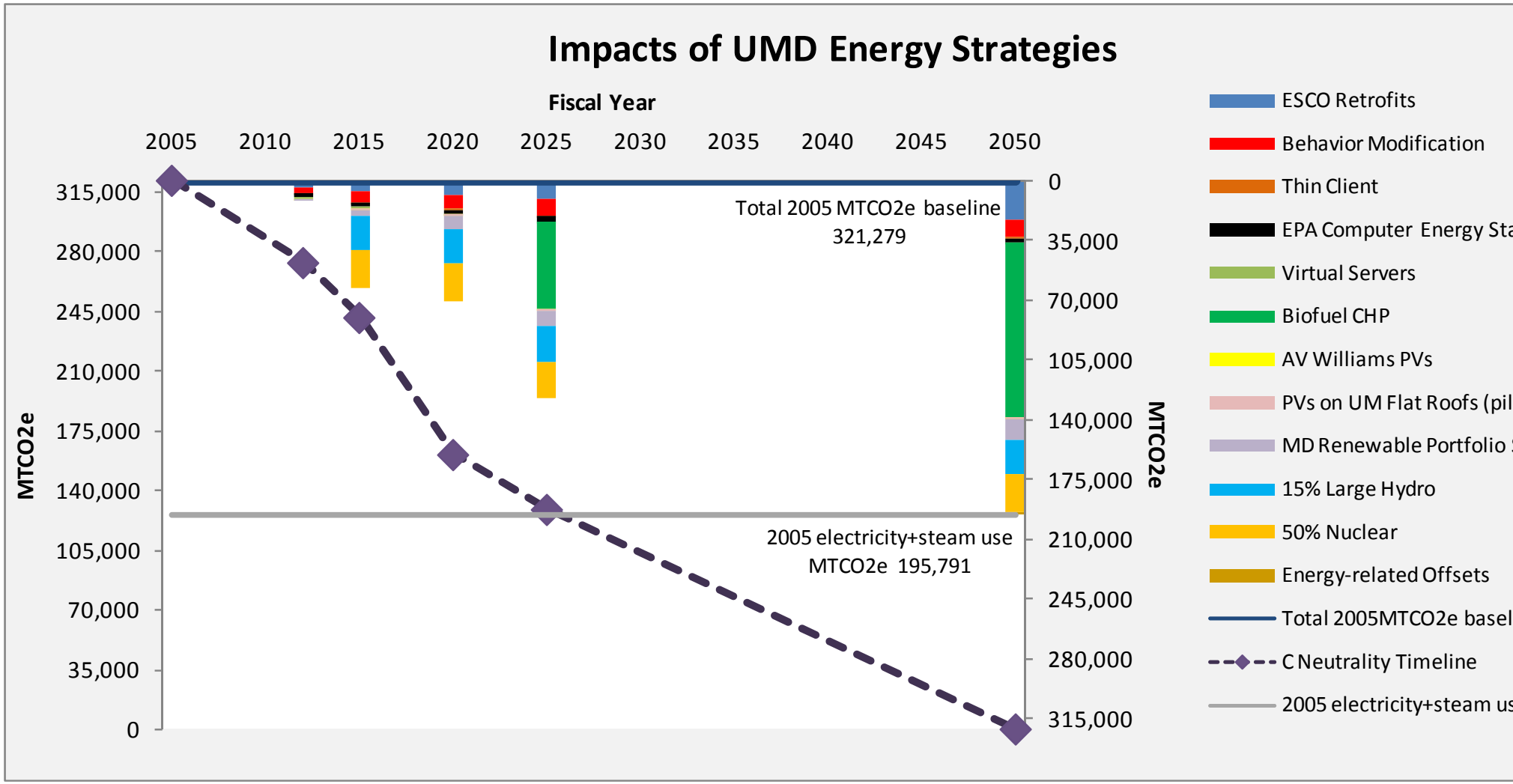

Figure 4. Impacts of University of Maryland Energy Strategies (Chapter 3)

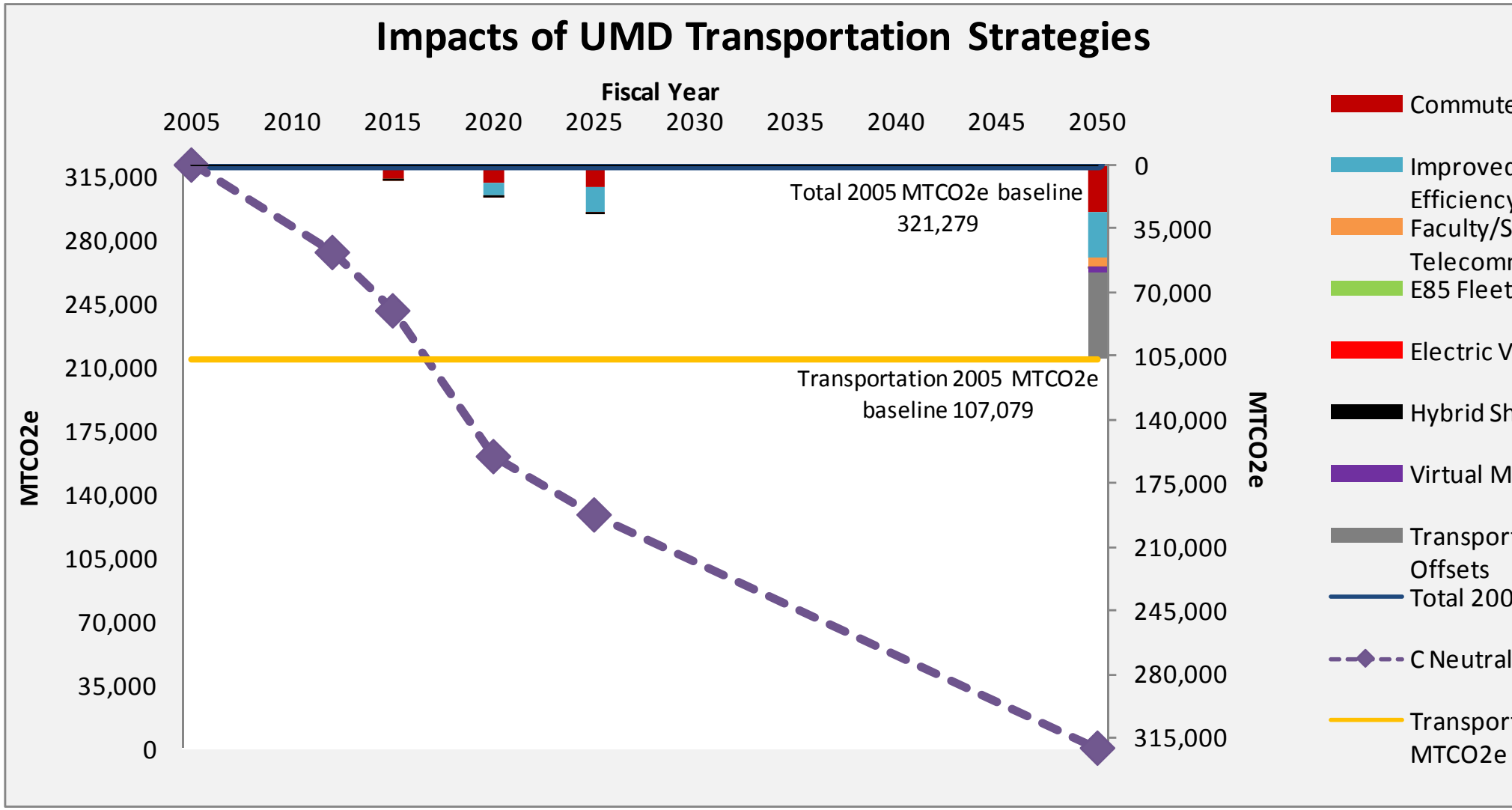

Figure 5. Impacts of University of Maryland Transportation Strategies (Chapter 4)

Tracking Progress

The next campus greenhouse gas inventory, expected in late summer 2009, will cover emissions for FY 2008. In addition to the emissions sources included in the first inventory (FY 2002-2007), this report will also include discussion of campus ecosystem services (e.g., from forests, wetlands, etc.) and their carbon contributions as sources and sinks.

The campus will report its greenhouse gas emissions on a biennial basis starting in FY 2010. These results will be carefully analyzed and new data collection and reporting protocols will make the data more accurate over time. Also, as data collection methods are refined, it is possible that additional aspects of the campus carbon footprint may be included such as emissions from procured products and services, such as food service, building materials, office supplies, etc. Methodologies for this accounting are still at an early stage but these emissions (or their avoidance through practices such as the proposed "Environmentally Preferable Procurement Policy") may be appropriate to include in future inventories.

As the Climate Action Plan Work Group finalizes its work in 2009, the University will need to determine the appropriate body to monitor campus progress and oversee the development of periodic updates to the plan. The Vice President for Administrative Affairs has proposed and the President has agreed to form a high-level University Sustainability Council that would be responsible for monitoring campus progress and overseeing future updates to the plan as well as serving as a resource and advisory body on general campus sustainability issues. The Council will consist of senior administrators and select faculty and students and would be supported by the Office of Sustainability. For further details, see Chapter 8 of this document.

Climate Action Plan Structure

The remainder of this document is structured as follows. Chapter 2 contains a discussion of Administrative Policies that may promote carbon neutrality and sustainable material and energy use practices more generally. Several of the proposals discussed here are taken up again in greater detail when presenting options for the reductions of emissions from particular sources identified in the greenhouse gas inventory. Chapters 3 through 5 focus on strategies to mitigate emissions from Power and Operations, Transportation, and Solid Waste, respectively. Chapter 6 explores the relationship between emission reduction strategies and the University's research and education missions. Chapter 7 briefly discusses strategies to support the financing of the plan, and Chapter 8 closes the report with a discussion of how progress toward carbon neutrality will be tracked and what the next steps will be toward that goal. Additional background information is available in the appendices.

CHAPTER 2. ADMINISTRATIVE POLICIES

I. BACKGROUND

Carbon neutrality requires a paradigm shift in how the campus operates. The Climate Action Plan Work Group discussed a number of near-term strategies for reducing emissions through administrative policies. These discussions focused initially on green procurement policies for a wide range of products and services. However, the group has recognized that additional campus-wide policies are needed to support institutional and individual changes that will reduce campus emissions. These include external policies such as state energy finance and requirements under the Energy Policy Act of 1992 and 2005 (discussed in Chapter 4) as well as campus policies covering carbon-neutrality requirements for new buildings, the ability to hold units accountable for the energy they consume (and provide appropriate incentives to encourage units to conserve energy), providing direction and incentives for campus units to reduce their use of petroleum-based transportation fuels, and others. There will likely be additional policies and procedures that are needed over time as the campus works toward carbon neutrality.

Due to the cross-cutting nature of these policies, they relate to a number of strategies within the Mitigation Chapters (Chapters 3, 4, and 5) as well as Education and Research (Chapter 6), and Financing the Plan (Chapter 7). Because they create an enabling environment for campus emission reductions and ultimately carbon neutrality, they are also discussed here. The specific implementation strategies that would accompany the policies are included in the following chapters.

II. APPROACH

Administrative policies are needed to support many of the Climate Action Plan strategies outlined in this document. As with any issue, in a large, decentralized organization, there is a need for alignment between the diverse actions and interests of campus units and the values, goals, and aspirations of the institution as a whole. This is particularly true with respect to how energy is used on campus.

Energy to power campus buildings – both natural gas which powers the Combined Heat and Power (CHP) Plant and provides heat and chilled water (for air conditioning) and electricity which provides lighting and air conditioning – is centrally procured by Facilities Management and distributed across campus. State-supported campus units (e.g., all of the campus except for the Division of Student Affairs and the Department of Athletics with a few exceptions) are not charged for their energy consumption other than liquid fuel receipts (e.g., gasoline and diesel) and other campus travel. Because large numbers of campus energy users do not pay for energy based on consumption, they have no concept of their usage and little incentive to conserve.

A main tenet of the policies proposed by the Climate Action Plan Work Group is to make the campus community aware of and accountable for its energy use in all forms – buildings, ground transport, air travel – and the resulting greenhouse gas emissions. Broader recognition of the environmental impacts associated with procurement decisions is also needed. As noted in Chapter 1, it is important to incorporate life cycle thinking into decision making, particularly as it relates to procurement and building design and construction, so that life cycle energy and other environmental and social impacts are minimized. This helps to ensure that campus units and their daily operations support the University's goal of carbon neutrality.

The Work Group agrees that University policy, with appropriate accountability measures and incentives, should be used to support campus adherence to the Climate Action Plan and efforts to move toward carbon neutrality. There are however differences of opinion about how prescriptive and numerous the policies should be. Some Work Group members would like to see exhortatory language put forth as campus policy, while others suggest that these policies should be mandatory where possible and will require Presidential and/or cabinet-level promotion and follow-up. Goal setting and measurement of progress are also suggested components. There are a myriad of options as to how the various policies could be implemented. One compromise approach that might satisfy a wide range of members would be a voluntary, exhortatory policy that includes campus goals and a process to monitor and report progress and refine the goals and policy over time. This progress can be monitored and reported by the Office of Sustainability via the biennial Campus Sustainability Report and annual sustainability metrics.

III. ADMINISTRATIVE POLICY PROPOSALS

Table 3. Potential Internal and External Policy Strategies for Campus Action

Strategy	Implementation Mechanism	Rationale	Other Benefits
INTERNAL POLICIES TO ASSIST THE UNIVERSITY IN ACHIEVING CARBON NEUTRALITY			
1.0 Environmentally Preferable Procurement Policy (EPP)	Draft policy developed by the Office of Procurement and Supply with input from the CAP Work Group (see Appendix III.) Policy is voluntary, however, procurement of Energy Star products (where available) is required.[12] Includes designation of an EPP resource person within Procurement. Several CAP members have suggested that the policy set goals and monitor adoption for high priority products.	• Saves money (e.g., Energy Star computers use less energy). • Reduces the environmental impact of campus operations. • Makes use of the collective purchasing power of the University and other buying "consortia" to support "green" products. • Provides internal campus education on EPP. • Encourages behavior rather than requiring something that cannot be easily enforced.	• Supports markets for EPP. • Employee environmental awareness may strengthen other campus efforts such as energy conservation. • Reduce campus solid waste as more recyclable products are procured (including products that are "taken back" by manufacturers to be recycled).
2.1 Carbon Neutral New Buildings	A policy to seek state support for "carbon neutral" new buildings through increased energy efficiency; renewable applications on site; and renewable energy procurement. (Chapter 3, Strategy 2.0) Policy might also require a certain number of LEED energy efficiency points (in addition to those required for LEED Silver) and consider operations and maintenance cost savings over a 15 year period.	• New buildings will increase the campus' carbon footprint unless designed and built carbon neutral. • New buildings can employ the latest technologies. • Engage new building occupants to consider energy implications of design requirements. • Upfront investment in energy efficiency will reduce GHG emissions and lower operating costs.	• Policy would establish the University as a campus leader in sustainability and climate action.

[12] This is one of the "Tangible Actions" identified in the Presidents Climate Commitment.

Strategy	Implementation Mechanism	Rationale	Other Benefits
2.2 Carbon Neutral Grounds and Landscaping	Begin to explore landscaping opportunities to reduce maintenance and other emissions, including mowers, leaf blowers, trucks, and other power equipment needed to maintain plants and grass. (Chapter 4, Strategy 6.0)	• Grounds keeping is energy intensive.	• Storm water quantity and quality. • Aesthetics. • Education of the campus community (visible presence on campus).
3.0 LEED Silver and Gold Cost Benefit Analysis	Once LEED Silver and Gold buildings have been built on campus (two are under construction), conduct a cost benefit analysis to determine life cycle energy costs from the different achievement levels. Clarify LEED policy as appropriate.	• Need for data on the life cycle cost implications of LEED Silver and Gold. • Clarify benefits of achievement levels to campus community.	• Educate the campus community about LEED (pros and cons).
4.0 Energy Conservation - Behavior Modification through "Departmental Energy Reports"	A policy and energy reporting mechanism that encourages campus departments to reduce their energy usage.[13] Departments that exceed or fall below their goals could receive prescribed benefits or consequences. (Chapter 3, Strategy 3.0)	• Saves money. • Departmental leadership across campus needs to understand the energy implications of their operations and decision-making. • Units should be incentivized to reduce their consumption. • Measurement is needed to hold people accountable to campus goals.	• Policy and practice would establish the University as a campus leader in sustainability and climate action. • Might influence employee and student energy usage off campus, providing additional GHG reduction benefits.
5.0 Energy Star Computer Settings	Policy that implements standard energy saving settings for University-owned computers and other equipment, as appropriate. (Chapter 3, Strategy 8.3)	• Saves money. • Since equipment users don't pay for the energy associated with use, these settings have not been a priority to them.	• Might also influence employee and student home IT-related energy use.
6.0 Telecommuting Options for Employees	Policy to support faculty /staff telecommuting as appropriate. Significant resources exist through the Telework Program of the University Libraries. (Chapter 4, Strategy 3.0)	• Certain campus jobs could be conducted remotely, thereby saving commuting time, emissions, etc.	• Business continuity and disaster preparedness. • Employee satisfaction and retention.
7.0 Direct all "vehicle" procurement inquiries to Motor Transportation Services (MTS)	Policy/communication to reinforce that departments should make use of industry research on low emission vehicles conducted by MTS by procuring vehicles through MTS. (Chapter 4, Strategy 5.0)	• By designating MTS responsible for researching industry developments on low emission vehicles and requiring depts. to filter purchases through MTS, depts. will be educated on low emission vehicles available to meet operational needs.	• Increased procurement of low emission vehicles may provide lower procurement, maintenance and fueling costs.

[13] Based on prior usage, with consideration of exogenous factors such as variation in heating and cooling degree days.

Strategy	Implementation Mechanism	Rationale	Other Benefits
8.0 Modify campus fleet policies to underscore the importance of fuel efficiency and low emission vehicles	Add language to the Department of Business Service's (DBS) Campus Fleet Policies: "Vehicle purchase requests must take into consideration the most economical, most fuel efficient, and lowest emission vehicles available in a particular model year that meet the operational needs and policy requirements of the Institution (e.g., EPAct, COMAR, etc.). In addition, the Institution must consider safety issues, federal warnings, and commercial driver's license requirements when selecting vehicles." (Chapter 4, Section II.B)	• Include the greenhouse gas implications of vehicle purchases in Fleet policies.	• Education of campus community.
9.0 Campus Petroleum Fuel Reduction Goal	Policy requiring campus units to reduce their petroleum usage – 2 percent by 2012; 5 percent by 2015 and 15 percent by 2020. (Chapter 4, Section II.B)	• Provide a goal to encourage campus units to reduce their petroleum-based fuel consumption. • Oversight and accountability will be needed to measure how each unit is meeting the goal.	• Begin to introduce emission reduction goals into thinking and practices of fleet operators and users.
EXTERNAL POLICIES TO ASSIST THE UNIVERSITY IN ACHIEVING CARBON NEUTRALITY			
10.0 Cost Savings Returned to University/State Entity	Recognize repayment of internal loans to fund capital investments for energy efficiency and conservation measures. (Chapter 3) This could also apply to savings from increased recycling on campus. Savings may be needed to invest in infrastructure and education/ outreach. (Chapter 5)	• Saves money (once loan is repaid). • Provide financial incentives for energy efficiency and conservation measures and solid waste diversion efforts.	• Leadership in support of USM carbon neutrality efforts.
11.0 Additional Capital Investment for High Performing Energy Efficient Buildings	State should provide additional capital to construct high performing, energy efficient buildings based on engineering estimates /guarantees of operations and maintenance savings over the life of the building. Currently there is a small premium provided for green building construction and design but this is too small an amount to make the radical leap forward that is needed and possible.	• Saves money over the life of the building. • University cannot afford additional up-front capital costs. • State will recoup investment through lower operating costs.	• Opportunity to provide leadership that will support USM carbon neutrality.

Strategy	Implementation Mechanism	Rationale	Other Benefits
12.0 Federal and Other Policy Flexibility	Regulations such as the Energy Policy Act of 1992 and 2005 should allow more flexibility to achieve the overall emission reductions goals intended without limiting the alternatives as more options for reaching these goals become available. (Chapter 4, Section II.B)	• University currently has difficulty purchasing hybrid electric vehicles under the Act.	

The Climate Action Plan Work Group recommends that these policies be prioritized based on their ability to create an enabling environment for carbon neutrality and sustainability on campus. This includes streamlining data sharing and reporting on projects and issues related to the plan; influencing administrative and managerial support, funding mechanisms, and campus culture; as well as emission reduction potential and cost effectiveness.

IV. SUGGESTED COMMUNICATIONS AND OUTREACH

The Climate Action Work Group recommends that marketing and outreach about new policies and procedures include the broader context for the University's work to address climate change, including its leadership role in the state and region. Where possible, policies should come from the President and Vice Presidents to connote the importance of the policy as part of the Presidents Climate Commitment and the University's Climate Action Plan.

The University needs to launch a publicity campaign letting faculty, students and staff know of its commitment to climate action and concerted efforts to reduce energy consumption in buildings and from transportation. The rationale for the campaign should be that it will save the University and state money, preserve jobs, reduce the campus' contribution to global warming, enhance its research and education missions, and establish the University as a sustainability leader.

CHAPTER 3. POWER AND OPERATIONS

I. BACKGROUND

Emissions

In 2005, campus power and operations accounted for 60 percent of campus greenhouse gas emissions. The emissions in 2005 were as follows:

Table 4. 2005 Campus Emissions from Power and Operations

Emissions Type	$MTCO_2e$	Percentage
Purchased Electricity	72,280	22%
UM CHP Plant	123,511	38%
Total Power-Related Emissions	195,791	60%
Total Campus Emissions	321,279	100%

NOTE: FY 2005 was chosen as the campus baseline because prior State of Maryland energy reduction requirements used 2005 as a baseline.

To begin to address campus emissions from power and operations, the University has chosen, upon joining the Presidents Climate Commitment, to require new buildings to be lower energy consumers through improved design and is implementing the U.S. Green Building Council's LEED Silver standard for all new construction and major renovations. Additional strategies, beyond this early action item, are discussed below.

Electricity and Power Generation

The campus is largely powered by a natural gas-fired co-generation plant with supplemental boilers that are capable of producing all the steam required for heating, 90 percent of electric power demand in winter, and about 50 percent in summer. In addition to heating space and domestic water, the plant waste heat (in the form of steam) is used in summer to produce a portion of the chilled water required for air conditioning. The plant has an expected life of 25-30 years and operates at a total energy efficiency of 65-70 percent compared to 35 percent for coal-fired generators and uses about 16 percent less fuel than typical purchased electricity.[14]

Energy Finance

Energy is a significant portion of the University budget and as energy prices rise, efficiency upgrades and conservation are necessary to keep operating costs under control. Conversely, as energy prices drop, financial opportunities may be generated to invest in more efficient technology.

[14] Biomass Combined Heat and Power Catalog of Technologies. U.S. Environmental Protection Agency. 123 pp. http://www.epa.gov/CHP/documents/biomass_chp_catalog.pdf.

Table 5. University of Maryland Campus Energy Budget, 2002-2008*

	Energy Budget**	Total Campus Operating Budget	Energy % of Total Budget
2002	$ 19,636,325	$ 1,045,282,366	**1.9%**
2003	$ 20,171,900	$ 1,155,364,083	**1.7%**
2004	$ 22,871,969	$ 1,117,741,915	**2.0%**
2005	$ 28,149,979	$ 1,114,442,484	**2.5%**
2006	$ 44,855,688	$ 1,205,199,073	**3.7%**
2007	$ 44,490,408	$ 1,277,675,064	**3.5%**
2008	$ 49,968,353	$ 1,328,117,986	**3.8%**

** As captured in the 2002-2007 UM GHG inventory (numbers reflect that scope - College Park Campus plus MFRI and farms) and FY 2008 Update*

*** Combined budget for electricity, steam and chilled water, and on-campus stationary sources (heating, cooking). The increase in 2006 is in part due to a $12M bond for the CHP. Does not include transportation energy (e.g., diesel) nor water.*

The University's ability to implement energy efficiency projects is complicated by its relationship to the State of Maryland. As a public institution, the campus energy budget is established on an annual basis and is included in the State of Maryland's budget for the University. If the campus reduces its energy use by adopting new technologies or energy conservation measures, subsequent energy budgets will reflect this reduction. An exception is self-support units (e.g., Athletics, Residential Facilities, Dining Services, etc.) that do not receive state funds and are therefore allowed to keep any energy savings they accrue. To provide some incentives for state agencies to invest in energy efficiency, the State of Maryland has developed loan programs (see Energy Performance Contracts below) that can provide capital to state agencies to undertake energy efficiency investments. This is a good option for the University, provided energy prices remain stable and sufficient state funds are made available.

Table 7 in Section III explores a number of energy efficiency and conservation strategies that could be undertaken to reduce energy costs and emissions. Because much of the University cannot realize benefits from the savings these projects will provide, typical financial metrics such as Net Present Value (NPV, a calculation of the present value of an investment's future net cash flows minus the initial investment) are not particularly helpful in capturing the value of the projects to the University. An NPV analysis of dollars expended or saved per Metric Ton Carbon Dioxide Equivalent ($MTCO_2e$) avoided is provided from the state's perspective to provide some objective metric of the discounted cash flows (costs and savings) of the investment over the life of the project. Perhaps in the future, there will be additional mechanisms (discussed above in Chapter 2) to incentivize investments that will result in more significant emission reduction and energy cost savings to the State of Maryland.

II. APPROACH

A. Overview

Given the magnitude of the campus' energy- and power-related emissions, a wide range of aggressive strategies will be needed to reduce the University's carbon footprint and work toward carbon neutrality. Most of what is currently known to be feasible will have been implemented by 2025. This does not mean that the campus will not continue to progress on its path toward carbon neutrality, rather that the plan will need to be periodically revised as new technologies come on line and new incentive mechanisms are

developed that can help the campus reduce its carbon footprint. A number of near-term strategies are outlined below and quantified in Table 7 in Section III.

Reducing Energy Demand, Planning for Growth, and Procuring Renewable Energy

Table 6 shows how conservation strategies to reduce demand coupled with renewable energy procurement (from off-campus) and on-campus production can help make the campus carbon neutral by 2050. Aggressive renewable energy procurement is done to offset campus growth and on-campus production is ramped up over time. Any new campus growth should be powered by 100 percent renewable energy to keep the campus on a path to carbon neutrality. Between 2025 and 2050, it is hoped that a biofuel powered combined heat and power (CHP) plant (whether new or a conversion of the existing plant) can come on-line to meet campus power and heat requirements in a carbon neutral way. This is an important part of the overall strategy and the campus should set a goal to increase the use of on-campus renewable energy. Given the uncertainty associated with the viability of on-campus renewable energy applications, should on-campus renewable energy not prove viable, the procurement of more renewable energy from off-campus would be needed in lieu of replacing the current CHP.

Table 6. Renewable Energy Requirements Based on Energy Efficiency/Conservation Measures and Campus Growth

	Energy Reduction Goals			Planned Campus Growth		Renewable Energy Goals (initial estimates)			
	% Target Reduction (From Empower Maryland)	MWhs Used	MW Used*	Additional MW Needed**	Total MW Required	Off-campus (MW)	On-campus (MW)	Total (MW)	% renewable (given reductions in use + growth)
2005	(Baseline)	236,520	45.00	0.00	45.00	0.00	0.00	0.00	0%
2010	10%	212,868	40.50	0.90	41.40	0.90	0.00	0.90	2%
2015	15%	201,042	38.25	5.68	43.93	5.68	1.00	6.68	15%
2020	20%	189,216	36.00	10.95	46.95	10.95	2.00	12.95	28%
2025	25%	177,390	33.75	16.78	50.53	16.78	14.50	31.28	62%
2050	(Neutrality goal)	177,390	33.75	56.35	90.10	56.35	27.00	83.35	93%

*In 2005, approx. 50% of electricity demand was met by campus CHP (22MW)

**Over 2005 baseline

Table 6 assumes 2 percent annual campus growth or the following:

- By 2015 – an increase of 12.5 percent over 2005 baseline
- By 2020 – an increase of 24.0 percent over 2005 baseline
- By 2025 – an increase of 37.0 percent over 2005 baseline
- By 2050 – an increase of 125.0 percent over 2005 baseline

State Requirements

Under the "EmPOWER Maryland" initiative, the state is targeting a reduction in per capita electricity consumption of 15 percent by the year 2015 (below 2007 levels). The University is working to reduce energy consumption 10 percent (below 2005 levels) by 2010, and proposes additional reductions of 20 percent by 2020 over 2005 levels and 25 percent below 2005 levels by 2025.

B. Strategies

1.0 Energy Performance Contracts and Existing Building Retrofits

In order to achieve energy reduction goals, the campus is relying on a number of strategies. One current effort is through Energy Performance Contracts (EPCs) provided by Energy Service Companies or ESCOS. ESCOs typically include recommended modifications to major systems including lighting; heating, ventilation and air conditioning (HVAC); building envelope; water use, etc. The cost of the recommendations will have a combined average pay back of thirteen years and can be financed through bonds issued by the State of Maryland, however the repayment of the loan shows up as indirect debt on the University's balance sheet. Given this, and recent fluctuations in energy prices (which can make the payback significantly longer than 13 years if energy prices drop) it is likely that only one ESCO was contracted in FY 2009, covering 9 energy intensive buildings. The project includes communication with building occupants and promotes energy conserving behaviors in the retrofitted spaces. Once the building retrofits are completed on the first 9 energy intensive buildings, additional building retrofits will occur.

- *University Initiated Energy Projects* - In addition to EPCs, the University has numerous on-going energy conservation and efficiency projects on campus focused on lighting; heating, ventilation and air conditioning (HVAC) upgrades; fume hoods; window replacement; etc. Continuous investment in these upgrades will yield significant cost-saving and carbon emission reductions. Self-support units are a strong supporter of these projects, as these departments can keep their energy savings.

2.0 Carbon Neutral New Construction

As discussed in Chapter 2, another cornerstone strategy for emission reductions is for the campus to adopt a policy that it will seek state support to make all new buildings "carbon neutral" through energy efficiency, renewable energy applications, and renewable energy procurement. This is in part supported by the campus' adherence to the U.S. Green Building Council's LEED Silver (or higher) rating and a state program that will provide a 2 percent construction cost premium for green buildings. Obviously, there are additional capital and operating costs that will have to be financed to make new buildings carbon neutral. It is imperative that the campus and the state take a "total cost of ownership" approach and determine mechanisms to pay for energy efficiency investments during construction that will have long-term benefits in terms of reducing energy use over the life of the building.

3.0 Energy Conservation - Behavior Modification through "Departmental Energy Reports"

As is commonly recognized, significant energy reductions can be gained through behavior modification.[15] This plan estimates that a five percent reduction in energy use (over 2005 levels) is possible by 2015 through behavior modification aimed at energy conservation, and a half percent additional reduction is possible annually beyond 2015. This estimate needs to be tested and perhaps can be increased if pilot projects prove successful. Staff support will be needed to manage the program across campus, and marketing funds will be needed. A policy should be developed that encourages campus departments to reduce their energy usage (based on prior usage, taking factors such as climate variation into account). Departments that meet or exceed their goals would receive recognition and could receive monetary or other benefits. Education and outreach will be needed to help departments

[15] Jaffe, Adam B. & Stavins, Robert N., 1994. "The energy-efficiency gap. What does it mean?" Energy Policy, Elsevier, vol. 22(10), pages 804-810, October.

understand their options for energy use reductions. To begin to develop how this might work, the Office of Sustainability (the Office) has worked with a Dingman Center for Entrepreneurship Social Ventures MBA team to explore data collection, incentives, and marketing and outreach strategies. In fall 2009, a National Wildlife Federation Campus Ecology Fellow (and current Maryland student) will be working with the Office and the Campus Energy Manager to pilot the strategy in three campus buildings.

4.0 On-Campus Renewable Energy

Currently, the University is working with the Maryland Environmental Service to evaluate the application of on-campus renewable projects. A number of projects will be needed to meet these aggressive targets with ultimate conversion of the natural gas co-generation plant to biomass. Other options include a solar demonstration array and ground source heat pumps. Campus decision makers need to carefully weigh the carbon footprints of the various fuel options to ensure that they are not trading one high carbon fuel for another. This decision needs to be based on sound science and life cycle accounting for each fuel.

5.0 Renewable Portfolio Standard (RPS)

By 2022, 20 percent of electricity supplied in Maryland must be from renewable sources. This includes Renewable Energy Certificates or RECs. There is no additional cost to the University for this lower carbon electricity.

6.0 Low Carbon Electricity

As a large institutional buyer, the University can negotiate its fuel mix with its electricity provider. It is assumed that additional large hydro and nuclear capacity can be allocated to the University at no additional cost. While this lowers the University's carbon footprint, the net effect would be to increase the carbon footprint of other energy users in the region. However, a higher demand for nuclear- and hydro-produced energy may successfully increase the development of these projects in the region.

7.0 Off-site Renewable Energy to Offset Growth

As noted previously, the University must procure off-site renewable energy to offset most of the campus growth which could be significant over the 2010-2050 time horizon given plans for additional research and computing facilities and on-campus student accommodations.

8.0 Computer System Modifications

The plan includes three major information technology (IT) related emission reduction strategies:

- *Thin Client Systems* – Work stations do not have hard drives and rely on servers for processing power. Advantages include significantly lower energy usage (both power and cooling costs), lower hardware costs, less noise, lower IT maintenance costs, and reduced vulnerability to viruses. Disadvantages can include a more limited user interface (less multimedia functionality and no ability to load personal software) and in some cases reduced speed.
- *Virtual Servers* – Virtualization software allow multiple servers to run on a single machine, reducing hardware and operating costs, including power and cooling requirements. The University has numerous servers that experience periodic loads and then remain dormant (yet still use energy despite inactivity). Similar to Thin Client Systems, there are also significant labor savings and business continuity benefits.
- *EPA Energy Star Computer Settings* – These settings program University-owned computers to power down when not in use. Proper settings can provide significant power and emission savings. Strategy includes hiring an OIT "Energy Manager" to research power saving options by machine type and technology option (free settings, software, "chips") to ensure that critical

functions such as virus protection can be carried out with machines in energy saving "sleep" modes. Manager would work with OIT and other IT staff to explore additional energy saving strategies.

9.0 Investment in Certified Carbon Offsets

In order to reach carbon neutrality, carbon offsets may need to be considered. Offsets can play an important role in reducing emissions beyond what can technically be achieved on campus. However, early use of offsets as a means to achieve carbon neutrality may take away incentives to establish a culture and technology portfolio commensurate with sustainable campus operations and may instead be perceived as choosing the "easy way out" – paying third parties to compensate for the University's lack of emission reductions. Offsets should therefore be viewed only as a last resort, to be chosen once all other options are explored.

III. EMISSION REDUCTION STRATEGIES

Table7 quantifies energy efficiency upgrades from the perspective of the State of Maryland who pays the campus' energy bills in most cases (an exception is self support units) and similarly benefits from energy savings. The sixth column, NPV, measured in $ per ton of CO_2e avoided, shows Net Present Value (a calculation of the present value of an investment's future net cash flows minus the initial investment) as a metric for project effectiveness. This number includes both costs and savings from the project to determine whether there are net savings or costs from a project. A discount rate of 5% is assumed for all calculations.

Table 7. Suggested Power and Operations Strategies for Campus Action

Power and Operations Strategies	Implementation Mechanism	Estimated Annual Energy Reduction	Potential Annual Emission reduction ($MTCO_2e$)	Potential Annual Cost to Campus	NPV ($/ $MTCO_2e$)	Other Benefits
1.0 Existing Building Retrofits	Energy Performance Contract (EPC) - 9 energy intensive buildings by 2011; additional groups of buildings will follow every 2-5 years	4,982,030 kWh and 42,107 M Btus natural gas	4,726	$20 M capital cost	$15 savings	• Save state money after loan is repaid • Campus auxiliaries keep their savings
2.0 Carbon Neutral New Construction	Increased energy efficiency; renewable applications; renewable energy procurement	None – Energy use avoidance	None – Emission avoidance	10% increase in energy costs due to purchase of RECs	TBD	• Establish green building leadership • Promote total cost of ownership • Create ethic of energy conservation
3.0 Energy Conservation - Behavior Modification	"Departmental Energy Reports" and other mechanisms to encourage units to reduce their carbon footprint – Goal of a 5% reduction of 2005 electricity use by 2015	2,617,425 kWh	1,310 annually; 5,849 by 2015 9,909 by 2025	$100K for software; $50K for staff support and marketing	$2,140 savings	• Greater awareness may translate into other behavior changes (e.g. transportation, home energy use)
4.1 On-Campus Renewable Energy	Biofuel Combined Heat and Power Plant (CHP); 12.5 MW by 2025 and 25 MW by 2050	None – fuel switching	50,965 by 2025 101,930 by 2050	$100K for feasibility study; Capital cost TBD	TBD	• Establish University as a renewable energy leader
4.2 On-Campus Renewable Energy	AV Williams Pilot – Photovoltaics to power minor ECE lab operations	6,570 kWh	3	Capital cost $36K	$330 cost	• Help promote renewable energy education and engagement among students
4.3 On-Campus Renewable Energy	Install 2 MW of photovoltaics on flat roofs	2,628,000 kWh	1,473	Capital cost $14.4 M	$300 cost	• See 3.0, 4.1, and 4.2 above
5.0 Renewable Portfolio Standard (RPS)	By 2022, 20% of campus purchased electricity will be renewable under the State of Maryland RPS	None	12,077	Embedded in energy costs	$0 (no cost)	

Power and Operations Strategies	Implementation Mechanism	Estimated Annual Energy Reduction	Potential Annual Emission reduction ($MTCO_2e$)	Potential Annual Cost to Campus	NPV ($/ $MTCO_2e$)	Other Benefits
6.0 Low Carbon Electricity	Electric procurement of 15% large hydro and 50% nuclear (from baseline of 37.5% nuclear in 2005)	None	44,255	$0	$0 (no cost)	
7.0 Off-site Renewable Energy to Offset Growth	Purchase renewable energy	None	13,336 in 2015; 33,379 in 2025 for cleaner purchased electricity	$449,737 in 2015; $720,390 in 2025	$25 cost in 2015; $10 cost in 2025	• EPA recognition as large "green power purchaser" • Support development of renewable energy markets
8.1 Computer System Modification	"Thin Client" Systems in 10% of existing campus work stations (primarily labs). Financing available through MD Energy Admin. loan program (via Energy Mgr)	432,750 kWh by 2010.	217	No cost premium compared to PCs	$269 [16] savings	• Higher reliability and longer life • No downtime for repairs for users • Business continuity benefits (files can be accessed remotely)
8.2 Computer System Modification	Virtual Servers - Virtualize 60 servers by 2010, 150 servers by 2011, and 300 servers by 2012.	2,040,000 kWh annually post 2012	991 annually post 2012	Capital cost $679K	$846 savings	• Repairs can take place during the business day (due to load balancing capabilities)
8.3 Computer System Modification	EPA Energy Star Settings on 50% of existing work stations (faculty, staff, labs) by 2011[17]	6,145,688 kWh by 2011	3,077	$94K	$189 [18] savings	
9.0 Investment in Certified Carbon Offsets	Placeholder for investments in carbon-reduction strategies not elsewhere quantified but needed to cover campus energy demand that cannot otherwise be mitigated. May be implemented, as a last resort, through procurement of offsets.	None	1,477	~$10-$20 per ton	$15 cost	• Provide incentives for broader structural change in the local community/state/region and nationally/internationally • Education of campus community • Improve community relations if offsets can be procured locally

[16] Assumes an 8-year project life; includes hardware savings and annual savings from kWh reductions. Does not include cost of incentives or reduced operating costs due to labor savings.

[17] Assumption: 15,000 computers under University control. 50% expected due to adoption of Thin Clients and computers that must stay on for remote access.

[18] Assumes 5-year project life. NPV includes $94K cost of 1 FTE (including benefits).

IV. OUTCOMES

Table 7 above includes 13 different strategies related to the power and operations of the campus. Table 8 below provides a snapshot of how the strategies, if fully implemented as described, would compare with University and State of Maryland greenhouse gas reduction goals. While complete implementation of all 13 strategies is unlikely, this table shows that CAP power and operations strategies are of an appropriate trajectory and magnitude.

Table 8. CAP Energy Strategies vs. University and State of Maryland GHG Reduction Goals

	Univ. Maryland Reduction Goals		State of Maryland Reduction Goals		University of Maryland Climate Action Plan		
Year	**Percent**	**$MTCO_2e$**	**Percent**	**$MTCO_2e$**	**Potential $MTCO_2e$ Reductions**	**% of UM Goal**	**% of State Goal**
2012	15%	29,369	10%	19,544	12,478	42%	64%
2015	25%	48,948	15%	29,315	63,205	129%	216%
2020	50%	97,895	25%*	48,859	70,625	72%	145%
2025	60%	117,474	-	-	128,274	109%	-
2050	100%	195,791	90%	175,892	195,791	100%	111%

State uses a baseline of 2006 therefore UM inventory numbers for that year are used.

* State goal is 25 to 50% by 2020

V. SUGGESTED COMMUNICATIONS AND OUTREACH

As discussed above in strategy 3.0, energy conservation through behavior modification holds great promise for reducing the campus' carbon footprint and perhaps the carbon intensiveness of campus community members lives' beyond College Park (both at home and in students' lives after graduation). The policies and programs that are developed will require extensive communications and outreach as well as support from diverse units across campus, including, but not limited to the Office of the President, the undergraduate and graduate student body, and the Divisions of Academic, Student, and Administrative Affairs.

A key next step is to identify targeted actions and practices that will have an impact through behavior modifications and methods ranging from raising awareness to competitions among dorms and colleges. The University should also launch a publicity campaign letting faculty, students, and staff know about its concerted efforts to reduce energy consumption in buildings and reduce its impact on the climate.

CHAPTER 4. TRANSPORTATION

I. BACKGROUND

Campus transportation is a significant contributor to the University's carbon footprint. In 2005, transportation accounted for 34 percent of campus emissions, as outlined in Table 9 below.

Table 9. 2005 Campus Emissions from Transportation

Emissions Type	$MTCO_2e$	Percentage
Student commuters	51,384	16%
Faculty/staff commuters	18,500	6%
Air Travel	31,209	10%
University Fleet Incl. Shuttle UM	5,985	2%
Total Trans. Emissions	107,079	34%
Total Campus Emissions	321,279	100%

NOTE: FY 2005 has been chosen as the campus baseline due to prior State of Maryland energy reduction requirements that used 2005 as a baseline year.

Upon signing the Presidents Climate Commitment, the University chose as one of its early action items to promote increased use of public transportation by faculty, staff, and students. The Department of Transportation Services (DOTS) operates Shuttle-UM, currently a fleet of 39 buses that provides on-campus, near-campus, and longer haul commuter service (i.e., "Park and Rides"). Utilization of these services by the campus community has seen triple digit growth in the past few years. The campus is also served by the Washington Metropolitan Area Transit Authority's Metro Rail and Metro Bus as well as other regional bus and rail service. The Maryland Transit Administration is currently studying a new east-west high capacity transit project known as the "Purple Line" that would further connect the campus to Montgomery and Prince George's County neighborhoods as well as the Metro rail system. This and other future public transit options will aid the campus in reducing its commuter-related greenhouse gas emissions.

The Climate Action Plan Work Group developed a number of strategies for reducing transportation-related emissions. These strategies are discussed in the following sections.

II. APPROACH

A. Faculty, Staff, and Student Commuting to Campus

Students, faculty, and staff commuters together comprised 22 percent of the campus' emissions in FY 2005. These numbers are estimated based on parking permit data from the Department of Transportation Services (DOTS). Readily available lower carbon vehicles (e.g., electric cars) and flexible alternatives to commuting in single occupancy vehicles are needed to reduce emissions associated with commuting and change established behaviors. In addition to serving students through Shuttle-UM, the University needs to provide diverse options that will help its employees lower their commuter carbon footprint.

Diverse Lower Carbon Strategies Needed

Lower carbon commuting strategies include greater use of Shuttle-UM (largely driven by the expansion of service to on- and near-campus housing but also through schedule and route enhancements of existing campus and commuter routes), carpools, van pools, walking, biking, and greater use of all public transit options. It also includes greater utilization of low carbon vehicles such as hybrid electric and electric vehicles. In order to encourage commuters to try different transit modes, the options need to be convenient, safe, reliable, and not overcrowded. Fortunately, many of these programs currently exist or are in development. Table 11 outlines each of these strategies in some detail.

In addition, more on- and near-campus housing development for undergraduate and graduate students is planned, with more than 2,300 new beds proposed for the campus by 2013 and more than 4,000 proposed for off-campus sites in close proximity to the University. These developments will provide easy access to campus via Shuttle-UM, walking, biking, and other local public transit. They will also contribute to the vibrancy of the College Park community.

Other developments, over which the University has more limited influence, include advancements in vehicle fuel economy, increases in fuel prices (which may encourage lower carbon commuting options), and broader societal changes that will stimulate carpooling and mode switching.

Impacts from Reduced Vehicles on Campus

There will likely be a number of impacts from reducing the number of cars on campus. Among these impacts is a lessening of congestion on campus, which may encourage even greater numbers of people to walk or commute by bicycle. There may be less demand for parking, which may allow certain lots or even garages to no longer be needed. This may free up land for other purposes such as buildings or recreation areas.

Another impact may be a reduction in the number of commuter parking permits sold by the Department of Transportation Services. This may mean a loss of revenue to DOTS. As a consequence, DOTS may be able to downsize its operations due to the lower volumes of parking required. It may be able to fund its operations though operating cost reductions[19] and alternative revenue streams including renting on-campus parking spaces to nearby off-campus residents.[20] Choice among these strategies (or a mix of strategies) will need to be guided by their impact on emission reductions as well as concerns about the overall development of the University's physical infrastructure, aesthetics, quality of life, and other business considerations.

Measuring the Adoption of Alternative Transportation Options

Given the challenge and expense of monitoring multiple modes of transportation to determine mode switching and the resulting emission reductions, the Climate Action Plan Work Group recommends that in the near-term, commuter parking permits be used as a proxy to track progress away from single occupancy vehicle commuting to more sustainable modes of transportation. It is recognized that this

[19] These operating cost savings have been estimated by DOTS and are included in the NPV calculations ($/MTCO$_2$e) in Table 11.

[20] This has occurred with other near-campus developments where off-campus residents obtain campus parking permits at campus resident rates (twice the cost of student commuter permits). These cars are driven infrequently on weekend errands, visits home, etc. Student weekend driving (whether on- or off-campus) is not captured in the GHG inventory.

metric is imperfect for a number of reasons. Specifically, the total number of issued commuter permits does not directly correlate to the amount of greenhouse gas emissions associated with commuting. The University does not have accurate survey data about campus commuter behavior, and therefore, use of the metric relies on a number of assumptions about commuter frequency and the average fuel economy of commuter vehicles. In addition, some people occasionally drive to campus and park at meters or use daily passes and these emissions are not included in the campus greenhouse gas inventory.

Nonetheless, using the number of issued commuter parking permits as a method of measuring progress is the most viable near-term strategy since the data is readily available and currently used to estimate commuter related emissions. Moreover, giving up one's commuter parking permit and the associated convenience signals a willingness to change one's behavior and try lower carbon modes. Thus, the milestones established by the Climate Action Plan Work Group are based on reducing commuter parking permits which are converted into an emission reduction target. The University needs better commuter frequency and vehicle data to more accurately estimate the commuter footprint. This will allow for direct computation of each individual's commuting footprint and diminish the need to use parking permits as the sole measurement tool.

Suggested milestones for reducing the commuter carbon footprint are as follows:

- By 2015 – a reduction of 3,450 commuter permits (7,659 $MTCO_2e$ annually by 2015);
- 2015-2020 – a reduction of an additional 1,200 commuter permits (an additional 2,664 $MTCO_2e$ annually by 2020, >10,323 annually post 2020);
- 2020-2025 – a reduction of an additional 1,200 commuter permits (an additional 2,664 $MTCO_2e$ annually by 2025, >12,987 annually, post 2025); and
- 2025-2050 – a reduction of an additional 6,050 commuter permits (an additional 13,431 $MTCO_2e$ annually by 2050, >26,418 annually, post 2050).

By 2050, this represents a reduction of more than one-half over current parking permit numbers.

It is important to note that from the standpoint of the campus' GHG Inventory, each University parking permit represents a 17-mile one way commute, on average. Thus an emission reduction strategy must strive to reduce the need for permits across a range of commuting distances in order to achieve an average one-way reduction of 17 miles. As the *Inventory of Greenhouse Gas Emissions* is able to better incorporate commuter behavior and more low carbon vehicles are available, the need to track commuter parking permits as a metric will diminish.

Tracking Progress

DOTS and interested campus units will work with appropriate campus stakeholders to develop, promote, manage, and track the progress of the sustainable transportation strategies outlined in Table 11 below. In addition, DOTS will work closely with CIER and the Office of Sustainability to develop, monitor, and evaluate data collection mechanisms regarding parking permit holder data used in the calculation of greenhouse gas emissions such as: the type of vehicle driven to campus, miles traveled to campus, and the number of days per week and number of weeks per year that a commuter travels to campus. Ultimately, the commuter behavior information gathered from all commuter parking permit holders (students as well as faculty and staff) will help ensure more accurate calculation of commuter-related emissions and a better means of gauging the effectiveness of the University's green commuting options.

To this end, DOTS, with assistance from CIER and the Office of Sustainability, have worked to develop a data collection system that will capture information about the vehicles driven to campus (make, model and year), commuting distance, and commuter behaviors such as the number of days per week on campus and willingness to carpool. The process to gather this data from faculty and staff is on-going and an on-line process is in place for students when they apply for a parking permit for fall 2009. Diligent monitoring of the data collected will be required to ensure that parking permit reductions correspond to desired campus emission reductions.

B. University Fleet

Background

The University of Maryland College Park Fleet is utilized for the support of the institution's academic, research, administrative and student activity missions. The fleet must be comprised of vehicles which provide for efficiency in operations and the safe transportation of personnel and equipment. University departments which heavily rely on fleet vehicles include: Business Services (Mail and Motor Transportation Services), Transportation Services, Facilities Management, Residential Facilities, Public Safety, Maryland Fire and Rescue Institute, and Environmental Safety as well as the College of Agriculture and Natural Resources. These vehicles are used for a variety of operations including University building and grounds maintenance, mail delivery, mass transportation of students and employees, crime prevention and detection, and for official University business travel within and outside the State of Maryland. The University Fleet includes approximately 987 vehicles for campus business travel. Motor Transportation Services (MTS) is responsible for reviewing proposed vehicle purchases, advising University departments on allowable vehicle specifications, and approving final requisitions for purchase prior to the submittal to the Department of Procurement and Supply.

Because of the need to securely transport personnel, tools and equipment to maintain University infrastructure, a large percentage of University vehicles are trucks and vans (e.g., to support facilities personnel, mail delivery, etc.) Given campus traffic and the relatively compact nature of the campus geography, the vast majority of campus service vehicles are driven short distances at low speeds, resulting in a low average fuel economy that does not improve substantially as older vehicles are replaced.

Energy Policy Act Requirements

In addition to rigorous performance specifications (secure transport, durability, etc.), the University fleet must comply with federal and state fleet requirements such as the Energy Policy Act of 1992 and 2005 which requires that 75 percent of "covered" University fleet purchases (non-emergency vehicles weighing less than 8,500 pounds) be alternative fuel vehicles as defined by the Act. This limits the types of purchases that can be made, but the University is committed to purchasing the most appropriate vehicles within the 75 percent requirement and striving to be innovative with the remaining 25 percent of covered vehicles, while balancing department needs and limited budgets. As noted in the Administrative Policy Section (Chapter 2), greater federal flexibility would allow the University to experiment with new technologies which currently must compete with priority institutional purchases that are not alternatively fueled. As an example, the University currently cannot buy hybrid electric vehicles under the Act, despite the fact that these vehicles perform well under the stop and go driving conditions present on campus.

No Single Solution for Fleet Improvements

Because electric vehicles and other cutting edge technologies are still in their infancy, ideal campus vehicles (economical, low emissions, durable workhorse trucks) do not readily exist. The University is actively researching, test driving, and judiciously purchasing trial vehicles. Various hurdles such as limited refueling infrastructure, funding, and the unavailability of highway speed electric vehicles also pose challenges.

Range of Strategies Needed Including Fuel Reduction Goal

There are no currently available, feasible fleet alternatives that will achieve an immediate, significant reduction in fleet carbon output, particularly given current budget constraints. The University must pursue a range of strategies, including using its current vehicles more efficiently. To encourage conservation, this plan proposes a minimum University goal of a 2 percent decrease in University petroleum-based fuel consumption by 2012, a 5 percent decrease by 2015, and 15 percent by 2020 (over 2005 levels). It will be difficult for some departments to achieve this goal. However, by establishing a goal, departments will be encouraged to seek innovative means of conducting business in a less fuel intensive way. Provided campus departments can reduce their fuel consumption by the milestones outline above, the campus would see the emission reductions outlined in Table 10.

Table 10. Proposed Campus Petroleum-based Fuel Reduction Goals

Fuel Reduction Goal	Milestone Year	$MTCO_2e$ Reduction
2%	2012	113
5%	2015	227
15%	2020	852

Other states have enacted petroleum fuel displacement goals. The State of North Carolina issued a goal in 2005 that state agencies including universities reduce petroleum-based fuel consumption 20 percent over 2005 levels by 2010. Many state universities are exceeding their targets through procurement of electric vehicles, use of E10 (10 percent ethanol) in all gasoline powered vehicles, greater use of carpooling to state meetings, use of centralized campus couriers to make timely deliveries more efficient , etc.

Recommended Change to Campus Fleet Policy

To further underscore the importance of fuel efficiency and reducing the University's carbon footprint, this plan recommends adding the following language to campus fleet policies: *"Vehicle purchase requests must take into consideration the most economical, most fuel efficient, and lowest emission vehicles available in a particular model year that meet the operational needs and policy requirements of the Institution (e.g., EPAct, COMAR, etc.). In addition, the Institution must consider safety issues, federal warnings, and commercial driver's license requirements when selecting vehicles."* Previous policy language did not include discussion of fuel efficiency and low emission vehicles.

C. Additional Strategies

In addition to the commuter-related reduction strategies (1.1 to 1.6 below) and University Fleet-related strategies (5.0 and 7.1 to 7.2), a number of additional transportation-related strategies are outlined in Table 11 below including:

- Actions to determine improvements in average fuel efficiency of commuter vehicles (Strategy 2.0)

- Telecommuting/ compressed work schedules (Strategy 3.0)
- Virtual meetings (Strategy 4.0)
- Landscaping practices – reducing the need for mowing "vehicles" and other equipment (Strategy 6.0)
- Hybrid Shuttle-UM replacement buses (Strategy 8.0)
- Transportation-related offsets to cover remaining ground transportation emissions that cannot be reduced and those from air travel (Strategy 9.0)

III. EMISSION REDUCTION STRATEGIES

The sixth column, NPV in $ per ton of CO_2e avoided, shows Net Present Value (a calculation of the present value of an investment's future net cash flows minus the initial investment) as a metric for the project's effectiveness. This number includes both costs and savings from the project to determine whether there are net savings or costs from a project. A discount rate of 5% is assumed for all calculations.

Table 11. Suggested Transportation Strategies for Campus Action

Transportation Strategies	**Targets**	**Implementation Mechanism**	**Potential Annual Emission reduction - ($MTCO_2e$)**	**Potential Annual Cost**	**NPV ($/ $MTCO_2e$)**	**Other Benefits (quantitative, qualitative)**
1.1. Increase use of public transit (non-Shuttle-UM) for commuting	250 fewer commuter permits by 2015[21]	• Increase and improve public transit marketing • Educate new hires and off-campus students about housing options accessible by public transit • Promote Metrochek (pre-tax) benefit to faculty and staff • SmarTrip University ID	111 (2010); 555[22] (2015)	$5K in marketing expenses; 10% of sustainable transportation FTE (FTE)[23] at $94K = $9,400.	$80 cost	• Reduced traffic • Enhanced quality of life • Greater utilization of WDC region's resources (internships, cultural events, etc.) by transit savvy students
1.2. Increase use of Shuttle-UM for commuting	2,250 fewer commuter permits by 2015	• More on/near-campus housing • Increase number and frequency of commuter routes • Increase Park and Rides and frequency/timing of service	955 (2010); 4,776 (2015)	$5K in marketing expenses; purchase of 10 additional buses at $500K per bus; 50% FTE.	$487 cost	• Reduced traffic • Lower commuter costs • Enhanced quality of life (ab$_i$lity to read or work while commuting)
1.3 Increase use of carpooling for	400 fewer commuter	• Provide ridesharing system that facilitates people making	178 (2010); 888 (2015)	$32K in incentives (reduced fees); $10K for carpool matching software;	$254 cost	• Reduced traffic • Lower commuter costs

[21] Strategies 1.1, 1.3, 1.4, 1.5, and 1.6 are assumed to have a 5 year project life. Strategy 1.2 has a project life of 16 years (the life of a hybrid bus). The cost of these strategies beyond 2015 has not been estimated.
[22] Emissions associated with greater public transportation utilization are outside the scope of this plan.
[23] Hired to manage and promote low carbon commuting options. Estimated that FTE will cost $75K per year plus benefits or $94K total.

Transportation Strategies	Targets	Implementation Mechanism	Potential Annual Emission reduction - ($MTCO_2e$)	Potential Annual Cost	NPV ($/ $MTCO_2e$)	Other Benefits (quantitative, qualitative)
commuting	permits by 2015	carpooling connections		$5K in marketing expenses; 10% FTE		
1.4 Increase use of vanpools for commuting	500 fewer commuter permits by 2015	• Via a contractor, develop employee-financed vanpools • Provide preferential parking	212 in Year 1; 1,058[24] post 2015	10% FTE; no additional cost unless University subsidizes vanpools.	$1 savings	• Reduced traffic • Lower commuter costs
1.5 Increase use of bicycling for commuting	115 fewer commuter permits by 2015[25]	• Provide information about bicycling (routes, bike racks on buses, shower facilities, etc.) • Develop incentives • Improve infrastructure	4.4 in Year 1; 22 post 2015	10% FTE. Cost estimates due in Spring 2009.	(TBD)	• Reduced traffic • Lower commuter costs • Growth of bicycle culture • Healthier campus
1.6 Increase use of walking for commuting[26]	675 fewer commuter permits by 2015[27]	• More on/near-campus housing • Improve cross walks and pedestrian access • Increase knowledge of options when walking isn't ideal	18 in Year 1; 89 post 2015	10% FTE.	$180 savings	• Reduced traffic • Lower commuter costs • Growth of pedestrian-friendly culture • Healthier campus

[24] This assumes (50) 10-person vanpools traveling an average of 17 miles each way to campus, 5 days per week.
[25] This assumes that bicyclists will commute 1-5 miles each way, half of each year. 115 vehicle permits that switch to bicycling (3 miles each way on average) represent approximately 10 AVERAGE commuter permits (17 miles each way) in terms of carbon emissions.
[26] Strategy piggy backs on marketing costs of previous strategies and bicycle infrastructure investments.
[27] Assumption that pedestrians will live ~1 mile from campus. So 675 vehicle permit holders that switch to walking represent 40 AVERAGE commuter permits.

Transportation Strategies	Targets	Implementation Mechanism	Potential Annual Emission reduction - ($MTCO_2e$)	Potential Annual Cost	NPV ($/ $MTCO_2e$)	Other Benefits (quantitative, qualitative)
2.0 Improve avg. fuel efficiency of commuter vehicles	Commuter vehicles at 35 mpg[28]	CAFE Standards[29] and data collection[30]. (Widespread adoption of commuter electric vehicles would provide even greater reductions.)	6,439 (2020) 12,879 (2030) 25,757 (2040)	No cost.	$0 (no cost)	• Lower commuter costs • Reduces emissions during non-commuter travel
3.0 Support faculty /staff telecommuting (one day per week on average)		• Employees can telecommute with a supervisor's permission • Provide support tools such as best practices, sample work agreements,[31] and training to facilitate implementation.	3,700	Marketing, training, and tracking costs of $20K per year over 5 years.	$5 cost	• Reduced commuting time and money • Reduced parking needed • Employee retention • Business continuity
4.0 Promote virtual meetings	TBD	Increase availability and use of existing virtual meeting facilities.[32] Develop website request form where those needing support can request use of the technology and be matched with existing on-campus resources.	TBD	Little cost unless dedicated meeting space established in OIT (to keep staffing costs low). $8-10K estimate per room for dedicated space. Coordinator/scheduler time needed plus marketing/promotion support. *Additional work is needed.*	$0 or low cost for dedicated rooms within OIT	• Increased employee productivity (given reduced travel time) • Lesser impact on employees' personal lives

[28] 25% of vehicles at 35 mpg by 2020; 50% by 2030, and 100% by 2040.
[29] Energy Independence and Security Act increased Corporate Average Fuel Economy to 35 mpg by 2020; trucks, SUVs under 10,000 pounds no longer exempt.
[30] DOTS will collect more extensive student commuter information as part of the parking permit application process including make/model of vehicle, distance traveled, and days per week on campus.
[31] University Libraries has a telework program that has been in existence since 2000. The programs website has sample work agreements, guidelines, home office check lists, etc. http://www.lib.umd.edu/PASD/LPO/telework.html#guidelines.
[32] The University currently houses seven videoconference/distance learning facilities (Joint Program for Survey Methodology, Le Frak Hall; RH Smith School of Business; Distance Education Technology & Services, Glen L. Martin Hall; Physics Building; AGNR Distance Education, Plant Sciences Bldg.; Office of Academic Support, Le Frak Hall; Office of International& Executive Program, Taliaferro Hall). These and other resources would be included in a virtual meeting clearinghouse.

Transportation Strategies	Targets	Implementation Mechanism	Potential Annual Emission reduction - ($MTCO_2e$)	Potential Annual Cost	NPV ($/ $MTCO_2e$)	Other Benefits (quantitative, qualitative)
5.0 Direct all "vehicle" procurement inquiries to MTS	All campus "motorized vehicles" incl. golf carts, riding mowers	• Policy requiring that depts. benefit from MTS research on low emission vehicles • Block P-card purchases for certain SIC codes (e.g., golf carts and other "vehicles")	TBD	No cost to campus; product research and vehicle market monitoring already conducted by MTS.	$0 (no cost)	• Campus purchasers educated about low emission options that meet specifications • Increased safety • Reduced liability
6.0 Explore how landscaping practices could reduce mowing, leaf blowing, etc.		Assess landscaping practices to determine how to reduce their carbon intensiveness. Could include maintaining taller grass or different plantings altogether such as perennial grasses, shrubs, etc.	TBD	TBD	TBD	• Pervious surfaces reduce runoff and improve water quality • Potential for cost savings (e.g., if native vegetation less costly)
7.1 Improve fuel efficiency fleet - procure alternatively fueled vehicles (AFVs)	25 percent of AFV miles driven by 2015 will utilize E85	• Continue compliance with Energy Policy Act requiring 75 percent of fleet purchases to be AFVs • Modify fleet policies to underscore importance of fuel efficiency/low emissions [33]	393[34]	No cost. AFVs are available without a cost premium and University has an E85 pump (which fuels current generation AFVs).	$0 (no cost)	• Education of campus community
7.2 Improve fuel efficiency fleet – procure alternatively fueled vehicles	Encourage zero emission all electric vehicles	• Fund 4 solar recharging stations • Procure 12 all electric vehicles in 2010 and scale up purchases as technology is tested and proven for campus needs	63	Initial investment of $35K per charging station; annual maintenance of $3,500 per charging station; per vehicle premiums of ~$11,000 over standard vehicles.	$311 cost	• Education of campus community (charging stations/vehicles are visible statement of campus commitment)

[33] See Strategy 8.0 on page 24 for specific policy language.

[34] Assumes AFVs will use E85 25 percent of the time. There are refueling challenges when vehicles travel off campus as E85 pumps are not common.

Transportation Strategies	Targets	Implementation Mechanism	Potential Annual Emission reduction - ($MTCO_2e$)	Potential Annual Cost	NPV ($/ $MTCO_2e$)	Other Benefits (quantitative, qualitative)
8.0 Improve fuel efficiency of fleet by procuring hybrid technology	Hybrid Shuttle-UM Buses	8 hybrid buses (replacements) that use 30% less fuel. FY 2010 delivery (4 buses) and 2012 (4 buses)	75 post 2012[35]	Marginal cost of hybrid buses is $220K per bus totaling $1.8 million, paid by an increase in student fees.	$987 cost	• Education of campus community • Reduction of soot, particulate matter • Reduction in maintenance costs
9.0 Investment in other carbon offset strategies	TBD	Placeholder for investments in carbon-reduction strategies not elsewhere quantified but needed to cover campus transportation emissions that cannot otherwise be mitigated. May be implemented, as a last resort, through procurement of offsets.	47,538	Potential cost depends on the specific investment option. Priced at the average value of offsets (which currently range from approximately $10-20 per ton)	$15 cost	• Provide incentives for broader structural change in the local community/state/ region and nationally/ internationally • Education of campus community • Improve community relations if offsets can be procured locally

[35] Assumes 16-year life of vehicles; buses use B5 (5 % biodiesel).

IV. OUTCOMES

Table 11 above includes 15 different strategies related to reducing the campus' transportation- related greenhouse gas emissions. It should be noted that a number of strategies such as virtual meetings and the procurement of transportation-related investments that offset carbon emissions are still being explored and discussed. Table 12 below provides a snapshot of how the strategies, if fully implemented as described, would compare with University and State of Maryland greenhouse gas reduction goals. This scenario uses the purchase of carbon offsets in 2050 as a placeholder for investment in strategies that are needed to neutralize transportation-related emissions which have not been otherwise reduced. Data points for 2015, 2020, and 2025 milestones show that while the numbers are directionally correct, greater near- and medium-term action is needed to reduce transportation-related greenhouse gas emissions in line with University and state targets. Creative and dedicated work will be needed to push emission reduction strategies as far as possible so that the remaining emissions that need to be offset are minimized.

As stated above, the calculation does not include emission reductions from virtual meetings (a promising strategy) but does include investment in carbon offsets for 48,213 $MTCO_2e$ of transportation-related emissions. Ideally, these investments take place "close to home", such as in the form of community improvements in the vicinity of the campus, or in the State of Maryland, thus demonstrating the University's commitment to the local community and the state. The bulk of this requirement for offsets is from air travel, which accounted for 10 percent of total campus emissions in 2005. The campus is exploring whether there are local or Maryland-based carbon offsets that could be procured to offset campus emissions. These offsets, while helping to neutralize campus emissions that cannot otherwise be avoided, would also provide local benefits such as jobs and perhaps the ability to improve the lives of community members (e.g., through energy efficiency upgrades for low income area homeowners who otherwise would not reduce their household GHG emissions.)

It should also be noted that innovations in person vehicles would provide a dramatic reduction in the University's transportation-related emissions and a number of promising technologies are on a path to market in the next few years.

Table 12. CAP Transportation Strategies vs. University & State of MD GHG Reduction Goals

	Univ. Maryland Reduction Goals		State of Maryland Reduction Goals		University of Maryland Climate Action Plan		
Year	**Percent**	**$MTCO_2e$**	**Percent**	**$MTCO_2e$**	**Potential $MTCO_2e$ Reductions**	**% of UM Goal**	**% of State Goal**
2015	25%	26,770	15%	16,147	8,190	31%	51%
2020	50%	53,540	25%*	26,912	17,293	32%	64%
2025	60%	64,247	-	-	26,396	41%	-
2050	100%	107,079	90%	96,883	107,079	100%	111%

State uses a baseline of 2006 therefore UM inventory numbers for that year are used.

* State goal is 25 to 50% by 2020

V. SUGGESTED COMMUNICATIONS AND OUTREACH

Many of the transportation strategies identified above are communications oriented and involve the use of established channels to better educate the campus community about low carbon transportation-related programs. They suggest a need for greater outreach and stronger partnerships among diverse campus stakeholders.

A. Suggested Communication Channels

There are a number of existing channels for communicating with the campus community about low carbon transportation options. These include:

- Department of Transportation Services (DOTS) - Transportation Coordinators, DOTS' website (Green Commuting Options page)
- Department of Business Services (DBS) – Motor Transportation Services, Travel Coordinators, the Travel Customer List, DBS' Websites
- Human Resources (HR) - New Employee Orientation, HR's website and other employee benefits outreach so transportation options are communicated to new hires and all employees
- Resident Life / Student Orientation – Welcome information for students
- Off-Campus Housing Office – Off-campus housing fair, office website
- Provost's Office – Welcome packets sent to new faculty hires
- Office of Sustainability – Website, sustainability blog (planned), features on low carbon commuters
- Campus Departments –Information provided to new hires and incoming students (particularly graduate students)
- Campus listservs – campus-wide "FYI" (sent to all faculty and staff) and "SFYI" (sent to all students)

Clearly, more partnerships and collaboration are needed to promote and incentivize the adoption of lower carbon transportation options.

B. Existing Programs

Programs whose greater visibility and promotion could help reduce the campus' transportation-related carbon footprint include:

- Metrocheck – Employees can have public transit funds deducted from their paychecks on a pre-tax basis (up to $1,320 annually). Funds are loaded onto "SmarTrip" or paper cards and can be used on Metro and Metro Bus and other regional transit options. The Work Group recommends that DOTS and Human Resources work to promote the program with the goal to increase the use of this benefit by 50 percent annually by 2015 over current usage (175 employees are currently using this benefit).
- Smart Park Carpool Program – A new "Terp Riders Carpool Program" is currently under development.
- Bundle-packs - Single use parking permits sold in packs of 10 for $40 for use when one cannot bike, carpool, or use transit to get to campus. Lack of knowledge about this option

may be keeping some commuters from giving up their permits (e.g., if commuters cannot carpool or take Shuttle-UM every day).

C. New Low Carbon Outreach and Partnerships

- Motor Transportation Services (MTS) Vehicle Fleet – MTS rents vehicles to campus departments for business travel. Through MTS, there is an opportunity to educate individuals and departments about alternative fuel vehicles, including solar and electric vehicles. DOTS should provide MTS with convenient on-campus parking spots in existing lots for rental vehicles.
- Green Travel –Encourage University Travel Agencies to develop online resources so that campus travelers are aware of "green" options for all services used during travel (hotels, airlines, ground transportation, etc.). Require University Travel Agencies to ensure that the agents serving the University are familiar with emerging airline and hotel programs and offer "green" alternatives, as reasonably available. When the next RFP for travel agency services is issued, require agencies to promote "green" services.
- Departmental Sustainability Coordinators (planned by Office of Sustainability) – similar to DOTS "Transportation Coordinators," Departmental Sustainability Coordinators would promote sustainability practices within departments and offices and could provide information about low carbon commuting and other GHG-related practices (such as energy conservation measures).

CHAPTER 5. SOLID WASTE

I. BACKGROUND

In 2005, solid waste accounted for 2 percent of campus emissions. While this is a small portion of the campus' total carbon footprint, recycling and waste minimization are an important means of raising campus awareness and support for sustainability-related initiatives. Further, the campus has been aggressive in increasing its waste minimization practices. In FY 2005 (the baseline year for this plan), the campus recycled 23 percent of the waste stream. By 2008, that percentage had grown to 48 percent (including some construction waste). 2005 baseline numbers for composting are not available as the program started in 2006, but in FY 2008, the campus diverted an impressive 230 tons of food waste from local landfills.

Table 13. 2005 Campus Solid Waste-related Emissions

Emissions Type	$MTCO_2e$	Percentage
Solid Waste	7,591	2%
Total Campus Emissions	336,869	100%

NOTE: FY 2005 has been chosen as the campus baseline due to State of Maryland energy reduction requirements that use 2005 as a baseline year.

Composting and recycling reduce landfill space and save the University money through reduced landfill tipping fees. Composting also reduces the University's carbon footprint. When solid waste decomposes under anaerobic conditions (without the presence of oxygen) in landfills, methane gas is produced. Methane (CH_4) is a greenhouse gas, with a heat trapping or global warming potential 23 times greater than carbon dioxide. By composting its food waste, the University reduces the formation of methane from its solid waste disposal.

While the University has been a leader in its solid waste practices, there is more that can be done. The Climate Action Plan Work Group discussed a number of opportunities to reduce solid-waste related emissions and environmental impacts associated with campus operations, events, and activities. As a result of those discussions, the "Feed the Turtle" recycling and composting pilot for home football games was developed and implemented in fall 2008 under the leadership of the Athletics Department.

The Climate Action Plan Work Group recommends that recycling should be readily available in all campus units and broad campus waste reduction and recycling goals are needed to encourage waste minimization and innovative practices. The recycling of construction waste is an area where the University can still affect use of additional building materials and should be emphasized in any solid waste diversion strategy, particularly given the high weight to volume nature of this material.

II. APPROACH

Reducing solid waste and implementing sustainability practices in campus activities mitigates emissions and improves campus aesthetics. Putting a "greener" touch on campus activities such as athletic events, conferences, and performances also showcases Maryland's sustainability efforts to the larger community.

The Climate Action Plan Work Group, in coordination with the Maryland Recycling Act (MRA) provisions, proposes ambitious yet attainable goals for reducing waste generation and diverting a greater percentage of campus waste through increased recycling and composting efforts on campus. Specifically, the Work Group proposes that the University reduce and/or divert 60 percent by 2010 and 75 percent by 2013 of the campus solid waste stream from disposal. These reductions should be based on the quantity of solid waste generated in 2005 (baseline year).

To achieve these goals, the University will implement a campus-wide waste reduction, recycling, and composting plan by 2010, reduce the amount of disposable food and drink products (non-recyclable and non-compostable) sold on campus (efforts are already underway in Dining Services through a switch to compostable carry-out containers), and develop a green products and services option for all contracted campus events. In addition to the recommended waste reduction and diversion goals, the Climate Action Plan Work Group also recommends the development of a campus-wide marketing and communication plan for the University's sustainability initiatives.

As with all emission reduction strategies, it is important to be clear about the assumptions made in calculating the reductions. The following are several assumptions involved in calculating emission reductions due to increasing recycling on campus:

1. *The solid waste stream is static at 2005 levels. All reduction strategies refer to decreasing waste amounts by a percentage of 2005 levels.*
2. *Increases in recycling, composting and reuse yield equivalent reductions in solid waste disposal.*

   The current emission reduction calculation assumes that an increase in the quantity of recycling will correspond to an equal decrease in the volume of waste.
3. *How the University's solid waste is disposed of will remain constant over time and reductions in solid waste will lead to emission reductions.*

   Facilities Management sends part of the campus' solid waste to a gas-flaring landfill and part to one that does not use flaring. This decision is based on which landfill is accepting waste on a given day, not the practices of the two nearby landfills that the campus uses. More waste in recent years has gone to the non-flaring landfill, which results in higher GHG emissions. Depending on how this trend changes in coming years, the carbon-intensity of the University's waste could change.
4. *Beyond transportation-related emissions, the recycling option does not create any emissions.*

   The process of recycling used goods requires energy for transportation and processing. The University's carbon calculator can currently calculate transportation-related emissions but processing-related emissions are outside the current scope. If this type of information can be included in future calculations, the true emissions savings from recycling can be better captured.

III. EMISSION REDUCTION STRATEGIES

Table 14. Suggested Solid Waste Strategies for Campus Action

Strategies	Implementation Mechanism	Potential Emission reduction – Annual $MTCO_2e$	Potential Annual Savings and Costs (over 2005 baseline)	NPV ($/$MTCO_2$)	Other Benefits (quantitative, qualitative)
1.0 Reduce solid waste	Increase campus-wide recycling, composting, and material reuse efforts to increase the total quantity of solid waste diverted from disposal facilities: 60% by 2010 and 75% by 2013 (over 2005 levels).	2,946 (2010) 4,440 (2013)	Annual savings 2010 - $210K 2013 - $307K Annual costs $115K per year for 5 years for labor and infrastructure	$71 savings	• Increases awareness of campus sustainability • Reduces campus' hauling costs
2.0 Investment in other carbon offset strategies	Placeholder for investments in carbon-reduction strategies not elsewhere quantified but needed to cover campus solid waste emissions that cannot otherwise be mitigated. May be implemented, as a last resort, through procurement of offsets.	3,151	~$10-20 per ton cost	$15 cost	• Provide incentives for broader structural change in the local community/state/region and nationally/ internationally • Education of campus community • Improve community relations if offsets can be procured locally

IV. OUTCOMES

Table 14 above includes aggressive campus-wide recycling, composting, and material reuse efforts to increase the total quantity of solid waste diverted from disposal facilities. Table 15 below provides a snapshot of how the strategies, if fully implemented as described, would compare with University and State of Maryland greenhouse gas reduction goals. It should be noted that the State of Maryland has specific waste reduction goals[36] and the University's proposed activities would greatly exceed those targets over the near-term. Further targets will need to be set and offsets should only be purchased as a last resort after all possible emissions have been reduced through source reduction, reuse, recycling, composting, etc. This scenario includes the purchase of offsets in 2050 to bring solid waste emissions to

[36] The Maryland Recycling Act (MRA) requires all Counties and Baltimore City to recycle 15% or 20% of the waste generated depending on population. Additionally, in 2000, Maryland established a voluntary statewide waste diversion goal of 40% by 2005.

zero. If aggressive action is taken through procurement efforts, construction waste recycling, and general waste diversion on campus, this level of offset purchase will not be needed.

Table 15. CAP Solid Waste Strategies vs. University & State of MD GHG Reduction Goals

	Univ. Maryland Reduction Goals		State of Maryland Reduction Goals		University of Maryland Climate Action Plan		
Year	**Percent**	**$MTCO_2e$**	**Percent**	**$MTCO_2e$**	**Potential $MTCO_2e$ Reductions**	**% of UM Goal**	**% of State Goal**
2012	15%	1,139	10%	670	2,946	259%	440%
2015	25%	1,898	15%	1,005	4,440	234%	442%
2050	100%	7,591	90%	6,032	7,591	100%	126%

State uses a baseline of 2006 therefore UM inventory numbers for that year are used.

* State goal is 25 to 50% by 2020

V. SUGGESTED COMMUNICATIONS AND OUTREACH

Many of the strategies identified by the Work Group are communications oriented and involve using established channels to better educate the campus community about waste reduction initiatives. They suggest a need for greater outreach and stronger partnerships among campus stakeholders.

Suggested Channels of Communication

As the Work Group noted, there are a number of existing channels for communicating with the campus community. These include but are not limited to:

- Facilities Management staff outreach through daily work across campus
- Office of Procurement and Supply which advises the campus community on purchasing and could educate about product recycling, take backs (e.g., toner cartridges), design for re-use, etc. via their website and procurement specialists.
- Athletics events and marketing
- Performing arts events and marketing
- Dining Services guest education and marketing
- Conference and Visitor Services meetings and events
- Resident Life resident education
- Residential Facilities staff outreach through daily maintenance and upkeep in residence halls
- Fraternity and Sorority Life education and outreach
- Other Student Affairs venues such as the Stamp Student Union, Campus Recreation Services, and Transportation Services
- Academic departments – office operations and student education
- Business Services (DBS) - Travel Coordinators, the Travel Customer List, DBS' Websites
- Human Resources (HR) - New Employee Orientation, HR's website and other employee benefits outreach
- Office of Sustainability and other Administrative Affairs departments – office operations and campus outreach

Effective waste reduction and diversion policies require involvement of the entire campus. Providing waste reduction training to employees and practicing effective outreach, especially to the large undergraduate population, will be key to reaching the campus' waste reduction and diversion goals.

Existing Programs

Programs whose greater visibility and promotion could help reduce the solid waste-related carbon footprint include:

- Recycle Mania –a voluntary program where campuses compete to reduce waste and increase recycling efforts. The program emphasizes reduction and reuse over recycling, which should be kept in mind when determining sustainability goals for the services sector on campus.

New Low Carbon Outreach

- Develop a green products and services option for all contracted campus events.
- Develop a waste reduction training program for University employees in select departments and job functions.

CHAPTER 6. Education and Research

I. BACKGROUND

The University of Maryland strives to be "a national model for a Green University"[37] and "a University that seeks solutions to the world's most challenging and vexing problems." The University is well on its way to becoming a leader in campus sustainability and the strategies included in this plan will further reduce the campus' environmental impacts, but to be successful, the institution's efforts to green its operations must be matched by its efforts to green the curriculum. Attention must be given to increasing the environmental literacy of all students, creating opportunities for students to devise strategies to address challenging societal problems, fostering research on climate change and sustainability, and creating an intellectual environment and community in which the lessons from science are translated into action, and, conversely, in which identified needs for action inform research and education. Students need to see the potential for careers that address the multiple challenges of a warming climate, finite resources, energy dependence, etc. There also needs to be a greater emphasis on green jobs and bringing prospective employers to campus to engage with students and promote internship and career opportunities.

II. APPROACH

Achieving carbon neutrality will depend on the ability of the University community to better understand the carbon footprint implications of all kinds of campus activities. Ideally, the University itself becomes a learning laboratory for the promotion of sustainability science and action. Within that laboratory setting, students, staff, and faculty improve their understanding of the interplay among behaviors, technologies, and environmental performance. It will be essential to creating this understanding that research and education become closely related to each other and placed in the larger regional and social context within which the University operates. Only if the campus practices what it preaches will the Climate Action Plan become a sincere attempt to address climate change and make lasting contributions toward a more sustainable society.

Information Sharing

Many students are looking for opportunities to study or conduct research on climate change and sustainability. The Campus Sustainability website[38] now features a list of more than 100 courses offered at the University related to these issues. A second student resource will be developed that identifies potential thesis topics and projects to help advance campus sustainability and carbon neutrality.

Education

The education strategies below focus on integrating sustainability in the curriculum so that all students have, at a minimum, a basic understanding of how to contribute to a sustainable society and those students interested in gaining deep knowledge of the issues are given the opportunities to do so. This plan recommends that sustainability be introduced to all new students through the freshmen seminar classes (UNIV100, HONR100, GEMS100, etc.) by utilizing the Sustainability Advisors peer education

[37] University Strategic Plan, 2008, p.36.
[38] www.sustainability.umd.edu.

program being developed by the Office of Sustainability. After learning the foundational issues, students would then experience a thread of sustainability woven through many of their courses. The new General Education portion of the University Strategic Plan may be guided in part by learning outcomes for sustainability. Furthermore, faculty in many disciplines are learning how to integrate sustainability in their existing courses through a workshop called The Chesapeake Project. The first annual workshop was held in May 2009 with 26 faculty from 20 diverse disciplines participating in the two-day training. By viewing contemporary issues through multiple disciplinary lenses, students will have a holistic understanding of how to positively affect change.

For students who want to pursue graduate studies and careers in sustainability, this plan recommends that a new minor, major, and graduate degree programs in sustainability be developed along with increased support of student involvement in University research centers. These programs would make the University of Maryland a global leader in sustainability education along with a handful of other institutions that have recently created new sustainability-related academic programs and research centers.

Research

This plan recommends a few strategies to enhance the University's research on sustainability topics. First, the University should maintain and publish a list of climate actions that may help reduce campus emissions and for which insufficient data or research are available to guide decisions. Second, incentives may be provided for undergraduates, graduate students, and faculty to initiate projects and sustain research programs that have the potential to reduce carbon emissions. Such incentives could, for example, be in the form of scholarships, grants, and prizes for research on subjects such as alternative energy, carbon neutral buildings, and behavior change strategies for energy conservation, whose implementation can reduce campus carbon emissions.

Co-Benefits

Most of these strategies have numerous co-benefits. The impact on climate emissions of these strategies is difficult to measure directly so emission reductions have not been calculated. However, appropriate indicators and measures should be developed to track progress over time.

III. EDUCATION AND RESEARCH STRATEGIES

Table 16. Suggested Education and Research Strategies for Campus Action

Strategies	Implementation Mechanism	Timing	Cost
1.0 Information Sharing 1.1 Make education- and research-related resources that relate to climate change, energy efficiency, and economic and environmental sustainability accessible to the University of Maryland community	Compile a document listing these offerings and encourage the University to place this prominently on the Campus Sustainability website and link to it wherever relevant.	Completed	Time: 20 hrs/yr
1.2 Direct student projects to address campus-relevant research questions	Develop a "craigslist"/wiki of potential term paper, class projects, and thesis topics to help advance campus carbon neutrality. Provide advice to students as needed (e.g., sources of campus data, key contacts, etc).	Summer 2009	Time: 100 hrs/yr
2.0 Education 2.1 Educate first year undergraduate students about sustainability so that they have a foundational understanding of the issues	Utilize Student Sustainability Advisors (trained undergraduate instructors) to teach a lesson on sustainability in all UNIV100, HONR100, GEMS100, and other freshmen seminar classes. Consider a student sustainability training similar to Alcohol EDU (where all freshmen are required to complete the on-line program before the first day of classes).	Fall 2010	Time: 100 hrs /yr
2.2 Compile "learning outcomes" to guide the creation of new courses for the General Education portion of the Strategic Plan	CAP Workgroup members developed outcomes to share with the University committee developing new general education	Spring 2009	Time: 50 hrs/yr
2.3 CORE[39] should review the viability and benefits of a sustainability literacy graduation requirement	Implement possible sustainability requirements for undergraduates	Within 3 years	TBD
2.4 Integrate themes of sustainability throughout various disciplines so that students gain a comprehensive understanding of global and local	A) The Chesapeake Project is a multiday workshop designed with the Center for Teaching Excellence to help faculty integrate sustainability across various disciplines. After learning about the core concepts of social,	Spring 2009	$16,000/yr

[39] CORE Liberal Arts and Sciences Studies Program. All first-time college students and most transfer students at the University are under CORE requirements.

Strategies	Implementation Mechanism	Timing	Cost
issues and are prepared to become change agents.	economic, and environmental sustainability, University faculty will work with resource experts to tie sustainability lessons to their existing courses. Eventually, this workshop will be offered to K-12 teachers and faculty from other colleges and universities in the region, and similar projects may be launched on other environmental themes.		
	B) When not obvious, work with academic department to determine how sustainability could be incorporated into their curriculum.	Fall 2009	TBD
2.5 Establish sustainability minor, major, undergraduate, and graduate degrees	Implementation may be led by existing programs/colleges as well as Undergraduate Studies and the Graduate School.	Within 3 years	TBD
2.6 Foster active learning programs that help students develop skills and knowledge relevant to alternative energy, low or no carbon economies, and reducing greenhouse gas emissions.	A) Provide financial support to University environmental research centers to increase opportunities for student involvement. With support, centers could offer additional internships for students who want real world experience in solving environmental problems and developing new sustainable technologies. Funds could also be used to create institutionalized structures that support special projects, such as the U.S. Department of Energy's international Solar Decathlon competition. Within 5 Years: All undergraduate students have access to active learning, service learning, and travel-related programs with financial support.	Within 3 years	TBD
	B) Provide financial support for summer internship programs on campus to study the local environment and improve environmental performance of the campus.	Summer 2010	$15,000/yr (five students)
3.0 Research Foster research on sustainability	A) The University will maintain and publish a list of potential climate action items (such as the feasibility of geothermal technology on campus and the role of green roofs) that may help reduce campus emissions and for which insufficient data or research are available to guide decisions.	Fall 2009	Time: 40 hrs
	B) The campus should actively consider sustainability and climate-related research and education programs (including scholarships and fellowships for undergraduates, graduate students, and faculty) in its portfolio of solicitations for donor support and alumni giving.	Fall 2009	No cost

Strategies	Implementation Mechanism	Timing	Cost
	C) The Provost and Vice President for Research should look at the impacts of internally funded research proposals on GHG emission reductions and campus sustainability when evaluating those proposals.	Fall 2009	No cost
	D) Encourage the faculty to bring forward to the General Research Board (GRB) and other internal and external funding sources projects that reduce GHG emissions and help overcome other sustainability-related challenges.	Fall 2009	No cost
	E) Establish campus awards for outstanding undergraduate, graduate, and faculty research that will lead to reduced carbon emissions and/or enhanced campus sustainability. Researchers investigating topics such as alternative energy, carbon neutral buildings, behavior change strategies for energy conservation, etc. would be eligible.	Fall 2009	TBD

IV. SUGGESTED COMMUNICATIONS AND OUTREACH

Giving special recognition to campus-oriented education and research projects focused on climate challenges and reducing the campus' carbon footprint is an essential component of the Climate Action Plan. This recognition could be in the form of special features in University publications and awards, with the purpose of changing the current teaching and research culture to one that values projects focused on the institution as well as projects that attend to broader national and international challenges.

Helping students and faculty identify opportunities for campus-oriented sustainability projects requires bringing knowledge of campus needs to them, and, conversely, orienting existing and new research projects toward the campus. The Office of Sustainability and the Center for Integrative Environmental Research will continue to network with students, faculty, and staff to help them identify contributions their activities can make in advancing Climate Action Plan goals and strategies.

CHAPTER 7. FINANCING THE PLAN

The University will finance the plan through traditional mechanisms such as capital project requests, individual departmental budgets, funding from the University Finance Committee, and external grants as available. The campus is also evaluating the feasibility of establishing a Campus Green Fund as a mechanism for funding portions of the Climate Action Plan. This fund would include monies generated by student fees and alumni, donor, faculty, and staff gifts that would support specific climate action and sustainability strategies.

CHAPTER 8. TRACKING PROGRESS AND NEXT STEPS

I. BACKGROUND

As stated previously, as part of the Presidents Climate Commitment, a campus Greenhouse Gas Inventory must be completed every two years. The inventory, coupled with campus-wide sustainability metrics currently being developed will assist the campus in monitoring its progress including total campus energy consumption, energy per square foot of conditioned space, total GHG emissions, and GHG emissions per capita. The FY 2008 inventory is in process and the University's next inventory will be conducted in early 2010, covering calendar year 2009. Sustainability metrics have been collected for FY 2008 and will be collected annually. This data are critical to tracking the University's progress in implementing its Climate Action Plan. With the development of each inventory, the research team is refining its approach and determining the best methodology and data sources for capturing each emissions source.

II. APPROACH

As the strategies within the plan are revised and adopted by senior leadership, a responsible party will be named to champion the implementation of each strategy. In some cases, such as commuter transportation strategies, a responsible party (i.e., the Department of Transportation Services) is clear. In other cases, such as the Departmental Energy Reports strategy to reduce energy consumption in buildings, there will likely be a need for a partnership between the Campus Energy Manager, Facilities Management, the Office of Sustainability, and participating departments. These responsibilities will be clearly delineated in specific implementation plans and subsequent versions of this plan.

As the Climate Action Plan Work Group finalized its responsibilities in 2009, senior leadership saw the need for a new group to oversee campus progress and develop periodic updates. The President has formed a University Sustainability Council that will be responsible for monitoring progress and overseeing periodic revisions of this plan. The Council will be chaired by the Vice President for Administrative Affairs and will consist of senior administrators and select faculty, staff, and students. The Council will be supported by Office of Sustainability staff.

To support implementation of the plan, the Office of Sustainability and the Center for Integrative Environmental Research will continue to present inventory findings to key campus decision makers and make suggestions for policy and process improvements that can lead to emission reductions. These findings and recommendations will be shared with the Vice President for Administrative Affairs and others as appropriate.

III. NEXT STEPS

Regular updating of the Climate Action Plan and the *Inventory of Greenhouse Gas Emissions* requires streamlining the flow of information to help quantify the costs and benefits of individual strategies and to track progress. Establishment of reporting requirements, as they already exist in many instances (e.g. for compliance with state and federal regulation) will facilitate inventory and plan updates as well as on-going monitoring and evaluation.

The plan and its execution will always be a work in progress. The campus will learn as it goes but it is also important to maintain a vision (i.e., be widely recognized as a national model for a green university) and set a path by which the campus can explore creative, non-conventional approaches that may arise along the way, even if the carbon benefits may be difficult to quantify. A number of such ideas were generated over the course of the Work Group's discussions and are included in Appendix IV so that they may be considered for future updates to this plan.

Beyond these ideas, it will be important to begin to think about the University of the future, what it means to do research and educate students in 20 or 50 years time, and what it means to live on or be associated with a campus and its surrounding community. A vision of that future, carefully articulated, may help transition to more sustainable practices and transform this institution from a good one to one that is truly great.

In addition to these visionary exercises are very tangible actions the campus community can take to shape the economic, political, and social environment within which the University operates. One such action will be to exert influence on policy and financial decisions makers to abolish regulations, rules, and practices that stand in the way of more environmentally friendly, less carbon intensive activities. Another example is a closer partnership with local and regional schools, many of which are feeders to the undergraduate programs of the University, and with businesses whose employees continue their education at the University of Maryland, and who may benefit from the knowledge generated at the University as it implements its Climate Action Plan.

The first steps have been taken with the development of this Climate Action Plan. It is the extent to which its suggestions are translated into action, and the vigor with which new action items are added over the years, that will determine success.

Appendix I. Acronym List

ACUPCC	American College and University Presidents Climate Commitment
AFV	Alternatively Fueled Vehicle
AGNR	College of Agriculture and Natural Resources
AREC	Agricultural and Resource Economics
CAFE	Corporate Average Fuel Economy
CAP	Climate Action Plan
CHP	Combined Heat and Power
CIER	Center for Integrative Environmental Research
CO_2	Carbon dioxide
COMAR	Code of Maryland Regulations
CPU	Central Processing Unit
DBS	Department of Business Services
DOTS	Department of Transportation Services
ECE	Electrical and Computer Engineering
EPA	Environmental Protection Agency
EPAct	Energy Policy Act of 2005 / 1992
EPC	Energy Performance Contract
EPP	Environmentally Preferable Procurement
ESCO	Energy Service Company
FM	Facilities Management
FTE	Full Time Equivalent
FY	Fiscal Year
GHG	Greenhouse Gas
GRB	General Research Board
HR	Human Resources
HVAC	Heating, Ventilation and Air Conditioning
IT	Information Technology
KWh	Kilowatt-hour
LEED	Leadership in Energy and Environmental Design
MBA	Master of Business Administration
MD	Maryland
MFRI	Maryland Fire and Rescue Institute
MRA	Maryland Recycling Act
$MTCO_2e$	Metric Ton CO_2 equivalent
MTS	Motor Transportation Services
MW	Megawatt
NPV	Net Present Value
OIT	Office of Information Technology
PRD	Performance Review and Development Process
PV	Photovoltaic
REC	Renewable Energy Certificate
RPS	Renewable Energy Portfolio Standard
SGA	Student Government Association
TBD	To Be Determined
UM/UMD	University of Maryland
WG	Work Group

Appendix II. Climate Action Plan Work Group Membership List

David Allen
Director, Transportation Services

Chris Arkell
Associate Director, OIT-Technical Services and Support

Jack Baker
Director, Operations and Maintenance

Steve Beeland
Executive Director of Development, Schools and Colleges

Karen Breen
Director, Business Services

Joanna Calabrese
Environmental Science and Policy student, Student Government Association Vice President, UMD Students for Clean Energy

Simon Chafetz
Marketing student, Society for Green Business, Hillel Center member

Brian Childs
MBA student, MBA Energy Club, Net Impact

Ioana Cionea
Graduate Assistant, Department of Communication

Betty Dabney
Research Associate Professor, School of Public Health

Matt Dernoga
Government student, UMD Students for Clean Energy, writer for The Diamondback

William Dorland
Associate Professor, Physics – Computer, Math & Physical Sciences

Sandy Dykes
Assistant Director, Building & Landscape Services

Asher Epstein
Director, Dingman Center for Entrepreneurship

John Farley
Assistant Vice President, Administrative Affairs

James Farquhar
Associate Professor, Geology, Computer, Math & Physical Sciences

Gerald Galloway
Research Professor, Department of Civil and Environmental Engineering

Amy Gardner
Associate Professor, School of Architecture

James Greenwell
Senior Associate Director, Athletics

Phil Hannam
Mechanical Engineering student, Engineers Without Borders President, "Renewables at UMD" Gemstone Team leader

Carol Kennedy Hearle
Environmental Planner, Facilities Planning

David Inouye
Professor, Biology, College of Chemical & Life Sciences

Bruce James
Professor and Director, Environmental Science and Policy

Laura Johnson
Engineering student, Undergrad Senator, Provost's Student Advisory Committee

Steve Kallmyer
Associate Director, Residential Facilities

Lisa Kiely
Assistant Dean, Undergraduate Studies

Dan Kirk-Davidoff
Assistant Professor, Atmospheric and Oceanic Science

Sally Koblinsky
Assistant President and Chief of Staff, President's Office

Joan Kowal
Energy Manager, Facilities Management

Heather Lair
Project Manager, Office of Sustainability

Cheryl Levick
Chief of Staff, Athletics

Maria Lonsbury
Project Specialist, Student Affairs

Scott Lupin
Director, Office of Sustainability and Associate Director, Environmental Safety

Patricia Mielke
Assistant Vice President, Student Affairs

Joe Mullineaux
Senior Associate Director, Dining Services

Sue Nash
Associate Director, Business Services

Lars Olson
Professor, Agricultural & Resource Economics

Michael Passarella-George
Senior Research Analyst, Office of Institutional Research, Planning & Assessment

Pat Perfetto
Director, Conferences & Visitor Services

Jim Riker
Director, Beyond the Classroom

Kim Ross
Executive Director, Center for Integrative Environmental Research (CIER)

Matthias Ruth (Chair)
Roy F. Weston Chair, School of Public Policy and Director, Center for Integrative Environmental Research

Andrew Septimus
Finance and Agricultural & Resource Economics student, Hinman CEOs

Ramy Serour
Marine Estuarine Environmental Sciences graduate student and Research Assistant, Center for Integrative Environmental Research

Mark Stewart
Campus Sustainability Coordinator, Office of Sustainability

Jim Stirling
Director, Procurement and Supply

Harry Teabout
Director, Building & Landscape Services

David Tilley
Assistant Professor, Environmental Science & Technology and GHG Inventory Project Manager

Karl Valentine
Assistant Vice President for Corporate & Foundation Relations Development

Sean Williamson
Environmental Policy graduate student, Research Assistant, Center for Integrative Environmental Research

Alison Willman
Finance student, Society for Green Business, Delta Gamma

Deborah Wiltrout
Executive Director, Marketing Strategy

Ann Wylie
Vice President for Administrative Affairs

Appendix III. Environmentally Preferable Procurement Policy

DRAFT (Revised 05/07/09)

VIII-3.10(C): University of Maryland, College Park Policies and Procedures for Environmentally Preferable Procurement

POLICY: The University of Maryland, College Park will procure all supplies, services, maintenance, construction and architect-engineer services in a manner consistent with the promotion of environmental sustainability and, in particular, promoting the reduction of carbon emissions as envisioned by the University's endorsement of the American College and University Presidents Climate Commitment. Consideration of the environmental impact of products and services must be an integral part of the procurement process and should be weighed along with price and other factors when making procurement decisions.

PURPOSE: The purpose of these policies and procedures is to implement broad policy objectives promoting the principles of responsible environmental stewardship in the University's procurement practices. The University will employ strategies to encourage, to the extent feasible within budget limitations and compatible with the mission of the University and its various units, procurement of:

- Existing surplus property and materials for re-use
- Materials having recycled content
- Recyclable products
- Compostable materials
- Non-hazardous materials
- Biodegradable products
- Energy efficient equipment and appliances
- Water saving equipment and appliances
- Sustainable design and construction of new facilities
- Sustainable design features for renovation of existing facilities
- Renewable energy supplies
- Energy performance contracts

AUTHORITY and DELEGATION: Procurement authority is derived from the University System of Maryland, Procurement Policies and Procedures. Further guidance is promulgated through University of Maryland, College Park Policy VIII-3.10 (A) University of Maryland, College Park Procurement Policies and Procedures and VIII-3.10 (B) University of Maryland, College Park Policies and Procedures for Delegated Procurement.

APPLICABILITY: The policies and procedures described herein shall be applicable to all procurements made by the University of Maryland, College Park via the Department of Procurement and Supply or by any other unit exercising delegated procurement authority under Policy VIII-3.10 (B).

PROCEDURES:

1. General: All units of the University shall consider the policy objectives stated above when preparing specifications or developing statements of work, for procurement of goods and services.

2. Requesting Department/Unit Responsibilities: Specifications and statements of work prepared by Departments and units of the University shall:

a. Promote to the maximum extent feasible and within the limitations of existing laws and regulations, the procurement and use of:

- Post-consumer recycled-content paper products:
  - The University's goal is to procure 100% of its general purpose office paper from Forest Stewardship Council (FSC) certified sources, having a minimum of 30% post-consumer recycled material content.
  - Recycled content and chlorine-free paper goods (letterhead, envelopes, business cards, etc.)
  - Recycled content and process chlorine-free (PCF) paper towels and toilet tissue.
- Remanufactured toner cartridges and refillable ink cartridges (or toner cartridges made from recycled content material)
- Biodegradable and/or compostable food service packaging and service items
- Vegetable oil based inks
- Recycled biosolids for use as mulch or compost
- Energy efficient lighting fixtures and bulbs
- Energy-Star (or equal) rated appliances and equipment. Procurement of Energy Star (or equal) rated equipment and appliances is mandatory when such products are available
- EPEAT certified green electronic equipment
- Carbon-neutral energy sources such as wind, solar, and nuclear energy
- Biodegradable-biobased, non-hazardous, and/or "Green Seal (or equal)" certified cleaning products
- Re-crushed/ recycled concrete and asphalt materials
- Re-treaded tires and products made from recycled tire rubber
- Low noise emitting equipment and appliances
- Carpeting and flooring products which are manufactured from recycled-content materials and are recyclable
- Green furniture products containing materials from renewable sources or recycled-content
- Building products containing recycled material content
- Low (or no) VOC painting products, adhesives and solvents

- LEED Silver (or equal) or higher design standards for eligible new facilities and major renovations. Incorporation of sustainable design features to the maximum extent possible, on facilities projects not eligible for LEED.
- Low emission, fuel efficient vehicles
- Alternative fuels for use in vehicles: ethanol, biodiesel, CNG, electric and other fuel types as may become available and associated infrastructure
- Local sources for goods and services

b. Discourage to the maximum extent feasible and within the limitation of existing laws and regulations, the procurement and use of:

- Asbestos –containing materials
- Mercury-containing materials
- Chlorofluorocarbons (CFCs)
- Hazardous substances requiring special handling and disposal
- Polystyrene products and packaging
- Bleached, virgin paper with 0% post-consumer recycled content

c. To the maximum extent possible, order required goods and services from Master Contracts established by the Department of Procurement and Supply.

3. Department of Procurement and Supply Responsibilities: The Director of Procurement and Supply shall structure procurement procedures to:

a. Include a review of compliance with this policy as a part of regularly scheduled assistance visits for review of delegated procurement. Include in assistance visit reports, furnished to Deans, Directors, Department Heads and Vice Presidents (as applicable), comments regarding the extent of compliance and suggestions for improvement.

b. Review requisitions received from Departments and units of the University. Suggest environmentally preferable alternatives for consideration by the requestor.

c. Facilitate green procurement by actively seeking sources for green products. The Department shall identify and post links to appropriate search tools which may be of use to the campus community in identifying green or environmentally preferable product alternatives, such as the U.S. Environmental Protection Agency (EPA) database of environmentally preferable products at:

www.epa.gov/opptintr/epp/pubs/products/index.htm

d. Establish and actively promote the use of Master Contracts for environmentally preferable goods and services commonly used by the campus. Upon expiration of existing Master Contracts, consider opportunities for replacing them with more environmentally preferable options. All such Master Contract opportunities shall be posted on the Department of Procurement and Supply website, including specific instructions for ordering.

e. Appoint one or more environmental sustainability coordinators with responsibility for researching opportunities for environmentally preferable goods and services; issuing solicitations to establish contracts; and promoting the goods and services to the campus community. Establish an outreach and education program designed to inform the campus about the availability of green products and the benefits associated with their use.

e. Encourage all vendors to offer environmentally preferable product promotions. Actively market these opportunities to the campus via the Department web-site, e-mail, and other venues likely to reach the campus community at-large.

f. Actively promote the re-use of surplus personal property available at the Terrapin Trader as an alternative to procurement of new products.

g. Aggressively seek multiple sources and promote competitive bidding for the environmentally preferable products specified by requesting Departments and units.

h. Develop and implement the use of standard contract provisions promoting the policies established herein.

Appendix IV. Additional Strategies for Future Consideration

Brainstorming List from Work Group Members and Public Comments (Ideas Not Included in Plan)

Strategy	Comments
ENERGY-RELATED	
Off peak class scheduling	Consider consolidating classes in fewer buidings, particularly in the summer and winter terms, to reduce energy use.
Ground source heat pumps	Consider as means of heating and cooling campus buildings
Smart buildings	When occupants enter their building, they scan their ID and the building system turns on lights, HVAC, etc., in the appropriate location in the building
Roll solar collectors over bleachers in stadium when unused	
Departments pay for the utilities that they use	Would require sub-metering
Charge departments a per-square foot energy fee	Would discourage departments from acquiring office and lab space that isn't essential
Require that buildings be designed for multiple purposes	• Space needs to be modular so departments can add or subtract space and buildings can be more easily modified as usage changes • Old labs could be converted to class rooms or apartments
No net growth policy	Consider a no net growth policy (as something is built, something else must be taken out of service). Would require further analysis of current space allocation.
Energy marshal	Create a culture where at the start of each class or staff meeting, a person is chosen who is responsible for turning out the lights, closing windows, etc. Some manufacturing companies do this with safety (e.g., identify exits and emergency procedures at the start of each meeting).
Low carbon footprint competitions	• Create competitions whereby students, student teams, residence halls, departments, schools, offices, or buildings would compete to have the lowest carbon footprint • Make it fun, cool, incentivized (recognition as "the greenest")
Develop and deploy gym equipment that captures energy for lighting or other end uses. Display in gym the total energy generated.	Although possibly an insignificant contribution to the overall footprint, this may be a fun way of making energy issues part of the everyday experience of students
TRANSPORTATION-RELATED	
Develop a state of the art carpool matching and GHG tracking program	• On-line tool (using other successful platforms – match.com, Facebook, google maps) that finds good "matches" (close proximity to home, route

Strategy	Comments
	to work, and campus destination) • Connected to region (e.g., Commuter Connection) to make use of rides going to nearby employers • Adequate user incentives to ensure carpools register for GHG inventory tracking • With large enough pool of users, could be very convenient transit mode
Ensure low carbon transit options are attractive to commuters	Transit options should be convenient, clean, comfortable, and not overcrowded. If the alternatives do not at least meet minimum standards and expectations, commuters will return to their cars.
Better connect campus to regional bike trails	Campus Bike Study (Spring 2009) should address the need for this
Provide free or subsidized Metrorail/bus passes for employees who take public transportation to work	
Provide preferential parking spaces for fuel efficient vehicles	
Build and operate an Elementary School on campus (or contribute to the improvement of area elementary schools)	• Could encourage faculty and staff to live in College Park • May reduce faculty/staff/student commuter miles
Build and operate a middle and high school on campus (or contribute to the improvement of area middle and high schools)	• Could encourage faculty and staff to live in College Park • May reduce faculty/staff/student commuter miles
Provide financial incentives for faculty/staff to locate in College Park or other close-by communities	E.g., money toward closing costs
Lobby State of Maryland to create a "live near work incentive"	State income tax break for employees who live within a certain distance of their workplace
Provide incentives for students to reside on campus or in College Park	Provide a tuition rebate for students living in College Park
WASTE-RELATED	
Develop on-campus composting facilities	Currently, compost is trucked off campus and the University does not get credit for methane reduction. An on-campus facility would reduce transportation emissions, allow the campus to receive the methane reduction credits as off-sets, and provide free mulch to campus grounds.
Expand composting to University Good Tidings Catering	Allow composting for catered events
Trash compaction	Explore compactors for trash and recycling to reduce transportation emissions associated with disposal.
PROCUREMENT-RELATED	
Require recycling in purchase orders (POs)	When replacing products that may be recycled, be specific in POs that "products must be recycled"

Strategy	Comments
	instead of "old material must be disposed of by contractor." Should also be included for recyclable packing materials that vendors are required to dispose.
Require that copy paper used on campus be 100% recycled post consumer content paper	Not currently accounted for in GHG inventory
Require a percentage of food served on campus to be from local farms (within a certain distance)	• Supports Maryland farmers • Some percentage must be locally grown (by $ value)
Further reduce sale of bottled water on campus	Explore options to reduce or eliminate sales of bottled water wherever practical. The campus beverage contract will be renewed in 2013 and that this is an opportunity to influence campus waste and associated emissions.
EDUCATION-RELATED	
Establish a sustainability institute	Arizona State provides a successful example
Work with graduating classes on sustainability-related class gifts (and perhaps use their donation to leverage additional money)	High visibility at comparatively low cost
OTHER	
Investment policy	The USM Foundation should draft and implement an environmentally and socially responsible investment policy. This policy should guide endowment investment priorities.