



UNIVERSITY *of* MARYLAND  
EASTERN SHORE

# Climate Action Plan V1.0

August 2011

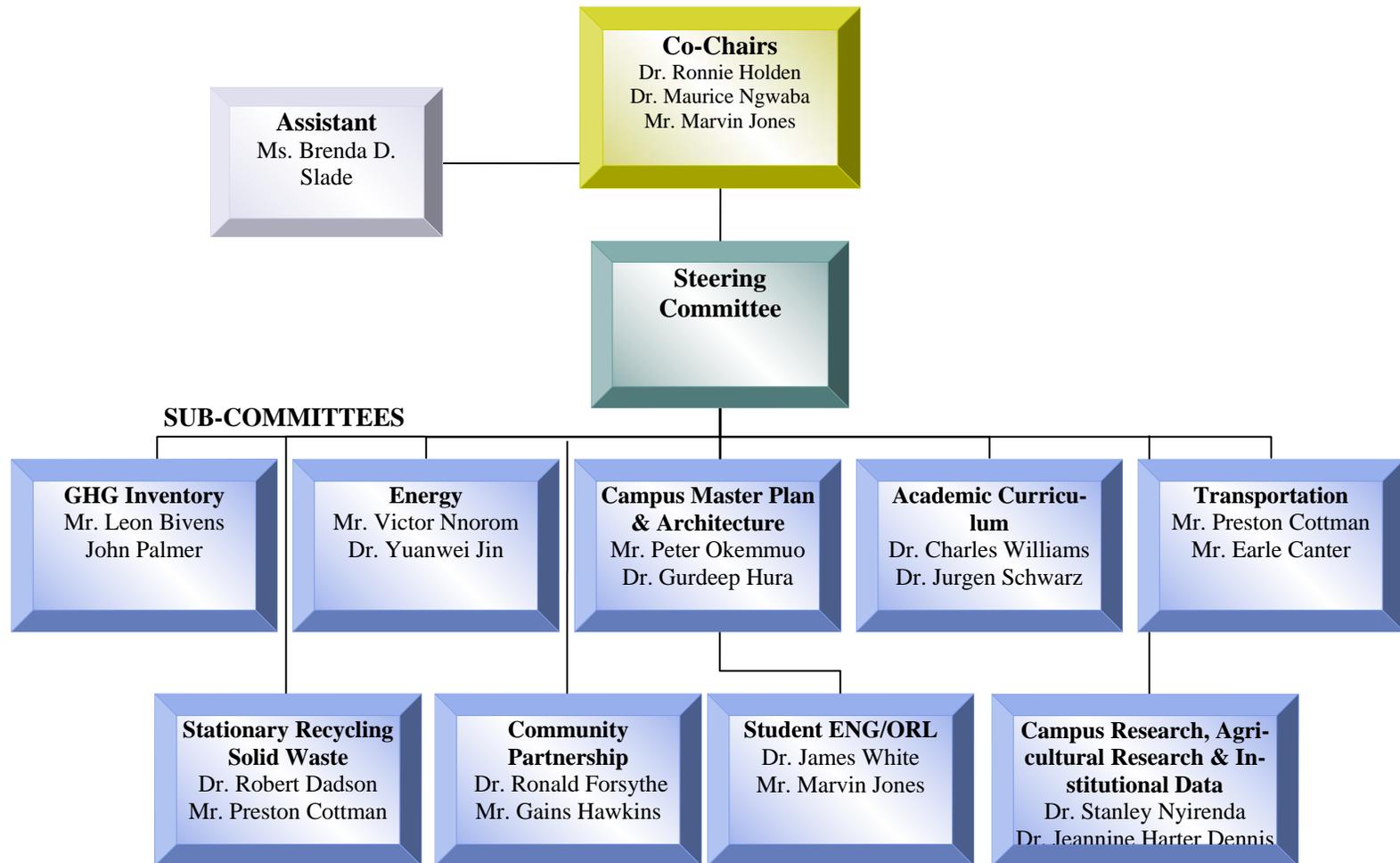
Prepared with Assistance from John Silkey - Consultant

## Acknowledgements

Many people have contributed to the completion of this first Climate Action Plan. Beginning with the leadership of University President Dr. Thelma signing the ACUPCC commitment in 2007, UMES appointed a 26 member Climate Change Steering Committee in January of 2008, to lead the efforts of fulfilling this commitment:

Dr. Ronnie E. Holden - Co-Chair	Dr. Jurgen G. Schwarz
Mr. Marvin Jones - Co-Chair	Mr. David Scott
Dr. Maurice Ngwaba - Co-Chair/UMES Liaison	Ms. Valerie Matthews
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Mr. Gains Hawkins	Mr. Samuel Douglass
Ms. Catherine Bolek	Dr. Jeannine Harter-Dennis
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Mr. Leon Bivens	Dr. Gurdeep Hura
Mr. Preston Cottman	Dr. Emmanuel Acquah
Mr. Victor Nnorom	Mr. Torrey Brown
Dr. Charles Williams	Dr. Robert Dadson
Mr. Earle Canter	Dr. Stanley Nyirenda

This committee held its inaugural meeting in August of 2008 and created nine sub-committees (see below) to work on the creation of the Climate Action Plan. The various committees report to the steering committee and each committee have representatives from the steering committee. The University Liaison and co-chair is responsible for coordinating the overall climate change program with assistance from other co-chairs. The initial GHG Inventory was completed in January of 2009 and submitted to the ACUPCC shortly after.



Representatives of the sub-committees gathered for a series of facilitated climate action planning workshops over the winter of 2010-2011, during which an extensive list of potential emissions reducing actions was created, and comprise the

heart of this plan. For their particular efforts and contributions in creating the recommendations included in this report during those workshops, special acknowledgements go out to: Dr. Stanley Nyirenda, Mr. Earle Canter, Dr. Jurgen Schwarz, Dr. Tao Gong, Dr. Jeannine Harter-Dennis, Jamie Webster, Ms. Nicole Gale, Ms. Brenda Slade, Mr. Preston Cottman, Ms. Jackie Collins, Ms. Danna Maloney, Mr. Frederick Wheatley, and Mr. Mark Clauss, Dr. Ronnie Holden, and Mr. Peter Okemmuo. Additional acknowledgements go out to Dr. Abhijit Nagchaudhuri, Dr. Kate Brown, Dr. Leon Copeland, Dr. Emmanuel Acquah and Dr. Joseph Okoh for their contributions on curriculum development and climate change specific and sustainability research initiatives. Special thanks to Dr. Maurice Ngwaba for coordinating the UMES Climate Action Plan process.

Some graphs, tables or charts were duplicated or recreated from: *Carbon Footprint of the University of Maryland Eastern Shore: An Inventory of Greenhouse Gas Emissions FY 2008, prepared with assistance from Honeywell 2009.*

## Executive Summary

### Introduction

In 2008, University of Maryland Eastern Shore President Dr. Thelma Thompson signed the American College and University Presidents' Climate Commitment, joining hundreds of other leading higher education institutions in pursuing climate neutrality. Dr. Thompson appointed a 26 member Climate Change Steering Committee, who then approved nine sub-committees to work on creating a Climate Action Plan ("CAP"). During the winter of 2010 and spring of 2011, these sub-committees submitted recommendations for this plan that define a target date for carbon neutrality in 2050, milestones along the way, strategies for moving towards those milestones, and various actions that will allow UMES to achieve its aim.

This CAP aims to provide an honest and frank assessment of UMES' current reality, including its positive attributes that can be leveraged as assets in this quest, as well as its challenges that may hinder progress. UMES intends to take an aggressive approach to mitigating its climate impact, and does not intend to rely in the short-term on offsets to make progress. However, in later years of this plan, according to progress levels and coordination of financial implications, offsets will likely become part of the overall strategy.

As an educational institution, UMES also strives to enlighten its students about the challenging times that we live in and the ways in which we will operate in the future in order to be successful in managing greenhouse gas emission. Accordingly, this plan sets out strategies that aim to make sustainability a part of the curriculum and overall student experience.

### GHG Footprint and Target for Neutrality

For the period of FY 2008 the University's greenhouse gas ("GHG") emissions inventory was 30,350.3 metric tons of carbon dioxide equivalent (MT-CO<sub>2</sub>e), or approximately 16.9kg per square foot of building space. The largest percentage by far of these emissions are related to the purchase of power from Delmarva Power, and accordingly many of the actions suggested in this report are related to energy consumption on campus. A second major area of emissions is on campus power generation and transportation, and recommendations in these areas are also plentiful.

*UMES Climate Neutral*

**2050**

*UMES FY '08 GHG Footprint*

**30,350.3 MT-CO<sub>2</sub>e**

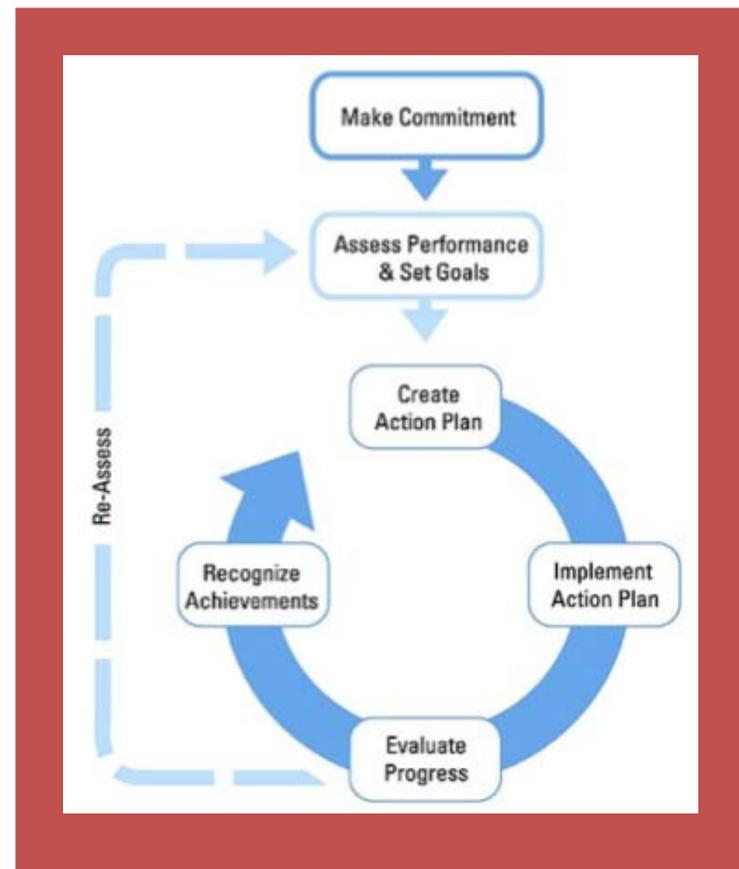
The state of Maryland has established a target of reducing emissions by 25% from a 2006 baseline by 2020. UMES has decided to align with this objective, and will use 2007 as the baseline year, when it completed its first GHG Inventory. Achieving this milestone will require, on average, just more than 12% reductions over five-year periods. UMES reduction targets have been extrapolated, taking into account the uncertainty of changing circumstances and a growing campus community, to maintain this trajectory over the coming decades. This trajectory points UMES to attain carbon neutrality by the year 2050.

### Recommendations in Brief

Highlighted here are short-term actions that will have the greatest impact in mitigating UMES' climate impact in the coming years, many of which were developed by UMES faculty and staff during CAP workshops. Acknowledging that this CAP is the inaugural version of a living document, UMES will set targets for specific GHG impacts that lead towards its overall goal of climate neutrality, and periodically revisit these targets, reviewing and amending strategies as needed. By regularly examining progress, UMES will set itself on a path of continuous improvement, generating greater and deeper gains as it progresses (see figure right). Please refer to the full "Summary Recommendations" sections later in this document for a more extensive list of actions, as well as context discussion for each Focus Area.

#### First Steps

- Re-engage the campus community (faculty, staff, and students) by holding informational workshops that explain the background on the ACUPCC commitment, and give context for the climate commitment as part of the University's move towards a sustainable future
- Engage faculty and staff by solidifying a CAP Implementation



Team and schedule regular status meetings and review of the Climate Action Plan progress, reviewing and amending proposed timelines for each action

- Solidify the Climate Action Plan by designating a “point-person” who will be accountable for each proposed action and creating its detailed implementation work plan
- Identify key skills required for the implementation of the CAP (such as building energy management), integrate these skills into core competencies and job requirements, and deliver appropriate sustainability education programming to staff members of influence

### **Education & Student Life**

- Establish a vivid and compelling UMES sustainability vision and communicate it widely to all stakeholders
- Engage students by integrating sustainability goals into student recruiting materials and orientation packages and creating a CAP Student Committee to participate in the development and implementation of climate mitigation strategies
- Create a Curriculum Working Group to develop educational programming that integrates sustainability

### **Energy, Buildings & Facilities**

- Conduct a baseline assessment of energy performance in all UMES buildings and a scoping exercise to determine immediate low-cost measures to reduce energy demand and consumption, including a review of the HVAC systems, and the installation of green roofs and cool roofs to dramatically reduce building energy needs, and add grey water and rain catchment systems
- Set performance targets and reporting protocols for all facilities that feed energy use data to facilities staff and senior administration
- Integrate sustainability metrics into procurement policies
- Develop strategic relationships with the Historical Preservation Society to facilitate more ambitious building retrofits, with Delmarva to explore alternative energy options and the potential extension of a natural gas line from Fruitland to campus, and with Rep. Andy Harris, chair of the House sub-committee on energy

## **Transportation & Fuels**

- Survey stakeholders about commuting habits and receptiveness to alternative options and use data to inform decision-making
- Develop programs that reduce the number of car trips to and from the UMES campus, such as: an extensive carpooling program that involves students, staff, faculty and visitors; and a 4-day work week during the summer
- Develop programs that reduce the average carbon emissions of car trips taken on and to the UMES campus, including: preferential parking for low-emissions vehicles; and a regular maintenance schedule for the UMES fleet
- Establish potential feasibility of running commuter train to UMES using existing rail lines on campus, phased in replacement of UMES fleet with hybrid or electric vehicles, a campus-wide bike sharing program, and biomass electricity generation from organics such as grass clippings, food scraps, and animal wastes
- Create a procurement policy that favors local goods and services to reduce unnecessary transportation and that strengthens the Maryland's Eastern Shore economy
- Promote to stakeholders all existing alternative transportation solutions, including: carpooling, campus Shuttle Bus from Salisbury, bicycle infrastructure

## **Waste & Recycling**

- Purchase biodegradable cutlery and containers for food services, and utilize grass clippings and maintenance by-products for erosion prevention measures, reducing volume of waste to landfill
- Develop waste reduction targets and programs including: promotion and betterment of campus recycling program; end-of-year residence buy-back for furniture; paper-use policy and online course materials to reduce printing; composting of food wastes; and smoke-free UMES campus
- Establish partnerships with materials recyclers to reduce key waste streams including hazardous materials and wooden shipping palettes

## **Academic Research**

- Create UMES organizational structure that will best facilitate interdisciplinary collaboration and research on global sustainability challenges

- Conduct climate-specific research programs on carbon capture & sequestration and greenhouse gas mitigation strategies at large
- Conduct indirect impact research on ammonia reductions in poultry houses and use of growth regulators on grass to reduce energy use for maintenance

### **Communications**

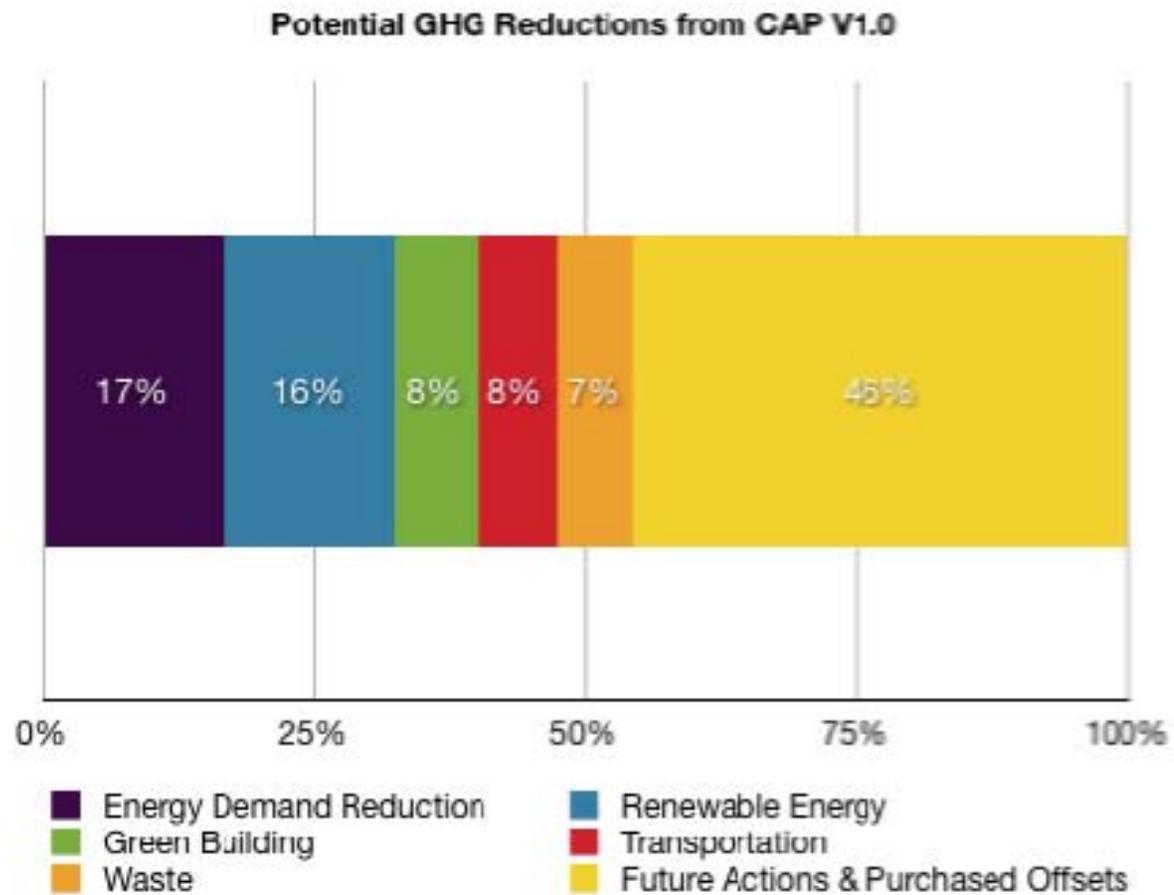
- Communicate previous successes, existing initiatives, goals, and ongoing progress to build awareness of UMES sustainability and climate initiatives amongst stakeholders
- Conduct a survey of stakeholder awareness and environmental consciousness that can be used as a baseline to track changing attitudes and behaviors
- Create UMES climate action week or month and offer various challenges to draw focus to commitment, mobilize action, and reduce environmental footprint
- Engage stakeholders by offering regular invitations for stakeholders to participate in UMES sustainability program and by providing regular advice for mitigating individual impact
- Celebrate achievements by including regular sustainability progress metrics in general UMES communication channels, and by partnering with the local media to communicate initiatives and outcomes

These initial steps will set UMES on course for eliminating its climate impacts by 2050.

### **Conclusion**

UMES has made a bold commitment to become a carbon neutral university. Considerable efforts have brought UMES to this point, where it has a forward-thinking approach to sustainability and an imperative of responsibility to future generations. While there is much to do to move UMES toward carbon neutrality, this Climate Action Plan represents a brief moment to reflect on the ACUPCC commitment and celebrate the progressive culture of the university. Successes to date must be heralded as worthwhile and beneficial to the university, communicated to stakeholders, and viewed as stepping stones to bigger achievements in the future.

There are a number of groups and individuals who have played a part in UMES' sustainability endeavors to date. These people should be commended and encouraged to continue their efforts above and beyond, for the success of this Climate Action Plan depends on it.



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## 1. Introduction

The University of Maryland Eastern Shore (UMES) is a land grant, historically black college, originally founded in 1886 as the Delaware Conference Academy, eventually joining the University of Maryland system in 1988. With 1,793,344 square feet across 87 buildings on a campus of 745 acres in Princess Anne, Maryland, the UMES education focuses on teaching, research, extension, and engagement for its 5,300 students<sup>1</sup> in an ethnically diverse environment. The university holds itself responsible for developing human potential, enriching cultural expressions, and sharing its expertise with the wider community. The 239 faculty and 660 staff at the University combined for a total community membership of 6,199 in 2007. The campus community membership is expected to increase steadily during the upcoming years, increasing 25% by 2018. Nestled between the Loretto Branch and the Manokin Branch, both of which are part of the Chesapeake watershed, UMES understands that its on-campus activity can impact areas beyond its own boundaries.

*UMES aims to “create superior places to study, work and live that enhance the health and performance of building occupants through sustainable planning, design, construction, operations, retrofits and biomimicry.” UMES Master Plan 2008-2018*

When UMES developed its most recent master plan, it did so with a systems view towards creating a sustainable campus. Understanding that they did not have all of the tools and ideas to get there right away, members of this committee created guidelines by which the community could make decisions on campus development moving forward. A few of these include:

- Calling for low-impact development to manage stormwater, including bioretention areas, vegetated swales, rain barrels and cisterns. Using natural techniques for campus development has a compound effect on emissions, eliminating those associated with the production of non-natural techniques (concrete drainage, piping etc.) and maintaining or increasing photosynthetic capacity on campus, while also reducing the need for powered water treatment before release into Chesapeake area estuaries.

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<sup>1</sup> 1 Fiscal Year 2007: 4,086 full-time, 614 part-time, and 600 summer school students.

- Siting and zoning strategies that create facilities clusters minimizing utility runs
- Transportation and shading strategies that promote pedestrian activity with reducing the heat island effect
- Further explore the possibility for on-campus renewable energy generation

Taken together, the guidelines given in the master plan and this Climate Action Plan will put UMES on a path towards sustainable development, while significantly reducing campus demand for fossil fuel based energy and reducing its greenhouse gas emissions.

## 2. Climate Change and the ACUPCC Commitment

### 2.1 Climate Change

Climate instability has gone mainstream with high level media coverage and mass awareness of the discussions surrounding this issue. Greenhouse gasses (GHGs) such as carbon dioxide (CO<sub>2</sub>) nitrogen dioxides, sulfur dioxide, and methane (CH<sub>4</sub>), all of which are either naturally occurring and/or products of industrial or agricultural processes, have entered the consciousness of business and organizational conversation.

Carbon dioxide, the most abundant of the main GHGs, is responsible for almost two-thirds of the warming trend in our atmosphere<sup>2</sup>, and it has been shown that there is a strong correlation between atmospheric CO<sub>2</sub> levels and global mean temperatures<sup>3</sup>. Methane also has a strong warming effect in the atmosphere, and the concentrations of both CO<sub>2</sub> and methane currently far exceed their natural boundaries for the past 420,000 years<sup>4</sup>. Though the growth rate of methane has slowed recently<sup>5</sup>, significant natural stores of methane in frozen tundra are still a potential danger if increasing global temperatures thaw out the tundra and release those stores to the atmosphere. In fact, this slowing, along with the decrease in other greenhouse gases like CFCs have actually masked some of the warming effect of increasing CO<sub>2</sub> concentrations<sup>6</sup>.

Science has shown that anthropomorphic causes have led to these rapidly elevated levels of GHGs in the atmosphere. The atmospheric concentration of CO<sub>2</sub> has steadily increased since the pre-industrial era ended in 1750<sup>7</sup>. During the previous 650,000 years, CO<sub>2</sub> concentrations never exceeded 300 parts per million<sup>8</sup>, while in 2005 it measured at 379 parts per million<sup>9</sup>, a 64% increase from the next highest pre-Industrial era reading.

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<sup>2</sup> 2 Hoffman 2006, 614

<sup>3</sup> 3 Petit 1999, 429

<sup>4</sup> 4 Petit 1999, 433

<sup>5</sup> 5 Hofmann 2006, 614

<sup>6</sup> 6 Ibid.

<sup>7</sup> 7 IPCC 2007, 2

<sup>8</sup> 8 Petit 1999, 433

<sup>9</sup> 9 IPCC 2007, 2

The rise in GHG levels can be directly connected to human activities during the Industrial era through today<sup>10</sup>, due primarily to the use of fossil fuels and changes in how we use our land<sup>11</sup>. As a society we are pulling Carbon accumulated and stored over millions of years from the Earth's crust as fossil fuels, and are systematically increasing its concentration in the atmosphere as CO<sub>2</sub>, while emitting other greenhouse compounds through industrial practices. Our rate of extraction and use of fossil fuels, and the subsequent release of GHGs, far exceeds nature's capacity to absorb and process those GHGs back into the Earth's natural cycles. And concurrently, we are handicapping Earth's ability to absorb these gasses through practices such as deforestation and manipulation of lands. In effect, we're increasing the flow of GHGs from our industrial faucet and plugging the natural drain through which these gasses would otherwise exit the atmosphere.

## 2.2 Climate Commitment

UMES recognizes the vital leadership role our education system plays in combating society's impacts on our climate, not only in its operations, but also as part of its educational philosophy. As a result, in 2008 the University of Maryland Eastern Shore joined the American College & University Presidents' Climate Commitment (ACUPCC). Accordingly, UMES recognizes the need to reduce GHGs by 80% by mid-century in order to avoid the worst impacts of climate change. As part of this commitment, UMES submitted an inventory of the University's GHG emissions in 2009, as well as this Climate Action Plan and its associated targets and goals. (See Appendix A for full ACUPCC Commitment text)

## 2.3 A History of Commitment

Socio-ecological stewardship has been a part of the UMES fabric for many years. Upon its completion in 2008, UMES incorporated climate change initiatives in its Facilities Master Plan update (FMP) and has made carbon neutrality plan part of its overall strategy. The plan utilized the ACUPCC definition of Climate Neutrality<sup>12</sup>, and was in part guided by the four

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<sup>10</sup> 10 Hoffman 2006, 614

<sup>11</sup> 11 IPCC 2007, 2

<sup>12</sup> 12 "Climate neutrality is defined as having no net GHG emissions, to be achieved by minimizing GHG emissions as much as possible, and using carbon offsets or other measures to mitigate the remaining emissions."

system conditions for sustainability as articulated by The Natural Step<sup>13</sup>. To help begin to address its largest GHG contribution, the plan places an emphasis on minimizing GHG emissions as much as possible through energy efficiency, conservation, on-site generation and strategic procurement of clean and renewable energy. Many initiatives have been completed or are currently underway (See Table 1), including a recently completed 20 acre Solar Farm on campus that will generate 2.2 Megawatts of electricity, enough production for approximately 7-8% of the University's need.

Past and current highlights of this commitment include:

- As far back as 1990, the campus master plan mandated that UMES become a pedestrian campus where parking lots are located within the periphery of the campus allowing ¼ mile walking distance to any building
- UMES is committed to a minimum LEED Silver rating on all new capital projects
- Installed a geothermal heating and cooling system in an existing residence hall, the first of its kind in the University System of Maryland
- Adopting the use of biodegradable products in housekeeping
- All new buildings will be appropriately sited and have roof designs that are capable of accommodating present or future solar panels or green roof structures

A more detailed list of UMES' past accomplishments can be found in Appendix B.

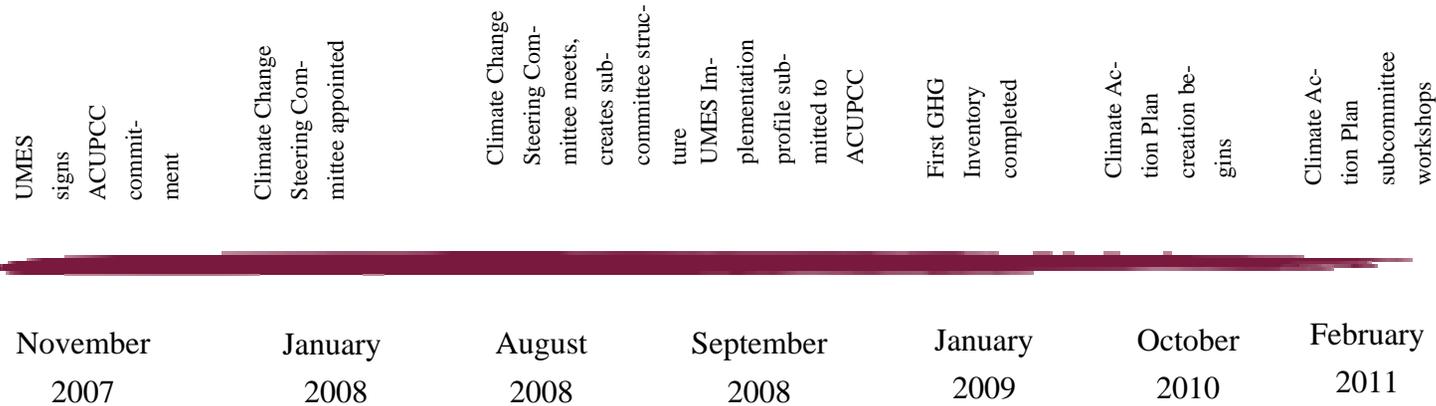
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<sup>13</sup> 13 The Natural Step is a Swedish NGO that has built, from consensus within the scientific community, a definition of 'sustainability' based on the laws of thermodynamics and social science.

### 3. UMES Climate Action Planning Process & Implementation

#### 3.1 Progress to Date

Beginning with its signing of the ACUPCC commitment in 2007, UMES is well on its way in addressing its climate impact. The submission of this Climate Action Plan represents the next major milestone in this process (see timeline below).



#### 3.2 First Steps 2011-2012

With the first version of a Climate Action Plan in hand, critical first steps for the University revolve around re-building traction with its own sub-committees, and with the campus community at large. Since it has been nearly four years since the initial ACUPCC pledge, and most of the student body from then has moved on past graduation, it is important to re-engage the campus community in the efforts to pursue climate neutrality.

In order to set ourselves in the right direction, these first steps will also include prioritizing the initial recommendations based on a number of factors including: Does it move us towards climate neutrality? Is it a step we can build further upon or is it a dead-end? Does it provide us with an adequate return on investment? The initial actions will then be developed

into detailed work plans, aiming to be included in the University’s first progress check with the ACUPCC, due in 2013 (see Section 3.2).

UMES understands that this initial plan, which includes broad, long-range estimates, will change with each evolution and progress check with the ACUPCC. As circumstances, technology, and capacity changes, so too will the details of a university climate action plan.

**First Steps**

Strategy	Actions	Accountable	Target Date	Progress Review	Progress Indicators
1. Staff engagement	Prioritize initial steps within this plan, create detailed implementation plans, and set additional goals for the next CAP Progress Report (January 2012)	Executive Committee	Immediately	January 2013	Regularly scheduled progress reviews and CAP assessments
	Conduct climate campaign workshops that explain the ACUPCC commitment to the campus community, and give context for the climate commitment as part of the University’s move towards a sustainable future		Immediately	N/A	Number of workshops held Results from “State of UMES” awareness surveys (pre & post campaign)

Strategy	Actions	Accountable	Target Date	Progress Review	Progress Indicators
2. Solidifying the Climate Action Plan	Prioritize and define accountability of CAP recommendations	Executive and Sub-Committees	Fall 2011	Bi-Annually	Accountability for tasks in Climate Action Plan
	Review & amend proposed timelines for tasks in the CAP		Winter 2011	Bi-Annually	Target dates for tasks in CAP
3. Education of staff	Identify and integrate key skills required for energy management into core competencies & job requirements		Spring 2012	Annually	Inventory of required skills & key staff
	Deliver sustainability education program to key staff members of influence		Spring 2012	Semi-Annually	Delivery of educational programming
4. Measure Emissions	Complete 2nd GHG Inventory and submit to ACUPCC, as scheduled		Winter 2011	N/A	Completed Inventory

### 3.3 Discussion

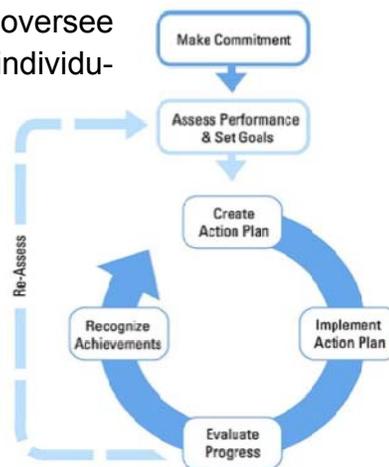
These are critical success factors for the CAP that should be completed immediately and will assist in building commitment and momentum for the future.

## Staff Engagement

The initial task for UMES will be to task the existing Executive Committee to oversee the implementation of the CAP. Going forward, rather than appointment, these individuals should be selected according to their skill-sets, areas of expertise, and passion and commitment to advancing UMES' goal of carbon neutrality. With an engaged Executive Committee in place, this group can begin to lay the groundwork for the implementation of the plan, beginning with the scheduling of regular Executive Committee status meetings and CAP review sessions.

The Executive Committee must also:

- prioritize immediate actions and create work plans
- ensure that the strategies and tasks are assigned to a “point-person”, an individual accountable for the completion of that action
- set goals to include in the 2013 Progress Report



## Education

Educational programming should strive to establish a common vision and shared language for how the CAP will be implemented, within the context of the global sustainability challenge. Contextualizing Climate Neutrality within systemic sustainability challenges grounds it in a way that generates firm understanding of why it is a critical issue that we all must address. The Executive Committee should define what gaps exist, and create a plan to deliver appropriate sustainability education to the team.

Building operators, engineers and maintenance specialists are all key players in helping ensure fiduciary and sustainability objectives are being achieved in the built environment. Ensuring each has a foundational understanding of sustainability and energy management will lead to the building of institutional expertise necessary to identify and capture future savings opportunities. We recommend that UMES identify which energy management skill sets will most directly benefit the institu-

tion and build that language into job descriptions and performance reviews. Furthermore, UMES should engage faculty to develop an education and training plan to achieve those skills.

### 3.4 Goals for 2013 Progress Report

Following the submission of this Climate Action Plan, UMES will be required to submit progress reports every other year, in accordance with the ACUPCC commitment. The first progress report in fall 2013 will be a revision of this CAP that includes measurement of successes to date, and each subsequent progress report will follow the same pattern.

These section references specific recommended actions including fundamental first steps, to be completed and included in the first progress report in 2013 (see chart below).

#### 2013 Progress Goals

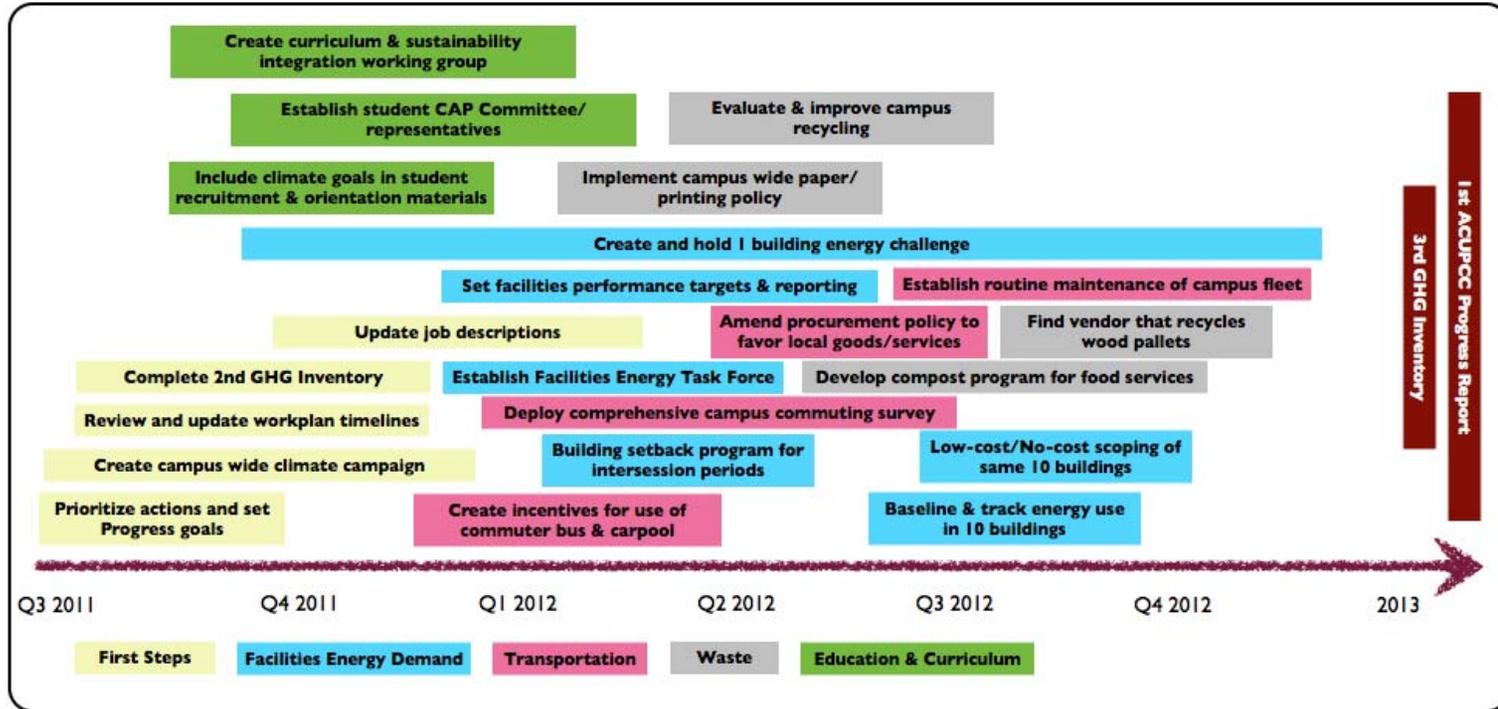
Focus Area	Initial CAP Actions	To include in 2013 Progress Report	Target Completion Date
First Steps	Conduct climate campaign workshops that explain the ACUPCC commitment to the campus community, and give context for the climate commitment as part of the University's move towards a sustainable future	Post campaign evaluation Updated actions table for "Communications" Focus Area	Summer 2013

Focus Area	Initial CAP Actions	To include in 2013 Progress Report	Target Completion Date
	Review & amend proposed timelines for tasks in the CAP	Updated target dates for completion of CAP actions	Summer 2013
	Define accountability for CAP tasks	All existing & new tasks assigned to responsible committees or individuals	Summer 2013
	Identify key skills required, integrate into core competencies & job requirements	Inventory of key staff, required skills, gaps & training needs	Summer 2013
Education & Curriculum	Establish Curriculum Working Group to integrate sustainability into curriculum and programs	Comprehensive plan to integrate climate & sustainability into curriculum by 2015	Spring 2013
Facilities Energy Demand	Establish a facilities 'Energy Task Force' with focus on building energy consumption	Updated table of required actions for "Energy, Buildings & Facilities" focus area	Spring 2013
Transportation	Survey students, faculty & staff about commuting habits and preferences	Findings of research to-date integrated into updated CAP as "Next Steps"	Summer 2013
Waste & Recycling	Research feasibility of converting organic wastes on-campus into usable bio-fuels	Actionable plan for bio-fuel generation on-campus as "Next Steps"	Spring 2013

Focus Area	Initial CAP Actions	To include in 2013 Progress Report	Target Completion Date
Climate Change & Sustainability Research Initiatives	Investigate organizational structure more conducive to interdisciplinary research	Defined organizational structure and transition plan to facilitate cross-functional research	Spring 2013
	Develop research program on resistance to GHG mitigation strategies	Findings of research to-date integrated into updated CAP as "Next Steps"	Summer 2013
Communications	Stakeholder survey of environmental consciousness and behaviors	Findings of research to-date integrated into updated CAP as "Next Steps"	Summer 2013
<b>Authoring revised CAP / progress report</b>	Conduct audit of progress on tasks in original CAP	Current status of all actions in original CAP	Summer 2013
	Identify additional tasks for each Focus Area to be included in updated CAP	Updated actions tables for each Focus Area	Summer 2013
	Review & amend proposed timelines for tasks in the updated CAP	Target dates for tasks in updated CAP	Summer 2013
	Conduct audit of ongoing CAP review & assessment process	Recommendations for process improvement	Summer 2013

<b>Focus Area</b>	<b>Initial CAP Actions</b>	<b>To include in 2013 Progress Report</b>	<b>Target Completion Date</b>
	Finalize updated CAP / Progress Report	Updated CAP / Progress Report submitted to ACUPCC	Fall 2013

### 3.5 Getting Started - Initial Implementation Plan



## 4. 2007 GHG Inventory

### Methodology

A Campus Greenhouse Gas Inventory Taskforce (GHG Taskforce), appointed by the co-chairs of the UMES Climate Change Steering Committee, undertook the completion of the inventory with assistance from Honeywell. The Clean Air-Cool Planet Campus Carbon Calculator version 6.1 was used to conduct the greenhouse gas (GHG) inventory. The Campus Carbon Calculator uses standard methodologies codified by the GHG Protocol Initiative. Clean Air-Cool Planet segments emissions into three categories (See Figure 1)<sup>14</sup>.

The GHG Taskforce chose the fiscal year 2007 (FY 2007)<sup>15</sup> as the study period because of data availability, while selection of the organization/spatial boundary was based on simple guiding principles. These were:

- 1) only include University operations located within the state of Maryland, and

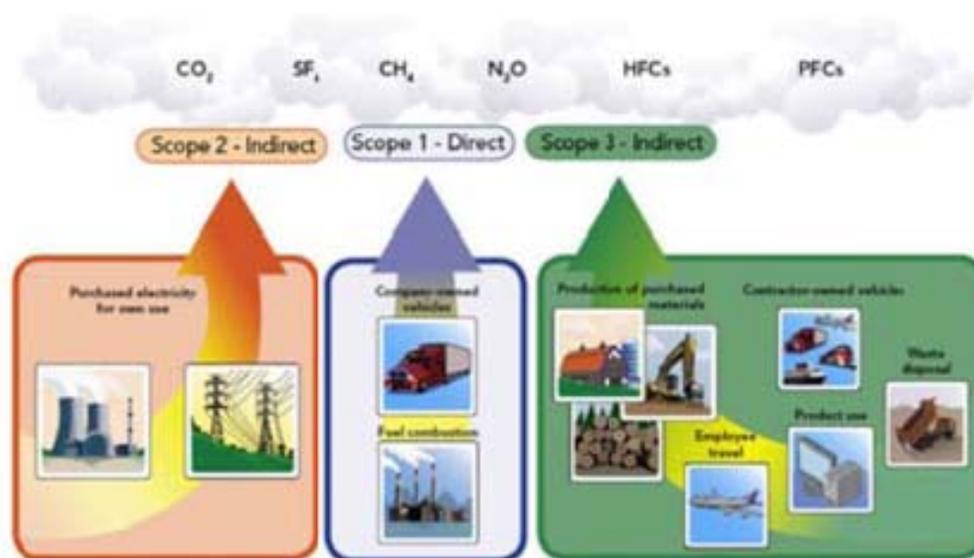


Figure 1. Clean Air-Cool Planet Emissions Scope

<sup>14</sup>14 From: WRI/WBCSD Greenhouse Gas Protocol

<sup>15</sup>15 The fiscal year for 2007 UMES runs June 2007 - June 2008

2) only include buildings owned and controlled by the University or for which the University paid the electric-power bill. This definition included the Eastern Shore campus and the University owned buildings for which electricity consumption was funded by the University. It did not include buildings/operations where the University is a tenant.

Emissions Inventoried

The ACUPCC expects signatories to follow emissions of the major greenhouse gases as designated by the Kyoto Protocol: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF<sub>6</sub>). With differing radiative properties, each gas is calculated separately and then aggregated into carbon dioxide equivalents (CO<sub>2</sub>e) based on each gas' global warming potential (GWP)<sup>16</sup>. The GHG Protocol defines three “scopes” for GHG accounting and reporting purposes:

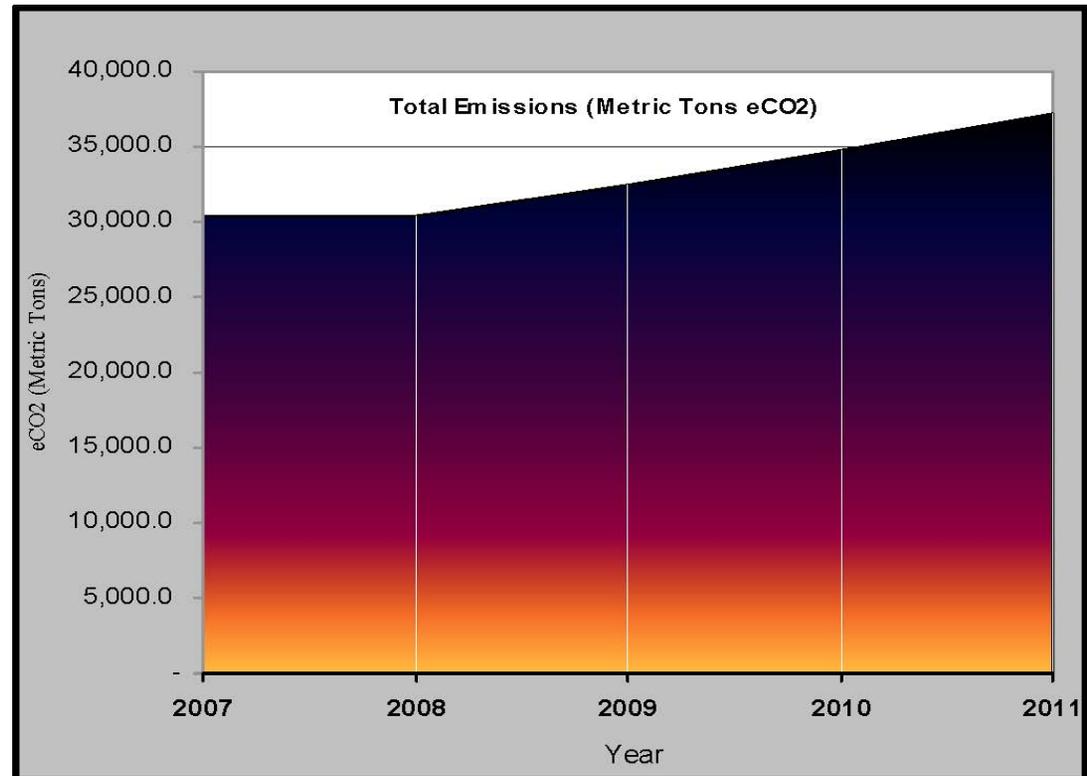


Figure 2. Total University greenhouse gas emissions for FY 2007 and Projected to 2011

**Scope 1: Direct emissions** These are all direct GHG emissions produced by facilities owned and controlled by the organization (e.g., production of electricity and steam, vehicle fuel consumption and fugitive emissions).

<sup>16</sup> 16 Global warming potential refers to the total contribution to global warming over a certain time horizon resulting from the emission of one unit of gas relative to one unit of carbon dioxide. For example, if methane has a global warming potential of 21 over a 100 year time horizon, it means that over a period of 100 years, 1 lb. of methane has the same impact on climate change as 21 lbs. of carbon dioxide and thus 1 lb. of methane would count as 21 lbs. of carbon dioxide equivalent.

**Scope 2: Indirect emissions from purchased electricity and steam** Includes all emissions associated with purchased electricity, heat or steam. Scope 2 emissions physically occurred at the facilities where the energy was generated and not at the user site.

**Scope 3: All other indirect emissions.** Includes all emissions from outsourced activities. Such emissions may have resulted from the activities of community members in the institution but occurred at sources owned and controlled by another organization (e.g. air travel, solid waste management, commuting activities).

### GHG Emissions Included in 2007 Inventory

For this inventory, Scope 1 emissions were associated with on-campus stationary sources (oil and propane), the University fleet (gasoline, diesel, compressed natural gas), agricultural activities (fertilizer application, manure management, enteric fermentation), and fugitive emissions from hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs) from HVAC systems. Scope 2 emissions included purchased electricity. Scope 3 considered GHG emissions associated with students and faculty/staff commuting in personally-owned vehicles, air travel for university-related activities, and landfill emissions that resulted from University generated solid waste (See Table 2).

Table 2. University inventoried emissions sources for FY 2007

Scope 1		
	Emissions Source	Source of Data
On-Campus Stationary Heating & Power	Fuel Oil & Propane	Fuel use data from the Energy Management Office
Campus Vehicle Fleet (Direct Transportation)	Gasoline & Diesel	Annual fuel use from the University Motor Pool
Refrigerants	HFCs & HCFCs	University HVAC/Physical Plant Dept.
Agriculture Emissions & Fertilizers		Data on animal head counts and total fertilizer applies from the University Farm Manager
Scope 2		
UMES Purchased Electricity	Delmarva Power Fuel Mix (54.2% coal, 33.5% nuclear, 4.9% natural gas, 3.8% renewable, 0.37% oil, & 3.5% PJM System Mix representing RECs purchased	Purchased electricity data & meters from on and off campus buildings with separate accounts, from Energy Management Office
Scope 3		
Commuter Traffic*		Personal mileage reimbursement figures from Accounting Dept.
Outsourced Travel**	Bus, ferry, taxi, rental car, personal car & air	Air miles data from Univ. System of MD, University's Travel Management System/Expense Statements, the University Travel Card Payment System, & University Contract Travel Agency
Solid Waste	Land-fill with no CH <sub>4</sub> recovery	University Environmental Dept. and Somerset County Solid Waste Department
Paper Purchase/Use		Accounting Dept.

## **FY 2007 Total Emissions**

For the period of FY 2007 the University's GHG emissions was 30,350.3 metric tons of carbon dioxide equivalent (MT-CO<sub>2</sub>e); approximately 16.9kg per square foot of building space. The inventory clearly demonstrates that the primary contributor is purchased electricity from Delmarva Power (See Table 2). With more than half fueled by coal and natural gas, purchased electricity accounts for 55% of GHG emissions in FY 2007. Combined with the on-campus power generation from fuel oil and propane, 72% of emissions result from the use of fossil fuels for heat and power.

Other sources of emissions include:

- GHG emissions from transportation, solid waste, refrigerant releases, and agricultural operations together made up the remainder of total GHG emissions in FY 2007.
- Direct Transportation Contribution: Transportation, overall, generated 2.7% of total GHG emissions in FY 2007 with sources including gasoline and diesel from the university fleet of vehicles.
- Commuting Contribution: Of the total transportation-related GHG emissions, commuting to and from campus was estimated to contribute 12% of total GHG emissions.

Table 2. Total University greenhouse gas emissions for FY 2007

MODULE		Summary				
WORKSHEET		Overview of Annual Emissions				
UNIVERSITY		Please enter university name on 'Introduction' sheet				
Select Year -->	2007	Energy Consumption	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	eCO <sub>2</sub>
		MMBtu	kg	kg	kg	Metric Tonnes
<b>Scope 1</b>	Co-gen Electricity	-	-	-	-	-
	Co-gen Steam	-	-	-	-	-
	Other On-Campus Stationary	68,581.8	5,065,332.4	723.5	43.4	5,094.8
	Direct Transportation	11,448.9	805,293.9	149.6	52.0	824.1
	Refrigerants & Chemicals	-	-	-	-	241.7
	Agriculture	-	-	5,349.1	226.8	190.2
<b>Scope 2</b>	Purchased Electricity	289,443.8	16,770,085.2	197.0	275.5	16,856.2
	Purchased Steam / Chilled Water	-	-	-	-	-
<b>Scope 3</b>	Faculty / Staff Commuting	20,017.5	1,403,663.5	280.7	96.6	1,438.7
	Student Commuting	5,806.7	407,419.4	80.3	27.7	417.5
	Directly Financed Air Travel	8,419.9	1,653,146.2	16.3	18.7	1,659.1
	Other Directly Financed Travel	732.4	51,512.7	9.6	3.3	52.7
	Study Abroad Air Travel	-	-	-	-	-
	Solid Waste	-	-	34,395.4	-	791.1
	Wastewater	-	-	-	-	-
	Paper	-	-	-	-	1,119.1
	Scope 2 T&D Losses	28,626.3	1,658,579.9	19.5	27.2	1,667.1
	<b>Offsets</b>	Additional				
Non-Additional						-
<b>Totals</b>	Scope 1	80,030.7	5,870,626.3	6,222.2	322.2	6,350.8
	Scope 2	289,443.8	16,770,085.2	197.0	275.5	16,856.2
	Scope 3	63,602.8	5,174,321.6	34,801.8	173.6	7,145.3
	All Scopes	433,077.4	27,815,033.1	41,221.0	771.3	30,352.2
	All Offsets					(1.9)
	<b>Net Emissions:</b>					

## Analysis

Of the 30,350.3 MT-CO<sub>2</sub>e, the largest portion (55%) was Scope 2 (See figure 2). Scope 2 consists of indirect emissions from sources that are neither owned nor operated by the University of Maryland Eastern Shore but whose products are

directly linked to on-campus energy consumption. This includes purchased electricity. Scope 3 accounted for 24% of the emissions, while Scope 1 was 21% of the total inventory.

**Scope 1**

**Purchased Energy & Other On-Campus Stationary Sources**

The University’s on-campus stationary sources of GHG emissions include fuels (fuel oil and propane) used for heating and in kitchens, laboratories, and emergency electric generators. (See Figure 3 for breakdown.)

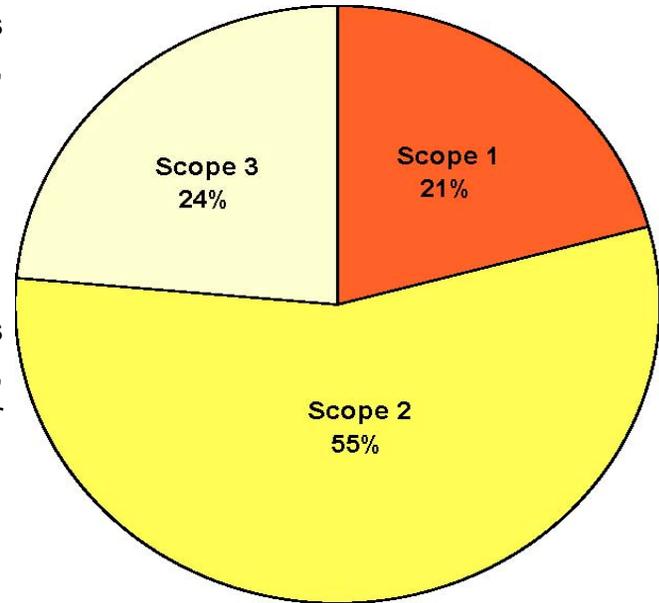


Figure 2 - University GHG emissions by scope for the fiscal year 2007

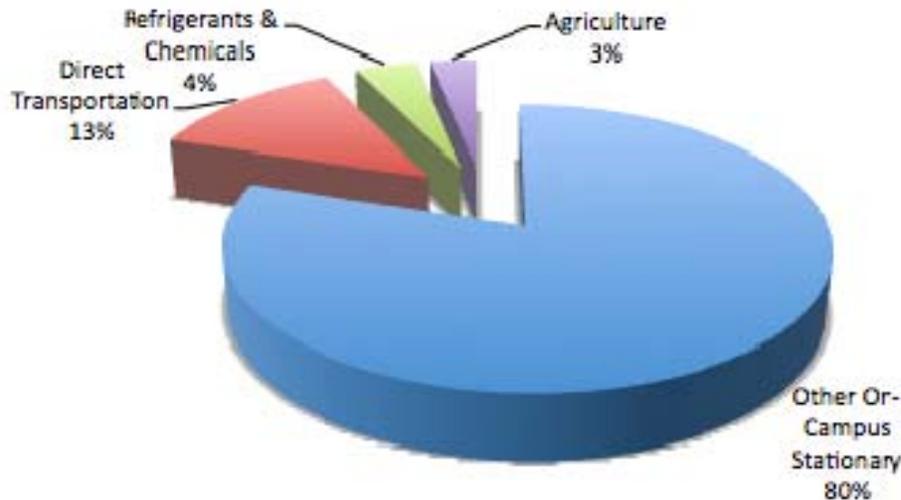


Figure 3. A detailed breakdown of Scope 1 GHG emissions by source for the fiscal year 2007

**Direct Transportation Sources**

This includes everything from waste collection to moving equipment and transit systems owned by the university. The fleet consumed a total of 83,280 gallons of gasoline and 8,030 gallons of diesel.

**Refrigeration and other Chemicals**

Three out of the seven gases reported were CFCs. However, the IPCC and EPA suggest that GHG

inventories should not account for CFCs since they are being phased out by the Montreal Protocol and Clean Air Act Amendments; thus CFCs were excluded from the inventory. HFC's were less than 10 pounds and HCFC was less than 300 pounds.

**Agriculture**

The agriculture section of the Carbon Calculator inventoried methane emissions from the guts of ruminant animals (e.g. dairy cows) by microbial action, a process called enteric fermentation and manure decomposition of all barn animals. The inventory also included nitrous oxide emissions that were released from animal waste and the application of nitrogen fertilizers on fields and grounds.

**Animal Husbandry**

Animal head count records of the University's barn were provided by the Farm manager. Herd sizes of swine, goats, and sheep varied throughout the year so an average annual size was used. This also included a large poultry population (~17,000).

**Scope 2**

**Purchased Electricity**

More than half of the University's electricity consumption was purchased from Delmarva Power (See Table 3). The Delmarva Power Energy Source Fuel Mix specific emission factors for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O are 54.2% coal, 4.9% natural gas, 33.5% nuclear, 0.37% oil, 3.8% renewable energy and 3.5% PJM System Mix, which represents the purchase of Renewable Energy Certificates. The University did not purchase any steam or chilled water.

*Table 3. University electricity use*

<b>Electrical use</b>	<b>kWh</b>
Lighting	12,866,351
Cooling	7,572,063
Ventilation	3,385,882
Refrigeration	2,216,213
Cooking	1,631,379
Office Equip.	1,015,765
Misc.	954,203
Heating	707,957
Water Heating	430,930
<b>FY 2007 kWh consumption</b>	<b>30,780,743</b>

### Scope 3

#### Faculty, Staff and Student Commuting

Due to a lack of transportation-related surveys, average commuting behavior (e.g. carpool, single driver, frequency of trips to campus, commuting distance) was not available, but the university was able to provide a total miles figure based on their records. The Carbon Calculator breaks down University commuting by community member (i.e., student, faculty, and staff) and by mode of transportation (i.e., personally-owned vehicle, bus, rail, and commuter rail). The only category separated was commuting by a personally-owned vehicle. Shuttle bus ridership was accounted for within the University vehicle fleet because it was based on diesel dispensation records (See Figure 4).

#### Directly Financed Outsourced Travel

The inventory did not include travel paid by individuals for which they were reimbursed by non-University organizations and travel reimbursed through the University of Maryland Eastern Shore's Accounting Office. In FY 2007, the campus community flew just over 2 million passenger miles, which yielded 1,659 MT-CO<sub>2</sub>e.

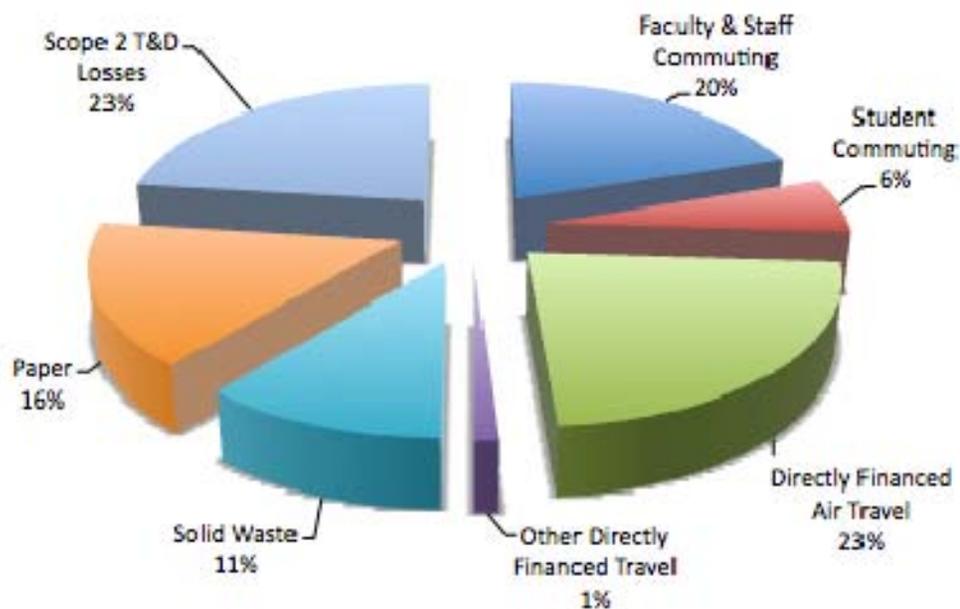


Figure 4. A detailed breakdown of Scope 3 emissions by source for the fiscal year 2007

## Solid Waste

The waste generated by the University was all land-filled with no methane recovery. Somerset County only has one closed site where they are currently removing methane. This site was closed approximately five years ago and does not include any waste from FY 2007. Current plans do not include any additional sites for methane recovery in the next ten years. No incineration is being done on the UMES campus. Emission offsets were included in the inventory since composting does take place within the organizational boundary of the campus and emission credits may be taken by the composting facility.

## Paper Purchasing

The campus uses approximately 900,000 pounds of paper, of which 354,000 pounds is 25% recycled.

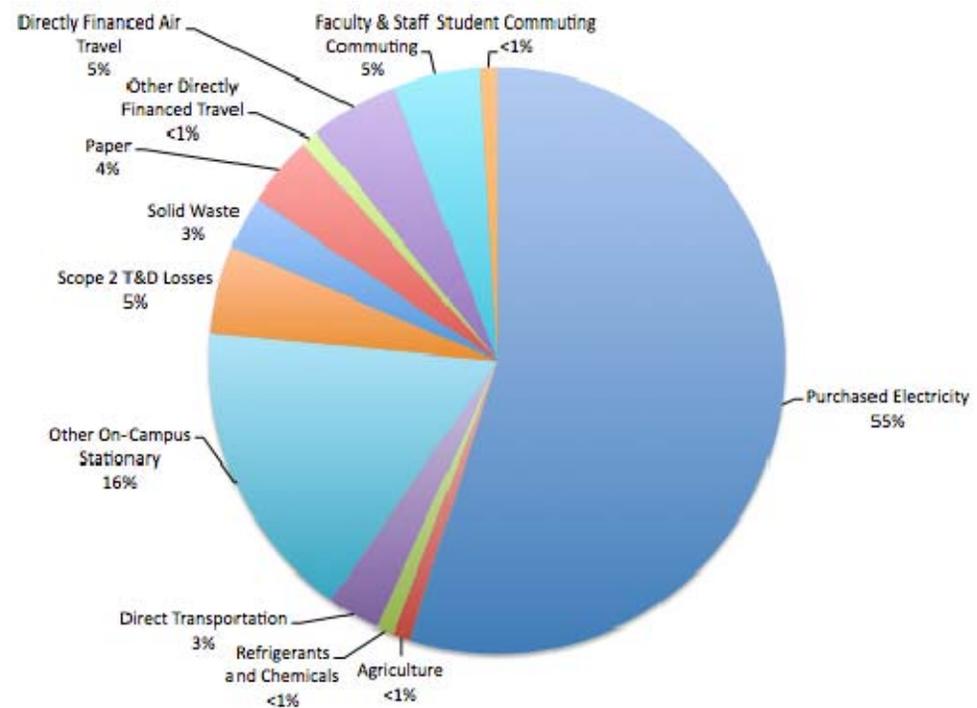


Figure 5. A detailed breakdown of all GHG emissions (Scope 1,2&3) by source for the fiscal year 2007

## 5. Estimated Future GHG Trajectory

Based on projections from the UMES Master Plan 2008-2018 pertaining to campus growth and potential energy use, UMES could see a dramatic increase in emissions over the next decade<sup>17</sup>. In fact, without aggressive action to mitigate such increases, emissions could double by 2020.

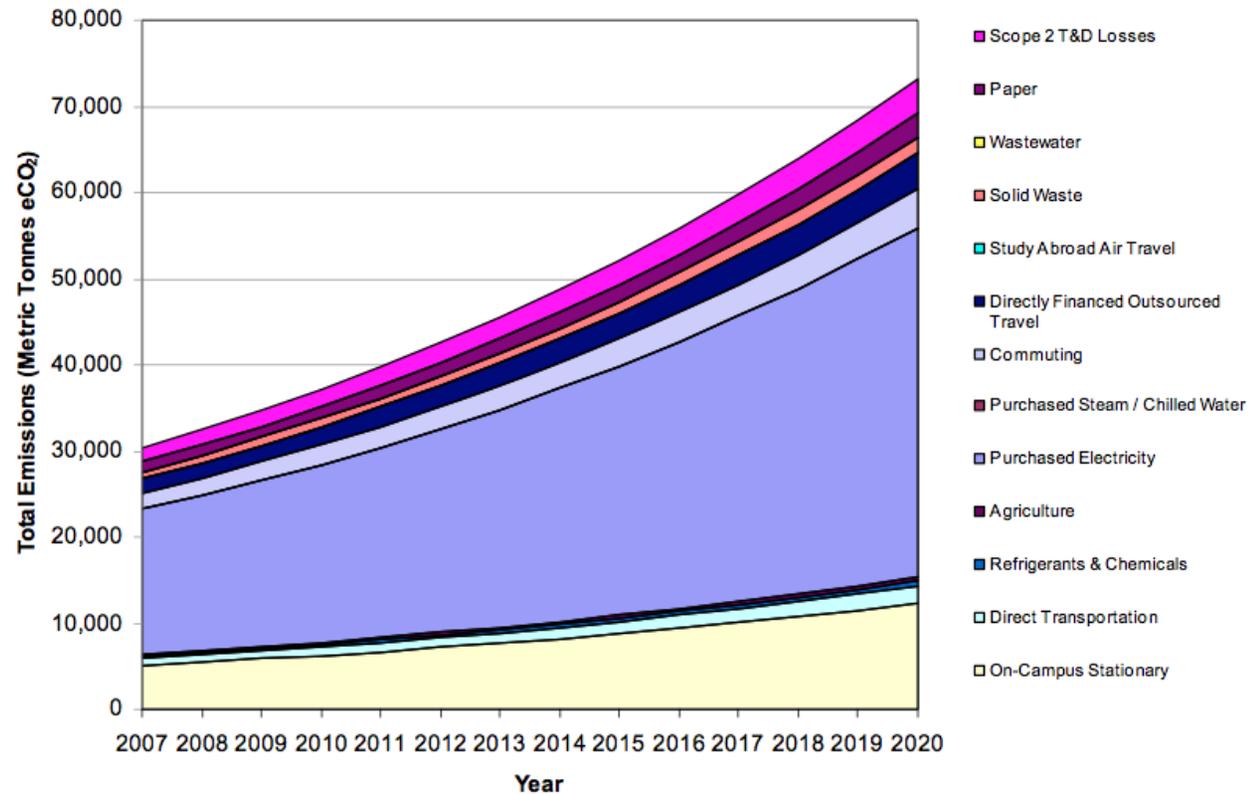


Figure 6. GHG Emissions Projections 2020

<sup>17</sup>17 UMES Master Plan 2008-2018 p.102: Enrollment Projections Table - With corresponding increased projections for Faculty/Staff FTE and demand for instructional space, as per UM System Space Planning Guidelines.

## 6. Emissions Reductions Milestones

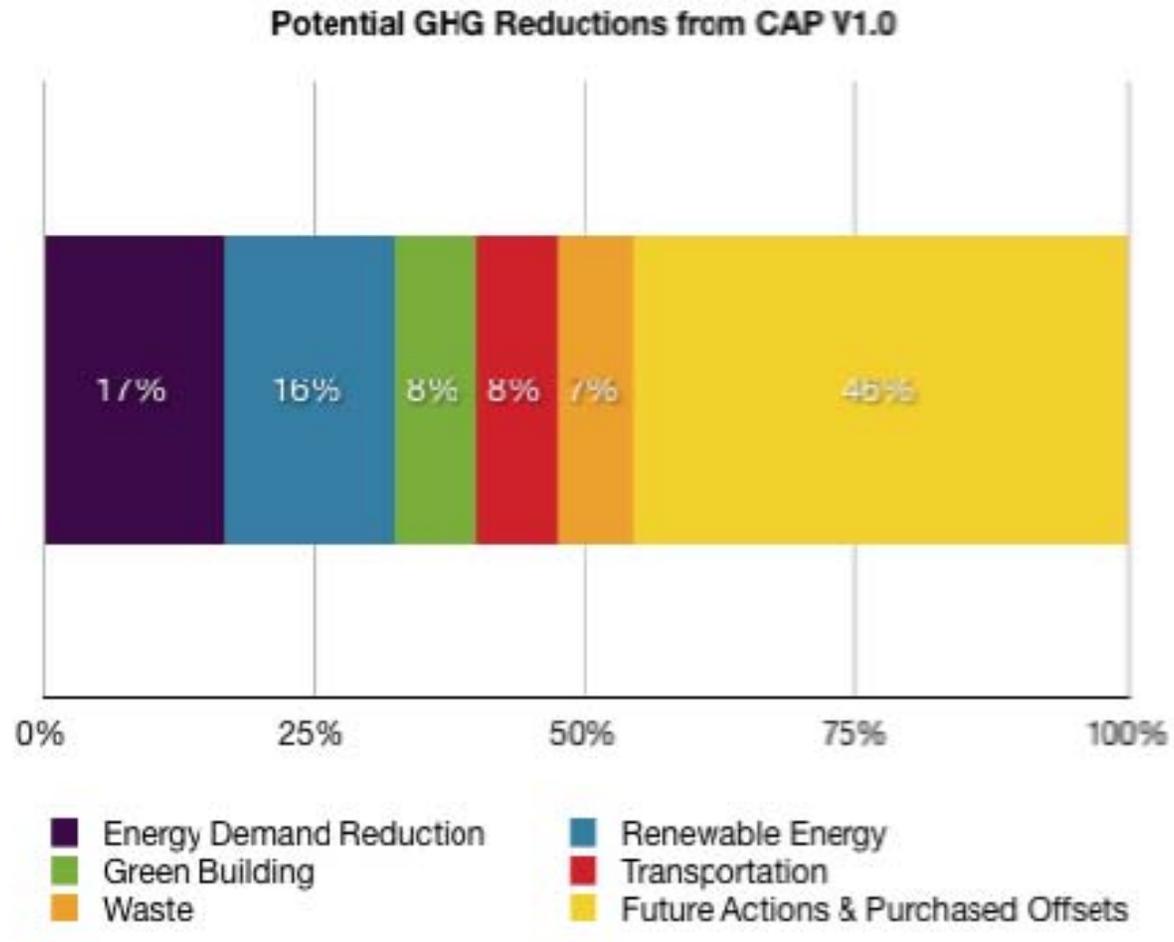
UMES will initially follow the Maryland state targets for greenhouse gas reductions that were established in 2009. The Greenhouse Gas Emissions Reduction Act of 2009 calls for a 25% reduction on 2006 levels by 2020, and UMES will strive for the same interim target (based on the provided 2007 levels) on its path to carbon neutrality.

Therefore, five-year emission reduction milestones for UMES have been proposed:

Year	Percentage Reduction
2015	12%
2020	25%
2025	37%
2030	50%
2035	62%
2040	75%
2045	87%
2050	100%

The steady decline by 12-13% over each five-year period takes into account the State of Maryland's goal of reducing emissions 25% from 2006 levels by 2020, and then maintains this trajectory over the following three decades to zero emissions. Reductions will be obtained in the first decade by capturing "low-hanging fruit", or most readily available and cost-efficient reductions. As the "low-hanging fruit" disappears, UMES will need to tackle more ambitious and costly areas of reduction. A key assumption in the milestone projection is that technological costs and advancement will aid in the capture of these percentages in the later years.

This plan includes recommendations with estimates of potential CO<sub>2</sub>e reductions towards these targets. Acknowledging that the lion's share of our current GHG footprint cannot be addressed at once, we can note that this initial version of the UMES CAP can set us towards not only stabilizing our current emissions, but begin to approach reducing current emissions by nearly one-third (see below). If we were able to directly quantify many of the other actions included here, this reduction would increase further.



## 7. Recommendations Overview

This section includes proposed actions developed by UMES faculty and staff to mitigate the University's climate impact. The recommendations are divided into Focus Areas (First Steps; Education & Student Life; Renewable Energy, Energy Conservation; Transportation & Fuels; Waste & Recycling; Academic Research; and Communications & Awareness) and grouped into areas of strategic focus. One of UMES' first steps is to prioritize these actions into a sequenced work plan and revise target completion and review dates. Using the indicators given we will be able to track our progress on specific tasks while connecting that progress to our five year targets, periodic GHG Inventories, and regular CAP updates.

### **IMPORTANT:**

***The carbon dioxide emission reduction information for each action is estimated POTENTIAL based upon the UMES GHG baseline and available results from similar programs/technology already deployed in the marketplace. There are a number of factors, known and unknown, that may affect actual GHG reduction amounts. For example, the real energy savings of an energy conservation awareness program will depend on the effectiveness of the program, behavior change of students, faculty and staff, etc. Evaluation, measurement and verification of energy efficiency behavior based programs is an emerging field, with major utilities across the US attempting to accurately baseline and track performance associated with these programs. In addition, technological changes between now and the UMES carbon neutral date of 2050 will be immense and have an equally immense impact on this plan moving forward. Therefore, these estimates will be continually refined as UMES progresses through its cycle of continuous improvement over the next few decades. (Emissions impacts marked with "N/A" are non-quantifiable, but would contribute to overall emissions reductions.)***

***Target and review dates will change as the university adjusts priorities, allocates resources and develops detailed and specific action plans over time.***

### **Accountability**

The first and most important actions recommended in this plan are identifying key staff members and skill sets that will be required to enact the CAP, and to create a CAP Executive Committee who will be accountable for the tasks outlined in the CAP. Accountability for tasks will ensure that UMES makes progress toward carbon neutrality.

## **Timelines**

The CAP Executive Committee and sub-committees will establish more precise target and review dates for various tasks depending on the individuals and factors associated with each task as well as the University's competing priorities. We understand that "long-term" tasks, once completed, will not get us to the end of the road. We illustrate them now only to remind ourselves that new ideas and needs will still exist down the road, and it is in our best interest to begin thinking about them now.

Tasks here are loosely prioritized based on two factors: 1) The potential of the action to decrease UMES emissions; and 2) The potential cost and feasibility of completing the action with current resources.

Together these will begin to create a cycle of continuous improvement, where UMES becomes more proficient, and more aggressive towards its goals, with every new action plan implemented, always evaluating its goals and performance.

## **8. Facilities Energy Demand Reduction Strategies**

This area hones in on the physical plant and energy use of the UMES campus. Many of the initiatives proposed are tangible projects that address areas for efficiency improvements in the built environment. Feasibility and scoping studies are required to determine the potential of many other proposed actions. Establishing partnerships with some key stakeholders will enable and accelerate the completion of many of these initiatives.

### 8.1 Summary Recommendations

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
Energy conservation programs	Establish a facilities 'Energy Task Force' with focus on building energy consumption		2012	December 2011	Team of building operators, engineers and faculty established Total energy usage	1,685	10%*
	Set energy performance targets and reporting protocols to UMES senior administration		2012	December 2011	Targets established Campus energy usage	N/A	N/A
	Baseline measurements & ongoing tracking of energy use at all buildings		First 10 buildings by December 2012 (10 more each quarter)	Quarterly	Energy usage Utility expenditures	853	5%

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Building scoping exercise on all buildings to determine immediate no-cost/low-cost measures to reduce energy demand & consumption		First 10 buildings by December 2012 (10 more each quarter)	Quarterly	Buildings scoped Number of opportunities identified Building level energy usage	853	5%
	Install heat exchangers in confined broiler operations to capture heat from animals		2020	2018	Energy usage in animal confines	N/A	N/A
	Update & repair HVAC systems, improve preventative maintenance procedures		To begin 2013	2012	Building energy usage, system on/off durations	853	5%

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Establish contact with Rep. Andy Harris (chair of House sub-committee on energy and representative from Eastern Shore) to promote energy efficiency on Eastern Shore		January 2012	January 2012	N/A	N/A	N/A
	Implement "Cloud Computing" model for UMES campus		November 2015	November 2013	Energy use E-Waste volume IT purchasing costs	N/A	N/A
	Feasibility study for developing a central chiller plant on campus		December 2013	December 2013	Completed study	N/A	N/A

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Integrate RTK GIS for underground irrigation systems and update overhead systems (RTK also used to prevent overlap)		2025	2023	Water usage	N/A	N/A
Energy / climate awareness programs	Communicate existing initiatives		Begin Immediately	Quarterly	Communication strategy	N/A	N/A
	Set goals, measure & communicate progress		Begin Immediately	Quarterly	N/A	N/A	N/A
	Stakeholder survey of environmental consciousness and behaviors		Begin Immediately	Semi-Annually	Completed baseline survey results	N/A	N/A
	UMES Climate Action week/month		April 2013	April 2012	Climate week event complete	N/A	N/A

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Offer regular advice to students, staff, faculty and guests on how to mitigate climate impacts		Begin Immediately	Quarterly	Energy efficiency tips campaign established	Unknown	Unknown
	Create challenges for stakeholders to participate in		December 2012	August 2011	Building to building challenge	Dependent on challenge	Dependent on challenge
	Include progress metrics in general UMES communications		August 2013	August 2012	UMES collateral includes climate commitment and progress	N/A	N/A
	Partner with local media to communicate progress		August 2013	August 2012	Number of news stories	N/A	N/A
Heating oil options	Research alternative energies to generate steam for campus heating		On-going	December 2018	Alternative identified	Dependent on alternative	Dependent on alternative

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
Performance contracting	Once existing building systems are performing optimally, explore performance contracts with building systems specialists for improving building performance		July 2016	July 2016	NA	NA	NA
Optimize space utilization	Establish building setbacks for inter-session and off-peak periods		June 2012	February 2012	Intersession setback strategy Peak & minimum load profile	853	5%

\* (Based on success rates and in conjunction with other measures over a period of 5 years at other universities)

## 8.2 Discussion

### Greening UMES physical plant & equipment

A crucial early move in attaining reductions in energy use is to conduct a baseline assessment of energy use in each of the facilities on the campus. The data gathered in this exercise will provide the context for facility-specific goals throughout the execution of the CAP. Ongoing metering and monitoring protocols must be put in place to evaluate progress. Typically, buildings that begin to track energy performance see an average decrease in energy demand of 5% to 15%,

simply because the performance is being measured. In conjunction with a baseline assessment, UMES should conduct an audit for no-cost/low-cost improvements involving buildings thermal envelope, use and scheduling, sequence of operations, nighttime usage, controls issues etc. These opportunities will help UMES demonstrate early progress in its emissions reductions and build support for the CAP initiatives at large. With facility performance data and monitoring protocols in place, UMES should establish energy use targets for each facility and the campus at large, and a mechanism for reporting performance on a quarterly basis to senior administration.

Other energy efficiency projects that should to be explored include updating HVAC systems and improving upon their maintenance schedules, the installation of green roofs or cool roofs, and heat exchangers to capture heat from livestock.

### **Feasibility & planning**

Several programs in particular require in-depth feasibility study before UMES proceeds with them. UMES should explore sources of steam and waste heat on campus that could be captured to heat buildings and reduce energy needs. A “cloud computing” model that utilizes central servers and mobile devices rather than work-stations may drastically reduce power consumption. Converting to a paperless campus would reduce printing needs and associated energy usage, as well as drastically reduce the amount of solid waste produced by UMES. Incorporating sustainability metrics into procurement policies would ensure ongoing and future efficiencies. A small bio-mass energy generation plant on campus would allow UMES to convert waste from agricultural and culinary facilities into electricity, reducing demand on purchased power.

### **Build awareness**

Crucial to the success of the CAP is an engaged community. To build awareness of UMES’ approach to climate change and sustainability, it must strive to communicate its successes broadly. It is crucial for UMES to set ambitious, yet attainable goals, and to communicate progress against those goals regularly.

A survey of current attitudes and behaviors around climate, energy use, and sustainability awareness would give UMES a baseline understanding of its stakeholders to evaluate against in future. Over time, with regular engagement and promotion of sustainability initiatives on campus and in the community, UMES can expect a growing level of awareness and behavior change in support of the CAP goals.

A UMES Climate Action week or month would be an effective way to draw attention to goals and initiatives that are

ongoing, but also to seek input from stakeholders on upcoming endeavors and new ideas for how UMES can make progress.

### **Engage action**

Participation is affected by the perception of opportunities to participate. UMES must actively seek out opportunities to invite stakeholders to participate in the process of mitigating the climate impact of the university. This can take a number of forms, but should include regular advice about how to limit one's own personal footprint. Tips and "Did you know" messages could be posted on signboards around the campus, included in newsletters, etc. These facts could pertain to transportation, energy use, and any other climate-related activity that an individual has the agency to affect.

Challenges to stakeholders are a fun way to create a positive impact. UMES could offer rewards or prizes as part of regular programming to reduce climate impacts on campus. Examples of this could include "proof-of-carpool" tickets that could be redeemed for food and drink in campus eateries, or bookstore discounts for students who demonstrate bicycle use over driving.

### **Celebrate achievements**

To build buy-in with the CAP, UMES must promote and celebrate its achievements. This can be done with special events on campus, by including progress data in common UMES publications, and by partnering with local media to disseminate results. UMES has a history of resource efficiency projects, but a lack of communication about these initiatives has proven to be a missed opportunity to build awareness and commitment amongst the community. Celebrating sustainability successes is a powerful way for UMES to demonstrate its leadership and consolidate its reputation in the community and as an educational institution of excellence.

## 9. Renewable Energy Strategies

### 9.1 Summary Recommendations

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
Renewable energy generation	Solar panels and rechargeable batteries for equipment in agricultural, animal & field research facilities		2013	December 2012	Fuel usage	190.2	0.06%
	Feasibility study for developing a small-scale biomass energy plant on campus		2013	December 2012	Completed study	N/A	N/A
	Install additional 2.2 MW photovoltaic array		2024	2017	Purchased energy	2,428.2	8.0%
	Install two 1 MW wind turbines		2030	2027	Purchased energy	2124.5	7.0%
Renewable energy purchasing	Work with Delmarva to explore alternative energy sources		2015	2014	Green energy purchasing options	N/A	N/A

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Purchase all energy from carbon free sources		2035	2030	Scope 2 emissions from purchased energy	Dependent on future energy use / generation	Dependent on future energy use / generation

## 9.2 Discussion

Purchased electricity accounts for approximately 55% of UMES total emissions. This massive factor can be addressed in three possible ways: 1) UMES reducing the amount of energy it uses, and therefore reducing the amount purchased from carbon emitting sources; 2) UMES generating renewable energy; and 3) UMES purchasing power from low-carbon or carbon-free sources. The first will be addressed in section 7.4, while the latter two are addressed here.

UMES has already installed a 2.2MW photovoltaic array, and should look to double this capacity by the end of the coming decade. This would provide an additional 8% of UMES' energy needs, based upon the performance of the existing solar array. Installation of two 1 MW wind turbines in the following decade (by 2030) would powerfully illustrate UMES' commitment to climate neutrality and account for a further 7% of UMES power needs based on 2007 levels.

UMES should work with Delmarva to explore all energy options available. Being a large customer, UMES may exercise influence over the utility to begin considering alternative means of power generation, and this strategy should commence as soon as possible. Ultimately, UMES should aim to secure all required purchased electricity from carbon-neutral sources by 2035. By the carbon neutrality date of 2050, purchased electricity would represent approximately 30% of UMES total energy needs, depending on the execution of the CAP, technological advances, etc.

## 10. Green Building / Facilities Development Strategies

### 10.1 Summary Recommendations

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
Capital investments	Install rain water catchment & grey water systems in all new buildings, potentially in renovations		To begin 2015	2014	Number of systems installed Water usage	N/A	N/A
	Install green roofs & cool roofs on existing and new buildings		To begin 2016	2015	Roofs installed Building energy usage	2306.6	7.6%
Develop partnerships & procurement strategies	Work with Historical Preservation Society to establish middle ground on updating buildings		2015	2014	Complete deep renovation for energy efficiency of historical building	N/A	N/A

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Work with Delmarva / municipality to extend natural gas line from Fruitland to campus		2025	2020	N/A	N/A	N/A
	Integrate sustainability metrics into procurement policies and bid specs		2013	November 2012	Revised policies & RFP criteria	N/A	N/A
Research programs	Develop storm-water management plan including bio-retention		2020	2018	Design protocol	N/A	N/A
	Expand program for use of cooking oils for heating and farm equipment		2013	December 2012	Fuel expenditure	N/A	N/A

## 10.2 Discussion

### Relationships with strategic partners

UMES has already committed to minimum standard of LEED Silver for all major capital projects, as well as purchasing only Energy Star rated products when available. Building on this, an audit of energy consumption on the UMES campus will result in a variety of proposed subsequent actions, and many of those will pertain to the older buildings. An ongoing relationship with the Historical Preservation Society will allow UMES to understand and negotiate for potential changes to

protected buildings, striking a balance between honoring the past and ensuring a low-emission future. UMES should also establish a working relationship with Delmarva to explore alternative energy sources.

Currently, 55% of UMES emissions result from the purchase of Delmarva electricity derived from coal and gas. It is absolutely critical that UMES partner with Delmarva to explore alternative, lower emissions energy sources to make major strides toward reduction targets. It may also be possible to extend the natural gas line from Fruitland to the UMES campus. Finally, a relationship with Representative Andy Harris, chair of the House sub-committee on energy, would help UMES leverage its status as a leader on the Eastern Shore to influence policy promoting renewable energy sources in the region.

## 11. Transportation Solutions

### 11.1 Summary Recommendations

(\*Until a comprehensive campus commuting survey is completed, these numbers are considered highly subjective)

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
Investments in equipment & infrastructure	Enhance biking infrastructure on campus with covered storage at each housing cluster, covered storage at central location for commuters, and racks at all facilities		2013	December 2012	Number of racks per FTE, storage areas, cycle path mileage	182.1	0.6%
	Require EPA Tier-4 emissions standards or bio-fuel capability for all new vehicles		2013	December 2012	Policy established Average emissions rating of fleet	151.7	0.5%
	Install electric-vehicle charging stations on campus		2015	2014	Number of charging stations	394.6	1.3%

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Replace grounds carts with electric versions		2015	2014	Gas to electric cart ratio	151.7	0.5%
	Convert existing fleet and fuel station to compressed natural gas (CNG)		2016	2015	Gas to CNG fleet ratio	182.1	0.6%
	Purchase 50-passenger coach to reduce contracting mini-buses		2016	2015	N/A	15.7	0.5%
Program development	Promote/incentivize use of commuter buses & carpooling		2012	December 2011	Quantity of cars on campus Commuter bus ridership	N/A	N/A
	Establish routine maintenance check schedule on existing fleet to ensure efficiency		2012	October 2012	Number of checks, tire pressure, fuel costs Vehicle life	60.7	0.2%

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Provide preferential parking locations for low-emission vehicles		2013	October 2012	Quantity of low-emission vehicles Number of spaces per FTE	N/A	N/A
	Create all-campus car-pooling program for students, faculty & staff		2013	October 2012	Quantity of cars on campus Use of car-pooling program	364.2	1.2%
	Install teleconferencing software to mitigate some business travel		2014	May 2013	Amount of official UMES air travel	33	2%
	Offer 4-day work week (10-hour days)		2016	2015	Energy usage & operating costs Employee satisfaction	28	2%

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
Feasibility & planning	Develop procurement policy that favors local goods & services		2012	June 2012	Policy document	N/A	N/A
	Survey students, faculty & staff about commuting habits and preferences		2012	Bi-Annually	No. of survey respondents Statistics of current habits	N/A	N/A
	Research feasibility of UMES bike-sharing program		2013	December 2012	Feasibility report	N/A	N/A
	Research feasibility of commuter rail using existing tracks on campus		2024	2017	Feasibility report	Unknown	Unknown

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Research feasibility of electric or bio-fuel vehicles to replace existing fleet (costs, electricity source, overall emissions impact)		2018	2015	Feasibility report	N/A	N/A
Communications with stakeholders	Promote green transportation options & initiatives to all campus visitors		2013	November 2012	Signage, recognition survey results	333.9	1.1%
	Encourage carpooling & group travel to off-campus events		2013	November 2012	Campus commuting survey Cars on campus	60.7	0.2%
	Promote central pick-up location of UMES Shuttle Bus in Salisbury, alter offering times to maximize efficiency		2013	July 2012	Number of users, cars on campus	333.9	1.1%

## 11.2 Discussion

Commuting represents 12% of UMES' total emissions and accordingly is an area in which significant gains can be made in the short-term. Prioritized actions in this section are focused on limiting the number of individual trips taken to and from the campus, and converting to cleaner modes of transportation.

### **Investments in equipment & infrastructure**

Investing in a 50-passenger bus will limit the number of trips being taken in multiple mini-buses to events off-campus. An increase in biking infrastructure will promote self-propelled transportation in warmer months.

The campus fleet is responsible for 3% of total emissions, and this percentage could be curtailed by implementing extremely low-emissions standards for new vehicles, conversion to bio-fuels or compressed natural gas (CNG), and replacement of gas powered carts with electric. Electric charging stations are a medium to long-term incentive for low-emissions travel to and from the campus by students, staff, faculty, and visitors.

### **Program development**

Car-pooling has the potential to drastically reduce the number of single-person trips to and from the campus. UMES should strive to boost carpooling by expanding the current program to a more comprehensive approach that includes students, faculty, and staff. A four-day working week would also drastically reduce the number of trips, and should be investigated as an option, particularly during summer months.

Preferential parking arrangements for low-emissions vehicles would be an effective reward mechanism for eco-friendly commuters.

### **Feasibility & planning**

A recommended first step in transportation feasibility and planning is to survey stakeholders about their commuting preferences and current habits. Additionally, a survey should seek to explore how amenable stakeholders' would be to various other methods in the future.

Feasibility studies are required for a potential bike-sharing program on-campus, as well as the aforementioned carpooling program. Studies should also explore the cost-benefit ratio of conversion of the campus fleet to electric, hybrid, or natural gas power.

UMES has an unused rail line that runs through the campus. This may in future allow for commuter train access, which

would dramatically reduce the number of car trips to and from the campus.

### Communication with stakeholders

The commuter shuttle bus from Salisbury is a relatively untapped opportunity for the reduction of car trips to the campus. Aggressive campaigns to promote this, as well as carpooling, ride-sharing, and cycling should be undertaken.

## 12. Waste Disposal

### 12.1 Summary Recommendations

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
Purchasing & investments in physical plant	Mandate the purchase of biodegradable cutlery and dishes		2013	November 2012	Procurement policy % dining ware non-compostable	N/A	N/A
	Research gasification of animal wastes for fuels		2016	September 2015	Feasibility report	N/A	N/A
	Research feasibility of algae & other organic material (grass cuttings, etc) to create bio-fuels		2016	2015	Feasibility report	N/A	N/A

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Use grass clippings for erosion prevention in vulnerable areas (under construction, etc)		2014	September 2012	Volume diverted from waste stream Erosion rate	N/A	N/A
Program development	Create end-of-year residence donation, buy-back program for resale to future students		2012	April 2012	Solid waste diversion volume from dorms at end-of-year	N/A	N/A
	Develop paper-use policy to reduce printing, mandate double-sided, etc		2012	April 2012	Volume of paper purchased Solid waste volume	546.3	1.8%
	Evaluate, improve & promote on-campus recycling program to overcome skepticism		2012	April 2012	Promotional materials deployed on campus	N/A	N/A

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Develop compost program & protocols for food services		2012	May 2012	Volume diverted from waste stream	N/A	N/A
	Mandate online course materials to reduce printing		2016	January 2015	Volume of paper purchased Solid waste volume	151.7	0.5%
	Create strategy to become paperless university in academics and administration		2020	2017	Paper waste volume, printer power consumption, printing costs	1123.0	3.7%
	Make UMES a smoke-free campus		2020	2013	No smoking policy	emissions of 1 smoked cigarette 0.24 kg CO <sub>2</sub> e	N/A
Feasibility & partnerships	Identify vendor to recycle wooden shipping pallets		2012	August 2012	Volume diverted from waste stream	N/A	N/A

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Identify vendor to microwave hazardous wastes to create fertilizers		2016	September 2016	Volume diverted from waste stream	N/A	N/A
	Research feasibility of converting plant waste to bio-char for heat generation		2015	February 2013	Volume diverted from waste stream Energy costs	303.5	1.0%

## 12.2 Discussion

### Purchasing & investments in physical plant

Investigation should be conducted around fuels that could be derived from by-products currently available on the campus. Grass clippings, and agricultural and livestock wastes could potentially provide an ongoing source of bio-fuel that would reduce UMES' need for purchased power, which currently accounts for 55% of total emissions.

### Program development

Many of the programs to be developed involve reductions of solid waste. These initiatives are linked to climate in an indirect way by reducing fuel usage for transport and processing, but they also signify UMES' commitment to a broader, more comprehensive approach to sustainability.

A residence buy-back program could drastically reduce the amount of solid waste at year-end, but also the number of trips that students in residence take when moving in and out of the campus.

UMES should aggressively seek to reduce the amount of paper consumption on the campus. This can be achieved by mandating online course materials, and strict limits to the amount of printing for staff and faculty.

Finally, the campus recycling program needs to be enhanced, reinforced, and promoted to overcome the current skepticism that surrounds it. A compost program for food and agricultural wastes should also be explored and developed, possibly in collaboration with an academic department. There may also be a potential synergy with the bio-fuel strategy suggested in the previous section.

### **Feasibility & partnerships**

Vendor partnerships should be explored to boost the amount of material removed from the campus to be recycled. Wooden shipping palettes are a large source of this solid waste, and should be treated as such. A partner should be sought to handle hazardous wastes to prevent this material from reaching landfill.

## 13. Sustainability Education & Curriculum Development

### 13.1 Summary Recommendations

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
Create shared vision & purpose	Communicate UMES sustainability commitment & approach		2012	October 2011	Inclusion in all UMES communications materials & events of significance	N/A	N/A
Student engagement	Integrate sustainability and carbon neutrality goals into recruitment and orientation content		2012	December 2011	Number of students selecting UMES based on sustainability commitment	N/A	N/A
	Establish CAP Student Committee		2012	October 2011	Committee established	N/A	N/A

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
Program development	Establish Curriculum Working Group to integrate sustainability into curriculum and programs		2012	November 2011	Number of student projects/classes utilizing the UMES climate commitment for direction	N/A	N/A

## 13.2 Discussion

### Create shared vision & purpose

In order to be strategic, you must be clear about what you are trying to achieve. Presently, the UMES community, faculty and students included, lacks awareness of the University's commitment to becoming carbon neutral. As such, UMES should create a comprehensive communications strategy that includes its commitment to carbon neutrality as part of the University's other strategic goals. Transparency of this bold commitment legitimizes the deployment of resources to realize the University's mission of climate neutrality. It can provide context for resource efficiency projects and be communicated to facilities management teams, faculty, staff and students to enable the achievement of campus emissions reductions. Communicating this vision broadly will allow faculty, staff, students, and the community at large to share a common understanding of what UMES intends to become over time. This will facilitate engagement and collaboration in the right direction. Opportunities to communicate the vision are explored in Focus Area F: Communications, to follow below.

### Student engagement

For UMES' CAP to be successful in the long-term, students must be engaged to contribute to the UMES quest for carbon neutrality and sustainability progress. This message should be included into student communications wherever possible

and appropriate, particularly in recruitment and orientation materials. New students must be made aware of UMES commitment to carbon neutrality such that it will become a seamless component of their full experience as a UMES student.

One of the greatest assets UMES holds is its student body. The students that enter our community today have grown up in a world where recycling and climate talks are the norm. To further engage the student body, a CAP Student Committee should be established to represent the student voice in upholding the UMES commitment. This group should meet regularly to generate student driven ideas and assist where possible in the completion of tasks outlined in the CAP. Also, representatives from the CAP Student Committee should be in attendance at the quarterly Executive Committee meetings, or Focus Area Committee gatherings and planning sessions as appropriate. The CAP Student Committee will serve as a conduit between the CAP Executive Committee and the student body, keeping them in-the-know about initiatives to move the UMES campus toward climate neutrality.

### **Program development**

As part of its Master Plan, UMES aims to increase the educational opportunities that help enable agricultural producers achieve economic and environmental sustainability, and support renewable natural resource stewardship. Indeed, as an educational institution, one of the highest areas of leverage that UMES can access is the student learning experience. By establishing a Curriculum Working Group, UMES will be able to identify strategic opportunities to integrate sustainability content into the curriculum. These opportunities may be new degree and certificate programs, capstone/thesis projects, minors, courses, course modules, etc. Potential areas of synergy include existing graduate programs in Marine Estuarine-Environmental Sciences Human Ecology, Toxicology, and undergraduate programs in Marine Ecology, Environmental Chemistry, Environmental Toxicology, Fisheries Biology, Urban Forestry etc. These programs are all aimed at preserving and protecting the environment, humans and species, and consequently endow UMES with students who are predisposed to supporting sustainability goals.

UMES is currently engaged in Mid-Atlantic Renewal Energy Education program for Rural Electric Power Sector. According to Buterbaugh & Ancona (2011), UMES is partnering with Worcester and Wicomico Community College, Choptank Electric Cooperative, Old Dominion Electric Cooperative, Maryland Energy Administration and Princeton Energy Resources International (PERI) in providing workforce development to accelerate the use of sustainable energy resources in

the Mid-Atlantic Region. The PERI team is assisting UMES in the development of a Rural Energy Business Administration Certificate program that focuses on business issues related to sustainable and renewable energy. This partnership goals and objectives include: (1) Develop academic training in renewable energy technologies at the community college level, (2) Implement business administration education that directly applies to the renewable energy industry at the university level, (3) Provide hands-on training in wind and solar technologies, (4) Collaborate with stakeholders to ensure that curriculum fulfills workforce requirements in renewable energy industry. The benefits of the partnership includes: (1) High-tech education in renewable energy technologies, (2) Workplace-ready graduates prepared to resolve cross-disciplinary engineering and business issues confronting the rural electric industry, (3) Active participation with cooperatives in power energy education, (4) Education for rural communities on the potential value and benefits of sustainable energy.

Various academic departments at UMES are updating some academic programs and are infusing sustainability and green building content in appropriate courses. According to Dr. Leon Copeland, in the Construction Management Technology program courses such as CMTE 230- Construction Materials, CMTE 201- Architectural Drawing & Plan Reading, CMTE 312 -Construction Methods II, CMTE 214 - Surveying and CMTE 425 - Construction Management are revised to incorporate sustainability and green building principles. Construction Management Technology faculty will also completely revise CMTE 311- Construction Methods I to include sustainability and green building content during the fall semester, 2011. This is an ongoing process is to insure that course contents are current and reflect emerging industry trends.

## 14. Climate Change & Sustainability Research Initiatives

### 14.1 Summary Recommendations

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
Program development	Investigate organizational structure more conducive to interdisciplinary research		2013	August 2012	Committee Formed	N/A	N/A
Climate specific research	Develop research program on public resistance to GHG mitigation strategies		2012	April 2012	Number of research papers on topic	N/A	N/A
	Increase research on carbon capture & sequestration (CCS)		2017	December 2015	Number of research papers on topic	N/A	N/A
Indirect impact research	Investigate reduction of ammonia in poultry houses to reduce ventilation needs		2012	May 2012	Feasibility report	N/A	N/A

Strategy	Actions	Point Person	Target Date	Review	Progress Indicators	Pot. CO <sub>2</sub> e Reduction (t)	Pot. CO <sub>2</sub> e Reduction (%)
	Research conversion of grass spaces to pasture or meadow		2014	June 2013	Feasibility report	N/A	N/A
	Research growth regulators to limit grass cutting needs		2016	September 2015	Feasibility report	N/A	N/A

## 14.2 Discussion

### Program development

UMES should seek to establish an organizational structure that enhances cross-functional collaboration. The systemic nature of sustainability issues means that this type of collaboration is crucial to problem-solving and solution generation. This structure would enhance UMES' research performance in all areas, but certainly in sustainability.

### Climate-specific research

Carbon capture and sequestration is an emerging field that may provide UMES with future options to limiting emissions. Research in this area should be targeted to options most pertinent to UMES and its agricultural focus. Furthermore, a program on GHG mitigation strategies would serve UMES and the implementation of this Climate Action Plan over the long-term.

The UMES climate change initiative research has two components: (1) Center for the Integrated Study of Coastal Ecosystem Processes and Dynamics in the Mid-Atlantic Region, and (2) Carbon Capture Research.

Center for the Integrated Study of Coastal Ecosystem Processes and Dynamics in the Mid-Atlantic Region: In fall 2010, UMES established the above center funded by the National Science Foundation's CREST (Center for Research Excellence in Science and Technology) program for \$5 million over a five-year period. Land use and two major climatic phenomena; El Nino-Southern Oscillation (ENSO) and the North Atlantic Oscillation (NAO) are two factors which influence the climate in this region. It has also been projected that the regional global air temperatures will increase by 1.4 to 5.8°C in the region during this century because of an increase in greenhouse gases in the atmosphere. As a component of the UMES Climate Change project, the Center recruits, mentors and educates undergraduate and graduate students, particularly members of the underrepresented minorities while conducting research on impacts of climate change on biodiversity in the mid-Atlantic Region.

Carbon Capture Research: Carbon dioxide (CO<sub>2</sub>) is one of the major greenhouse gases affecting the change in the global climate. To reduce the rate of global warming, it is important to develop the technology that will decrease carbon dioxide emissions from point sources. As part of an initiative to establish a Carbon Capture and Sequestration Research Center, UMES secured \$245,000 in external funds in January 2011 from the U.S. Department of Education to establish a laboratory of carbon management in which the carbon capture research will be conducted.

The goal of the UMES carbon capture research is to develop a novel method for capturing carbon. Carbon sequestration is generally considered the most effective means of reducing emissions of the greenhouse gas, CO<sub>2</sub> from large point sources and the first step to sequestration is the capture of CO<sub>2</sub>. The UMES project will involve the synthesis and characterization of novel biodegradable amine grafted high-surface area solids which are cost effective for use in capturing carbon. Results from the project will earn a patent for UMES on novel biodegradable solvents for CO<sub>2</sub>

UMES Engineering department is engaged in a multi-disciplinary program titled: Bio-Fuel, Sustainability, and Geospatial Information Technologies to Enhance Experiential Learning Paradigm for Precision Agriculture Project. The project's aim is the design of experiential learning activity for Engineering and other STEM students to advance learning in classroom, field, and laboratory settings integrating bio-fuels, remote sensing, and geospatial information technologies in environmentally friendly precision agriculture. The project activities will be consistent with (1) "green" initiatives of the UMES campus and the University System of Maryland, (2) reinforce modern infrastructure for improved agricultural practices on campus that be a model for regional farmers, (3) provide exposure to and facilitate a broader base of the campus community to embrace the institution's land grant mission, (4) engage students in activities that expose them to contemporary issues and facilitate workforce development needs of the region, state and nation.

While it is the goal of the project team to continue to address the efficiency of production agriculture by integration of geospatial information technologies and nutrient management efforts, the future thrust will also include replacing the fuel

needs of farm equipment with "biodiesel" instead of petroleum-based diesel, as well as explore environmentally friendly alternatives for the remote sensing needs of the project. The objectives of the project are:

1. To involve students in experiential learning activities to produce and utilize biodiesel for farm equipment by processing waste oil from university dining services and explore other avenues of utilizing renewable energy for environmentally friendly farming practices.
2. To continue and enhance teaching and experiential learning efforts by the integration of GIS and remote sensing, mechatronics, and renewable energy with environmentally friendly "Precision Agriculture" and provide summer internships and hourly wages (regular semester) to interested "STEAM" undergraduate and graduate students.
3. To continue to work with NASA and USDA collaborators, as well as Farmsite Technologies Inc. (a local company involved in precision agriculture) to enhance student learning experiences and professional development.
4. To provide outreach activities to K-12 institutions and local farmers in collaboration with existing programs on the UMES campus.

The program framework under the supervision of the project leaders and the oversight of safety personnel, the students will coordinate with dining services, physical plant, and the farm shop to manage the logistics of the project including: (i) the acquisition and installation of identified biodiesel production unit (Biopro, 190); (ii) streamlining operations, storage, and materials and supplies with due regard to safety considerations; (iii) working with the farm shop to make appropriate modifications when necessary to farm equipment for biodiesel use; and (iv) addressing other details, including the transportation of used cooking oil and the preliminary filtering to remove solid particles. The present scope will be limited to utilizing the biodiesel produced for the farm equipment. Future possibilities for using the biodiesel for steam generation and other university vehicles will also be explored. The project leaders and student participants have discussed the present and future scope of "biodiesel" related efforts on campus with appropriate personnel in the dining services, the physical plant, the farm shop, the vice president of administrative affairs who oversees these units, as well as the dean of the School of Agricultural and Natural Sciences/ 1890 Research Director, and the vice president of academic affairs. This project is another example of an integrated sustainability project among others by UMES, faculty, staff and students.

In another sustainability research initiative, the USDA's National Institute of Food and Agriculture awarded \$4.9 million to the University of Maryland Eastern Shore, Cornell University and three other institutions to fund a project aimed at creating sustainable education opportunities for educators interested in bio-energy and bio-based products.

According to the UMES office of Public Relations, Drs. Madhumi Mitra and Abhijit Nagchaudhuri of UMES will partner with Dr. Corinne Rutzke of Cornell University and researchers at Delaware State University, Pace Law School, and The Ohio State University on the joint project. UMES will take the lead for research and education outreach in bio-diesel from vegetable oils and algae. Throughout the study, information will be shared to help educators prepare students for career options available in the fields of bio-energy and bio-based products.

### **Indirect impact research**

Indirect research areas have additional benefits to the campus in terms of cost-reductions, but also serve to reduce GHG emissions by limiting energy and fuel use. A reduction of ammonia in poultry houses would accordingly reduce the need for intense ventilation. And using growth regulators on campus could reduce the frequency of landscaping on the campus. This program should be explored carefully, and from a high-level systemic perspective, because the use of growth regulators may have other implications (chemically, etc) that is undesirable, and not worth pursuing when dealt with as a trade-off in relation to carbon emissions. UMES should also explore if grass-covered areas could be converted into meadow or pasture, which would both serve as a carbon sink on campus, and reduce the amount of landscaping required.

## 15. Tracking Progress

The UMES CAP Executive Committee will meet regularly (at least once quarterly). For the remainder of 2011 and 2012, the primary tasks of the Executive Committee will be to:

- Update the Climate Action Plan (CAP) work plan to define roles, accountability, review accomplishments and measure progress.
- Develop the programs that will have the greatest impact on an ongoing basis, such as sourcing energy from alternative energy sources (partnership with Delmarva), feasibility studies on installation of PV arrays, a green fleet policy, building energy efficiency projects, and commuting strategies such as carpooling and bicycle infrastructure. Feasibility studies conducted in the early years of the CAP will allow UMES to revisit the options that provide the greatest gains, and the highest cost-benefit ratios.
- Track progress towards the goals for the 2013 Progress Report due to the ACUPCC (see Section 3.4)

UMES recognizes that there are a variety of factors that will affect campus emissions levels over the coming decades. Growth of the student body, resource costs, and technological advancements and usage are just three areas that could dramatically affect the UMES CAP in coming years. As such, the CAP will be subject to review and revision at the final Executive Committee meeting at the final scheduled meeting of each calendar year.

## 16. Financing Climate Action

UMES has already shown its leadership in this area, creatively partnering in a power purchase agreement to develop its on campus solar array. Unique tactics such as this, along with grants (such as Kresge Foundation grants), traditional financing mechanisms, operating budgets and smart strategic planning will continue to drive this program. Other strategies to consider include:

- Self and state funded bond issuance
- Revolving loan funds (See Appendix C for examples)

- Bundling of capital projects (for example, HVAC upgrades with lighting controls) in order to demonstrate greater potential combined benefit when compared against each project implemented independently
- Involve Delmarva Power in identifying and prioritizing potential projects so as to line up with any Delmarva incentives offered

## 17. Barriers & Success Factors

For UMES to achieve these milestones and ultimately the carbon neutrality, there are a number of potential barriers that must be overcome. Identifying and considering them empowers the CAP Executive Committee and enable rapid progress.

The mission of becoming carbon neutral is an audacious one, but one that is noble and engaging. UMES should strive to engage and involve all stakeholders as much as possible. Each and every individual that steps onto the UMES campus is a stakeholder, and a potential partner or ally in the quest to carbon neutrality. UMES should seek out opportunities to communicate goals, update on progress, share challenges, and invite participation and collaboration from the community. This will inevitably bring new ideas and partnerships that will advance the Climate Action Plan over the years.

As stressed in the 'First Steps' section of the recommended actions, it is crucial to establish and maintain accountability for the Climate Action Plan. Accountability will ensure, first and foremost, that the plan does not simply become a binder sitting on a shelf in someone's office, but retains its spirit as a living, working document under current review and implementation. Accountability for individual tasks helps the plan to seem manageable, as no one individual is responsible for such an ambitious endeavor as climate neutrality. Indeed, such a project will reach beyond the career and even the lives of many involved at this stage. Maintaining, redefining, and transferring accountability as necessary will be a crucial factor in keeping momentum at the necessary levels.

Ongoing review of the plan is another crucial factor for success. As discussed at numerous points throughout this document, circumstances are bound to change dramatically over a multi-decade commitment to achieve carbon neutrality. While the target will remain the same, the political, economic, academic, social, and technological factors that surround UMES will be in constant flux. This must be accepted, embraced, and taken into account through regular review of the CAP. The plan should also be regularly compared with the UMES Master Plan to exploit synergies and identify potential conflicts that may be resolved before they become major issues.

At the implementation phase of any action, there are a host of potential pitfalls that could prevent progress. A lack of commitment to delivering on initiatives will destine them for failure. The UMES Executive Committee and Senior Administration must be willing to support the plan and those who are committed to enacting it. This support must be political, financial, and personal.

The CAP Executive Committee must be prepared for criticism. There will be naysayers who oppose some of the measures in the plan, and UMES should be prepared to anticipate and respond to criticism promptly and civilly. Criticism may be unwarranted at times, but also may provide useful perspective or previously unseen solutions. Criticism is free of charge, and provides an opportunity to evaluate proposed measures from a new vantage point.

Finally, UMES should approach the CAP with a systems thinking perspective. By considering UMES as a full system, we can identify the interconnections between actions and consequences, and how those interactions can be utilized to best effect to advance the plan. UMES should continually ask questions like the following:

- “If we take this course of action, what will be the outcome in other areas?”
- “What are the biggest areas of leverage to advance our goals?”
- “How can we maximize our resource efficiency by tackling multiple issues at the same time?”
- “Is this action a move in the right direction toward carbon neutrality, or towards our vision of sustainability?”
- “Is this action a flexible platform for future actions? Can we build upon it, modify it, or abort it if circumstances should change dramatically?”
- “Does this action provide us with an adequate return-on-investment? (Financial benefit, increased reputation, risk mitigation, heightened stakeholder engagement, political goodwill, etc)

By taking all of these factors into consideration, UMES will have the greatest chance of reaching its milestones and ultimately achieving carbon neutrality.

## 18. Conclusion

Carbon neutrality is an ambitious goal. But aiming for neutrality by 2050, with established targets along the way, gives UMES direction, against which decisions can be made and progress can be measured. In scripting our initial first steps, we hope to gain momentum that can be carried into the next GHG Inventory and the following update to this Climate Action Plan. Focus will be kept both on people and place. Though at times we may emphasize one over the other, we understand that in the end our physical campus, our community, and our curriculum are all key components on this journey.

Our success will depend on the degree to which we engage all stakeholders in our community and a view on patient progress, regularly evaluating how far we have come, and what needs to be done to push ahead. Doing so will make UMES a healthier, and more cohesive community as we strive towards Carbon Neutral 2050.

## 19. References

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# Appendix A: ACUPCC Climate Commitment Text

“We, the undersigned presidents and chancellors of colleges and universities, are deeply concerned about the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic and ecological effects. We recognize the scientific consensus that global warming is real and is largely being caused by humans. We further recognize the need to reduce the global emission of greenhouse gases by 80% by mid-century at the latest, in order to avert the worst impacts of global warming and to reestablish the more stable climatic conditions that have made human progress over the last 10,000 years possible.

While we understand that there might be short-term challenges associated with this effort, we believe that there will be great short-, medium-, and long-term economic, health, social and environmental benefits, including achieving energy independence for the U.S. as quickly as possible.

We believe colleges and universities must exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality. Campuses that address the climate challenge by reducing global warming emissions and by integrating sustainability into their curriculum will better serve their students and meet their social mandate to help create a thriving, ethical and civil society. These colleges and universities will be providing students with the knowledge and skills needed to address the critical, systemic challenges faced by the world in this new century and enable them to benefit from the economic opportunities that will arise as a result of solutions they develop.

We further believe that colleges and universities that exert leadership in addressing climate change will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni and local communities. Accordingly, we commit our institutions to taking the following steps in pursuit of climate neutrality.

1. Initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible.
  - a. Within two months of signing this document, create institutional structures to guide the development and implementation of the plan.
  - b. 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.
  - c. Within two years of signing this document, develop an institutional action plan for becoming climate neutral, which will include:
    - i. A target date for achieving climate neutrality as soon as possible.
    - ii. Interim targets for goals and actions that will lead to climate neutrality.
    - iii. Actions to make climate neutrality and sustainability a part of the curriculum and other educational experience for all students.
    - iv. Actions to expand research or other efforts necessary to achieve climate neutrality.
    - v. Mechanisms for tracking progress on goals and actions.
2. Initiate two or more of the following tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed.
  - a. Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.

- b. Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.
  - c. Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution.
  - d. Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.
  - e. Within one year of signing this document, begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.
  - f. Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.
  - g. Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste.
3. 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.

In recognition of the need to build support for this effort among college and university administrations across America, we will encourage other presidents to join this effort and become signatories to this commitment.”

# Appendix B: Past Energy/Sustainability Initiatives

Mitigation/Elimination Initiative	Description
<b>Existing Buildings &amp; Facilities</b>	
Building Systems Program	<ul style="list-style-type: none"> <li><input type="checkbox"/> Beginning in 1991 UMES building lighting systems used energy efficient lighting fixtures</li> <li><input type="checkbox"/> Light and motion sensor (occupancy sensors) monitoring systems were installed in 80% of the campus academic buildings</li> <li><input type="checkbox"/> Energy management system gives central control of energy usage in 70% of major building systems</li> <li><input type="checkbox"/> Use of VAV boxes in building HVAC systems &amp; Automated control of dampers in buildings</li> <li><input type="checkbox"/> Automated plumbing fixtures are installed in 35% of buildings</li> <li><input type="checkbox"/> Adopted an appliance purchasing policy requiring Energy Star certified products in all areas where such ratings exist</li> <li><input type="checkbox"/> Energy efficient HVAC equipment upgrades and replacements are part of the facility renewal system</li> <li><input type="checkbox"/> A geothermal system was used as part of the HVAC system in Wicomico Hall renovation project</li> <li><input type="checkbox"/> Adopted use of biodegradable products in housekeeping</li> </ul>

Mitigation/Elimination Initiative	Description
Parking	<input type="checkbox"/> Future parking and roadway expansion will be on the campus periphery in order to maintain integrity and character of UMES as a pedestrian campus <input type="checkbox"/> The entire campus would be within a 5 minute walk a major point of vehicular arrival.
Recycling	<input type="checkbox"/> UMES recycles approximately 22% of its paper, aluminum, computers, tires, metal batteries, phone books, newspaper, and vehicles
<b>New Buildings &amp; Facilities</b>	<input type="checkbox"/>
Siting & Zoning	<input type="checkbox"/> The 1990 master plan mandated that UMES become a pedestrian campus, with parking lots on the periphery. <input type="checkbox"/> Zoning system supports short utility runs, pedestrian access, and limited vehicular access while minimizing building footprints <input type="checkbox"/> All new buildings will be sited and have roof designs that are capable of accommodating present or future solar panels or green roof structures <input type="checkbox"/> Site planning will maximize solar alignment, shade opportunities and prevailing winds <input type="checkbox"/> Reduce heat island effect and maintain a high percentage of pervious surfaces with Solar Reflective Index (SRI) of at least 29 <input type="checkbox"/> Provide more on-campus housing and amenities to reduce vehicular commuting and daily off-campus vehicular trips <input type="checkbox"/> The UMES 2008-2018 Master Plan mandated sustainability guidelines for UMES <input type="checkbox"/> The UMES All-Hazard Mitigation plan dated 2009 addressed mitigation actions that addressed zoning and flood issues and the preservation and protection of infrastructure and the environment

Mitigation/Elimination Initiative	Description
New Buildings	<ul style="list-style-type: none"> <li><input type="checkbox"/> UMES Coastal Ecology building was designed and constructed around LEED goals</li> <li><input type="checkbox"/> All new buildings will be built to a minimum LEED Silver standard</li> <li><input type="checkbox"/> Somerset Hall building renovated in 2010 to house the new Pharmacy program received the LEED Gold certification in February, 2011</li> <li><input type="checkbox"/> Aviation Science, Engineering, Math &amp; Computer Science Building commissioned for design in August, 2011 is mandated to design to LEED Gold Standard</li> <li><input type="checkbox"/> UMES is aspiring to make LEED Gold as standard for building projects with a cost of \$6 million and above</li> </ul>
<b>Transportation</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/></li> </ul>
Campus Fleet	<ul style="list-style-type: none"> <li><input type="checkbox"/> UMES uses hybrid/flex fueled vehicles that burn either gas or ethanol</li> <li><input type="checkbox"/> Gas fueled carts are used on campus grounds</li> <li><input type="checkbox"/> UMES have propane powered maintenance vehicles</li> </ul>
Commuting	<ul style="list-style-type: none"> <li><input type="checkbox"/> Developed partnerships with the Eastern Shore Transit System enabling UMES and area community members to travel between campus and nearby institutions and towns</li> <li><input type="checkbox"/> Bike path around campus connecting to town</li> <li><input type="checkbox"/> Bike racks and sheds are strategically located on campus to support alternative means of transportation on campus</li> </ul>
<b>Grounds</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/></li> </ul>

Mitigation/Elimination Initiative	Description
	<ul style="list-style-type: none"> <li><input type="checkbox"/> Created integrated wetland and forest conservation plans</li> <li><input type="checkbox"/> Native plants and natural materials are used in landscaping</li> </ul>
<b>Energy &amp; Infrastructure</b>	<input type="checkbox"/>
Electric	<ul style="list-style-type: none"> <li><input type="checkbox"/> Highly efficient and smaller switch gears and transformers are installed on campus</li> <li><input type="checkbox"/> Energy efficient fuses are being installed at the Campus main power substation to effect efficient use of electricity, create redundancy and reduce risk of failure</li> <li><input type="checkbox"/> UMES will begin by purchasing or producing at least 15% of its electricity from renewable sources</li> <li><input type="checkbox"/> Currently installing a geothermal heating and cooling system in an existing residence hall, the first of its kind in the University System of Maryland</li> <li><input type="checkbox"/> In March 2011, UMES and SunEdison installed and commissioned a 2.2 megawatts solar farm that provides about 8% of UMES total electric consumption through green energy</li> </ul>
Water	<ul style="list-style-type: none"> <li><input type="checkbox"/> UMES partnered with Somerset County in the construction of a 600,000 gallon water tower construction and portable water distribution in the county, and in other water conservation strategies in the county</li> </ul>

# Appendix C: Example Revolving Loan Funds

University	First Year	Size	Use Parameters	Payback Period	Results
Harvard	2001	\$12 Million <ul style="list-style-type: none"> <li>• (\$500,000 per project limit)</li> </ul>	High-performance campus design, operations, maintenance, and occupant behavior projects.	Projects pay back the loan from their savings within five years.	<ul style="list-style-type: none"> <li>• 153 projects</li> <li>• \$11.5M loaned out</li> <li>• \$4M in savings</li> <li>• 27% Median ROI</li> </ul>
California Institute of Technology	2008 (\$25,000 pilot)	~\$8 Million	<ul style="list-style-type: none"> <li>• Show verifiable savings,</li> <li>• ROI over 15%</li> <li>• Have M&amp;V plan</li> </ul>	Less than 6 years	<ul style="list-style-type: none"> <li>• ROI of 33%</li> <li>• 2009 &amp; 2010 \$1.3M in avoided utility costs</li> </ul>
Iowa State University	2008	\$3 Million (\$1M per project limit)	<ul style="list-style-type: none"> <li>• Reduce annual operating expenses</li> <li>• Decrease energy costs</li> <li>• Engage students, staff and faculty</li> </ul>	Projects pay back the loan from their savings within five years.	<ul style="list-style-type: none"> <li>• ROI of 29%</li> </ul>
University of Colorado - Boulder	2007	\$500,000	Must reduce campus energy use	Less than 5 years	<ul style="list-style-type: none"> <li>• ROI of 38%</li> </ul>