UMBC

Climate Action Plan

Revised February 2010

Part 1. Overview

Message from President Freeman Hrabowski

In 2007, I joined more than 330 college and university presidents in signing the American College and University Presidents Climate Commitment. This document expresses our deep concern regarding "the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic, and ecological effects." It also emphasizes the need for "colleges and universities [to] exercise leadership in their communities and throughout society" in addressing climate change.

By signing the document, I have committed UMBC to (1) developing "a comprehensive plan to achieve climate neutrality as soon as possible;" (2) initiating a number of "tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed;" and (3) making our "action plan, inventory, and periodic progress reports publicly available by providing them to the Association for the Advancement of Sustainability in Higher Education." Through our research and curriculum, we are committed also to "providing the knowledge and the educated graduates" needed to help move the world towards climate neutrality.

Our Climate Change Task Force—comprised of students, faculty and staff—will lead UMBC's efforts in meeting this commitment.

We will continue to update the campus community on our plans and hope you will join us by making a commitment to living a more sustainable lifestyle and getting involved in sustainability initiatives.

Overview of the Commitment

President Hrabowski signed the American College and University Presidents Climate Commitment (ACUPCC), along with over 500 other college and university presidents around the country with the long term goal that UMBC become "climate neutral." The ACUPCC acknowledges "a deep concern about the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic and ecological effects." The presidents who have signed the commitment on behalf of their institutions have agreed that "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."

To provide a formal structure to develop, oversee, and promote campus actions to achieve the Commitment goals and to effectively engage the entire campus community in this effort, President Hrabowski formed the Climate Change Task Force in the fall of 2007. The CCTF is made up of faculty, staff, and students from across the campus, as listed in Appendix 1. The CCTF has met monthly through the last two years.

Charge to the Climate Change Task Force

To advise the President on strategies to reduce greenhouse gas emissions generated by the campus community, to engage the campus community in efforts to reduce greenhouse gas emissions, and to promote and support instruction and research on the impact of greenhouse gas emissions.

Specific Responsibilities of the CCTF:

1. Provide oversight and guidance in meeting the requirements of the American College and University Presidents Climate Commitment, especially as follows:

    a. Advise and oversee the completion of a comprehensive inventory of all greenhouse gas emissions by August 15, 2008, and update the inventory on an annual basis thereafter.

    b. By September 15, 2009, submit recommendations for an institutional Climate Action Plan, including the following:
        i. An analysis of costs and contributions to achieving climate neutrality for each action recommended.
        ii. A proposed timeline, including interim goals and milestones, for achieving climate neutrality.

iii. Recommendations on ways to make climate neutrality and sustainability a part of the curriculum and other educational experiences for students.
iv. Recommendations for expanding research on climate issues, sustainability, and greenhouse gas reduction.
v. Recommendation for outreach to engage the UMBC community
vi. A set of measures for tracking progress on goals and actions.

c. Consider and advise the President on specific interim actions and goals, as listed in item 2 of the Presidents Climate Commitment statement.

d. Make the GHG Inventory, Climate Action Plan, 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.

2. Establish mechanisms for regular communications to the campus community regarding efforts of the CCTF, and to engage the campus community in the goals and actions in the Climate Action Plan.

3. Receive regular reports from and make recommendations regarding implementation of the Climate Action Plan.

Approach to Implementation

The CCTF has worked successfully over the past two years on all of these tasks. Key to efforts to fulfill these goals was the creation of workgroups with specific areas of focus. Each workgroup includes some members of the CCTF and many other members from across the campus, including students, staff, and faculty. The workgroup memberships are shown in Appendix 1. The workgroups during the first few years of the CCTF efforts were:
:

- GHG Inventory
- Campus Outreach
- Mitigation Strategies
- Transportation
- Research and Education
- Long-Range Planning

Some of the workgroups will change over time as the efforts of the CCTF change. For example, the GHG Inventory workgroup has not been meeting because there is now a process in place for completing the inventory.

State Actions

Shortly before the Climate Commitment was signed at UMBC, Governor O'Malley signed an Executive Order in April of 2007 to create a Statewide Climate Change Commission to advise the Governor and General Assembly on matters related to climate change. They are to (1) develop a plan of action to address the drivers and causes of climate change; (2) prepare for the likely consequences and impacts of climate change to Maryland; and (3) establish firm benchmarks and timetables for implementing the Plan of Action.

Mitigation Strategies

To meet the goals of the Climate Commitment, the campus will have to dramatically reduce greenhouse gas emissions on campus. There are both short-term and long-term actions, policies and practices that will have to be implemented to achieve these goals. It is anticipated that these changes will also be able to provide reductions in the costs of energy use in many cases. Broadly, the approaches include:

- Energy conservation and improved efficiency
- Energy performance contracting
- Purchase of green power and Renewable Energy Credits (RECs)
- Improvement in space utilization to avoid or minimize new construction
- Design and construction of only the most energy-efficient/green new buildings (LEED Silver minimum)
- Sustainable transportation solutions
- Installation of green technologies and renewable energy on campus
- Other GHG mitigation strategies (waste minimization, purchasing, food)
- Carbon offsets

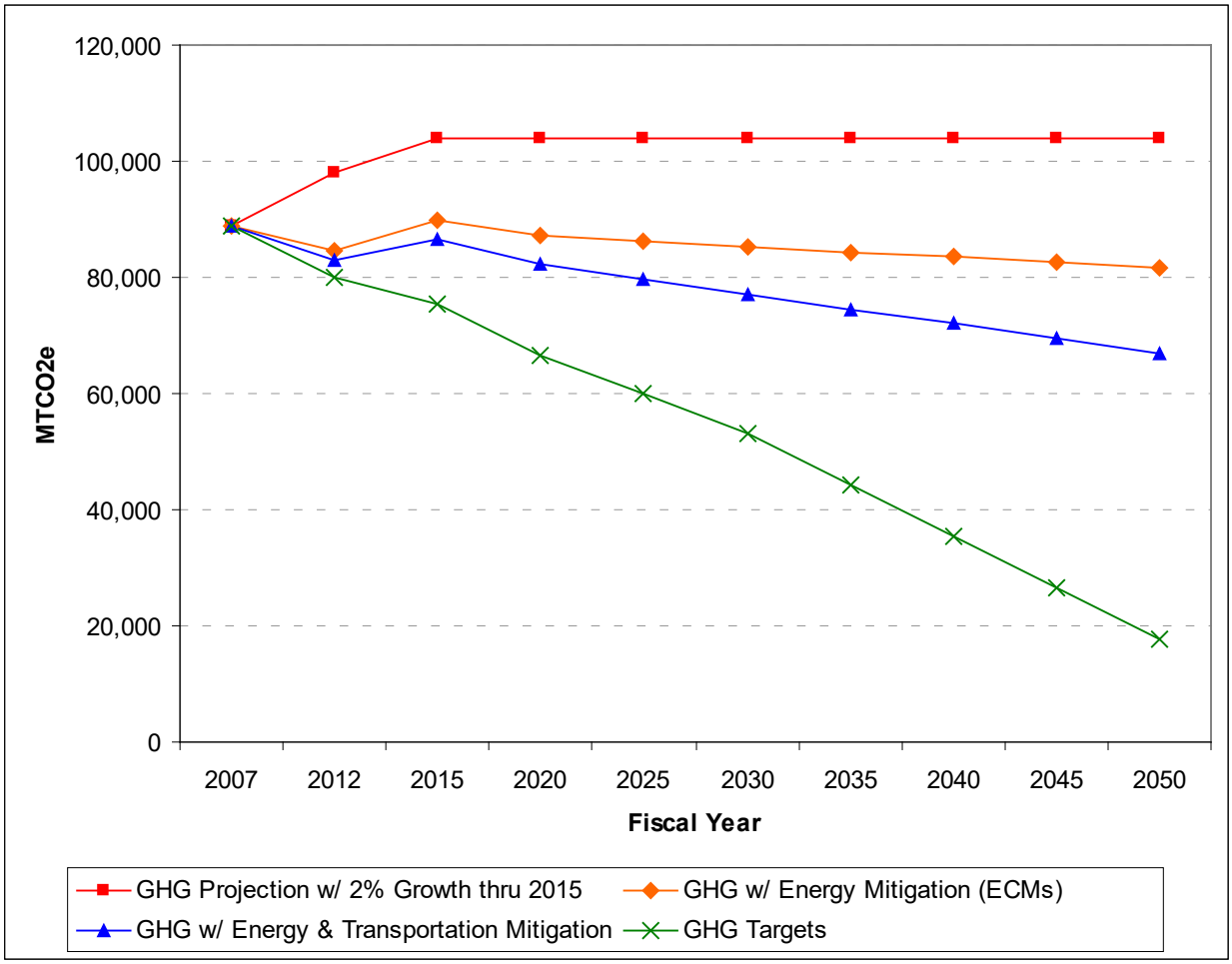
To meet the commitment, the CCTF has identified the following milestones as targets. Many of these are consistent with goals set by the State of Maryland as well.

Table 1. Anticipated Milestones

Reductions	Milestones	Source
10%	**2012**	MD Commission on Climate Change
15%	**2015**	MD Commission on Climate Change
25%	**2020**	MD Greenhouse Gas Emissions Reduction Act of 2009
40%	**2030**	Progression to 80% reduction by 2050
60%	**2040**	
80%	**2050**	ACUPCC recommends at least 80% reduction by mid-century. MD Greenhouse Gas Emissions Reduction Act of 2009 has a goal of up to 90% reduction by 2050.
100%	**2075**	Carbon neutrality.

The top line of Figure 1 below shows the business as usual emissions over time, as the campus grows during the current period to 2015 at which time growth levels off. We assume growth in emissions of about 2% a year during this period. The bottom line shows the target emissions reductions with mitigation strategies. It is clear that even with currently projected mitigation efforts and policies, the campus will need to undertake additional measures, even in the early years. It is important to note that the assumption of the 2% growth rate is critical to the shortfall in emissions reductions for the early years of the program. With no growth in emissions up to 2015 or even slower than 2% growth, the targets appear to be achievable with planned mitigation, fuel and technology policies on the energy and transportation sides. Additional reductions to meet targets in later years will be large, and will have to be from reductions beyond those included here, and some may come from the purchase of offsets.

Figure 1. Projected GHG Emissions Changes, with and without Mitigation Efforts



Part 2. Greenhouse Gas Inventory

To identify the amount and sources of emissions that contribute to global warming, the campus must develop an annual greenhouse gas inventory. This inventory has now been completed for Fiscal years 2007, 2008, and 2009. For these years, the results have been consistent: about 60%

of the emissions are from energy use for electricity and heating fuels, another roughly 25% is due to use of vehicles, mostly from commuters to and from the campus, and air travel by faculty and staff comprise 11% - 13%. Finally, about 2% is due to solid waste disposal and refrigerants used on campus. The emissions have declined slightly over the period, despite some growth in campus size and population. The reductions are due to a number of mitigation efforts, and to an increasing share of purchased electricity from renewable sources.

Table 2. GHG Summary and Comparisons

Metric Tons of CO2e	FY 2007	FY 2008	FY 2009
Purchased Electricity	42,029	42,484	41,337
Nat Gas & Fuel Oil	12,965	12,819	14,245
Student Commuters	14,342	14,682	15,091
Faculty/Staff Commuters	6,619	6,661	6,788
Air Travel	11,653	11,653	9,322
University Fleet	722	824	720
Solid Waste	865	1,041	1,102
Refrigerants	565	784	291
Agriculture	2	3	6
Total Emissions	**89,761**	**90,952**	**88,901**
Offsets via RECs	(1,051)	(2,074)	(6,556)
Net Emissions	**88,710**	**88,878**	**82,346**

Table 2.1

Pct of Total Emissions	FY 2007	FY 2008	FY 2009
Purchased Electricity	46.8%	46.7%	46.5%
Nat Gas & Fuel Oil	14.4%	14.1%	16.0%
Student Commuters	16.0%	16.1%	17.0%
Faculty/Staff Commuters	7.4%	7.3%	7.6%
Air Travel	13.0%	12.8%	10.5%
University Fleet	0.8%	0.9%	0.8%
Solid Waste	1.0%	1.1%	1.2%
Refrigerants	0.6%	0.9%	0.3%
Agriculture	0.0%	0.0%	0.0%

Table 2.2

Pct of Net Emissions	FY 2007	FY 2008	FY 2009
Purchased Electricity	46.2%	45.5%	42.2%
Nat Gas & Fuel Oil	14.6%	14.4%	17.3%
Student Commuters	16.2%	16.5%	18.3%
Faculty/Staff Commuters	7.5%	7.5%	8.2%
Air Travel	13.1%	13.1%	11.3%
University Fleet	0.8%	0.9%	0.9%
Solid Waste	1.0%	1.2%	1.3%
Refrigerants	0.6%	0.9%	0.4%

Agriculture	0.0%	0.0%	0.0%

Table 2.3

Part 3. Energy Use

Background:

Carbon emissions related to energy generation and use are the largest part of the overall campus footprint. Purchased Electricity makes up the largest share of energy-related emissions, and also the largest share of the costs of energy expenditures for the campus (Figure 3). Of all of the uses of energy, heating the campus uses the most energy, with cooling second, and lighting third (Figure 4).

FY 2008 (July 2008 - June 2009)

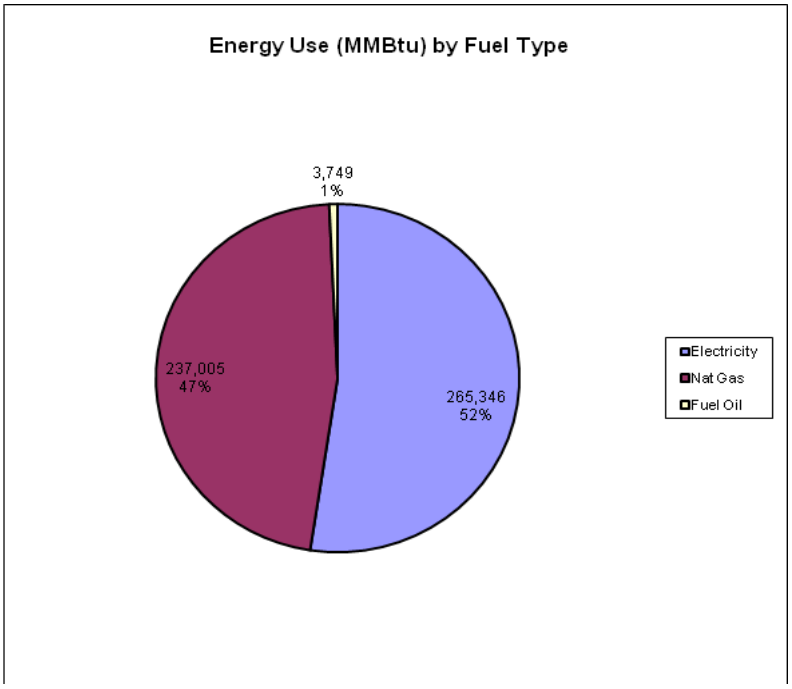
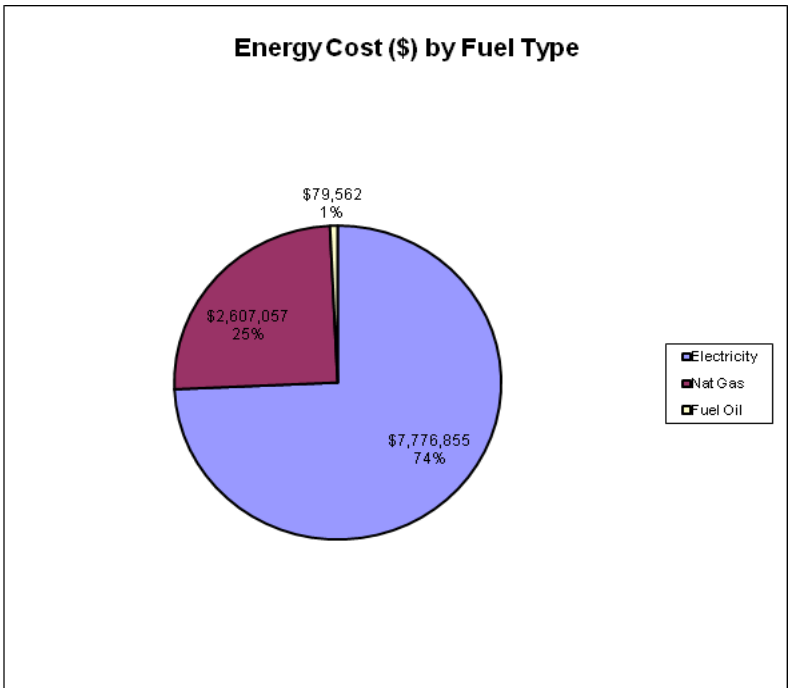


Figure 2



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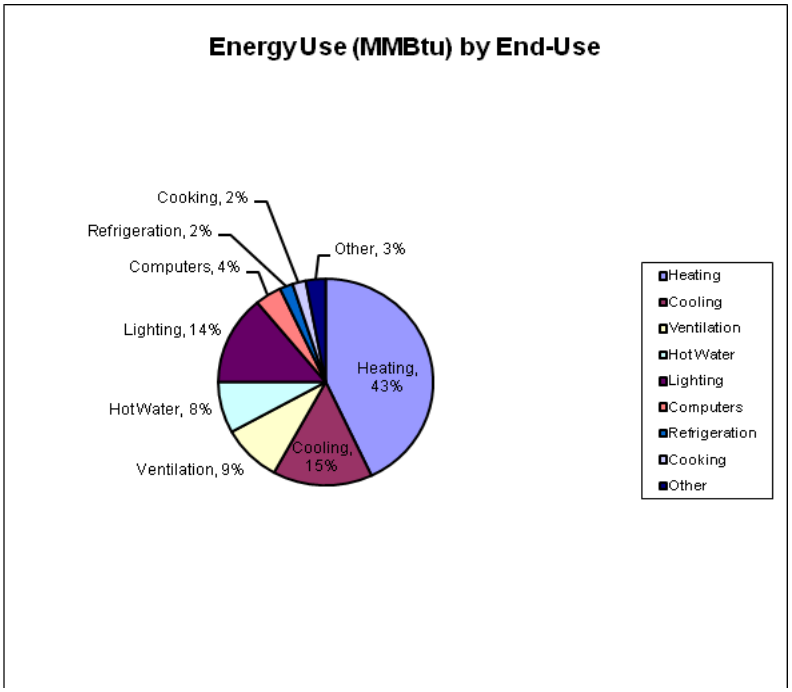

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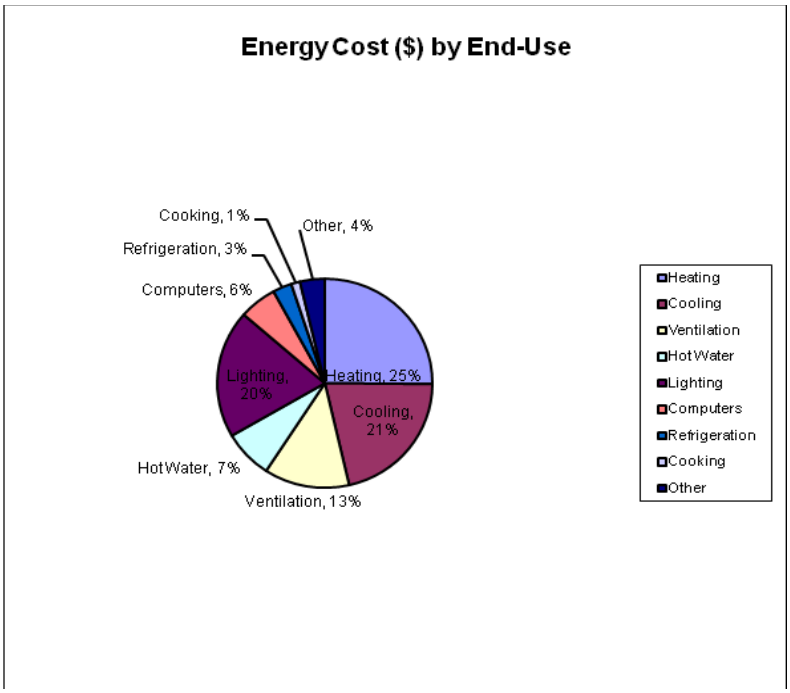

Figure 5

Mitigation Strategies for Energy Use

The campus is pursuing both short-term and long-term initiatives to reduce energy use. For a Summary of Mitigation Strategies, refer to Appendix 2.

Renewable Energy Plan

In calendar year 2010, UMBC will get roughly 20% of its purchased electricity from renewable sources: 5.525% is from compliance with the Renewable Portfolio Standard (RPS) and 15% is from the purchase of Renewable Energy Credits (RECs).

UMBC's voluntary RECs are from Maryland Hydroelectric (Conowingo), which is a Tier 2 renewable source. Tier 2 RECs allow UMBC to cost-effectively reduce its carbon footprint, as described in Figure 6..

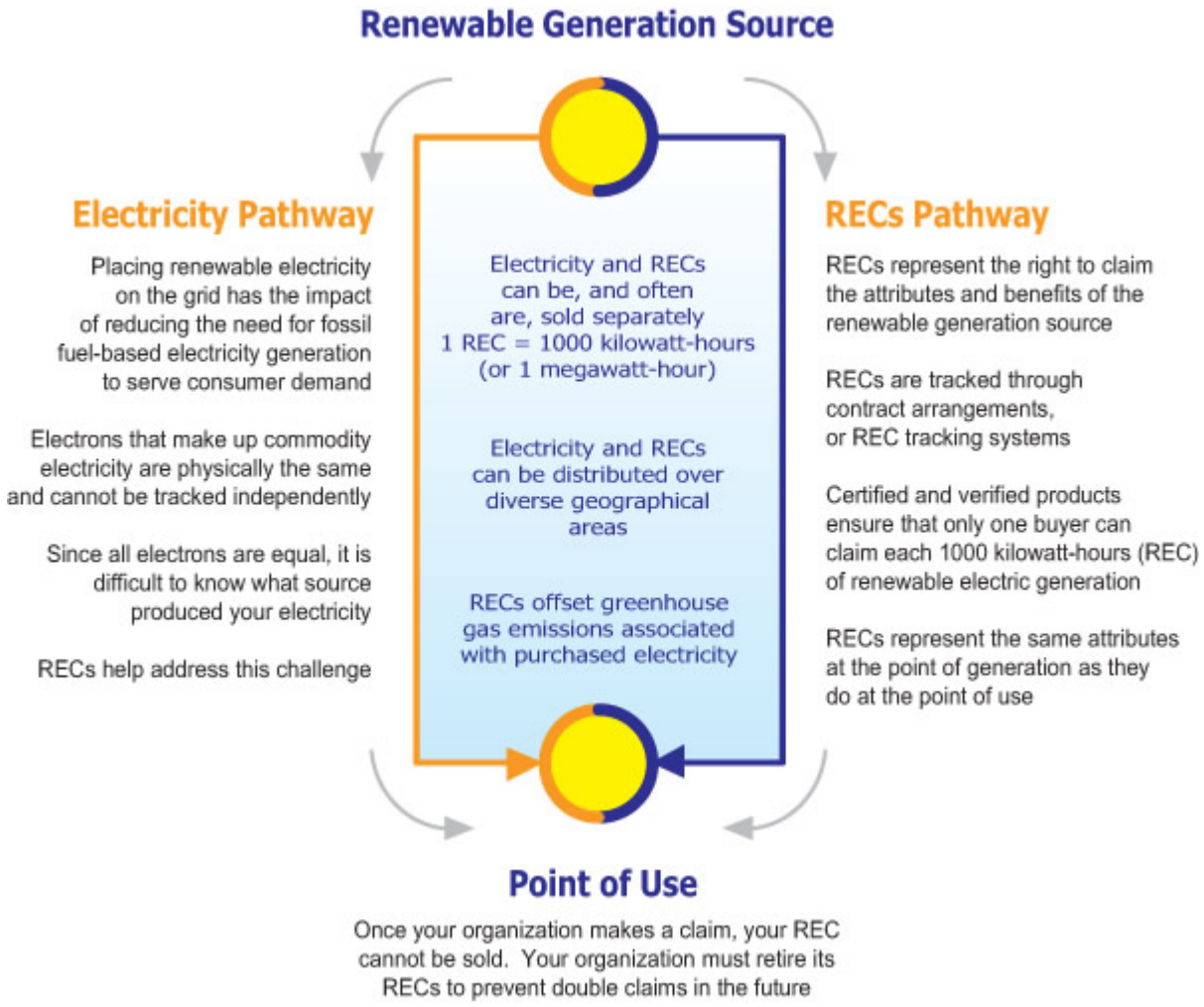

Figure 6. Electricity and RECs.

UMBC was involved in the State's collaborative process for "Generating Clean Horizons," a first-of-its-kind initiative to spur large-scale renewable projects in/near Maryland. With Clean Horizons, renewable energy will be produced where it is most physically and economically viable. As a result of a competitive bid, the recommended projects include land-based wind, solar PV, and offshore wind. The renewable energy from Clean Horizons is expected to come online as early as January 2011. The plan is for Clean Horizons to ultimately produce 20% of the ALL electricity used by State agencies. UMBC--along with all State agencies--will be buying this clean/green energy via long-term Power Purchase Agreements (PPAs) that include the electricity commodity and the associated RECs.

Beginning in 2011, via Clean Horizons Power Purchase Agreements, UMBC will begin getting renewable energy and the associated RECs from wind and solar, both of which are Tier 1 renewable sources.

The Renewable Energy Plan of getting 20% of the campus electricity from renewable sources has already achieved a 6,556 metric ton eCO2 reduction in our carbon footprint (Table 2.1), a reduction of 7% from UMBC's 2007 baseline. These carbon footprint reductions will continue as UMBC continues to get at least 20% of its electricity from renewable sources.

Energy Performance Contracting

The campus is in the process of negotiating an Energy Performance Contract (EPC) with NORESCO. NORESCO will implement an array of energy-saving projects on the UMBC campus that essentially pay for themselves over time (up to 15 years) via the associated energy savings. The savings are guaranteed and the cash flow will be positive throughout the period of the contract.

Although the specific costs and savings are not finalized, it is currently estimated that the EPC will reduce UMBC's energy consumption by 16% (and utility costs by 20%) and reduce annual GHG emissions by 11,000 metric tons eCO_2, which is a 12% reduction to UMBC's total carbon footprint baseline of 89,000 metric tons eCO_2.

After the negotiations and approval processes, the EPC should be signed with NORESCO in mid 2010. It will include a range of Energy Conservation Measures (ECMs). The ECMs will be implemented within twelve to twenty-four months of the contract signing. Therefore, the associated energy savings and greenhouse gas reductions will be achieved by mid 2012.

Facilities Management and NORESCO have considered a large range of possible energy/green projects. Those which appear to have sufficient payback to be included in the EPC are:

- Lighting Improvements
- Water Conservation
- Chilled Water Optimization
- Building Envelope Improvements
- Energy Management System (EMS) Upgrades
- Energy Conservation Through Behavior Change
- LEED-EB Screening
- Comprehensive Metering
- Solar Photovoltaic (PV)
- Lab Hood Controls

Lighting Improvements

Interior Lighting

NORESCO intends to retrofit or replace existing T12 fluorescent lamps and 4' 32-watt T8 lamps with new high-efficiency 25-watt T8, low-mercury lamp and high-efficiency instant-start electronic ballast combinations. Fixtures that are damaged and unable to be retrofitted will be replaced. Exit signs that not currently LED will be replaced with new LED exit signs. Depending on the application, existing HID fixtures will be replaced with either linear fluorescent T8 or linear fluorescent T5 high-output fixtures. Incandescent fixtures with will be replaced with either new linear or compact fluorescent fixtures or retrofitted with screw-in compact fluorescent lamps. Where appropriate, NORESCO will install dual-technology occupancy sensor controls.

Exterior Lighting

NORESCO intends to replace pole top parking, street, and walkway lighting either with more energy efficient metal halide lamp and ballast retrofits or LED fixtures that are currently being tested onsite.

Water Conservation

Domestic

NORESCO intends to install new toilets, urinal flush valves, showerheads, and lavatory sink flow controls. All the new fixtures and valves will be low-flow devices conforming to the latest standards. This action will reduce unnecessary water use, minimize maintenance requirements, and provide the facilities with new, more attractive plumbing fixtures. The replacement equipment will provide flushing action adequate to remove waste and will be consistent with the fixtures in the newer campus buildings. Recently renovated areas that currently have low flow fixtures will not be retrofitted.

Irrigation

NORESCO intends to install weather based web controllers, allowing for efficient operation and watering schedules. These central controls have the ability to collect and disseminate daily weather information so that water savings can be maximized. The irrigation control system specified is a comprehensive, web-enabled water management system that allows remote control for one or more irrigation controllers. In addition to central control, this system has:

- The ability to collect and disseminate daily weather information so that water savings can be maximized.
- A digital flow sensing device that logs water flow data and communicates the information to the main irrigation control unit. This data will allow the irrigation manager to measure and verify the system is operating per the original design intent.
- A master control valve to protect against water losses due to a piping system failure, a control valve malfunction, or a broken sprinkler or drip tubing. The control system will automatically recognize an excessive flow of water, shut down the appropriate zone, and send a notification via email or text to the irrigation manager.

Chilled Water Optimization

Central Plant

The campus chilled water distribution system at UMBC is an extensive system and makes use of control valves and DDC controls to meter the secondary chilled water into individual building systems. Some of the building systems still employ three-way valves on the chilled water coils. Currently the chilled water system as a whole does not operate optimally because the return chilled water is significantly lower than is recommended and therefore the plant suffers from classic "low delta T syndrome."

There are currently three secondary chilled water pumps at the central plant which are used to distribute chilled water to the campus. These pumps, 200 hp, 400 hp, and 500 hp respectively are staged sequentially to meet the campus load. While this system provides a measure of efficiency over a single pump run at constant speed, substantial savings can be realized by using smaller pumps and VFDs that control pump speed to more closely match the chilled water load.

NORESCO intends to convert the chilled water distribution within the central plant to a variable-primary flow arrangement. The existing primary CHW pumps and 400 and 500 HP secondary pumps shall be removed and replaced with seven (7) new 250 HP chilled water pumps rated at 460V/3Ø to distribute water between all the chillers and out to the building loops. These pumps will be able to meet the campus chilled water load much more efficiently while providing energy savings.

Additionally, NORESCO intends to replace and upsize the thermal energy storage pumps and VFDs to allow for use with the new variable primary system. Modifications to the existing control logic will be made to ensure that the return chilled water to the central plant is at the highest practical temperature, thus, allowing the chillers to operate as efficiently as possible. All new pumps have been sized for the existing campus conditions plus the planned Performing Arts and Humanities Facility (PAHF). New electrical substations shall be provided to handle the additional loads of the new pumps. NORESCO anticipates that the addition of VFDs on the cooling towers under the PAHF project will result in better staging and control of the cooling tower fans as well as additional energy savings under an adjusted baseline condition.

Tertiary Chilled Water Loop

NORESCO is also investigating converting the remaining three-way valves on the building chilled water coils to two-way valves so that the building return chilled water temperatures will be as high as possible. Butterfly valves will be installed in the building decoupler, or bridge lines, to prevent bypassing of chilled water supplied to the building. Building CHW distribution pumps will be equipped with VFDs and shall control to differential pressure set points within the building, resulting in additional energy savings.

Building Envelope Improvements

A visual exploratory forensic analysis was conducted to determine if existing structural conditions were indicative of wasteful energy usage, including heat loss/gain through breaches in the building envelope or lack of thermal boundary. The buildings surveyed varied in design, construction and year completed. All exhibited building envelope conditions suggesting upgrades needed to be addressed. Areas of concern included openings in the "skin" that were "built-in" during the original construction, created during a "retrofit period" and/or have deteriorated through time.

With the exception of Public Policy, most of the buildings surveyed on campus appeared to need some measure of building envelope improvement. These measures include, adjusting, replacing or installation of weatherstripping, sealing roof/wall intersections, sealing of soffit areas, sealing various penetrations located throughout the buildings, compartmentalizing air drafts in the building by sealing them with thermax insulation boards, and installing additional attic insulation where cost-effective.

EMS Improvements

Demand Control Ventilation

UMBC has several buildings with large auditoriums, classrooms, conference rooms, gymnasiums, and open dining areas. These large spaces are ventilated per code (according to when the AHUs were put in place) to meet the ventilation requirements which are based on maximum occupancy. During normal operating hours, however, these spaces follow a variable occupancy profile, sometimes experiencing minimum occupancy for extended periods of time. This leads to over-ventilation of these spaces and becomes a source of wasted energy.

NORESCO intends to install CO2 sensors in selected lecture halls and larger rooms on campus. These sensors will be tied into the various building's DDC systems to control outside-air damper position at each installation. The CO2 sensors will be used to control a threshold CO2 concentration in each space. This will allow the outside air damper to be used more effectively to allow unconditioned air into the building only as necessary. During periods of low occupancy, this will lead to significant energy savings.

Air-Handler Scheduling

UMBC is currently scheduling several AHUs throughout the campus to be shut down during unoccupied hours. NORESCO has identified several more AHUs that may be shut down and do not serve critical loads. NORESCO will make these scheduling changes along with Facilities Management's help, most likely during the Chilled Water Optimization EMS programming since the two ECMs are related.

Energy Conservation Through Behavioral Change

As part of our holistic approach toward performance contracting, NORESCO will create a comprehensive, custom-tailored program known as Energy Conservation Through Behavior

Change® or ECTBC which further optimizes the benefits from the newly installed high-efficiency equipment and systems by introducing a "social responsibility" component that actually generates additional energy savings. This is a three-part program consisting of: (1) Awareness-Communication; (2) Green Energy Education; and (3) Behavior Change Intervention.

Using the inherent opportunity to "go green" within performance contracting, the ECTBC Program reinforces and sustains a culture of energy efficiency within your campus. This ECM is a cognitive-social-based program that promotes cultural change by reinforcing energy conserving behaviors while discouraging energy wasting behaviors. It relies on a tested and proven process which assesses attitudes, social norms, control perceptions, knowledge, behaviors, and other aspects of energy use among faculty, staff, and students. Assessing these factors allows NORESCO to custom-tailor a program specifically for UMBC. Our program has multiple associated individual, organizational, and community benefits in addition to reducing energy consumption. These benefits occur while enhancing the educational learning experience and increasing your sustainability through greater effectiveness.

LEED-EB Screening of Physics, ITE, and Public Policy Buildings

NORESCO will evaluate Physics, ITE, and Public Policy buildings in order to assess their potential for attaining LEED-EB (Existing Building) certification. The performance of these three academic buildings will be compared against the LEED-EB's silver criteria and a scorecard developed for each. Based on the screening results, NORESCO will develop recommendations as to whether UMBC should pursue certification for any of these buildings along with the measures and estimated costs required to attain the certification.

Comprehensive Metering Plan

UMBC wishes to implement a campus-wide utility metering program. Under the program, meters will be installed throughout the campus to monitor electric, hot water energy usage, chilled water energy usage, natural gas, and domestic water where applicable. The metering data shall be tied into a central front-end capable of archiving and analyzing real-time utility usage.

Metering of energy and water by itself saves no energy. However, metering and tracking utility consumption in individual buildings can facilitate energy management initiatives and achieve significant savings. By monitoring and tracking energy consumption against established benchmarks, degradations in a building's energy performance can be prevented. Monitoring utilities at individual buildings will also enable UMBC to identify situations where abnormal usage is occurring, take appropriate corrective action and, in many cases, identify problems early to avoid costly O&M expenses.

NORESCO is developing two distinct energy and water sub-metering scopes for UMBC. The first scope covers the "core" of UMBC's buildings, which are academic and administrative buildings. These building receive their chilled water and hot water from the main central plant.

The second scope of work covers the residential life buildings which are served by the satellite plant. Residential life also includes the many apartments found on campus.

Solar Photo-voltaic

NORESCO initially evaluated installing solar photo-voltaic (PV) on a large scale across numerous roofs and open areas across campus. The cost and payback of a large scale installation proved too long for inclusion in the base project. Further development will be taken to provide go to contract cost and savings for demonstration PV installations in select locations. For example, the Alumni House roof area indicates these modules have the potential to produce approximately 2 kW of electric power from a clean, renewable energy source.

This measure will produce a reduction in electricity demand and contribute to a reduction in greenhouse gas emissions. The installation of this ECM will help serve as a demonstration of UMBC's commitment to incorporate non-polluting renewable energy to help meet their electric needs.

Fume Hood Controls

NORESCO will investigate retrofitting the existing Phoenix control system. Zone Presence Sensors (ZPS) will be installed on the fume hoods and integrated into the existing Phoenix hood controllers. The ZPS system shall safely cut the flow from 100 to 60 ft per second whenever someone is not standing at the hood, thereby maximizing energy savings and system diversity.

Additional Strategies Beyond the Energy Contract

Combined, the Renewable Energy Plan (6,556 metric ton eCO2 reduction) and the Energy Performance Contract (11,000 metric ton eCO2 reduction) will reduce the campus total GHG emissions by over 19% from the 2007 baseline. As discussed above in Part 1, there will still need to be additional reductions given the growth in emissions that are likely to result in campus expansion over the next few years.

The Mitigation Workgroup of the CCTF has been exploring additional strategies for reducing energy use and GHG reductions beyond those actions that will be taken under the energy contract. Many of the strategies that have been considered are listed in Appendix 2. A newly formed workgroup, the Utilities and Energy Workgroup will be reviewing these and other options to determine the most cost-effective ways to reduce energy use in the future. Some of these options include:

- More Efficient Space Utilization and Scheduling
- Technological Advancements in Equipment (more efficient HVAC equipment, lighting, appliances, computers, etc.)
- Technological Advancements in Renewable Energy (lower costs and/or higher outputs)
- Energy Rebates and Incentives to facilitate implementation of any of the above

- Additional RECs (beyond the current 20% level)
- Carbon Offsets

Part 4. Transportation

Background

Carbon emissions related to transportation are a significant part of the overall campus footprint. Transport related emissions of greenhouse gases were 37% of the total campus footprint in 2008. The contribution of the different transportation sources are shown in Table 3.1. Commuting to campus makes up the largest share of emissions. Air travel for campus-related work is about a third of the total annual emissions.

Table 3. Carbon Emissions from Transportation Related Sources, Year 2008

	eCO_2 Metric tons	Percentage
Transportation Total	33,820	100%
University Fleet	824	2.4%
Student Commuters	14,682	43.4%
Faculty/Staff Commuters	6,661	19.7%
Air Travel	11,653	34.5%

GHGs from the transportation sector will increase over time as the campus is expected to grow in the next 5 years (2% growth in student body assumed each year over the next 5 years) if no new policies or changes are put in place. On the other hand, federal regulations that were put in place in spring 2009 to improve fuel economy of new vehicles sold will result in significant improvements in fuel economy of the overall fleet in the coming years. The best estimates for average fuel economy from the Department of Energy are shown in Table 4. These CAFE requirements will reduce energy use and greenhouse gases from the commuter fleet, even without changes in the numbers of commuters to campus and the length of their commute. The second row of Table 4 shows the percent reductions in energy use implied by these standards, assuming no changes in numbers of vehicles or vehicle miles travelled.

Table 4. Forecasts of average fleet fuel economy, CAFE standards of 2009

	2010	2015	2020	2025	2030
Average fleet fuel economy[1]	20	22	25	27	29
Percent reduction in energy use from 2010 (assumes VMT constant)		9.6%	18.7%	25.8%	30.7%

[1] : Source: U.S.Department of Energy

Development of Additional Policies for Reducing GHG Emissions from Transportation

To address additional ways the campus can reduce greenhouse gas emissions from transportation, the CCTF formed a Transportation workgroup.

The workgroup has developed a set of strategies that it will be implementing in the near future, and others that are under serious consideration, and still others that are in the discussion and planning stages for longer term consideration and action. These policies and strategies are listed below:

Policies and Projects being implemented over the next year:

The following projects are designed to improve opportunities to use alternatives to private vehicles for commuting to campus, or to reduce across campus local commuting. These have recently been implemented or they are approved and will be implemented.

- Improvements to pedestrian paths, and improved signage on campus
- Revised bus stops on campus to provide better safety and convenience. Addition of covered shelters at the stops, and addition of taxi stands.
- Improved coordination of stops and routes of shuttle service with Maryland Transit Administration (MTA)
  - Bus
  - Rail
- Participation in All College Access Discount program. This allows students to purchase discount bus passes from MTA.
- Additional Bike Racks being installed on campus
- Campus fleet vehicles will be converted to cleaner fueled vehicles over time. Currently there are 6 natural gas vehicles, 10 GEMS, and 2 electric golf carts, out of 100 vehicles that make up the campus fleet. The existing fleet will be replaced with alternative fueled, fuel efficient vehicles as they are replaced over time.

In the development stage:

- Improvement in shuttle bus routes that are better aligned with geographic origin of commuting faculty, staff and students.
- Partner with MTA to develop improved MTA routes that better serve UMBC students, faculty and staff.
- Establish the use of Smart Cards, to allow students, faculty and staff to obtain pre-tax payroll deductions for expenditures on public transportation options, including bus, rail, and vanpooling. This will reduce the cost of these alternatives to driving to campus.

- Enhanced information and opportunities for carpooling and ride-sharing on campus. Focus groups being formed and policies examined.

- Advanced Parking Management Strategies

- Making vanpooling available to groups on campus. Providing the opportunity for tax savings for those who elect to vanpool.

- Providing Zip Cars for students, faculty and staff to use

- Addition of fleet of bikes to be used on campus

- Parking discounts for carpooling

Policies/initiatives that are under discussion for the future:

- A range of pricing incentives for taking transit or biking, for registering vehicles on campus, and for parking are being considered.
    - Daily parking passes
    - Differential fees for different lots
    - Parking discounts for fuel-efficient vehicles
    - Changing the parking policy to one where not all students are required to pay for parking
    - Payroll deductions for commuter options (MTA, Van pools, etc.)

- Additional policies related to telecommuting and compressed work schedules. The campus currently has a telecommuting policy, and there will be on-going discussions about this strategy**.**

- Exploration of the use of virtual meetings

- Policies that reduce campus-related air travel

- Discussions with regional planners in the area to identify ways to improve bike paths, to make biking to campus from some locations a safer and more feasible option.

Tracking Progress in reducing Transportation Emissions:

Reducing GHG emissions from overall commuting to campus, beyond the reductions due to increases in average fuel economy, can occur in a number of ways. The more students who live on campus, the less commuting there will be. Also, the number of faculty, students and staff who carpool or use shuttle or public transportation will reduce the number of vehicles coming to campus. The current assumptions related to commuting are summarized below, in Table 5.

These estimates will be improved upon and tracked over time as part of the effort to monitor future emissions reductions.

Table 5. Commuter related assumptions for UMBC GHG inventory

UMBC Commuter Estimates for FY2008 - FY2009				
	FTE Students	**Summer Students**	**Faculty**	**Staff**
Live On-Campus	30.00%	20.00%	0.00%	0.00%
Live Off-Campus	70.00%	80.00%	100.00%	100.00%
Personal Vehicle - Alone	65.75%	75.50%	98.50%	85.00%
Personal Vehicle - Carpool	1.00%	0.00%	0.50%	0.50%
MTA Bus	0.75%	0.50%	0.00%	13.00%
UMBC Shuttle	2.00%	3.00%	0.50%	1.00%
Walk or Bike	0.50%	1.00%	0.50%	0.50%
Roundtrips/Day	1	1	1	1
Days/Year	120	30	180	240
Miles/Roundtrip	40	30	40	30

Part 5. Solid Waste

Waste Reduction

Solid waste makes up only 1.2% of UMBC's greenhouse gas emissions (Table 2.2). It is a goal of UMBC to minimize the waste that is produced by the campus community. Keeping waste out of the landfills decreases greenhouse gas (GHG) emissions associated with resource extraction, manufacturing, landfill disposal and incineration and saves the university money. Reusable items should not be put into the dumpsters. UMBC collects unwanted or reusable furniture, electronics and other large items that can be re-purposed. Surplus furniture, electronics, building supplies and other materials are reused, recycled, sold at auction or donated to charity.

Campus Recycling/Surplus

UMBC Facilities Management coordinates campus recycling. Student groups, other university offices and contractors work together to promote sustainability. Aluminum, glass and plastic recycling are available throughout campus. Containers marked for recycling are found in public spaces, hallways, individual academic departments, resident's hall lounge areas and apartment stairwells. Paper recycling for academic departments is available through the "WOW" box program. UMBC participates in the annual RecycleMania program.

Policies to be considered for the future

- On campus composting
- Encouraging the use of mugs and personal water bottles
- Discouraging the purchase of bottled water

Part 6. Education and Research

UMBC Degree Programs – Focus on Natural Environment & Sustainability

An Environmental Council was established in 2007, consisting of faculty across the University with active interest in teaching and research in environmental areas. The Council identified current degree programs that provide an emphasis on environment and sustainability. The following list is an outgrowth of that effort.

Biology
B.A. Biological Sciences
B.S. Biological Sciences
M.S., Ph.D. Biological Sciences
M.S., Ph.D. Marine Esturine & Environmental Science

Civil and Environmental Engineering
M.S., Ph.D. Civil Engineering w/ emphasis in Environmental Engineering/Water Resources

Geography and Environmental Systems
B.A. Geography
B.S. Geography
B.A. Environmental Science
B.S. Environmental Science
Minors – Geography, Environmental Science
M.S., Ph.D. in Geography and Environmental Science
M.P.S. Geographic Information Systems (Shady Grove)

Interdisciplinary Studies
B.A. Interdisciplinary Studies
B.S. Interdisciplinary Studies

Marine-Estuarine-Environmental (MEES) Graduate Program
M.S. MEES
Ph.D. MEES

Physics
M.S., Ph.D. Atmospheric Physics

Public Policy
M.P.P.

Ph.D. Public Policy

Courses Related to Sustainability

In many of the programs listed above, there are courses related to sustainability and global climate. For example, there are courses in Geography and Environmental Systems (GES) and Physics, and in Economics and Public Policy. There are also courses for undergraduates offered as part of the Interdisciplinary Studies department (INDS). The Education and Research Workgroup will be compiling a list of these current courses, and will also we examining new opportunities for adding courses in the future.

Sustainability Interns.

Two Sustainability Intern positions have been created on campus starting in the spring of 2010. These are students who will work for 15 hours a week on issues related to sustainability on campus. It is likely that this program will be expanded, with more interns in the future.

Future Initiatives in Research and Education- Climate Action Plan:

1. Web Resources – Maintain a current listing and archive of scholarly articles, newspaper articles (i.e. *New York Times* science articles), books, reports, PPT talks and primers written by UMBC faculty, DVDs/videos and web links pertaining to global warming, climate change and environmental sustainability. For instance, we should compile links to many websites that allow the user to calculate his/her carbon footprint, or provide on-line training on how one can live "more green". The works should be categorized according to depth of content i.e. general appeal, technical, etc. Downloadable articles should use .pdf format when possible.

2. Freshmen Initiatives – Getting students thinking about environmental awareness, questions and debates on global change and environmental stewardship should begin as early as possible. A variety of venues can be used to cultivate a lifelong interest in these topics, and it is important to get students thinking critically about key environmental change issues and how these issues will impact their lives. Potential opportunities for early education can include required summer reading of a book that addresses the politics of sustainability or climate change, a First Year Seminar, or a course requirement implemented as part of GFR/GEP.

3. Student Involvement in Research – Students should be given a broad choice of directed study and internship opportunities throughout their undergraduate career. Research should not be perceived as something only "smart geeks" engage in but should be promoted as engaging, rewarding and even fun. Importantly, research could emphasize both a team and interdisciplinary approach. Individual departments of Deans may wish to sponsor competitions on campus and offer a variety of awards and incentives for student research projects, with students presenting their findings at the annual Summer Research Festival, or receiving some other sort of campus-wide recognition for their work. Research projects may also involve team enrollment in national competitions that tackle efficient uses of technology to solve or ameliorate

climate change impacts. Other projects may involve ongoing carbon footprint assessments, greenhouse gas inventories, and Opportunities for research scholarships and fellowships for undergraduates and graduates should be mined, organized and presented on UMBC's Sustainability web site, and actively promoted within departments via chairs.

4. Expanded Pedagogy in Climate, Environmental Change and Sustainability. Professors and lecturers should be encouraged wherever possible to include these topics broadly or specifically within academic programs, individual courses and seminars. UMBC's CCTF may wish to sponsor now and then a fall or spring campus-wide seminar series on climate change/sustainability or a facilitated screening of a movie or documentary. UMBC's participation in the annual national "Teach In" on Climate Change should continue as this provides a focal point for the entire campus and engages students with a variety of activities ranging from open classes addressing environmental topics, expert panels, film screenings and visits by corporations and agencies promoting green living. An additional possibility would be creating a permanent exhibit or display area in the Commons i.e. "The Green Space" which might simply consist of a flat screen monitor that continuously shows information on green living, sustainability and the science of global change (perhaps interviews w/ UMBC scientists and problem-solvers).

5. Faculty Participation in Research. While UMBC accomplishes a great deal of environmental research, particularly through the Cooperative Institutes (i.e. JCET, GEST), UMBC could probably increase financial support or incentives offered to the various departments and research centers – either directly funding faculty research, or providing support for undergraduate interns and RAs to assist faculty in pursuit of research directed at solving environmental problems, developing new sustainable technologies, etc. Greater steps must be taken to encourage faculty to provide popular summaries of their environmental research and to disseminate this research through the UMBC Public Affairs Office.

Part 7. Outreach

Community Outreach

- A Campus Outreach workgroup, serving under the Climate Change Task, is charged with continuing to reach out to the campus community to inform, engage and persuade widespread involvement in efforts to eliminate our carbon footprint.

- Campus sustainability website created and launched in September 2008 (www.umbc.edu/sustainability). The site highlights research, academic programs, tips for reducing carbon footprint, and resources available to members of the campus community.

- A campus teach-in on Global Warming Solutions was held on February 5, 2009, including over 30 open classes, a panel discussion of national, state and local officials, a market fair of vendors and governmental agencies offering services and support for sustainability, and many more activities. The plan is to repeat this event in the future, forging a partnership with the Students for Environmental Awareness for support.

- UMBC has participated in RecycleMania for three years, and intends to continue to do so in the future.

- At the annual University Retreat in August 2009, a 2.5 hour session on Environment and Sustainability was offered twice, presenting to more than 40 campus leaders. The session shared the most recent global warming data, the ACUPC commitment, campus efforts to date, and plans for the next 1-3 years.

- As part of an Energy Performance Contract, UMBC will invest in efforts to affect the culture and behavior of members of the campus community through education, and incentives.

Part 8. Tracking Progress for Meeting Goals and Next Steps

Guiding Principles for Identification and Measurement for Projects to Reduce GHGs

1. Plan to achieve targets identified by Climate Action Plan and State mandates. See Table1.

2. Identify a range of strategies to reduce emissions across sectors. Determine those that will be most effective, and focus resources on them.

3. Estimate costs of different strategies to extent possible, and try to meet targets in a cost-effective (least cost) way taking the time value of money into account. Discount using the state bond rate.

4. Plan for the life-cycle of capital equipment. As equipment and buildings come up for replacement or construction, consider impact of replacement on achievement of GHG targets.

5. Cost elements may include avoided cost of purchasing RECs, or additional costs associated with state budget limitations.

6. Consider the value of flexibility in waiting for new technology or information.

7. Routinely monitor initiatives and strategies for carbon footprint reduction at other universities and colleges via their websites' sustainability pages and through such groups as the Association for the Advancement of Sustainability in Higher Education and the National Association of Colleges and University Business Officers reports.

GHG Inventory

The emissions inventory that will be prepared every year and will provide key information about progress that is being made on campus to reduce greenhouse gas emissions. Some aspects of the inventory are derived from direct measurement, such as from measured energy use, while others are approximated from the best available data. Some of the commuter data, such as the number of days students travel to campus, and air travel data, such as average trip distance, are based on estimates. Better data collection over time will allow for assessment of different initiatives and their effectiveness, and will also improve the accuracy of the emissions inventory. Data collection is a key element in the UMBC plan, and will improve over time as more effort is focused in this area.

Tracking Emissions Reductions from Individual Strategies

It will also be important to hone methods for assessing the effectiveness of different strategies for reducing GHG emissions and calculating their costs. The approach will be to determine the potential emissions reductions from each strategy, and estimate its cost. From these, the cost-effectiveness of each strategy will be determined. In general, the most cost-effective strategies will be implemented first.

The Energy, Utilities and Waste workgroup will also work toward developing the concept of a maximum avoided cost to which the cost and emissions reductions of each policy could be compared. The campus would not want to pay more than some alternative cost, for example, the costs of purchasing offsets. Any project that reduces the carbon footprint (CF) of the campus has a present value cost avoided based on the purchase of offsets. If the project cost is less than the avoided cost, then it should be preferred (uncertainty in avoided costs must be considered).

Both the campus GHG Inventory and the Climate Action Plan (CAP) will evolve over time, as new information and approaches become available or are developed. In addition, the goals of the CAP must be considered to be flexible, and may be changed over time based on new information about global warming and about the potential of new technologies and opportunities.

Appendix 1. List of members of CCTF and Workgroups

CCTF

Co-Chair, **Virginia McConnell**, Professor, Economics
Co-Chair, **Lynne C. Schaefer**, Vice President for Administration and Finance
Shawn Blum, Energy Manager, Facilities Management
Robert Burchard, Professor Emeritus, Biological Science
Warren DeVries, Dean, College of Engineering and Information Technology
Michael Dick, Library, NEESS representative
James Donlan, Director, Facilities Management
Jeff Halverson, Associate Director, JCET
Joe Hill, Associate Director Energy and Utilities, Facilities Management
B. Rose Huber, Assistant Director, Public Relations
Patricia La Noue, Director, Interdisciplinary Studies
Eleanor Lewis, Director, Institutional Communications
Dannielle Lipinski, SGA, Students for Environmental Awareness
Michelle Massey, GSA Representative, Undergraduate Admissions Counselor
Rob Neff, Asst. Professor, Geography and Environmental Science
Sandy Parker, Chair, Geography and Environmental Science
Valerie Thomas, Asst. Vice President, Human Resources
Tim Topoleski, Professor, Mechanical Engineering
Beth Wells, Assistant Vice Provost for Academic Affairs

GHG Inventory Workgroup

Shawn Blum, Energy Manager, Facilities Management, Chair
Scott Farrow, Economics Department
Joe Hill, Facilities Management
Virginia McConnell, Economics Department
Rob Neff, GES

Campus Outreach Workgroup
Lynne Schaefer, Chair
Robert Burchard
Rose Huber
Eleanor Lewis
Michele Massey
Valerie Thomas
Beth Wells

Mitigation Strategies Workgroup
Jim Donlan, Facilities Management, Chair
Larry Hennessey, Assistant Director, Facilities Management, Co-Chair
Donna Anderson
Joe Hill, Associate Director Energy and Utilities, Facilities Management
Shawn Blum, Energy Manager, Facilities Management
Virginia McConnell, Economics Department
Scott Farrow, Economics Department
Bob Burchard
Larry Wilt, Library
Patricia Lanoue, INDS
Michael Dick

Transportation Workgroup

Terry Cook, Co-chair, Administration and Finance
Virginia McConnell, Co-chair, Economics Department
Donna Anderson, Facilities Management- Grounds
Ramona Arthur, Off Campus Student Services
Michael Dick, Non-exempt Excluded Staff Senate
James Donlan, Facilities Management
Helen Garland, Parking
Madeline Hall, Students for Environmental Awareness
Linda Miller, Financial Services
Rob Neff, Geography and Environmental Systems
Joe Regier, Student Affairs
Beth Wells, Professional Staff Senate
Antonio Williams, Police Department

Research and Education Workgroup
Jeff Halvorsen, GES, Chair
Warren DeVries, Engineering
Sandy Parker, GES
Madeleine Hall, SEA

Long-Range Planning Workgroup

Jim Donlan, Chair
Larry Hennessey, Facilities Management
Jack Suess, Academic Computing
Julianne Simpson
Scott Farrow, Economics Department
Bob Burchard, Emeritus Biology Department
Tim Topeleski, Engineering
Virginia McConnell, Economics Department
Lynne Schaefer, Vice President for Administration

Appendix 2. Summary of Mitigation Strategies (as listed in the Climate Commitment Implementation Guide)

GREEN BUILDING POLICY **Conserve Energy in Existing Buildings:**	**Status**
Re-commission existing buildings to optimize performance of existing equipment.	Future consideration (NORESCO LEED EB Screening)
Perform Major Renovations and Building Upgrades to LEED Silver or LEED Certified levels, where applicable.	Comply with High Performance Building Act
UMBC standards for sustainable practices for building modifications.	Comply with High Performance Building Act
Minimum Roof Replacement Standard: Energy Star.	Current Policy
Building Envelope Retrofits: Develop program to assess condition of buildings on campus and identify priority list of remedial work necessary to minimize energy loss through building envelope defects.	Building audit started; Some included in NORESCO Proposal
Eliminate incandescent lamps.	Included in NORESCO proposal
Change exit signs to LED type. (Alternate: Change exit signs to photo luminescent type)	LED Type included in NORESCO proposal
Install motion sensors for lighting.	Included in NORESCO proposal
Install daylight sensors for lighting where applicable.	Considered by NORESCO
Change old florescent lamps to more efficient type.	Included in NORESCO proposal
HVAC Controls: Demand control ventilation; campus-wide temperature settings; optimize temperature setbacks and scheduling.	Included in NORESCO proposal
HVAC Exhaust: Evaluate heat recovery options; optimize fume hood and biological safety cabinet exhaust systems.	Under review by NORESCO
Conserve Energy in New Buildings:	
Minimum Building Standard: LEED Silver with focus on reduction of energy and resource usage.	New State Policy
More Efficient Energy Production and Distribution	
Optimize Central Plant expansion and upgrade (on-going project associated with PAHF).	Start construction June 2010
Provide variable frequency drive units to optimize heating and cooling distribution systems (under discussion with Energy Service Company).	Included in NORESCO proposal
Cogeneration facility.	Investigated, not selected

Photovoltaic units.	Investigated; limited scope being considered
Solar hot water heating.	Still being investigated
Wind power.	Considered, not selected.
Geothermal energy.	Considered; not selected.
Reduce Energy of Computer Operations on Campus	
Join Energy Star Low Carbon IT Campaign (see attachment).	
Conserve Water in Existing Buildings:	
Install low flow aerators on faucets.	Included in NORESCO proposal
Install low flow shower heads.	Included in NORESCO proposal
Replace urinals flush-o-meters with 1- gpf type.	Included in NORESCO proposal
Replace toilets with 1.2 gpf type.	Included in NORESCO proposal
Conserve Resources through Landscape and Grounds Activities	
Improve irrigation system efficiency (meter, monitor, optimize water use).	Included in NORESCO proposal
Install rain gardens for small scale storm water management and ground water recharging.	
Include native species in planting schemes.	Current practice
Provide landscaped or naturalized buffers along streams and water courses.	
Establish no-mow areas for naturalization (campus edges not main quads).	
Maintain biodiversity by protecting existing trees and natural areas from invasive plant species (for example English ivy and other invasive climbing vines). Example program: Weed Warrior volunteer program used by various government agencies and conservation groups.	
Evaluate power equipment selection (including contract work) to minimize energy use and emissions.	To be investigated for next contract
ENERGY STAR PROCUREMENT POLICY	
Purchase Energy Star equipment wherever financially possible. This includes: • Computers. • Monitors. • Printers. • Copiers. • Scanners. • Exit signs. • Roofing. • Televisions.	Develop policy

• VCRs, DVD recorder/players. • Water coolers. • Kitchen equipment. • Vending machines. • Air conditioners. • Clothes washers/dryers.	
Refit existing vending machines with switch for automated hibernation.	
AIR TRAVEL OFFSET POLICY	
Purchase carbon offsets for air travel required for campus business. • Review options for tracking air travel and purchasing carbon offsets.	
PUBLIC TRANSPORTATION POLICY	
Encourage public transportation use by faculty, staff, students, and visitors. • Improve intermodal connections such as coordinating campus shuttle schedule with MARC train (including reacting to train delays). • Encourage wider use of UMBC Shuttle; consider interface with Community College of Baltimore County - Catonsville. • Promote MTA bus routes 35 and 77.	
GREEN POWER PRODUCTION OR PURCHASING POLICY	
Purchase or produce at least 15-percent of electricity from renewable sources. • Energy contract for 2009 exceeds required percentage of electricity generated from alternative (non-fossil fuel) sources.	2009 contract: 19-percent
CLIMATE-FRIENDLY INVESTING POLICY	
Support climate and sustainability shareholder proposals at companies where endowment is invested. • Details TBD	
WASTE MINIZATION POLICY	
Support goal of zero waste on campus.	
Expand recycling program (additional collection points; user education; feedback to campus community).	Ongoing effort.
Recycle construction and demolition waste to extent practical.	Current practice
Implement user education and behavior modification regarding wasteful practices.	Included in NORESCO proposal
Develop guidelines for zero waste events.	Future consideration
Initiate on-site composting.	For discussion
Provide waste reduction guides (less waste = more money).	Future consideration
Solicit and support acceptable waste minimization measures. For example: Bottled water use could be reduced by providing filtered water "fill stations" instead of or in addition to drinking fountains. Re-usable, non-leaching water	

containers could be made readily available.	
GENERAL Future energy savings will be used to payback Energy Savings Measures provided under contract with the Energy Service Company. Consider dedicating other savings generated through energy saving or waste reduction to support new initiatives.	
Optimize fuel consumption of campus fleet: • More electric vehicles for on-campus use.	Future consideration
• Sell or scrap older gasoline fueled vehicles.	Removal contingent on above
• Include bio-diesel fuel in fuel mix for buses and other diesel vehicles.	4-buses purchased with bi diesel feature; cost and availability are factor.
Optimize Building Use/Scheduling to consolidate building use and maximize "off-hours" for entire buildings or building floors.	
Provide carpooling incentives through priority parking and discounted parking permits.	
Establish "no-idle" policy for UMBC vehicles; include visiting team buses.	
Consider Tele-work policy and reduction in 5-day work week to reduce employee commuting.	
WORK GROUP PROPOSALS UNDER CONSIDERATION	
Building temperature set point policy:	In effect
• Summer 76-deg F; Winter 70-deg F	
• Off-hours setback	
• Curtail use of space heaters	
Domestic hot water policy:	Under discussion
• Lower delivery temperature of hot water	
• Optimize production of hot water	
• Motivate conservation	

The above items are for discussion purposes only and have not necessarily been adopted or otherwise acted on by the task force or workgroups. The order and main headings follow those listed in the Climate Commitment Implementation Guide.

Complied by Larry Hennessey
Updated December 11, 2009

Appendix 3. International/Regional/State Greenhouse Gas (GHG) Initiatives and Energy Conservation Requirements

Kyoto Protocol - Agreement for industrialized countries to reduce their GHG emissions. Collective world target is 5.2% below 1990 levels by 2012. The US target is 7% below 1990 levels by 2012. The US did not sign the Kyoto Protocol. The Kyoto Protocol expires in 2012, and will be succeeded by the **Copenhagen Protocol**. In December 2009, the UNFCCC will meet in Copenhagen to develop a new agreement for 2013 and beyond. http://unfccc.int/2860.php

American College & University Presidents Climate Commitment (ACUPCC) - Carbon Neutrality by target date. Reduction milestones and target dates are to be set by each university and included in each university's Climate Action Plan. http://www.presidentsclimatecommitment.org/

Carbon Neutrality - Net result of zero emissions of carbon dioxide equivalents (CDE). Organizations generally begin the process of achieving carbon neutrality by taking an inventory of their GHG emissions. As energy use is typically the largest component of an organization's carbon footprint, the next step is reducing energy use through a spectrum of energy efficiency measures. A variety of potential next steps include fuel shifting (such as burning biodiesel, which can be a carbon-neutral fuel) and behavioral changes (such as increased use of public transportation) to further reduce the CDE. Ultimately, when emissions have been reduced as much as possible, carbon neutrality can be reached by purchasing carbon offsets in an amount equal to the number of tons of CDE remaining.

Association for the Advancement of Sustainability in Higher Education (AASHE) - As a signatory of the ACUPCC, UMBC is committed to making our greenhouse gas reports publicly available by providing them to AASHE. http://acupcc.aashe.org/index.php?abs=&q=University%20of%20Maryland%20Baltimore%20County

Sustainability Matters at UMBC - http://www.umbc.edu/sustainability/

Renewable Portfolio Standard (RPS) - The Maryland Public Service Commission's renewable energy portfolio standard (RPS) is a requirement that applies to all retail electricity sales in Maryland. Electricity suppliers must get a specified percentage of the electricity they sell from renewable sources. In 2009, the RPS is 2.01% from Tier 1 renewable resources, including at least 0.01% from solar, and 2.5% from Tier 2 renewable resources. Each year the Tier 1 and solar requirements increase, until...In 2022 and later, the RPS is 20% from Tier 1 renewable resources, including at least 2 from solar, and 0% from Tier 2 renewable resources. http://webapp.psc.state.md.us/intranet/ElectricInfo/home_new.cfm

Renewable Energy Credits (RECs) - In addition to the RPS% that the supplier is required to provide, UMBC purchases an additional 15% of our electricity from renewable sources via RECs. UMBC purchases Tier 2 RECs from Conowingo Hydroelectric Plant.

State Buildings Energy Efficiency and Conservation Act (MD Senate Bill 267) - Stipulates that all State agencies shall reduce their energy consumption 5% by 2009 and 10% by 2010. The baseline year was to be 2005; however, DGS and MEA established calendar year 2008 as the baseline year, because complete energy data was not available for 2005 or 2006 or 2007. DGS, in cooperation with MEA, are to set forth energy performance indices for each agency based upon each agency's potential for energy savings. SB 267 also requires all State agencies to submit an Energy Conservation Plan to MEA by July 1, 2008. Potential Energy Conservation Measures (ECMs) cited in SB 267 include energy performance contracting, energy efficient lighting retrofits, water conservation devices, weatherization, efficient heating and cooling equipment, and employee training. http://www.energy.maryland.gov/incentives/state-local/sbeeca/index.asp

BITH Energy Database - The Maryland Energy Administration (MEA) and the Department of General Services (DGS) contracted BITH Energy to compile and maintain a comprehensive database of all utility bills for all State agencies, with full data beginning January 2008. This database will be used to help set goals and track performance for each State agency with regard to energy savings, GHG reductions, and environmental initiatives.

EmPower Maryland Energy Efficiency Act of 2008 (MD Senate Bill 205) - Requires statewide per capita 15% reduction in electricity consumption by 2015 and 15% reduction in peak demand by 2015. Utility companies are responsible for 10% per capita reduction in consumption and 15% reduction in peak demand. The State is responsible for the remaining 5% per capita reduction in consumption. http://energy.maryland.gov/facts/empower/index.asp SB 205 was signed into law on April 24, 2008. http://www.governor.maryland.gov/pressreleases/080424.asp

Maryland High Performance Building Act (MD Senate Bill 208) - Requires all new public construction and major renovation projects greater than 7500 square feet to achieve either the LEED Silver standard or two Green Globes. SB 208 was signed into law on April 24, 2008. http://www.governor.maryland.gov/pressreleases/080424.asp

Regional Greenhouse Gas Initiative (RGGI) - Ten northeastern states (CT, DE, ME, **MD**, MA, NH, NJ, NY, RI, and VT) are implementing the first cap-and-trade program in the United States, which is mandatory for power plants. Recent auction priced CO2 at $3.51/ton for 2009-2011 and $3.05/ton for 2012-2014. http://www.rggi.org/about

MD Environmental Footprint - Directive by Governor O'Malley to quantify, reduce, and track the environmental footprint of the State Government. Higher Education Summit was held on May 1, 2009 for various MD colleges and universities to highlight their efforts. http://www.usmd.edu/usm/sustainability/presentations.php

MD Commission on Climate Change - Recommends goals for the State of reducing GHG emissions 10% by 2012 and 15% by 2015, from 2006 levels. http://www.mdclimatechange.us/

Greenhouse Gas Emissions Reduction Act of 2009 (MD Senate Bill 278) - Sets target for Maryland of reducing GHG emissions 25% from 2006 levels by 2020...and "a longer-term goal

of reducing GHG emissions up to 90% from 2006 levels by 2050." SB 267 also requires a task force to create a plan for achieving these targets while providing a net economic benefit to the State and a net increase in jobs. The plan must be submitted by December 2011 and adopted by December 2012.
http://www.mde.state.md.us/assets/document/Air/ClimateChange/GGRA_factsheet.pdf This bill is part of the "Smart, Green, and Growing" legislation signed into law on May 7, 2009.
http://www.governor.maryland.gov/pressreleases/090507.asp