UNIVERSITY SUSTAINABILITY COUNCIL

CARBON OFFSET WORK GROUP REPORT

December 2015

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EXECUTIVE SUMMARY

The University Sustainability Council created a Carbon Offset Work Group to investigate the potential use of carbon offsets as part of the university's carbon reduction strategy and Climate Action Plan. After eight months of discussions with industry experts and consultations with stakeholder groups including the Department of Business Services, Education Abroad, and Inter-Collegiate Athletics, the Work Group proposes to create a new program based on these recommendations:

Recommendation 1: Focus on Direct Emissions Reductions before Offsets

Focus on reducing campus emissions as a higher priority than purchasing or developing offset projects. The primary effort should always be on reducing our direct emissions, but at times when that is not cost-effective, offsets will help the university meet future carbon reduction goals.

Recommendation 2: Create a Greenhouse Gas Reduction Fund for On-Campus and Offset Projects

The objective of the Greenhouse Gas Reduction Fund would be to find the most cost-effective solutions for reducing the university's carbon footprint and keeping the university on track for meeting its Climate Action Plan goals. Fund monies would be used for on-campus projects or carbon offset projects, whichever have more favorable net present values.

Recommendation 3: Create a Carbon Offset Program

The university will seek carbon offset projects that align with the university's mission including service to the state, global partnerships, innovation and entrepreneurship, and creating new education and research experiences. Offset projects should, whenever possible, be in Maryland and the area surrounding the university. If projects in Maryland cannot be found, project location by order of priority should be within Chesapeake Bay watershed, then from international locations where the university already has an established connection or presence, and finally from Big 10 school states where there are few or no policies that support renewable energy.

Recommendation 4: Offset Air Travel Emissions

Air travel emissions are what the carbon accounting industry calls "unavoidable." There is general industry agreement that carbon offsetting is a good strategy for reducing this category of environmental impacts. Consequently, the Carbon Offset Work Group recommends the university focus its carbon offset strategy on eliminating 100% of air travel emissions or at least enough air travel emissions to keep the university on track for meeting future CAP goals. Offsets for air travel could be implemented on a voluntary basis between 2016 and 2019 for business, athletic, and Education Abroad air travel but become mandatory for all air travel starting in calendar year 2020.

Recommendation 5: Give Commuters the Option to Offset their Emissions

Some members of the UMD community may want to help the university meet its carbon reduction goals by choosing to offset the carbon emissions associated with their personal commutes, so the Department of Transportation Services should make it optional for students, faculty, and staff to offset their commuting emissions when registering for parking permits.

Recommendation 6: Find Innovative Ways to Develop and Support Local Offset Projects

Reflecting its Land Grant Mission, the university should find strategies for helping Maryland business owners, farmers, and government leaders develop environmental projects that reduce greenhouse gas emissions in the state. The university should explore the possibility of self-funding research that leads to the verification of carbon offset projects in exchange for carbon offsets from the project it helped launch.

Recommendation 7: Seek Carbon Offsets Verified by Gold Standard or VCS and CCBS

Seek offsets verified by these organizations, especially since the co-benefits of offset projects (including creating jobs, preserving habitat, cleaning water, etc.) support the university's mission.

Recommendation 8: Explore the Potential of Developing Offset Projects to Reduce the Carbon Intensity of Power Generation

The university should explore opportunities to develop renewable energy projects that create offsets (as opposed to Renewable Energy Certificates) and use those offsets to reduce emissions associated with on-campus power generation.

In addition to these recommendations, the Work Group also projected air travel emissions through 2025, and the associated offset costs. To meet these costs, the Work Group outlined potential funding strategies for Education Abroad, Athletics, and Business air travel.

If the university implements these recommendations, then it may come very close to meeting its Climate Action Plan goal of reducing its greenhouse gas emissions 50% from 2005 to 2020. However, if the university does not offset any air travel emissions, then the university's carbon footprint in 2020 may be only 30% below its 2005 baseline, or 66,500 MT-CO_2e short of reaching its goal.

This report will ideally serve as a guideline for how to approach carbon offsets as an important piece of the university's Climate Action Plan. By investing in a focused, thoughtful carbon offset strategy, the university will continue to lead in higher education sustainability progress.

BACKGROUND ON CARBON OFFSET WORK GROUP

The University Sustainability Council authorized the creation of a Carbon Offset Work Group in 2014 in response to presentations from the Office of Sustainability detailing the University of Maryland's progress and challenges toward meeting its Climate Action Plan (CAP) goals. A summary of those challenges is included in the Introduction of this report. In order to continue building the university's reputation as a national model of a green university, it is important to the Council to make annual progress toward CAP goals and be a leader within the group of 685 schools that have signed the Climate Leadership Commitments to date. The Council specified that the Carbon Offset Work Group should propose a carbon offset strategy that would keep the university on track to meet its 2020 goal of reducing its carbon footprint 50% from its 2005 baseline. Joanne Throwe, Former Director of the University of Maryland Environmental Finance Center, agreed to chair this effort and launched the Carbon Offset Work Group in the spring of 2015 with the following objectives and membership:

Work Group Objectives

Objective 1: Develop procurement guidelines for registered carbon offsets to specify the types, sources, terms and uses that are acceptable within the university's carbon management strategy.

Objective 2: Develop a plan to offset unavoidable emissions from air travel for Education Abroad, athletic competitions, faculty research and other necessary business trips. The plan should include guidelines for structuring an offsets portfolio and options for financing offsets.

Objective 3: Consider how the university's participation in the carbon offset marketplace could create new opportunities for local and regional carbon offset projects and/or study abroad experiences for students.

Objective 4: Determine if and how the university can participate in the carbon offset marketplace through non-financial transactions including student implementation of offset projects, faculty/staff consultation on offset projects, and other in-kind contributions.

Work Group Membership

Chair (Feb. 2015 – Oct. 2015): **Joanne Throwe**	Former Director	Environmental Finance Center
Chair (Oct. 2015 – Dec. 2015): **Daniel Nees**	Director	Environmental Finance Center
Andrew Fellows	Program Manager	Environmental Finance Center (and Mayor, City of College Park)
Anna McLaughlin	Assistant Director	Transportation Services
Courtney Ferraro	Graduate Student	Public Policy
Elisabeth Gilmore	Assistant Professor	Public Policy
Evan Ellicott	Assistant Research Professor	Geographical Sciences
Josh Kaplan	Associate Director	Intercollegiate Athletics
Kate Richard	Associate	Office of Sustainability
Kim Glinka	Associate Director	Center for Social Value Creation
Leanne Johnson	Associate Director of Operations	Education Abroad
Maria Lonsbury	Project Specialist	Office of the VP for Student Affairs
Mark Stewart	Senior Project Manager	Office of Sustainability
Mary-Ann Ibeziako	Director	FM Department of Engineering and Energy
Maya Spaur	Undergraduate Student	Env. Sci. & Tech. and Gov. & Pol.
Naomi Standing	Research Economist	Environmental Finance Center
Russell Furr	Former Director	Department of Environmental Safety
Sally DeLeon	Project Manager	Office of Sustainability
Sean Williamson	Program Manager	Environmental Finance Center

INTRODUCTION

Reaching Climate Action Plan Goals

The University of Maryland reduced emissions 22% from 2005 to 2014 and will likely achieve the 2015 CAP goal of a 25% emissions reduction as the university's use of renewable energy grows. The Office of Sustainability estimates that President Loh's Energy Initiatives — if fully implemented over the next five years — will bring projected total emissions reductions to approximately 30% below the 2005 baseline by 2020, which will get the campus closer but not completely to the CAP goal of a 50% reduction by 2020. The university may have to offset an additional 66,500 metric tons of carbon dioxide equivalent (MT-CO_2e) or more to achieve that goal. President Loh authorized the purchase of carbon offsets to keep the university on track for meeting CAP goals when he announced his energy initiatives in 2014.

In 2020, almost all of the university's remaining greenhouse gas emissions will come from three sources: 1) the combined heat and power plant (CHP), 2) commuter vehicles, and 3) air travel.

The CHP is primarily fueled by natural gas with "number 2" fuel oil as a back-up fuel during periods of gas curtailment. The CHP is a relatively stable source of emissions since the plant typically operates at or near full capacity. Fluctuations in campus energy demand result in increases or decreases in the amount of grid-supplied electricity the university purchases from regional power plants instead of reducing output from the CHP. Therefore, the best opportunities to significantly decrease CHP emissions are to increase central plant efficiency, shift to low/no-carbon fuel(s), implement a more efficient distributed energy system, and/or sequester emissions from power generation. All options are being explored but are not likely to be implemented in time to meet the 2020 CAP target.

On the transportation side, commuter emissions are expected to continue trending gradually downward – albeit at a slower rate than in the first few years of CAP implementation – as more student housing becomes available on/near campus and vehicles become more fuel efficient. However, in recent years, increases in air travel emissions have exceeded reductions in commuting emissions. As more faculty travel overseas for research, more students study abroad, and athletic teams travel farther for sporting events (all of which support university goals), the air travel footprint is expected to continue to grow. The rate of growth may begin to slow after 2020 when airlines are expected to cap aviation greenhouse emissions and begin to work toward net emission reductions. The Office of Sustainability will work with campus partners to implement programs to attempt to reduce air travel emissions to the greatest extent possible, but such transportation is necessary to the mission of the institution. Therefore, offsets may be needed where other mitigation strategies are not feasible.

What is a Carbon Offset?

A carbon offset is a credit for greenhouse gas reductions achieved by one party that — once verified by a qualified third party — can be used to compensate for (offset) the emissions of another party. For instance, the University of Maryland could contribute to projects that restore carbon sequestration capabilities of wetlands in the Chesapeake Bay or capture methane at a landfill. Because the greenhouse gas reductions from those projects can be measured, verified, and registered in the offset marketplace, the university can claim credit for those greenhouse reductions and subtract them from emissions that result from the university's operations.

For carbon offset projects to be verified and accepted by the Climate Leadership Commitments, they must meet the following guidelines:

1. **Offset projects are real and emissions reductions are additional:** Projects result in actual reductions of GHG emissions and would not have otherwise occurred under a reasonable and realistic business-as-usual scenario.
2. **Offset projects are transparent:** Project details (including project type, location, developer, duration, standard employed, etc.) are known to the institution and communicated to stakeholders in a transparent way to help ensure validity and further the goal of education on climate disruption and sustainability.
3. **Emissions reductions are measurable:** Projects result in measurable reductions of GHG emissions.
4. **Emissions reductions are permanent:** Projects result in permanent reductions of GHG emissions.
5. **Emissions are verified:** Projects result in reductions of GHG emissions that have been verified by an independent third-party auditor that has been evaluated using the accompanying criteria (available online).
6. **Offset projects are synchronous:** Projects result in reductions of GHG emissions that take place during a distinct period of time that is reasonably close to the period of time during which the GHG emissions that are being offset took place.
7. **Offset projects account for leakage:** Projects take into account any increases in direct or indirect GHG emissions that result from the project activity.
8. **Credits are registered:** Credits generated from project activities are registered with a well-regarded registry that has been evaluated using the accompanying criteria (available online).
9. **Credits are not double-counted:** Credits generated from project activities are not double-counted or claimed by any other party.
10. **Credits are retired:** Credits are retired before they are claimed to offset an institution's annual GHG inventory, or a portion thereof.

Benchmarking

Several universities have developed their own carbon offset programs to help them reach climate action goals. Most of the programs researched give preference to investing in local projects.

UC Berkeley has drafted guidelines for the purchase of renewable energy certificates and carbon offsets. Berkeley recognizes that after mitigation projects and energy reduction on campus, offsets will likely be necessary to reach reductions goals. CalCAP, a partnership of students, faculty, and staff guiding the university on climate action, recommends purchasing a mix of 80-90% RECs and 10-20% offsets. They also look toward the American College and University Climate Commitment and the Global Warming Solutions Act (or AB 32, a California state law) for offset project selection criteria. Projects should be verified by independent third party organizations or by the Climate Action Reserve; in some cases, Berkeley may use even stricter criteria to select projects. Project location is important, and California-based projects, though not necessarily a priority, are supported. The group recommends that Berkeley consider more expensive projects if offsets fall under California state cap and trade rules. Finally, CalCAP advises to consider alternative to livestock methane digester projects due to the carbon-intensive nature of raising livestock. UC Berkeley aims to be carbon neutral by 2025.

The University of Florida, through the Neutral Gator Project, has undertaken multiple carbon offset efforts. Some of the university's offsets come from the Revolving Tree Fund, a program that plants native tree species in Alachua County. Each tree planted offsets one ton of carbon. In a low-income apartment complex in East Gainesville, Florida, volunteers retrofit apartments for more efficient water and energy usage. This project has offset 20,000 tons of carbon since 2008. Finally, the University of Florida athletics program was the first in the country to reach carbon neutrality. The university offsets all athletics facilities and athlete travel, using offsets generated in Florida. In addition to offsetting the athletics program's operations, the university also offers individual offsets for fans traveling to University of Florida games. The University of Florida aims to be carbon neutral by 2025.

Duke University has two full time employees who run a carbon offset program, which is funded centrally by university administration. A major focus of their offset program is highlighting innovative, exciting offset projects, and engaging students in the process. They started off by piloting small offset programs, such as swine waste to energy and home efficiency upgrades, and found that the projects worked well on a small scale but could not be managed on a larger scale by the university. Duke is also exploring funding other larger projects with the intent of receiving their offsets once the projects are operational. A voluntary offset program for students studying abroad has been successful, and the carbon offset coordinators credit this to the students' ability to select the offset projects themselves. Duke has not verified their pilot projects, but openly shares data and are transparent about the process; Duke is also open to purchasing unverified offsets for innovative projects in order to help them get off the ground. Likely, when nearing its carbon neutrality goal year, the university will purchase large numbers of lower cost offsets from less innovative projects. Duke aims to be carbon neutral by 2024.

Yale University has a Community Carbon Fund, a voluntary fund that purchases offsets for individuals, groups of friends or colleagues, special events, or departments. A person or office that wishes to offset their emissions (air travel, community, or events) uses the Community Carbon Fund Calculator to generate an offset cost, which the purchaser than donates to the fund. The donations are then invested in local offset projects in New Haven and Connecticut. Yale funds additional, unverified offset projects. Specific projects include residential yard tree plantings, programmable thermostat installation, insulation installation in low-income households, and energy efficiency retrofits.

Middlebury College established a carbon offset program in 2006 for study abroad air travel emissions. Middlebury purchased offsets through Native Energy, supporting projects abroad and in the United States. Native Energy sells independently verified carbon offsets. The program has since been discontinued, though Middlebury continues to encourage students studying abroad to offset their emissions individually.

Opportunity for Leadership and Learning

By investing in meaningful carbon offsets, the university will join other leaders in higher education sustainability efforts. There are even more opportunities to lead the way if the university helps to develop projects, supports project leaders through the verification process, and involves students in research and learning around the projects. The university has a goal of being a national model of a green university, and pursuing a carbon offset program would certainly put the university in a forward-thinking position. his would make Maryland one of only a handful of universities purchasing verified offsets beyond individual level, voluntary programs. In working with research partners and innovators, the university can be a launch pad for new technologies and projects that will not only offset university emissions, but also expand the opportunities for carbon reduction beyond this campus.

There are also myriad opportunities for an offset program to support the community in College Park and the state of Maryland, and in communities abroad that have ties to the university. Through collaborating with local and global community partners, the program can demonstrate the impact of offset projects to the university. If students participate in project development, verification, or research, they will gain unique hands-on learning experiences while learning about ways to address one of the most challenging problems facing the world today.

SOURCES OF EMISSIONS

Combined Heat and Power Plant

The university's combined heat and power plant (CHP), located behind the Service Building on Route 1, is an EPA Energy Star certified facility that burns primarily natural gas to simultaneously produce steam and electricity. The system produces all of the steam required for heating and in some cases cooling for the campus. CHP is capable of producing up to 90% of the university's electric demand in the winter and approximately 50% of the summer demand. Consisting of two gas-fired combustion turbines, one steam-driven electric turbine, and two heat recovery steam generators, the system operates at efficiencies of around 70%, significantly higher than like-sized independent steam boilers and electric generators. The system requires approximately 16% less fuel than typical purchased electricity with separate steam generation, resulting in a reduction of nitrous oxide, sulfur dioxide, and roughly 53,000 MT-CO_2e annually. Despite its efficiency, CHP produces an average of 121,300 MT-CO_2e each year, which accounted for 40-48% of the university's carbon footprint in recent years.

The university has direct control over its energy infrastructure and should prioritize projects that reduce energy consumption and reduce the carbon intensity of its energy generation. These infrastructure projects, though costly to implement, can yield savings to the university throughout their operational lifespans whereas purchasing carbon offsets is an annual expense with no direct return on investment. Purchasing carbon offsets to reduce emissions associated with the CHP should be considered a last resort. However, other strategies that tie the CHP into regional renewable energy generation and efforts to increase carbon storage locally should be considered.

Within the current emission-reporting framework of the Climate Leadership Commitments, there are a few types of carbon reduction projects that the university can use to compensate for emissions from its operations. Verified carbon offsets (as discussed above) are one of these types and they are the only type that the university has not yet executed. The other types (listed below) are exemplified by existing projects that are measured and reported annually by the Office of Sustainability to the Climate Leadership Commitments:

1. **Composting as a carbon sink:** Composting prevents the development of methane that occurs when organic waste decomposes in landfills. Also, applying organic fertilizers, such as those resulting from composting, to agricultural land increases the amount of carbon stored in these soils. Because compost can create a carbon sink, greenhouse gas accounting protocol allows the university to reduce its carbon footprint by at least 750 MT-CO_2e from the tons of organic waste it composts annually (as compost collection becomes more widely available across campus this reduction will continue to increase).

2. **Forests as a carbon sink:** The university property contains approximately 166,000 trees according to a 2008 study of the campus arboretum. Because forests (both dense and urban) sequester carbon, the university is able to reduce its annual carbon footprint by 683 MT-CO_2e. The Office of Sustainability is working with the University of Maryland Extension's Research and Education Centers to try to find appropriate and feasible ways to quantify annual carbon sequestration of forests on these properties as well.

3. **Renewable energy projects as carbon avoidance:** Along with other University System of Maryland schools, the university helped develop a 16 megawatt (MW) solar power facility at Mount St. Mary's University, a 10 MW wind power project in western Maryland, and a 55 MW wind power project in West Virginia. New renewable energy projects have carbon benefits because they either prevent the development of future fossil fuel power plants or actually replace existing fossil fuel power plants. The environmental benefits of these projects are exchanged from project owner to renewable energy purchaser as renewable energy credits (RECs), which are different from carbon offsets but serve a similar function. Whereas carbon offsets provide a way of transferring the environmental benefits of a project as measured in tons of carbon dioxide, RECs are a way of transferring those benefits as measured in megawatts of electricity generation. Greenhouse gas accounting protocols allow the university to use RECs generated by its distant renewable energy facilities to negate the emissions generated by closer power plants that actually produce the electrons that power the campus.

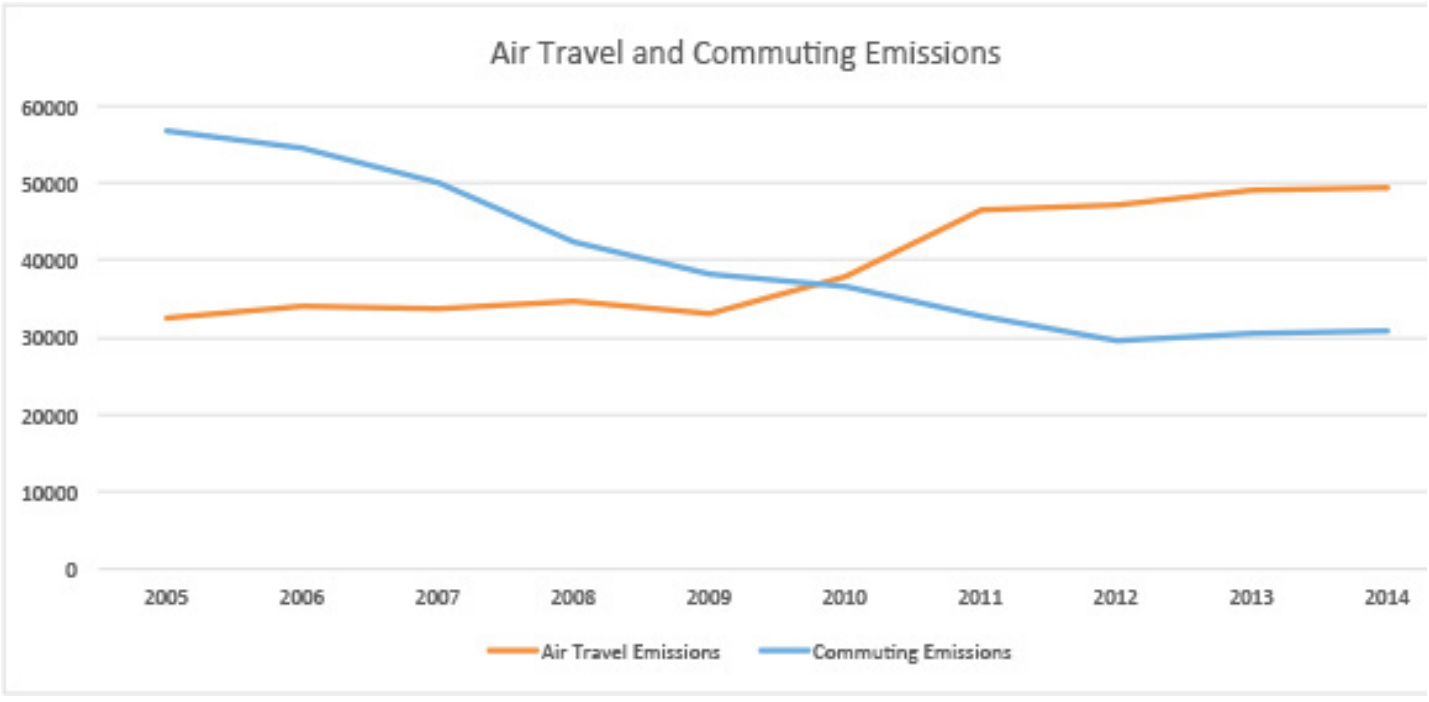
The university should consider offset strategies similar to those listed above for reducing emissions associated with its CHP. One potential strategy is included in the Recommendations section.

Commuting

Commuting emissions accounted for 11.7% (31,014 MT-CO_2e) of the university's carbon footprint in 2014. Although the university has little control over the types of vehicles that students, faculty, and staff use to go to and from campus, there are numerous strategies the university uses to encourage people to choose low-carbon transportation methods. These include offering discounted parking rates for low-emissions vehicles, developing bicycling infrastructure on campus, and offering free rides on Shuttle-UM busses that serve both local and distant neighborhoods. Because alternatives to driving single-occupancy-vehicles exist and people have a financial incentive for purchasing high-efficiency (low-emissions) vehicles, it is not a top priority to target commuting emissions as part of the university's carbon offset strategy at this time. However, a voluntary offset program (as described in the Recommendations section) could be offered to commuters who want to offset their personal carbon footprints.

Air Travel

Whereas the university has complete control of its energy infrastructure and some influence over commuter behaviors, it has little effective control of air travel emissions. Given the university's goal to be globally connected, restrictions on flying would hinder important university work. Faculty travel internationally for research, students travel abroad to study, athletes fly for competitions, staff fly for conferences; all of which supports important functions of the university and it is not in the university's interest to limit that travel. The university can encourage students, faculty, and staff to travel by train, bus, and even car instead of flying to destinations within a specified distance of campus, but even full compliance in that program would have limited impact on reducing air travel emissions. At the same time, people currently do not have the ability to choose airlines that fly aircraft on biofuel or other no/low-carbon fuels, or that aggressively implement strategies to increase the fuel efficiency of their fleets. In 2014, air travel emissions accounted for 18.6% (49,332 MT-CO_2e) of the university's carbon footprint. If that number continues to increase at its recent average annual growth rate of 2.79% per year (based on change from 2010 to 2014), then by 2020, air travel emissions could equal 57,583 MT-CO_2e. Addressing these emissions is the focal point and top priority of the proposed Carbon Offset Program.



OFFSETS THAT SUPPORT THE UNIVERSITY'S MISSION

Local Offset Projects

Developing New Projects

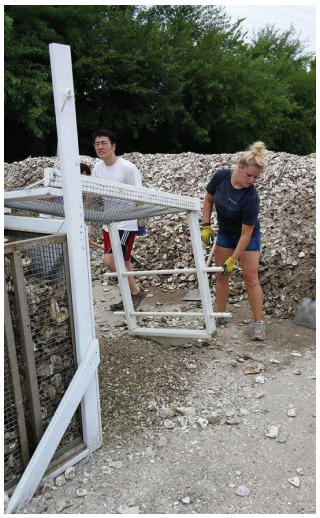
The university has the opportunity to help local businesses, government, and non-governmental organizations develop projects that reduce greenhouse gas emissions, create jobs, and strengthen communities in Maryland and throughout the Chesapeake Bay Watershed. Possibilities for different types of carbon offset projects are extensive, yet, as described below, very few registered carbon offset projects exist in this state or region. The process of verifying and registering an offset project can be overwhelming for resource-strained organizations but the university is in the unique position of having both (1) expertise in its research community to calculate carbon emissions reductions from projects and (2) relationships with organizations that could provide grants to pay for the research and development of projects that could lead to verification of offsets.

There are also many opportunities for students to become involved in this process. Students required to complete a capstone or final thesis project may be able to work on a project verification to complete that requirement. The university's access to grant funding, research expertise, and students eager for hands-on learning opportunities can all help alleviate the significant financial and time burden of verifying a project. Potentially, the university could provide the resources to get a project off the ground in exchange for the first few years of the project's offsets. Though this would present some risk to the university if the project failed or was unable to operate successfully, it would be a great benefit – and complementary to the university's mission – to be the driving force behind carbon reduction projects in the region.

One example of the opportunities to develop carbon offset projects is the university's collaboration with Maryland-based company, Global Resource Recyclers (GRR). This is an excellent example for the sort of relationships the UMD Carbon Offset Program can develop with the business community. GRR is introducing to the mid-Atlantic a relatively new type of road and parking lot repaving process called foam stabilize base. During

OFFSETS THAT SUPPORT THE UNIVERSITY'S MISSION continued

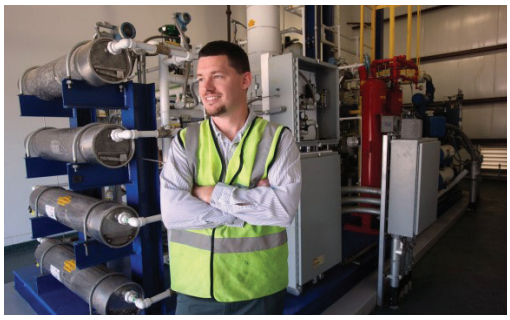
construction foam stabilize base produces 50-80% fewer carbon emissions than hot mix asphalt, which is the common alternative. GRR received a grant through Maryland Industrial Partnerships to work with Professor Qingbin Cui in the Civil and Environmental Engineering department to develop a methodology for verifying the carbon emissions benefits of this new repaving process. GRR, with the university's help, will soon complete the verification process and start selling carbon offsets. The collaboration brought in grant money to the university, provided valuable research experience to graduate students working with Professor Cui, and will create a new revenue stream for a Maryland company as it reduces greenhouse gas emissions in our region.



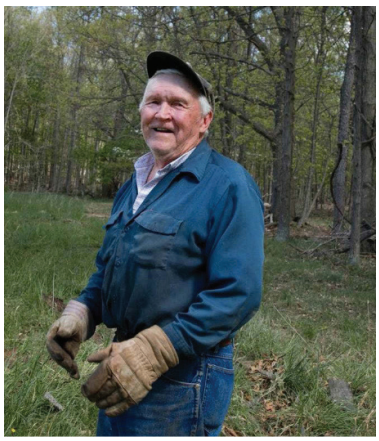
Supporting Existing Projects

The University of Maryland strives to be a national model of a green university. A handful of local offset projects – either in the state of Maryland or in the Chesapeake Bay Watershed – integrate these same environmental stewardship ideals to which UMD aspires. Supporting local projects demonstrates a commitment to investing in sustainable growth in the state of Maryland, and supporting projects in the Chesapeake Bay Watershed honors the natural resource that is such a part of Maryland's identity.

Examples include:



- The WGL CleanSteps Offset Program offers Maryland-based offsets that are sourced from a landfill gas capture project in Dorchester County, Maryland. Methane, a greenhouse gas more potent than carbon dioxide, is captured and destroyed, instead of being emitted from these landfills. Local environmental co-benefits are included in addition to the verified carbon offsets; the CleanSteps program also partners with the Chesapeake Bay Foundation to complete unverified offset projects – such a tree plantings – that benefit the Chesapeake Bay.
- Other landfill gas capture projects are available in Maryland. For instance, a project in Frederick, MD, captures methane emissions from the FC Landfill Energy Facility. Outside of Easton, MD, another landfill gas capture carbon offset project is located at the Midshore Regional Solid Waste Facility. Both of these projects have been third-party verified to the Verified Carbon Standard (VCS). Another project at the New Beulah Landfill on the Eastern Shore has been third-party verified to standards of the Climate Action Reserve (CAR). At this project site, landfill gas is captured, and a system is in place to convert the methane into energy in the future.



- A forest management project based in Lock Haven, PA, is not in the state of Maryland but does lie in the Chesapeake Bay Watershed. The 4,800 acres of forestland were put under a conservation easement in 2012 as part of the Nature Conservancy's Working Woodlands Program. To generate offsets, the forest is conserved more effectively than under basic forest management practices. There are lower harvest rates, and trees have longer growth periods before harvest. Offsets generated by the forest are third-party verified to the VCS.

Maryland/Chesapeake Bay Watershed Carbon Offset Projects Currently Available

Project Name	Offset Seller	Verifying Party	Approximate Offset Cost ($/MT-$CO_2e$)
Landfill Gas Capture	WGL CleanSteps	Climate Action Reserve, American Carbon Registry, and Canadian Standards Association	$5
FC Landfill Energy Facility	Renewable Choice Energy	Verified Carbon Standard	$8
New Beulah Landfill	Terrapass	Climate Action Reserve	$4-$7
Midshore Regional Solid Waste Facility Landfill Gas Combustion Project	Blue Source	Verified Carbon Standard	$4-$8
Lock Haven Improved Forest Management Project	Blue Source	Verified Carbon Standard	$15
Foam Stabilize Base*	To be determined	Verified Carbon Standard	$6

**This project is not yet selling offsets. Price shown is the projected price in 2020.*

Global Partnership Offset Projects

Developing New Projects

The University of Maryland maintains partnerships with universities and other organizations all over the world. From research collaborations, to study abroad opportunities, to service work, faculty and students already devote their time and knowledge to working with global partners. Many of these individuals and projects have an environmental focus. At some point, there may be an opportunity for Maryland faculty or students to work on a project – for instance, going through the verification process – in another country, in exchange for the offsets. Beyond the research connections faculty have with colleagues around the world, there are at least a couple other opportunities to develop new projects globally.

First, students participate in many service-learning projects through programs such as Engineers without Borders and Alternative Breaks. In the future, if students could make a project out of verifying their work, then

perhaps the university would have access to the offsets. Second, existing and new study abroad programs have the opportunity to integrate carbon offset projects into the coursework. Faculty can use the Education Abroad office's established proposal process to revise existing or develop new study abroad programs that allow students to contribute to carbon offset projects. The Education Abroad office solicits short term study abroad courses about a year in advance. Faculty with an interest in environmental issues or carbon offsets could propose a course that visits another country in order to develop or help maintain a carbon offset project. Ideally, these offsets would be put toward Education Abroad air travel emissions.

Supporting Existing Projects

There is an extensive variety of global carbon offset projects. The university would have the option to support a wide range of global environmental goals, such as forest preservation, renewable energy projects, clean cook stoves, and sustainable agriculture.

Existing and new Education Abroad programs in regions with offset projects could potentially incorporate curricular or co-curricular elements to teach travelling UMD students about a project where the university has made an investment to offset emissions from UMD air travel. This would help support UMD's goal to educate all students about sustainability.

Forestry projects are abundant in developing countries. The UN-REDD Programme drives development of projects that reduce emissions from deforestation and forest degradation in developing countries and – in the case of REDD+ projects – go beyond to incorporate conservation, sustainable development of forests and enhancement of forest carbon stocks. Two examples are REDD+ projects in Cambodia and Brazil. In the Oddar Meanchey community in Cambodia, thirteen community groups manage the forest land to reduce deforestation. This region has higher rates of deforestation than anywhere else in Cambodia. The Acre Amazonian Rainforest Conservation project protects 35,000 hectares of Amazonian rainforest in Brazil. Through the project, long-term squatters were granted land ownership. Both of these projects address root causes of deforestation through educational and community empowerment efforts.

Renewable energy projects are available, and potentially of particular interest in countries with high energy demands. Two examples are VCS wind farm projects available in Inner Mongolia, China and Karnataka State, India. In addition to improving air quality and generating clean energy, both of these projects provide permanent jobs for local residents. Many other global energy projects – for wind, or other types of renewable energy such as solar, geothermal, and biomass – are also available.

Clean cook stove projects are available in a number of developing countries. One project pairs efficient cook stoves with low-energy water filtration systems in Guatemala. "Eko-stoves" burn wood more efficiently, and improve indoor air quality. Gravity-powered water filters eliminate 99% of pathogens without needing to boil the water. Both of these devices improve energy efficiency and human health. An efficient cook stove project in India generates "fair traded credits;" these ensure that participating households and individuals receive

an income for using the new cook stove. Similar to the project in Guatemala, these cook stoves burn wood fuel more efficiently, reducing both the demand on limited energy resources and greenhouse gas emissions, and improving air quality. The project also helps women in participating households, as they usually bear responsibility for searching for fuel wood and cooking family meals. Less time spent bringing fuel wood into the home and cleaner burning stoves mean more time and healthier home environments for women.

A unique project that combines the health benefits of cleaner burning cook stoves and sustainable agriculture can be found in the Ghimbi area of Ethiopia. Coffee farming is common in the region, and these farmers' livelihoods are threatened by deforestation. Cook stoves requiring less wood help the participating coffee farmer families – approximately 30,000 households – in two ways. They provide a healthier, cleaner home environment, and they maintain the quality of arable land by reducing deforestation.

Selected Examples of Global Carbon Offset Projects Currently Available

Project Name	Offset Seller	Verification Standard	Offset Cost ($/MT-$CO_2$e)
Wind Power/ Renewable Energy	The Carbon Neutral Company	Verified Carbon Standard	$2-$13
Cook Stove and Water Filtration in Guatemala	The Carbon Neutral Company	Gold Standard	$2-$13
Improved Cook Stoves in Rural India	Fair Climate Fund	Gold Standard	$21
Oddar Meanchey Community REDD+	The Carbon Neutral Company	Verified Carbon Standard and Climate Community & Biodiversity Standard	$2-$13
Acre Amazonian Rainforest Conservation REDD+	The Carbon Neutral Company	Verified Carbon Standard and Climate Community & Biodiversity Standard	$2-$13
Coffee Farming and Cook Stoves in Ethiopia	Fair Climate Fund	Gold Standard	$17

RECOMMENDATIONS

The Carbon Offset Work Group recommends the university take the following actions:

Recommendation 1: Focus on Direct Emissions Reductions before Offsets

The Carbon Offset Work Group believes that the first priority for carbon emissions mitigation and reduction should always be on-campus projects that will impact the university's direct emissions. The Office of Sustainability, Department of Engineering and Energy, and partners should continue to find the most cost-effective solutions for reducing direct emissions and keeping the university on track for meeting its Climate Action Plan goals. However, the Work Group also recognizes that sometimes those direct-emissions-reduction projects will not be cost-effective or will not be implemented in the time and quantity required to keep the university on target for meeting CAP goals. In these cases, carbon offset projects are a good way to help the university meet its goals while supporting or developing environmental projects in Maryland or other communities around the world.

Recommendation 2: Create a Greenhouse Gas Reduction Fund for On-Campus and Offset Projects

The objective of the Greenhouse Gas Reduction Fund would be to find the most cost-effective solutions for reducing the university's carbon footprint and keeping the university on track for meeting its Climate Action Plan goals. The Fund would prioritize projects that directly reduce the university's carbon footprint, such as energy conservation, renewable energy development, carbon sequestration, and alternative transportation. The Fund may also pay for carbon offsets if the net present value of an offset project is more favorable than the net present value of a direct reduction project. If Fund monies are used to purchase or develop carbon offset projects, then the UMD Carbon Offset Program would invest Fund monies according to the guidelines specified in this report (see Recommendation 3).

Process

1. Revenue would come to the Greenhouse Gas Reduction Fund from various sources (specified in the Financials section of this report) and would be managed by a Greenhouse Gas Reduction Fund Committee consisting of staff members from the Office of Sustainability and Department of Engineering and Energy as well as a student representative nominated through the SGA. The Vice President for Administration and Finance would give final approval for funding projects recommended by the Greenhouse Gas Reduction Fund Committee.
2. Greenhouse Gas Reduction Fund monies would first be used for any projects that directly reduce the university's carbon footprint and have a net present value (NPV calculated as dollars per metric ton of carbon dioxide equivalent) equal to or less than the NPV of the Carbon Offset Program portfolio. Direct emission reduction projects would be evaluated annually by the Department of Engineering and Energy, Office of Sustainability, and campus community through the Sustainability Fund proposal process.
3. If monies remain in the Greenhouse Gas Reduction Fund after all direct emission reduction projects are funded, then monies would carry forward to the next year unless additional carbon offsets are needed to meet Climate Action Plan targets in the current year.

Recommendation 3: Create a Carbon Offset Program

The university will likely need to utilize carbon offsets to meet its CAP goals and continue its leadership as a national model for a green university. A Carbon Offset Program would seek carbon offset projects that align with the university's mission, especially addressing these core objectives:

- Service to the State of Maryland
- Strengthening Global Partnerships
- Developing Innovation and Entrepreneurship Opportunities
- Creating New Education and Research Experiences

As such, the Carbon Offset Program would operate according to these guidelines, listed in order of priority:

- **Priority 1:** Develop new carbon offset projects or purchase carbon offsets from existing projects in Maryland, especially in communities close to campus so that it is easy for students and faculty to participate in the projects. Reach out to business owners, farmers, municipal governments, and government agencies to offer technical assistance for creating new offset projects and discuss options for transferring offset credits to the university in exchange for that technical assistance.
- **Priority 2:** Develop or purchase carbon offsets outside of Maryland but in the Chesapeake Bay watershed if not enough Maryland-based projects exist to meet the university's demand for offsets in a given year. Prioritize projects that have co-benefits including job creation, habitat preservation, Chesapeake Bay cleanup efforts, promotion of environmental justice, etc.
- **Priority 3:** Develop or purchase carbon offsets in developing nations, especially those nations that are most impacted by climate change and where the university has interest in strengthening its relationships. When possible, seek projects where there already exist or there is the potential to create new Education Abroad opportunities for UMD students and/or new research collaborations for UMD faculty. Try to use carbon offsets from these international projects to offset emissions associated with Education Abroad air travel.
- **Priority 4:** Develop or purchase carbon offsets in states represented by the Big Ten Conference institutions. Focus on states that do not have policies to encourage the development of renewable energy or other environmental initiatives. Try to use carbon offsets from these domestic projects to offset emissions associated with Intercollegiate Athletic air travel.
- **Priority 5:** For all carbon offset activities, seek the most cost-effective solutions to decreasing the university's carbon footprint while meeting the above objectives.

Each year, the university should review the available options for carbon offset purchases. Yearly evaluations will allow the university to adhere to the guidelines above, while still allowing for flexibility to find the most cost-effective solutions to meeting CAP goals.

Recommendation 4: Offset Air Travel Emissions

Air travel emissions are what the carbon accounting industry calls “unavoidable.” There is general industry agreement that carbon offsetting is a good strategy for reducing this category of environmental impacts. Consequently, the Carbon Offset Work Group recommends the university focus its carbon offset strategy on eliminating 100% of air travel emissions or at least enough air travel emissions to keep the university on track for meeting future CAP goals. Offsets for air travel could be implemented on a voluntary basis between 2016 and 2019 for business, athletic, and Education Abroad air travel but become mandatory for all air travel starting in calendar year 2020.

Although it is sometimes considered a best practice to align types of offsets with sources of emissions (such as offsetting commuting emissions with investments in public transit projects), there are essentially no offsets currently available that aim to reduce emissions from the airline industry. Instead, the university should offset air travel emissions using other types of low-cost offsets that support the objectives of the Carbon Offset Program. Specifically, business air travel could be offset from Maryland or Chesapeake Bay watershed based projects, Education Abroad air travel could be offset from international/Global Partnership projects, and athletic air travel could be offset from projects located in other Big Ten states.

Recommendation 5: Give Commuters the Option to Offset their Emissions

The Carbon Offset Work Group does not recommend targeting commuting emissions with mandatory carbon offsets at this time. However, the Work Group recognizes that some members of the UMD community may want to help the university meet its carbon reduction goals by choosing to offset the carbon emissions associated with their personal commutes. Also, if carbon offsets for personal commutes were purchased through the bulk-purchasing power of the UMD Carbon Offset Program, then offsets could be made available to individuals at a lower price than if individuals were to purchase offsets on their own. For these reasons, the Work Group recommends that the Department of Transportation Services make it optional for students, faculty, and staff to offset their commuting emissions when registering for parking permits. The university could use revenue generated through this voluntary program to purchase or develop carbon offset projects that reduce emissions from the transportation sector, ideally in Maryland. These projects could include developing electric vehicle support infrastructure, switching from high-carbon to low-carbon fuels in the transport industry, or developing public transit systems like the Purple Line.

Recommendation 6: Find Innovative Ways to Develop and Support Local Offset Projects

Reflecting its Land Grant Mission, the university should find strategies for helping Maryland business owners, farmers, and government leaders develop environmental projects that reduce greenhouse gas emissions in the state. The university should explore the possibility of self-funding research that leads to the verification of carbon offset projects in exchange for carbon offsets from the project it helped launch. It could do this by entering an agreement with a local business, government, or a non-governmental organization to share the cost of verifying, validating, and registering a carbon offset project. Once the project is registered, the project developer would donate carbon offsets back to the university at the market price until the university’s investment is repaid. This would act as a zero-cost loan to the project developer

and would demonstrate the university's strengths in environmental research and business development. It would also allow the university to use its money to support graduate students and faculty members who conduct relevant research, instead of putting money directly into purchasing carbon offsets.

In addition to developing new offset projects, the university should support existing offset projects in Maryland, especially projects that were developed with involvement from UMD faculty, students, or staff or that otherwise speak to core university values.

Recommendation 7: Seek Carbon Offsets that are Verified through Gold Standard or VCS and CCBS

Several organizations around the world specialize in the verification of carbon offset projects and evaluate projects based on established criteria. While developing a carbon offset program for American University, graduate students at AU, with guidance from faculty and staff, recently evaluated the quality of those organizations that set carbon offset standards and accredit verification bodies. They recommend that AU seek carbon offsets verified through **Gold Standard or Verified Carbon Standard (VCS)** plus **Climate, Community, and Biodiversity Standards (CCBS)**. According to their analysis, these standards have the following strengths:

- **Gold Standard** is the most thorough in determining the carbon savings and co-benefits (such as creating jobs for the local community, preserving habitat, cleaning water, etc.) of offset projects.
- **VCS** is also highly rated as a carbon offset standard and has a larger portfolio of verified projects than Gold Standard has but VCS only evaluates the carbon savings from projects and does not evaluate co-benefits.
- **CCBS** specializes in evaluating carbon offset projects for their co-benefits and, when used in combination with VCS, is approximately as rigorous as the Gold Standard.

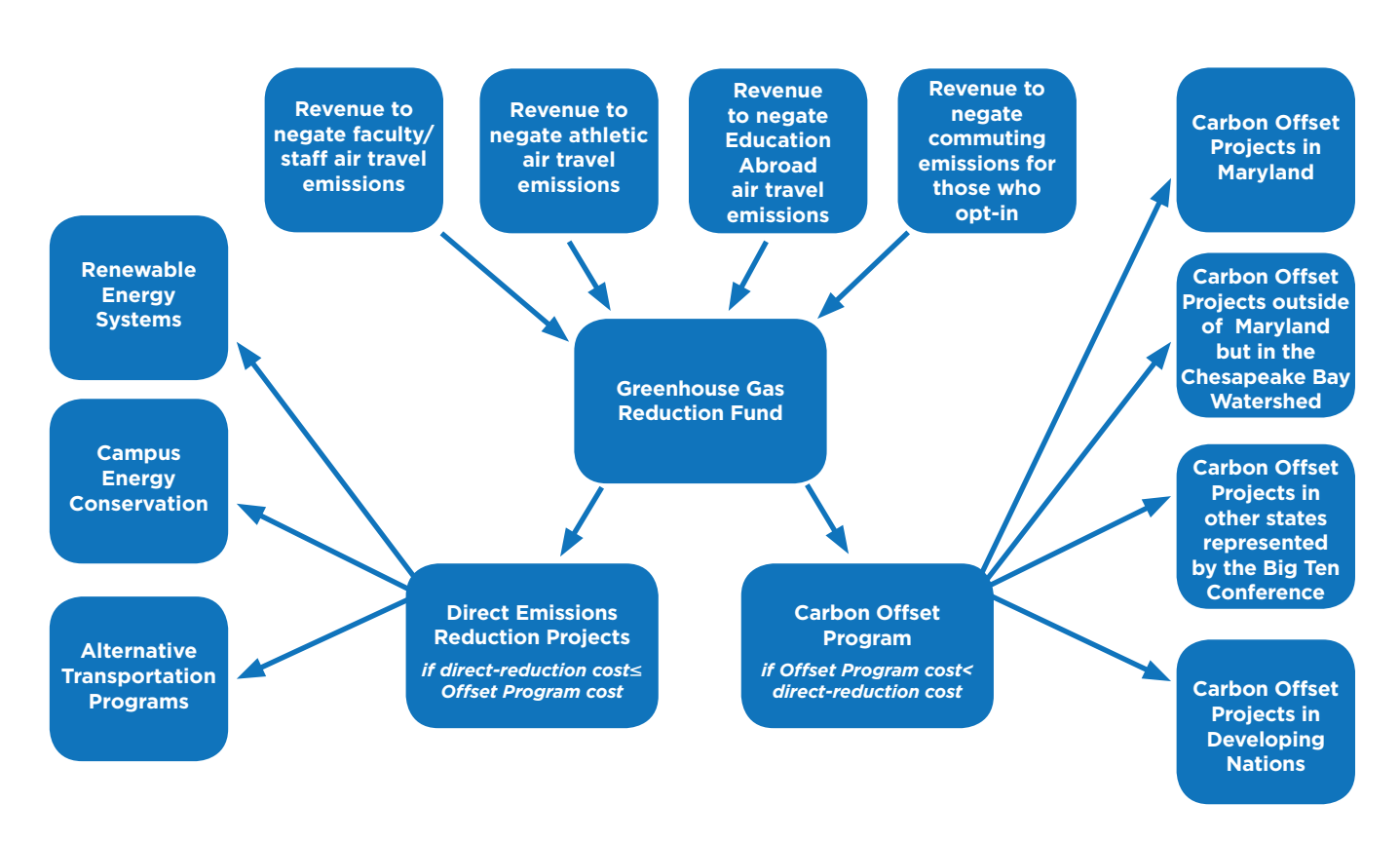
The Carbon Offset Work Group recommends the University of Maryland seek offsets that comply with these standards, especially since the co-benefits of offset projects (including supporting jobs, preserving habitat, cleaning water, etc.) support the university's mission.

Recommendation 8: Explore the Potential of Developing Offset Projects to Reduce the Carbon Intensity of Power Generation

The university plans on negating all emissions associated with electricity produced off-site (scope 2 emissions) by 2020 through the development of renewable energy projects and concurrent transfer of Renewable Energy Certificates (RECs). RECs can only be applied to scope 2 emissions, so the university cannot utilize RECs to eliminate emissions associated with on-campus power generation (scope 1 emissions). However, the university could develop renewable energy projects that create offsets instead of RECs and use those offsets to reduce emissions associated with scope 1. One such example comes from Arizona State University where they are partnering with a waste water treatment plant to capture biogas and distribute it through the regional natural gas grid. While ASU does not actually use that biogas on campus, they can claim the carbon offset benefits of the gas they helped put into the pipeline and effectively reduce the university's carbon footprint. The University of Maryland should explore similar opportunities in its region.

STRUCTURE

The following diagram illustrates the flow of money through the proposed system.



FINANCIALS
Expenses

Carbon Offset Pricing

The global average price of a voluntary carbon offset in 2014 was $3.80 according to a 2015 study by Ecosystems Marketplace.[1] The historical average price is $5.80. Offsets from projects based in developing nations tend to cost less than projects in developed nations due to the relative purchasing power of the dollar. Offsets from projects in or around Maryland have an average price of $7.14. Since the UMD Carbon Offset Program would seek a portfolio of local, domestic, and international projects, we used a blended price (50% global average price, 50% local average price) of $5.47 as a 2014 starting price for projections.

The annual rate of increase for air travel was determined using data from 2012-2014 for business travel, and from 2010-2014 for education abroad travel. The 2012-2014 business travel range was selected because it demonstrates a consistent trend of small increases in business travel each year. Additionally, the recent years better reflect the current budget climate and business travel goals. The longer 2010-2014 education abroad travel range was selected because there is more annual fluctuation in study abroad, students generally stay on campus for four years, and a longer time frame is a better predictor of the long term trends in this case. Once annual rates of increase were calculated for each sector in the above time ranges, the two numbers were weighted (63% business travel and 29% study abroad travel, based on their relative percentages of the 2014 air travel total) and summed. Athletics air travel is projected to remain the same; however, the 2014 emissions number is slightly lower than the eventual, constant emissions number. 2014 data reflect one semester in the ACC and one semester in the Big 10; joining the Big 10 led to increased air travel, so a full calendar year in the Big 10 will probably have higher air travel emissions than 2014. However, that number should remain consistent, since athletics travel needs don't vary from year to year. Therefore, business and education abroad air travel is projected to increase 2.79% annually, and athletics air travel is projected to be relatively constant.

Assuming the price of offsets could increase 5% per year, then the price per offset in 2020 could be $7.33. Assuming air travel emissions increase on average 2.79% per year, then the university's air travel footprint in 2020 could be 57,583 MT-CO_2e. In that case, it would cost $422,105 to eliminate all emissions associated with university air travel in 2020. The share per sector of air travel is as follows:

Faculty/Staff Air Travel – 36,822 MT-CO_2e x $7.33 = $269,919

Education Abroad Air Travel – 17,403 MT-CO_2e x $7.33 = $127,567

Athletic Air Travel – 3,359 MT-CO_2e x $7.33 = $24,620

Tables in the appendix show a breakdown of annual costs (2014-2025) per sector assuming each sector eliminates 100% of air travel emissions by purchasing offsets.

All of these numbers are projected to the best knowledge and estimates available at the time of writing the report. Carbon offset prices could change depending on the future of the carbon market or future regulation. Currently, the market is voluntary; mandated carbon offset programs would influence the price. As carbon offsets become more common, the prices may decrease. Similarly, the air travel emissions were calculated using emissions factors provided by the federal government, as of 2015. The federal emissions factors typically remain the same for several years, but between 2015 and 2025, the number may change, effecting the CO_2e emissions numbers. Finally, the air travel industry may make strides and become more efficient. The Federal Aviation Administration has a goal of improving air travel efficiency by 1.5% each year. This too would impact emissions numbers, likely lowering the projected emissions outlined below.

[1]http://forest-trends.org/releases/uploads/SOVCM2015_FullReport.pdf

Direct Emission Reduction Pricing

Since the Greenhouse Gas Reduction Fund would first use monies to develop direct-emission-reduction projects on campus that are more cost effective than carbon offsets, the university's actual price per MT-CO_2e of reduction would be lower than the price of offsets. Some direct-emission-reduction projects could even provide financial return on investment, especially energy conservation/efficiency projects or renewable energy projects that have lower operating costs than fossil fuel alternatives. However, if these sort of projects are not available in the time and scale needed to meet Climate Action Plan goals, then the university may choose to develop or purchase carbon offsets. For these reasons, the carbon offset price is a reasonable but conservative estimate used for cost projections in this report.

Administrative Costs

Labor associated with implementing the recommendations of this report range from minimal (work can be absorbed by current staffing) to costly (additional staffing could be needed) depending on methodologies for collecting revenue and paying for projects.

Revenue Collection Costs – In general, administrative costs are minimal when revenue comes from central funds instead of departments or individual travelers.

Low Cost (no new FTE) ⟵ ⟶ **High Cost (0.5 FTE)**

- Revenue from Central Funds to offset all air travel
- Revenue from Divisions to offset faculty/staff travel
- Revenue from donors to offset Education Abroad travel
- Revenue from ICA to offset athletic air travel
- Revenue from commuters who choose to offset emissions
- Revenue from Departments to offset faculty/staff travel
- Revenue from individual students who study abroad
- Revenue from ICA programs to offset team travel

In the low-cost scenario, Office of Sustainability staff would calculate the total annual cost of reducing greenhouse gas emissions associated with university air travel and then collect that revenue from central funds. This would take a few hours and could be accomplished with existing staffing. In the middle-cost scenario, Office of Sustainability and Business Services staff would need to organize air travel data by Division, bill and collect revenue from each Division and ICA, and Education Abroad staff would need to find a donor. This would take approximately 0.25 FTE combined, which may require contract labor ($15,000 annually). In the high-cost scenario, Office of Sustainability and Business Services staff would need to organize air travel data by Department and ICA team, bill and collect revenue from each Department and ICA, and Education Abroad staff would need to create and manage a system for collecting revenue from individual travelers. This would take approximately 0.5 FTE combined, which would require contract labor ($30,000 annually).

Project Selection Costs – Selecting direct-emissions-reduction projects that are on-campus or purchasing carbon offsets from existing projects would have lower labor costs than developing new carbon offset projects beyond the campus.

Low Cost (no new FTE) ⟵ ⟶ **High Cost (0.5-1 FTE)**

- Selecting on-campus projects
- Purchasing carbon offsets from existing projects
- Developing new on-campus projects
- Finding ways for students and faculty to get involved with existing carbon offset projects
- Developing new carbon offset projects in Maryland, in the Chesapeake Bay watershed, and in developing nations through faculty, student, and staff involvement

Financials continued

In the low-cost scenario, Office of Sustainability (OS) and Department of Engineering and Energy (E&E) staff and SGA representatives would determine the net-present value of on-campus projects, compare with the price of carbon offsets, and decide annually how to use Greenhouse Gas Reduction Fund monies. This would be accomplished with existing staffing. In the middle-cost scenario, OS and E&E staff would have to find new on-campus projects to implement and work with campus partners to expand opportunities for faculty and students to engage with existing carbon offset projects. This would be accomplished with existing staffing but it would add significant workload on current staff. In the high-cost scenario, OS staff would work with faculty, local business owners, government leaders, and/or international organizations to develop new carbon offset projects around the world. This would take 0.5-1.0 FTE.

Revenue

After meeting with representatives from Education Abroad, Athletics, and Business Services, the work group has come up with multiple options for funding a carbon offsets program.

Business air travel offsets could be paid by departments, based on how much employees in the office travel, or centrally by Divisional or Campus funds. Business Services directors strongly encouraged using central funds for these expenses to avoid administrative costs, equity issues between departments, and limitations on using federal research grants to pay for offsets. Whichever option is selected, considerations should be made to ensure that offices with very little travel are not paying as much as offices with extensive travel, and to the fact that some departments have less funding which they could use to pay for offsets. Federal research grant money might not be eligible for paying for carbon offsets, which would make it difficult for departments to pay for offsetting travel for research activities.

Education Abroad offsets could be paid by individual student travelers to offset their own trips, in total by a donor, or in partnership with the partner travel agencies. If the individual student traveler option is selected, an effort should be made to find a fund that will provide small, need-based scholarships to pay the offsets for students who are studying abroad. One possible source of this money could be the University Sustainability Fund. Alternately, students could work a number of community service hours in exchange for their offset cost. Education Abroad is also interested in working with faculty to create short-term (winter or summer) study abroad trips that work in or focus on specific offset projects. The Office of Sustainability would assist faculty in developing these programs.

Athletics directors would prefer for air travel offsets to be paid using central or campus funds but can find a way to fund offset costs internally if need be. As a department, Athletics is most interested in investing in campus infrastructure projects to reduce emissions or in an offset project that has visible campus impacts.

Again, tables in the appendix show a breakdown of annual costs (2014-2025) per sector assuming each sector eliminates 100% of air travel emissions by purchasing offsets.

CONCLUSION

The Carbon Offsets Work Group encourages the university to build a robust and impactful carbon offsets portfolio that demonstrates UMD's commitment to innovation and service while emphasizing fiscal responsibility and thoughtful planning to meet CAP goals. In order to balance both of these values, a diverse set of project opportunities will need to be curated by the Office of Sustainability, the Department of Energy & Engineering, and their campus partners. By exploring all the options and building relationships to make them feasible, the university can be nimble in its approach to offsetting unavoidable carbon emissions and help to lead the way for other institutions in our region.

APPENDIX

Business Services

	Offset Cost	Cost per Mile		Average Cost per Trip*	
	Total	Domestic	International	Domestic	International
2014	$170,762	$0.0072	$0.0059	$17.85	$44.37
2015	$187,805	$0.0077	$0.0063	$19.10	$47.47
2016	$198,917	$0.0079	$0.0065	$19.68	$48.91
2017	$214,691	$0.0083	$0.0068	$20.67	$51.36
2018	$231,714	$0.0088	$0.0071	$21.70	$53.93
2019	$250,088	$0.0092	$0.0075	$22.79	$56.62
2020	$269,919	$0.0097	$0.0079	$23.92	$59.45
2021	$291,322	$0.0101	$0.0082	$25.12	$62.43
2022	$314,423	$0.0107	$0.0087	$26.38	$65.55
2023	$339,355	$0.0112	$0.0091	$27.70	$68.83
2024	$366,264	$0.0117	$0.0095	$29.08	$72.27
2025	$395,307	$0.0123	$0.0100	$30.53	$75.88

**Using cost per mile and average miles per trip, which stays constant at 2,476 miles per domestic trip and 7,570 miles per international trip. Remains constant because assuming same rate of increase for number of trips and miles flown.*

Education Abroad

Price per Student							
	Asia	Africa	Australia	South America	North America	Europe	Total Offset Cost
2014	$56.26	$42.86	$71.90	$31.09	$15.65	$31.60	$80,704
2015	$59.08	$45.00	$75.50	$32.64	$16.44	$33.19	$87,104
2016	$62.03	$47.25	$79.27	$34.28	$17.26	$34.84	$94,011
2017	$65.13	$49.61	$83.23	$35.99	$18.12	$36.59	$101,465
2018	$68.39	$52.09	$87.40	$37.79	$19.03	$38.42	$109,511
2019	$71.81	$54.70	$91.77	$39.68	$19.98	$40.34	$118,195
2020	$75.40	$57.43	$96.35	$41.66	$20.98	$42.35	$127,567
2021	$79.17	$60.30	$101.17	$43.75	$22.02	$44.47	$137,682
2022	$83.13	$63.32	$106.23	$45.93	$23.13	$46.69	$148,600
2023	$87.28	$66.48	$111.54	$48.23	$24.28	$49.03	$160,383
2024	$91.65	$69.81	$117.12	$50.64	$25.50	$51.48	$173,101
2025	$96.23	$73.30	$122.97	$53.17	$26.77	$54.06	$186,827
	35.14%	6.58%	13.45%	8.01%	1.92%	34.89%	
Share of Offset Cost (by miles traveled)							

Athletics

	Trips	Offset Cost	Average Cost per Trip
2014	4,946	$18,372	$3.71
2015	4,946	$19,290	$3.90
2016	4,946	$20,255	$4.10
2017	4,946	$21,267	$4.30
2018	4,946	$22,331	$4.51
2019	4,946	$23,447	$4.74
2020	4,946	$24,620	$4.98
2021	4,946	$25,851	$5.23
2022	4,946	$27,143	$5.49
2023	4,946	$28,500	$5.76
2024	4,946	$29,925	$6.05
2025	4,946	$31,422	$6.35

Appendix continued

Sector Emissions, Trips, and Offset Costs

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Offset Price (per MT CO_2e)	$5.47	$5.74	$6.03	$6.33	$6.65	$6.98	$7.33	$7.70	$8.08	$8.49	$8.91	$9.36
Education Abroad												
Emissions (MT-CO_2e)	14,754	15,166	15,589	16,024	16,471	16,930	17,403	17,888	18,387	18,900	19,428	19,970
Total Offset Cost	$80,704	$87,103	$94,010	$101,465	$109,511	$118,194	$127,566	$137,682	$148,599	$160,383	$173,100	$186,827
Number of Trips	1,977	2,032	2,089	2,147	2,207	2,269	2,332	2,397	2,464	2,533	2,603	2,676
Average Offset Cost per Trip	$40.82	$42.86	$45.01	$47.26	$49.62	$52.10	$54.70	$57.44	$60.31	$63.33	$66.49	$69.82
Athletics												
Emissions (MT-CO_2e)	3,359	3,359	3,359	3,359	3,359	3,359	3,359	3,359	3,359	3,359	3,359	3,359
Total Offset Cost	$18,371	$19,290	$20,254	$21,267	$22,331	$23,447	$24,620	$25,851	$27,143	$28,500	$29,925	$31,422
Number of Trips	4,946	4,946	4,946	4,946	4,946	4,946	4,946	4,946	4,946	4,946	4,946	4,946
Average Offset Cost per Trip	$3.71	$3.90	$4.10	$4.30	$4.51	$4.74	$4.98	$5.23	$5.49	$5.76	$6.05	$6.35
Business												
Emissions (MT-CO_2e)	31,218	32,089	32,984	33,905	34,850	35,823	36,822	37,850	38,906	39,991	41,107	42,254
Total Offset Cost	$170,762	$184,303	$198,917	$214,691	$231,714	$250,088	$269,919	$291,322	$314,423	$339,355	$366,264	$395,307
Number of Trips	13,414	13,788	14,173	14,568	14,975	15,393	15,822	16,264	16,717	17,184	17,663	18,156
Average Offset Cost per Trip	$12.73	$13.37	$14.04	$14.74	$15.47	$16.25	$17.06	$17.91	$18.81	$19.75	$20.74	$21.77


VILNIUS
WARSAW
MOSCOW

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