GEORGE MASON UNIVERSITY

CLIMATE ACTION PLAN
JANUARY 2010 – DECEMBER 2011

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Table of Contents

Executive Summary

President Alan Merten set George Mason University on a path to climate neutrality – net zero greenhouse gas emissions – by signing the American College and University Presidents Climate Commitment in July 2007. Since that time, progress has taken the form of policies that encourage emissions reduction, such as Mason's commitment to green building and the expansion and encouragement of alternative transportation methods. Mason's first Greenhouse Gas Inventory was completed in September 2008 and updated in December 2009. [i] This Climate Action Plan completes Mason's first cycle to measure the progression of the university's greenhouse gas emissions and to chart the path to climate neutrality beginning with the 2010-2011 cycle.

Mason's average metric tons of carbon dioxide equivalent (MTCDE) emissions for fiscal years 2006 through 2009 were approximately 106,000 per year. In year 2006, energy intensity metrics of MTCDE per full-time equivalent student and per 1,000 gross square feet emitted were 4.51 and 18.32, respectively. [ii] Emissions *increased* roughly 1.8% over this period. Based on planned construction and projected student increases, "business as usual" emissions projections forecast about 130,000 metric tons by the year 2014, or an increase of almost 25%. To slow that progression and move toward climate neutrality, the following goals are set:

- 2012: reduce *net greenhouse gas emissions* to 2006 levels
- 2014: maintain *net greenhouse gas emissions* at 2006 levels; decrease *energy intensity* metrics by 10% from 2006 baseline, or about 2% per year starting in 2010
- 2020: 50% reduction in *energy intensity* metrics from 2006 baseline; 20% reduction in *net greenhouse gas emissions*
- 2050: 80% reduction in *net greenhouse gas emissions* from 2006 baseline

To meet these emissions reduction targets, the Office of Sustainability and the Core Planning Committee (CPC) of the Climate Action Planning Team recommend an approach that combines the creation of a solid foundation to manage ongoing climate planning efforts, with a set of specific policies, projects, and research in nine over-arching categories:

1. Develop Efficiency Strategies
2. Update Design Information Manual for Increased Efficiency and Sustainability of Buildings
3. Develop Renewable Energy Generation Strategies
4. Develop Transportation Emissions Reduction Strategies
5. Develop Waste Minimization and Recycling Strategy
6. Develop a Sustainability and Climate Communications and Education Strategy/Enhance Community Interaction
7. Develop Strategies for Dedicated Climate Action and Sustainability Funding
8. Integrate Climate and Sustainability Goals in to Master Planning Process
9. Develop Offset Strategies

[i] Data from the December 2009 inventory are used for this document, although not yet published.

[ii] Overall emissions are frequently translated in to industry benchmark numbers of emissions per 1,000 gross square feet of built space and emissions per full-time equivalent student. These are known as *energy intensity* metrics.

To support the ongoing tracking, management, and measurement of climate activities, the CPC recommends that several critical foundational elements be established, including an Environmental Management and Sustainability System, a full-time Climate Initiatives Coordinator position, and an annually-renewed research assistantship and internship fund.

There is much already in progress to improve Mason's operational efficiency, including projects in the Energy Management Office and the Information Technology Unit. Policies, quantifiable projects, and research presented in this Plan represent both initiatives already underway but not completed, and new initiatives geared toward expected completion within this biennial cycle. All initiatives have been reviewed and approved by the administration, and are detailed in Appendix 1.

With the support of the administration, Mason's Office of Sustainability will work iteratively to ensure that the Climate Action Plan evolves along with technology, federal and state regulation and legislation, and the Mason community culture. Targets will remain flexible yet as aggressive as possible to secure and retain the university's leadership status in carbon reduction efforts. In these financially lean years, it is essential that all new recurring program funding requested must go through the same budget approval process as all other programs at the university. In addition, projects requiring capital financing require a separate review and approval process with the Commonwealth of Virginia, and must show a favorable return on investment, regardless of the positive impact on emissions reduction. As such, all emissions goals will be contingent on available funding and authorization.

Acknowledgements

Thanks to the Mason Community!

The Office of Sustainability and the Climate Action Plan Core Planning Committee would like to thank the following groups and individuals for assistance with the construction of our first Climate Action Plan (For a detailed list of names in each group, please see **Appendix A**):

First and foremost–

> Dr. Alan Merten, President of George Mason University, for his sponsorship and leadership in committing the university toward climate neutrality with his signature participation in the ACUPCC.

And to all the members of these groups–

> Mason's Executive Steering Committee for Sustainability, who provided oversight, review, and direction for the CPC and the CAP approach.
>
> Mason's first Climate Action Team, who provided research, coordination, and documentation for all of the proposed solutions.
>
> The spring 2008 Climate Change Communications Campaigns graduate class (led by Dr. Ed Maibach), who provided a critical start for our Mason climate communications strategy.
>
> Mason's subject matter experts and process owners, for providing their expertise about university processes, technology, and people, and their review of all proposed projects to provide a critical reality check for various climate action recommendations.

Completing the first iteration of a long-term strategy and developing projects to meet that strategy has been, and will continue to be, a substantial team effort. Without the help of our many Mason colleagues, this would not have been possible.

1 Introduction

George Mason University is rapidly evolving from its roots as a Northern Virginia regional college into a nationally recognized leader, now globally ranked among the top 200 world universities.[iii] Today, more than 32,000 Mason students hail from all 50 states, the District of Columbia, and almost 130 nations. More than 5,000 faculty and staff join them in over 135 buildings on 806 acres, spread across three campuses and a variety of instructional and research sites. Mason's community, educational, research, and ecological impacts are sizable and consistently growing.

In July 2007, George Mason University President Alan Merten signed the American College and University Presidents Climate Commitment (ACUPCC), committing the university to becoming climate neutral. The signing of the ACUPCC prompted the creation of an Office of Sustainability (OoS) in August 2007, and the hiring of Mason's first University Sustainability Manager, who began the process of planning for the creation of the university's first greenhouse gas inventory (GHGI). After the completion of the GHGI in September of 2008, the OoS promptly began development of a climate action plan.

Given its proximity to Washington, D.C., and position as an emerging premier university in Virginia, Mason has a superb opportunity to demonstrate to a local community of national policy-makers how a university can simultaneously thrive academically and economically, while becoming a model for climate neutrality. Through Mason's own academic programs, as well as its involvement with local, state, regional, and national organizations and governments, a wealth of regional and national experts can be leveraged to define and implement greenhouse gas emissions-reducing projects.

This Climate Action Plan (CAP) report presents Mason's first set of emissions reductions solutions, prefaced with a summary of the processes and structure used for their development. The report begins with an overview of the university's first greenhouse gas inventory then elaborates upon several departmental initiatives that have driven much of Mason's recent resource efficiency improvements. After providing emissions projections for business-as-usual, and goals for reducing emissions over time, the bulk of the CAP elaborates on upon an initial set of proposed solutions and presents their expected emissions reduction and cost profiles, where feasible.

2

[iii] Mason Gazette: "Mason Tops U.S. News List of Schools to Watch," April 2008. http://gazette.gmu.edu/articles/12396

Greenhouse Gas Inventory Overview

Mason's Office of Sustainability completed the university's first greenhouse gas inventory (GHGI) in 2008 using the Clean Air-Cool Planet Campus Carbon Calculator (CA-CP CCC) (version 6)[iv] and the assistance of several hard-working research assistants.[v] Based on World Resources Institute (WRI) GHG Protocol,[vi] the CA-CP CCC calculates emissions based on data from many sources within the university. The GHG Protocol categorizes emissions by scope:

Scope 1: *Direct emissions or those from sources owned or controlled by the institution and directly related to the operation of the campus.* For colleges and universities, scope 1 is primarily composed of fossil fuel combustion for heating, cooling, and other power generation. However, it also includes fertilizer, campus vehicle fleets, refrigerant releases and research livestock.

Scope 2: *Indirect emissions from the generation of power or other end-use utilities imported to the institution.* If a college or university purchases electricity, steam, hot water, or chilled water, the emissions that were created during its generation and distribution fall under scope 2.

Scope 3: *Other indirect emissions that are the result of the institution's activities but not owned or controlled by the institution.* The list of possible scope 3 emissions could go on for some length, however the primary sources of scope 3 emissions are commuting, directly financed air travel, other air travel, waste disposal, paper consumption, and wastewater processing.

2.1 Fiscal Year 2009 Greenhouse Gas Inventory Highlights

In September 2009, Mason contracted with consultant Sightlines[vii] to verify data previously collected and reported upon, and to update the GHGI with fiscal years 2008 and 2009.

Presented by scope in Figure 1, George Mason University generated a total of 105,636 metric tons of carbon dioxide equivalent (MTCDE) of greenhouse gas emissions in FY2009. Overall this was lower than the previous two years (107,611 and 107,656), but slightly higher than emissions in 2006 (103,753).

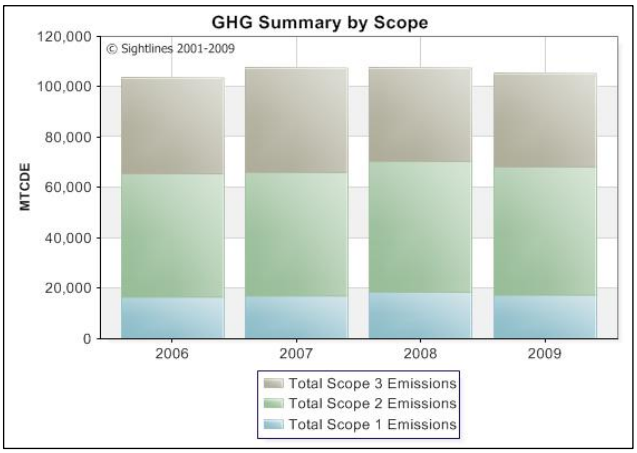


Figure 1: GHG Emissions by Scope

[iv] The tool can be downloaded here: http://www.cleanair-coolplanet.org/toolkit/content/view/43/124/

[v] To read Mason's entire public 2007 GHGI, see: http://acupcc.aashe.org/ghg-report.php?id=94

[vi] http://www.ghgprotocol.org/

[vii] Content and charts provided in the GHGI Overview section are from the Draft GHGI Report currently in process by Sightlines, LLC.

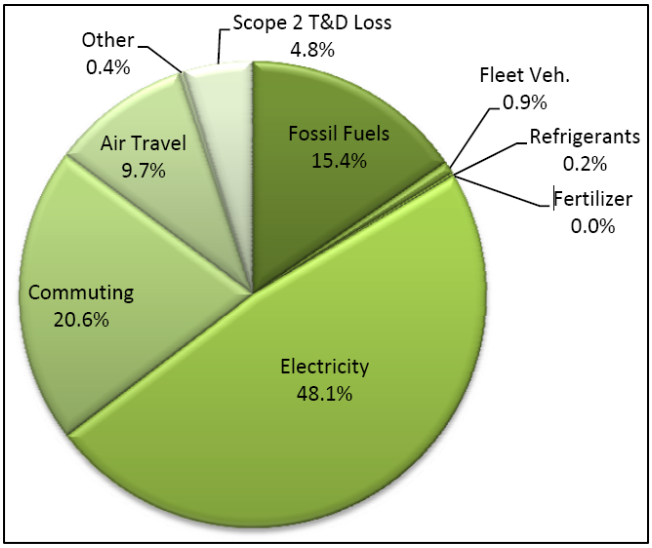


Figure 2: Major GHG Emission Sources

As illustrated by Figure 2, almost half of these emissions (48%) resulted from purchased electricity, which includes chilled water production for cooling buildings. This is not uncommon in a region where electricity production is largely the result of coal power plants. Other large sources of emissions are daily commuting at 21% and on-campus stationary fossil fuel consumption at 15%. Air travel, transmission, and distribution (T&D) losses account for roughly 10% and 5%, of emissions, respectively. There are no other sources of emissions greater than 1% of the total.[viii]

During the years studied, the university saw a roughly 10% increase in square footage and a 4% increase in students, while net emissions increased by less than 2% from 2006 to 2009.

There are two benchmarks that are widely used within higher education in the realm of GHG emissions management to enable peer-to-peer comparison: emissions per 1,000 gross square feet and emissions per FTE student. These benchmarks are known as "energy intensity" benchmarks. Examining emissions from a per-square-foot perspective provides a view of operational performance – how efficiently Mason provides heating, cooling, and electricity to run campus buildings. Examining emissions-per-student incorporates the concept of efficiency of space utilization and allocation. Both show declines since fiscal year 2007. Figures 3 and 4 provide a graphical representation of these trends.

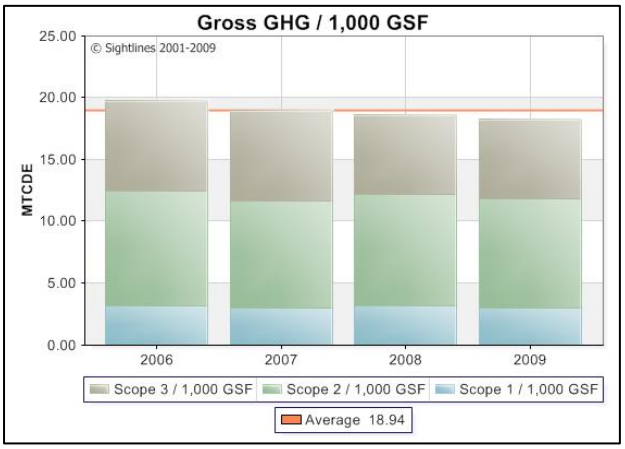


Figure 3: GHG per 1000 Gross Square Feet

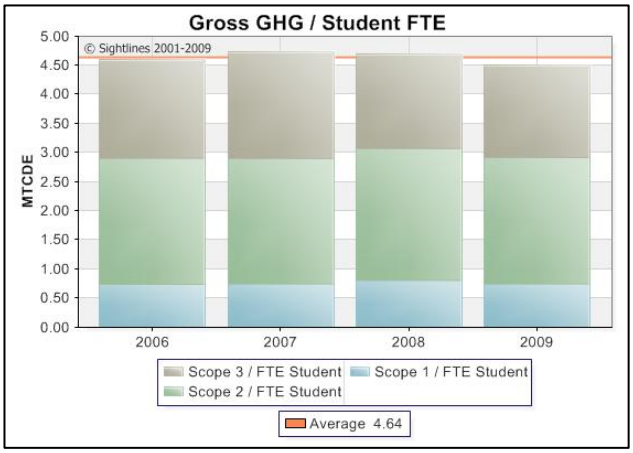


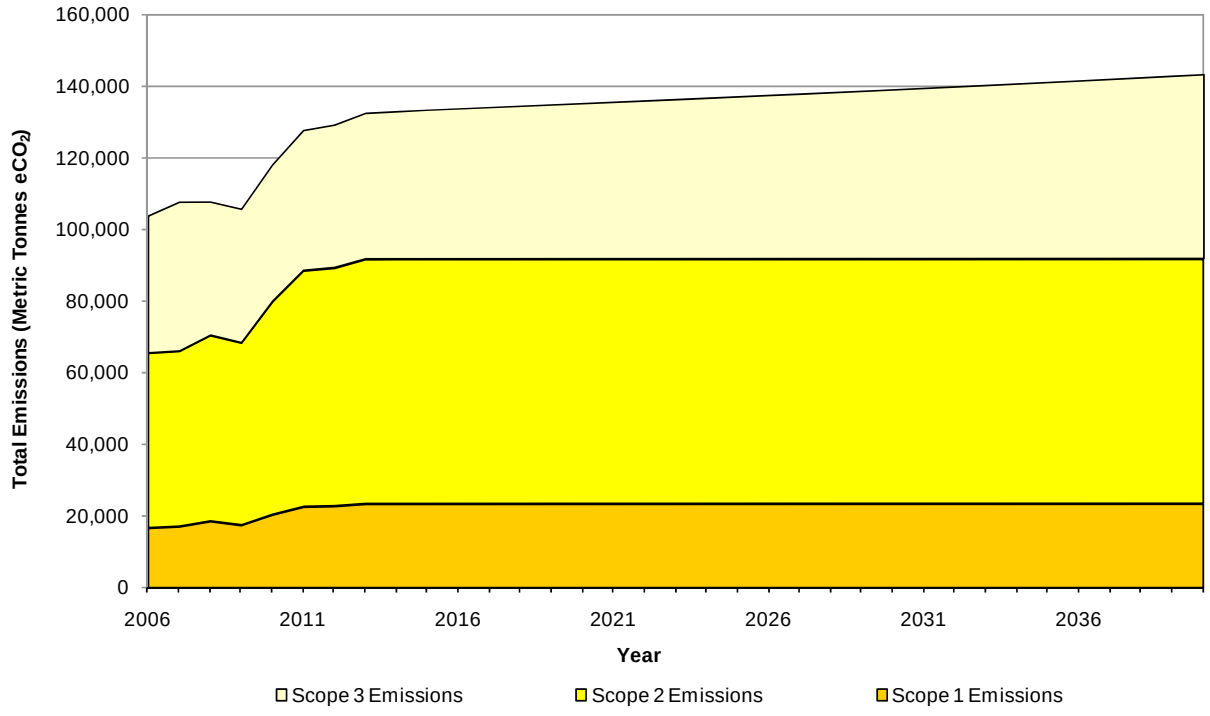
Figure 4: GHG per Student FTE

[viii] The category marked "other" includes minute emission sources including waste removal, wastewater processing, and paper purchases.

All of these positive trends may be attributed to a variety of factors, including the possibility of weather variability, but aggressive efficiency measures taken by the university have unquestionably played a feature role. Specific efficiency improvement actions taken by the Energy Management Office, the Information Technology Unit, and by the Associate Provost for Distance Education are described in further detail in section 3.1.

2.2 Projected Emissions

Mason has been able to keep its emissions fairly flat in spite of its growth in size. However, based on the approved and budgeted construction schedule for the next 5 years, emissions are expected to rise to an overall number over 130,000 metric tons by 2014. This is a 25% increase from fiscal year 2009. Figure 5 shows the growth in emissions expected within each emission scope, assuming no further construction after 2014. Although there is some certainty that construction will continue fairly unabated after 2014, there is no data upon which to base estimates after 2014. Therefore, the trend below is likely very conservative.



3 Highlights of Efficiency Efforts Currently Underway

3.1 Energy Management Office Initiatives

As awareness of energy impacts on costs and on the environment continue to rise, Mason has been actively pursuing creative methods to reduce its energy use. Virginia Executive Orders 54 and 48 require all agencies of the Commonwealth to monitor, report, and reduce energy costs and consumption for all state-owned facilities through a comprehensive energy plan. The university chose to pursue significant energy reduction through the use of an Energy Savings Performance Contract (ESPC), and in April of 2005 awarded an ESPC. This contract included a university lighting upgrade project, university water conservation project, and an energy management installation project. The lighting upgrade project included replacing existing fluorescent lighting systems from T12 lamps with magnetic ballasts to T8 lamps with electronic ballasts. This switch generated nearly 45% in lamp and ballast wattage savings. Additionally all new lamps are fitted with T8 electronic ballasts. The water conservation project consisted of retrofitting existing plumbing fixtures with new, low-flow faucets, faucets, showerheads, and toilets. This project reduced water consumption by nearly 50% from previous levels.

The energy management system installation project established real-time energy consumption monitoring data for each building. This system was also designed to provide the Energy Management Office with remote control capabilities for heating, cooling, ventilation, and lighting. Through the increased transparency in energy consumption data, energy-saving measures such as demand management, monitoring for proper temperature and controlling set points remotely, and temperature reduction or shutdown of systems could be implemented.

Mason's Energy Management Office is continuing work on energy and water efficiency measures with its ESPC through a second contract, recently approved and funded. The second ESPC includes projects like outdoor lighting upgrades, water conservation, infrared heating in the Facilities Warehouse, Patriot Center lighting upgrades, natural gas meter consolidation, and exploration of green roof installation. The contract consists of the implementation of 22 projects reducing annual consumption of electricity by 4.83 million kWh and natural gas by 17,158 MMBTU, for a reduction in emissions of approximately 3,373 MT eCO_2 per year, equal to about 3.2% of total emissions in 2009.

In addition to the projects recommended in the Energy Savings Performance Contract, Mason's Energy Management Office is always seeking efficiency solutions. One recent example is the implementation of high temperature hot water insulation. The high temperature hot water insulation project consists of the installation of thermal blankets on exposed hot water tunnels on Mason's Fairfax Campus. These blankets save energy, retain radiant heat, and minimize insulation maintenance. The projected energy savings is approximately $800,000 (or $53,333 per year) over the next 15 years and 947,227 kWh on an annual basis, equating to a reduction in about 495 MT eCO2 per year, which is approximately 0.5% of total emissions in 2009.

3.2 Information Technology Unit (ITU)

Mason's ITU is responsible for providing library and information technology resources, systems, services, tools, and training to the university community. This includes areas such as classroom technologies, technology infrastructure, computing services, and information literacy and research.

The ITU's sustainability efforts in recent years (many of which followed the creation of an ITU Green Team) include:

- Working on policy statements related to greener technology procurement,
- Significantly increasing the number of ITU staff participating in work arrangements that reduce travel to campus each week (such as telework),
- Cycling out old CRTs in favor of flat screen monitors, and
- Initiating recycling programs for ink/toner cartridges, rechargeable batteries, and cell phones.
- Designing a new energy efficient data center to be occupied in 2010.
- Virtualizing both servers and storage to significantly reduce energy usage.

The ITU continues to work on reducing overall electricity usage of computer resources. Computer energy use at Mason varies; the average desktop computer uses between 140-170 watts per hour. There are approximately 1,200 lab and classroom computers across all campuses, many of which are left on 24 hours a day most days during the year (due to late classes and not enough personnel to manually turn them off after hours). The ITU recently acquired new, site-licensed power management software that enables staff shut off/on all desired computers connected to the server remotely. The pilot project conducted during 2009 has been a great success and will be expanded across all lab and classroom computers across Mason's campuses.[ix]

This single upgrade should save the university 339,000-543,000 kilowatts of electricity and, more importantly, reduce 243-390 metric tons of CO_2-equivalent emissions every year. With an estimate of 6 cents per kilowatt-hour for the university's electricity costs, this equates to potential savings of $20,000-$32,500 per year. The software's site license expense for the university is a one-time cost of $43 per computer. 1,200 lab and classroom computers amount to $51,600. Once the license count exceeds 2,000 computers, the cost is prorated to $39 per computer. Because the cost for the license is so small in comparison to its benefits, it pays for itself almost immediately. In terms of actual median electricity cost, however, it would pay for itself within about two years.

Recently, the Virginia Virtual Computing Laboratory (VAVCL) received a 2009 Virginia Governor's Technology Award for Innovative Use of Technology in Higher Education. This cloud computing initiative provides users access to dedicated virtual computers built in virtual space to fit their particular needs.[1] With this arrangement, students, for example, no longer need to make special trips to campus to access software available only in particular labs (thereby reducing fuel-related GHG emissions). At current estimates, the yearly cost of building and maintaining the VAVCL is 27% of its physical counterpart and consumes 13% of the power.

[ix] Ideally, this will reduce the time these computers are on by roughly five to eight hours (depending on software updates that run at night). At an average of 155 watts per hour per computer, or a total average of 186 kilowatts per hour (4,464 kW per day), the potential energy savings with these 1,200 computers would be from 930 to 1488 kW every day depending on nightly update needs.

Mason spearheads and serves as host to the VAVCL cooperative that allows other institutions to use Mason as a hosting site. Students from universities across Virginia as well as in other states and even a few other countries are already using VAVCL. As the host site for these other institutions, Mason provides the system management software and the technical infrastructure.[2]

The virtual computing pilot project described above was developed with the deployment of virtual server technology. Sixty-four physical servers were virtualized onto three larger servers. Based on a detailed analysis of server energy consumption using Dell's Datacenter Capacity Planner and using the cost per kilowatt-hour for a Virginia commercial business, the university is estimated to save $21,888 per year in electrical costs alone due to this initiative.

Additionally, the ITU consolidated numerous storage arrays onto a single enterprise Storage Attached Network (SAN) resulting in greater efficiency and significant energy reduction. In January 2010, the ITU will deploy a new file backup system using de-duplication technology. This new system replaces a considerable amount of older, less efficient equipment. The result will be a 10-30 times data reduction.

Mason's new datacenter (complete in early 2010) was designed using the best practices for a green data center. The datacenter will drive the reduction in emissions in several ways. First, careful design of the air flows will reduce hot spots and will allow the datacenter to leverage the campus' existing cold water chilling method, avoiding the need for additional cooling equipment. Second, the datacenter is built to accommodate both research and departmental computing needs, reducing the need for additional servers to be added in the future. Finally, the power management of the datacenter is equipped with advanced power usage efficiency monitoring equipment, allowing the timely adjustment of computing and cooling equipment to ensure efficiency.

Technology plays a very significant role in GHG emissions and other ways that affect the environment. Mason's ITU is making great strides to limit these impacts in the ever-changing world of technology and academic needs.

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3.3 Distance Education

The infrastructure that ITU puts in place, Mason faculty and students utilize to fundamentally transform the delivery of learning and, by extension, its carbon footprint. The resulting distance education (DE) revolution is truly a "game changer" with respect to energy intensity per student, per square foot and per operating dollar.

Schedules of classes on Patriotweb indicate Mason added a net average of 21 Internet-based courses per semester, including summer terms, over the past three years. While fall enrollment increased 7%, the number of Internet-based course sections increased over 200%, from 89 in 2006 to 277 in the 2009 calendar year. That's without including courses delivered by more traditional DE media (e.g., TV, CD-ROM). Building upon ITU foundations, the faculty now

offers multitudes of course materials on-line instead of in-print and delivers numerous hybrid classroom-DE courses. The last decade also ended with at least one unit, the College of Science, converting its entire course evaluation system to electronic mode.

Together, these initiatives place mind over matter: They facilitate learning without moving cars, books, paper and people across our region to descend upon Mason's crowded campuses. Given commuting accounts for 21% of Mason's GHG emissions, this DE growth should have a profound impact on our reduction efforts. For instance, an ongoing informal survey by ESP professor Dann Sklarew indicates that each student's roundtrip drive to Fairfax campus consumes an average of about one gallon of gas, producing roughly 9 kg CDE in emissions. He and his student Erick Tucker further calculated that lighting and computer usage from their summer 2009 DE ecology course produced only 28% of the emissions, at 2.5% of the energy cost, of driving to class.

Under the direction of Mason's new Associate Provost for Distance Education, more formal and extensive community surveys and tracking of DE trends should help us to better quantify and realize the GHG impact of Mason's present surge into distance education.

4 Climate Action Planning Approach

In November 2008, the OoS began developing a strategic approach for generating and evaluating potential emissions reduction solutions. This approach was complex and highly inclusive.

Over winter 2009, the OoS folded volunteers into a Climate Action Team, comprised of a Core Planning Committee (CPC) and five sub-groups. Identified at the start of this document, the CPC consisted of OoS staff, a College of Science faculty member, a staff member serving as the Co-Chair with the University Sustainability Manager for the Energy and Climate Working Group of the Sustainability Council, and two graduate students from the Department of Environmental Science and Policy. The five sub-groups were: office and auxiliary space, classroom and special use space, residential space, transportation, and master planning.

During spring 2009, two town hall-style, working sessions were publicized and held to invite the broader Mason community to help identify potential projects to reduce GHG emissions. With President Merten speaking at the outset, over 60 people participated in these sessions.

In parallel, the Environmental Science and Policy department and the OoS partnered to create a seminar course, called Climate Action Plans and Energy Strategies (CAPES). This open door, for-credit course aimed to:

- aid the Office of Sustainability in examining best practices from other university climate action plans to develop the structure and content of Mason's climate action plan report,
- propose reasonable emissions reduction targets (in line with our university peers), and
- assist the sub-groups with developing and evaluating relevant projects to address all scopes of emissions.

With the help of facilitators from the CAPES class and the CPC, the approach resulted in a list of over 300 potential emissions-reducing projects. Over 40 volunteer participants – administrators, staff, graduates, undergraduates, and faculty – from across the university and all aspects of university operations contributed to this process.

Over the summer, the CPC, assisted by several students (both paid research assistants and service learning students) pursued several critical tasks:

- vetting and refining potential solutions with process owners and subject matter experts across the university,
- conducting research on potential solutions to determine their estimated costs and emissions savings, and
- constructing a robust climate communications campaign.

4.1 Project selection methodology

Several criteria were used to select solutions to be further examined or implemented in this cycle:

- community acceptance,
- financial efficiency (more emissions reduced for fewer dollars),
- educational opportunity,
- successes at other institutions (best practices), and
- opportunity for prestige or reputational gains.

The CPC gathered supporting evidence through research and discussions with decision-makers,[x] process owners,[xi] and subject matter experts.[xii] After this exercise had been completed, projects were sorted in to categories.

4.2 Project categories

The CPC thoroughly reviewed, prioritized, and consolidated the proposed list of climate solutions into eight CAP categories, along with a ninth category to address emissions offset strategies. These categories are:

1. Develop Efficiency Strategies
2. Update Design Information Manual for Increased Efficiency and Sustainability of Buildings
3. Develop Renewable Energy Generation Strategies
4. Develop Transportation Emissions Reduction Strategies
5. Develop Waste Minimization and Recycling Strategy

[x] A decision-maker is defined as a community member of authority who can make budget allocation decisions. An example of a decision-maker is the Vice President for Facilities.

[xi] A process owner is defined as a community member who is responsible for the outputs and outcomes of a particular university function. An example is a process owner is the Energy Manager.

[xii] A subject matter expert is defined as a person who is able to provide technical information to support the analysis of climate action solutions, but that does not necessarily have decision-making authority or process ownership.

6. Develop a Sustainability and Climate Communications and Education Strategy/Enhance Community Interaction
7. Develop Strategies for Dedicated Climate Action and Sustainability Funding
8. Integrate Climate and Sustainability Goals in to Master Planning Process
9. Develop Offset Strategies

These categories will also frame future CAP planning efforts.

In order to determine the types of resources and commitment needed for each potential emissions reduction solution, solutions were sorted by type: policies, measurable projects, and research projects. Policies are public agreements that will have an expected impact on emissions, though difficult to measure. Quantifiable projects are projects that are more technical in nature, that if implemented will have an immediate and measurable impact on energy use and resulting emissions. Priority research projects are projects that decision-makers and process owners have agreed are critical for Mason to gain a better understanding of before agreeing to invest in resources to implement particular solutions.

4.2.1 Project type: Policies

Policy changes are critical to support the university's quest for climate neutrality. Some policy recommendations may have a cost attached, while others are merely statements of intent that provide the strategic direction to develop implementation plans. One of the most critical policies that should be implemented is the creation of dependable investment and funding streams for the implementation of solutions that reduce operating costs and emissions. Another is the significant updating of the George Mason Design Information Manual, which will establish a set of rigorous standards for all new buildings and renovations on all campuses, preventing any ambiguity about Mason's building standards. Other recommended policies affect one or more departments at Mason in one of more emission scopes.

4.2.2 Project type: Quantifiable Projects

There were few projects that could actually be quantified and receive committment to within the planning period for this CAP. Most projects classified as "quantifiable" are budgeted and approved already, but have not yet been implemented, and therefore have not yet had a positive impact on our overall emissions. Projects of this nature include things like the energy savings performance contracts, efforts by the Energy Management Office, and efforts by the Information Technology Unit (as described above). The methods for calculating emissions for many projects that are innovative or behavior-changing, such as distance education, are not yet developed. While behavior changes leading to university cultural changes have the greatest impact on long-term emissions, their impact is difficult to quantify.

4.2.3 Project type: Research, Analysis, and Feasibility Studies

In order to continue forward movement toward sustainability, ongoing student research should be funded both at the undergraduate and graduate levels.[xiii] By consulting with process owners at Mason, the CPC was able to narrow down the most critical 15 research and market study projects

[xiii] This request will go through the standard process for submitting funding requests through the Budget and Planning Team. The funding for these positions has not yet been approved.

for this two-year cycle. The CPC recommends that students are interviewed for these positions, and that payment or course credit is contingent on specific deliverables. Process owners must agree to manage the outcomes of these student projects, but the Office of Sustainability will provide administrative support as required. The projects are listed in detail in Appendix A within each umbrella project under the "Research and Acceptability Studies" header.

5 Setting Carbon Reduction Goals

For the first time, Mason's 5-year strategic goals[xiv] include sustainability and climate neutrality in a formal way by expecting the "integrat[ion of] sustainability into academic and extracurricular activities" and by "measurably advanc[ing] toward climate neutrality." With this mandate in hand, the university has cleared the path forward to work in an interdisciplinary manner to reach climate neutrality.

Foremost, Mason should aim to be an exemplary neighbor with respect to the climate action commitments of the jurisdictions within which the university operates. In particular, Arlington, and Fairfax counties – where two of Mason's campuses reside – have both signed the Cool Counties agreement, committing to "halt the growth of greenhouse gas emissions by 2010, and to reduce greenhouse gas emissions by 80 percent below 2006 levels by 2050." (MWCOG 2008, p.36)

Encouraged by recent leveling-off of university emissions, Mason should join Fairfax and Arlington counties in permanently halting growth of its greenhouse gas emissions in 2010. Thereafter, net GHG emissions should decline by at least 20% by 2020, and at least 80% by 2050 (MWCOG 2008).

With the proactive approach taken by Mason's Energy Management Office, ITU, and other departments to save energy, it will be challenging to continue the energy savings momentum of the past 5 years. Many solutions which will enable Mason to make the kind of leaps in efficiency that have already been made will require a much more innovative, integrated, and strategic approach. This will require further investments in "game changing" activities like distance education, partnerships with consultants and contractors, entering into aggressive searches for grants in partnership with faculty, and creative financing through partnerships with energy companies and investors. In these challenging fiscal years, it is critical to understand that any new recurring program funding requested must go through the same budget approval process as all other programs at the university. In addition, projects requiring capital financing require a separate review and approval process with the Commonwealth of Virginia, and must show a favorable return on investment, regardless of the positive impact on emissions reduction. As such, all emissions goals will be contingent on available funding.

5.1 2012 – Building the Foundation

Since fiscal year 2010, Mason's net GHG emissions have not exceeded 2006 levels (103,753 MTCDE). Energy intensity metrics have shown a 2% decline per year starting in fiscal year 2010 through the end of fiscal year 2012, and are now around 4.32 MTCDE per student and 18.6 MTCDE per 1,000 square feet of building space per year.

[xiv] See p. 11,

The first two years of our climate action plan are focused on continuing to build a foundation of understanding of issues confronting our operational efficiency, and examining the options for overcoming them. In these years, great strides will be made in shifting the culture and awareness of climate neutrality on Mason's campuses. Major planning will set in motion large and technically feasible infrastructural changes. Because emissions are projected to be about 128,000 MTCDE by 2012, a reduction or avoidance of approximately 25,000 MTCDE net emissions will be needed to remain at 2006 levels. To begin to show an immediate reduction in emissions, 5% of non-renewable electricity purchased should be "greened" through the use of renewable energy certificates (see 6.2, category 9 Develop Offset Strategies) by 2011, and 10% by 2012. While this will negate approximately 5,000 MTCDE, other projects will need to reduce emissions by a remaining 20,000 MTCDE per year. During the two-year cycle, focus must be on identifying and assessing the feasibility of large long-term solutions if Mason wants to have any hope of stabilizing emissions.

5.2 2014 – Emissions stable at 2006 levels, energy intensity down by 10% from 2006

Mason's energy intensity metrics have declined by at least 2% per year since fiscal year 2010, and are now 10% below 2006 levels (at 4.14 MTCDE per student and 17.8 MTCDE per 1,000 square feet of building space); frameworks have been implemented to internalize emissions costs across university operations; and carbon offsets purchased if emissions exceed annual targets.

Based on the planned speed of growth in Mason's building square feet until 2014, it will be a challenge to keep emissions as level as they have been, overall. However, with the increase in green building square footage and number of students on campus, Mason's energy intensity (emissions per student and square foot) should decrease over time in the near term. Projected emissions are estimated at around 131,000 MTCDE in 2014. As in 2012, stabilizing net emissions will require a concerted effort to avoid or offset approximately 28,000 MTCDE per year. As such, a minimum of 15% of non-renewable electricity purchased should be "greened" through the use of renewable energy certificates (see #9, Offset Strategies), bringing the remaining total to about 20,000. Targeted projects should eliminate the remainder of emissions.

5.3 2020 – 50% energy intensity reduction from 2006 levels, 20% reduction in net emissions

No later than 2020, financing and institutional structures should be in place to ensure that Mason's net emissions are fully counterbalanced by investments in carbon offsets. At only 50% of 2006 energy intensity metrics, Mason will be on a strong path toward carbon neutrality. Net GHG emissions should be approaching a 20% reduction by 2020, as committed by Arlington and Fairfax Counties. Emissions per 1,000 square feet will be under 10 MTCDE and emissions per student will be about 2.3 MTCDE. Based on reductions achieved and technological and political advances, a decade of specific goals will be set for the period through 2030.

5.4 2050 – Climate Neutrality

Consistent with local government and peer commitments, Mason has achieved an 80% reduction in net greenhouse gas emissions by 2050, every year thereafter investing in carbon offsets to counterbalance all remaining emissions.

Ultimately, the university should reduce its net GHG emissions to a minimum of 80% of a 2006 baseline by 2050, as per the United Nations Development Programme's 2008 Human Development Report.[xv] The commitment must also be made to offset any remaining emissions through the purchase of carbon offsets. Localities like Arlington and Fairfax Counties and multiple universities in Virginia have made the same commitment, and by working together, with the Commonwealth of Virginia government, and with Virginia's major power producers, this is not beyond the university's reach.[xvi]

5.5 Indicators of Success

Key indicators to measure and track Mason's progress against the above goals include:

- Percentage reduction in net greenhouse gas emissions
- Percentage reduction in energy intensity per square foot of built space
- Percentage reduction in energy intensity per full-time equivalent student
- Percentage reduction in energy intensity per operating dollar

These indicators will be tracked on an annual basis by the OoS, supported by the annual data collected via the greenhouse gas inventory process, which includes assistance from various departments and offices across Mason. They will be reported to the Executive Steering Committee for Sustainability using an online dashboard provided by consultant Sightlines, who provides services in support of Mason's GHGI process. Please see **Appendix C** for a summary of expected emissions reductions, timelines, and offset percentages.

6 Climate Action Strategies – January 2010 - December 2011

There are two critical components of managing a successful climate action planning initiative: building the foundation through the creation of repeatable processes and funding, and elaborating on specific targeted strategies to reach quantifiable emissions reduction goals.

6.1 Building the Foundation - Managing Ongoing Emissions Reduction Efforts

In order to ensure the ongoing creation, tracking, and management of proposed climate solutions, a strong foundation must be in place, accompanied by resources. The creation of three new programs will make up this foundation. Please see **Appendix D** for a detailed budget to support the creation of these programmatic elements.

1) Mason's Environmental Management and Sustainability System (EMS^2)
In order to manage these solutions, the university must implement a systematic way to approve, fund, and track all projects supporting the Climate Action Plan. In cooperation with the Office

[xv] United Nations Environment Programme, "Kick the Habit, a UN Guide to Climate Neutrality." See: http://www.unep.org/publications/ebooks/kick-the-habit/Default.aspx?bid=ID0EHJAC

[xvi] Virginia Commonwealth University, carbon neutral by 2050. See: http://www.yearofenvironment.vcu.edu/, Virginia Tech, 80% reduction below 1990 levels by 2050. See: http://www.roanoke.com/news/nrv/052309_VTCACSPfinaldraft.pdf, University of Richmond, neutral by 2050. See: http://sustainability.richmond.edu/action-plan/index.html

of Sustainability, the Environmental Health and Safety Office has developed an Environmental Management and Sustainability System (EMS^2). This EMS^2 consists of a university policy statement and a set of processes that enable the strategic management of sustainability and environmental compliance projects. Virginia Executive Order 82: *Greening of State Government*[xvii] specifies the establishment of an Environmental Management System (EMS) at all state institutions. George Mason University's EMS incorporates sustainability, allowing the tracking and management of sustainability projects. Implementation of this first Climate Action Plan will leverage this new platform, enabling two goals to be met at the same time: the execution of climate action solutions, and the assessment of this new system and its associated processes.

The EMS^2 incorporates a Project Management Tool (PMT) to document details for each project. The PMT has been used to produce draft documents supporting each of the categories of projects described below, and will be used to detail projects of greater complexity in subordinate documents, as necessary. These PMT documents are separate from this Climate Action Plan, and will be refined after project teams have been assembled to execute these projects.

2) Climate Initiatives Coordinator and a Standing Climate Action Team
Managing the creation of a greenhouse gas inventory and climate action strategy on alternating years requires a commitment of full-time resources. While the Office of Sustainability can and will oversee these functions, current resources in place will need to be augmented by a climate-focused coordinator position, in order for the Office to continue to support the broad array of climate and non-climate focused sustainability initiatives. This person would not only ensure the timely publication of climate documentation, but would be responsible for coordinating and tracking all activities across our campuses supporting emissions reduction. This person would provide project support where needed, would participate as the primary representative of the sustainability office on the EMS^2 process (in relation to climate initiatives) and would work with the Sustainability Outreach Coordinator on climate outreach initiatives.[xviii] If this position is not funded, the coordination of climate initiatives will be handled by the Office of Sustainability as time permits. Timelines for execution of projects can be expected to fall back by approximately 2 years without centralized coordination of climate initiatives.

3) Climate Action Team Internships
The research required to assess the value of each climate solution to the university is immense. New technologies and approaches to university climate neutrality are constantly emerging. Existing full-time resources have been actively pursuing projects as possible, but frequently have long lists of research needing to be done that they do not have the time to pursue. The creation of an annual internship program to support technical research as well as outreach efforts should be created and funded. Interns will work with service learning students and faculty/staff to develop the scope of their work and to execute on projects that will benefit the university while at the same time building student experience in climate and sustainability issues, which is a valuable commodity in the emerging "green economy."[xix] Although students will be engaged via unpaid internships through New Century College and other departments interested in providing

[xvii] See: http://www.governor.virginia.gov/initiatives/executiveorders/2009/EO_82.cfm.
[xviii] This request will go through the standard process for submitting funding requests through the Budget and Planning Team. The funding for these positions has not yet been approved.
[xix] Same as above.

course credit, using this *ad hoc* approach only may delay critical research to move forward with climate initiatives.

In parallel with the creation of a strong foundation to manage ongoing projects, the Office of Sustainability personnel will work with departments across Mason to begin targeting reductions in specific areas.

6.2 Targeted Strategies to Reduce Emissions

Each of the nine categories (listed in section 4.2) has its own goals and objectives, metrics to verify progress against these goals and objectives, and expected outcomes. Solutions developed to meet these subsidiary objectives have been organized according to several types of actions: policies, quantifiable projects, and priority research projects. Appendix B provides details about all proposed solutions, by category then action type. Any solutions that could not conceivably be achieved in this two-year CAP cycle are included, by CAP category, under the header "Projects for Future Consideration." Projects will be assessed by May 1st, 2010, for cost and feasibility, and the CAP will be adjusted appropriately where necessary.

1 DEVELOP EFFICIENCY STRATEGIES

Energy efficiency measures have been shown to be by far the least expensive means of reducing both the impact on operational cost and on climate emissions. Mason will therefore continue to emphasize efficiency measures as our primary means of emissions reduction in the short term (within the next 5 years). Efficiency strategies are not limited to electricity (which includes cooling), but include heating and hot water, and water efficiencies for municipal treated water, as well.

Objectives and Indicators

- Reduce use of non-renewable electricity and natural gas per square foot of built space by 10% below 2006 by 2014.
- Reduce use of non-renewable electricity and natural gas per full-time equivalent student by 10% below 2006 by 2020.

2 UPDATE DESIGN INFORMATION MANUAL FOR INCREASED EFFICIENCY AND SUSTAINABILITY OF BUILDINGS

As part of our commitment to climate neutrality (signed by President Merten in 2007), George Mason University has made a policy commitment to build all new buildings and renovations to a minimum of U.S. Green Building Council's LEED Silver standard (or equivalent). Buildings and their activities currently account for approximately 70% of our emissions, including heating and cooling and electricity usage. New construction and renovations are a critical opportunity to improve the efficiency of our buildings, and Mason will expect each contractual partner in building to consider the following issues when designing and building these projects:

- High energy and resource efficiency of buildings
- Environmentally sensitive site design, including restoration of habitat where possible and attention to replicating natural resource flows in the original

environment
- Aggressive stormwater management strategies, preferring on-site management over traditional methods
- Efficient use of resources, including consideration of local sourcing and recycling as much waste as possible

Objectives and Indicators

- Mason publication of revised Design Information Manual aligned with and promoting building standards that encourage emissions reductions.

3 DEVELOP RENEWABLE ENERGY GENERATION STRATEGIES

The only way for Mason to become climate neutral is to actively engage in strategies to develop its own sources of renewable energy. This includes examining creative options like power purchase agreements, direct purchase and installation of equipment, partnerships with investors in construction of new sources of renewable energy, and funding faculty and student research in to innovative strategies for renewable energy.

Objectives and Indicators

- 10% of all electricity being consumed is from renewable sources, regardless of the mechanism, by 2014.

4 DEVELOP TRANSPORTATION EMISSIONS REDUCTION STRATEGIES

Greenhouse gas emissions by vehicles contribute about 40% of Mason's total emissions. These vehicles include commuters (student, staff, and faculty), university-owned fleet vehicles (landscaping, vehicle pool), and shuttle buses. These projects will include measures to reduce vehicle-produced greenhouse gas emissions by: phasing out University-operated, fossil-fuel based vehicles; implementing incentives for alternative transportation / commuting methods; and implementing methods to reduce student, staff, and faculty commuting.

Objectives and Indicators

- Percentage of Mason community commuting to Mason campuses in single-occupancy vehicles declines by 5% by 2014.
- Percentage of Mason community requesting commuter choice benefits increases by 5% by 2014.

5 DEVELOP WASTE MINIMIZATION AND RECYCLING STRATEGY

Recycling and waste management play an essential part in the emissions strategy of any university. The recycling and waste management program at Mason is a functional program (at approximately 19% of solid waste recycled), but there is room for improvement. Because Mason's waste is sent to the Lorton Waste-to-Energy Facility in Springfield, VA, fewer emissions result from our waste stream than if the waste was landfilled. However, Mason pays for every ton of waste hauled away without gaining direct benefit of using the energy generated from this waste stream. Money used for trash hauling could be used to fund

climate reduction initiatives. Therefore, shifting waste from trash to recycling has the potential for generating a funding stream and for reducing harmful emissions generated through the combustion of the waste.

Objectives and Indicators

- Recycling Rate Increased to 25% by 2014.

6A DEVELOP A SUSTAINABILITY AND CLIMATE COMMUNICATIONS AND EDUCATION STRATEGY

The Climate Action Plan Education and Outreach Campaign will educate the majority of the Mason community on the goal of the Climate Action Plan and the projects it describes. The campaign will assist the university in becoming climate neutral and radically transform Mason's physical operations as well its overall zeitgeist- at the end of the first year of the campaign, climate change and Mason's commitment to climate neutrality will be a priority to the majority of the Mason community. Through persistent outreach efforts as laid out in "A Communication Plan in Support of Mason's Climate Commitment" and other documents, this campaign will play an integral role in Mason becoming climate neutral. This campaign will be developed around a core message (or "story"). Please see Appendix for more project details.

Objectives and Indicators

- At least 90% of the Mason community will become aware that Mason has committed to becoming "climate neutral" by December 2010.
- At least 70% of the Mason community will have at least basic knowledge of the major actions (current and planned) that Mason will take (e.g., all new buildings will be green) by December 2010.
- At least 70% of the university community will be able to name at least three important ways they are, or could be, contributing to the goal by May 2011.
- At least 50% of the Mason community will have signed the Mason Climate Commitment by May 2011.
- At least 70% of the Mason community will feel a sense of pride in- and collective responsibility for- the goal, and eventually will feel a sense of collective accomplishment as progress is made toward the goal by May 2011.

6B ENHANCE COMMUNITY INTERACTION and OUTREACH

Mason is a huge economic contributor to its surrounding communities. The sustainability of the regions in which Mason's campuses reside is impacted by the activities taking place on these campuses, and it up to Mason to decide whether this is going to be positive or negative impact. Working with local communities as partners in sustainability is critical to all local citizens. Therefore, community outreach and partnerships are critical to Mason's ability to be sustainable and to encourage sustainability in our communities and local governments. Public commitment and ongoing engagement on these issues is essential not only with the Office of Sustainability but through all departments across the university.

Objectives and Indicators

- Each Mason campus meets the GHG emissions targets and timelines of the jurisdictions in which it resides.
- Mason is recognized as a leader, partner and resource for regional climate change planning and implementation at the community and local level.
- Mason collaborates with Fairfax County to realize at least 1 demonstration of University-locality partnership in climate action education and outreach to the community surrounding the University's largest campus.

7 DEVELOP FUNDING STRATEGIES FOR DEDICATED CLIMATE ACTION AND SUSTAINABILITY

This project would provide the essential funding for sustainability projects on campus. This project is imperative because it would lead to increased funding, which would enable many projects that currently lack funding to happen. Currently it is hard to find money to allocate to a project due to the poor economic climate and budget cuts. Even in the future, when the economy gets better or worse, there will still always be difficulties in securing funding for every project that gets proposed. A funding strategy would help to establish a source of funding, which would allow more projects to be implemented, and could extend the lives of projects indefinitely.

Objectives and Indicators

- By the end of fiscal year 2010 (June 30th), the Office of Sustainability will have developed three unique strategies for funding climate and sustainability projects.

8 INTEGRATE CLIMATE AND SUSTAINABILITY GOALS IN TO MASTER PLANNING PROCESS

Mason updates its Master Plan approximately every five years. The current Master Plan (in development, not yet published) includes strategic vision for the intended development of buildings and open space across all campuses. Mason has also recently begun a related Utility Master Planning process, which provides a strategic vision of utility upgrades that must be pursued to support Mason's Master Plan. In the Master Planning category, there are no quantifiable projects being recommended, but recommendations that university resources should be allocated to consider related master planning processes and policies.

Objectives and Indicators

- None possible for this category.

9 DEVELOP OFFSET STRATEGIES

The issue of purchasing renewable energy certificates (RECs) and carbon offsets has been debated with vigor in many circles of sustainability in higher education. In most cases, RECs and offsets are a short-term strategy to leverage while in search of opportunities to generate renewable energy. However, without offsets, carbon neutrality is an impossibility with current technology. Therefore, the graduated use of RECs and carbon offsets will be used as Mason examines long-term strategies for renewable energy generation and alternative fuels.

Objectives and Indicators

- 5% of non-renewable electricity purchased is "greened" through the use of RECs by 2011.
- 10% of non-renewable electricity purchased is "greened" through the use of RECs by 2012.
- 15% of non-renewable electricity purchased is "greened" through the use of RECs by 2014.

7 Next steps

Establishing the foundation for managing the execution of climate action solutions will be a critical first step in the successful trip to climate neutrality. Mason leadership will meet to identify funding strategies for all projects and foundational elements recommended in the CAP that require additional funding by May 1st, 2010. In parallel, the Executive Steering Committee for Sustainability should convene by April 1st and identify resources needed to lead and implement recommended policies, projects, and research/feasibility studies within this CAP cycle that do not need additional funding, but do require staff time. This CAP will be adjusted where budgetary or resource constraints make it apparent that a project will not be able to be executed in this cycle.

Only through a consistent project management process will this aggressive schedule be met. It is therefore essential to quickly approve the proposed Mason EMS^2. The proposed EMS^2 will be presented to the Executive Steering Committee by the end of February 2010, by the Sustainability Manager and the Environmental Compliance Officer. Through the use of the EMS^2 framework, project teams will be formed and project documentation and tracking will begin. Each solution will be required to develop an associated set of metrics (as per the EMS^2) and each team will be expected to track and report success against those metrics. At the end of 2010, all project teams will be required to provide a status update to the Executive Steering Committee guided by the EMS^2 process and the Office of Sustainability.

Through the communications strategy, the Mason community will be engaged in a more direct and targeted manner in future iterations of the Climate Action Plan. As this process evolves to include more of the campus community, the CPC expects that synergies will develop to encourage the ongoing development of emissions reduction projects.

[1] How does cloud computing work? If the university has a site license to a particular piece of software a student needs to use, a virtual computer is "built" with that in consideration specifically for the user's session and ceases to exist when that user logs out; the student accesses the newly created virtual desktop remotely. Unlike a physical lab, the virtual lab is available to students 24 hours a day, all year long. The cost per square footage to house student computing resources as well as limiting unnecessary e-waste is significantly reduced as well. Theoretically, a thousand students can access software virtually in the same square footage as one computer station in a physical lab. An average computer might last three or four years before it needs to be replaced or rebuilt (with new parts). While the server would need to be updated, as well, doing so for a handful of server computers as opposed to many, many hundreds of computers reduces the ecological impact of electronic waste that needs to be disposed of.

While this does not negate the use of computers somewhere (either on campus with personal laptops or off campus), being able to remove physical lab space in favor of virtual lab space means less demand on servers, less waste heat produced by hundreds of computers and people confined to particular spaces (as this will inevitably mean reduced needs for physical computers and lab space), as well as a reduction of necessary maintenance, disposal, and other incidental costs (both environmental and monetary) related to maintaining physical computer labs.

[2] VAVCL currently serves as host to an institution in Mexico which allows their students access to software programs their institution has access to, but for which the student might not have been able to access because the computer they were using would not normally be able to handle the software. This is because, essentially, the virtual computer is doing the work, not their personal computer (or even an outdated computer in a campus lab if they do not have their own). This can be expanded to include other institutions in developing nations, and allows Mason to not only help these institutions reduce their global contributions to GHG emissions, but also help stimulate their growth in the global society we live in.

List of Appendices

Appendix A: Full List of Acknowledgements
Appendix B: CAP Categories and Activity Details
Appendix C: Summary of Emissions Projections and Goals
Appendix D: Budget Request Summary: 2010-2014 (Internal Document Only)

Appendix A: Full List of Acknowledgments

Thanks to the Mason Community!

The Office of Sustainability and the Climate Action Plan Core Planning Committee would like to thank the following groups and individuals for assistance with the construction of our first Climate Action Plan. First and foremost–

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Thomas Ashcraft, College of Visual and Performing Arts Representative
Gil Brown, Office of Budget and Planning
Thomas Calhoun, Vice President, Facilities
Rick Davis, Office of the Provost
Sharon deMonsabert, Information Technology and Engineering Representative
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Mark Kraner, Assistant Vice President, University Services
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Sandy Scherrens, Vice President, University Life
Paul Schopf, Professor, College of Science Representative

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Lesley Markham, Graduate Student, Environmental Science and Policy
David McAbee, Undergraduate Student, Individualized Study
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Ashley Mott, Graduate Student, Environmental Science and Policy
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Larry Spaine, Director, Facilities Management
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Cathy Wolfe, Director, Campus Planning, Facilities Administration

Gregory Woodyard, Diversity Supplier Manager- Purchasing and Accounts Payable
Edmund Zolnik, Assistant Professor, Geography and Geoinformation Science Dept

Completing the first iteration of a long-term strategy and developing projects to meet that strategy has been and will continue to be a substantial team effort. Without the help of our many Mason colleagues, this would not have been possible.

Appendix B: CAP Categories and Activity Details

All Climate Action Plan recommendations are aggregated under nine categories:

1. Develop Efficiency Strategies
2. Update Design Information Manual for Increased Efficiency and Sustainability of Buildings
3. Develop Renewable Energy Generation Strategies
4. Develop Transportation Emissions Reduction Strategies
5. Develop Waste Minimization and Recycling Strategy
6. Develop a Sustainability and Climate Communications and Education Strategy (A)/Enhance Community Interaction (B)
7. Develop Funding Strategies for Dedicated Climate Action and Sustainability
8. Integrate Climate and Sustainability Goals in to Master Planning Process
9. Develop Offset Strategies

The outputs of each category will contribute in some way to emissions reductions within that category, to be rolled up in to overall university emissions reduction goals.

Within each category, policies, quantifiable projects, and research priorities have been developed.

1 DEVELOP EFFICIENCY STRATEGIES

Energy efficiency measures have been shown to be by far the least expensive means of reducing both the impact on operational cost and on climate emissions. Mason will therefore continue to emphasize efficiency measures as our primary means of emissions reduction in the short term (within the next 5 years). Efficiency strategies are not limited to electricity (which includes cooling), but include heating and hot water, and water efficiencies for municipal treated water, as well.

Objectives and Indicators

- Reduce use of non-renewable electricity and natural gas per square foot of built space by 10% below 2006 by 2014.
- Reduce use of non-renewable electricity and natural gas per full-time equivalent student by 10% below 2006 by 2020.

Recommended Projects and Policies for 2010/2011 CAP Cycle

Policies

1.1 Bill For Actual Energy Consumption
Charge building tenants for actual energy consumed for their space, and charge extra fees for additional plug load; give credits for below-average use. (Energy Management Office, Office of Budget and Planning, Fiscal Services)

1.2 Energy Efficient Computer Procurement Policy
Procure only highly energy efficient computers through the Equipment Trust Fund (ETF). (ITU) Publish statement by procurement office that departmental purchases of PCs will be reviewed to ensure they meet high energy-efficiency standards, as defined

minimally by the EnergyStar program. (Purchasing and Accounts Payable Department)

1.3 Interdepartmental Space Sharing
Determine spaces in departments that could quickly and effectively be used by other departments and implement an online booking system. (Office of the Provost, Space Management Office)

1.4 Become a Labs 21 Partner
Select a Mason academic point of contact with the EPA "Laboratories for the 21st Century" program (Labs21). Select a new lab building or renovation project for which Labs21 will be implemented. (College of Science, College of Information Technology and Engineering)

1.5 Improve Efficiency of Vending Machines
Vending machines across campus are being examined for their efficiency and where possible, more efficient machines are being included in the vendor contracts. While energy usage measurements have been taken, they have proven to be inconsistent such that precise measurements of the potential energy reduction are not feasible (University Services).

1.6 CFL Exchange
Establish a CFL-exchange program in which students living in residence halls can trade in incandescent bulbs for energy efficient CFL bulbs to reduce purchased electricity. (Office of Housing and Residence Life)

1.7 Facilities Condition Assessments Should Include Building Efficiency Analyses
In conjunction with the University's periodic facilities conditions assessments and ongoing maintenance reserve project updates, an analysis of the building efficiency shall be included. Efficiency of buildings will be measured across several axis, including: space utilization, energy usage, indoor environmental quality, sustainable sites (including minimization of storm water run-off and erosion), water usage, and furnishing conditions/reuse. Such assessments need to make recommendations how how best to reuse existing facilities within their footprint as a priority over creating new additional facilities.

Quantifiable Projects

1.8 Computer Power Down Policy and Software Implementation
All Mason-owned and ITU-operated labs and PCs will be centrally controlled through the use of software. Pilot labs are currently being tested, but all 1200 PCs on Mason's three campuses will have this software installed. (Information Technology Unit)

1.9 Virtual Computing Labs
VCL is an initiative that can save the university time, energy, and money. It provides users access to specialized software from any computer with an Internet connection anywhere in the world at any time providing them dedicated virtual computers built in virtual space to fit the needs of the user. (Information Technology Unit)

1.10 Reduce Energy Used for Residential Laundry

Heating water for laundry requires 90% of the energy used in laundry facilities and eliminating hot water use will reduce use of natural gas.

1.10.1 Office of Housing and Residence Life will work with laundry vendor to begin replacing all top-load washers with front-loading washers as they get to their retirement age. Changing laundry machines from top loaders (MAT14) to front loaders (MAH22) will save Mason expenses of water, water heating, sewage, and electricity. Currently, Mason possesses 28 front load and 110 top load washers. The amount of energy consumed by a top load washer is approximately .10 kWh per cycle and the front loaders use approximately .08 kWh per cycle. By 2011, the remaining 110 washing machines ideally should be replaced to front loaders. (more research is needed to be able to complete the analysis, to be done in January 2010)

1.10.2 The laundry vendor will work with OHRL to provide laundry education services to complement the installation of front-loading machines in order to avoid the misuse that tends to negate the energy and water savings benefits.

1.10.3 OHRL will reduce the number of loads available to each resident per year starting in 2010. This is expected to encourage the careful use of laundry privileges by students and discourage non-resident use of machines.

Research, Analysis, and Feasibility Studies

1.11 Thermal imaging for leaks

A thermal imaging audit of all buildings on campus* should be conducted to check for building envelope problems; leak fixes should be prioritized based on buildings' energy intensity (per square foot usage of heating and cooling) of the building. (* If cost-prohibitive, implement iteratively, starting with the most energy intensive per sq. foot buildings.) (Energy Management Office)

1.12 Research for Heating and Cooling Efficiency

Research is needed to determine thermal comfort and discomfort in all buildings. Space users have reported discomfort during certain times of day and year, leading to the necessity to bring in fans or heaters to make the space tolerable. Conduct research to determine how space is being used now versus how it was initially designed to be used and/or how it can be used more efficiently. Conduct research on usage of plug-in devices for individual climate control. Conduct surveys and data collection activities to determine buildings with the most thermal inconsistencies. Develop working group to solve these problems through technical and social solutions. (Energy Management Office)

1.13 Phantom Load and Appliance Shut-Down Research

Phantom load (i.e., energy consumption of electronics that are turned off) should be regulated through the use of power strips. Research appropriate technical fixes for ensuring unused equipment is automatically turned off when space user is not present. A pilot may be implemented, for example, in residence halls: Either using motion

sensor power strips or the remote shut-off switch, [xx] conduct a pilot study on residence hall room plug load usage (Energy Management Office and departments assisting with pilot projects)

1.14 Centralize Printing, Copying, and Scanning Policy Analysis
Examine the financial and energy benefits of using centralized printer functions already available through RICOH copiers. Ideally, this will lead to purchasing policy restricting any purchase of desktop peripherals without express permission of the CFO. (Auxiliary Enterprises - Print Services, Information Technology Unit, Purchasing and Accounts Payable Department)

1.15 Hallway and Common Area Light Sensor Analysis
Retrofit all hallway lighting with programmable motion sensors, so that they come on at night if people are detected but remain off when hallways are unoccupied. Needs further study to address potential safety issues. (Energy Management Office)

1.16 Natural Light Sensor Analysis
Retrofit all the lighting in Mason's hallways and common areas to detect natural light available and dim accordingly. Reduce lighting in communal areas during the day when they can be lit naturally be installing set points to dim the lights during the day, to reduce purchased electricity. (Energy Management Office)

1.17 Lighting Retrofit Audit
Perform lighting audits on all buildings on campus to identify which rooms have NOT yet been retrofitted with efficient lighting, and document them for future retrofits. (Energy Management Office)

Projects for Future Consideration

1.18 Limit Water Temperature Range in Student Housing
Assess the water temperature range used in dorm showers to determine if it can be appropriately decreased.

1.19 Pay-per-load of laundry
Eliminate free laundry and charge for each load of laundry, reducing housing costs appropriately, or refund students for any loads of laundry NOT used during the year.

1.20 Drying Racks for Residential Laundry
Provide drying racks in dorm laundry facilities and have racks available for students to use in their dorm rooms to dry clothes, rather than using clothes driers that use a lot of electricity.

1.21 Incentive Program for Faculty "Hotelling"
Provide a faculty incentive program that encourages hotelling (which is an office setup in which mobile workers do not have permanent desks or cubicles) which would encourage a more effective use of space.

[xx] e.g., Isole: http://www.wattstopper.com/products/details.html?id=74 and BELKIN Conserve, respectively

1.22 Community Print Stations
Install community printers in residence halls to reduce the number of printers used in each dorm room to reduce energy use.

1.23 Appliance Use Student Survey
Conduct a survey of students on appliance use and acceptance of behavioral changes to reduce or utilize them in an energy efficient manner.

1.24 Appliance Energy Use Education Program
Implement an educational program to encourage students to use fewer appliances in their door rooms and behavioral changes to use them in a more energy efficient manner to reduce purchased electricity usage.

1.25 Occupancy Sensor Switches in Student Housing
Install occupancy sensor switches in dorms to ensure electricity is off when students are not occupying their room and thus reducing purchased electricity.

1.26 Efficiency Retrofits Scheduling Process
To speed up renovation in existing buildings, a procedure should be formulated. Projects that are smaller in scope should be done over a longer period of time; energy and water efficiency devices can and should be installed promptly regardless of larger renovations scheduled for the building.)

1.27 Facility Kinetic Energy Capture
The kinetic energy produced by people exercising in the fitness facilities (e.g. through the use of stationary exercise bikes at the Aquatic and Fitness Center) should be captured and used to provide power on campus.

Expected Outputs

- Bill-Back Process in Place: Billing process in place for charge-backs for energy use by department.
- Labs21 Pilot Lab Executed: One certified lab under Labs21 program.
- Space Sharing Software: Launch of software enabling online booking of shared space.
- Inefficient Buildings Identified: Thermal imaging for all of campus complete, list of priority buildings for insulation retrofits assembled.
- Pilot Building with Hallway Lighting Controls: Building chosen, surveyed, and retrofit for pilot assessment of feasibility across campuses.

2 UPDATE DESIGN INFORMATION MANUAL FOR INCREASED EFFICIENCY AND SUSTAINABILITY OF BUILDINGS

As part of our commitment to climate neutrality (signed by President Merten in 2007), George Mason University has made a policy commitment to build all new buildings and renovations to a minimum of U.S. Green Building Council's LEED Silver standard (or equivalent). Buildings and their activities currently account for approximately 70% of our emissions, including heating and cooling and electricity usage. New construction and

renovations are a critical opportunity to improve the efficiency of our buildings, and Mason will expect each contractual partner in building to consider the following issues when designing and building these projects:

- High energy and resource efficiency of buildings
- Environmentally sensitive site design, including restoration of habitat where possible and attention to replicating natural resource flows in the original environment
- Aggressive stormwater management strategies, preferring on-site management over traditional methods
- Efficient use of resources, including consideration of local sourcing and recycling as much waste as possible

As the process of developing green standards continues, the climate action team recommends that Facilities Planning consider the following options for inclusion in to the document. Most of these projects will be owned by the Campus and Facilities Planning Offices. Where they are not owned by that office, or other departments/offices are assisting, they will be noted in parentheses after the project description.

Objectives and Indicators

- Mason publication of revised Design Information Manual aligned with and promoting building standards that encourage emissions reductions.

Recommended Projects and Policies for 2010/2011 CAP Cycle

Policies

2.1 Rainwater catchment and use

Rainwater catchment methods must be considered for all buildings on campus as part of the overall utility master planning effort. Potable water consumes resources for treatment and pumping, and its waste costs the university money unnecessarily. Just as reducing energy saves resources and improves Mason's sustainability, using treated water more wisely contributes to our sustainability. (see a recent published paper by a Mason PhD student and professor, Ali Bakhshi and Sharon deMonsabert, quantifying the emissions generated from municipal water and wastewater treatment: Bakhshi, A. and deMonsabert, S., "A GIS Methodology for Estimating the Carbon Footprint in Municipal Water and Wastewater in Fairfax County, Virginia," *Energy Engineering*, Vol. 106, No. 5, 2009. It is recommended this research be continued and used in Mason's planning for climate neutrality.)

2.2 Locally-sourced Building Materials

Builder should be required to provide a list of sources for all materials used in construction and source from within 500-mile radius where possible.

2.3 Local Sources and Sustainable Supplies/Materials Appendix

In the university's design information manual, an appendix should be written which includes all the sources for local and green supplies and materials used in green buildings by construction companies who have and will build on GMU campuses.

2.4 Include Recycling Space and Resources in All New Buildings and Building Renovations
The design information manual should include standards for space and resources required for recycling and waste management in new buildings and renovations across all campuses.

2.5 Deciduous Tree Planting Policy
Trees need to be planted on lawns outside of all South-facing buildings to provide summer cooling and allow the winter sun to enter the building.

2.6 Replace Grassy Areas with Perennial Shrubs, Trees, and Wildflower Meadows
The design information manual should include the use of perennial shrubs, trees, and wildflower meadows to reduce fertilizer input, mowing expenses, and air pollution.

2.7 Low-Flow Shower Heads
Install low-flow showerheads in all campus showers to reduce water usage.

2.8 Double Door Delay
In buildings with double doors, delay the opening of the outer door until the inner door has completely closed. This will deter people from using these entrances unless they truly need to.

2.9 Energy Efficient Roofing
Green (vegetated) and white roofs should be considered for every new and roof replacement project. Painting roofs white -White roofs allow the sun to reflect off of the roof, thus lowering air conditioning and energy costs; Green roofs can reduce the heating and cooling a building requires, reduce stormwater runoff, create a carbon sink, and also be an accessible area for students to "be with nature."

Research, Analysis, and Feasibility Studies

2.10 Electricity Card System
Install card reader systems in residential halls, in which students' Mason ID cards are inserted to activate electricity in individual rooms. When students leave the door room, the card is removed and all electricity in the room is shut off. This eliminates excess electricity being used when the student is absent.

Projects for Future Consideration

2.11 Bulb Socket Audit
Perform audits on all buildings on campus to identify and remove unneeded light bulb sockets.

2.12 Hot water recycling
As used in hotels, system allows for instant hot water so that taps/showers are not run until they produce hot water

2.13 Grey Water Reclamation
Research the possibility of grey water reclamation systems in new building to conserve

energy used to pump water. Grey water from sinks, showers, etc. is then used in toilets rather than sent directly into outbound treatment lines.

2.14 Solar Water Heaters

Install buildings with rooftop solar water heaters to reduce the amount of energy used to heat water for use in residence halls or other high hot-water-use buildings, like athletic facilities.

Expected Outputs

- Revised GMU Design Information Manual: Necessary text devised and incorporated into the university's official design information manual to supplement or replace existing policy.
- Schedule of Pilot Tests for New Concepts: Once policies are in place, implementation of programs such as rainwater catchment, deciduous tree planting, and so forth move forward.

3 DEVELOP RENEWABLE GENERATION STRATEGIES

The only way for Mason to become climate neutral is to actively engage in strategies to develop its own sources of renewable energy. This includes examining creative options like power purchase agreements, direct purchase and installation of equipment, partnerships with investors in construction of new sources of renewable energy, and funding faculty and student research in to innovative strategies for renewable energy.

Objectives and Indicators

- 10% of all electricity being consumed is from renewable sources, regardless of the mechanism, by 2014.

Recommended Projects and Policies for 2010/2011 CAP Cycle

Policies

3.1 Non-Coal Based Energy Commitment Policy

Commit to supporting the research of non-coal based energy alternatives through small grant funding of faculty and student research.

Research, Analysis, and Feasibility Studies

3.2 Assess feasibility of Vegawatt for use in CHCP or Southside Dining

Determine whether Vegawatt product is feasible for reducing natural gas used for water heating and for power generation using waste fryer oil from campus food operations. (University Services – Mason Dining, Facilities Management – CHCP)

3.3 Sun / Wind Availability

Determine whether Fairfax campus has appropriate sun exposure and yearly average wind to make energy generation feasible.

3.4 Infrastructure Assessment for Solar Panels and/or Rooftop Turbines

Determine whether roofs at Fairfax campus can support (size, weight, orientation) solar panels and/or wind turbines. Determine whether there is appropriate open-space to site a wind turbine.

3.5 Assess Feasibility of Solar or Wind Power Purchase Agreements
Research cost and construction timelines for potential solar / wind technology providers. Write Request for Proposal if feasible, and implement as soon as possible.

3.6 Assess grant funding availability
Research federal, state, non-governmental sources of funding for pilot projects for renewable technologies.

Expected Outputs

- Renewable Energy Feasibility Assessment: All potential solutions have been assessed for feasibility and written up for the next CAP cycle.

4 DEVELOP TRANSPORTATION EMISSIONS REDUCTION STRATEGIES

Greenhouse gas emissions by vehicles contribute about 40% of Mason's total emissions. These vehicles include commuters (student, staff, and faculty), university-owned fleet vehicles (landscaping, vehicle pool), and shuttle buses. These projects will include measures to reduce vehicle-produced greenhouse gas emissions by: phasing out University-operated, fossil-fuel based vehicles; implementing incentives for alternative transportation / commuting methods; and implementing methods to reduce student, staff, and faculty commuting. Most of these projects will be owned by the Office of Parking and Transportation. Where they are not owned by that office, or other departments/offices are assisting, they will be noted in parentheses after the project description.

Objectives and Indicators

- Percentage of Mason community commuting to Mason campuses in single-occupancy vehicles declines by 5% by 2014.
- Percentage of Mason community requesting commuter choice benefits increases by 5% by 2014.

Recommended Projects and Policies for 2010/2011 CAP Cycle

Policies

4.1 University-wide Carpooling
Develop carpooling program and incentives.

4.2 Carpooling Policy for Fleet Vehicles
Policy statement that every effort is made to share rides to common destination with state vehicles.

4.3 Promote Faculty and Staff Telecommuting
Develop / codify policies for telecommuting. (staff)- (Policy) Exclusive Use of Alternative Fuel for Shuttles: Develop / codify policies for alternative fuel use

(including hybrids) in shuttles.

4.4 Energy-Efficient Fleet Replacement
Develop fleet replacement plan for vehicles and pool vehicles to replace conventionally (fossil fuel) powered with electric, hybrid, or alternative fuel (including PHEV).

4.5 Advance Bike-Share Program
Create a bike share, donation, and repair program.

4.6 Bike Path Improvements
Policy enacted to ensure that all new roads constructed on campus will include an internal bike lane/path.

4.7 Annual Transportation Survey
Conduct an annual / bi-annual transportation survey (audit) of Mason population focused on carpooling (as part of Transportation Survey.)

4.8 Implement Car-Sharing Program
Research feasibility, logistics, and implementation of a car-sharing program at Fairfax campus (potentially including shuttles to car-sharing locations for residential students). (http://gazette.gmu.edu/articles/10156)

4.9 Increase Technology-Based Distance Education
Create a GMU-hosted, on-line video service for students and teachers to attend / teach from off-campus.

4.10 Increase Biking To-From Campus
Develop and implement biking incentives (e.g., residence hall bike enclosure (covered, secure), more showers, improved path lighting, bike share program, bike donations, and financial incentives for not introducing a car to campus.)

4.11 Increase Carpooling through Web-based Network
Facilitate carpooling information exchange through a social networking website.

4.12 Parking Permit Carbon Surcharge
Charge an additional fee to offset the emissions resulting from the average Mason commuter, based on commuter type (student, staff, faculty). Carbonfund.org provides a calculator to calculate the emissions of a precise make and model of automobile, which would enable the parking office to calculate the emissions reduction for a specific vehicle type. A relationship with a reputable carbon offset vendor would need to be established. Analysis needed to determine whether this fee would also act as a disincentive for commuting to campus.

Research, Analysis, and Feasibility Studies

4.13 Increase Distance Education and Telecommuting Opportunities
Conduct research (and specifically a faculty survey) in order to assess potential emissions reduction from telecommuting or virtualization technologies. Should be led

by Associate Provost for Distance Education to ensure research supports evolving efforts in that office already underway.

4.14 Assess Potential for Biodiesel in Fairfax
Research the potential local partners who would be able to use biodiesel in trucks, such as Fairfax County/City, VDOT, etc to encourage biodiesel distributors to ship larger quantities to this region. Research distributors. Develop written agreement or letter with local partners for distribution to distributors soliciting their fuel. (Facilities – Fleet, Office of Sustainability)

Projects for Future Consideration

4.15 Increase Frequency/Participation in Virtual Meetings
Develop / codify policies / goals / objectives for virtual meetings (staff.) (Policy)

4.16 Assess Potential for Alternative Power for Landscaping Equipment
Research alternative options for gas and diesel powered landscaping equipment. - (Research)

4.17 Diesel Idling Emissions-Audit
Conduct Research project to determine diesel idling emissions from shuttles stop / start vs. continuous operation.

4.18 Commuter Incentive Card to Increase Alternate Transportation
Develop an incentive program (through a commuter card) that will provide Mason members benefits when using alternate modes of transportation.

Expected Outputs

- Faculty/Staff Carpool Program Launched
- Transportation surveys complete: conducted and completed by early 2010 and 2011. Results compared to 2011 survey to measure GHG emission changes. Survey conducted on a yearly cycle.
- Research/Analysis projects assigned to appropriate units at the university to assess feasibility and implementation strategies/timelines and allocation of resources.
- Once policies are put in place, implementation of programs such as bike-sharing, car-sharing, and so forth move forward.

5 DEVELOP WASTE MINIMIZATION AND RECYCLING STRATEGY

Recycling and waste management play an essential part in the emissions strategy of any university. The recycling and waste management program at Mason is a functional program (at approximately 19% of solid waste recycled), but there is room for improvement. Because Mason's waste is sent to the Lorton Waste-to-Energy Facility in Springfield, VA, fewer emissions result from our waste stream than if the waste was landfilled. However, Mason pays for every ton of waste hauled away without gaining direct benefit of using the energy

generated from this waste stream. Money used for trash hauling could be used to fund climate reduction initiatives. Therefore, shifting waste from trash to recycling has the potential for generating a funding stream and for reducing harmful emissions generated through the combustion of the waste.

Objectives and Indicators

- Recycling Rate Increased to 25% by 2014.

Recommended Projects and Policies for 2010/2011 CAP Cycle

Policies

5.1 Implement Campus-Wide Standards for Recycling Collection
Bin placement, directional and educational signs, and bin styles should be standardized across campus to ensure recognition and compliance. Free "RE3" campaign materials should be integrated in to these process improvements. (Office of Recycling and Waste Management, Office of Sustainability)

5.2 Campus Composting
Currently pulped and dehydrated food waste on campus needs to be composted through a partnership between Mason Dining, Grounds, and other campus entities. Currently, there is a large pilot project in place at the main campus dining hall that assists with the reduction of waste. A process regarding composting this waste should be developed and the compost should be utilized in campus grounds and gardens (also see category 9, Develop Offset Strategies). (University Services - Mason Dining, Office of Sustainability)

5.3 Encourage Purchasing to Require Minimal Packaging Policy
To contribute to waste minimization, publish a purchasing policy that encourages purchase of products requiring minimal disposable packaging. (Purchasing and Accounts Payable Department)

Research, Analysis, and Feasibility Studies

5.4 Plastic bag reduction strategy
As part of a waste minimization strategy, determine the feasibility of eliminating plastic bags on the Fairfax campus or charging for their use. University Administration has been, and will continue to, examine options to replace plastic bags with biodegradable and reusable bags across all contracts under their control. (University Services – Mason Dining)

Projects for Future Consideration

5.5 Reduction or Elimination of Bottled Water
Mason's convenience stores and vending machines should reduce the number of bottled waters sold. Water is abundantly available through the tap system at each of Mason's campuses. Water bottles contribute to emissions from drilling (plastic is made from petroleum) to production to incineration/disposal. Examining the potential for reducing

water bottle usage on campus, including vending, catering, and convenience stores or restaurants. The preliminary goal is a per-capita 5% reduction within 2 years' time.

Expected Outputs

- University-Wide Standards for Recycling Implemented: All Mason buildings will use standard procedures, signage, and bins to encourage recognition of recycling and increase recycling rates to 25% from the current 19%.

6A DEVELOP A SUSTAINABILITY AND CLIMATE COMMUNICATIONS AND EDUCATION STRATEGY

The Climate Action Plan Education and Outreach Campaign will educate the majority of the Mason community on the goal of the Climate Action Plan and the projects it describes. The campaign will assist the university in becoming climate neutral and radically transform Mason's physical operations as well its overall zeitgeist- at the end of the first year of the campaign, climate change and Mason's commitment to climate neutrality will be a priority to the majority of the Mason community. Through persistent outreach efforts as laid out in "A Communication Plan in Support of Mason's Climate Commitment" and other documents, this campaign will play an integral role in Mason becoming climate neutral. This campaign will be developed around a core message (or "story").

There are multiple references that discuss both climate change communication strategies and campaigns and approaches to institute projects that will change behavior and educate a campus audience. The book Fostering Sustainable Behavior by Doug Mackenzie-Mohr was one of the primary sources that we used. It provides a wide range of example methods, strategies, and projects to institute a behavioral shift among target audiences. Our overall climate education and outreach campaign attempts to incorporate these and tailor them for a campus audience.

Mason's *Climate Action Plan Education and Outreach Campaign* will educate the majority of the Mason community on the goals of our Climate Action Plan and the projects it describes, as well as institute efforts to change culture on campus. We hope to instigate a university-wide cultural shift towards more sustainable behavior by:

- implementing consistent messaging
- using face-to-face, peer-to-peer communications methods
- providing specific, individual actions
- using multiple media for information distribution
- providing audience-specific stories
- Additionally, many of our technical projects require education components for the correct operation of new equipment; these projects are mentioned in the Education and Outreach Campaign Plan are described in more detail in their respective projects, and will be a continuing part of the education and outreach effort.

The goals of Mason's *Climate Action Plan Education and Outreach Campaign* are:

- Inspire changes in the university community's personal behavior and habits that reduce GHG emissions;
- Create a meaningful education and communication campaign to promote communication between the Office of Sustainability and the rest of the university and instill a sense of collective responsibility in reducing emissions;
- Teach faculty, staff, and students how to be sustainable at Mason;
- Engage / leverage the research power of undergraduates and graduates – Provide range of sustainability topics that need further research in order to encourage and leverage student body projects.

Objectives and Indicators

- At least 90% of the Mason community will become aware that Mason has committed to becoming "climate neutral" by December 2010.
- At least 70% of the Mason community will have at least basic knowledge of the major actions (current and planned) that Mason will take (e.g., all new buildings will be green) by December 2010.
- At least 70% of the university community will be able to name at least three important ways they are, or could be, contributing to the goal by May 2011.
- At least 50% of the Mason community will have signed the Mason Climate Commitment by May 2011.
- At least 70% of the Mason community will feel a sense of pride in- and collective responsibility for- the goal, and eventually will feel a sense of collective accomplishment as progress is made toward the goal by May 2011.

By focusing on these goals, engaging the multitude of stakeholders, and enlisting students and staff through the Climate Champions and Green Representatives programs, we will begin the process of implementing a culture of sustainability actions and behaviors at Mason.

Projects and Policies for 2010/2011 CAP Cycle

Projects in this category do not fit in to the three categories of other projects, because they support projects in other categories. Projects for this CAP cycle are:

6.1 Climate tip-of-the-week

A series of weekly 'tips' on how to reduce an individual's carbon emissions will be distributed to targeted segments of the Mason community, i.e. faculty and staff, resident students, and non-resident students. The tips will be sent out via electronic mail and reinforced by prompts placed strategically around campus.

6.2 Energy efficiency training / education

The Office of Sustainability, in conjunction with other relevant departments and offices at Mason, will develop and implement energy efficiency educational programs for the Mason community. These programs will give people the knowledge and skills they need to reduce their energy consumption by applying simple energy efficiency measures. After completing the program, participants will be expected to share what they learn with their peers at Mason.

6.3 Cross-linking to other university websites

In order to learn from and share best practices with other universities committed to climate neutrality, Mason's Office of Sustainability's website will include links to the website of sustainability offices at other institutions. In additional to the educational component of this tactic, being able to easily access information regarding other schools' climate efforts should serve to spur increased climate action among members of the Mason community.

6.4 Statement of sustainability on syllabi

All syllabi will include a statement outlining Mason's climate commitment. The statement will include information about the importance of the commitment as well contact information for the Office of Sustainability.

6.5 Transportation events

In order to reduce the climate emissions associated with vehicular travel, events showcasing alternative modes of transportation with reduced climate impact will be organized. The events will be planned by the Office of Sustainability in conjunction with the Office of Parking and Transportation as well as other interested departments.

6.6 Green Reps (Faculty/Staff & Student)

The faculty and staff Green Representatives Program, or Green Reps, will serve as an extension of the Office of Sustainability. Participating faculty and staff members will engage their peers in Mason's commitment to climate neutrality and sustainability. The Green Reps program will serve to ensure that the entire Mason community "buys into" Mason's climate commitment. They will assist the Office of Sustainability in disseminating educational information and/or processes throughout all of Mason's campuses in a consistent and predictable manner.

6.7 Educational Signage

Signs, flyers, posters, and other promotional outlets will be utilized to educate the Mason community about the school's climate commitment. They will also be used to reinforce the "Climate tip-of-the-week" and other relevant messages.

6.8 Orientation Packages

All new employees and students of Mason will be made aware of Mason's climate commitment during their initial orientation. They will receive specific information on how to maintain a low 'carbon footprint' while at Mason and contact information for the Office of Sustainability.

6.9 Mason Climate Action Team

A team of five to ten students will be employed by the Office of Sustainability to assist in the Mason Climate Education and Outreach Campaign. The students will be responsible work necessary to make the campaign successful. Their duties will include, organizing events, collecting climate pledges, and creating educational and promotional materials.

6.10 Double Sided Printing Education

Implement educational program at PC labs to educate users on double-sided printing. Institute incentive of a lower cost per impression for people who double-sided print. (University Administration) Devise an educational message and policy statement that can be distributed to all departments assisting individuals with setting up double-sided printing. ITU desktop support may provide support for anyone who is having trouble. (Information Technology Unit, University Services – Print Services)

Expected Outputs

Some of the key projects that we plan to implement over the next 2 years include:

- Recruit and institute a Mason Climate Action Team (MasonCAT) through a combination of internships (for credit and paid), service-learning students, and volunteers (the Climate Action Team and internship descriptions are provided as appendices);
- Create student, staff, and faculty Green Rep programs;
- Continue the *Climate Champions* program (that was started in 2008);
- Testimonial and showcase videos to provide tangible examples of existing activities or potential actions;
- Distributing information packets to residents and new students through the existing orientation program;
- Developing signage to promulgate informational messages as well as instructions on how to use new equipment (e.g., appropriate use of high efficiency washers and dryers); and
- Develop and hold a series of Sustainability Town Halls and Climate Education sessions targeted at students, staff, and faculty.

6B ENHANCE COMMUNITY INTERACTION and OUTREACH

Mason is a huge economic contributor to its surrounding communities. The sustainability of the regions in which Mason's campuses reside is impacted by the activities taking place on these campuses, and it up to Mason to decide whether this is going to be positive or negative impact. Working with local communities as partners in sustainability is critical to all local citizens. Therefore, community outreach and partnerships are critical to Mason's ability to be sustainable and to encourage sustainability in our communities and local governments. Public commitment and ongoing engagement on these issues is essential not only with the Office of Sustainability but through all departments across the university.

Objectives and Indicators

- Each Mason campus meets the GHG emissions targets and timelines of the jurisdictions in which it resides.
- Mason is recognized as a leader, partner and resource for regional climate change planning and implementation at the community and local level.
- Mason collaborates with Fairfax County to realize at least 1 demonstration of University-locality partnership in climate action education and outreach to the community surrounding the University's largest campus.

Projects and Policies for 2010/2011 CAP Cycle

Projects in this category do not fit in to the three categories of other projects, because they support projects in other categories. Projects for this CAP cycle are:

6.11 Publish Multi-Point University Policy Statement in Support of EO82, Climate, and Sustainability

Three Governor's Executive Orders have been executed within the last 5 years in Virginia: 48, 52, and most recently, 82. In addition, the university has not publicly stated its specific commitments to climate neutrality and sustainability with any clarity. In conjunction with the release of this CAP, it is recommended that the President release a statement similar to that recently released by Virginia Tech Board of Visitors in June 2009.[xxi] A policy statement should be developed in support of climate and sustainability initiatives as agreed upon in this climate action plan, as per Governor Executive Orders EO 48, 52, and 82, and as per the University's Sustainability Strategy. (University Executive Steering Committee on Sustainability, University Relations, Office of Sustainability, Office of the President)

6.12 Organizational interaction / engagement

As available (and mostly ad hoc), engage (continue to engage) local, regional, and state stakeholders in Virginia to advertise Mason's climate commitment, on-campus projects, and provide substantive input to state, regional, and local policies / projects. Engage with local infrastructure decision makers to discuss long-term improvements to non-auto transportation (e.g., pedestrian safety issues).

Expected Outputs

- Multi-point presidential policy statement in support of climate and sustainability is written and published.
- Mason is engaged with, and informed about, all local and regional climate commitments and strategies.

7 DEVELOP FUNDING STRATEGIES FOR DEDICATED CLIMATE ACTION AND SUSTAINABILITY

This project would provide the essential funding for sustainability projects on campus. This project is imperative because it would lead to increased funding, which would enable many projects that currently lack funding to happen. Currently it is hard to find money to allocate to a project due to the poor economic climate and budget cuts. Even in the future, when the economy gets better or worse, there will still always be difficulties in securing funding for every project that gets proposed. A funding strategy would help to establish a source of funding, which would allow more projects to be implemented, and could extend the lives of projects indefinitely.

Objectives and Indicators

[xxi] see: http://www.vtnews.vt.edu/story.php?relyear=2009&itemno=469

- None for this category in this CAP cycle. Future cycles may have dollar goals for each fund type.

Recommended Projects and Policies for 2010/2011 CAP Cycle

Policies

7.1 Create Revolving Loan Fund.
New money should be made available to the university community through the use of a revolving loan fund. This will manage capital raised through innovative trading and investment schemes like demand management programs, recycling revenues, and other resource-saving projects. Projects only with a payback should be funded with this fund. (Office of Budget and Planning and Budget and Planning Team, Office of Sustainability)

7.2 Promote Sustainability Fund in Mason Foundation.
Several targeted campaigns should be developed with the Development Office to draw attention and funding to the Sustainability Fund. This fund may be leveraged for projects that either have an extended payback period, or have a high non-market value to the university. (University Development Office, Office of Sustainability)

7.3 Promote Sustainability Scholarship Endowment in Mason Foundation.
New sustainability scholarship endowment fund should be promoted as above. Students receiving this scholarship should be encouraged or required to provide research in support of Mason's commitment to climate neutrality and/or sustainability by executing research projects as defined in the CAP. (University Development Office, Office of Sustainability)

7.4 Create a student green fee through referendum and leadership of the student Environmental Action Group.
The student Environmental Action Group at Mason is currently engaged in the promotion of a student green fee, leading to a referendum. This fee would support the student-approved sustainability and climate goals of graduating student classes, enabling each class to leave a permanent green mark on the Mason campuses. (Environmental Action Group, Office of Sustainability)

7.5 Create Annual Research Assistant and Internship Fund
Research and feasibility assessments are often the most difficult for staff to find time to work on. Allocating annual funding for a vibrant research assistant and internship program is critical to move our strategy forward. It should include both undergraduate and graduate students. The Office of Sustainability can work with academic departments to publicize for-credit internships, but there should also be approximately 10 projects funded per each 2-year CAP cycle, or five per year. The OoS will also develop an outreach program to ensure new research needs are identified and collected for future research funding. The Sustainability Academic Council may also play a central role in this project. (Office of Sustainability, Office of Budget and Planning,

Budget and Planning Team, Academic Departments, Sustainability Academic Council)

Expected Outputs

- Mechanism for revolving loan fund has been created.
- Fundraising Campaign: One fundraising campaign has been executed by the Development Office and Office of Sustainability.

8 INTEGRATE CLIMATE AND SUSTAINABILITY GOALS IN TO MASTER PLANNING PROCESS

Mason updates its Master Plan approximately every five years. This Master Plan includes strategic vision for the intended development of buildings and open space across all campuses. Mason has recently begun a related Utility Master Planning process, which provides a strategic vision of utility upgrades that must be pursued to support Mason's Master Plan. In regards Master Planning, there are no quantifiable projects being recommended, but recommendations that university resources should be allocated to consider related master planning processes and policies.

Objectives and Indicators

- None possible for this category.

Recommended Projects and Policies for 2010/2011 CAP Cycle

Policies

8.1 Utility Master Planning Policy
Develop policy statement for including energy efficiency as one of the main goals for the utility master planning process, and include the long-term planning of renewable energy sources in the Utility Master Planning process.

8.2 Green Space and Forest Retention Policy Statement
Develop a policy statement to retain or replace green and open space in the university Master Plan.

8.2.1. If current green space must be developed, an equal square footage must be replaced to retain green space (could be on rooftops, as well).

8.2.2. If university-owned forested land is to be developed, an equal number of new trees must be planned and planted, or retained, across all campuses.

8.2.3. Develop land preservation areas: Policy and processes should be developed to work with faculty using exterior space as classroom space to identify

8.3 Zero Net Energy Building
Incorporate into the Master Plan the building of a zero net energy building to include an additional fundraising effort in partnership with the George Mason Foundation if necessary. This will provide an opportunity for education, leadership, and energy efficiency (i.e., one of the new buildings already planned should serve as a pilot building that has a net zero emission output).

8.4 Funds for Inventories of Natural Resources

Allocate funds for an inventory of all natural resources on all campuses to support leverage concepts of Smart Growth and Urban Ecology.

8.5 Develop density and zoning for all campuses

The University, as a part of its master plan, will designate zoning density on a per capita basis for the various sectors and zones of each of the campuses. This zoning will drive to maximize land use at the campus cores, while preserving more open space at the fringes. Zoning also needs to include designations for surface and/or structured parking permissibility in each zone and inter-modality requirements for pedestrian and other traffic, as well as required buffer zones between surface features. This project/policy will tie-in closely with the "Green Space and Forest Retention Policy".

8.6 Hire a Full-Time Forester

The Mason Forester would manage existing forests, create maps of forest resources on campuses, identify high-value species, and re-forest or change forest mixes to be higher value. Save the Arlington Campus, George Mason University has been and retains the character of a "University in the Woods". Good stewardship of the native forestry within the University requires intentional and well throught through forest management practices that not only tie-into ongoing development, but also the ongoing maintenance of the forest land that the University owns. To this end, a comprehensive forestry program I required for the University that includes the hiring of a staff forester to plan, assess, maintain, and periodically harvest the timber on the campus in order to keep healthy, safe, and sustainable forests for years to come.

8.7 Identify 5 Building Renovations for which LEED for Existing Buildings can be Executed

Renovations are a critical opportunity to improve the efficiency of Mason's aging buildings to reap far more energy saving opportunities than on building new buildings. It is therefore critical to identify buildings of the greatest opportunity for improvement for execution by 2020.

Expected Outputs

- Natural resource inventory budget has been set and approved.
- Facilities has engaged the appropriate departments and agencies to begin planning for a net zero energy building.

- Facilities Planning and the Energy Management Office have identified 5 buildings of the highest value to renovate to LEED Existing Building standards.

9 DEVELOP OFFSET STRATEGIES

The issue of purchasing renewable energy certificates (RECs) and carbon offsets has been debated with vigor in many circles of sustainability in higher education. In most cases, RECs and offsets are a short-term strategy to leverage while in search of opportunities to generate renewable energy. However, the lack of direct control the university has over the use of automobiles at what is still a commuter university creates a dilemma that may only be solved by

either requiring or recommending the purchase of offsets along with a parking pass. Therefore, offsets may be the only practical way to reduce Mason's emissions for commuting.

Recommended Projects and Policies for 2010/2011 CAP Cycle

Quantifiable Projects

9.1 Campus Composting
Implement on-site composting for campus dining facility, Southside. In FY10, this will be a pilot project to demonstrate the waste and emissions reduction in anticipation of establishing on-site composting at other areas of the Fairfax campus (see 5.2).

9.2 Renewable Energy Certificates (RECs)
Evaluate REC costs and providers. Determine feasibility of integrating RECs into Master Plan (build-out strategy) to offset future, fossil fuel-based electricity requirements.

9.3 Voluntary offset purchase: Resident Student pilot
Determine impact of offsetting residential student electricity usage. Conduct survey of resident students to determine whether they would be willing to pay a minimal fee to offset their electricity usage. Determine barriers to implementation of this project (e.g., do students want/need to know *who* is providing RECs?).

9.4 Voluntary offset purchase: Parking pass pilot
Determine impact of including offset option on parking pass purchases (how much are emissions reduced?) Determine feasibility of basing cost of offset on commute distance (e.g., are individuals willing to pay more if they commute farther?). Determine barriers to implementation of this project (e.g., do individuals want/need to know who is providing the offsets?).

Alternatively, as a pilot project, add offset purchase option to parking pass application based on commute distance (e.g., increasing costs in following bounds: <5 miles, 5-10 miles, 10-20 miles, and > 20 miles). Evaluate how many people selected the option and whether the option they selected was tied to the distance of their registered address from campus.

Research, Analysis, and Feasibility Studies

9.5 Research Ability to Use Forest Resources as Offsets
While most strategies for offsets has focused on sequestering or otherwise mitigating the release of GHG emissions, accounting for the ability for forests and other biological processes to "offset" and contain such emissions is not well understood or easily quantifiable. To this end research must be considered to determine the quantity of GHG emissions (in measures of MTCDE or similar) that are captured and rendered helpful (returned to O2 or other non-harmful gases) per area of forest (in measures of hectares or similar). Such research will enable a way to quantify an appropriate balance of forestation against emissions for future generations, fostering an increase of forest restoration and preservation over time if appropriate measures are enacted.

Expected Outputs

- REC purchases have been executed.

Following is a table summarizing the options and costs associated with each potential carbon offset approach.

Offset Type	Description	Potential Metric Tons Reduced/Yr	Cost/ $MTeCO_2$ Reduced	Total Cost Based on 2009 Numbers
On-site composting	On-site disposition of approximately 50% of campus food waste through pulping, dehydration, and final compost production	44 MT per year[xxii]	Uncertain	Likely higher than any other source of reduction; need more cost research
Renewable Energy Credits	Only allowed to be used to offset electricity usage	50,927		
Estimate #1	Approximately $175,188/year to offset 100% of all electricity usage		$0.0018-$0.0023/kWh, or about $3.44/MT	15% offset ~$26,000/yr
Estimate #2	Approximately $127,318/year at low end to offset 100% of all electricity usage		$2.50-$7.25/MT	15% offset Low: $19,100 High: $55,383
Voluntary offset purchase: Resident Student pilot	Opportunity for students to purchase annual offsets for the school year will be offered on the websites of Housing and Sustainability. Of ~5000 resident students, goal of recruiting about 20% of all resident students at ~ 6 MT per student for $36/year	6,000	$6/$MTeCO_2$	No direct cost to Mason; could "subsidize" some portion to encourage students to participate; 100% subsidy = $36,000
Voluntary offset purchase: Parking pass pilot	Opportunity for commuters to eliminate their driving-related emissions through partnership with reputable offset	43,959	$8-10/$MTeCO_2$	No direct cost to Mason; could "subsidize" some portion to encourage

[xxii] 44 MT of emissions would be avoided if all of the campus food waste was composted, which is expected to occur within the next 3 years.

	provider; analysis should lead to potential requirement of fee added during parking pass purchase			drivers to participate; 100% subsidy up to $440,000 per year

Appendix C: Summary of Emissions Projections and Goals

Year	Projected Emissions (MTCDE)	Net GHG Emissions Goal (MTCDE)	Difference Between Projected and Goal (MTCDE)	Emissions per 1,000 Square Feet (MTCDE)	Emissions per FTE Student (MTCDE)	% of Purchased Electricity "Greened"
2010	120,000	103,753	16,000	19.4	4.5	0%
2011	127,000	103,753	24,000	19.0	4.4	5%
2012	130,000	103,753	26,000	18.6	4.3	10%
2013	132,000	103,753	28,000	18.2	4.2	10%
2014	135,000	103,753	31,000	17.9	4.1	15%
2020*	137,000	80,000	57,000	10	2.3	50%
2030*	139,000	60,000	79,000	10	2.3	100%
2050**	150,000	20,000	130,000	2.5	0.5	100%

* These are linear reduction estimates, and just general guidelines for Mason's progress. They will be updated every year as progress is estimated.
** This is an 80% reduction in 2006 net GHG emissions.

The graph below illustrates the reductions in emissions resulting from various projects and each phase of purchased RECs as offsets. Each colored block represents a different level from the chart above. With 50% of purchased electricity offset using RECs, Mason's emissions stay stable at 2006 emissions levels. This would cost approximately $65,000 per year.