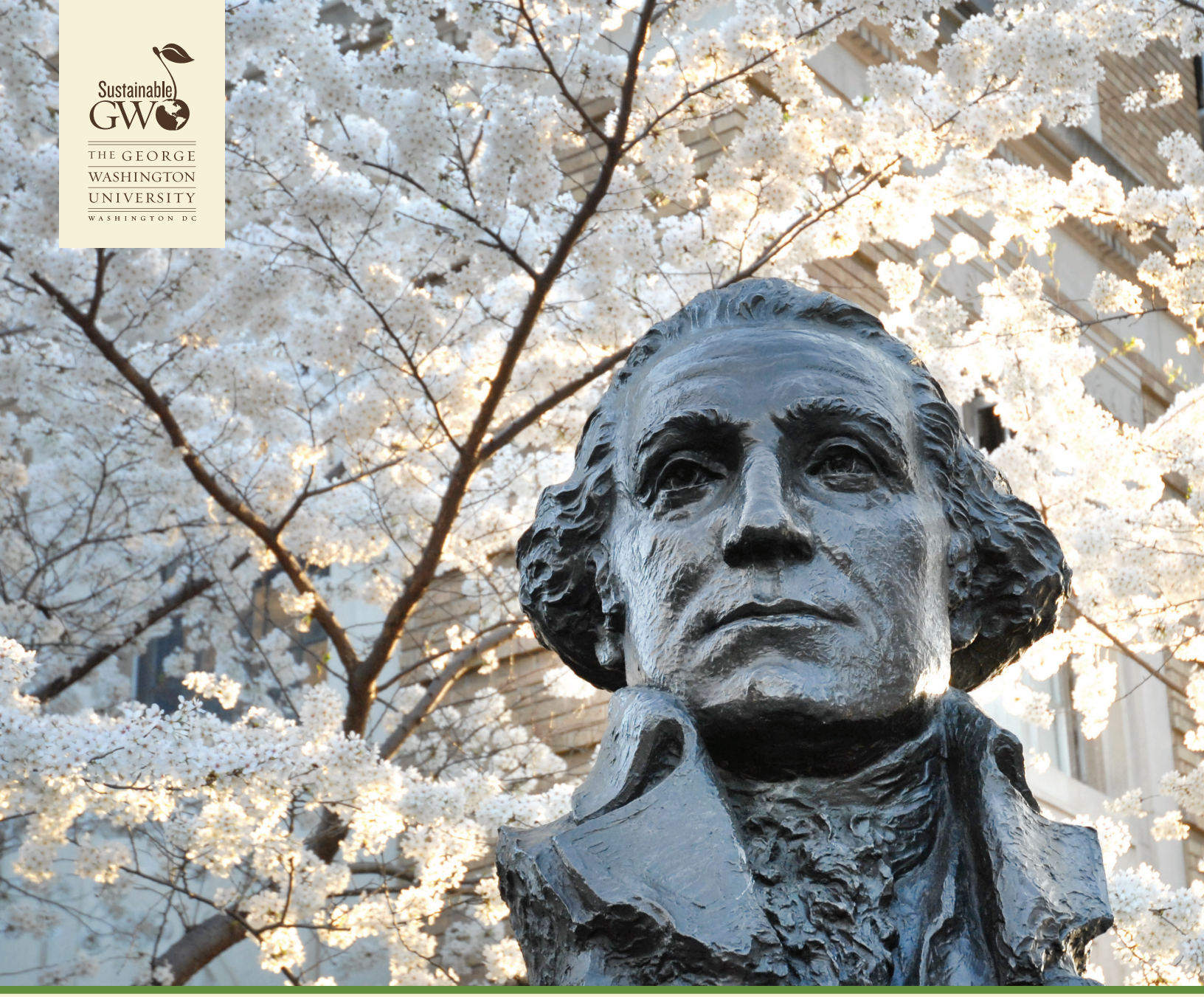
Sustainable GW

THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON DC



CLIMATE ACTION PLAN | MAY 2010

The George Washington University
Climate Action Plan

May 15, 2010

To provide feedback or comments on this document, please refer to the GW Idea Garden:
www.sustainability.gwu.edu/ideagarden

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The George Washington University's Sustainability Vision and Mission

The university envisions a future with resource systems that are healthy and thriving for all. In an effort to enhance its campus, the nation's capital, and the world at large, GW is building a greener campus, providing research and intellectual discourse on policies and pathways to sustainable systems and equipping students with skills and knowledge to contribute to a sustainable future.

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EXECUTIVE SUMMARY

BACKGROUND

As an institution of higher education, The George Washington University (GW) takes its responsibility to help solve national and global problems seriously. Recognizing this duty, GW became the first university in the Washington, D.C., area to join the American College and University Presidents' Climate Commitment (ACUPCC) in 2008 with the signature of GW's 16th president, Steven Knapp. The university, along with more than 660 other higher education institutions, committed to develop a Climate Action Plan for carbon neutrality and to spotlight and support its academic endeavors on climate issues.

GW targets neutrality in 2040 and a 40 percent reduction across all scopes by 2025

GW SUSTAINABILITY

The Climate Action Plan is part of GW's broad sustainability vision. The university envisions a future with healthy and thriving resource systems for all. In an effort to enhance its campus, the nation's capital, and the world at large, GW is building a greener campus, providing research and intellectual discourse on policies and pathways to sustainable systems and equipping students with skills and knowledge to contribute to a sustainable future. As a first step, GW tackled the Climate Action Plan and, in the future, will extend the focus to its other strategic priorities including water conservation and ecosystem enhancement.

GW CLIMATE CHANGE STRATEGY

The Climate Action Plan addresses climate change through the design, management and use of GW's campuses and transportation options, as well as through education and research, where the university has an even broader reach.

The university's commitment to carbon neutrality is the cornerstone of its climate change strategy. It aims to reach its target for carbon neutrality across all scopes of emissions by FY 2040 by reducing its emissions through efficiencies and cleaner energy sources by at least 80 percent, and using credible, local offsets to negate the remaining emissions. As a first milestone, GW is working toward a 40 percent reduction across all scopes of emissions by 2025. This plan summarizes the directional strategy GW will follow to achieve carbon neutrality in 2040; specific projects within each strategy may change. The university aspires to achieve climate neutrality earlier, and starting in 2012, it will periodically revise the CAP to reflect changes in technology, policy and markets.

The university's approach to carbon neutrality simultaneously focuses on:

1. **Reducing** the production of greenhouse gas (GHG) emissions through more efficient operations and transportation
2. Improving the sources of energy it uses through **innovation**
3. Developing **partnerships** to find solutions to our common climate challenges

1. **Reduce—**Energy use in existing buildings comprises 80 percent of the university's GHG emissions. Transportation (commuting and air travel) also significantly contributes to GW's carbon footprint. The university plans to improve building energy efficiency and enhance IT systems that will result in energy use reductions. The Climate Action Plan also explores options to reduce the carbon footprint from transportation. For its relatively small campus fleet, GW plans to deploy vehicles more efficiently and with less carbon-intensive fuels.

2. **Innovate—**The Climate Action Plan outlines the university's intent to use its campuses as test beds for green energy technologies and to integrate their performance into learning and research opportunities for students and faculty, as appropriate. By 2025, GW hopes to use on-site low-carbon energy technologies to reduce at least 1,000 metric tons of carbon dioxide equivalents (MTCO2e) of GHG emissions. Then, by 2040, the university aims to produce 10 percent of its energy from on-site low-carbon technologies.

3. **Partner—**The university will forge partnerships with policymakers, utility providers and other institutions to generate dialogue and seek solutions to the dilemma of sourcing cleaner energy that feeds the grid. The university relies on utility providers for electricity, and thus is bound to the carbon footprint of their electricity fuel mix. If the mix of fuel sources becomes less carbon intensive, this will significantly impact GW's GHG emissions. The university will also work with partners to identify and invest in credible, local offsets to reach neutrality.

In addition to reaching carbon neutrality, the Climate Action Plan outlines tactics for the university to provide climate change and broader sustainability curriculum and research in an interdisciplinary manner. The plan emphasizes service-learning opportunities and a focus on urban sustainability. The plan also outlines how GW can use communications resources to provide transparency, encourage community participation and celebrate progress as it reaches these goals.

FINANCING AND NEXT STEPS

To reach carbon neutrality, GW will invest millions of dollars in a portfolio of efficiencies and technologies over the next 30 years. These investments will be evaluated on life-cycle costs and projected return on investment to result in significant cost savings. The university expects to finance some projects through existing budgets for new construction, major renovations, and building maintenance such as its capital project budget and its operating budget. Additionally, GW is launching the Green Campus Fund, a $2 million seed fund that will initially fund Climate Action Plan projects. The university will also evaluate and pursue a range of future funding options including grants, rebate programs, donor opportunities and financing partnerships like power purchase agreements to help fund its Climate Action Plan projects.

The Climate Action Plan not only serves as a blueprint for GW to address climate change, but also reflects the progress GW is making toward carbon neutrality. Stakeholders from across the university community and beyond have substantively contributed to this plan, and are better positioned than ever to take strides to minimize GW's carbon footprint. The Climate Action Plan's success continues to rely on collective actions from the entire community.

INTRODUCTION

SCIENCE OF CLIMATE CHANGE

Scientific research continues to emphasize that human actions, primarily the burning of fossil fuels, increases the amount of CO_2 and other greenhouse gases (GHGs) in the atmosphere. According to the Intergovernmental Panel on Climate Change (IPCC), burning fossil fuel accounts for the majority of global GHG emissions, in carbon dioxide equivalents (CO2e) (Figure 1). Additionally, burning fossil fuels is strongly linked to generating the world's energy supply (Figure 2).[1]

Research institutions such as the Pew Center on Global Climate Change link the escalation in GHGs to the global increase in temperature of 1.4°F (0.8°C) since the beginning of the 20th century.[2] The NASA Goddard Institute for Space Studies' mean temperature data illustrates this rising temperature trend, as shown in Figure 3.[3]

Scientists predict that climate change will affect the earth's natural balance causing rising sea levels, loss of glaciers and ice sheets and more extreme weather patterns. These changes will lead to droughts in some areas and flooding in others, increase in disease and a decrease in the supply of food and fresh water, affecting human populations around the world.[4] Despite these potentially severe consequences, there is still opportunity to prevent the most serious consequences of climate change by acting now to reduce GHG emissions. To support the efforts to reduce GHGs, the U.S. House of Representatives passed the American Clean Energy and Security Act in June 2009 calling for an 83 percent reduction on 2005 emission levels by 2050 for entities emitting more than 25,000 tons of GHGs/year.[5]

Share of Global Emissions, in Carbon Dioxide Equivalent, 2004

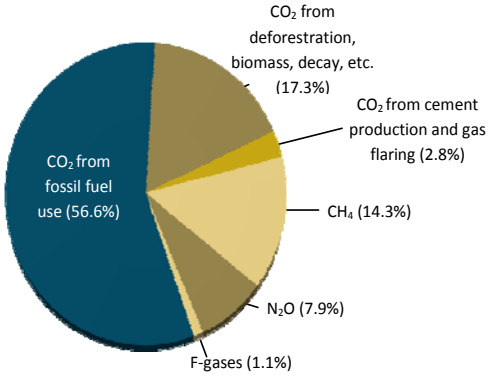


Figure 1

Emission by Sector, in Carbon Dioxide Equivalent, 2004

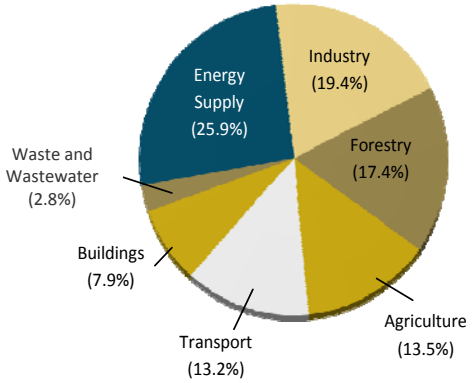


Figure 2

Yearly Mean Global Temperature

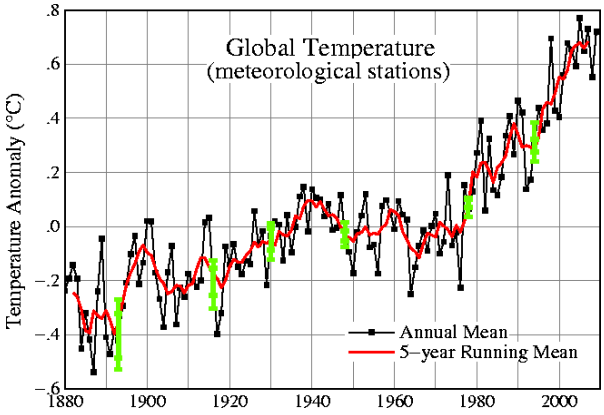


Figure 3

AMERICAN COLLEGE AND UNIVERSITY PRESIDENTS CLIMATE COMMITMENT

In 2008 GW was the first university in Washington, D.C., to join the American College and University Presidents' Climate Commitment (ACUPCC). By signing, GW joined 660 higher education institutions committed to achieving carbon neutrality as soon as feasible, integrating sustainability in their curricula and engaging with their communities on issues surrounding climate change.

Following President Knapp's signature, the university fulfilled its commitment to complete and publicly disclose its first GHG inventory and took immediate steps to reduce university emissions. GW continues to disclose its emissions annually to ensure it makes progress toward its goal of carbon neutrality. This Climate Action Plan marks the achievement of the next milestone in the university's commitment but is by no means the final stage.[6] Moving past the submission of the Climate Action Plan, the university will continue to invest in the strategies outlined in this document to ensure it meets its commitment. The university will also continue to update this Climate Action Plan periodically.

Sustainability Task Force Recommendations

1. Make an institutional commitment to sustainability
2. Create an Office of Sustainability to coordinate and lead the university in sustainability efforts
3. Expand coursework offerings related to sustainability
4. Form an interdisciplinary Sustainability Research Institute to engage students in sustainable policy research
5. Conserve energy to help the university reach climate neutrality
6. Increase campus recycling
7. Address building efficiency through LEED certification
8. Establish a purchasing protocol that supports recycled content products and energy efficient equipment
9. Partner with the community to increase sustainability awareness
10. Make information about sustainable initiatives accessible to the greater community
11. Ensure that the university meets the ACUPCC pledge to reach climate neutrality
12. Invest in sustainability efforts with university funding

CLIMATE ACTION PLAN PROCESS AND ENGAGEMENT

Steven Knapp became president of The George Washington University in August 2007. In fall 2007, President Knapp assembled the Presidential Task Force on Sustainability consisting of faculty, staff and students. The task force evaluated GW's existing initiatives and provided 12 recommendations for the university's future sustainability efforts, including the pledge to reach carbon neutrality.

The university continues to build on the foundational goals established by the task force. In addition to providing initial direction for GW's sustainability efforts and helping create the Office of Sustainability in 2008, the task force established a structure to coordinate sustainability activity across the decentralized university community. This structure provided the platform for community engagement in GW's Climate Action Plan.

In addition to involving faculty, staff and students, the Climate Action Plan's engagement structure called upon the expertise of the external GW community, including local government and other D.C.-based institutions. Figure 4 illustrates the structure for the plan's participants. For a complete list of contributors and the role of each of the groups, please see "Appendix A: CAP Team Responsibilities and Members," page 35.

CAP Engagement Structure

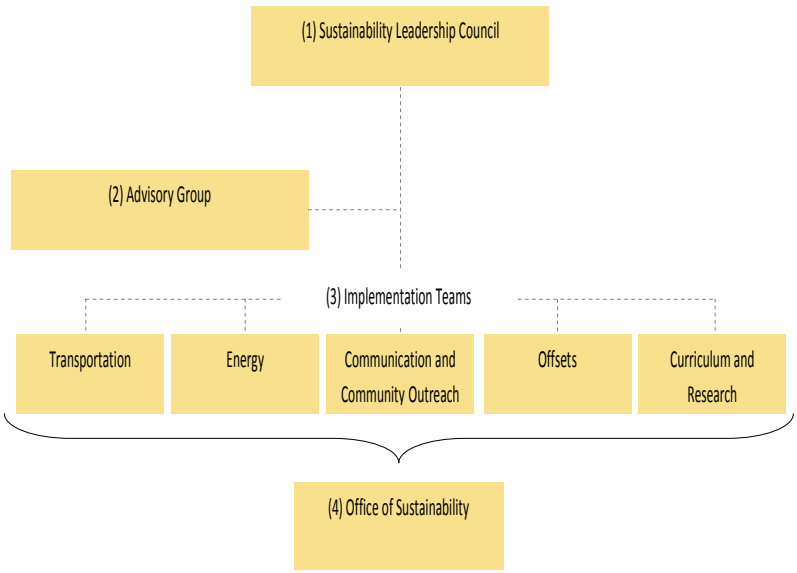


Figure 4

Contributor Roles

1. **Sustainability Leadership Council:** Provided overall leadership and direction for the Climate Action Plan
2. **Advisory Group:** Brainstormed ideas for GHG mitigation and provided counsel to the Climate Action Plan Implementation Teams
3. **Implementation Teams:** Responsible for plans to reduce emissions in their respective areas of impact
4. **Office of Sustainability:** Guided Climate Action Plan process across the engagement structure

See Appendix A for details on the Advisory Group and Implementation Teams.

Community Engagement in the Climate Action Plan

Throughout the Climate Action Plan development process, the Implementation Teams engaged the broader GW community to solicit feedback and support on mitigation strategies. The teams used two main forums: the GW Greenhouse and Advisory Group sessions, detailed below:

- GW Greenhouse: Held in January 2010, more than 100 GW faculty, staff and students presented ideas to the Climate Action Plan's Implementation Team leadership on ways to make the GW campuses more sustainable.
- Advisory Group: Experts and professionals in climate change from throughout the D.C., community met in March and May 2010 to brainstorm ideas for reducing emissions on GW's campuses and to provide feedback on the Climate Action Plan to the Implementation Team leads.

[1] IPCC, "Climate Change 2007: Synthesis Report, Summary for Policy Makers," http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf, page 5.
[2] Pew Center, "About Science and Impacts," http://www.pewclimate.org/science-impacts/about.
[3] Makiko Sato, "NASA: Data Sets and Images," http://data.giss.nasa.gov/gistemp/graphs/.

[4] Pew Center on Global Climate Change, "Climate Change 101 Science and Impacts," http://www.pewclimate.org/docUploads/Climate101-Science-Jan09.pdf, page 5.
[5] Pew Center On Global Climate Change, "American Clean Energy and Securities Act," http://www.pewclimate.org/docUploads/Waxman-Markey-short-summary-revised-June26.pdf.
[6] American College and University Presidents' Climate Commitment, Mission and History, http://www.presidentsclimatecommitment.org/about/mission-history.

GHG INVENTORY

The university conducted its first GHG inventory in FY 2008, which serves as the baseline year for the university's emissions and reductions tracking. The inventory calculates emissions of a variety of GHGs resulting from GW's activities and converts these emissions into their metric ton carbon dioxide equivalent (MTCO2e).

METHODOLOGY AND BOUNDARIES

The university's GHG inventory calculates emissions for all activities directly contributing to GW's business. The inventory includes the university's three primary campuses (Foggy Bottom, Mount Vernon and Virginia Science and Technology), as well as emissions from facilities owned or leased by the university that house activities and/or personnel that directly contribute to and/or support GW's academic mission. The inventory does not include facilities that GW owns and leases to other entities.

The inventory includes estimates for commuting and air travel emissions (despite the current lack of verifiable data for these categories). The estimates will set a precedent for more accurate tracking in the future and to encourage the start of reduction activities. Because the university does not currently track air travel mileage, information on dollars spent was used to extrapolate air-miles and corresponding carbon impact.[7] The baseline year inventory also used commuting data from a 2005 survey to extrapolate the average method and frequency of commuting to the university's three primary campuses based on the FY 2008 population. The university plans to continue to refine the data sources for these categories to enable more accurate tracking and reductions of emissions in these categories. For a discussion of the inventory process and tools used, see "Appendix B: GHG Inventory Methodology," page 39.

PRIMARY SOURCES OF EMISSIONS

In 2008, the majority of GW's 128,300 MTCO2e (approximately 80 percent) resulted from energy consumption from the activities conducted in the university's owned and leased buildings. Transportation, consisting of university-related air travel and commuting, is the next largest category, as illustrated in Figure 5. For an overview of GW's emissions by scope 1, 2 and 3 emissions, see "Appendix C: GHG Emissions by Scope, FY 2008," page 42.

2008 Emissions by Category

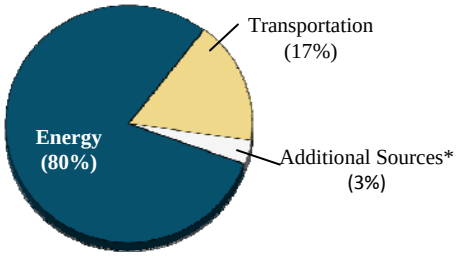


Figure 5

* Additional sources include mobile combustion, custom sources, and solid waste

Energy

As a primarily urban campus, GW relies on grid electricity for the majority of its energy. In 2008, purchased electricity represented 73 percent of the university's energy emissions with the remaining 27 percent coming from natural gas and distillate oil combustion, illustrated in Figure 6. Of the university's energy that comes from the grid, more than half is generated through coal combustion, one of the most GHG-intensive fuel sources. Figure 7 illustrates the fuel mix used to generate the majority of the university's electricity.

GW's 2008 Energy Mix

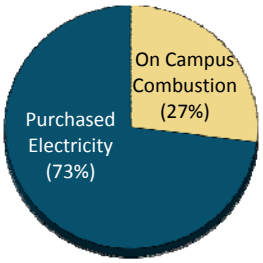


Figure 6

GW's Electricity Fuel Mix

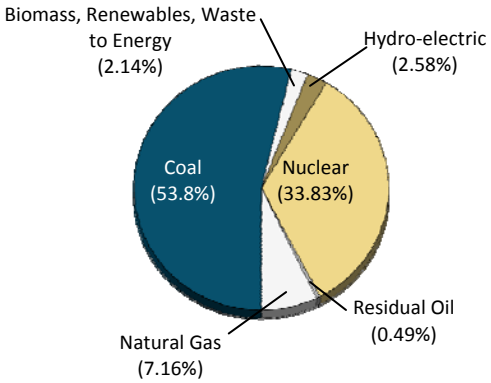


Figure 7

Given the impact of the university's energy use, the Climate Action Plan focuses on reducing the university's energy consumption while simultaneously looking for ways to help shift the mix of the university's electricity fuel sources to cleaner options.

Transportation

The transportation component of GW's inventory includes air travel for conducting university business and faculty, staff and student commuting to the campus. The municipalities in which GW operates provide access to a variety of public transportation options for commuters. As a result, the emissions impact of GW's commuting activities is relatively low, comprising less than 7 percent of the university's total emissions.

Transportation Emissions

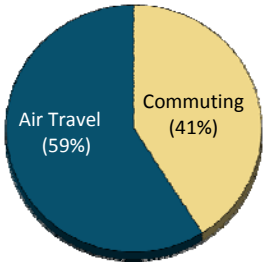


Figure 8

As a globally focused research institution, GW relies on air travel to fulfill its mission. Air travel itself is a carbon-intensive activity and represents the majority of the university's transportation-specific emissions, as illustrated in Figure 8. The university does not anticipate the volume of its commuting or air travel activities to decrease over time; therefore, strategies in this area must focus on pursuing less carbon intensive means of transportation.

The university's GHG inventory data collection requires further refinement to accurately capture air travel and commuting activities. As an initial step, GW issued a new commuting survey that influenced the FY 2009 inventory. Further data refinements will change subsequent inventories and provide the insight required to accurately target additional reduction programs.

PROGRESS TO DATE

In the FY 2009 GHG inventory, GW achieved a GHG emissions reduction, bringing total emissions to approximately 124,670 MTCO2e. Emissions resulting from building energy consumption decreased 6 percent, due to conservation measures the university undertook, which are discussed in more detail in "Appendix D: Initial GHG Reduction and Sustainability Actions," page 43. Figure 9 illustrates the differences between the FY 2008 and FY 2009 inventories.

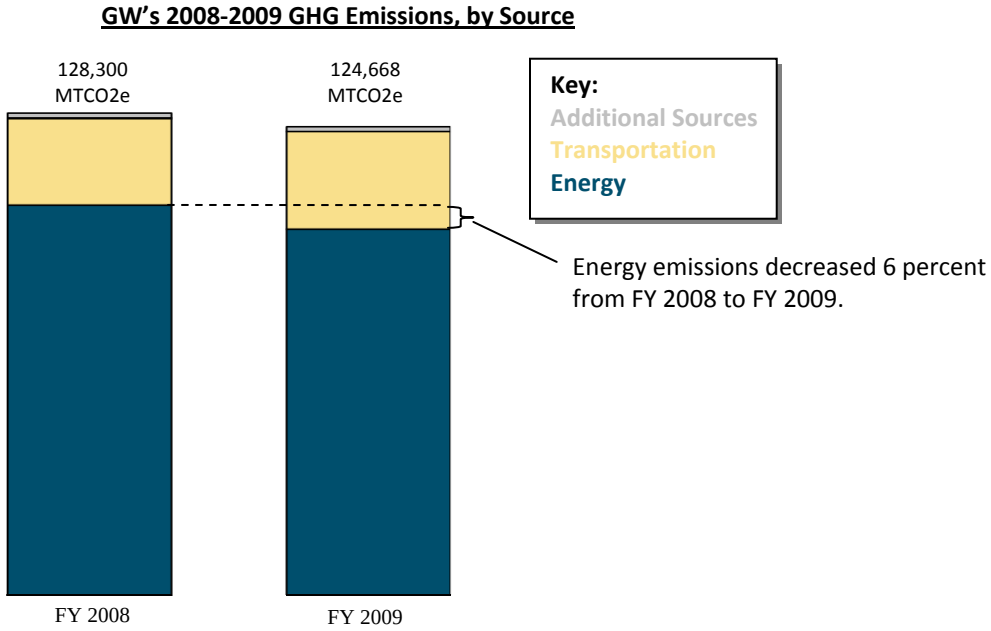


Figure 9

POTENTIAL REVISIONS TO FY 2008 BASELINE

The university undertook a commuting survey in FY 2010, and the data were used for the most recent inventory. Because the methodologies of the FY 2008 and FY 2009 inventories differed, a comparison in the year-to-year emissions in this category is difficult to draw. However, had the university based its commuting emissions assumptions on the same survey data in 2008 and 2009, commuting emissions would have been 11,108 MTCO2e instead of 8,870 MTCO2e. Because of the difference in methodologies and resulting emissions GW is exploring the most accurate and efficient methodology for gathering its commuting data for purposes of the inventory and will consider whether to revise its FY 2008 baseline inventory based on these refinements.

[7] Air travel calculations were based on the ACUPCC/AASHE suggested approach to base air travel mileage on the separate dollars spent on international and domestic flights divided by the respective factors of dollars-per-air-mile-traveled for 2007 as tabulated by the Air Transport Association of America (ATA).

STRATEGY FOR ADDRESSING CLIMATE CHANGE

Overview

Universities have a unique role to play in the climate change arena. The purpose of the Climate Action Plan is to address climate change through GW's physical footprint as well as through education and research, where it has a broader impact. The university's strategies for tackling climate change will focus on developing campuses and deploying technologies for carbon neutrality, and serving as a model for other institutions. The university will also use communications tools to encourage the GW community to contribute to carbon neutrality through wise use of resources. Finally, as a place of higher education, GW will contribute to the understanding of and solutions for climate change through educational programs and research. The "Projections and Commitments for Carbon Neutrality" section of this Climate Action Plan provides the university with a roadmap to reach these aspirations.

GW's goal is to reduce its cumulate emissions 40% relative to its FY 2008 baseline by 2025 with a 2040 neutrality date

PROJECTIONS AND COMMITMENTS FOR CARBON NEUTRALITY

Without implementation of carbon reduction strategies such as those described in this Climate Action Plan, GW's emissions would increase in line with the university's projected growth.[8] Figure 10 illustrates one potential growth scenario combining the growth possibilities described in the university's campus plan (detailing projections for square footage and personnel growth) with assumptions drawn from the FY 2008 baseline. The university's goal is to reduce its cumulative emissions 40 percent relative to its FY 2008 baseline by 2025 with a 2040 neutrality date. As Figure 10 illustrates, business as usual would lead to continuing increases in emissions through 2040, particularly in 2014 when the university's new Science and Engineering Complex comes online. Assuming a business-as-usual approach and the increased energy intensity associated with laboratory buildings such as this one, the new approximately 400,000-square-foot building will increase GW's emissions 10 percent when it is completed. The university is currently in the planning process for this building; recognizing the potential impact on its emissions GW is examining methods for reducing the building's emissions, relative to the business-as-usual scenario.

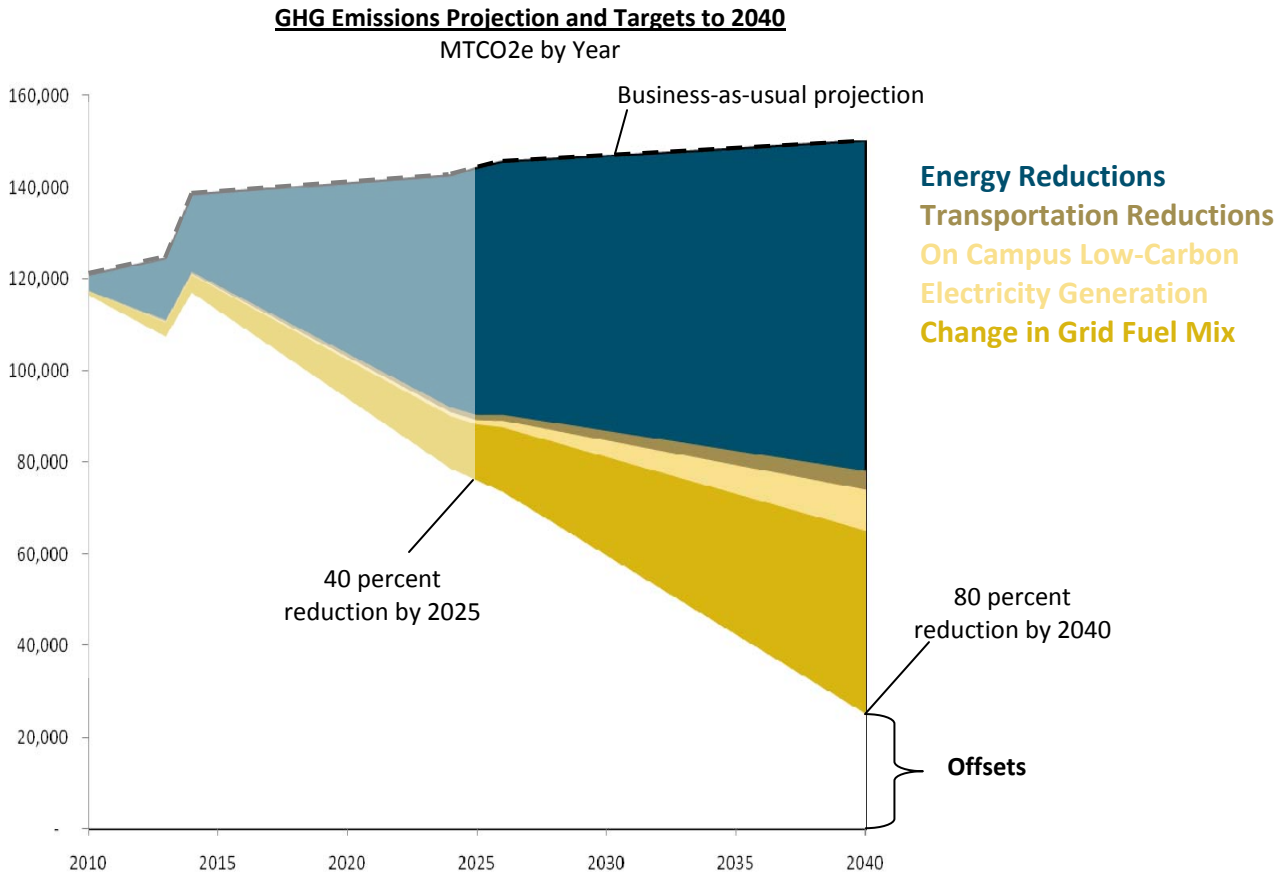
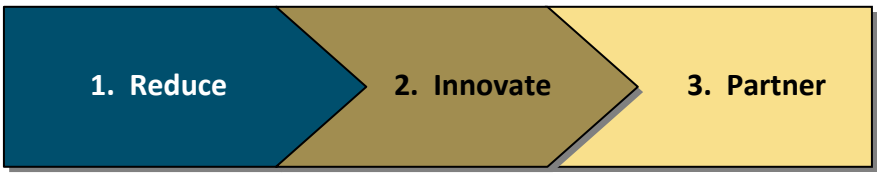

GHG Emissions Projection and Targets to 2040
MTCO2e by Year
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
2010
2015
2020
2025
2030
2035
2040
Business-as-usual projection
Energy Reductions
Transportation Reductions
On Campus Low-Carbon Electricity Generation
Change in Grid Fuel Mix
40 percent reduction by 2025
80 percent reduction by 2040
Offsets

Figure 10

CARBON NEUTRALITY STRATEGY



The university plans to use three broad strategies to reach carbon neutrality: reduce, innovate, and partner.

To reach its targets, GW will emphasize strategies that reduce energy consumption. The greatest portion of the university's carbon footprint comes from energy used by GW's buildings. The projects in the "reduce" category comprise close to 80 percent of GW's 2025 target, totaling 54,000 MTCO2e. GW will therefore focus on reducing building energy consumption through a combination of efficiency and conservation projects including:

The projects in the "reduce" category comprise approximately 80% of GW's 2025 target, totaling 55,000 MTCO2e

- Conserving energy through building and technology improvements to decrease energy consumption of existing buildings.
- Improving energy efficiency of new construction to reduce increases in emissions resulting from campus growth.
- Encouraging behavior changes to engage the campus community in energy reduction efforts.

The university also plans to reduce its transportation emissions by increasing access to low-emission commuting options and encouraging behavior shifts to efficient commuting methods.

With the main campus located in a dense urban area, on-site clean energy generation and carbon sequestration options are limited. However, GW is committed to leveraging its urban campuses in the District of Columbia and its Northern Virginia campus to pilot innovative green energy generation and sequestration options that can help reduce carbon emissions, both for the university directly and for its community.

New discoveries, equipment and systems for green energy and carbon sequestration are emerging at a rapid pace, but require testing and improvements. The university will use its campuses as testing grounds for new technologies and integrate the performance of these options into learning and research opportunities for students and faculty as appropriate. As part of this innovation strategy GW targets a 1,000 MTCO2e reduction in its emissions by 2025 through use of on-campus clean energy sources. Additionally, the university aims to produce 10 percent of its energy needs through on-site low-carbon technologies by 2040.

Partner

Many contributors to the GW carbon footprint are out of the university's direct control. As a single player in a complex system GW realizes it cannot reach carbon neutrality independently or in isolation of other entities affecting carbon emissions for the D.C. area. The university intends to forge partnerships with other institutions in the Washington, D.C. community to both achieve GW's own targets and assist the region in reducing its carbon emissions as well. The university will reach out to community institutions to identify partners and projects that can help decrease the carbon intensity of the region's electricity fuel mix and create a system for credible, local carbon offsets.

COMMUNICATIONS STRATEGY

The university's communications efforts for the Climate Action Plan will support GW's goal to become carbon neutral by encouraging behavior change and awareness among members of its community. The university first commits to transparency to provide the GW community with insight into sustainability practices, progress and achievements. Second, GW aims to inspire more participation from its students, faculty and staff through their involvement in residence halls, classrooms, and offices. Third, GW commits to leveraging communication channels to celebrate achievements to help increase awareness of the university's progress.

While behavior change is necessary to help GW achieve carbon neutrality, it would be naïve to assume that focusing only on small, individual actions will help the university achieve its goals. The intent is to communicate institutional changes as well as to engage the GW community. While energy conservation and the strategies to achieve carbon neutrality range from the visible to the invisible and the exciting to the mundane, they are all part of a comprehensive strategy to reduce the university's carbon footprint.

CURRICULUM AND RESEARCH STRATEGY

The university is committed to addressing climate change through its education and research offerings, areas where GW has a broad, intellectual footprint. Within the academy, GW faculty members collectively look at climate change as inseparable from a wider context of sustainability that includes ecosystem, social and economic impacts. The university's curricular offerings and current faculty research reflect these systemic connections, and the university will need to encourage an interdisciplinary approach to address the complexity and interconnectedness of climate-related challenges. Additionally, faculty involved in the climate action planning process have a strong interest in promoting the GW culture of service by supporting action- and service-learning opportunities on sustainability issues for students. Finally, drawing on the location of GW's main campus and its current academic strengths, GW will focus on urban sustainability and the role of cities in creating a more sustainable future.

[8] For more information regarding GW's square foot and population growth projections , see http://neighborhood.gwu.edu/campusdev/CampusPlan.cfm

STRATEGIES IN FOCUS

Strategies for 2025 Target

	MTCO2e	*Percentage of 2025 Reduction*	*Percentage Reduced from Baseline Emissions*
2008 Baseline Emissions	**128,300**		
Total Emissions 2025	**144,300**		
Energy Reduction and Conservation*	(54,000)	78%	**38%**
Utility Supplier Fuel Mix Changes	(12,500)	18%	**1.5%**
Transportation Reduction	(1,000)	2%	**.5%**
On Site Renewables	(1,000)	2%	
Totals	**75,800 (remaining)**	**100%**	**40%**

STRATEGY 1: REDUCE

BUILDING ENERGY REDUCTIONS

Overview

Energy use in GW's existing buildings across its three campuses comprises 80 percent of the university's GHG emissions. Therefore, reducing the energy consumption of the university's buildings will be the most significant contribution GW can directly make toward achieving its targets. The university's building energy reduction strategies will include conservation and optimization, behavior changes of building users, and efficiencies in new buildings. The university aims to reduce the energy consumption of its buildings by implementing projects across these categories, in addition to continuing the programs already initiated and detailed in "Appendix D: Initial GHG Reduction and Sustainability Actions," page 43. These programs will both reduce current emissions and avoid additional emissions as GW grows, resulting in approximately 54,000 MTCO2e annual avoided emissions by 2025.

Building Energy Reduction Strategies

1. Conservation and Optimization
2. New Construction
3. Behavior Changes

Conservation and Optimization

To reduce energy use related to building operations, the university will apply a holistic approach to its building portfolio. Given implementation logistics to wholesale building energy efficiency retrofits, the university must implement building improvements incrementally. To ensure the program's success the university will carefully plan in terms of timing and integrated design principles, coordinating energy efficiency projects in major systems (e.g., windows, roofs, lighting, and HVAC) with renovations as appropriate to minimize building down-time and disruption to occupants.

Recommendation: Improve Energy Efficiency of Existing Buildings

The university will decrease the average energy consumption per square foot of building space by ensuring its buildings run more efficiently through a variety of programs. The university will apply some programs, such as training operations staff to provide awareness of optimal operations of building systems, simultaneously across its building portfolio. The university will target other programs, such as retro-commissioning and re-commissioning buildings, to specific "energy hogs" on campus to ensure it captures the greatest available energy savings quickly. Regular monitoring and maintenance of building systems will also enable GW to continually refine priorities for larger-scale investments with longer-term energy efficiency payback periods, such as HVAC equipment upgrades and building envelope improvements.

Sample Energy Improvements

During the past few years, GW took steps to reduce the energy intensity of its existing buildings. Sample projects implemented in specific buildings include:

- Eliminating the use of oil-fired heating equipment in all but four small University-owned townhomes.
- Switching out T-12 lighting for T-8 energy efficient lighting.
- Installing occupancy sensors.
- Expanding EMS control systems.
- Implementing building set-backs during off-peak hours.
- Replacing inefficient chillers.
- Installing energy efficient boilers and hot water heating systems in the Charles E. Smith Center (home of GW athletics).
- Replacing a legacy data center with a modern data center with energy-efficient design.
- Adopting server virtualization.

Recommendation: Expand IT Systems Enabling Energy Reductions

The university currently encourages personal computer users to reduce the amount of electricity used by shutting systems down when not in use for long periods of time. The university is investigating software solutions that will automate shutdowns to maximize energy savings, potentially reducing power usage significantly.

The university is also evaluating thin-clients as alternatives to personal computers. Thin-clients use three to six times less energy than personal computers. In 2010, the university's IT department estimated it could replace 1,000 of the approximately 12,000 PCs at GW with thin-clients.

The university currently manages computer labs for students to provide course-specific applications with PCs available around the clock. Providing course applications online through virtualization will enable the elimination of over 400 PCs and their associated energy consumption.

Increasing IT systems that enable the GW community to interact across distances will reduce both the university's energy consumption and transportation GHG impacts. The university continues to increase the course offerings provided for distance education. In addition, increasing teleconferencing and telecommuting capabilities and policies will reduce commuting activities for staff, both from their residences and between campuses.

New Construction

The university's reduction goals factor in plans for campus growth beyond the 2008 physical footprint. To ensure the university meets energy reduction targets despite additional campus growth, GW must apply an energy-efficient design approach to its new construction efforts.

Recommendation: Target the Equivalent of LEED Silver on All New Buildings, Focusing on Energy Efficiency Points

While any new construction will result in an increase in energy consumption, utilizing energy efficiency design principles for new buildings will enable GW to minimize these increases, compared to conventional building construction. The university currently has two residence halls submitted to the USGBC review process, one in the design review phase and the other just awarded LEED gold on April 1, 2010, making GW the first higher education institution in the District of Columbia to achieve LEED gold on any of its buildings. For more information on GW's LEED applications, see "Appendix D: Initial Reduction and Sustainability Actions," page 43.

New Construction Example: South Hall

South Hall, GW's first LEED-certified residence hall, obtained LEED Gold status in April 2010. The building's sustainable features include:

- Energy star appliances.
- Climate neutral cool carpet.
- Building envelope efficiencies.
- Bamboo paneling.
- Low-VOC paints.
- Low-flow plumbing fixtures.
- Bike storage and fuel-efficient vehicle parking.

Behavior Changes

The actions of occupants impact the energy consumption within GW's buildings. During the 2008-2009 academic year, GW's undergraduate resident students provided an example of the potential impact of individual actions by saving 1,284,890 kWh of electricity through the Eco-Challenge program.[9] The contributions of each occupant's actions will ensure the university achieves its reduction targets.

Recommendation: Expand Eco-Challenge Activities and Energy Efficiency Policies

To build upon the progress made by the undergraduate participants, GW should continue the Eco-Challenge program and seek methods for expanding communication around the program's benefits. The university will seek to expand the program to Faculty and Staff through its Green @ Work initiatives.

In addition to expanding Eco-Challenge, the university will consider implementing policies, such as those listed in "Appendix E: Sample Energy Reduction Policies," page 48 that require adaptation and accommodation by building occupants, but have the potential to contribute significantly to reductions in the university's energy use.

COMMUTING REDUCTIONS

Overview

As a primarily urban campus with access to a variety of public transportation options, GW's commuting activities comprise a relatively small portion of its overall GHG footprint. To better understand commuting patterns for its three primary campuses, the university undertook a commuting survey in FY 2010. While the data from this survey were not available to inform the strategies for this Climate Action Plan, the team will analyze the results to continue to refine its recommendations.

The majority of the more than 20,000 daily commuters to the university's campuses utilize a form of transportation other than single occupancy vehicles (SOVs). Therefore, the approach for decreasing commuting emissions does not focus solely on reducing SOV trips, but also encouraging commuters to select the most carbon efficient mode of transportation feasible for each individual, whether this entails shifting from SOV to mass transit or from mass transit to biking or walking. Creating this behavior shift requires addressing current barriers to choosing the most efficient method. To identify these hurdles the Transportation Implementation Team gathered feedback in public forums, such as the GW Greenhouse and the Advisory Group sessions. The feedback sessions provided two barriers to immediately address:

1. "First Mile" Concern: Many of GW's commuters live in suburban areas with public transportation located a mile or more from their homes. Therefore, they rely on SOVs for at least the "first mile" of their commutes. While GW's urban setting provides adequate low emission options for the "last mile" to campus, the first mile remains a barrier to lower emission choices.
2. Amenities for Bike Commuters: Commuters indicated the need for more bike amenities. Feedback included lack of bike storage, absence of safe bike lanes and minimal access to showers as concerns.

The transportation team focused its recommendations on strategies addressing these concerns. To gather information on additional commuting barriers the team will include questions regarding hurdles in future commuting surveys.

Recommendation: Provide Commuter Van Options

To help address the first mile concern, the transportation team will explore the feasibility of offering a commuter van service option. These vans may shuttle commuters directly to campus or from their homes to other public transportation services helping to eliminate SOV commutes.

Recommendation: Increase Amenities for Bike Commuters

To make bike commuting accessible the transportation team will evaluate all current bike rack locations and explore the potential for new bike racks, based on available space and city zoning restrictions for street-level bike racks. To provide bike storage removed from street level, new parking garage designs include bike rack rooms. To provide showers for bikers, the team will encourage commuters to access the discounted membership to the university's Health and Wellness Center and will also investigate the feasibility of further discounts for shower-only access.

As an urban campus on city-owned streets, GW cannot directly install bike safety lanes. However, the transportation team will continue to work with its city and community partners to determine the feasibility of lanes. The team will also work to bring city biking safety classes to campus to increase commuter comfort with city bike commuting.

Recommendation: Incentivize Lower-Carbon Intensity Commuting Options

The transportation team will continue to examine whether additional incentives will encourage new commuting patterns that utilize more efficient modes of transportation. These incentives may include on-campus bike repair services, public transportation subsidies, and premium parking services for fuel efficient vehicles and carpools.

CAMPUS FLEET

Recommendation: Optimize Vehicle Use and Convert Fuel Sources

The transportation team also reviewed strategies for reducing emissions of vehicles used to conduct university business, such as campus shuttles, the GW police fleet and athletics and facilities maintenance vehicles. Strategies for reducing these vehicles' emissions focus on improving the overall carbon impact of the fleets by using vehicles efficiently and converting vehicles to less carbon-intensive fuels when possible. To use vehicles efficiently the university will assess the carbon impact of each vehicle type based on its fuel source, efficiency and use and then select and schedule vehicles appropriately. Through this type of analysis, GW already reduced its police fleet requirements by shifting to bike patrol units and also incorporating hybrid police vehicles. The university will also explore converting the vehicles it leases through its transportation and fleet contracts to include a timeline for shifting to alternative fuel and/or hybrid vehicles.

AIR TRAVEL

Recommendation: Improve Data Collection and Purchase Offsets

The university relies on air travel to fulfill its mission as an institution committed to innovation, research and leadership. The university uses air travel for a variety of purposes including global research, outreach to alumni and donors, recruiting activities and athletic team events. Because of the importance of air travel to conducting university business, GW is unlikely to directly decrease emissions in this category in the short term. Instead, GW will focus first on gaining a better understanding of its air travel patterns by improving its data collection and analysis regarding air travel uses. This information will help identify possible policy changes and/or technology improvements (e.g., expansion of video conferencing capabilities) to potentially reduce air travel in the long term without impacting the university's ability to achieve its goals. The university will then negate remaining emissions from its air travel activities by purchasing credible local offsets.

Spotlight on Communications

While infrastructure changes are crucial to achieving substantial energy reductions on campus, the university relies on its entire community to participate in energy conservation and reduction to help make carbon neutrality a reality. To support the reduction recommendations outlined above, the university will encourage behavior change. Options for increasing participation and awareness about the importance of energy conservation include:

- Adding messages and call to action prompts at various visual points of access where individuals make choices that impact our carbon footprint (e.g., laundry rooms, printers, thermostats).
- Developing a sustainability recognition program for students, faculty, and staff to encourage them to lead lower-carbon lifestyles.
- Coordinating with existing GW committees such as Green@Work and Green Living to increase the network of sustainability champions on campus. For more information on these committees see "Appendix F: Initial Engagement Activities", page 53.
- Leveraging Planet Forward as an innovative media platform for discussion and coverage of unique campus projects leading to reductions in GW's carbon footprint. For more information on Planet Forward, see "Appendix F: Initial Engagement Activities", page 53.
- Branding Climate Action Plan projects to help internal and external audiences identify the "Climate Action Plan at Work".
- Coordinating press releases and stories to publicize sustainability efforts and achievements.

STRATEGY 2: INNOVATE

Overview

Many urban institutions, which lack open space for on-site electricity generation, share the challenge of reducing emissions while relying on energy from the grid. Existing performance restrictions of renewable and low-carbon emissions energy and sequestration technologies (e.g., output per square foot, location requirements for optimal performance, etc.) prevent them from providing a viable solution for reducing reliance on grid power. For example, using current technology, GW would require a solar PV array larger than the capacity of its campuses—close to 650 acres or approximately 80 percent the size of Central Park in New York—to meet its annual energy requirements. While these technologies have constraints today, their improvement is a crucial component to solving the climate change problem while simultaneously meeting the energy requirements of growing and thriving institutions.

Recommendation: Use GW's Campuses as Laboratories for Testing Low-Emissions Energy Generation Technologies

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The university's leadership in urban sustainability includes its commitment to identify and test sustainable technologies appropriate for urban settings. The university targets a 1,000 MTCO2e reduction in emissions by 2025 due to the use of on-site low-carbon emissions technologies that draw on alternative fuels and/or renewable power sources. The university also aims to obtain 10 percent of its energy requirements through on-site low-carbon technologies by 2040. To help achieve these goals, GW has three campuses providing a range of variables including space availability, building ages, zoning requirements and energy costs on which it can perform experiments. The university will use its campuses to compare the energy generation and carbon sequestration capabilities and costs of a variety of technologies, starting with solar hot water installations on its Foggy Bottom Campus. The university will integrate the projects into learning and research opportunities for students and faculty as appropriate.

GW targets a 1,000 MTCO2e reduction in emissions due to the use of on-site low-carbon emissions technologies by 2025

Spotlight on Communications

As the university increases its leadership and visibility with respect to on-site green and renewable energy pilots, GW will provide communication to garner stakeholder endorsement, funding support, and opportunities for student engagement. Options for ensuring ample publicity and support for low-emissions energy generation technologies include:

- Issuing press releases for new pilot technologies on campus.
- Compiling funding priority areas to ensure that development officers are able to appropriately solicit funds for the expansion of new technologies on campus.
- Ensuring consistent branding and signage for all innovative energy projects on campus.
- Creating an interactive campus map that highlights innovative sustainability projects and information to provide campus community members with insight into projects around campus and in buildings.
- Enabling students to experience Climate Action Plan projects as a "living laboratory" to enhance their classroom learning.

STRATEGY 3: PARTNER

Overview

The university operates in a complex system of interconnected entities including its students, faculty and staff, suppliers and the municipalities in which it operates. The university recognizes that the reduction actions under its direct control do not take place in a vacuum but rather impact all the players within this system. To achieve neutrality, GW must involve this entire system and help all members work toward the same goal.

ENERGY MIX FACTORS

In examining its reduction strategies, GW recognized that the fuel mix used by its electricity providers is a contributing factor to its buildings' emissions. Therefore, in addition to the building reduction strategies within the university's direct control, the fuel mix used by utility providers to generate the university's electricity will considerably impact GW's ability to achieve its reduction targets (i.e., a less carbon-intensive fuel mix would contribute significantly to decreasing GW's carbon footprint). District of Columbia legislation currently sets a renewable energy portfolio standard for utility providers; GW set its targets in the context of utility providers meeting the portfolio standard's provisions.[10] The university will work in partnership with policy makers, utility providers, fellow customers and other entities to generate dialogue and seek solutions to the dilemma of sourcing cleaner energy. This will help not only the carbon impact of its own campuses but also of other facilities in the region.

OFFSETS

The university will look to purchase credible, local offsets to help reach its emissions targets. Identifying, generating, and investing in these offsets will involve partnership between the GW community, local government, industry and other players.

Spotlight on Communications

GW has many partners it currently works with on sustainability topics, including organizations like Casey Trees and Zipcar. As GW expands its partnership base and incorporates more sustainable vendors and groups on campus, it needs to ensure that it effectively communicates these new relationships. Options for highlighting partnership launches and activities include:

- Creating opportunities for students, faculty, and staff to engage with our partners through internships and volunteer opportunities.
- Leveraging media opportunities to ensure that external communities are aware of GW's strategic partnerships.
- Incorporating partners into existing GW information forums.
- Creating university-wide special events to highlight new partnerships.
- Ensuring an integrated social media strategy with partner groups.

[9] For more information on GW's Eco-Challenge, see http://living.gwu.edu/greenliving/ecochallenge/
[10] *DC Renewable Portfolio Standard Act* Codification District of Columbia Official Code, 2001 Edition, 2005 Winter Supplement, West Group Publisher.

CURRICULUM AND RESEARCH

OVERVIEW

The Climate Action Plan Curriculum and Research Implementation Team (CRIT) met several times to discuss and draft recommendations for continuing to integrate sustainability in the university's curriculum and research. The team first developed a context statement to frame its recommendations, detailed below. For additional information regarding additional coursework, research and programs in sustainability at GW, see "Appendix H: Sustainability and Climate-Related Academics," page 53.

CRIT Philosophy

1. The CRIT agrees that while implementing the Climate Action Plan on a university-wide basis addresses climate change, the Climate Action Plan is also about sustainability more broadly. Climate change is inseparable from a wider context that includes not only ecosystem impacts but also, to some extent, every aspect of the way GW operates as an educational institution. The CRIT provides its recommendations in this overall context.

2. The key connection between climate change and sustainability is the systemic environmental deterioration caused by climate change. Ecosystems weakened by pollution, species loss, deforestation, wetlands degradation, feedbacks in global air and water circulation, and contaminated groundwater will be less able to withstand the stress of climate change. In this way, climate change directly challenges the ability of humans and ecosystems to survive.

3. The CRIT defines sustainability simply as the ability to endure. Sustainability addresses the impact of environmental change on society and the scientific, technological, political and economic responses to these challenges. Ultimately sustainability research attempts to answer the question of how best to manage human interactions with the environment in a way that prevents or minimizes environmental degradation over both the short and long term.

4. GW stands to benefit from a Climate Action Plan that fully engages the academic research, teaching, and service missions of the university. The additional benefits of "building sustainability" into GW's courses and research include the facts that sustainability:
   - Is interdisciplinary
   - Is applied
   - Gets students involved; and
   - Can have a local focus

5. The university must simultaneously broaden and deepen current efforts to foster sustainability. To broaden, we embrace the concept of *pervasive sustainability* - enhancing curriculum so sustainability reflects from across the curriculum. To deepen, GW has the opportunity to build on its strengths, developing a central entity that can facilitate interdisciplinary faculty and student research collaborations.

6. The university should build on several initiatives that already identified key interdisciplinary areas of strength. The GW Institute for Sustainability Research, Education, and Policy identified four foci (global/climate change/energy; sustainable organizations; sustainable communities and infrastructure; and urban sustainability). The Sustainability Research Initiative recommended a focus on urban sustainability, and, within this, the interaction among water resources, climate, energy and public health. Specific example of current research into both climate change and sustainability include areas as various as ancient and recent ecosystem change (paleontology), legal policy, Arctic climate impacts and adaptation to climate change in low-income countries.

RECOMMENDATIONS

After defining the context for the curriculum and research portion of the Climate Action Plan, the CRIT developed three recommendations for the university to consider.

Recommendation: Have Every College, School, Department, and Program Examine its Curriculum and Identify Where an Expanded Focus on Sustainability Is Appropriate

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Expanding course offerings is essential to ensure students entering GW with interests in climate change and sustainability can find courses of interest. Specific areas of need identified include:

1. Expanded basic ecology education.
2. Include additional field courses on the GW campuses, in the Washington, D.C., area (including the Shenandoah Valley and Chesapeake Bay), and in other locations around the world that would serve as a laboratory with the focus on water and air quality, impacts of urbanization and suburbanization, smart growth and transportation.
3. Support for interdisciplinary, team-taught courses.
4. Financial and logistical support for the development of sustainability service-learning and applied, current class material.

The university can improve its publicizing of sustainability course listings by adding a green icon to courses with a substantial percentage of sustainability content. By linking syllabi to courses, students and advisers would be able to see how sustainability is taught in different disciplines.

The university may review its degree and certificate options to consider a sustainability major or certification, support the existing environmental studies major, or create an environmental studies minor or concentration.

The university could also target hires in areas of sustainability research and teaching, particularly pressing considering the turnover of key faculty positions (such as geology, geography, and biological sciences) and growing interest in the field in several other disciplines.

Finally, GW could make the interdisciplinary efforts of its students easier by encouraging dual degrees between schools (e.g., the Columbian College of Arts and Sciences and the School of Public Health and Health Services).

Recommendation: Foster Interdisciplinary Sustainability through Research and Teaching Collaboration and Communication across Disciplines

The university could create a permanent, university-wide center to facilitate collaboration among faculty and promote interdisciplinary sustainability teaching and research. Such an entity could be a central (and perhaps a physical) place for sustainability scholarship. This would improve communication among faculty engaged in climate change and related areas through:

1. A sustainability faculty listserv
2. Regular seminar series and social get-togethers
3. Interdisciplinary research and teaching facilitation

The university could connect policy, engineering, science and other disciplines around sustainability themes by organizing one or more cross-cutting research foci. Such foci could include one of those identified by the current GW Institute for Sustainability Research, Education and Policy and the Sustainability Research Initiative (which recommends a focus on urban sustainability and its interaction with water resources, climate, energy and public health). The recently revitalized Environmental Resource Policy (ENRP) master's program highlights the successful merger of science and policy and acts as a model for the addition of other cross-cutting programs.

Recommendation: Connect with the University's Urban Community Through Applied Sustainability Education, Including Service Learning and Applied Class Projects

The university could promote service-learning classes, field trips, internships and research opportunities on the GW campuses, in the Washington, D.C.-area and around the world. The university could create these programs in partnership with area environmental and natural resource agencies and policy bodies (e.g., the Office of Management and Budget, the Environmental Protection Agency, the Council on Environmental Quality, D.C. Office of the Environment, etc.). Programs could assist students in developing skills vital to sustainability such as:

1. Environmental monitoring
2. Environmental impact assessment
3. Cost-benefit analysis
4. Integrated (biophysical and human systems) assessment
5. Policy analysis

The CRIT team also supports maintaining and encouraging student involvement in ecology issues specific to GW's physical campus ecology through the following efforts:

1. Student-led sustainability-themed clubs and programs
2. Tours for students highlighting the university's recycling systems, solid waste disposal and electricity sources.
3. Programs enabling students to monitor the impacts and outcomes of the university's environmental efforts.

Spotlight on Communications

As GW enhances its research and learning offerings in sustainability, GW must expand its communications and outreach to ensure it makes current and prospective students aware of the sustainability opportunities available to them. Options for highlighting research and learning opportunities include:

- Creating comprehensive materials that highlight academic and degree offerings in sustainability.
- Developing a list of sustainability faculty experts accessible on-line.
- Marketing and packaging sustainability offerings to prospective students and to other external audiences.
- Expanding on existing symposia and conferences to highlight new sustainability research at GW.

FINANCING

Overview

The university will invest millions of dollars in efficiencies and technologies over the next 30 years to reach climate neutrality. The efficiencies that will result from this investment will pay off even more in dividends over time as GW eliminates energy waste and significantly cuts energy use. Each project implemented as a result of the Climate Action Plan will be evaluated based on life-cycle costs and projected return on investment to ensure the overall portfolio of Climate Action Plan projects maintains a level of return in line with the university's expectations. Additionally, GW will look to the future to bring more efficient and affordable technologies, as well as collaborative efforts from energy partners and suppliers to help reach its targets.

CAPITAL PROJECT AND OPERATING BUDGETS

The university's existing budgets for funding new construction, major renovations, and building maintenance are its capital project budget and its operating budget. The university typically allocates its capital budget for large-scale projects, including major building renovations, while the operating budget goes toward building systems maintenance. Projects in this Climate Action Plan will often fall within the scope of both of these budgets during the normal course of business for the university. When this occurs, the university will evaluate the projects to ensure they meet an acceptable return on investment threshold and will fund projects as appropriate; as a result, GW expects to finance some of its Climate Action Plan projects through existing designated funds.

GREEN CAMPUS FUND

In addition to exploring a variety of financing options for its Climate Action Plan projects, GW established a "Green Campus Fund." With seed funding of $2 million, the fund will initially finance projects related to the Climate Action Plan and act as a revolving fund that will increase from the cost avoided from energy savings resulting from the projects.

CLASS GIFTS, SPECIALIZED FUNDS, AND OTHER DONATIONS

The university obtains and allocates funds from a variety of donors, including alumni. One example is GW's partnership with Casey Trees, which increases urban landscaping of trees on campus. Another is the Class of 2007's senior class gift to the university, a "Class Green Campus Fund," used annually for implementation of energy efficiency projects. The university will continue to use specialized funds to finance specific projects within the Climate Action Plan as they become available.

FUTURE FUNDING SOURCES

Sources of funding need not be limited to those readily available through GW's existing funding sources. The university will consider and evaluate a range of funding options including grants, local utility rebate programs, targeted donor opportunities and financing partnerships like power purchase agreements to help fund its Climate Action Plan programs. For example, GW already received some funding for specific energy efficiency upgrades from its primary supplier of electricity, Potomac Electric Power Company (Pepco), through an existing rebate program. These more innovative funding sources will be especially important for making changes to transportation and academic practices. As financing options and funding sources increase and become more accessible and credible, the university is committed to identifying and pursuing such opportunities to reach the goals of the Climate Action Plan.

CONCLUSION

Overview

This document acts as a planning guide and reflects the real progress GW is making toward carbon neutrality. The process for creating this Climate Action Plan has been a powerful tool for organizational momentum and change. Staff from GW administrative divisions, faculty from several GW schools and academic departments, students from various organizations and programs, and experts in the public and private sectors have proposed, discussed, debated, and created both the plan and the energy for implementation. Through collaborative exploration of credible carbon reduction and sequestration solutions, GW has come to a new level of understanding of what is practical and a new belief in what is possible.

2040 HORIZON

The university bases its targets and commitments in this Climate Action Plan on current conditions with the understanding that technologies and financial measures will change significantly during the timeline from today to 2040. Factors outside of GW's control, such as policy changes, global economic conditions, and technological advances will impact the university's trajectory toward climate neutrality. The strategies in this plan are therefore broad principles that will guide the university toward its targets, even though the specific projects within each strategy may change. The university aspires for its trajectory to steepen toward earlier climate neutrality and will periodically revise its Climate Action Plan to account for changes in conditions that impact its goals, starting with an initial revision in 2012.

A CALL TO THE GW COMMUNITY

The collective actions of the entire GW community will continue to be critical to the success of the Climate Action Plan. Both leadership steps and incremental actions from GW students, staff, and faculty and area partners will lead to reductions in GHG emissions. For example, staff, student and faculty leaders can take the initiative to propose and implement new ways of conducting business in GW's operations. Those who reside in university buildings, use electronic equipment on-site and travel to and from the campuses can take individual daily actions to minimize energy use. Additionally, area business and energy partners can join GW in addressing systemic challenges to reducing GHG emissions.

Through climate and other sustainability commitments at The George Washington University, the university is taking responsibility for ensuring a better quality of life for today and tomorrow. While the journey is not easy, direct or simple, collaboration and contributions from across the community will ensure that GW reduces its impact and acts as a model for others in the community.

ACKNOWLEDGEMENTS

The George Washington University Office of Sustainability would like to recognize the following people for their contributions and feedback to the GW Climate Action Plan.

Students, Faculty, Staff:

President Steven Knapp
Trustee George Coelho
Donald Lehman
Louis Katz
Beth Nolan
Robert A. Chernak
John Kudless
Lorraine Ann Voles
Leo Chalupa
Stephanie Baldwin
Gina Laur
Alisha Camacho
Jeremy Duomo
Andy Ludwig
Catherine Munro
Spencer Olson
Erica Orsini
Debra Jacobson
Stuart Licht
Lee Paddock
Mark Starik
Rumana Riffat
John Ralls
Sophie Waskow
Bridgette Behling
Jin Chon
Erica Hayton
Matt Lindsay
Matt Trainum

Students, Faculty, Staff:

David Rain
Robert L. Glicksman
Melissa Keeley
Diana L. Lipscomb
W.M. Kim Roddis
Stephen C. Smith
Dawn Marie Mancini
Chris Orlando
Casey Pierzchala
Larry Cohen
Wendy Martino
Scott Anderson
Frank Demes
Elan Schnitzer
Nancy Giammatteo
Doug Spengel
Adam Aaronson
Mike Brown
Tom Dwyer
Michael Howell
John Huennekens
Jeff Lenn
Arni Nicholas
Bob Oakley
Margie O'Leary
Chris Orlando
Jim Schrote
Charlie Spann
Chris Wertzler
Alex Winn

Alumni and Partners:

Kristy Ortiz
Adam Lenkin
Sara Loveland

District of Columbia Office of Planning
Colleen Mitchell

District of Columbia Department of Environment
Daniel Barry

District of Columbia Councilmember Mary Cheh's Office and Committee on Government Operations and the Environment
Tom Moir

National Council for Science and the Environment
David Blockstein

Metropolitan Washington Council of Governments
Stuart Freudberg
Anne Mariani

Point Carbon
Emilie Mazzacurati

From Meghan Chapple-Brown, director of The George Washington University Office of Sustainability: I would like to extend my deep gratitude to the students, faculty, staff, alumni, and partners for their ideas, feedback, expertise, analysis, and enthusiasm. Special heartfelt thanks go to two people who worked tirelessly behind the scenes: Cristina Luthy, project facilitator at the Office of Sustainability, for managing the planning process and for writing and editing the report, and Alicia O'Neil, senior associate vice president for operations, for her guidance and input to the process.

GLOSSARY

AASHE
Association for the Advancement of Sustainability in Higher Education

ACUPCC
American College and University Presidents' Climate Commitment

ASHRAE
American Society of Heating, Refrigerating and Air-Conditioning Engineers

ASLA
American Society of Landscape Architects

CACP (Clean Air Cool Planet)
A scientific nonprofit that supports universities in reducing carbon emissions and developed the Campus Carbon Calculator for universities to measure GHG emissions.

CO2e
Carbon dioxide equivalents. Other GHGs are converted into this unit to make comparisons between different emission categories.

CBECS
Commercial Buildings Energy Consumption Survey
Collects information on US buildings related to energy consumption and expenses.

DOE
U.S. Department of Energy

EMS
Energy Management System

Enthalpy Wheels
Compact and efficient technology that controls heating, cooling and moisture.

GHG
Greenhouse gases absorb and emit radiation within the thermal infrared range, causing the greenhouse effect. The main greenhouse gases in the Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide and ozone.

Global Warming Potential
Quantified rating of how much a given greenhouse gas impacts the effects of global warming.

IPCC
Intergovernmental Panel on Climate Change

Established by the United Nations Environment Programme. This scientific body evaluates climate change as caused by human activity. The IPCC does not conduct original research, but provides reports based on scientific peer reviewed data.

MTCO2e
Standard measurement of the amount of carbon dioxide emitted or reduced. MTCO2e is different from carbon dioxide – to calculate emissions in MTCO2e, the quantity of each type of GHG is first converted to its MTCO2e equivalent, then all totals are added.

NOAA
National Oceanic and Atmospheric Administration
U.S. Federal Agency focused on the conditions of the oceans and atmosphere. NOAA conducts research to improve understanding of the environment.

Offsets
Measured in MTCO2e and purchased to mitigate GHG emissions. Typically money goes toward projects that reduce GHG emissions in the short and long-term.

Pew Center on Global Climate Change
A nongovernmental organization that conducts research on climate change.

PV
Photovoltaics, arrays of cells containing a solar photovoltaic material that converts solar radiation into direct current electricity.

Power Usage Effectiveness (PUE)
Metric used to determine the efficiency of a data center determined by dividing the amount of power entering the center by the power used to run the IT infrastructure within it.

Sustainable Sites Initiative
Voluntary national guidelines for performance benchmarks for sustainable landscape design, construction and maintenance set forth by the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center and the US Botanic Garden.

Thin-Clients
Specially designed small software or computers that rely on data processing that occurs on a server.

Uninterruptible Power Supply (UPS)
Equipment that provides emergency power to a load when the regular power supply is interrupted.

USGBC
United States Green Building Council
Developed the internationally recognized LEED certification system for green buildings.

WTE (Waste to Energy)
Process of incinerating trash to create electricity.

APPENDIX A: CAP TEAM RESPONSIBILITIES AND MEMBERS

THE SUSTAINABILITY LEADERSHIP COUNCIL

Consists of University Leadership. Provided overall leadership and direction on the Climate Action Plan.

Members

Steven Knapp	President
Leo Chalupa	Vice President for Research
Robert A. Chernak	Senior Vice President for Student and Academic Support Services
George Coelho	Board of Trustees and CEO, Good Energies
Louis Katz	Executive Vice President and Treasurer
John Kudless	Interim Vice President of Development and Alumni Relations
Donald Lehman	Executive Vice President for Academic Affairs
Beth Nolan	Senior Vice President and General Counsel
Lorraine Ann Voles	Vice President for External Relations

THE ADVISORY GROUP

Helped GW engage with a larger cross-section of its community. Consists of original members of the Presidential Task Force on Sustainability, as well as members of the DC government and other local organizations focused on climate change advocacy and research. This group brainstormed ideas for GHG mitigation and provided advice and counsel to the Climate Action Plan implementation teams.

Chair

Kristy Ortiz (Alumna), Pace Global Consulting

Members

Student Groups

Alisha Camacho	Food Justice Alliance
Jeremy Duomo	Net Impact
Andy Ludwig	Net Impact
Catherine Munro	Students for Sustainability
Spencer Olson	Green GW
Erica Orsini	Revolution Green

Faculty

Debra Jacobson	GW Solar Institute
Stuart Licht	GW Energy Institute
Lee Paddock	GW Law School, Environmental Law Program
Rumana Riffat	GW School of Engineering, Civil & Environmental Engineering Dept.
Mark Starik	GW School of Business and GW Sustainability Institute

Members from Outside Organizations

Daniel Barry	District of Columbia Department of the Environment
David Blockstein	National Council for Science and the Environment
Stuart Freudberg with Anne Mariani	Metropolitan Washington Council of Governments
Adam Lenkin (Alumnus)	Solar Expert
Sara Loveland (Alumna)	Access Green
Emilie Mazzacurati	Point Carbon
Colleen Mitchell	District of Columbia Office of Planning
Tom Moir	District of Columbia Councilmember Mary Cheh's Office and Committee on Government Operations and the Environment

CAP IMPLEMENTATION TEAM MEMBERS

The CAP implementation teams consist of members of the GW faculty and staff community and focused on specific components of the Climate Action Plan.

Communication and Community Outreach

Developed the ongoing strategy for ensuring stakeholders are aware of Climate Action Plan activities. Spanned across implementation teams to create plans for encouraging the cross-community behavioral changes required for Climate Action Plan success.

Team Leads

- John Ralls, special advisor for communications, Division of Operations
- Sophie Waskow, stakeholder engagement coordinator, Office of Sustainability

Members

- Bridgette Behling, coordinator for student involvement, Student Activities Center
- Jin Chon, executive director, strategic planning, External Relations
- Erica Hayton, HR strategic development manager, Human Resources
- Matt Lindsay, director of alumni communications, Alumni Relations
- Chris Orlando, special assistant to the AVP for academic planning, Academic Operations
- Matt Trainum, director, GW Housing Programs

Curriculum and Research

Developed plans to ensure that climate change and sustainability are part of the curriculum and academic efforts. Discussed enhancing the level of faculty research aimed at addressing climate change.

Team Lead

- David Rain, director of the environmental studies program, associate professor of geography and international affairs, Department of Geography

Team Members

- Robert L. Glicksman, J.B. and Maurice C. Shapiro Professor of Environmental Law, Law School
- Melissa Keeley, assistant professor of geography and of public policy and public administration, Department of Geography, Columbian College of Arts and Sciences
- Diana L. Lipscomb, chair Department of Biological Science, Robert L. Weintraub Professor of Biological Sciences, Biological Sciences, Columbian College of Arts and Sciences
- W.M. Kim Roddis, chair of the Department of Civil and Environmental Engineering, professor of civil and environmental engineering, School of Engineering and Applied Science
- Stephen C. Smith, director of the Institute for International Economic Policy, professor of economics and international Affairs, Department of Economics, Columbian College of Arts and Sciences

Offsets

Evaluated offset opportunities and recommended offset strategy.

Team Members

- Meghan Chapple-Brown, director, Office of Sustainability, Division of Operations
- Cristina Luthy, project facilitator, Office of Sustainability, Division of Operations
- Casey Pierzchala, sustainability project assistant, Division of Operations

Transportation

Focused on reducing emissions from university fleet vehicles, commuting, and air travel.

Team Leads

- Larry Cohen, director, Parking and Transportation, Division of Operations
- Wendy Martino, director, Business Process Management, Division of Operations

Team Members

- Scott Anderson, deputy director, Auxiliary and Support Services
- Frank Demes, assistant chief, GWPD
- Elan Schnitzer, marketing coordinator for event and special services, Mount Vernon Campus Life

Energy

Team Leads

- Nancy Giammatteo, director facilities planning and design review, Division of Operations
- Doug Spengel, energy and environmental manager, facilities services, Division of Operations

Team Members

- Adam Aaronson, assistant director, Division of Operations
- Mike Brown, director, Marvin Center Operations
- Tom Dwyer, managing director, residential property management, Division of Operations
- Michael Howell, supervisor, electrical maintenance, Division of Operations
- John Huennekens, engineering manager, Division of Operations
- Jeff Lenn, associate vice president¸ Academic Operations
- Arni Nicholas, foreman, engineering operations, Division of Operations
- Bob Oakley, HVAC supervisor, engineering maintenance, Division of Operations
- Margie O'Leary, assistant director, general services, Division of Operations
- Chris Orlando, special assistant to associate vice president, Academic Operations
- Jim Schrote, executive director facilities services, Division of Operations
- Charlie Spann, managing director, ISS Business Process Management
- Chris Wertzler, deputy director, Residential Property Management
- Alex Winn, executive coordinator, Solar Institute

APPENDIX B: GHG INVENTORY METHODOLOGY

TOOL USED

GW staff conducted the inventory for FY08 using the Clean Air-Cool Planet Campus Carbon Calculator. The calculator is based on the World Resources Institute/World Business Council for Sustainable Development's Greenhouse Gas Protocol, the most widely used international accounting tool for GHG Emissions.

DATA SOURCES AND ASSUMPTIONS

Stationary Combustion

Natural gas is used in campus buildings for heating, hot water, cooking, generators, labs and art studio kilns. No. 2 oil is another fuel source which is used for some heating and generators. The data source was utility bills for natural gas and No. 2 oil for owned/operated buildings with assumptions for energy used in leased spaces based on DOE CBECS data.

Purchased Electricity

The inventory includes electricity used by the University's owned and leased buildings for heating, air conditioning, lighting, other mechanical equipment, plug loads, and some cooking. It also includes electricity that powers facilities management's fleet of 20 electric vehicles. The data source was electric utility bills for university owned/operated buildings while some assumptions using DOE CBECS data were made about energy used in leased spaces.

Commuting

Commuting includes student, faculty, and staff commuting to and from GW's campuses each day. The emissions data for this category does not include student travel to/from campus at the beginning and end of each semester. The data are based on an analysis of a comprehensive 2005 campus transportation survey of each population (students, faculty, and staff) that allowed us to extrapolate the average method and frequency of commuting to the three primary campuses based on the FY2008 population.

Air Travel

The ideal data to measure GHG emissions from air travel is the number of air miles traveled using university funds for both domestic and international flights. The university does not currently track air travel mileage, though information on dollars spent is available. To develop a mileage figure, dollars spent were converted into miles flown (per AASHE's suggestion). GW's air travel mileage is based on the separate dollars spent on international and domestic flights during FY2008, divided by the respective factors of dollars-per-air-mile-traveled for 2007 as tabulated by the Air Transport Association of America.

Building Assumptions

All facilities used for university purposes that are either owned and operated or rented from a third party are included in GW's inventory. Buildings GW owns but rents to others were excluded as they do not house GW personnel or activities and GW does not control consumption patterns in these locations.

Metrics for emissions from leased building spaces included certain assumptions, as the University is limited in its ability to track emissions from spaces it does not own/manage. For this metric, emissions were calculated using the following energy estimates in kBTU/GSF: 45 for warehouses, 83 for classrooms, 93 for offices, and 105 for medical spaces. Energy consumption is allocated as 60 percent from electricity and 40 percent from natural gas. These figures were based on existing data from similar buildings and Department of Energy statistics.

DE MINIMUS SOURCES AND EXCLUSIONS

Mobile Combustion

Mobile combustion includes gasoline and diesel fuel used in all University vehicles and those under contract for shuttle service to the Virginia and Mount Vernon campuses. The data source was credit card purchase records, with the exception of athletics-related vehicles, where a conversion to miles was performed by dividing total dollars spent by an average cost-per-gallon for the year. The calculation also included fuel used on two shuttle-bus routes operated by contractors (here as Scope 1 rather than Scope 3 emissions).

Fugitive Emissions

A small component of GW's GHG emissions comes from fugitive sources such as refrigerants and agriculture. The inventory includes emissions from refrigerants lost from air conditioning and refrigeration equipment on campus. Refrigerants are lost during gas exchanges and equipment failures. Also included are emissions from fertilizers used on campus and from waste produced by animals kept for research purposes.

Custom Sources

The CACP Calculator provides additional calculations for the Scope 3 emissions associated with wastewater, paper purchases, and other travel not included in the rest of the calculator. These categories are not required by the ACUPCC. GW has included data for wastewater and some paper purchases through OfficeMax. Paper purchased with a P-Card (the university's credit system) or petty cash are not captured in the inventory because data are not readily available. Other travel includes personal mileage reimbursements and bus miles traveled by GW students, faculty, and staff.

Solid Waste

Transitioning to a Waste-to-Energy (WTE) facility was one of the university's first steps toward reducing its GHG emissions. In October 2009, GW began disposing of its waste from both the Foggy Bottom and Mount Vernon campuses at a WTE facility in Alexandria, Va., instead of a landfill 150 miles away. Using GW's approximately 3,500 tons of yearly waste, the WTE facility will produce more than 1,800 megawatt

hours of electricity (enough to power more than 100 U.S homes for an entire year). This eliminates the 564 MTCO2e related to waste in GW's FY 2008 GHG inventory as well as the university's use of landfills for disposal of its solid waste.

Due to the timing of the implementation the GHG impact of this transition is not included in the FY 2009 GHG inventory, but will impact the 2010 calculation.

Transmission and Distribution Losses

The CACP Calculator provides a transmission and distribution losses category for electricity. This category is not required by the ACUPCC and is not directly impacted by GW; therefore, it is not included in this inventory.

APPENDIX C: GHG EMISSIONS BY SCOPE, FY 2008

OVERALL EMISSIONS

	Total (MTCO2e)	Per Full-Time Enrollment	Per 1000 Square Feet	Percentage Offset
Gross Emissions (Scopes 1 and 2)	105,064	5.2	13.6	0.1%
Gross Emissions (Scopes 1, 2 and 3)	128,301	6.4	16.7	0.1%

EMISSIONS BY SCOPE

Scope 1 Emissions – Direct, Occurring Onsite

Stationary Combustion	27,492	MTCO2e
Mobile Combustion	1,300	MTCO2e
Fugitive Emissions	1,292	MTCO2e
Total Scope 1 Emissions	**30,084**	**MTCO2e**

Scope 2 Emissions – Indirect Emissions that Result from Generating GW's Electricity

Purchased Electricity	74,980	MTCO2e
Total Scope 2 Emissions	**74,980**	**MTCO2e**

Scope 3 Emissions – Other Indirect Emissions that are a Consequence of GW's Activities

Commuting	8,870	MTCO2e
Air Travel	12,749	MTCO2e
Solid Waste	564	MTCO2e
Wastewater	117	MTCO2e
Paper Purchased	716	MTCO2e
Other Directly Financed Travel	221	MTCO2e
Total Scope 3 Emissions	**23,237**	**MTCO2e**

APPENDIX D: INITIAL GHG REDUCTION AND SUSTAINABILITY ACTIONS

ENERGY

Examples of Energy Efficiency Upgrades

During the past few years, GW took steps to decrease the energy intensity of its existing buildings. For example, the university eliminated the use of oil-fired heating equipment across its three campuses with only four small university-owned townhomes relying on oil heat. This improvement decreases university emissions because burning natural gas produces less MTCO2e than oil. The university also implemented efficiencies in specific buildings including switching out T-12 lighting with electronic ballasts for T-8 energy efficient lighting and magnetic ballasts, installing occupancy sensors in restrooms, classrooms and public spaces in academic and residential buildings, expanding energy management control systems, entering into a demand response program with its local utility provider and implementing building set-backs during off-peak, evening and weekend hours.

In FY 2009 GW replaced two chillers in the Law School and installed and updated heat timers in seven Foggy Bottom dorms. The university also renovated the Charles E. Smith Center, home of GW athletics, with energy efficient boilers and a hot water heating system. All new systems resulted in energy efficiencies and associated reductions in MTCO2e.

New Construction

In GW's LEED-certified residence hall, South Hall, the university's commitment to energy efficiency and environmental design focused on:

- Site selection based on access to public transportation, provision of secure bike storage and changing facilities; provision of parking for carpool and fuel efficient vehicles; limitations on the number of parking spaces to the minimum allowable by code.
- Energy savings of 20-30 percent when comparing the proposed design to the baseline building performance rating set by current ASHRAE Standards.
- Elimination of permanent irrigation and use of native and adaptive plant species.
- Fundamental and enhanced refrigerant management and building commissioning.
- Minimum water use reduction of 30 percent.
- Construction waste diversion of 50-75 percent.
- Use of recycled, local and regional, and low emitting building materials.
- Providing daylight and views to a minimum of 90 percent of regularly occupied spaces.
- Energy-Star rated appliances throughout.

As a part of the process, the university took ownership of several of the credits including:

- Purchase of wind power RECs for 70 percent of the projected electric use for the first 2 years of occupancy.
- Implementation of a thermal comfort survey of the building occupants. If more than 20 percent express dissatisfaction with their thermal comfort, the university is committed to develop a plan to take corrective action.

- Educational outreach through creating a brochure for a self-guided green tour of the building as well as the posting of informational signage throughout the facility highlighting the environmental design aspects.

GW has several buildings currently undergoing the LEED certification process, as detailed below. In future projects, the university hopes to employ the use of green roofs, storm-water capture for use as non-potable grey water, daylight shut-off of interior lighting and additional energy conservation strategies such as geo-thermal, chilled beam, enthalpy wheels, co-generation and on-site renewable energy.

Building	LEED Version	Rating Target
Pelham	LEED NC 2.2	Silver
Ames	LEED 2009 NC	Silver
Lafayette	LEED 2009 NC	Silver
Smith Center (multi-phase project)	LEED NC 2.2	Certified
Law Learning Center, Phase 1	LEED 2009 NC	Certified

Green Roofs

In October 2008, the university installed a pilot green roof project. With the assistance of faculty and students from its Sustainable Landscape Design program, volunteers installed a 2000-square-foot extensive green roof on the existing roof terrace shared by the 1957/1959 E Street academic and residential complex.

Sustainable Sites

In spring 2010, GW completed a pilot Sustainable Sites project by converting a surface parking lot into a green space for use by the students living on a major residential quad. The university submitted the project as a pilot to the Sustainable Sites Initiative, the nation's first rating system for sustainable landscapes, sponsored by the ASLA. While it provides a large (approximately 2/5 acre) lawn for light recreation, along with emergency vehicular access, the balance of the site incorporates the following sustainable features:

- Captures all hard-scaped surface drainage through an under-pavement drainage system that returns water to one of three cisterns, with 33,000 gallon total capacity.
- Takes water for irrigation from the cistern system; uses no potable water.
- Channels rain water into tree boxes through pavement "runnels."
- Uses a rain garden in the courtyard area to feed plantings.
- Diverts rain water from the roof of 2109 F St. Residence Hall into an above-ground 350-gallon cistern, which overflows to the main cistern.
- Uses native and adapted species for all plantings.
- Uses photocell-control for site lighting.
- Uses limited "grass pave" to allow for occasional vehicle parking.

Eco-Challenge

The Eco-Challenge prompts GW residents to directly reduce the carbon footprint of the university through conservation-based living techniques. Residence halls compete to determine which can reduce its water and energy consumption the greatest amount between September and April each year. The university aggregates consumption by residence hall and then posts results in each lobby for residents to view. This educational program allows students to understand the connection between their behavior and resource consumption. In the 2008-2009 school year, students saved 1,284,890 kWh of electricity and 1,971,070 gallons of water as compared with the previous year. Three quarters of the way through the 2009-2010 school year, students already saved an additional 803,743 kWh of electricity and 4,669,410 gallons of water as compared to 2008-2009.

IT Efficiencies

In 2010 GW decommissioned its legacy data center, which is estimated to have a Power Usage Effectiveness (PUE) rating of 3.3. The university constructed a modern data center facility to replace the legacy data center. This energy-efficient design currently delivers a PUE of 2.34 and GW expects it to deliver a PUE of 2.0.

During the construction of the university's Support Building Data Center, the university implemented a number of energy efficient alternatives to traditional data center designs. The design focused on two major areas: the electrical infrastructure and the mechanical infrastructure.

The university built the center's electrical infrastructure with a modular UPS enabling continual operation at a higher utilization rate and with higher efficiency. As the IT environment grows, GW can add additional modules to the UPS to provide incremental capacity with a large reduction in utilization. The electrical power distribution from the UPS to the IT equipment also consists of higher efficiency power distribution units, which delivers three phase power to the IT equipment cabinets. This power distribution increases the efficiency of the power delivery system by ensuring a balance across phases and supports an optimal power factor to reduce loss in the system.

GW designed the data center's mechanical infrastructure to deliver air to cool the IT equipment to keep it from overheating and shutting down. By using a closed-loop air return system, the data center reduces inefficiencies related to mixed air enabling the cooling equipment to provide higher temperature supply air to the IT equipment. This reduces the load on the cooling system and requires less energy. GW also constructed the air delivery systems with automated variable speed fans to work with the air return system to deliver cool air to the IT equipment. The variable speed fans reduce the amount of power the air delivery system utilizes in delivering the air during low load times for the IT equipment. This allows the mechanical systems to self-adjust during low utilization periods and reduces the amount of energy used by the mechanical systems.

GW adopted server virtualization to improve energy consumption. Through server virtualization, GW maximizes the utilization of physical server hardware and reduces the number of physical servers consuming power in the data center. By replacing older physical servers with virtual servers, IT operations decreased the load from 115kW to 82kW.

Composting

GW currently composts kitchen waste at its Mount Vernon Campus dining facility. Currently the program only includes kitchen scraps; however, GW plans to expand the program to include food waste from the dining area with the fall 2010 opening of Pelham Hall.

Recycling

Recycling is an integral component of student, faculty and staff life on all three of GW's campuses. GW provides recycling facilities both throughout the interiors of its 160 buildings, as well as through its urban campus exterior streetscape plan. The university participated in the nation-wide RecycleMania competition for the last four years and its current recycling rate is 26 percent and rising. GW is committed to a waste diversion goal of 30 percent. The recycling program includes e-cycling, toner cartridges, batteries, and mercury-containing light bulbs in addition to more standard items such as mixed paper, bottles, and cans.

The university also engages in Green Move-In and Move-Out programs to encourage recycling and reduction of waste throughout the student moving process. The *Washington Business Journal* awarded GW the 2009 Greater Washington Green Business Award for Innovation for its 2009 Green Move Out initiative in recognition of its efforts to incorporate environmentally sustainable practices into its business and community work.

WASTE

Solid Waste Management

Transitioning to a Waste-to-Energy (WTE) facility was one of the university's first steps toward reducing its GHG emissions. In October 2009, GW began disposing of its waste from both the Foggy Bottom and Mount Vernon campuses at a WTE facility in Alexandria, Va., instead of a landfill 150 miles away. Using GW's approximately 3,500 tons of yearly waste, the WTE facility will produce more than 1,800 megawatt hours of electricity (enough to power more than 100 U.S homes for an entire year). This eliminates the 564 MTCO2e related to waste in GW's FY 2008 GHG inventory as well as the university's use of landfills for disposal of its solid waste.

Due to the timing of the implementation the GHG impact of this transition is not included in the FY 2009 GHG inventory, but will impact the 2010 calculation.

REFRIGERANTS

The university uses refrigerants in nearly all of its buildings for air conditioning systems (the largest users of refrigerants), refrigerators, freezers, vending machines and drinking water fountains. Over time, GW replaces this equipment and new systems use refrigerants with lower ozone-depleting and global-warming potentials than the systems they replace. For example, the university replaced an air conditioning system serving several large buildings in early 2009 and a smaller system in a mid-sized building in early 2010.

GW's GHG inventory includes accidental releases of refrigerants each year. While the volumes of refrigerants accidentally released each year vary, the climate effect of the release of a particular volume of refrigerant decreases over time as the university transitions to use of refrigerants with lower global warming potentials. The GHG emissions attributed to the university's use of refrigerants decreased from approximately 1,284 to 906 MTCO2e (a decrease of 378 MTCO2e) from the FY 2008 to FY 2009 inventory.

TRANSPORTATION

Two of GW's campuses (Foggy Bottom and Mount Vernon) are located in Washington, D.C., with residents enjoying the public transportation benefits of this urban setting. Through Washington Metro Area Transit Authority (WMATA), the university's commuters have rail and bus options to the Foggy Bottom campus and convenient bus options to Mount Vernon. In addition to the two urban campus settings, GW has a Virginia campus in Loudoun County, which is approximately 25 miles from the main campus in Foggy Bottom. The university offers a number of shuttle options for travel between different GW campuses including: the Vern Express, the Virginia Campus Shuttle and the Colonial Express Shuttle.

To encourage faculty, staff and students to choose commuting options with lower GHG intensity, the university provides information about commuting options and offers incentives for public transportation. For example, to promote carpooling, the GW NuRide program connects GW commuters from around the D.C. area. Registered riders earn rewards for each carpool ride found through NuRide and the GW Parking Office provides carpoolers with a reduced monthly parking rate of $190, versus the standard $210. To encourage Metro use, GW supports pre-tax payroll deductions for Metro SmarTrip cards for employees. To further discourage SOV trips from campus, the university worked with Zipcar to provide car sharing options throughout the university and provides bike storage at many academic buildings and residence halls. Commuters also have access to The Smart Bike (a bike share program operated by the District Department of Transportation and Clear Channel Outdoor) next to the Foggy Bottom Metro on GW's campus.

APPENDIX E: SAMPLE ENERGY REDUCTION POLICIES

In addition to the projects described in this Climate Action Plan, the energy team proposed additional policies to consider during implementation. The team will continue to examine the impacts of these policies and work with university leadership to determine the feasibility of each policy.

1. **Ban individual electric heaters and fans.** Many building occupants currently use personal heaters and fans to attempt to individually control the temperature of their environments. This equipment increases energy consumption both by directly using power and by inhibiting building systems from operating optimally, in addition to posing a safety hazard. Instead of allowing individual equipment, GW should require faculty and staff to submit a request to Work Control so that technicians can identify the cause of the problem and develop a long-term, energy-efficient solution.
2. **Establish building operating hours.** The university could save energy by expanding its program of cycling down (turning off or reducing building heating and cooling systems) during hours of minimal use, such as academic holidays, weekends and evenings. During these times, building occupants could make a formal request in advance to have lighting and HVAC turned on in portions of a particular building as required for specific functions or programs.
3. **Coordinate scheduling of building use and class locations** to consolidate use of space in fewer buildings during non-peak hours.
4. **Establish uniform heating and cooling temperature settings throughout campus** with the goal of maintaining occupied buildings in the temperature range of 68 to 78 degrees Fahrenheit year round. Within this temperature range, operations will balance occupant comfort and program/research needs with the university's climate commitment and energy conservation goals in mind. If building temperatures remain outside the established temperature range for a sustained period, occupants should contact Work Control. If Work Control is unable to achieve a temperature within the proper range by adjusting the building's HVAC systems, it will work with the occupants to find an alternate solution.
5. **Establish standards for lighting levels in university buildings and grounds.** The lighting levels recommended by the Illuminating Engineer Society of North America (IESNA) shall be the established lighting standards. Examples of current IESNA lighting levels include: (a) offices, classrooms and laboratories: 30-50 foot candles (depending on specific work tasks) on desk and table tops; (b) hallways: 5-8 foot candles; (c) stairwells: 5-8 foot candles; (d) restrooms: 5-8 foot candles. To achieve the desired lighting levels, the university will employ the most energy efficient technology available. Operations will work to balance occupant needs with the energy conservation objectives of the IESNA standards. To advance the university's climate commitment, building occupants are strongly discouraged from adding supplemental lighting to attain lighting levels above the IESNA standard. If a building occupant believes the level of lighting is less than the IESNA standard, Work Control will measure the level and take such remedial action as appropriate.
6. **Require occupants to turn off lights, computers, monitors, printers, chargers and other electronics** during evenings, weekends, vacations and holidays.
7. **Provide motion sensor power strips** in residence halls and offices to power down equipment when spaces are unoccupied.

APPENDIX F: INITIAL ENGAGEMENT ACTIVITIES

GW has an active and engaged community with whom the university has already partnered in a variety of ways. For continued progress on the climate change strategy, GW will need to leverage these relationships in the future. Groups and programs the university has engaged with include:

Green@Work Committee

A partnership between GW's Operations Division and Human Resources focused on encouraging faculty and staff to incorporate sustainability into their jobs. For the last two years the group sponsored a Green@Work fair to inform more than 200 GW staff members about sustainable practices, provide an opportunity for recycling used electronics and promote GW's sustainability programs and resources. In 2009, Green @ Work also organized a sustainability panel and book club to allow faculty and staff to connect to the Freshman Reading Program selection, Hot, Flat and Crowded. Currently the committee is piloting an office assessment program to help faculty and staff members integrate sustainability into their workplaces more systematically.

The Green Alumni Network

GW created the Green Alumni Network to engage its many alumni in law, policy, engineering and business who are focused on sustainability and making a difference through their work. This group seeks to utilize the expertise/experience of these alumni to enhance GW's sustainable efforts in a variety of ways, including: finding panelists and guest speakers for classes and campus events; providing career mentoring for students/young alumni and promoting a sustainability fund to support initiatives.

Green Living/Campaign GW Committee

The main organizing group on campus for students and staff to discuss sustainability, the Green Living/Campaign GW committee focuses on increasing green practices in the residence halls, including support of Eco-Challenge, RecycleMania, Earth Hour and Earth Week.

Planet Forward

A project of GW's Center for Innovative Media, Planet Forward is led by Emmy-Award winning journalist Frank Sesno and serves as a virtual public square for students, scientists, activists and entrepreneurs to make their case about the nation's energy future. Students and citizens submit videos and opinions while experts and the Planet Forward community engage online to promote a new "bottom-up" type of citizen conversation, flowing from web to television and back again. It explores the feasibility of moving rapidly away from fossil fuels. A new online edition in 2010 followed Planet Forward's 2009 PBS broadcast.

Student Groups

Numerous student groups on campus make commitments and impacts on sustainability at GW and beyond. In the past academic year, student groups organized a conference on climate change, opened the first on-campus community garden, held fairs to celebrate Earth Day, lobbied on Capitol Hill for climate legislation and promoted sustainable products to the GW community. Students are the motivating force behind most of GW's major sustainability accomplishments, including projects such as signing the ACUPCC, installing the first green roof and proposing the Green Campus Fund.

APPENDIX G: COMPLETE COMMUNICATIONS TACTICS

The section below compiles a more detailed outline of possible communications tactics for the proposed projects in the Climate Action Plan. This is intended as a starting point rather than a comprehensive communications plan.

IDEAS TO SUPPORT THE STRATEGY FOR "REDUCE"

- Coordinate press releases and stories to publicize sustainability efforts and achievements.
- Add branding messages and call to action prompts at various visual points of access where individuals make choices that impact GW's carbon footprint.
  - Entrance to parking lots, garages (e.g., "Hybrids Park Here").
  - Light switches in buildings (e.g., "Turn Off Lights").
  - Computer login screens (e.g., encourage proper monitor settings and printer settings).
  - Inside Mount Vernon Shuttles and Virginia Shuttles (e.g., facts about the environmental benefits of the shuttles).
  - Laundry rooms in residence halls (e.g., encourage shorter cycles and cold water washes).
  - Thermostats in buildings (e.g., encourage people to turn them down and/or explain new temperature policies).
  - Classrooms (e.g., highlight energy-saving tactics).
  - Colonial Inauguration and new employee orientation.
  - Develop transportation centers/external campus maps on pylons to help brand the Foggy Bottom area to both visitors and GW residents for our transportation options.
- Develop sustainability recognition program for employees to encourage them to lead lower-carbon lifestyles. Elements of this program could:
  - Give awards for greenest employee or greenest department.
  - Offer prizes such as a new hybrid vehicle or a green cleaning company for a year.
  - Leverage existing web tracking technology (e.g., Volunteer Match) to ensure seamless integration with existing university initiatives.
  - Challenge employees to participate in activities such as carpooling, biking, a sustainability service activity or a green activity at work.
  - Encourage employees to record their participation and document it via video or photography to be entered into the contest.
- Develop sustainability recognition program for students to encourage them to lead lower-carbon lifestyles. Model this program after Eco-Challenge and potentially:
  - Feature dashboards to help people visualize their energy and water consumption.
  - Develop prizes linked to tangible and desirable outcomes, which could include incentives such as housing lottery first pick or winning naming rights to a new green project on campus.
  - Market and promote competition results in a visually appealing way to help increase awareness and promote sustainable behaviors (e.g., enhanced website).
- Expand Excellence in Student Life awards to include a sustainability specific award.
- Continue the sustainability award at the Service Excellence Awards to highlight contributions made to reducing GW's carbon footprint.
- Leverage existing sustainability groups (GreenLiving, Green@Work, Campaign GW) and the sustainability student groups to help encourage and drive behavior change events and distribute

messages among their respective audiences. As these committees expand, they will have a wider distribution network to help pass pertinent messages through and enable central coordination to better engage them.

- Leverage Planet Forward as an innovative media platform to discuss GW's carbon footprint reductions strategies and highlight unique campus projects. Branding infrastructure projects related to the Climate Action Plan and Green Campus Fund to help internal and external audiences identify the "CAP at work."
- Ensure that marketing materials and fact sheets are updated continually to highlight sustainability accomplishments and facts.
- Increase marketing materials to identify unique transportation options on the GW campus and consider using the Foggy Bottom metro area as a staging ground for information kiosks.

Ideas to Support the Strategy for "Innovate"

- Coordinate press releases and talking points for new pilot technologies on campus.
- Develop funding priority areas to ensure that development officers appropriately solicit funds for the expansion of new technology on campus.
- Ensure consistent branding and signage for all renewables projects on campus.
- Create an interactive campus map that highlights innovative sustainability projects and information to inform people of projects around campus and in their buildings.
- Enable students to leverage Climate Action Plan projects as a "living laboratory" to enhance their classroom leaning.

Ideas to Support the Strategy for "Partner"

- Create opportunities for students, faculty and staff to engage with our partners through internships and volunteer opportunities.
- Leverage media opportunities to ensure that external communities are aware of GW's strategic partnerships.
- Incorporate partners into existing GW information forums.
- Create University-wide special events to highlight new partnerships.
- Ensure an integrated social media strategy with our partner groups.
- Challenge and encourage student groups, Green @ Work, Green Living/CampaignGW to partner more for events (e.g., Green @ Work could host a sustainable cook-off with internal GW groups and with external groups focused on food issues).
- Consult with new sustainable vendors to create co-branded materials to help publicize their programs on our campuses.

Ideas to Support the Strategy for "Research/Learning"

- Create comprehensive materials that highlight all academic and degree offerings in sustainability.
- Develop a public list of sustainability faculty experts online.
- Market and package our sustainability offerings in sustainability to prospective students and to other external audiences.
- Expand on existing symposia and conferences to highlight new sustainability research happening on campus.

APPENDIX H: SUSTAINABILITY AND CLIMATE-RELATED ACADEMICS

COURSEWORK

College of Professional Studies

Landscape Design

- Ecological Restoration
- Introduction to Sustainable Design
- Sustainable Design Charrette
- Sustainable Design Methods
- Sustenance and the Landscape
- The Green Scale Spectrum
- Tools for Sustainable Design

Columbian College of Arts and Sciences

American Studies

- Food in Washington D.C.

Anthropology

- Cultural Ecology
- Our Place in Nature
- The Anthropology of Development

Biological Sciences

- Conservation Biology
- The Building Blocks of Life
- Field Botany
- General Ecology
- Ecology Seminar
- Plant Biochemistry
- Environmental Biochemistry

Chemistry

- Environmental Chemistry

Geography

- Cities and Society
- Cities in the Developing World
- Climate and Human Ecology
- Energy Resources
- Environmental Hazards
- Environmental Issues in Development
- Environmental Quality and Management
- Field Methods in Geography
- Introduction to Human Geography
- Introduction to Physical Geography
- Land Use and Urban Transportation Planning
- Land, People and Food
- Population Geography
- Seminar: Climate Change
- Seminar: Population and Health
- Seminar: Resources and the Environment
- Seminar: Urban Climate
- Society and Environment
- Urban Geography
- Urban Planning and Development
- Urban Sustainability
- Water and Climate
- Water Resources
- World Regional Geography

Geology

- Environmental Geology
- Environmental Geophysics
- Environmental Policy
- Geological Field Methods
- Geological Hazards and Land-Use Planning
- Global Climate Change
- Science and the Environment
- U.S. Urban History

History

- Let's Eat: Food and American Culture

Philosophy

- Economic Justice
- Environmental Philosophy and Policy
- Ethical Issues in Policy Arguments

Political Science

- Issues in Domestic Public Policy

Elliot School of International Affairs

- Food, Globalization and Security

Trachtenberg School of Policy and Public Administration

- Environmental Impact Statement Procedures and Environmental Law
- Environmental Policy
- Land Use Planning and Community Development
- Urban and Regional Policy Analysis

School of Business

Strategic Management and Public Policy

- Environmental, Energy, Technology and Society
- Ethics and Business
- Strategic Environmental Management

Tourism and Hospitality Management

- Economic, Cultural and Environmental Aspects of Tourism

School of Engineering and Applied Science

Civil and Environmental Engineering

- Advanced Hydrology
- Advanced Sanitary Engineering Design
- Advanced Treatment Processes
- Civil and Environmental Engineering Graduate Internship
- Environmental Engineering I Water Resource and Water Quality
- Environmental Engineering II Water Supply and Pollution Control
- Environmental Engineering Laboratory
- Environmental Impact Assessment
- Environmental Sustainability
- Groundwater and Seepage
- Hydraulic Modeling
- Hydrology and Hydraulic Design
- Industrial Waste Treatment
- Introduction to a Sustainable World
- Introduction to Geoenvironmental Engineering
- Introduction to Geotechnical Engineering
- Introduction to Hazardous Wastes
- Introduction to Transportation Engineering: Mobility, Safety and Sustainability
- Microbiology for Environmental Engineers
- Numerical Methods in Environmental and Water Resources
- Pollution Transport System
- Principles of Environmental Engineering
- Sustainable Urban Planning Dynamics
- Sustainability in Engineering Materials
- Water and Wastewater Treatment Processes
- Water Resources Planning and Control

Engineering Management and Systems Engineering

- Air Quality Management
- Analytical Tools for Energy Management
- Analytical Tools in Environmental Management
- Energy Management
- Environmental Management
- Hazardous Waste Management and Cleanup
- Management of Risk and Vulnerability for Hazards and Terrorism
- Policy Factors in Environmental and Energy Management
- Water Quality Management

Mechanical and Aerospace Engineering

- Air Pollution

School of Law

- Air Pollution Control
- Animal Law Seminar
- Coastal, Navigational, Wet Lands Resources
- Control-Toxic/Hazardous Waste
- Energy Law and Regulation
- Environmental and Toxic Torts
- Environmental Crimes Project
- Environmental Issues
- Environmental Issues/Energy Law
- Environmental Law
- Environmental Law Seminar – Marine Environmental Law
- Environmental Legislation Project
- Federal Facilities Environmental Law
- International Environmental Law
- International Law – Human Rights
- Land Use Law
- Law of the Sea
- Natural Resource Law
- Regional Protection/Human Rights
- Sustainable Regional Growth Seminar
- Trade and Sustainable Development Law
- Water Pollution Control

School of Public Health and Health Services

Public Health

- Advanced Health Economics Research
- Ecology, Health and Social Development
- Environmental and Occupational Epidemiology
- Environmental and Occupational Health in a Sustainable World
- Global Environmental and Occupational Health
- Health and the Environment
- Information Sources in Environmental and Occupational Health
- Introduction to Outdoor and Environmental Education
- Introduction to Children's Health and the Environment
- Introduction to Global Health and Development
- Principle of Environmental Health Risk Science
- Toxicology: Applications for Public Health Policy

Exercise Science

- Body Image in the Concept of Health

University Writing Program

- Food, Rhetorical Agency and Social Change
- Contemporary Issues in American Foodways
- The Politics of the Kitchen: Examining Contemporary Women's Food Writing

LIST OF RESEARCH FUNDED AS OF SPRING, 2010

Columbian College of Arts and Sciences

Departments of Anthropology and Anatomy and Regenerative Biology

Integrative Analysis of Hominid Feeding Biomechanics, and Recovery and Analysis of Early Pleistocene Hominid Fossils and Footprints, Ileret, Kenya

Brian G. Richmond, Center for the Advanced Study of Hominid Paleobiology

Field research for this project is conducted in collaboration with Behrensmeyer at Koobi Fora, an area of human occupation in Kenya spanning about 4 to 1.4 million years ago. This site preserves long sequences of environmental records that include evidence of periods of both environmental change and stasis and also periods when human species thrived or periods of extinction.

Department of Biological Sciences

Prototypical Development and Implementation of a Process to Propagate and Restore the Federally Listed Endangered Plant Species Harperella (Ptillimnium Nodosum)

Elizabeth F. Wells, associate professor of botany

The purpose of the project is to understand how to prevent the extinction of harperella. During the study, harperella was successfully germinated and cultivated at the greenhouses at The George Washington University. The plants were then transplanted to 11 sites in two streams in West Virginia.

Department of Chemistry

Building Computational Models for Graphene Nanostrips, Electrical Double Layers, and Shock Waves and Development of Fast-Accurate Computational Codes w/Applications in Electrochemistry, Hypervelocity & Shock Waves

David Ramaker, professor of chemistry

The research group has developed a new analysis technique that enables both the determination of atomic and molecular adsorption sites and coverage on small metal nanoparticles, and correlation of that with the structural information obtained from the Extended X-ray Absorption Fine Structure (EXAFS). Both techniques can be applied to very complex systems such as in electrochemical cells, operating fuel cells, batteries and catalysts under reaction conditions.

Department of Geography

The Circumpolar Active Layer Monitoring Network --CALM III (2009-2014): Long-term Observations on the Climate-Active-Layer Permafrost System
Nikolay Shiklomanov, PhD; assistant professor
The CALM program is concerned with observing the response of near-surface permafrost parameters to climate change at multi-decade time scales. The CALM long-term observations have been used effectively and extensively by the climate modeling community and they have helped to shape recent Arctic Climate Impact Assessments and IPCC reports.

Development of an Urban Site Sustainability Metric in the Anacostia Waterfront Planning
Melissa Keely; assistant professor of geography and public policy and public administration
This project integrates environmental data and spatial analysis tools to develop an environmental policy mechanism based upon Berlin's Green Area Ratio policy for implementation in Washington, DC. Remote sensing data is used to classify land cover and land use in order to understand the implementation potential to integrate green infrastructure into the existing urban fabric. Regulatory options will also be assessed. Combined, this information will give cities science-based tools to support sustainable development policies.

Integrating Filed and Remotely Sensed Data for Improved Characterization of Permafrost Landscapes in the Russian Arctic
Nikolay Shiklomanov, assistant professor
The objective of the project is to investigate the response of permafrost and the active layer to climate change and increased human activities, using a combination of ground-based and satellite observations on Arctic ecosystems of the Northern Eurasia. Research is focused on aggregating and integrating diverse geocryologic observations from clusters of CALM sites.

Northern Eurasian Landscapes: Interactions Between Humans, Hydrology, Land cover, and Land Use
Nikolay Shiklomanov, assistant professor
This is a multidisciplinary project administered by the University of New Hampshire with the main goal of evaluating the cumulative effect of climate change and human development on northern Eurasian landscapes. GW is assessing the effect of climate change on stability of human infrastructure build on permafrost.

GW Solar Institute

Solar Vision Study: Solar PV Cost Reductions and Scale-up Opportunities: Chapter Working Group Support
Ken Zweibel, director GW Solar Institute, research professor of energy
This is a major project that focuses on the effort to develop a 20-year roadmap to accelerate the use of solar energy in the United States.

School of Media and Public Affairs

Planet Forward

Frank Sesno, director, School of Media and Public Affairs, professor of media and public affairs and international affairs

Planet Forward is a project of GW's Center for Innovative Media that serves as a virtual public square for students, scientists, activists and entrepreneurs to make their case about the nation's energy future. It promotes a new "bottom up" type of citizen conversation, flowing from web to television and back again. It explores the feasibility of moving rapidly away from fossil fuels. Its April 2009 PBS broadcast will be followed with a new edition in fall 2010.

Elliott School of International Affairs

Department of Economics

Economics of Adaptation to Climate Change in Low-Income Countries

Arun Malik, professor of economics, public policy and public administration

Stephen C. Smith, director, institute for international economic policy, professor of economics and international affairs

Nicholas Vonortas, director, Center for International Science and Technology Policy, professor of economics and international affairs

This project focuses on "autonomous adaptation" by firms, households and local communities to climate change, and the interaction with government and international climate change policy. To understand this relationship, the project will use micro data sets that capture the response of agents to past environmental shocks as models of adaptation to potential climate change shocks. Also, new data will be collected at the household level in the targeted low-income countries.

Partnerships for International Strategies in Asia (PISA)

Leadership Institute on Global Climate Change in Vietnam

Linda J. Yarr; director, PISA

PISA is collaborating with the Vietnamese Academy of Social Sciences to promote cross-sectoral and interdisciplinary research, dialogue, and problem-solving on global climate change, sustainable development, and social justice. Currently, recipients of a mini-grant are carrying out a project in Northwest Vietnam to introduce fuel-efficient cook stoves to a mountain community.

Political Science Department

Generating Popular Support in Non-Democratic Regimes

Bruce Dickson, professor of political science and international affairs

This projects looks at a variety of ways the Chinese government tries to create public support. The environment is one aspect of that effort, and one aspect of the research project. What are local governments in China doing to clean up the environment, and are respondents in those communities are happy with the results?

Implementing Regionalism: Connecting Emerging Theory and Practice to Inform Economic Development
Harold Wolman, director, GW Institute of Public Policy, professor of political science, public policy and public administration
This project focuses on emerging policies and programs that show signs of effectively driving positive economic outcomes. Identify principles for successful practices to applying to a regional framework for economic development of all kinds.

Regional Economic Resilience
Harold Wolman, director, GW Institute of Public Policy, professor of political science, public policy and public administration
The focus of this project is regional resilience and identifying resilient and non-resilient regions in order to explore the differences between the two. Research also consists of examining whether regions that have experienced negative economic shocks recover and, if so, how.

School of Business

Department of Tourism and Hospitality Management

Global Sustainable Tourism Alliance
Kristin M. Lamoureux, director, International Institute of Tourism Studies
The Global Sustainable Tourism Alliance (GSTA) is a partnership of leading organizations in the sustainable tourism field working together with USAID missions to apply a holistic and market-driven approach to sustainable tourism development. GW is one of four managing partners of the GSTA. GTSA members (including leading tourism development institutions, conservation organizations, the private sector and USAID) combine resources, expertise and reach in innovative ways to achieve sustainable results for the destinations. GW is currently involved in GSTA projects in the Dominican Republic and Ethiopia.

School of Engineering and Applied Science

Department of Computer Science

Mobile Underwater Sensor Networks (AMUSE): Design and Applications
Xiuzhen (Susan) Cheng, associate professor
The project investigates the design and application of autonomous mobile Underwater Acoustic Sensor networks (UWA-SN). UWA-SN is envisioned to enable applications for environmental monitoring of physical and chemical/biological indicators, tactical surveillance applications, disaster prevention, undersea exploration and assisted navigation.

Civil and Environmental Engineering Department

Energy-efficient Forward Osmosis Membrane Process for Sustainable Water Purification
Baoxia Mi, assistant professor
This project focuses on energy-efficient membrane processes for sustainable water reuse and desalination.

Engineering Management and Systems Engineering

NL-US Water Crisis Research Network (NUWCREN)
Doctor Gregory Shaw, co-director, Institute for Crisis, Disaster and Risk Management, associate professor
The NUWCREN network provides the framework for U.S. academic, and Dutch academic, private sector and government parties to generate and share relevant knowledge to support the Dutch government in crisis situations where flooding has the potential to cause damage and casualties. To date, the NUWCREN researchers have conducted several joint meetings to discuss potential collaboration related to issues identified after the Hurricane Katrina disaster and to the high-risk profile of the Netherlands.

NL-US Water Crisis Research Network (NUWCREN) Collaborative Research: Modeling the *Efficacy of Inventory for Extreme Event Preparedness Decision Making in Interdependent Systems*
Joose Santos, assistant professor
Global climate change can potentially trigger a host of extreme events including high-intensity hurricanes. In an effort to address the challenges associated with climate change adaptation, this research focuses on enhancing the resilience of economic and infrastructure systems in the aftermath of extreme events. The primary objective is to develop and deploy analytical and simulation-based inventory models to reduce the cascade of productivity disruptions across regional interdependent systems.

Develop & Validate a Finite Element Model for Current Year Small Car, Development of a Reusable Bogie Test Vehicle for the Foil
Steve Cing-Dao Kan, director, National Crash Analysis Center, GW Virginia Campus of Science and Technology
The purpose is to develop a generic test vehicle that has reusable front nose to represent different sizes of vehicles. The vehicle will be impact tested with different types of highway/roadside safety devices and system to evaluate the safety performance. The initial prototype will be built through computer simulation analysis and then be tested through a full crash test. With design improvement through optimization, the final design of this generic bogie test vehicle will be recommended to U.S. Department of Transportation.

School of Law

China Climate Change-Related Technology and Patent Policy
Michael P. Ryan, director, Creative and Innovative Economy Center
The study focuses on public and private Chinese technology projects in which the goal is to understand commercialized innovation related to energy and environmental fields such as clean coal, solar power, wind power, and bio-fuels. Chinese patent law and policy implementation by the State Intellectual Property Office with respect to the patent behavior of real and potential innovators are also being analyzed.

School of Public Health and Health Services

Department of Health Policy

Policy Brief on U.S. Government Participation in International Health Treaties, Regulations and Agreements

Rebecca Katz, assistant research professor

This project consists of producing a Kaiser Family Foundation issue brief focused on U.S. participation in international treaties, commitments and other agreements that either directly or indirectly impact health. As part of this project, seven international agreements will be examined, all of which are legally binding, that pertain to the environment and climate change.

Department of Prevention and Community Health

Inner City Families Who Successfully Adopt New Food Behaviors

Lorien Abroms, assistant professor of prevention and community health

This study uses a qualitative approach to learn about inner-city families who have increased their fruit and vegetable intake and what strategies they used to do so. These strategies will be promoted in future interventions for increasing fruit and vegetable consumption within inner cities.

ADDITIONAL FACULTY AND STAFF RESEARCH INTERESTS

College of Professional Studies

Landscape Design and Sustainable Landscapes

Adele Ashkar
Research interests: low-impact development (LID); applying and testing conservation landscaping; storm water harvesting, retention and infiltration; native vegetation on small-scale sites, both urban and suburban; urban infrastructure as it relates to storm water management; urban watershed restoration; and bioretention.

Charles Cushman
Research interests: politics and public policy, national security policymaking and Congress' role in defense policy.

Columbian College of Arts and Sciences

Art Therapy

Elizabeth Warson
Research interests: developing sustainable curricula to address quality of life factors for American Indians and Alaska Natives.

Classical and Semitic Languages and Literatures

Andrew Smith
Research interests: working in Jordan with the Hashemite Fund for the Development of the Jordan Badia on developing an archaeological and nature park in Wadi Araba, which will be centered on the site of Bir Madhkur. The entire project is geared toward sustainable economic development, in response to King Abdullah's initiative to promote economic development in Wadi Araba. This work is linked with an archaeological project that Andrew Smith is directing. Two fundamental components of his research are particularly relevant: 1) the documentation of the ancient Incense Road in Jordan to promote its eventual nomination to World Heritage Status (similar to the 2007 nomination of the incense road in Israel); and 2) the efforts to document the ancient agricultural systems and to investigate whether any of these ancient systems can be revived to benefit the local Bedouin community. Through his work in Wadi Araba, he has been working very closely with the local Bedouin community, in addition to local governmental and non-governmental bodies.

Center for Advanced Study of Hominid Paleobiology

Kay Behrensnmeyer
Research interests: leading expert in reconstructing past environments at paleontological and archeological sites spanning the past 6 million years in Africa. She is part of the National Museum of Natural History (NMNH).

Robin Bernstein
Research interests: stress physiology and the sustainability of critically endangered primate species in their native and non-native environments.

Alison Brooks
Research interests: collaborative research on the relationship between genetic evolution of disease resistance and archeological evidence of new human ecologies and settlement patterns, including archeological excavations.

Shannon McFarlin
Research interests: examining how environmental variables including human disturbance influence the growth and health of individuals in natural populations of critically endangered great apes.

Rick Potts
Research interests: directs a long-term archeological project at a site (Olorgesailie) in Kenya spanning the last c. 1.4 million years, a site that provides some of the most detailed data available for long periods of human occupation. He is part of the NMNH.

Brian Richmond
Research interests: conducts field research in collaboration with Behrensmeyer at an area (Koobi Fora) of human occupation in Kenya spanning about 4 to 1.4 million years ago that preserves: 1) long sequences of environmental records that include evidence of periods of both environmental change and stasis; and 2) periods when human species thrived and periods when some went extinct.

Biological Sciences

Catherine Forster
Research interests: the interpretation of Mesozoic-age fossils, particularly dinosaurs.

John Lill
Research interests: ecology of plant research interactions.

Randall Packer
Research interests: ion balance, respiration and acid-base balance in Teleost fish.

Courtney Smith
Research interests: the immunology of marine invertebrates and the purple sea urchin in particular. The sustainability of marine ecosystems is in part based on the immunological health of the animals that live there. Some of the degradation of coral reefs is due to disease, which may be the result of poor immune function in animals stressed by environmental changes.

Chemistry

Liesl Baumann – Doctoral Student
Research interests: carbon sequestration.

Stuart Licht
Research interests: research focuses on chemical solutions to renewable energy challenges, which face the global community by developing a new approach to capturing sunlight, and new energy dense batteries and fuels. Researches using solar energy to efficiently generate energetic chemicals through a new STEP process, for example hydrogen as a fuel and the removal of carbon dioxide by solar conversion into useful products. Also explores new clean chemistries for the high energy storage required for electric vehicles and for the next generation of consumer and medical portable electronics. Examples include a super-iron and boride air batteries that utilize multi-electron processes. Together, this fundamental solar and battery research proposes sustainable solutions to the challenges of energy, climate change and depletion of fossil fuels.

Henry Teng
Research interests: the behavior of natural materials in aqueous environments.

Jack Tossell
Research interests: The geometric and electronic structure of various molecules and clusters occurring both in gas and condensed phases.

Geography

Lisa Benton-Short
Research interests: urban sustainability, with attention to the role of public space, parks and urban planning. She also does research on policy with regard to urban air, land and water issues.

Ryan Engstrom
Research interests: uses remote sensing and GIS to map and understand climate change, population distributions, and health outcomes. This work is done in the Arctic, (e.g., the northern part of Alaska), Vietnam, Ghana, Haiti, and Pakistan. He provides the technical part for people doing a wide range of research on issues that can be linked to sustainability.

David Rain
Geography and International Affairs
Research interests: urban geography, population geography, economic development, Africa and GIS. His work has examined populations vulnerable to environmental hazards.

Interior Design

Nancy Evans
Research interests: graduate institutional studio is currently competing in the 2010 ASID (American Society of Interior Design) Design Competition; designing a rehabilitation facility for United States veterans. This project sponsored by Carnegie Fabric (whose textiles are PVC and plasticizer free and contribute to LEED points on various projects) emphasizes sustainability. Carnegie offers and continues to develop new protocols and new products, which address raw material usage, energy use and indoor air quality. All of these qualities will be enforced in the rehabilitative facility.

Nadia Volchansky Nieves
Research interests: Seeds of Hope is a projected model for healthcare delivery in rural areas of Haiti. Focusing on women and children's care, it proposes sustainable, phased construction of a main clinic

facility, which will offer prenatal care, labor/delivery and post-natal care, as well as preventative care and general medical and surgical services. Additionally, an outreach program will offer family planning, immunization, HIV/AIDS screening, nutrition and breast-feeding support and counseling services. The education center, housed on site, will provide midwife and first aid maternal health training to women from nearby villages. After completion of the training program, these women will staff branch clinics in their home villages. Branch clinics will be placed in rural residential areas and will serve as the first point of entry into Seeds of Hope for many Haitians. The Seeds of Hope project was presented as a proposed model, incorporating socially-responsible practices of construction such as using natural and local resources, minimizing water and energy use, and providing a safe healing environment as enforced by evidence.

Museum Studies

Sarah Brophy
Research interests: green museums.

Martha Morris
Research interests: sustainability and museums.

Philosophy

Paul Churchill
Research interests: environmental ethics and policy, sustainability. He has directed masters theses on sustainability and teaches the MA seminar on normative issues in foreign policy including the critical subjects of ethics of global development including "sustainable development."

Physics

Bill Briscoe
Research interests: The Data Analysis Center of GW's Center for Nuclear Studies maintains a worldwide database on the properties of nucleon-protons and neutrons. The analysis they have done on the nucleon - nucleon interactions is considered the world standard and is directly related to the production to nuclear energy. Future work on nuclear energy production depends on knowing the exact production cross sections of these reactions. Combining their work with new hires in the area of nuclear energy can provide a path to sustainability that GW has yet to go down.

Political Science

Llewelyn Hughes
Research interests: oil sector, platform for negotiating trade, energy policy, published an article on climate change in the Brookings Review.

School of Media and Public Affairs

Robert Entman
Research interests: the media's role in shaping the political environment around the issue of climate change.

Trachtenberg School of Policy and Public Administration

Melissa Keeley

Research interests: urban water resource management and the intersection between urban ecology, engineering, and environmental policy and planning. Her interests include urban watershed management, land use planning and sustainable building practices and the environmental services provided by urban vegetation, and her work contributes a comparative, transatlantic dimension to these topics.

Ivy Ken

Research interests: beginning to work on a project about sustainable food systems. Specifically, she is investigating the challenges that urban, suburban and rural day care centers have to participating in progressive food initiatives like Farm to School, on-site gardens, local and organic food supplies and the like. One big factor in all this is whether the food systems that supply day care centers are sustainable, and how they may be made more sustainable (for all affected parties) with different practices, regulations and norm.

University Writing Program

Michael Svoboda

Research interests: with Mark Starik and Karim Boughida in Gelman Library, he submitted a proposal to the science, technology and society division of the National Science Foundation for the collection, coding, and archiving of NGO documents related to climate change and sustainability. The proposal received fairly positive reviews on its first submission and was revised and resubmitted for the NSF's STS deadline in February.

Elliott School of International Affairs

Susan Aaronson

Research interests: human rights, governance and economic growth; global trade; global corporate social responsibility.

Michael E. Brown, dean

Research interests: international security, conflict and conflict resolution, U.S. foreign and defense policy.

Joseph Cordes

Research interests: public finance, taxation, corporation financial policy.

James E. Foster
Research interests: development economics, inequality, and poverty, economic theory, and policy.

Peter Hotez
Research interests: tropical disease vaccinology; pediatric infectious tropical diseases.

Ellen Messer
Research interests: food globalization and security, taught most recently at the Tufts School of Nutrition Science and Policy. She also served as director of the World Hunger Project at Brown University and will teach several courses related to anthropology, ethics and human rights.

Nicholas Vonortas and Stephen Smith
Research interests: Nicholas Vonortas, who leads the Center for International Science and Technology Policy, and Stephen Smith, who leads the Institute for International Economic Policy, have a plan that is significantly developed but as yet unfunded for a major conference on adaptation to climate change in the developing world. They envision a major conference in spring 2011 leading to an edited volume.

Graduate School of Education and Human Development

Human and Organization Learning

David Schwandt
Research interests: sustainability and education.

Ellen Scully-Russ
Research interests: green jobs, organization and cultures.

Institute for Public Policy

Andrea Sarzynski
Research interests: urban air quality.

School of Law

Steve Charnovitz
Research interests: trade and the environment.

David Freestone
Research interests: international environmental law, climate change, maritime law.

Rob Glicksman
Research interests: environmental regulation, public natural resources, risk regulation.

Jamie Grodsky
Research interests: specializes in environmental law, genomics and tort law and in endangered species.

Debra Jacobson
Research interests: energy and environmental law and policy, co-director of the GW Solar Institute.

Raymond Mushal
Research interests: environmental law.

LeRoy Paddock
Research interests: environmental governance, collaborative environmental problem solving, environmental justice, nanotechnology governance, environmental compliance and enforcement.

Dinah Shelton
Research interests: international environmental law, environmental law and human rights, climate change and human rights.

School of Business

Department of Decisions Sciences

Denis Cioffi
Research interests: sustainability modeling, solar energy technology development, and sustainable project management.

Theodore Glickman
Research interests: green chemistry relationships to supply chain management.

Marie Matta
Research interests: sustainability in supply chain management, green procurement and sustainability operations management.

Department of Finance

Arthur Wilson
Research interests: sustainability and finance.

Department of Marketing

Salah Hassan
Research interests: sustainable brand management and sustainability in the Middle East.

Vanessa Perry
Research interests: social sustainability related to housing discrimination.

Department of Management

D. Christopher Kayes
Research interests: social sustainability related to organizational integrity.

Patrick McHugh
Research interests: social sustainability related to employee involvement programs and collective bargaining.

Stuart Umpleby
Research interests: physical relationships among matter, energy and information.

Department of Strategic Management and Public Policy

John Forrer
Research interests: scale-factors in sustainability programs, ecological footprinting, and sustainability-related public-private partnerships.

Tim Fort
Research interests: social sustainability related to business ethics, peace through commerce and corporations as agents of social change.

Jennifer Griffin
Research interests: social sustainability related to global corporate social responsibility and public affairs.

Eun-Hee Kim
Research interests: business environmental economics and policy; electric utility environmental management policies, practices and performance.

D. Jeffrey Lenn
Research interests: social sustainability related to CSR, trade associations and accountability.

Jorge Rivera
Research interests: environmental policy and management in developing countries, voluntary environmental programs, corporate environmental governance, business environmental policy processes and ecotourism certification programs.

Mark Starik
Research interests: strategic environmental management, environmental and energy policy, environmental entrepreneurship, connections between environmental and social sustainability, university and business school greening efforts and climate action policies and practices.

Amy Townsend
Research interests: sustainable business and environmental science.

Department of Tourism and Hospitality Management

Soyoung Boo
Research interests: sustainable destination management.

Heather Bowen
Research interests: sustainable destination management.

Donald Hawkins
Research interests: sustainable destination management.

Steward Levy
Research interests: consumer perception of sustainability.

Lisa Delpy Neirotti
Research interests: environmental management in the sports industry sector.

Information Systems & Technology Management

Elias Carayannis
Research interests: sustainable technology management, sustainable technology transfer and international sustainable technology collaboration.

School of Engineering and Applied Science

Aerospace Engineering

David Dolling
Research interests: aerospace engineering.

Civil and Environmental Engineering Department

Baoxia Mi

Research interests: engineered processes for water sustainability, with a focus on nanotechnology and membrane separation for water purification and wastewater reuse. Her current research centers on a novel, sustainable forward osmosis process, which can be applied for desalination as well as renewable energy production. Her research experiences also include other membrane processes (e.g., nanofiltration, reverse osmosis, ultrafiltration, microfiltration), membrane synthesis and characterization, membrane fouling and membrane surface modification using nanomaterials.

Rumana Riffat

Research interests: sustainable biological treatment of wastewater, removal of nutrients from wastewater discharges to the Chesapeake Bay, determination of reaction kinetics, and development of advanced sludge treatment processes for production of Class-A biosolids.

Engineering Management and Systems Engineering

Jonathan P. Deason

Research interests: wide array of renewable energy and environmental sustainability research including energy policy, alternative fuel vehicles, hydrogen economy, urban water resources, sustainability of national parks and multi-objective optimization and other quantitative decision aiding methods.

Michael R. Duffey

Research interests: research to develop new methodologies for analysis of engineering systems, their lifecycle costs, and their design processes. Research projects have included offshore wind farms, scrap tire recycling and electricity infrastructure.

Howard Eisner

Research interests: creating and managing new systems that lead to a more sustainable society involves an understanding of systems engineering as well as advanced forms of engineering management. The former helps in building these systems, and the latter informs the use and management of such systems. His books and research papers on systems engineering and engineering management, and their various elements, provide guidelines as well as specific suggestions as to how to achieve a more sustainable society, in the sense described above.

Edward Hagarty

Research Interests: environmental and energy management.

Mechanical Engineering

Stephen Hsu

Research interests: energy efficiency, materials energy, manufacturing.

School of Public Health and Health Policy

Department of Global Health

Tilly Gurman
Research interests: health, maternal health and climate.

Environmental and Occupational Health

David Goldsmith
Research interests: environmental health (silica, sillicosis and cancer risks), respiratory illnesses and exposure to wood dust/paints/welding fumes, risk assessment/communication, chronic health effects (cancer associated with pesticide exposure), legal aspects, museum health/safety, chronic illness and agriculture.

Tee Guidotti
Research interests: child health and the environment, the initiation of pediatric environmental health specialty units, the North American network of resources centers for environmental exposures affecting children.

Katherine Hunting
Research interests: construction worker safety and health, occupational injuries and ergonomics, occupational epidemiology and surveillance.

David Michaels
Research interests: epidemiology and sustainability.

Celeste Monforton
Research interests: occupational injury and illness epidemiology, prevention strategies, regulatory policies, the precautionary use of evidence to reduce population risk to environmental hazards.

Peter LaPuma, PE, CIH
Research interests: having retired from the military, he was a leader in helping the Armed Services become more sustainable. As an alternative energy consultant, he helped establish utility scale solar systems, wind farms biomass and alternative fuel initiatives to foster energy security. He is now studying the life cycle energy and water inputs as well as air and water pollutant outputs from various sustainable actions particularly where they impact public health.

Jerome Paulson
Research interests: children's health.

Bob Rycroft
Research interests: science, technology and public policy; science, technology and complexity; environmental politics.

Exercise Science

Patrick Rahm
Research interests: personal health and wellness.

Melissa Van Orman
Research interests: personal health and wellness.

Organization Science

Liz Davis
Research interests: education, women in sustainability, climate literacy, org change, networks, sustainable organizations.

INSTITUTES

Energy Institute

Explores new approaches to energy science and technology directed toward developing new sources of renewable energy and increasing energy efficiency in order to ensure a sustainable energy future.

Environmental Law Program

One of the oldest environmental law programs in existence and ranked 16th in the nation, GW's Environmental Law Program provides tools needed to address climate change, fisheries depletion, air pollution, water scarcity and developing new sources of energy.

Institute for Corporate Responsibility

GW's Institute for Corporate Responsibility has four program areas including Peace through Commerce, Environmental Sustainability, Corporate Governance and Global Stakeholder Strategies.

Institute for International Economic Policy

Supports high-quality research that addresses critical issues surrounding the emerging global economy in the fields of international trade, international finance and international economic development and poverty reduction.

Institute for Sustainability Research, Education & Policy

Advances the quality and quantity of sustainability-related research conducted, education delivered, and policy considered throughout and beyond the university and its stakeholders.

Solar Institute

Focuses on the economic, technical and public policy issues associated with development/deployment of solar energy to meet global energy needs and environmental challenges.

DEGREES AND CURRICULA OFFERINGS

College of Professional Studies

- M.S. in Sustainable Urban Planning
- Sustainable Landscape Design Program

Columbian College of Arts and Sciences

- B.A. in Environmental Studies
- B.S. in Environmental Science
- M.A. in Environmental and Resource Policy (focuses in Environmental Science and Policy, Urban Sustainability and Renewable Energy)

Elliott School of International Affairs

- M.A. in International Development (Sustainable Development Focus)

School of Business

- Certificate Program in Responsible Management
- M.B.A. in Environmental Policy and Management
- M.B.A. with emphases in Sustainability and Corporate Responsibility

School of Engineering and Applied Science

Offers M.S. and B.S. with specialties in:

- Environmental Engineering
- Geotechnical Engineering
- Infrastructure Engineering
- Solid Mechanics and Materials Engineering
- Structural Engineering
- Transportation Engineering
- Water Resources Engineering

School of Law

- J.D. in Environmental Law
- L.L.M. in Environmental Law

School of Public Health and Health Policy

- M.P.H. in Environmental and Occupational Health
- M.P.H. in Environmental Health Science and Policy