Drew University's Climate Action Plan, Appendix A: Greenhouse Gas Inventory Methodology

Clean Air – Cool Planet's Campus Carbon Calculator, an assessment tool recommended by *The Presidents' Climate Commitment*, was used to determine Drew's greenhouse gas emissions. The Carbon Calculator takes into account Drew's use of fuel and electricity to heat and power buildings, fuel for running the university fleet, landfill waste, and travel. Energy data was collected mostly from the Facilities Department. In addition, the Purchasing Department, International and Off-Campus Programs, and a commuting survey provided data that was then put into the Carbon Calculator for travel.

A.1. Direct and Indirect Emissions.

The Presidents' Climate Commitment requires each institution to measure emissions from operations and activities at all university-owned facilities. Greenhouse gases, when released, contribute to climate change by trapping heat inside the Earth's atmosphere. Four of the six greenhouse gases included in the Kyoto Protocol[1] were measured in Drew's inventory. They are carbon dioxide, methane, nitrous oxide and refrigerants (HFC). Emissions were measured based on fiscal year.

The Drew Campus Carbon Inventory tracks both direct and indirect emissions. Direct emissions, or greenhouse gases physically created on campus, are the result of heating campus buildings, burning fuel in university fleet vehicles, and leaked refrigerants from refrigeration and air conditioning equipment. Indirect emissions result from "sources that are neither owned nor operated by [Drew] but whose products are directly linked to on-campus energy consumption." These emissions are created from the generation of purchased electricity[2] consumed on campus and off-campus travel, waste disposal and commuting.

Emissions are converted to metric tons of carbon dioxide equivalent (CO_2e) for consistency based on their global warming potential (GWP). GWP is the contribution to global warming by one unit of carbon dioxide equivalent. The sources are ranked by those that contribute the most towards the emission of a particular greenhouse gas.

Table A1. Greenhouse Gases Included in Inventory

Greenhouse Gas	GWP	Source
Carbon dioxide	1	Electricity, heat, fleet fuel
Methane	21	Solid Waste, Fleet Fuel
Nitrous oxide	310	Fertilizers, Electricity
Refrigerant R-22	1700	Cooling
Refrig. R-134a	1300	Cooling
Refrig. R-407C	1526	Cooling
Refrig. R-410A	1725	Window A/C Units

A.2. Data Collection.

Data covering direct and indirect emissions were collected from Drew's facilities department. Energy data came directly from financial records managed by facilities. Heating data, fuel for university-owned vehicles and total purchased electricity[2] was provided by the Facilities Business Analyst. Drew uses natural gas in on-site steam plants to heat buildings. Oil (#2 fuel) is sometimes used in the central steam plant in the winter and this amounted to six percent of total heating energy in 2008. The university's fleet of vehicles runs on gasoline except for a garbage truck that runs on diesel fuel.

Two approaches were taken to gather data related to travel. Study abroad emissions were determined based on air miles travelled with data collected from the International and Off-Campus Programs Office. Air travel for business travel was estimated based on miles travelled using the University's Procurement Card for ticket purchases. Thus, emissions from air travel are underestimated because not all Drew employees have a Procurement Card and may not always use one when purchasing travel tickets. A survey was sent out to Drew

employees to gather information about their daily commute to and from campus. A total of 217 employees responded, which constitutes a 42 percent response rate. The data received from the survey was extrapolated to measure remaining Drew employee commuting habits.

Drew is a primarily residential institution, but a large number of those living on campus travel off campus on the weekend. Weekend student commuting behavior was calculated by measuring the number of students not eating in the university's dining hall on Saturdays and Sundays and this number was then multiplied by the average miles students travel off-campus for the weekend.

Waste disposal data was provided by Drew's account manager at Waste Management, Inc. The Borough of Madison provided information about how Drew's wastewater is processed to determine what kinds of greenhouse gases are released. The amount of paper used by the Drew community was calculated based on financial records from the Copy Center and Shipping/Receiving.

Once all data were collected, they were converted to standard units and plugged into the Carbon Calculator. Emissions factors internal to the Carbon Calculator were then applied. For those refrigerants not listed in the Carbon Calculator (e.g. R-407C), additional emissions factors were added based on the Intergovernmental Panel on Climate Change's Third Assessment Report.

A.3. Results.

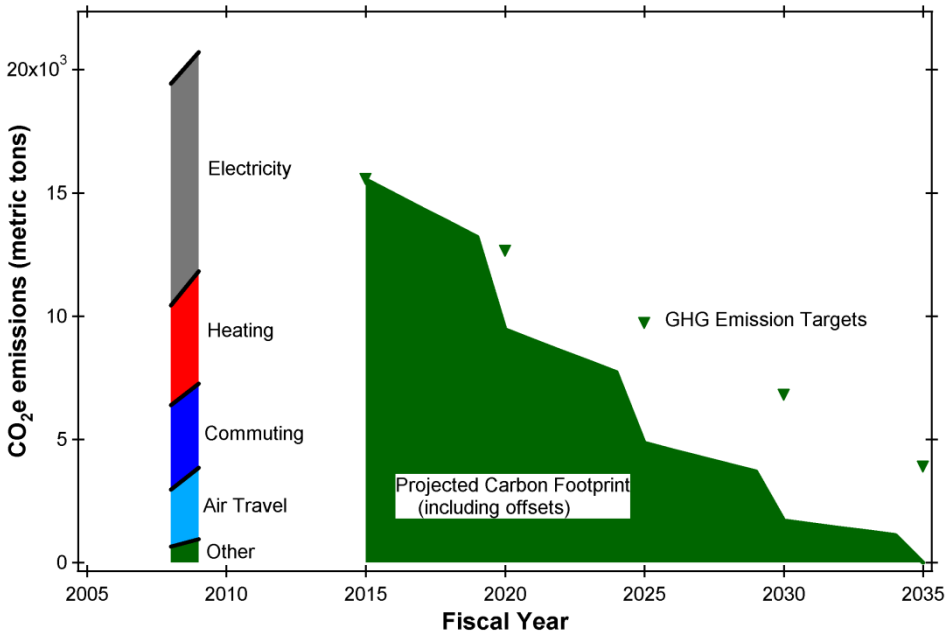
The result of Drew's Greenhouse Gas Inventory showed the university emitted 18,081 metric tons of carbon dioxide equivalents in fiscal year 2008. [One metric ton equals 2,200 pounds.] In terms of specific sources, emissions are attributed to electricity (45%), heat (21%), commuting of faculty, staff and students (18%), air travel (12%, of which student travel was 9% of the total) and other (4%).

Table A2. FY 2008 Campus Carbon Inventory Summary for Drew University

	Total metric tons of CO_2e	Per FTE Student metric tons of CO_2e	Per 1,000 Square Feet metric tons of CO_2e
Electricity	8,183	3.5	6.4
Heating	4,054	1.7	3.2
Commuting	3,430	1.5	---
Air travel (abroad & conf)	2,297	1.0	---
Electricity distribution losses	813	0.3	---
Waste (solid & water)	315	0.1	---
Fleet vehicles	180	0.1	---
Refrigerants	77	---	---
Paper purchasing	83	---	---
All sources	**19,432**	**8.3**	**15.2**

Table A3. FY 2009 Campus Carbon Inventory Summary for Drew University

	Total metric tons of CO_2e	Per FTE Student metric tons of CO_2e	Per 1,000 Square Feet metric tons of CO_2e
Electricity	8,098	3.5	6.3
Heating	4,550	2.0	3.5
Commuting	3,424	1.5	---
Air travel (abroad & conf)	2,894	1.3	---
Electricity distribution losses	803	0.3	---
Waste (solid & water)	305	0.1	---
Fleet vehicles	136	0.1	---
Refrigerants	421	0.2	---
Paper purchasing	87	---	---
All sources	**20,718**	**9.0**	**16.1**



The Climate Action Plan uses the 2008 GHG Inventory as a baseline for carbon neutral targets. The 2009 GHG Inventory was completed in July 2010, and its preliminary results are included in Table A3. As expected with the increases student population and the addition of MeLendon Hall, the 2009 results show a 6.6% increase relative to 2008. This increase was primarily associated with increases in heating, study abroad air travel, and refrigerants. Increased heating resulted from an increased number of "heating degree days" in 2009 relative to 2008. Notable GHG decreases were recorded for electricity and fleet vehicles.

Table A4 compares Drew University's GHG Inventory results to other private, similarly sized, peer institutions in Drew's regional climate. Peer institution data was collected from reports published on *The Presidents' Climate Commitment website*. Drew University emits a relatively large amount of greenhouse gases on a per student and per building area basis.

Table A4. 2008 Greenhouse Gas Inventory Summary Compared to Peer Institutions.

College	Total	per student	per 1000 ft^2
Drew	***19,432***	***8.3***	***15.2***
Gettysburg	19,088	7.3	12.2
Union	16,703	5.9	NA
Bard	16,492	7	11.1
Dickinson	12,456	5	6.4
Ursinus	7,460	4.8	6.4
Peer Average	***14,440***	***6.0***	***9.0***

(1) The Kyoto Protocol is an international environmental treaty to stabilize the emission of gases in the atmosphere that contribute to climate change.

(2) Drew purchases electricity from the Borough of Madison and does not have any control over the fuel mix used to generate the electricity. The Borough is one of several municipalities in New Jersey to provide electricity to residents and businesses. The Borough does not produce its own electricity, but rather purchases electricity from a public utility. The Borough then sells the electricity to Madison residents and businesses. The Borough's fuel mix varies year to year depending on the utility that is contracted for electricity. As the Borough's purchased electricity provider changes, so does Drew's fuel mix. Since Drew's purchased fuel mix changes regularly, this greenhouse gas inventory used data from the regional electric fuel mix to report emissions related to electricity consumption for consistency purposes.

Drew University's Climate Action Plan, Appendix B: Energy Report – Electricity, Heating and Purchasing

B.1. Introduction.

The energy category of greenhouse gas emissions stems from two major elements: electricity usage on campus (and the carbon content of the fuels used to produce it) and fuels burned on campus in the central heating plant and in individual buildings to provide building heat, cooling and hot water. Natural gas is the primary fuel used to heat the campus. In FY 2008, emissions from electricity and heat accounted for 67% of the total estimated campus emissions of 19,432 metric tons of CO_2 equivalent greenhouse gases. Of this amount, 46% came from the electricity purchased by the University and 21% came from heating in the various buildings on campus. Electricity and heating emissions rose by 401 metric tons in 2009, due primarily to an increased number of "heating degree days" and the addition of MeLendon Hall.

The greenhouse gases associated with the consumption of electricity, heat and hot water on campus are a function of the number of people on campus, the number of buildings, the complexity of equipment and services provided (e.g., the 24/7 local area network), the efficiency of the equipment using electricity and that producing hot water and heating, and the particular fuels burned to generated electricity off-campus and heating and hot water on campus. With such a sizable share of Drew's emissions coming from these two sources, the major focus of campus emissions reduction must concentrate on these two areas.

To reduce greenhouse gas emissions from heating and electricity will require a variety of efforts. These include the areas of electricity, heat and purchasing, discussed here. It also requires new approaches to new buildings and renovations of existing buildings, discussed in the following Appendix.

Increased efficiency in the use of energy is one of three major strategies for reducing Drew's greenhouse gas emissions. The others are conservation and fuel switching. Conservation involves turning off un-needed or unused equipment so that carbon fuels are not burned. The second way to conserve energy is to change heating, cooling and electrical use standards. For example, this might involve a policy of more energy-efficient temperature set points for winter and summer months that would result in slightly less heating in winter and cooling in summer. Over-heating of buildings frequently results in building residents opening windows to reach comfortable temperatures. Conservation also includes making the best use of the efficiency features of equipment, such as energy saving settings on computers and photocopiers and adopting a policy to procure only Energy Star equipment. It thus will involve a change in culture and behavioral patterns on campus (discussed in the Education Report). Fuel-switching entails the replacement of a more greenhouse gas intensive fuel source for a less intensive one (e.g., substituting natural gas for coal). All three methods will be explored as ways to reduce greenhouse gas emissions from the electricity and heat areas. Significant steps may be taken with current technologies and opportunities to reduce greenhouse gas emissions from this area significantly in a relatively short time frame as is presented below.

B.2. Existing Situation at Drew University.

Emissions of greenhouse gases from the burning of fuel on campus to generate heat and hot water (scope 1 emissions) and the emissions burned to generate electricity off campus (scope 2 emissions) account for two-thirds of Drew University's emissions total.

In terms of heating, Drew has a central heating plant that primarily burns natural gas to produce heat and hot water for 12 buildings on campus. Wendell Hall and Tipple Hall have recently been added to this system. The central heating plant is a dual fuel plant that can also burn#2 heating oil. Second, there are several mini-plants that heat two or three buildings each. They are fueled by natural gas. Third, McLendon Hall has a geo-thermal field that provides approximately 40% of the heating and 100% of the cooling requirements of the building. Finally,

the remaining buildings on campus - many of which were once private homes - have their own heating and hot water equipment. For cooling, this last group of buildings uses window air conditioner units. The core issue here is both the number of buildings that need to be provided with heating, cooling and hot water and also the number of systems with different technologies and efficiencies that must be maintained and operated at optimum efficiency levels.

Drew purchases all of the electricity used on campus from the Borough of Madison and does not have any control over the fuel mix used to generate the electricity. The Borough is one of several municipalities in New Jersey to provide electricity to residents and businesses. The Borough does not produce its own electricity, but rather purchases electricity from a public utility. The Borough then sells the electricity to Madison residents and businesses. The Borough's fuel mix varies year to year depending on the utility that is contracted for electricity. As the Borough's purchased electricity provider changes, so does Drew's fuel mix.

Existing programs. Existing efforts that reduce greenhouse gas emissions from these areas have been part of normal maintenance and upgrades, deferred maintenance and energy efficiency efforts. In terms of heating, the major improvement was the connection of several major buildings (including Seminary Hall, Wendell Hall and Tipple Hall) to the central heating plant which is a much more efficient way of producing heat. More energy efficient lighting fixtures have been installed in many buildings as have compact fluorescent light bulbs, though there is still a good way to go in this area. When equipment has reached the end of its useful life, it is replaced with more energy efficient technology, for example in the case of chillers. Occupancy sensors have been installed in many buildings to turn off lighting when no-one is in the building. Purchasing has paid attention to energy concerns in RFPs and in making purchasing and contract decisions. In terms of Information Technology, much has been done in the data center already to reduce power consumption—most notably, server virtualization, which allows Drew to run dozens of virtual servers on one physical box.

B.3. Proposals for Reduction of Electricity and Heating Greenhouse Gas Emissions.

There is great potential for reducing greenhouse gas emissions relative to the 2008 benchmark in this area. These changes involve conservation, efficiency, and alternative fuels. As noted above, conservation will involve eliminating wasted electricity in part through changes in the campus culture and behavior of all members of the Drew community. Efficiency increases will include changes in software, maintenance, collecting data, and hardware upgrades. It will also involve the green purchasing and green building policies. Alternative fuels will entail exploring the possibilities of converting scope 1 emissions on campus (heating and cooling) to lower carbon fuels and the possibility of obtaining a renewable energy alternative for purchased electricity (scope 2 emissions).

Specifics. In 2009, Drew contracted with an energy consultant to conduct an Energy Assessment. This report will provide the basis for the first round of greenhouse gas emission reductions from electricity and heating. The Assessment offers a three-part program for reducing both energy costs and greenhouse gas emissions, primarily from conservation and increased efficiency. [This initial assessment presented practical possibilities for GHG reductions. Reduction strategies will be finalized by an Energy Master Plan to be completed by Spring 2011.]

Phase I is a short-term optimization program that is estimated to reduce greenhouse gas emissions by 635 metric tons CO_2 equivalent, cutting building electrical use by 603,248 kwh with a payback period of 0.4 years. Energy conservation measures include changing operating set points, optimizing boiler plant energy, deactivating systems based on outside ambient temperatures, holiday energy curtailment policies, etc.

Phase II is a long term optimization program that is estimated to reduce greenhouse gas emissions by 1881 metric tons, lowering building electric use by 3,027,100 kwh with a payback period of 2.7 years. This phase continues optimization programs, installs new controls, increases or replaces insulation, deactivates boilers and chillers when not needed, incorporates additional reset strategies. It also includes student and staff awareness

programs, new power management software, exit sign fluorescent replacement, upgrading lighting fixtures and building energy awareness into the curriculum.

The final or third phase is long term capital investment. If fully implemented, this program is estimated to reduce emissions by 2,146 metric tons, cutting electricity consumption by 3,315,314 kwh with a payback period of 13.2 years. This phase involves replacement of equipment such as chillers, hot water heaters, solar hot water heating for the swimming pool, heat recovery coils, and boilers with more energy efficient models. It also includes replacement of windows, installation of window film and insulation, solar heating of the swimming pool, further upgrades of lighting and of building management systems.

Together, it is estimated that the three phases would result in the reduction of 4662 metric tons of CO_2 equivalent emissions or **25.8%** of Drew's estimated 2008 emissions.

B.4. Purchasing.

An Energy Star Policy will be presented to the Drew University Board of Trustees for adoption.

Drew University Energy Star Policy

By signing of *The Presidents' Climate Commitment*, Drew University pledged to reduce its greenhouse gas emissions, and (to meet these goals) its direct and indirect consumption of fossil fuels and electricity. In addition to other building uses, electricity is consumed by equipment plugged into electrical sockets. Equipment that is plugged in accounts for a minimum of 20-25% of the electricity consumption of buildings on campus. To reduce unnecessary electricity consumption, Drew will purchase the most energy efficient appliances, equipment and machinery possible, while ensuring that it performs well for intended uses.

Energy Star is program run by the Environmental Protection Agency that helps businesses and individuals reduce environmental impacts by labeling products with superior energy efficiency. Products with the Energy Star rating are typically 20-40% more energy efficient than non-Energy Star products. Reducing unnecessary energy consumption saves the University money and reduces pollution and greenhouse gas emissions. **When Energy Star ratings exist for a product, all appliances, electronics, and other equipment must have Energy Star designation (see http://www.energystar.gov/). Moreover, within the Energy Star group, options with higher energy efficiency should be selected over those with lower ratings, as long as they meet user needs.** Purchasers should ask equipment retailers which of the models are Energy Star and how the models rank. The following products should have the Energy Star rating to be purchased by Drew University: refrigerators, freezers, clothes washers, dishwashers, room air conditioners, televisions, audio visual equipment, computers, printers.

The following language should be added to requests for quotes (RFQ) and request for proposals (RFP) when bidding equipment:

> "ENERGY STAR is a government-backed program helping businesses choose the most energy-efficient product (www.energystar.gov). Does the product meet ENERGY STAR specifications for energy efficiency?
> Yes____
> No_____ (provide justification why ENERGY STAR equipment cannot meet the intended function)

If no Energy Star rating exists for the product, then products that rank in the upper 25 percent of energy efficiency as designated by the Federal Energy Management Program should be purchased. Departments not purchasing Energy Star products should provide an explanation of these purchases indicating the circumstances for not following this policy and indicate the energy consumption of the product. There is an online calculator that quantifies the cost savings of purchasing Energy Star rated products over less energy efficient models. (Available at http://www.energystar.gov/index.cfm?c=bulk_purchasing.bus_purchasing) The Sustainability Coordinator is available for further assistance in choosing a product that meets the Energy Star policy. The Sustainability Coordinator can be reached at extension 3660 or sustainability@drew.edu.

The Energy Star policy will be implemented September 2010. The Purchasing Department in conjunction with the Sustainability Office will review purchase orders to ensure compliance with this policy.

Implementation: Drew will institute awareness education and training of the Energy Star Purchasing Policy for departments and managers who purchase equipment. A new Administrative Computing System will allow the Purchasing Department to more accurately keep track of Energy Star criteria and purchases. Until then, the Purchasing Department will add a checkbox to purchase requisitions: "Does this product follow Drew Energy Star Policy?" The Sustainability Committee will also research expanding the Energy Star Purchasing Policy to include other products and developing approvals for other products not certified. If a persistent additional budgetary impact is discovered, funding should be made available to offset the additional cost of green items.

Information Technology. In terms of Information Technology, Drew will pursue the following steps: (1) Elimination of legacy phone systems. Drew currently has two large, older systems, which have considerably higher power consumption than a contemporary phone system would, and cause additional energy usage due to cooling needs. (2) Drew will continue to buy Energy Star certified servers. There are currently no Energy Star or EPEAT standards for network equipment, storage equipment, and other IT hardware. In the absence of a standard, University Technology will understand power consumption of non-certified equipment and consider overall power consumption of the equipment whenever possible. (3) Drew currently has no comprehensive way to monitor power consumption in the data centers. As data centers are renovated, power monitoring equipment should be installed that allows for instantaneous and historical power consumption charting, and comparisons of input power to power consumed by devices to monitor efficiency of UPSes and IT system power supplies. (4) New initiatives or new IT system uses should be evaluated for their additional demand for electrical power, both by systems themselves and for additional cooling, to be monitored appropriately. (5) University Technology currently deals with obsolete equipment in several ways. Sometimes the equipment has use to other people and it is donated for their use. Other equipment is purchased on a fixed-term lease and is returned to the leasing company for refurbishment and resale, or responsible recycling. Owned equipment that has exceeded its useful life is sent to an equipment recycler. Drew should ensure that equipment recycling companies are responsible with their waste streams, and that recycling of metals and other components is happening in a responsible fashion, ideally not being sent overseas to be recycled in an environmentally irresponsible fashion.

B.5. Implementation of Proposals.

It is recommended that these changes be implemented by an outside contractor with specific expertise in energy savings and greenhouse gas emissions reductions based on an Energy Master Plan to be developed by Spring 2011.

Implementation of the Energy Star Purchasing Policy should be the responsibility of the Purchasing Office in collaboration with relevant offices on campus and with the Sustainability Committee. Information Technology proposals should be implemented by the affected technology offices, including but not limited to Computing and Network Services, Administrative Computing, Telecom, the Media Resource Center and Instructional Technology Services, in conjunction with Purchasing and other offices as appropriate and under the supervision of the Assistant Vice President for Technology.

Financing. The senior management group discussed above should explore all financing options for the proposed changes. These would include grants and subsidies (as mentioned in the Energy Assessment), unused capital building funds from previous bonds, deferred maintenance budget, the capital campaign, targeted development efforts, and other corporate, non-governmental and governmental support. As discussed below, a revolving fund to support energy efficiency is of particular interest as is effective liaison with the Socially Responsible Investments Committee.

Longer Term Options to Further Reduce Energy Consumption and Greenhouse Gas Emissions from Electricity and Heating. As these first, large emissions

reduction projects are being implemented, Drew should study the option of several other potentially significant ways to reduce greenhouse gas emissions. These other options are not considered in this report. Drew will consider the feasibility of solar generation of electricity by photo-voltaic cells (e.g., on the roofs of any new structures), LED. lighting, and building a combined heat and power facility on campus, possibly fuelled by bio-mass or natural gas.

Implications for Drew. Implementation of the energy, purchasing and information technology proposals will both reduce greenhouse gas emissions and reduce expenditures on fossil fuel and electricity. They will require up-front investment of funds to pay for reduced energy costs and emissions. Unlike offsets or a surcharge for renewably generated electricity, these expenditures give the University two benefits: one environmental and the other financial. They should be undertaken quickly. Further, to get the most benefit from these (and many of the other proposals in this report), Drew will need to enlist the knowledgeable support and participation of students, faculty, staff and administrators (as discussed in Appendix D).

B.6. Summary.

Drew has paid attention to energy efficiency and waste as part of its normal operations for many years. Intending to build upon and ramp up these previous and current efforts to significantly reduce emissions, the recommendations of this section are three-fold. First, to reduce its emissions 25% below 2008 levels, Drew should adopt and implement the Energy Assessment recommendations as soon as possible in the context of the Energy Master Plan. This will involve the selection of an energy management contractor. The contract will include not only energy reduction targets but greenhouse gas reduction as a mandatory element of the R.F.P. and the contract. Second, Drew will engage in discussions with Madison Electric to secure a renewable energy option. Third, Drew will research grants and other funding sources in the short and medium terms and begin a research effort into the feasibility of technologies such as those listed above as longer term options. Part of this research effort should be continued monitoring of climate legislation, energy/fuel price future trends, and any other supply constraints on fuels such as oil, coal, and natural gas.

Drew University's Climate Action Plan, Appendix C: Environmentally Responsible Building Guidelines

The adoption of Drew University Environmentally Responsible Building Guidelines as official University Policy is central to full implementation of Drew's Climate Action Plan. These guidelines are intended to minimize the environmental and carbon footprints of new buildings and major building renovations on campus.

Drew University recognizes that environmentally responsible design should minimize the environmental impact and lifetime operational costs of University owned buildings. Building designs that are environmentally responsible promote energy efficiency, land stewardship and resource conservation, which, in turn, preserve the natural resources of the Drew community and the surrounding region. Financially, building design that incorporates life cycle cost analysis is important to responsible long-term fiscal planning for the University.

This policy affirms the commitment of Drew University to environmental, economic, and social stewardship through sustainable building practices for all facilities and buildings. It is the University's expectation that the implementation of this policy will contribute to the realization of protecting, conserving, and enhancing environmental resources, provide a healthy work place for students, faculty and staff, and yield cost savings through reduced operating costs. It is the intent of this policy to provide mechanisms to plan, design, construct, manage, renovate, and maintain University facilities in a sustainable manner, including new construction and building renovation projects.

To the extent that their implementation is consistent with the mission of Drew University and incurs reasonable expenses, the set of building principles described below collectively provide the framework for all new major construction and major renovation of buildings on campus. Architects, contractors, engineers, landscape architects, and all others involved in building projects on Drew's campus are expected to follow these guidelines.

LEED Rating System: LEED stands for Leadership in Energy and Environmental Design, and is a consensus based, market driven green building rating system. It is based on existing, proven technology and evaluates environmental performance from a "whole building" perspective. LEED contains prerequisites and credits in five categories: Sustainable Site Planning, Improving Energy Efficiency, Conserving Materials and Resources, Embracing Indoor Air Quality, and Safeguarding Water. There are four certification levels: Certified, Silver, Gold, and Platinum.

Purpose: The purpose of establishing this policy is to minimize increased use of nonrenewable energy and technologies to support our built environments. This will be achieved by the University's commitment to the principles of sustainability and LEED building practices, reducing operating costs through life-cycle cost analysis, and providing healthy environments for students, faculty, staff and visitors while providing an opportunity for regional outreach and education as it relates to sustainable building projects.

It is the policy of Drew University to finance, plan, design, construct, manage, renovate, and maintain its facilities in a sustainable fashion. This applies to new construction and major renovations in which they the criteria given. The most recent edition of the US Green Building Council's LEED rating system and accompanying Reference Guide shall be used as a design and measurement tool to determine what constitutes a sustainable building by national standards. All new facilities over 5,000 gross square feet shall meet and acquire a LEED Silver rating at a minimum. All major capital renovations costing more than 50% of the building replacement value shall meet and acquire LEED certification at a minimum while striving for a Silver rating whenever possible. In both cases, particular emphasis and prioritization is to be directed toward the project's ability to optimize energy performance, utilize advanced commissioning practices and measurement and verification standards as outlined by the USGBC.

All University divisions, departments and offices and their contractors responsible for financing, planning, designing, developing, constructing, renovating and managing University owned facilities and buildings regardless of location will comply with this policy.

Drew University expects those involved in building projects on campus to:

- Require that all new construction is built to LEED Silver standard or equivalent; as part of the American College and University President's Climate Commitment (ACUPCC). Particular attention should be directed toward the project's ability to optimize energy performance, utilize advanced commissioning practices and measurement and verification standards as outlined by the USGBC. The project team should always incorporate best management energy efficiency practices when appropriate and strive to exceed LEED silver standards within the appropriate rating category.
- Evaluate each building project individually for pursuing LEED ratings beyond the "silver" level. Architects and contractors should sustain a dialogue with University representatives when choosing which LEED points (i.e. environmentally responsible features) to pursue.
- Include an architect on the design team with environmentally-responsible design experience and are LEED Accredited Professionals as architects with these credentials provide experience with the LEED certification process and facilitate efficient incorporation of environmentally responsible technology into building design.
- Evaluate a building's lifecycle costs in addition to initial construction costs. The total cost of ownership, and not simply the initial cost, must be evaluated for all major building projects. Architects and engineers are expected to provide life cycle cost estimates of building systems during the earliest phase of building design. The university is particularly interested in receiving lifecycle cost estimates throughout the design process for the building envelope as well as the HVAC, lighting, and water systems.
- Use appropriate resource conservation technology to improve water and energy efficiency beyond industry baseline. Energy conservation should be looked at as a priority and the project team should strive to exceed LEED silver standards within the appropriate rating category.
- Present for consideration, building features which reduce environmental impact even if they have no economic payback. The University is willing to consider the building features impact that have no direct economic payback but reduce the negative environmental impact of the building. Examples of this type of building feature include: native landscaping, using building materials made of recycled content, and limiting storm water runoff.
- Use innovative technology only when a particular technology has proven itself reliable in a similar climate. The University assumes all liabilities for campus buildings and seeks to limit the risks associated with ownership by using only reliable technologies specific to the University's situation.
- Recycle construction debris from both new construction and remodeling projects in an effort to minimize the waste that is sent to the landfill. All construction contractors must have plans for reducing construction waste prior to start of project.
- Conduct commissioning of the building energy systems throughout the design and construction process to ensure optimal efficiency.
- In addition to vertical construction projects, the University is committed to utilizing sustainable design and construction methods as appropriate for scope, scale and impact of all horizontal projects, including but not limited to: parking lots, landscaping, and utility/infrastructure work.
- When relevant and feasible, Drew University will utilize the sustainable building design and construction process as a tool for teaching and learning within our community (students, faculty, staff, and the surrounding region). Our projects will serve as models and provide a mechanism for outreach for broader social engagement within the region.

Responsibility: All University employees shall be responsible for ensuring that projects and facility use are implemented so as to comply with the purpose of this policy. The Facilities Project Management Office shall be responsible for evaluating and documenting the applicability of all University design, construction, renovation and horizontal projects in meeting the goals of this policy. The President or his/her designee has final authority to determine the appropriate level of applicability of this policy.

This policy is to be reviewed every three years, and revised as appropriate based on the emerging opportunities for enhanced project implementation in regards to energy and resource efficiency.

Drew University's Climate Action Plan, Appendix D: Transportation Report

B.1. Introduction.

Transportation is the second largest source of greenhouse gas emissions in the U.S. For Drew the transportation category consists of faculty and staff commuting, fleet vehicle use, air travel by students studying abroad, and air travel paid for by Drew for employee travel. In fiscal year 2008, emissions from transportation accounted for 31 percent of the total emissions. Approximately 18% of these emissions stem from faculty, staff, and student commuting. Twelve percent of these emissions are the result of air travel: students studying abroad contribute 9% and faculty and staff conference travel account for 3%. Transportation emission in 2009 were relatively stable, with the exception of an increase in air travel associated with study abroad.

Significant steps can be taken to easily and quickly reduce transportation's impact on climate change. Reducing the number of single occupancy vehicles by ride sharing and eliminating idling fleet vehicles on campus are both ecologically and economically sound. When infrastructure allows, individuals can greatly reduce their climate impact by opting to utilize public transportation. New technologies are producing more efficient transportation methods, such as hybrid cars, which emit less GHGs and new federal CAFÉ standards are increasing vehicle efficiency. Finally, airline travel could be addressed through reputable carbon offset programs.

B.2. Existing Situation at Drew University.

There are a number of alternative transportation options available to the Drew community. Drew is within walking distance from the Madison Train Station run by New Jersey Transit. The Morris County Metro 3 bus stops in front of campus. Drew Yellow Bikes are available for rent to the entire Drew Community for a small deposit. Drew is also a pedestrian-friendly campus and the campus master plan includes strategies to enhance pedestrian walk-ways. Rental cars are available through the company Zipcar. Drew has two hybrid Prius cars available for hourly or daily rates. Drew also rents overnight, on-campus apartments to students and employees and reduces two single occupancy vehicle trips by doing so.

Existing Drew Programs to Reduce Transportation GHG Emissions. Drew already takes a number of steps to reduce the campus transportation footprint. The majority of students live on campus and are able to walk to classes. Drew does not allow first and second year students who live on campus to have a car on campus. This keeps student commuting miles down and encourages alternative transportation.

Human Resources currently subsidizes employee public transit by allowing monthly transit passes for bus and rail to be paid from employee paychecks before taxes are applied. The Drew Volunteer Resource Center has an 8-person van that can be rented by students and campus departments. This van takes students to the local supermarket and has the potential to serve as a campus shuttle for other uses.

B.3. Proposals for Reducing Drew's Transportation Greenhouse Gas Emissions.

A combination of education initiatives will help move the strategies forward including a guidebook of the proposed alternative transportation programs, presentations about the programs at new employee and student orientations, informational brochures about offsetting the climate effects of air travel, and replacing the campus fleet with more fuel-efficient vehicles. We are proposing that increasing the knowledge of the Drew Community about the high GHG emissions of transportation and the alternatives available to them will lead to a decrease in Drew's transportation footprint. We are also proposing a system of incentives to aid in the overall transition of individuals toward sustainable transportation.

Carpooling. Decreasing the number of Single Occupancy Vehicles (SOVs) at Drew is a primary concern.

There is a lack of education and information regarding carpooling which keeps people from considering it as a viable option for transportation. We have consulted with TransOptions, an NGO which coordinates all forms of public transportation and maintains a database of carpoolers in order to facilitate ride matching. TransOptions is currently working with the College of St. Elizabeth and Farleigh-Dickenson University to match commuters from all over New Jersey. We were encouraged by the wide geographic range and number of commuters they are working to match for carpooling purposes. Eventually, we hope to have a substantial database of just Drew affiliates in order to foster relationships between people.

We feel that carpooling will reduce the most transportation emissions. Employees who travel to Drew every business day generate the most GHGs due to the combined number of miles traveled in their commute each day. To encourage carpooling, a GIS carpool map is being developed to connect employees and students with those that live nearby. If 10% of employees carpooled, Drew could reduce its emissions by 197 tons of carbon.

Public Transportation. New Jersey Transit is the primary form of public transportation for Madison. There is a train station 0.5 miles from campus (0.7 miles to Seminary Hall). There is a bus route which makes of circuit through downtown Madison and through Morristown, and stops close to campus.

University Fleet Vehicles. Vehicle Update – the University should conduct a review of the current vehicles it owns. Replacing or updating these vehicles would bring the university long term economic benefits by reducing fuel expenses. This would decrease the university's emissions. Drew University will conduct a review of its fleet vehicles with the purpose of moving toward a smaller and more fuel efficient fleet. Drew University will encourage staff to select the most fuel efficient fleet vehicle appropriate to the job they are performing.

Drew should implement a "no idling" rule where Facilities' vehicles cannot be left running when they are not being driven from one place to another. It takes only five seconds of idling to use more fuel than it takes for a vehicle to turn off and back on again.

Bike/Walk Options. It is our intention to increase the availability of the Yellow Bike program, a bike rental program available for the campus community. Bikes are rented on a semester basis for a low cost. The Drew Yellow Bikes can be used both on and off campus in downtown Madison or to off-campus internships.

Airline Travel. The issue of airline travel will most likely be addressed through carbon offsets and the possibility of tele-conferences. Students traveling abroad will be informed of voluntary carbon offset options.

Education. Guidebook- Drew will develop an inclusive guidebook to describe all sustainable transportation programs and opportunities at. It will include a "Carpooling Etiquette" section. Employees will be informed of sustainable transportation options through new employee orientation.

Drew University's Climate Action Plan, Appendix E: Education Report – Developing a Culture of Sustainability

Developing a culture of sustainability at Drew University is crucial to our Climate Action Plan goals. Students, faculty, and staff committed to sustainability and provided with the knowledge to inform their actions will ensure participation in optional green house gas reduction programs, such as carpooling and purchasing offsets for student studying abroad. They will increase energy savings by ensuring others abide by best practices including turning off lights and unplugging appliances not in use. A culture of sustainability will build Drew University's commitment to carbon neutrality into the fabric of the University's identity. Deepening the culture of sustainability through Drew University's curricular and extra-curricular educational offerings, moreover, enhances the university's mission to promote intellectual rigor while creating responsible citizens prepared to contribute to society.

Drew University will foster this culture of sustainability through developing and supporting environmentally-related curriculum and extra-curricular educational events, encouraging a vibrant student movement, increasing coordination among faculty, staff, and students from across the university, and expanding community engagement efforts.

A Sustainable Mission Statement. At present, Drew University is engaged in conversations about revising its mission statement. This revision process provides the opportunity to recognize sustainability as a core value by including it in the official University mission statement. To do so would recognize the importance of Drew University's commitment to *The Presidents' Climate Commitment* and long-term devotion to achieving sustainability as an institution and incorporating sustainability into the curriculum.

Sustainability in the Curriculum of the Drew Theological School and Graduate Division of Religion. Sustainability is clearly recognized in the first line of the mission statement of the Theological School: "Drew Theological School empowers leadership for a global Christianity of justice, ecumenism, and the integrity of creation." This demonstrates the support for environmental concern and associated issues of justice for all the earth's communities that is widespread in the Theological School's many degree programs, although it is not explicitly present in all courses. The required Masters of Divinity (M. Div) course, Religion and Social Process, always contains a sustained discussion of issues related to sustainability and the issues inherent in religious worldviews and practices that may hinder action. Similarly, the M. Div required courses in Systematic Theology, Christian Ethics, and Church at Worship, Hebrew Scriptures and New Testament always contain some relevant material. Additionally, two professors regularly offer elective courses that focus on the ecological and economic issues involved in sustainability. About half of the professors offer electives including some relevant aspect. These professors represent all of the divisions of the Theological School and the Graduate Division of Religion, and many of their courses draw students from both programs. At the M.A and Ph.D. level, students in two of the areas can focus specifically on religion and ecology. Sustainable ecological and economic concerns are part of the Center for Christianities in Global Context and are increasingly incorporated into cross-cultural trips. Additionally, a steady stream of speakers, films, chapel services and field trips provide opportunities for raising awareness of sustainability and climate change issues and participating in creating change.

Sustainability in the Curriculum of the College of Liberal Arts. In 2008, the College of Liberal Arts replaced the minor in Environmental Studies (ESS) with a new major and minor in Environmental Studies and Sustainability supported by a generous grant from the Andrew Mellon Foundation. With support from the Mellon Foundation, faculty developed new courses across the disciplines. ESS now offers courses in 10 departments on campus. The program also hired a new tenure track faculty member in Geology and a GIS specialist and is supporting a new postdoctoral position in the humanities to expand offerings in underrepresented areas. The range of courses and the

diversity of courses offered increases the likelihood that students who are not majoring in Environmental Studies and Sustainability will still take courses highlighting sustainability. A generous grant from NASA should further extend student exposure to sustainability by supporting faculty development of civic engagement projects in areas of study such as climate change and energy issues.

The Environmental Studies and Sustainability program provides students with the in-depth knowledge, multidisciplinary perspectives, and critical skills necessary to address the complex environmental problems of today and of the future, including climate change. Five core courses, required of all majors, cover environmental science, sustainability, GIS, a senior capstone seminar, and laboratory science with focus on either ecology or environmental geology. Also integral to the major is an experiential requirement which can be met through relevant academic internships, study abroad, field research, civic engagement, or volunteer work. Students electing to major or minor in ESS enrich the campus conversation about the role of climate change, bringing their hands-on experiences with environmental internships and the breadth of their multidisciplinary coursework to the table.

The ESS program also contributes to campus knowledge of environmental issues, sponsoring a wide range of public events including an annual Environmental Film Festival, popular enough to be held in the largest lecture hall on campus. In Spring 2010, the ESS Program co-sponsored Robert Bullard, the principle founder of the academic field of environmental justice, to speak during Common Hour to the entire first year class. The program also sponsored an Environmental Justice alternative spring break in 2009-2010. Climate change teach-ins featuring faculty from fields as diverse as Geology, Economics, Political Science, and Chemistry have been held annually.

In 2009, the College of Liberal Arts approved new general education requirements, including courses in diversity. In the future, Drew University should consider the possibility of a sustainability requirement as part of its general education. One of the hallmarks of a Drew undergraduate education is the Drew International Seminar. It is advisable to expand the environmental offerings of the Drew International Seminars and for Drew to expand its relationships with study abroad programs with environmental studies components.

Extra-Curricular Environmental Education across the University. In 2008, Drew University hired a sustainability coordinator. The sustainability coordinator provides a green orientation to all first year College of Liberal Art students. Additionally, the sustainability coordinator manages a team of "Eco-Reps" who promote environmentally responsible behavior within the dorms. Through the "Lug a Mug" program instituted in 2008, Drew provides all incoming students with a reusable mug. Both the campus snack bar and coffee shop provide discounts for students using reusable drink containers. Recyclemania is one of the major educational events on campus involving the sustainability coordinator. Drew finished 20th out of 180 participations in Reyclemania 2008, recycling almost 45 tons of bottles, cans, paper and cardboard in just 10 weeks.

The Drew Theological School in particular has instituted a number of changes to increase awareness of sustainability through action. The Theological School offers paperless courses and engages in carbon fasts. The Theological School refrains from ordering pork, beef or lamb for any meals. They order biodegradable tableware, plates and glasses and serve no canned drinks or bottled water as part of teaching a heightened awareness of sustainability to students.

The University-wide Sustainability Committee is a key location for climate change conversations and campus climate change education. President Weisbuch initiated the Sustainability Committee in 2007 and charged it with creating a sustainable Drew. Faculty, staff, and students from across the University participate in the committee. The committee's primary responsibility is to implement the requirements of *The Presidents' Climate Commitment* but it also organizes a wide range of sustainability events, including climate change teach-ins and climate vigils.

Right now, the Sustainability Committee, student groups, and faculty only infrequently contact the student newspaper, *The Acorn*, or send out press advisories to the local newspapers pitching environmentally-themed stories or inviting media to

sustainability events on campus. Student groups, the Sustainability Committee, and interested faculty could make a more coordinated effort to contact campus and community press.

Student Sustainability Initiatives Across the University. There are many student- led sustainability initiatives underway at Drew University. While all of these projects are not necessarily designed to specifically deal with greenhouse gas mitigation, student groups recognize that environmental issues are not isolated from one another. Student groups view green house gas mitigation as part of a host of interconnected environmental practices and recognize environmental sustainability as a multi-faceted movement.

Members of the Drew Environmental Action League (DEAL) increase campus awareness of environmental issues and promote activism and positive change towards a more sustainable world and provide environmental volunteer opportunities for Drew undergraduates to partake in environmental initiatives beyond the University. Earth House is a communal living space for students at Drew that promotes sustainability through environmentally and socially responsible lifestyles. Members manage waste through recycling and composting and they use strategies such as rainwater entrapment to conserve water. Most importantly, Earth House extends its sustainability agenda to the wider community and fosters a cultural norm around green living – by organizing programs around local and global environmental and social issues.

Earth House and DEAL co-sponsor events such as "Fern Fest," an annual re-foresting event held during Earth Week. Members of the Drew community and the surrounding community of Madison, New Jersey work to replace a section of the campus lawn with diverse native ferns and wildflowers, helping to restore the forest ecosystem that once thrived here. Fern Fest is a community festival, often involving craft and food booths and bands playing into the evening, educating the University campus about the importance of local environmental action.

A more recent student-led group, the Socially Responsible Investment Committee, has a subgroup that focuses on environment, and this has led it to become more involved in environmental issues on campus and working with other groups.

Finally, each dormitory on campus selects an eco-representative who is responsible for promoting environmental responsibility to the members of their respective living environments, as well as the campus at large. The eco-representatives facilitate environmental education, conduct trash audits, and promote recycling and waste management. The eco-representatives also explore long-term energy conservation and efficiency goals as they strive to minimize Drew's ecological footprint.

Graduate students in the Theological School and the Graduate Division of Religion are active in the organization TERRA. TERRA works to raise awareness of ecological issues on campus as well as in our communities and our world; foster active participation of students in ecological movements and activities; engage religious traditions in ecological values and activities; and to celebrate those religious groups that are already actively engaged in environmental activism.

These various student groups indicate a wider acceptance of the importance of sustainability at Drew University. Yet, an environmental honor code would codify this commitment to a broader base of students than those active with environmental organizations. Undergraduate students have begun a conversation regarding an environmental honor code and the Sustainability Committee can play a supportive role in such discussions.

Despite the vibrancy of student efforts, structural restraints on behavior still exist on the campus. In order to increase education and awareness we need to contribute to a culture of student engagement on the Drew campus. We recommend a full review of polices on campus that may limit or inhibit student engagement with sustainability issues. This should include reviewing the policies regulating event planning to identify policies that may constrain the ability of community members to reserve rooms, advertise events, and otherwise organize events.

The University Community. Drew University is comprised of the College of the Liberal Arts, the Caspersen School of Graduate Studies, and the

Theological School. While many vibrant curricular, extra-curricular, and student-led initiatives exist at Drew University, coordination among the three schools could be increased. First, undergraduate student groups like DEAL and Earth House could work more closely with TERRA. Interaction and coordination between the three groups has historically depended on the will of individual student leaders. We encourage conversations about ways to institutionalize events or gatherings to bring TERRA, DEAL, and Earth House closer together. Similarly, extra-curricular events planned by students and faculty occasionally overlap. More coordination could happen to build each others' efforts rather than unknowingly overlap in planned speakers or events. Finally, it may be desirable to offer more cross-listing of courses among the three schools in regards to sustainability. Graduate students occasionally participate in appropriate College of Liberal Arts classes on sustainability. The differences in preparation and student culture posed challenges in the past for allowing undergraduates to enroll in graduate and theological school courses.

Additionally, the Caspersen School of Graduate studies is not integrated into the conversations about sustainability to the same extent as the Theological School and the College of the Liberal Arts. More efforts need to be made to reach out to the students and faculty at the Caspersen School of Graduate Studies. In particular, the MAT and Medical Humanities Programs may be particularly receptive to outreach around sustainability in the curriculum initiatives.

One of the most effective ways to increase coordination, collaboration, and communication among the three schools is through building an increased community. Right now the Sustainability Committee provides the most important institutional space where faculty and students from the three schools gather to converse and coordinate sustainability issues. We recommend including appropriate faculty from the Theological School and the Caspersen School of Graduate Studies in the College of the Liberal Arts' Environmental Studies and Sustainability Program's retreats and meetings. Additionally we suggest developing an annual civic engagement event each fall that includes students and faculty from all three schools interested in sustainability. Our work could also benefit from increased faculty and staff participation in and support of student initiatives as well as increased participation in of students in academic events without having to offer extra credit. This may happen by involving students more in decision making and the planning of events.

Recommendations for Deepening a Culture of Sustainability at Drew University

1. Include sustainability in Drew's revised Mission Statement
2. Increase communication, collaboration, and coordination among faculty, staff, and students across the University.
   a. Improve the coordination about and timing of sustainability events.
   b. Develop a stronger relationship between undergraduate groups like DEAL and Earth House and the graduate and theological student group TERRA.
   c. Consider ways to boost cross enrollment of students in sustainability courses from CLA and the Theological school.
   d. Increase efforts to incorporate students and faculty at the Caspersen School into sustainability conversations.
   e. Develop civic engagement courses and opportunities that include faculty, students, and staff from across the University. This could include a civic engagement event each Fall as well as long-term partnerships such as the one developing with the Ironbound Community Corporation in Newark, NJ.
3. Expand the environmental offerings of the Drew International Seminars and Theological School cross-cultural trips and expand Drew's relationships with study abroad programs with environmental studies components.
4. Continue to expand the course offerings and integration in the curriculum across the schools.
5. Review the institutional polices that contribute structural restraints to behavior.

6. Contact *The Acorn* and local newspapers more frequently to increase coverage of environmental issues on campus and sustainability themed events on campus.
7. Consider the possibility of a student-led initiative to institute an undergraduate environmental honor code.
8. Consider the long-term potential of adding a sustainability requirement to the College of Liberal Arts' general education requirements.

Drew University's Climate Action Plan, Appendix F: The Scientific Basis of Climate Change

Human activities are significantly changing Earth's climate, and the impacts of climate change will affect all regions of the globe and all aspects of civilization, including public health, agriculture, and fresh water supplies.

Systematic temperature measurements have been recorded around the globe since 1850, and these data indicate that Earth's surface air temperature warmed by 1.3 °F between 1906 and 2005.[1] The rate of warming, however, is dramatically increasing: from 1981 to 2005, Earth's surface air temperature warmed at a rate of 3.2 °F per century. The frequency of extreme temperature events, such as heat waves, has also changed. For instance, in the Northeast United States, the number of days with temperatures exceeding 90 °F has doubled since 1945.[2] Warmer temperatures alter precipitation patterns. Temperate regions have experienced moderate increases in rain and snow fall, including an increase in extreme precipitation events, while drought conditions have become more frequent in the tropics and subtropics. Arctic temperatures have risen twice as fast as the global average resulting in a steep decline in sea ice; the extent of arctic summer sea ice dropped by ~20% from 1979 to 2005.[1] These are but a few of the indicators of our changing climate.

Human civilization relies on the combustion of fossil and natural fuels for cooking, heating, and, especially in the industrialized world, electricity and transportation. Since the industrial revolution, combustion emissions have increased the atmospheric concentration of carbon dioxide from 280 parts per billion to 380 ppb, while methane concentrations jumped from 650 ppb to 1,950 ppb.[1] These long-lived greenhouse gases represent the dominant factor, quantified as radiative forcings, responsible for the observed warming. Although solar intensity fluctuations also affect climate change, it only contributed around 4% of the warming factors (i.e., positive radiative forcing) between 1750 and 2005. Volcanic eruptions constitute another natural factor; however, since their effect is temporary (i.e., <5 years) the long-term net result is minimal. Computational climate models provide a means for assessing our understanding of climate processes by using these radiative forcings as inputs and comparing model outputs to the observed climate data discussed above. These models can only reproduce the dramatic warming since 1970 when including the factors associated with human activities. This result, which includes the work of several independent modeling groups, indicates that the observed climate change is due primarily to human activities, of which the dominant factor is carbon dioxide emissions.

After verifying these computational climate models against historical records, they can be used to generate climate change forecasts. Future forecasts are variable since they depend not only on climate science but also on economic and policy projections. It is thus useful to compare forecasts using low emissions scenarios (e.g., slow economic growth and/or strong policy action) versus high emissions scenarios. By mid-century global surface air temperatures are forecast to rise by an additional 2.3 °F to 3.1 °F relative to the 1980-1999 average. Extreme temperature events in the northeast U.S. will also increase, with an additional 20-30 days annually with temperatures exceeding 90 °F.[3] Such increased summer temperatures will result in decreased air quality with more frequent high ozone alerts. Interested readers are directed to *Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions* for a more complete discussion of impacts affecting Drew University and our neighbors. Impacts in our region, however, will be relatively minor compared to climate forecasts for many more vulnerable developing countries. It is with this cumulative knowledge that we, the Drew University community, aim for carbon neutrality.

[1] IPCC Physical Science Basis of Climate Change, 2010.
[2] DeGaetano and Allen, *J. Climate Sci.* 2002, *15*, 3188.
[3] Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions, NECIA, July, 2007.