

Gettysburg Research and Action by Students for Sustainability  
(G.R.A.S.S.)

# Sustainability Proposal for Gettysburg College

## Contributors

Fred Reimer, 2007 (Senate Senior Class Representative)  
Monica Charpentier, 2008 (Senate Junior Class Representative)  
Andrew Rohrbaugh, 2007 (GECO)  
Keith Reinemann, 2008 (Energy Intern)  
Miriam Parson, 2008 (Recycling Intern)  
Natasha Gownaris, 2009 (Biosphere, CAB, GECO)  
Eric Canzano, 2009 (Amnesty International)  
Allison Rague, 2009 (Senate Sophomore Class Representative)

## Advisor

Caroline Nielsen (Environmental Studies Department)

## Contents

|  |    |
|--|----|
| <b>Section 1: Introduction and Mission</b> (Monica Charpentier)..... | 1  |
| <b>Brief Outline of Suggestions</b> .....                            | 2  |
| <b>Section 2: Green Buildings</b> (Natasha Gownaris).....            | 5  |
| <b>Section 3: Transportation</b> (Keith Reinemann).....              | 7  |
| <b>Section 4: Electricity Usage</b> (Eric Canzano).....              | 7  |
| <b>Section 5: Heating and Cooling</b> (Fred Reimer).....             | 10 |
| <b>Section 6: Carbon Neutrality</b> (Andrew Rohrbaugh).....          | 11 |
| <b>Section 7: Solid Waste</b> (Miriam Parson).....                   | 12 |
| <b>Section 8: Environmental Education</b> (Miriam Parson).....       | 13 |

## Section 1: Mission

- by Monica Charpentier

Gettysburg Research and Action by Students for Sustainability (G.R.A.S.S.) is an Ad hoc Student Senate committee, comprised of student senators, student leaders, and faculty, that was created in order to coordinate and advance the current efforts in the area of campus sustainability that were being made by various groups on campus. Organizations like the Gettysburg Environmental Concerns Organization (GECO) and Biosphere have independently provided this campus with significant advancements over the years in the area of sustainability. In light of the 175<sup>th</sup> Anniversary of the College and the development of a new Strategic Plan, this is a critical and appropriate time to help such organizations voice their opinions and organize their efforts. As Gettysburg College celebrates its past and plans for its future, sustainability must become both an institutional priority and a campus reality. This semester we have drafted a student-created proposal to serve as a roadmap for Gettysburg as it heads down the path towards increasing sustainability. We anticipate that a proposal of this nature will

be a successful way to further our mission of achieving campus sustainability, as similar proposals have at many of our peer institutions.

Efforts to increase campus sustainability reflect the goals and values of Gettysburg College. As a liberal arts institution, Gettysburg College strives to create an educational environment where students learn to synthesize ideas from many disciplines. Involving students in the goal of having a sustainable campus provides them with the opportunities to apply and integrate skills learned from a variety of disciplines, including environmental science, political science, philosophy, economics, globalization studies, physics, chemistry, and more. Ample co-curricular learning opportunities exist, ranging from having an environmental science class conduct energy audits of campus buildings to having a political science class investigate the impact of environmental and sustainability policies, or lack thereof, on international business relations. Campus-wide sustainability initiatives would promote the development of local and global citizenship by encouraging awareness of our physical impact on the environment and the social, political, and economic ramifications thereof. In this manner, sustainability initiatives also have the potential to create a better relationship with the local community by involving the community in our efforts and by having the institution behave in a socially responsible manner. As an institution of higher learning, it is essential that the College not only provide leadership in the education of future generations but also lead by example in taking responsibility for our impact on our physical and societal environment. Establishing Gettysburg College as a leader in environmental stewardship would bring us into the national spotlight and make us more attractive to national agencies and prospective students. In addition to the environmental and educational effects, campus sustainability will ultimately be cost-saving to the College.

Following this Introduction is a table summarizing our suggestions for short term and long term sustainability initiatives. Because the management of sustainability efforts would involve coordination across virtually all campus offices and departments, hiring and establishing a Sustainability Director is a crucial step in making Gettysburg College a sustainable campus. The Sustainability Director would coordinate, oversee, and direct the implementation of sustainability programs at Gettysburg College. We envision the establishment of a permanent committee of faculty, administrators, staff, and students that would work along side the Sustainability Director in planning and implementing these efforts. We also recognize that while sustainability efforts will be cost-saving in the long term, they require initial funds to start. We support the creation of a yearly fee (suggested amount of \$25) to be used to help offset these initial costs. To ensure the long term success of sustainability efforts, we suggest the creation of a revolving energy fund, in which the money saved from sustainability initiatives would be invested into additional sustainability projects.

As you read our report, we hope that you will see the benefits of developing a sustainability program at Gettysburg College. We look forward to your support in our efforts to make Gettysburg College a sustainable campus.

## Executive Summary

| <u>Short Term</u>   | <u>Long Term</u>  |
|---|---|
| <b>Management</b>   |   |
| Hire a Sustainability Director to coordinate Gettysburg College's sustainability efforts  | Establish a permanent body of faculty, administrators, staff, and students to oversee future sustainability initiatives |
| Create a page on the College website to detail our efforts and attract alumni and current and prospective students to the project | Ensure that Endowment investments are in environmentally-friendly companies   |

|   |   |
|---|---|
| Establish a yearly fee (suggested \$25) to fund sustainability efforts  |   |
| Establish a revolving energy fund where the money saved from sustainability projects is invested in additional projects       |   |
| <b>Green Buildings</b>  |   |
| Include in Master Plant Plan the goal for LEED Silver Certification for all new buildings                                     | Green Renovations to existing buildings   |
| Evaluate existing buildings for LEED Certification levels   | Creation of a Green Center as part of future renovations to the Science Center/McCreary                                   |
| <b>Transportation</b>   |   |
| Buy a biofuels processor  | Implement a full-scale program using biofuels for all diesel campus vehicles  |
| Biodiesel oil partnership between the College and community businesses, coordinated by the Energy Intern                      | Increase the percentage of diesel vehicles in the campus fleet  |
| No freshmen are allowed to have cars and include a fee of \$50 per semester for all upperclassman parking.                    |   |
| <b>Electricity</b>  |   |
| Implement an energy-reduction campaign in dorms   | Purchase electricity from alternative energy providers  |
| Replace current light bulbs with Compact Fluorescent Light bulbs  | Investigate potential for solar panels on new and existing buildings  |
| Ensure that the computers used by the Gettysburg Laptop Purchase Program are Energy Star rated                                | Investigate potential for co-generation technology  |
| Install additional motion detectors for lights  | Develop a community outreach program for CFL use  |
| <b>Heating and Cooling</b>  |   |
| Create thermostat set points for lower winter temperatures and reduced cooling temperatures                                   | To meet energy needs for new campus buildings, install a biomass burner for heating using local sources for woodchip fuel |
| Web updates for students on daily temperature and suggested appropriate clothing  | Create stand-alone heating systems for individual buildings to increase efficiency  |
| An educational campaign and contest with 'how low can you go' theme from mid-fall to mid-spring for reducing building heating | Investigate potential for geothermal heating systems  |
| Retrofit existing buildings with double-pane argon-insulated vinyl-framed windows   | Utilize passive solar energy design in new building construction  |
| Install low-flow showerheads and valves in  | Solar water heating for new dormitory   |

|  |  |
|--|--|
| all dormitory showers and bathrooms  | buildings and any buildings using electricity for water heating  |
|  | All new buildings should use double-pane argon-insulated vinyl-framed windows  |
| <b>Carbon Neutrality and Carbon Sequestration</b>  |  |
| Assessment of the College's emissions  |  |
| To sign on to the American College and University Presidents' Climate Commitment   | Purchase Carbon Offsets to reach Carbon Neutrality by the College's 200 <sup>th</sup> Birthday, 2032   |
| To increase the efficiency renewability of College Operations  | To increase the efficiency renewability of College Operations  |
| Align with nationwide college and university carbon neutrality initiatives   |  |
| <b>Solid Waste Management</b>  |  |
| Provide trash cans along with recycling bins for all dorm rooms to encourage proper separation   | Require that a high percentage of materials consumed in the Green Building are of sustainable and/or recyclable products, and eventually extend that recyclable material consumption requirement to the Dining Hall and Bullet Hole  |
| Battery recycling collection boxes in each dorm in addition to their placement in the CUB  |  |
| Have compost collection during all weekday lunches and evenings  |  |
| Institute a policy of recycling Styrofoam shipping materials such as packing peanuts   |  |
| <b>Environmental Education</b>   |  |
| Sponsor an Environmental Art Contest and Forum. Could be run by the Recycling Coordinator.   | Establish an Environmental Education Concentration in the ES   |
| Establish Building Recycling Coordinators responsible for generating student awareness of recycling procedures and social responsibility | Create an Environmental Institute program similar to Carnegie Mellon's, whose goal "is to provide opportunities for all ... undergraduate students to learn about environmental issues as part of their regular coursework, regardless of their major". Included in the program would be guest lectures, laboratory experiments, group projects, field trips, and other activities that demonstrate the relevance of sustainability issues with all disciplines. |
| Having the Recycling Intern bring awareness of relevant legislation and current events to the campus body on a regularly scheduled       | Develop a service partnership with community agencies connecting campus and town environmental initiatives   |

|  |  |
|--|--|
| basis  |  |
| Establishing an Upperclassman Orientation Guide to promote lifelong sustainability practices and behaviors in daily life | Create sustainability summer research grants for students to design and implement their own campus greening projects           |
| Introduce a separate campus Fraternity Recycling Program headed by Fraternity House Recycling Representatives            | Create a "women and the environment" educational program to highlight the relevance of social justice to environmental justice |
| Require a Recycling and Sustainability sessions during FYE and Residence Life staff member training                      |  |

## Section 2: Green Buildings

- by Natasha Gownaris

Buildings take a big toll on the environment in the United States, composing 36% of energy use and 65% of electricity consumption, 30% of greenhouse gas emissions and specifically 40% of CO<sub>2</sub> emissions, 30% of raw materials use, 30% of total waste output, and 12% of potable water consumption (USGBC 2007). These impacts can be minimized through the construction of more sustainable buildings, which are commonly known as green buildings. In general, green buildings on average use 30% less energy than conventional buildings, reduce emissions, reduce indoor water use by over 30% and landscape water use by over 50%, divert 50-75% of construction and demolition wastes, and increase worker productivity and health (Kats et al. 2003). More specifically, green schools use 33% less energy than conventional schools and show a substantial reduction in emissions (up to 1,200 lbs nitrogen oxides, 1,300 lbs sulfur dioxide, 585,000 lbs CO<sub>2</sub>, and 150 lbs coarse particulate matter annually). For green schools, financial benefits are approximately \$70/ft<sup>2</sup> compared to conventionally built schools, a value which is over 20 times larger than the \$2-3/ft<sup>2</sup>, the cost of making a school green (Kats 2006). Additionally, Matthlessen et al. (2004) found that there were no significant construction cost differences between 45 green and 93 conventional buildings (including libraries, laboratories and academic buildings).

In order to be certified as a green building, certain guidelines must be met through LEED (Leadership in Energy and Environmental Design). There are currently LEED projects in all 50 states and in 11 other countries, and approximately 7% of all LEED registered project square footage is of higher education facilities (USGBC 2005). Certification differs depending on the type of building, but the points required to achieve a certain level of certification are consistent. These point requirements are as follows: LEED certified 26-32 pts, LEED silver 33-38 pts, LEED gold 39-51 pts, and LEED platinum 52-69 pts (USGBC 2001). For Gettysburg, the types of certification of interest would be LEED for new construction and major renovations of on-campus buildings and LEED for lodging, which includes dormitories less than 4 stories high. Prerequisites for both of these certifications are erosion and sedimentation control, fundamental building systems commissioning, minimum energy performance, CFC reduction in HVAC&R Equipment, storage and collection of recyclables, minimum indoor environmental quality performance, and environmental tobacco smoke control (USGBC 2001 and 2005). Both of these types of LEED certification have a particular set of ways to earn points. Some ways to earn LEED certification points for new construction and major renovations include alternative transportation (4 pts), light pollution reduction (1 pt), optimal energy performance (10 pts) and for LEED lodging include use of renewable energy 5-20% (3 pts), construction waste management-salvage/reuse 50-75% (2 pts) and innovations in design (up to 4 pts) (USGBC 2001 and 2005). A maximum of 69 points is possible if all credit sections are met.

Gettysburg College currently has no LEED certified buildings. Sustainable features, however, have been implemented in many buildings on campus. The school has taken many of the steps required for green buildings, such as increasing energy efficiency. It is believed that some buildings may even fulfill many LEED requirements, but Gettysburg College has not yet sought certification for any of these buildings. Additionally, there has been serious consideration put into making the new dorm that will be built on campus LEED certified. Gettysburg College faculty and staff members involved with the project have attended a seminar on green buildings, read about the requirements of such buildings, and are working with the building's architect to assess the feasibility of a green residence hall. The building manager for this project is even considering geothermal heating for the building. Thus far, the college staff and architects involved believe that the dorm will in the least qualify for basic LEED certification. Gettysburg College is also working on renovating existing buildings on campus to be more efficient. For example, this summer the windows of Apple residence hall will be replaced with more efficient windows.

Many other colleges have become active in the effort of sustainable building practices. A prime example of this effort is Oberlin College's Adam Joseph Lewis Center for Environmental Science. Some features of this building include solar cells (which generate more power than the building can use), the use of biodegradable and recyclable materials, an organic water purification system (which fulfills the building's non-drinking water needs), and a pond with water storage for irrigation use (Oberlin College). Brown University recently built a new and more efficient science center, MacMillan Hall, which will yield estimated annual energy savings of 929,588 kWh, annual cost saving of \$59,030 and annual CO<sub>2</sub> reductions of 697 tons (Pleasant). The University of Michigan recently renovated their Dana Building to be certified LEED Gold. These renovations included composting toilets, active and passive solar power, water-saving plumbing features, efficient insulation and use of recycled, renewable and reused materials (University of Michigan). Carnegie Mellon has recently built 3 new LEED Silver certified buildings, including a new dormitory in 2004. The college website states that all new on-campus buildings must be LEED certified and that old buildings are being renovated to attain LEED certification (Carnegie Mellon, 2004).

Gettysburg College should also be one of the many colleges promoting green buildings. As the college is currently in the process of creating a master plan that will govern many of the changes to take place within the next 10 years, short-term and long-term building goals are somewhat melded. Short-term goals should include putting green buildings into the master plan. In the long-run, goals should include the actual construction of LEED certified buildings on campus, along with green renovations to old buildings on campus. An optimal goal would be for all new buildings at Gettysburg College to be built with LEED certification, such as done at Carnegie Mellon. These changes would not only reduce the impact that Gettysburg College has on the environment, but would also lead to financial savings for the college and to the attraction of prospective students and faculty.

*Sources:*

Carnegie Mellon. 2004. Environmental Indicators for Carnegie Mellon University: Baseline Assessment 2004. [www.cmu.edu](http://www.cmu.edu).

Kats, Greg, Leon Alevantis, Adam Berman, Evan Mills and Jeff Perlman. 2003. The Costs and Financial Benefits of Green Buildings.

Kats, Gregory. 2006. Greening America's Schools: Costs and Benefits. Capitol-E Report.

Matthlessen, Lisa Fay, Peter Morris, and David Langdon. 2004. Costing Green: A Comprehensive Cost Database and Budgeting Methodology.

Oberlin College. Adam Joseph Center for Environmental Studies. [www.oberlin.edu](http://www.oberlin.edu)

Pleasant, Andrew. Environmentally Responsible Design of W. Duncan MacMillan Hall. [www.brown.edu](http://www.brown.edu).

University of Michigan. The Greening of Dana. [www.snre.umich.edu](http://www.snre.umich.edu)

U.S. Green Building Council. LEED-NC. Application Guide for Multiple Buildings and On-Campus Building Projects. 2001. [www.usgbc.org](http://www.usgbc.org)

U.S. Green Building Council. LEED-NC. Application Guide for Multiple Buildings and On-Campus Building Projects. 2005. [www.usgbc.org](http://www.usgbc.org)

U.S. Green Building Council. 2007. Green Building Facts: Green Building by the Numbers. [www.usgbc.org](http://www.usgbc.org).

## Section 3: Transportation

- by Keith Reinemann

Gettysburg College is currently in the process of developing a biodiesel fuel production capability for use in currently owned diesel vehicles and equipment. Biodiesel is biodegradable and nontoxic, with low emission profiles, making this fuel environmentally desirable (Fangrui and Hannah, 1998). Biodiesel research and production is also being actively pursued and in fact we are far outpaced by our peer institutions, namely Wilson College in Chambersburg, PA and Dickinson College in Carlisle, PA.

The Biodiesel Research and Production Program at Gettysburg is currently being spearheaded as a senior research project by Keith Reinemann and his advisor Dr. John Commito. This biodiesel project will be able to increase its capacity many fold by the addition of a biofuels processor to its operating inventory. The funding for buying such a piece of equipment is currently being investigated by the Gettysburg College Facilities Department.<sup>1</sup>

The addition of biodiesel made from waste vegetable oil (WVO) will be a great addition to the energetic capability of Gettysburg College. Not only is this fuel extremely clean burning when compared with the standard petroleum that is currently in use, it is also extremely economical to produce with no modifications required to the vehicle utilizing it.

Use of biofuels, specifically biodiesel, will reduce the College's total carbon footprint with regards to energy used for transportation. The production of biodiesel at Gettysburg College will be beneficial in both the short and long term, saving money on fuel for our vehicle fleet and also useful as a marketing aid for new students by toting the College as 'Green' which is fast becoming a buzz-word among the collegiate community. Thus the production of biodiesel could pay for itself relatively quickly because reducing the cost of purchasing 'commercial' petroleum diesel fuel, as well as increasing the pool of potential students interested in attending a sustainable "green campus." In the future, should the College's capability be so high, there is a possibility of burning biodiesel fuel in the boilers that are used to generate heat for the buildings on campus.

While adapting to new technologies is an important step toward more sustainable practices, it is also very important to reduce our general consumption of fuel by behavioral changes. Not only will behavioral modification greatly reduce our consumption and save the College significant monetary

---

<sup>1</sup> A decision has been made by the Facilities Department not to invest in a biofuels processor until at least 2008, but with no commitments to anything at this time.

resources, but it will also greatly reduce the carbon footprint of the College and on top of all of this, it is the right thing to do.

In addition to investing in a sustainable biofuels program, the College should also consider investing in alternative fuel vehicles, such as plug and drive hybrid vehicles. These vehicles would be especially useful for the College due to the fact that the vast majority of the College vehicles are primarily utilized in on campus driving. Plug in Hybrid Electric Vehicles (PHEVs) are vehicles that are primarily fueled by electricity provided by plugging them into a standard outlet and they also have the capacity to store this electricity in batteries which are on board. It appears from relatively early research that a standard hybrid's miles per gallon (mpg) rating can be fully doubled by conversion of the vehicle to PHEV.

Unfortunately, this technology is not currently available off the shelf, but a conversion of an existing hybrid vehicle can be performed, most successfully of a Toyota Prius. A company called Hybrids Plus in Boulder, CO currently sells already converted Prius' for a simple upgrade cost which are then delivered directly to the consumer. The vehicles have a range of 15 miles driving at less than 34 mph, which is a perfect replacement for the small scale maintenance vehicles currently in use by the campus that are already restricted to slower speed driving.

Additional sustainable practices include not allowing freshman students to have vehicles on campus. This could greatly improve the air quality as well as conform to the college's master plan. In the past few years there has been an increase in the number of student owned vehicles and a lack of parking spaces. Rather than dominating the campus with parking lots, the number of vehicles should be reduced. Any upperclassmen wishing to have a vehicle on campus should pay a fee of \$50 per semester for parking. These practices should promote carpooling and teach students the importance of sustainable living.

#### *References:*

- Alovert, Maria, 2006. Formulas and Notes for Biodiesel Class revised March 25, 2006. Personal Correspondence.
- Altun, Recep, Selim Cetinkaya and Hüseyin Serdar Yücesu, 1999. The Potential of Using Vegetable Oil Fuels as Fuel for Diesel Engines. *Energy Conversion and Management*. Vol. 42: 529-538.
- Calais, Phillip and AR (Tony) Clark. Waste Vegetable Oil as a Diesel Replacement Fuel. (Unpublished Data)
- Dorado, M. P., J. M. Arnal, J. Gómez, A. Gil, F. J. López, 2002. The Effect of a Waste Vegetable Oil Blend with Diesel Fuel on Engine Performance. *American Society of Agricultural and Biological Engineers*. Vol. 45: 519-523.
- Fangrui, Ma and Milford A. Hanna, 1998. Biodiesel production: a review. *Bioresource Technology*. Vol. 70: 1-15.
- Steiman, Matt. Biodiesel Resource Guide: Some Handy Info, At a Glance. Wilson College Biodiesel Project
- Tomasevic, A. V., S. S. Siler-Marinkovic, 2003. Methanolysis of Used Frying Oil. *Fuel Processing Technology*. Vol. 81: 1-6.
- Wang, W. G., D. W. Lyons, N. N. Clark, M. Gautam and P. M. Norton, 2000. Emissions from Nine Heavy Trucks Fueled by Diesel and Biodiesel Blend without Engine Modification. *Environmental Science Technology*. Vol. 34: 933-939.
- Zhang, Y., M. A. Dubé, D. D. McLean and M. Kates, 2002. Biodiesel Production from Waste Cooking Oil: 1. Process Design and Technological Assessment. *Bioresource Technology*. Vol. 89: 1-16.
- Zhang, Y., M. A. Dubé, D. D. McLean and M. Kates, 2002. Biodiesel Production from Waste Cooking Oil: 2. Economic Assessment and Sensitivity Analysis. *Bioresource Technology*. Vol. 90: 229-240.



## Section 4: Campus Electricity Usage

- by Eric Canzano

The consumption of energy of any given college campus is responsible for the majority of its greenhouse gas emissions. These emissions come from a variety of sources, depending on where the college is buying off of the power grid, how much fossil fuel and oil the college is purchasing to fuel its heating and cooling system, and other minor sources of emissions, such as transportation. This section of the sustainability proposal is specifically concerned with the production and consumption of electricity on the Gettysburg college campus: how much is used and future methods to eliminate energy waste or upgrade current systems to improve efficiency.

In the fiscal year 2005-06, purchased electricity accounted for 59% percent of the total energy costs on the Gettysburg college campus (see Table 1). This consumption is extremely high compared to Middlebury College, where purchased electricity accounts for 40%<sup>1</sup>, or Wilson College, where purchased electricity accounts for only 31% of all campus emissions.<sup>2</sup> Amazingly, our electricity consumption has been reduced by 1.2% between fiscal years 2004-05 and 2005-06, a trend rarely seen on college campuses (Table 1). Nonetheless, with the construction of new buildings in the Master Plan over the next ten years being decided right now, our consumption will increase with additional building requirements. Not only that, but although Gettysburg College consumed less electricity in the 2005-06 fiscal year, the cost was still more than the previous year due to a rise in dollars/kWh. (Table 1)

### **Methods for Reducing Electricity Consumption**

When considering GHG emissions due to electrical consumption, there are two aspects contributing to the amount released: the production of electricity and the consequent use of that electricity on campus. Thus electrical sustainability does not only need to scrutinize the consumption behaviors on the Gettysburg campus, but who the college is buying their energy from, and how that energy is being produced by the provider. Ideally, any college has the potential to completely eliminate their carbon footprint by purchasing clean energy or investing in offsets, but this does not qualify an extravagant use of electricity on the campus grounds.

It is important to remember that Gettysburg College must not only focus on methods that will produce the greatest amount of change for the least amount of money. Sustainability, especially through electricity, is both powerful and difficult in that it involves *everyone*; every single member of the Gettysburg college community is not only responsible for creating GHG emissions, but also has the ability to reduce those emissions. Gettysburg sustainability necessarily *cannot* be hidden; it is not merely the job of the administration and Gettysburg employees responsible for electricity management to strive for these changes, but all students, all faculty, and all members *can* and *must* participate if the Gettysburg campus wants to effect any real change. Therefore low-cost, low-benefit initiatives, while they may seem inconsequential amidst the vast reductions Gettysburg College faces in the futures, are a means of advertisement, of support, and an opportunity for all college members to be involved and become aware of something it is ultimately a problem everyone is responsible for. To expand, this becomes a responsibility not only of Gettysburg College, but, as universities and institutions are becoming the example of efficiency and carbon reduction, we become part of a larger community in the mission of sustainability. This is encouraging, because we can draw on the already well established resources of other campuses' electricity practices and shape them to fit the Gettysburg College environment.

### **Electricity Reduction Campaign**

The first initiative is a campus-wide electricity reduction campaign, which is designed not necessarily for any large-scale reductions on campus, but as a way to promote awareness and spread the issue of sustainability to the doorstep and into the lives of all campus community members. This does not disregard the significance of the campaign: not only is it inexpensive and effective immediately, but payback happens quickly and benefits from reduced electricity consumption will shortly outrun the costs

of any initiatives. In this practice, we would not rely solely on the efforts of the students to produce reductions, but would institute practices that would guarantee savings. One such example already occurring on campus is the *CFL Campus Exchange*, a program in its infancy that intends to replace all incandescent bulbs in every campus building with an efficient, energy-star rated compact fluorescent bulb. The cost is minor: 500 bulbs have already been purchased at a cost of \$1000 dollars, and are currently being placed in a freshmen quad for data analysis. Each bulb can save potentially \$30 dollars over its lifetime (depending on usage patterns), and payback from bulb costs occurs in only roughly 4 months (Table 2). If each Gettysburg student were to replace only 1 bulb, the savings over the course of a year would be around \$39,000 dollars, nearly replacing 1 student's yearly expense. (Table 2) This program is an example of an energy reduction challenge that does not even require students to alter their consumption behavior in order to lower emissions.

Middlebury College, in their 2003 proposal of strategies to reduce campus climate impact, suggests using competition as a means of reducing energy consumption.<sup>1</sup> If it is possible to record and calculate the individual consumption of all campus housing, Gettysburg College could coordinate a competition between student housing, giving a reward to the building with the highest per capita reduction of electricity consumption. To show the progress of each dorm's electricity consumption, Middlebury used Kill-A-Watt<sup>®</sup> Watt-Meters to measure a typical room's energy usage.<sup>1</sup> The point is to produce competition, provide incentive, and constantly remind students of the progress in order to effectively produce a reduction in energy. Gettysburg College could offer a prize that would appeal to students who may not be interested in environmental friendliness.

### **Computer Use Reduction**

Being that every single student owns a PC or laptop, and "there are more than 100 lab machines"<sup>4</sup> on campus, on any given day there can be approximately 2700 computers running on campus. Given that a standard PC can use electricity at a rate of 110-330 watts<sup>1</sup>, the campus can be using a significant amount of electricity through computer use alone. Computer labs are easy to control and provide the most potential for regulating computer energy use. All campus computers should be programmed to go into "sleep" mode after a short period of time, in which the computer uses 60-70% less energy<sup>1</sup>. As part of the energy reduction campaign, brochures handed out to students or advertising in the computer labs would be effective in educating students in efficient computer use. There are many students who turn their computer on at the beginning of the day and leave it on until they go to sleep, allowing the computer to run hours at a time in full power mode. It would be simple to educate students how to program their computers to "sleep" and go into hibernation after a period of time, so even if we cannot alter their energy habits, we can alter the automatic processes to ensure more efficient use. This program isn't expensive or intended to incur drastic changes in energy consumption, but is more of a tool working towards, as mentioned before, the eventual realization in students that they use energy in many daily actions, actions which can be regulated or easily diminished to reduce consumption.

### **Motion Sensors**

Motion sensors are a cheap and effective way to reduce unnecessary electricity use due to people forgetting to shut off their lights or lights in public spaces. Twenty-four hour buildings waste large amounts of energy, where students might not even occupy most of the building, especially during the early morning hours. In the first-year quads, timers and sensors are already being implemented to reduce energy use. In the bathrooms, lights will automatically shut off after a certain time period if no one has entered the bathroom. Half of the hallway lights are shut off by a timer in the evening through to the morning. If these practices could be implemented in the 24 hour buildings, such as the Science Center or Musselmann Library, energy can be saved without the more difficult task of changing student behavior. Even more wasteful is the full use of lights in buildings during the day when there are ample windows to provide sunlight. Musselmann Library could make use of its large windows by shutting off half of their lights during the day without any effect on the visibility. The Science Center could shut off most of their lights during the night, as students generally only use computer labs or small desk spaces

spread around the building to complete night work. Sensors can be placed in public rooms where no one is responsible for shutting off the lights.

### **EPA Green Lights Pledge**

The EPA Green Lights Pledge, if taken, is a promise to upgrading 90% of lighting in floor spaces on campus. This would be a way for the college to set a standard for public lighting spaces and fulfill it within a certain time period. This, in addition to upgrading buildings with motion sensors and timers, would lead to substantial savings in electricity consumption. Tufts University, after implementing the EPA Green Lights Pledge and installing motion sensors in all public buildings, reported a savings of over \$90,000 dollars in electricity bills.<sup>5</sup>

### **Co-generation**

Co-generation is a process that takes advantage of the steam being produced for a heating/cooling system and converting some of it into electricity. The fuel is already being burned to create the steam, but by creating electricity as well, co-generation becomes a more efficient process of production which can save Gettysburg College thousands of dollars in energy costs. Middlebury's co-generation system saved them \$235,000 in the year 2002 alone, and \$270,000 in 2001.<sup>1</sup> The drawback to cogeneration is that it has a high investment and takes years to pay off, but savings will be significant after that time period. Cogeneration has been instituted in many foreign countries as a way to improve efficiency in industrial buildings.<sup>6</sup>

Sources:

ES 010 Class. *Carbon Neutrality at Middlebury College*. Middlebury College, 2003.

<<http://community.middlebury.edu/~cneutral/>>

*Carbon Dioxide Emissions Sources and History*. Williams College, 2006.

<[http://www.williams.edu/resources/sustainability/co2\\_sources.php](http://www.williams.edu/resources/sustainability/co2_sources.php)>

U.S. EPA and U.S. DOE. *Energy Star Savings Calculator (Table 2)*. Energystar,

2006.<[http://www.energystar.gov/business/bulk\\_purchasing/bpsavings\\_calc/Calc\\_CFLs.xls](http://www.energystar.gov/business/bulk_purchasing/bpsavings_calc/Calc_CFLs.xls)>

Information Technology. *Laptop Purchase Program FAQ*. Gettysburg College, 2006.

<<http://www.gettysburg.edu/about/offices/it/es/Laptop/laptopfaq.dot>>

Tufts Climate Initiative. *Lighting Upgrades & Motion Sensors*. Tufts University, 2001.

<<http://www.tufts.edu/tic/tci/LightingControls.htm>>

UNEP. *Baseline Methodologies for Clean Development*. Capacity Development for Clean Development Mechanisms, 2005.

<<http://www.cd4cdm.org/>>

## **Section 5: Heating and Cooling**

- by Fred Reimer

This section represents the largest potential for significant change, since heating and cooling systems are the largest consumers of energy on campus and the greatest generators of carbon emissions. Space heating and cooling and water heating are the three uses of these systems. To reduce our consumption of fuels associated with generated emissions, there are a number of different practices which Gettysburg College could mandate and there are also some physical improvements that could be made.

### **Short Term**

Using thermostat set points to maintain an average temperature in all academic buildings and dormitories is one way to reduce the need for heating during the winter and cooling during the summer months. Based on what the average temperature is across campus during each month, thermostats would be set a point or two lower in the winter and higher in the summer. It would be necessary to inform the campus of these changes and to remind students about the day's temperature and what the appropriate clothing would be for the day. In the event that people become cold, a limited amount of personal space heaters could be provided. Each degree that is saved could result in a one percent decrease in energy costs as it has at Middlebury College. To facilitate this change, thermostats would have to be installed and controlled from a central source and a study would need to be conducted to determine the appropriate temperatures. Additional education programs might be needed to motivate the campus to agree to such a plan. Competitions like a "How Low Can You Go?" campaign could also be used to encourage people to become involved in the programs.

Installing low flow shower heads and retrofitting existing buildings with more energy efficient windows would also help to cut back on the need for heat generation. The instillation of low flow shower heads may be initially unpopular with many students on campus, but the instillation would also allow students to take longer showers. Each new efficient window would reduce the amount of heat that is lost from buildings by as much as .86 BTU per hour. These windows should become standard in any new building construction.

### Long Term

One of the greatest reductions in carbon emissions could be accomplished by changing our fuel for heating to biomass. Biomass is a fuel source made of woodchips from low quality trees, harvest residuals, and wood waste from sawmills and lumber companies. Obtaining such fuels in South-Central Pennsylvania may be difficult and a study on its practicality would need to be conducted before such a plan would begin. Changing our fuel to a biomass option could result in an 11,000 to 22,000 ton reduction of carbon dioxide emissions. The burnt biomass fuels could also cogenerate energy by producing steam that could be used directly to heat buildings and also to turn turbines to produce electricity. Such a change would require a large capital investment, but in the long-run there would be a substantial return on the investment. At Middlebury College installing a biomass system was projected to cost approximately \$2,000,000. These costs include the purchasing of the biomass boilers and the facility that would be needed to house the biomass fuels. Although it appears to be quite a huge cost, the system would pay itself off in five years due to the reduction in fuel costs. These estimates were based on a cost differential between biomass and oil of \$631,000 annually. With the rising costs of energy and especially oil, such a change to biomass would make economic sense since the life of a boiler system is upwards of fifty years. Gettysburg College should look into this option especially as it looks to add capacity to its system, with the addition of new buildings to campus in the next few years.

Another long term option for attaining campus sustainability involves harnessing the energy of the sun. By using designs for new building construction that take into consideration passive solar energy, there would be a significant reduction in the heating and cooling needs of the buildings. Such techniques as having the longest part of the building run from east to west would give the building the maximum exposure to sunlight. This sunlight could be harnessed as heat by having the majority of the buildings insulated windows face south or by using concrete, stone slabs, or masonry during the building construction. The addition of a separate sun room that people wouldn't have access to could also harness passive solar energy that could be circulated throughout the building. To cool the building using passive solar energy practices, thermal chimneys could be installed to let excess heat out and shading could reduce the entry of solar heat into rooms.

Sources:

(This is in the process of being completed)

## Section 6: Carbon Neutrality

- by Andrew Rohrbaugh

The United Nations' Intergovernmental Panel on Climate Change recently produced its 4<sup>th</sup> Assessment Report on the world's climate, which was produced by over 2500 scientific reviewers over the last 6 years, contains the following sentence: "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level." (IPCC 2007) Thus, the IPCC has asserted that global warming is undeniable. Moreover, the report stated, "Most of the observed increase in globally averaged temperatures since the mid-20<sup>th</sup> century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC 2007), indicating that the source of this global problem is human activities.

Armed with the knowledge that we are all responsible for the environmental, economic and social impacts of global warming, it is crucial that we address this problem in order to diminish its effects. Some methods of reducing carbon emissions include decreasing the use of fossil fuels, as well as increasing the efficiency of buildings and vehicles. Another action aimed at reducing atmospheric carbon is carbon sequestration. It is very difficult to stop all emissions of carbon dioxide. However, there are ways to determine how much carbon dioxide a machine or institution creates, and then sequester this amount of carbon dioxide from the atmosphere into a fixed form. Some examples of carbon sequestration include injecting it into deep underground, such as in a capped oil well, or injecting it deep into the ocean. Additionally, carbon can be locked up in the body of organisms that use photosynthesis, such as trees or phytoplankton (U.S. Department of Energy). Paying to conserve areas of locked up carbon, such as that in forests, is known as purchasing 'carbon offsets'. These methods keep the carbon dioxide from collecting in the atmosphere and contributing to global warming. When an institution is sequestering as much carbon as it is creating, it is said to be 'carbon neutral'.

Amy Gutman, President of University of Pennsylvania, states that "global warming is a defining issue of the 21<sup>st</sup> century, and higher education must be a leader in addressing global climate change through research, education, and reduction of greenhouse gas emissions." The institutional nature of colleges allows them to take responsibility for their share of the environmental problems created by our society, and to experiment with various methods of reducing this impact. The educational nature of colleges allows this process to be a learning experience for both individuals and society on a larger scale.

Because the issue of climate change seems overwhelmingly large, the greatest challenge to fighting it is often just beginning to cut and sequester emissions. Other colleges throughout the nation, such as Middlebury, Dickinson, and Oberlin, are accepting this challenge to lead by example and combat global warming. Middlebury College's Trustees endorsed a plan to cut the college's carbon emissions 8% lower than 1990 levels per capita (Middlebury College). Dickinson and Oberlin are two of 145 educational institutions to have signed the American College & University's Presidents Climate Commitment (American College & University), which is a pledge to eliminate greenhouse gas emissions from their institutions over time.

The faculty, staff, and students of Gettysburg College should join with other educational institutions across the world in reducing and sequestering greenhouse gas emissions, in order to stop climate change. In order to manage this, there are several steps that must be taken. First, an accurate

assessment of the college's current emissions must be taken; this could be done by Gettysburg students as part of a class or internship. Second, the college must increase the efficiency and renewability of our current operations; this could possibly even save the college money! Finally, to become entirely carbon-neutral, it will probably be necessary to utilize carbon sequestration. This may take the form of planting more trees on campus, as one study by Gettysburg students in 2003 found that trees on campus are capable of sequestering 5.92 tons of carbon per year. Another possibility is that Gettysburg conserves land in areas that might be logged, thus buying carbon offsets. It is important that Gettysburg College serves as a role model by accepting responsibility for its emissions, and begins to act on these steps now. The goal of this proposal is to see carbon neutrality at Gettysburg by the 200<sup>th</sup> birthday of the college, or the year 2032.

Besides fulfilling Gettysburg's moral obligation, there are other benefits which come along with carbon neutrality. Our college prides itself on service learning and becoming involved in making the world a better place; this is another opportunity to bolster this reputation. The process of attaining and maintaining carbon neutrality would provide students with valuable real world experience of environmental action, something which would make Gettysburg College more attractive to prospective students.

*Sources:*

Climate Change 2007: The Physical Science Basis. Intergovernmental Panel on Climate Change. <<http://www.ipcc.ch/SPM2feb07.pdf>>

Carbon Sequestration. U.S. Department of Energy, Office of Science. <<http://cdiac2.esd.ornl.gov/index.html>>

Carbon Reduction Resolution. Middlebury College. <[http://www.middlebury.edu/administration/enviro/initiatives/carbon\\_reduction\\_resolution.htm](http://www.middlebury.edu/administration/enviro/initiatives/carbon_reduction_resolution.htm)>

Presidents Climate Commitment. American College & University. <http://www.presidentsclimatecommitment.org/html/about.php>

## **Section 7: Solid Waste**

- by Miriam Parson

### *Current Gettysburg College Initiatives*

Gettysburg College Facilities currently recycles aluminum, plastics and papers in accordance with Pennsylvania law. Additionally, we have established programs to recycle corrugated cardboard, batteries, printer cartridges, phone books, hardback books, car batteries and oil, computers, and compostable materials. At the end of every school year the school also hosts the Give It Up for Good Sale with the United Way to sell reusable materials discarded by students during move out.

### *Shorter Term, Lower Cost Suggestions*

Facilities could provide small trash cans in addition to the recycling receptacles in each dorm room so that proper separation is encouraged by eliminating barriers to programmatic participation. Battery recycling boxes could be placed in all dorm lobbies to augment the already established battery recycling receptacle in the CUB lobby, again eliminating barriers to participation by reducing the effort required. Compost should be collected every weekday during lunches and every weeknight after dinner from the kitchen rather than the currently scattered collection schedule. Finally, Styrofoam packing materials should be collected and shipped to the proper recycling facility since there is currently no program to eliminate this highly non-biodegradable product from the Gettysburg College waste stream.

### *Longer Term, Higher Cost Suggestions*

In the proposed Green Building and the Environmental Education Institute there should be a required percentage of consumption that must be of recyclable or reusable materials to minimize the Gettysburg Community's contribution to the waste stream and maximize its sustainability as a unit. This standard can then be modified and implemented for all Dining Services establishments to minimize waste from the most directly consumptive agent in our campus community.

### *Benefits*

The benefits to modifying and increasing our solid waste greening initiatives include less principle expenditure when consumption is reduced and lessened waste removal costs when there is simply less waste produced. Also, visible initiatives create belief in a system's efficacy, which is generally correlated to behavioral modification for increased participation in a system. Greater participation in this case translates into greater rates of recycling and lessened waste production.

### *Sources:*

Carnegie Mellon, (2007). Green Practices. Retrieved April 15, 2007, from Carnegie Mellon Green Practices Home Web site: <http://www.cmu.edu/greenpractices/>

Derksen, Author Linda, & Gartrell, John (1993). The social context of recycling. *American Sociological Review*, 58, 434-442.

Omoto, Allen M. (Ed.). (2005). *Process of Community Change and Social Action*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Thapa, Brijesh (1999). Environmentalism: the relation of environmental attitudes and environmentally responsible behaviors among undergraduate students. *Bulletin of Science, Technology & Society*, 19, 426-440.

## **Section 8: Environmental Education**

- by Miriam Parson

### *Current Gettysburg College Initiatives*

Gettysburg College's already existent environmental education framework is a strong base from which to expand and more solidly employ its current programs and to launch new agendas. At this time, Gettysburg College's Environmental Studies Department reaches beyond its normal curriculum to engage the overall student body through a First Year Seminar, through introductory level classes for all Gettysburg students, through summer research opportunities, and through independent student research projects. Outside of this department's integral role in the campus' environmental education goals, student initiatives are prominent in our campus community. The *Painted Turtle Farm*, our campus student garden, has been a large success in its inaugural year. It has provided an interdisciplinary learning environment for students through food security initiatives, campus greening projects, community education with local day-care centers, and organic agriculture experience. The *Gettysburg Environmental Concerns Organization* and *Biosphere* build student awareness and facilitates discussion of environmental issues both globally and locally through various campus events, including larger partnerships such as Earth Day. The newly formed *Biodiesel* project educates participants of both renewable fuel sources as well as the science of producing this particular fuel, and is expanding to provide more research opportunities as campus vehicles begin utilizing the fuel. *Amnesty International* in partnership with *Gettysburg Research and Action by Students for Sustainability* has instituted a fluorescent light bulb energy saving campaign, trading students for their incandescent bulbs to lessen

energy use and to introduce this energy saving technology to students' repertoire of environmental knowledge. The *RecycleMania* campaign this year from Facilities' Recycling Program with the student Recycling Coordinator Interns educates students of our campus' direct role in reducing waste and recycling where possible. The Recycling Program also provides First Year students with a handbook of campus environmental initiatives, largely focusing on student programs. Overall, Gettysburg College has a well established base from which to launch a more extensive environmental education system.

#### *Short Term, Lower Cost Suggestions*

The Recycling Interns in coordination with the GRASS Committee could organize a campus recycling art contest, as held on other campuses in the nation. Also, that intern could bring current news about relevant legislation to the student body. Residence Life could designate a staff member in each building as the Building Recycling Coordinator to function as a student information source for recycling procedures and responsibilities, and as a liaison to the Recycling Department's Coordinators. Also, during the First Year Experience there should be an environmental stewardship orientation to the Gettysburg College community. The Recycling Program could publish an upperclassmen environmental handbook as their lifestyle changes in new living settings and to continue the learning process past the first year. Also, the establishment of a separate Fraternity Recycling Program with designated fraternity house recycling coordinators would be more directly informative and highly effective in the community's sustainability efforts.

#### *Longer Term, Higher Cost Suggestions*

An Environmental Education concentration should be established within the Environmental Studies department, using similar institutions' programs as viable models; this is especially feasible now that the education dept has just hired a math/science/environment specialist. In conjunction, an Environmental Institute can be established to provide a forum and structured opportunities for environmental research and other initiatives regardless of major. Included in the program would be guest lectures, laboratory experiments, group projects, field trips, and other activities that demonstrate the relevance of sustainability issues to all disciplines. Environmentally focused service learning initiatives should partner the campus with its surrounding community for mutual learning. Summer research grants for students to design and implement their own campus greening projects would forward the school's and the greater community's overall sustainability goals. Also, the various relevant departments and programs can unite to form programs such as "Woman and the Environment" to highlight the interrelation of social justice issues with environmental stewardship.

#### *Benefits*

An expanded, interdisciplinary, and more integrated environmental education program will generate a more prominent understanding of stewardship of the environment, a critical component for effective citizen participation in environmental action both locally and globally. Also, education will establish a standard of life-long learning as a responsible partner in the global community. More immediately, environmental education at Gettysburg College will instill in students a greater belief in our campus programs' efficacy, and increased confidence in a system is correlated to greater participation.

#### *Sources:*

Carnegie Mellon. (2007). Green Practices. Retrieved April 15, 2007, from Carnegie Mellon Green Practices Home Web site: <http://www.cmu.edu/greenpractices/>

Kaiser, Florian G, Wolfing, Sybille, & Fuhrer, Urs (1999). Environmental attitude and ecological behavior. *Journal of Environmental Psychology*. 19, 1-19.



Omoto, Allen M. (Ed.). (2005). *Process of Community Change and Social Action*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Schultz, P. Wesley (2002). Knowledge, education, and household recycling: examining the knowledge-deficit model of behavior change. *New Tools for Environmental Protection: Education, Information, and Voluntary Measures*. 67-82.