Campus Sustainability Best Practices

A Resource for Colleges and Universities

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Deval L. Patrick, Governor, Timothy Murray, Lt. Governor, Ian A. Bowles, Secretary

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Part I: Introduction

This paper, ***Campus Sustainability Best Practices: A Resource for Colleges and Universities***, is intended to go hand in hand with EEA's *Greenhouse Gas Inventory Guide for Massachusetts Colleges and Universities*, which offers direction on establishing a greenhouse gas inventory at the state's public colleges and universities. Compiled in this report is a collection of sustainability initiatives developed and implemented by colleges and universities from across the country. Many of these initiatives can be adopted by Massachusetts state campuses as they seek to develop climate action plans and achieve greenhouse gas reductions.

The Commonwealth of Massachusetts has made a commitment to sustainability and climate protection through Governor Deval Patrick's Executive Order 484 "Leading by Example – Clean Energy and Efficient Buildings," which mandates that state agencies, including all UMass campuses and state and community colleges, reduce their environmental impacts and integrate clean energy practices, environmental protection, and resource conservation into all appropriate aspects of operations.

Additionally, within the higher education sector, the American College and University Presidents' Climate Commitment (ACUPCC) provides a framework for significant reductions in greenhouse gas emissions, as well as acceleration of research and educational efforts. All twenty-nine of the Massachusetts public colleges and universities have signed onto this Climate Commitment, requiring these campuses to develop new environmental strategies and energy-savings initiatives to achieve the GHG reductions goals of the ACUPCC.

Campus Sustainability Best Practices: A Resource for Colleges and Universities primarily focuses on energy and climate change, but also includes topics such as campus waste, food, and water usage; all of which can impact climate change. Practical and innovative sustainability efforts and methods are underway on campuses ranging from small private schools like Green Mountain College (VT) to large public institutions such as the University of Michigan. The examples provided in this report are a sampling of thousands of projects happening across college campuses and offer insights into what other higher education institutions are doing so that Massachusetts' public colleges and universities can formulate strategies and ensure the success of campus sustainability programs across the Commonwealth.

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Part II: Leading by Example:
College & University Sustainability Best Practices

A. Small-Scale Energy Efficiency

In order to reduce energy consumption, campuses can implement lower cost efficiency upgrades, employ awareness building strategies around energy usage, and behavior-changing tactics that offer the opportunity for increased student and community member involvement.

"Go Cold Turkey" Energy Competition

At ***Harvard University*** (MA) dormitories, students turned off their computers, lights, appliances and heat before leaving campus for the Thanksgiving holiday. Students saved about 329,000 kilowatt hours of electrical energy, which is equivalent to the amount needed to power 5.5 million standard incandescent 60-watt light bulbs for one hour.

Promoting Campus-Wide Energy Conservation

Emory University (GA) held an event where all the key buildings went dark for one-half hour to promote awareness of energy conservation. In addition to turning lights out on campus, Emory alumni worldwide are encouraged to turn their lights out simultaneously during the half-hour period.

Graphic credit: www.energystar.gov

Computer Energy Savings Program

The ***University of Ohio*** uses Computer Management Software that shuts down computers when they are not in use. It has saved the university 15,150,000 kilowatt hours and 15,000 tons of CO_2, which makes up 45% of their total computer energy use. ***Carnegie Mellon University*** (PA) participates in EPA's Energy Star Computer Monitor Power Management Program: "Sleep is Good!," which sets their computers to sleep/standby mode. For more information: http://www.energystar.gov/ia/business/healthcare/ashe_sep_oct_2003.pdf. ***Mount Holyoke*** (MA) has enabled power management features on 2,800 computers, saving 574,000 kWh and 411 tons of carbon dioxide emissions.

***EZ GPO* Software by Energy Star**

EZ GPO is used to assess power management settings of computers within a network and then sets appropriate energy-saving power management settings for each workstation monitor. ***Pomona College*** (CA) was able to save approximately $66 per school-owned computer, while reducing GHG emissions by nearly half a ton of CO_2 per year per computer. Universities can also require students to install this software on their personal computers in order to gain access to the school's online network.

Vending Misers

Vending misers allow vending machines to turn machine lights off and cycle machines when not in use while still keeping beverages cold. Vending misers cut energy consumption in half for beverage vending machines. They were installed by ***Tufts University*** (MA) on 90 machines, saving an estimated $17,000 and 100 tons of CO_2 annually. The vending misers cost $165 per unit and save approximately $190 per year.

Light Bulb Replacement

Replacing traditional incandescent bulbs with CFLs can cut lighting costs by up to 75%. The ***University of Tennessee*** purchased 1,760 CFLs to exchange for bulbs from students' desk lamps, saving $4,190 and 60 tons of CO_2 in a single semester. The ***University of Florida*** has replaced 3,700 incandescent light bulbs in university-owned light fixtures with compact fluorescent bulbs in the 208 apartments, which they anticipate will save residents more than $15,000, and will eliminate 200 tons of CO_2 annually.

Energy Efficiency in Laundry Rooms

Using front-loader washing machines provides substantial water savings. ***Tufts University*** (MA) has installed over 100 front-loading washing machines which save the university about $23,000 and 17,000 gallons of water per year and cut carbon emissions more than 30 tons a year. ***Brandeis University*** (MA) has prominent stickers and signage to encourage their students to use the "Bright Colors" or "Cold" water option when washing their clothes, as well as air drying their clothing.

University Heating /Cooling Policy

The ***State University of New York at Buffalo*** adopted a heating policy that calls for the university's facilities to be heated to 68 degrees during normal occupied hours and 55 degrees during off-hours.

Bold Sticker Reminders

The ***University of Texas A&M***, as part of their Energy Awareness Campaign, placed adhesive stickers on light switches to remind everyone to conserve energy by turning off the lights. News of the effort was shared with local and regional news media, distributed electronically with the campus community, and featured in the University's biannual magazine, *Prism.*

B. Large-Scale Energy Efficiency

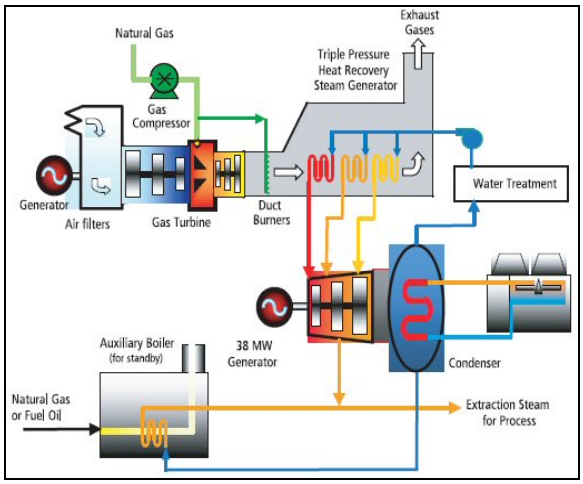
In an effort to reduce campus greenhouse gas emissions, campuses have implemented higher cost efficiency upgrades. Though requiring more up-front funding, these projects have a larger long-term impact.

Building Metering

Both the ***University of Virginia*** and ***Oberlin College*** (OH) have installed meters on all of their campus buildings. Using consumption data to monitor flows of electricity, water, chilled water, and steam allows schools to determine areas of inefficiency. Competitions between dorms can help promote sustainable resource use among the students. Using careful monitoring, ***Oberlin College*** has been able to save $66,000 annually in electricity costs, and reduce over 100 pounds of CO_2 per resident per year.

Cogeneration

Bucknell University (PA) converted its conventional coal-fired heating plant to a cogeneration facility fueled by natural gas in 1998. By producing both heat and electricity, the overall efficiency of the plant increased to 75-80% and led to big reductions in greenhouse gases—about 44% below 1990 levels based on a 2006 emissions inventory. ***Smith College*** (MA) replaced its 60-year-old steam plant with a 3.5 MW single-boiler CHP system in summer 2007 which saved them $1.8 million a year in costs with a seven-year payback, and cut greenhouse gas emissions in half.



Combined cycle **cogeneration** is the simultaneous production of electrical power, hot water, and steam from the same fuel source. Also called combined heat and power (CHP), these systems are more efficient and economical than conventional power plants or single boiler heating systems.

The conventional power generation efficiency of a power plant is at about 35% and the cogeneration power plant produces electrical power and processes heat at an efficiency of 80%; therefore, the production is more than twice as efficient.

Graphic: EPCORP Power L.P.

Performance Contracts

Bridgewater State College's (MA) energy conservation project resulted in a 25% reduction in energy use and eliminates 6,230 tons of CO_2 per year. There are 22 different initiatives on the plan that ranged from replacing the toilets, changing the fluorescent lights all over campus, and installing a new heating system for all classrooms and offices. The project was funded by a private agency working with the construction company. BSC borrowed $10.7 million, which is being paid back with the money that the college saves as a result of reduced energy consumption. ***Frederick Community College*** (MA) entered into an energy performance contract to commission a major HVAC system, install vending machine controllers, add lighting retrofit with occupancy sensor controls, improve integrity of building envelopes, and upgrade websites to increase energy awareness. The overall projected annualized benefit is $66,172. The ***University of Hawaii at Hilo*** and ***Hawaii Community College***, which are on the same campus, pursued an energy performance contract that allowed approximately fifty buildings to be retrofitted. The campus upgraded its lighting system, replaced its main chiller with a high-efficiency model, replaced its cooling tower, installed a building automation system to control air-conditioning, and expanded its chilled-water loop to include more buildings. The energy service company provided $2.9 million in upfront improvements and over the 10-year life of the contract, the schools expect to save $6.6 million in energy costs, as well as $200,000 a year in maintenance costs. See Project Contracting/Third Party Performance Contracts on page 19.

C. Renewable Energy

In an effort to reduce the large amount of energy currently generated from non-renewable resources such as oil, natural gas, or coal, universities are increasingly relying less on fossil fuels and turning to renewable energy resources such as wind, solar, and biomass.

Wind Energy

Campuses are starting to implement and utilize both small-scale and commercial wind systems. The ***Massachusetts Maritime Academy*** installed a 660 kW turbine in June 2006 which produces over 1 million kWh a year and saves the school $160,000 annually. In its first fifteen months of operation, 690 tons of CO_2 were avoided. An online monitor shows daily, monthly, and yearly totals of power produced (see www.maritime.edu/l2.cfm?page=160). In 2006, ***St. Olaf College*** (MN) erected a grant-funded commercial-scale 1.6 MW wind turbine on campus farmland, which produces approximately 6 million kWh of electricity each year, replaces one third of the school's energy needs, and saves $300,000 in utility costs. The ***University of Vermont*** has installed a small-scale 10 kilowatt wind turbine which is expected to generate 3,000-5,000 kilowatt hours of electricity per year.

Massachusetts Maritime Academy wind turbine near the village of Buzzards Bay in Bourne, MA.
Photo: Buzzards Bay National Estuary Program.

Biomass

Mt. Wachusett Community College (MA) successfully replaced their electric heat with a biomass heating plant that burns wood chips. The project, completed in 2003, helped the school reduce electrical consumption by 46%, while providing 85% of all heating needs. ***Middlebury College*** (VT) is set to start its $11 million biomass plant which will reduce greenhouse gas emissions by approximately 12,500 metric tons annually. The plant will require 20,000 tons of wood chips a year to operate. The ***University of South Carolina*** is starting a $19 million high-tech biomass energy plant which will annually consume an estimated 57,000 tons of tree waste and save $2 million a year in energy costs.

Solar/ Photovoltaic Energy

Although the up-front costs of solar projects are usually high, there are utility and government subsidies available to offset some of the initial investment. Thanks in part to a $2.8 million utility subsidy, in 2007 ***California State University, Fresno*** in partnership with Chevron Energy Solutions, completed a large-scale solar parking project at the university that will supply 20% of the university's annual power needs. Ten structures provide shaded parking and a location for 3,872 photovoltaic panels that generate 1.1 megawatts. At ***Cape Cod Community College*** (MA) a solar array has been installed on the school's new science building. Combined with the dual occupancy/daylight sensors and daylight controls, the building systems will use 35% less energy than conventional systems.

Solar Hot Water

Wright Community College (IA) uses sunlight to heat water for its cafeteria and science labs while the ***University of Wisconsin-Green Bay*** uses the system to heat its indoor swimming pool. On the roof, 3,880 square feet of solar collectors

preheat water for the pool. In 2005, the system saved 6,540 therms of natural gas, which is equivalent to producing hot water for twenty residential households.

Biomass Mixed with Fossil Fuels

A less expensive alternative to an entirely biomass or fossil fuel system is utilizing a mixture of biomass fuel with traditional fossil fuels, such as coal, that can be burned in an existing boiler. The ***University of Iowa*** uses the waste product from a nearby Quaker Oats factory (oat hulls) to mix in with their coal before it is burned. Using a circulating fluidized bed model, the oat hulls replace half of the coal in a boiler, cutting $750,000 in fuel costs and 20,000 tons of GHG emissions per year.

The University of Iowa Biomass Fuel Project uses oat hulls from the nearby Quaker Oats plant.

Geothermal

John Wood Community College (IL) installed a geothermal heating and cooling system in its new student activity center. The system has eighty closed-loops, each buried 200 feet in the ground near the building that provide the water source for the heat pump. The college saves approximately 540,000 kilowatt hours of energy and $25,000 annually. A $50,000 grant from the Association of Electric Cooperatives "GeoAlliance" Program and the Illinois Clean Energy Community subsidized the project.

Renewable Energy Certificates

Renewable Energy Certificates (RECs) are tradable environmental commodities that represent proof that 1 megawatt-hour (MWh) of electricity was generated from an eligible renewable energy source. Universities should prioritize actual on-site campus emissions through energy efficiency, conservation behaviors, on-site generation, and fuel switching before pursuing RECs. ***Connecticut College*** has purchased 3.2 million kilowatt hours of renewable energy certificates generated by wind farms. The certificates represent 22% of the college's annual electricity consumption, which is considered by the EPA to be the largest percentage of wind power purchased by any U.S. college or university. The College's REC initiative was started by students through a petition proposing that the college purchase energy from a "green" energy cooperative in Connecticut. Students voluntarily pay a special fee to cover the additional costs to the college of the purchase. More than 75% of students signed the petition, and it won overwhelming support from the Student Government Association followed by unanimous approval by the college's Board of Trustees in May 2001. For more information on RECs refer to EEA's *Leading by Example Renewable Energy Certificates Guidance* http://www.mass.gov/envir/Sustainable//.

Carbon Offsets

A carbon offset is the process of reducing the net carbon emissions of an individual or organization, either by their own actions, or through arrangements with a carbon-offset provider. Offset credits are a less mature market than RECs and do not directly reduce your campus' emissions, however, some universities have chosen to use them. The ***Yale School of Forestry and Environmental Studies*** minimized carbon dioxide emissions for commencement ceremonies by purchasing wind renewable energy certificates and forestry-based offset credits from a native tree-planting project in the Mississippi River Valley. The class offset the emissions of 325 tons of carbon dioxide that were estimated to result from graduation activities.

D. Transportation

In an effort to reduce greenhouse gas emissions from student, faculty, and university vehicles, campuses are implementing innovative methods to reduce vehicle fuel usage.

Give Free Bicycles to First-Year Students

Ripon College (WI) gives a free bike, helmet, and bike lock to the first 200 incoming freshman who agree to leave their cars at home for the first year. Students must sign an honor code in order to receive the $400 worth of equipment. The project was made possible by college donors, trustees, alumni, a local lock company, and a local bicycle corporation.

Students at Ripon College can receive a brand new 2007 model Trek 820 mountain bike.

Bike-Share Programs

At ***St. Lawrence University*** (NY) its Green Bikes Program, started in 2005 with 10 bicycles, allows students to check out bicycles for two days at a time with the same ID card they use to check out books from the library. The Green Bikes Program also provides a helmet and lock, and all the equipment is paid for by the student government.

Ride Your Bicycle to School

The ***University of Washington*** sponsors the Ride in the Rain Challenge every January, prompting 800 cyclists to commute by bike even during bad weather, saving a pound of CO_2 for each mile they pedal.

Bike Commuter Parking Pass

Free one-day car parking permits are now available to ***Duke University*** (NC) bike commuters. Students and employees who rely primarily on their bikes to commute to campus can receive up to 12 one-day parking passes, allowing them to park in visitor lots around campus at no cost when weather conditions or other needs demand they bring a car to campus.

Carpooling Programs

The ***University of Washington*** launched its U-Pass program to offer commuter alternatives to single occupant vehicles such as public transit, carpools, vanpools, bicycling perks, emergency rides home, car-sharing and even discounts at local merchants for U-Pass holders. Even as UW grows, this effort cuts the number of cars driving to campus by 10,000 vehicles per day. The ***University of Michigan*** launched GreenRide, a web-based, geographic information system ride-matching application. GreenRide allows potential carpoolers to find ride-sharing partners by searching for other UM staff who live close by or on the commute route, and who have similar work schedules. Additionally, the University's Carpool Program allows fellow carpoolers to split the cost of one parking permit using payroll deduction. New university carpoolers will get a 10% reduction in the shared parking permit fee for the first six months of the program and they will be entered in weekly drawings for $25 gas card prizes.

Car-Sharing Programs

Car-sharing companies such as Zipcar allow students to leave campus to get to places that they otherwise couldn't by public transportation. Zipcar offers hybrids and other efficient models and claims that each of its cars takes twenty private vehicles off the road. There are also local car-sharing programs such as Community Car based in Madison, Wisconsin which provides fourteen cars and a pickup truck to the entire city, with seven cars located on the ***University of Wisconsin-Madison***

Campus. ***Tufts University*** (MA) partnered with Zipcar to implement a car-sharing program on campus, using two hybrid-electric Toyota Priuses and two plug-in electric Toyota RAV4s. Tufts faculty, staff, and students can buy membership at a reduced rate (which covers insurance, maintenance, and gas) and reserve a car by phone or Internet.

Faculty and Staff Commuting

The ***University of California, Los Angeles*** created a vanpool program (owned and operated by the university) that provides commuter service for faculty, staff and students aboard one of the150 UCLA commuter vanpools, which service 85 communities. Additionally, UCLA has partnerships with municipal bus lines allowing faculty and staff to use the UCLA subsidized Go Metro pass.

Public Transit Systems/ Shuttle Buses

The ***University of California, Davis*** and the City of Davis, have partnered to provide Unitrans, a public transportation system that services all of Davis, with more than forty buses on fifteen routes carrying more 20,000 Davis residents a day, and more than 3 million passengers a year. ***Cornell University*** (NY) issues free bus passes to all new students.

Biofuels/ Alternative Fuels

Students at ***Appalachian State University*** (NC) voted to pay $5 per semester to build a "closed-loop" processing system to make biodiesel that uses solar-thermal and PV systems to supply all necessary electricity and hot water needs, as well as a greenhouse with aquatic habitats to treat wastewater. The 80-gallon processor converts waste vegetable oil to biodiesel and the finished product is blended with regular diesel (20% is biodiesel) and used in campus vehicles. The ***University of Alaska*** spends $2,000 less a year by using "greasel" made from waste cafeteria cooking oil to run its recycling truck. ***Louisiana State University*** converts its cafeteria cooking oil into biodiesel to make 50-gallon batches of biodiesel two times per week. ***Cornell University*** (NY) has begun using zero-emission electric vehicles for certain on-campus uses such as mail. The ***University of California Irvine*** has researched and tested an emission control device for their shuttle buses, enabling the conversion of ten shuttle buses to B100 fuel, which is 100% biodiesel. At ***UCLA***, eleven campus shuttle buses run on 100% Compressed Natural Gas (CNG), with on-campus CNG fueling in two locations, including one open to the public.

Above, one of the eleven UCLA campus shuttles that runs on natural gas. Over one million passenger rides are annually recorded, with the buses traveling a cumulative total of 333,000 miles. Photo credit: UCLA.

Vehicle Fleet Efficiency

Columbia University (NY) is introducing hybrid cars into its patrol fleet as older vehicles are retired, with a goal of eventually replacing the entire fleet. The hybrid vehicles offer more than 70% better city fuel economy than the department's older vehicles and are expected to save an estimated 2,200 gallons of gas per year.

E. Food

Campuses are buying locally-grown and organic food in order to reduce the use of fossil fuels in almost every step of conventional food production: from the operation of planting, harvesting, and irrigation equipment to the production, transportation, and application of pesticides and fertilizers. Increasingly, university dining services are starting sustainable dining initiatives that are based on seasonality, prioritizing food that is sourced locally from farmers who practice sustainable agriculture.

Organic Food

Maharishi University's (IA) new student center dining hall is serving 100% vegetarian and 90 - 95% organic food. Campus farms provide the school with fruits and vegetables during the summer, and campus greenhouses offer tomatoes and greens during the winter.

Keeping it Local

At ***Santa Clara University*** (CA), 80% of the produce served comes from local farms. At **Smith College** (MA) dining services purchase organic produce, dairy, and honey from eighteen local farms. **Stanford University** (CA) supports community-based growers, by buying milk and meat locally, utilizing biodegradable food containers and utensils, and creating educational opportunities by inviting local farmers and fishermen to meet with students in the dining halls.

Gardens and Farming

Eastern Mennonite University (VA) has recently started a campus garden to provide part of the produce for the campus. The initiative began with a campus-wide forum; *How Green Should EMU Be?*, that revealed a widespread interest among students, faculty, staff, and the community. The **Western Washington University** campus has a five-acre farm and community garden with forty available plots for students to grow anything as long as it is organic. At **Hampshire College** (MA), work-study and summer internship positions are available for students who are interested in working with the community supported agriculture program.

Cage Free Eggs

Wilfrid Laurier University in Ontario, Canada switched to cage-free eggs after students were surveyed through an online poll to determine that 68% of students were willing to pay an extra 10 cents per egg. However, Food Services decided to cover the extra cost.

Composting

Connecticut College has a composting system on campus which redirects 500 pounds of waste daily and was made possible by a $25,000 donation from an alumnus. In 2000, ***Bard College*** (NY) started a dorm composting program where each week a team of paid "Composting Commandos" take buckets from the dorm kitchens and bring the food waste to compost bins at the community garden.

Vegetables grown on campus utilizing the Connecticut College's onsite generated compost.

"Going Trayless"

Dalhousie University in Halifax, Canada recently implemented a policy that eliminates trays from all four of its campus dining halls. The initiative serves to reduce food waste because students take less food, as well as water and detergent consumption during the cleaning process of the 3,000 to 4,000 trays that were in circulation at Dalhousie each day.

Distributions to Local Farms

In order to reduce food waste from ending up in the garbage, ***Princeton University*** (NJ) collects food waste from dining halls sends it to a local pig farm for feed.

F. Environmental Procurement

In order to help preserve natural resources and reduce pollution, campuses are purchasing environmentally preferable products.

Recycled Paper

Ohio State University has adopted a new policy which ensures that copy paper used on campus contains at least 30% recycled materials. The ***University of Vermont*** is switching to 100% post-consumer recycled, chlorine-free paper for routine use in copiers and printers. Also, many faculty members are making their courses paper-less by having students hand in their assignments online. The ***Georgia Institute of Technology*** is installing No-Touch Hands Free Paper Towel and Tissue Dispensers, which will use Green Seal certified paper towels and toilet tissue.

Computer Procurement Policies

Tufts University (MA) has replaced CRT monitors with LCD monitors, which use only about a third to one half the energy of a CRT. The ***University of California*** adopted guidelines for buying greener electronics, disposing of "e-waste" and so-called "take-back" recycling, which places the burden of e-waste recycling and disposal on the electronics manufacturers rather than the school. UC has a "take-back" recycling policy in its purchasing contracts, which include a provision to send back all electronics packaging.

Purchase Reusable To-Go Cafeteria Containers

Eckerd College (FL) switched to using the EcoClamshell, a reusable to-go cafeteria container made out of a dishwasher-safe plastic material. Students sign up for a container in the cafeteria during any meal and are charged five dollars, covering the student's four years at Eckerd. Upon returning to the cafeteria, the student checks the container back in and places it on the dishwasher conveyor, where it is sanitized and put out for reuse. The initiative is the result of a $32,000 grant from the Environmental Research and Education Foundation.

Eckered College uses reusable take-out containers made of a durable, dishwasher-safe plastic; the first of its kind to be used at any college in FL.

Biodegradable Dishware

The ***University of Wisconsin-Green Bay*** replaced foam and paper dishware with biodegradable plates made from corn, potatoes, and limestone in each of the university's five dining facilities.

Reusable Bottles

Brandeis University (MA) purchases and distributes reusable aluminum water bottles to all of the approximately 1,000 first year students. The new students are expected to bring the bottles to all orientation events in order to reduce plastic bottle and cup waste.

Green Cleaning Products

The ***University of Washington*** has a green cleaning policy that states that the university will only use cleaning products that meet Green Seal standard or products with low-volatile organic compounds (VOC), purchase chemicals that are automatically and accurately diluted using cold water, and use products that are packed with recycled materials.

G. Waste

The manufacturing, distribution, use, and disposal of products indirectly or directly contribute to the concentration of greenhouse gases (GHG) in the atmosphere, affecting the global climate. Colleges and universities are implementing waste prevention and recycling programs that offer significant potential for decreasing greenhouse gas emissions. The EPA estimates that simply increasing our national recycling rate from its current level of 30% to 35% would reduce GHG emissions by 10 million metric tons of carbon equivalent.

Recycling Awareness

At the ***University of Colorado***, a 250 square foot structure filled with recyclable material was featured on campus to represent the amount of material that CU recycling diverts from the landfill every day. The ***University of Idaho*** sponsored a demonstration called "Trash Talk" that advocated the slogan "Use Less, Recycle the Rest." The students sorted through residence hall dumpsters and displayed all of materials from the garbage bags that could have been recycled, composted or reused. It was estimated that about 10% of what was sorted constituted actual trash and the rest could have been composted, recycled or reused.

The covers of the notebooks sold at the University of Michigan are made from cereal boxes from the residence hall cafeterias. The pages are made from discarded paper where only one side has been used.

Recycled Notebooks

The ***University of Michigan*** is taking steps to reduce paper consumption by starting a student project that is turning discarded paper printed on one side into 100-page notebooks. Each notebook is bound with a cover made from a cereal box which is being supplied by empty cereal boxes from residence halls. The group produced 500, 8.5 by 11 inch notebooks that are .75 inches thick, and sell for $1.

End of the Year Donation Drive

At ***Brandeis University*** (MA), a group of students held an end of year salvage collection. During the five-day period they collected over 2 tons of clothing, 550 pounds of food (which was donated to a local food bank), and approximately 1,200 books (which were donated to a local nonprofit bookstore). The ***University of Tennessee*** collects electronic items that students leave behind when moving out of residence halls. To date, UT has recycled more than 10,000 lbs of electronics that would have been disposed of in the trash.

Box Sale

A reuse strategy that many schools have employed is to collect cardboard boxes being recycled by local businesses and students, and store them for use by dorm residents when it comes time to move out for the summer. For example, during "Move-In Day" at the ***University of California, Davis*** there is a well coordinated effort to separately collect and then recycle cardboard and styrofoam when residents move-in.

Conservation Incentives Program

Ways to increase the use of refillable mugs on campus include coming up with catchy marketing phrases such as "Get Mugged," a successful slogan from the ***University of Idaho***. The goal is to encourage behavioral change so that students and citizens adopt this reuse practice, thereby saving paper resources and decreasing waste created from the use of disposable coffee cups.

Football and Basketball Recycling Program

The ***University of Arkansas*** recently began "Recycling with the Razorbacks," a program that places green recycling boxes at all home football and basketball games—encouraging fans to do their part. During the football season, clean-up crews collected more than 36.5 tons of recyclables and reduced the amount of trash going to the landfill to only 61.5 tons.

University of Arkansas' new program, 'Recycling with the Razorbacks,' enables fans at home football and basketball games to recycle more than a third of all the trash picked up after the games.

Reduce "Junk Mail"

The ***University of Idaho*** has started an initiative to stop unwanted and unsolicited junk mail by contacting the top sources of junk mail and asking them to stop, otherwise their mail will be immediately recycled in the mailroom and not be passed along to faculty, staff, and students. The University has also started an "opt-out" mail registry which allows students to not receive mail including flyers and mail distributed by the University of Idaho and its departments.

Reduce Plastic Bag Usage

Dickenson College (PA) started selling reusable bags to students to reduce waste at the dining centers. The bags, made of organic and unbleached cotton, were primarily funded by the administration, costing students only $3. To reduce plastic bag consumption, bookstores at ***New York University*** have begun are donating 5 cents to a nonprofit environmental organization for every plastic bag students refuse at the register.

Minimizing Bottled Water Use

Smith College (MA) has removed bottled water from certain dining hall locations and distributes polycarbonate bottles to students for water refills. ***Brandeis University*** (MA) recently announced that they will stop selling bottled water on campus.

Computer Reuse

At ***Cornell University*** (NY), a student group called the Cornell Computer Reuse Club takes computers from the various labs once they are no longer in use and gives them to the community so that other students in Ithaca can use them.

H. Green Building Design

In order to reduce greenhouse gas emissions almost immediately, campuses are investing in building energy efficiency by improving the energy performance of existing and new buildings.

White Roofs

At the ***University of California, Davis*** all dormitories with flat roofs have been upgraded to reflective white roofs, thus decreasing the solar heat gain of the facility and reducing demand for cooling.

White roof shield coating. Photo: Black Cat Roofing, www.blackcatroofing.com/au

Laboratories

University of California, Santa Barbara received the LEED Platinum award for new construction for the Donald Bren School of Environmental Science and Management. The new laboratory building saves the university $50,000 in typical energy costs and prevents 275 tons of CO_2 emissions per year. Furthermore, Bren Hall provides some of it own energy through its 42kW photovoltaic array that provides 7-10% of the building's energy.

Daylighting

Daylighting is the practice of placing windows, or other transparent media, and reflective surfaces in buildings so that, during the day, natural light provides effective internal illumination for building users. Colleges and universities such as ***Cape Cod Community College*** (MA) maximize the use of daylight in their new buildings in order to enhance the interior environment for learning while reducing the energy consumption that would require power generation for electrical lighting.

Cape Cod Community College's new Lyndon P. Lorusso Applied Technology Center was the first building constructed with Massachusetts' state funding to receive LEED® (Gold) certification.

Beyond LEED Certification

The ***University of British Columbia*** in Vancouver has begun developing the Centre for Interactive Research for Sustainability (CIRS), a "living laboratory" where both sustainable research and studies on the building's effectiveness as a sustainable working environment will be conducted. It will surpass LEED Platinum certification, and its design goals include greenhouse gas-neutrality and net energy generation using a 250-kilowatt fuel cell. Rainwater collection will provide all drinking water, and all waste, both liquid and solid, will be treated and managed on-site. All workspace will be 100% day-lit, and the building will make extensive use of photovoltaic cells and solar hot water collectors.

I. Water and Ecological Design

In order to tackle climate change and the decline of freshwater resources availability, campuses are conserving water and promoting low impact development (LID) by implementing initiatives that reduce impervious surfaces and the energy needed to supply water.

Green Roofs

A "green roof" is a roof of a building that is partially or completely covered with vegetation and soil. Green roofs provide energy savings (insulation for both heating and cooling), water runoff reduction, increased roof lifespan, aesthetic improvements, and other environmental benefits. Examples of successful green roof projects include ***Carleton College*** (MN) and ***Massachusetts College of Art***. ***Carleton College*** has a 666 sq. ft. roof which is the first student-designed and built green roof in the state of Minnesota. It is also the first green roof project to use only plant species native to the state. The ***University of Texas at Arlington*** recently installed a 1,000 square feet experimental green roof with the help of volunteers. The project included the installation of the roofing systems, irrigation, plants and about 30,000 pounds of soil.

Massachusetts College of Art's Green Roof Pilot was initiated through a $10,000 grant from the Executive Office of Energy and Environmental Affairs. Located on the 11th floor of the school's Tower Building, the garden portion is 750 square feet of native plant species.

Using Native Plants in Campus Landscaping

In order to combat invasive species threats and to maintain adaptive plants, ***Arizona State University*** established a policy of using native species in campus landscaping that are drought tolerant and adapted to the harsh desert conditions, requiring minimal watering and fertilizers.

LID Techniques

The ***University of New Hampshire*** has developed a comprehensive landscape master plan that utilizes Low Impact Development (LID) techniques which include, but are not limited to, rain gardens, vegetated swales, and permeable pavers, reducing stormwater runoff and recharging groundwater.

Reducing Use of Pesticides

University of Washington-Bothell has decided to bring in goats to help combat weeds on campus. The University has been herbicide free since July 2006, and the goats have been used in combination with other organic methods to remove weeds, including cutting and mechanical removal, as well as adding wood chips in the planting beds.

Permeable natural area created to reduce stormwater runoff in a parking lot. Photo: Virginia Polytechnic Institute and State University.

Parking Improvements

Virginia Tech has reduced stormwater runoff by utilizing LID techniques in parking areas. By creating a vegetated infiltration trench within an island of the parking lot, it captures, treats, and reduces peak flows of stormwater runoff. The trench, which is made of no. 57 stone, geotextile fabric, mulch, and plantings, promote infiltration back into the ground and treat excess runoff prior to downstream release.

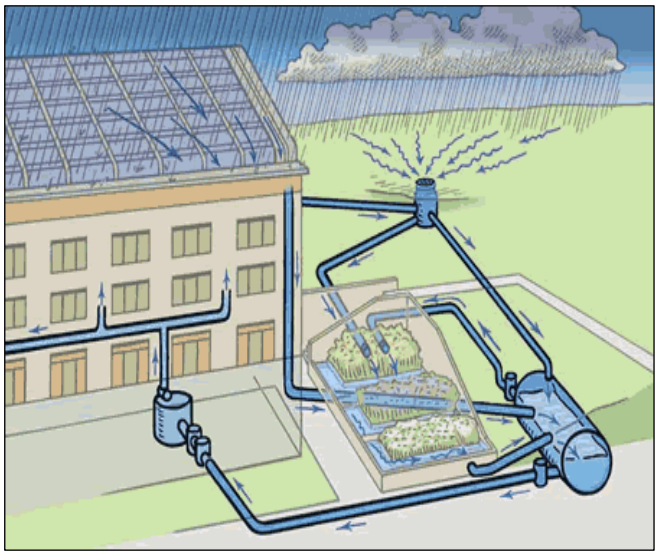
Reducing Campus Water Waste and Consumption

Motivated by strong student support and a long history of drought, ***Duke University*** (NC) has reduced their water use by 26% through several strategies—from low-flow showerhead giveaways to their conservation website with over 300 water conservation tips. The university gave away an initial batch of 5,000 low water flow showerheads to faculty, staff, and off-campus students. The chrome Earth Massage showerheads use 1.5 gallons per minute and will each save an estimated 7,300 gallons of water annually.

In order to reduce unnecessary water waste, ***Duke University*** has been taking steps to decrease campus and facilities water consumption including stopping the use of most automatic irrigation systems, using timers, reducing the watering of its fields from 36 minutes to 6 minutes, and installing drought tolerant landscaping. Additionally, the university's Facilities Management Department has stopped washing its fleet of 180 vehicles, except for windows which need to remain clean for safety, in order to save water.

Rainwater Harvesting

Yale University's Kroon Hall has installed an innovative rainwater harvesting system that will pay for itself in about 10 years and is expected to save 500,000 gallons of potable water annually. The rainwater harvesting system will provide water for flushing toilets, as well as for irrigating the native fauna in the two courtyards on the 3.5-acre site. ***Cape Cod Community College*** (MA) has implemented water reduction features that include: a water collection and reuse system that eliminates a permanent irrigation system by using native, drought-resistant species in the landscaping, and an 8,000-gallon system that collects rainwater from a rooftop storm drain and stores it for reuse in flushing toilets.



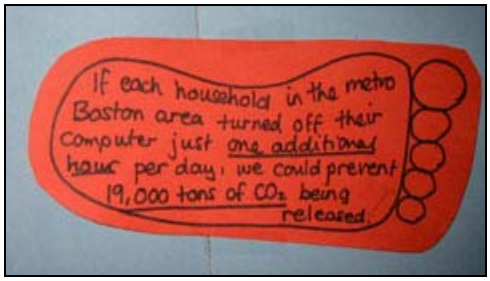
Rainwater Harvesting System at Yale University: Stormwater from roof and the ground collects in tank at upper right, which empties into pond, where it is cleansed and diverted into larger harvesting tank. The water in harvesting tank is pumped to another tank for use inside and back into the pond. Illustration: Gregory Nemec.

J. Education and Outreach

To help increase energy conservation on and off campus, campuses are discovering innovative ways of increasing environmental and energy awareness and incorporating sustainability into curricula.

Eco-Reps

At ***Tufts University*** (MA), the Eco-Reps program helps increase overall student awareness of environmental issues and promotes green campus initiatives. The Eco-Reps program, which usually runs in the fall semester, is a hybrid between a regular course and an internship. Eco-Reps have a weekly class which is organized around a particular topic, including recycling and waste prevention, climate change, water resources, food and the environment, population, and consumption. Students who successfully complete the whole semester receive a stipend of $150.



From Tufts University's Climate Initiative Eco-Reps webpage. http://www.tufts.edu/tie/tci/EcoReps.html

Expanding the Curriculum

The ***University of Wisconsin-Madison*** established the Center for Sustainability and the Global Environment (SAGE) to examine the linkages between natural resources, human health and security, and climate change. ***Iowa Lakes Community College*** (IA) offers a hands-on two-year degree program in Wind Energy and Turbine Technology using its 1.65 MW turbine, located a few blocks from campus. Universities such as the ***Illinois State University and Aquinas College*** (MI) have new degrees with concentrations in renewable energy economics and public policy. At ***Boston Architectural College*** (MA) students can earn a Sustainable Design Certificate that is endorsed by the U.S. Green Building Council.

Greening Greek Life

At the ***University of Florida*** a campaign was started by one of the prominent fraternities to help promote environmental awareness within the Greek community at the University of Florida. Greek houses implement one sustainable change a year within their house, such as participating in the sorority row recycling program, switching to compact fluorescent light bulbs, or planting more trees on the property or in the community.

Green Laboratories

The ***University of Oregon*** launched a green chemistry lab which uses less toxic solvents and reagents, and teaches students to consider the environmental cost of the chemistry they are learning by evaluating potential hazards of chemical processes.

Incorporate Sustainability Awareness Early

Many colleges and universities are now focusing sustainability efforts on first-year students, utilizing orientation and educational materials to promote environmental mindfulness and energy savings. Some schools have arranged field trips to recycling, water treatment, or energy plants or to a nearby green building. ***Middlebury College*** (VT) instills sustainable habits and practices early through its orientations for new staff, students, and faculty. The sustainability coordinator provides a bi-weekly session at new employee orientations and annually for new faculty on how to incorporate sustainability in their jobs.

Sustainability Blogs, Newsletters, and Websites

The ***University of New Hampshire's*** Office of Sustainability hosts a blog entitled; "Discover(ing) Sustainability." The goal of the blog is to share UNH's commitment to being a sustainable learning community. Recent posts have highlighted a "green cuisine" gourmet dinner at UNH and research related to climate change and clean water. The ***University of Texas at Austin*** produces a monthly newsletter, "Synergies," devoted to sustainability initiatives on campus as well as sustainability awareness/education. The ***Duke University*** (NC) environmental sustainability website (http://www.duke.edu/sustainability/) is updated frequently with news and events, has a search function, and provides full contact information on every page.

K. Innovative Sustainability Financing Opportunities

To help fund initiatives that reduce a campus' carbon footprint, colleges and universities are employing mechanisms to fund sustainability projects from various sources of financial support.

Revolving Loan Fund

A student initiative created in 2006, the Clean Energy Revolving Fund (CERF) at ***Macalester College*** (MN) totals $27,000, of which $20,000 came from the College's Student Government. The CERF funds projects that advance clean energy and efficiency measures on campus. ***Harvard University's*** (MA), Green Campus Loan Fund provides capital for high performance campus design, operations, maintenance, and occupant behavior projects. Projects must reduce the University's environmental impacts and have a payback period of 5-10 years or less. The fund provides the up-front capital to departments that agree to repay the fund via savings achieved by project-related reductions in utility consumption, waste removal or operating costs. ***Whitman College*** (WA) recently announced its plan to establish a $100,000 revolving loan fund for proposals from students, faculty and staff. Half of the money will come from money budgeted for building maintenance and the additional $50,000 will come from year-end surpluses.

Alumni Sustainability Fund

Schools that demonstrate leadership in sustainability may attract new gifts and donations from alumni. *The* ***University of California, Berkeley*** (CA) is working to cultivate a new support base of 3,000 environmentally-minded alumni for an alumni sustainability fund.

Student Fees

Student fees help expand small-scale energy efficiency initiatives and offset campus carbon emissions. At ***Tufts University*** (MA) undergraduate students voted overwhelmingly to create a yearly $20 fee to pay for wind power credits. At the ***University of North Carolina*** students pay a renewable energy fee of $8, collected as part of annual student fees. A student government committee and a student advocacy group, along with a set of advisors from the administration, help decide which sustainable initiative to pursue with the raised funds, which totals about $190,000 per year. Every semester students at the ***University of Illinois at Urbana-Champaign*** contribute $7 each toward sustainability—$5 for a Sustainable Campus Environment Fee and $2 for a Cleaner Energy Technologies Fee and projects have included helping a building achieve a LEED gold rating and a green roof. The ***University of Tennessee*** is funding $13,000 per year for five years to perform upgrades of controls and valves that turn steam on and off in certain buildings through a student environmental initiatives fee.

Class Gifts

At ***George Washington University*** (Washington, D.C.), the Class of 2007 dedicated their class gift of more than $38,000 to create the Campus Green Fund, an endowment that will be used primarily for energy conservation projects on campus.

Performance Contracts

In order to fund energy projects with no upfront capital costs, some private companies fund energy projects and are paid by the return on the resulting energy savings. The private company is reimbursed after 7-10 years (with the school repaying the investment from their savings as a direct result of the project). See ***Bridgewater State College*** (MA) page 6.

Third Party Ownership of Renewable Energy Projects

A company finances, installs, and maintains a renewable energy system and charges the host customer a fixed rate for electricity generated by the system. This type of agreement is becoming increasingly popular for colleges and universities that cannot afford the upfront cost of, for example, a solar photovoltaic (PV) system.

Part III: Helpful Online Resources

Association for the Advancement of Sustainability in Higher Education (AASHE) offers a how-to manual, entitled *Creating a Campus Sustainability Revolving Loan Fund: A Guide for Students*, describes an innovative mechanism for financing sustainability projects, such as energy efficiency upgrades and renewable energy installations, on campus.
http://www.aashe.org/resources/pdf/CERF.pdf

American College and University Presidents Climate Commitment:
http://www.presidentsclimatecommitment.org/

Campus Carbon Calculator
http://www.cleanair-coolplanet.org/toolkit/calculator/v5.xls

Clean Air-Cool Planet is a nonprofit organization that works directly with campuses to *develop effective climate policies and actions.* Anne Stephenson, Campus Outreach Coordinator
astephenson@cleanair-coolplanet.org

EPA – College and Universities in New England
http://www.epa.gov/region01/assistance/univ/

Guide to Developing a Sustainable Food Purchasing Policy
http://www.aashe.org/resources/pdf/food_policy_guide.pdf

ICLEI USA Local Governments for Sustainability
http://www.iclei.org/index.php?id=391

Massachusetts State Sustainability Program (EEA – Leading by Example Program)
http://www.mass.gov/envir/Sustainable/

Society for College and University Planning (SCUP)
http://www.scup.org/

Sustainability Endowments Institute
http://www.endowmentinstitute.org/

U.S. Green Building Council
http://www.usgbc.org/

Part IV: Campus Sustainability Websites

Arizona State University: http://president.asu.edu/library/sustainability/
Appalachian State University: http://asuses.appstate.edu
Aquinas College: http://www.centerforsustainability.org/resources.php?root=79&category=85
Bard College: http://inside.bard.edu/berd/
Brandeis University: http://www.brandeis.edu/best/
Bucknell University: http://www.bucknell.edu/x3564.xml
Carleton College: http://apps.carleton.edu/campus/sustainability/
Carnegie Mellon University: http://www.cmu.edu/corporate/cic/design.shtml
Connecticut College:http://greenliving.conncoll.edu/
Cornell University: http://www.sustainablecampus.cornell.edu/
Dickenson College: http://www.dickinson.edu/departments/sustainability/
Duke University: http://www.duke.edu/web/ESC/
Eastern Mennonite University: http://www.emu.edu/begreen/
Emory University: http://www.emory.edu/sustainability.cfm
George Washington University: http://sustainability.gwu.edu/
Hampshire College: http://essp.hampshire.edu/
Harvard University: http://www.greencampus.harvard.edu/
Massachusetts Maritime Academy: http://view2.fatspaniel.net/PV2Web/merge?view=PV/detail/HostedAdmin&eid=67668/
http://www.maritime.edu/l2.cfm?page=169
Middlebury College: http://www.middlebury.edu/administration/planning/reports/environment.htm
Mount Holyoke: http://www.mtholyoke.edu/ce/5598.shtml
Mt. Wachusett Community College: http://www.mwcc.mass.edu/renewable/default.html
Oberlin College: http://www.oberlin.edu/sustainability/index.html
Pomona College: http://www.pomona.edu/cpm/sustainability.shtml
Princeton University: http://www.princeton.edu/sustainability/
Smith College: http://www.smith.edu/physplant/sustainability.php
Stanford University: http://environment.stanford.edu/cgi-bin/index.php
State University of New York at Buffalo: http://ubgreen.buffalo.edu/content/programs/greendesign/main.html
St. Lawrence University: http://www.stlawu.edu/green/
St. Olaf College: http://www.stolaf.edu/green/
Tufts University: http://www.tufts.edu/tie/tci/TuftsSustainability.htm
University of Alaska Anchorage: http://www.uaa.alaska.edu/sustainability/
University of Arkansas: http://sustainability.uark.edu/
University of British Columbia: http://www.sustain.ubc.ca/
University of California, Berkeley : http://sustainability.berkeley.edu/
University of California, Davis: http://sustainability.ucdavis.edu/index.html
University of California, Irvine: http://www.sustainability.uci.edu/
University of California, Los Angeles: http://www.sustain.ucla.edu/
University of California, Santa Barbara: http://sustainability.ucsb.edu/
University of Colorado: http://ecenter.colorado.edu/greening_cu/css2003/index.html
University of Florida: http://www.sustainable.ufl.edu/
University of Iowa: http://energy.uiowa.edu/
University of Idaho: http://www.uidaho.edu/uisc/
University of Illinois at Urbana-Champaign: http://asap.sustainability.uiuc.edu/
University of New Hampshire: http://www.sustainableunh.unh.edu/
University of North Carolina: http://sustainability.unc.edu/
University of Michigan: http://www.oseh.umich.edu/stewardship/
University of Ohio: http://www.facilities.ohiou.edu/conservation/
University of Oregon: http://sustainability.uoregon.edu/
University of Tennessee, Knoxville: http://environment.utk.edu/
University of Vermont: http://www.uvm.edu/greening/
University of Washington: http://www.washington.edu/about/environmentalstewardship/
University of Wisconsin-Madison: http://www.sage.wisc.edu/
University of Virginia: http://www.virginia.edu/sustainability/
Virginia Tech: http://www.facilities.vt.edu/sustainability/
Western Washington University: http://www.wwu.edu/sustain/
Yale University: http://www.yale.edu/sustainability/