



University of Massachusetts

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## Annual Sustainability Efforts



## Board of Trustees Administration & Finance Committee



September 11, 2013



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## Executive Summary

The University of Massachusetts which includes five campuses in Amherst, Boston, Dartmouth, Lowell and the Medical School in Worcester has made a collective commitment to be “good stewards of resources” including responsibly managing our fiscal resources, increasing external support, investing in our capital assets and continuing our commitment to being environmentally responsible. To demonstrate the University’s pledge to sustainability, in February, the President launched UMass Performance: Accountable & On The Move with a specific commitment to the University’s environmental responsibility. This assertion combined with the efforts and achievements of each of the campuses demonstrates the strong responsibility felt by members of the University community to our role as stewards of environmental resources.

The Environmental Protection Agency (EPA) has published that *“Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations. Sustainability is important to making sure that we have and will continue to have, the water, materials, and resources to protect human health and our environment.”*

In 2007, the University President and all five campus Chancellors signed the American College and University Presidents Climate Commitment. In so doing, the University committed to developing a plan for achieving carbon neutrality, taking concrete initial steps to achieve that, and publishing annual progress reports. In the years since, the University has succeeded in reducing its carbon emissions by 19% when compared to baseline. Strategic investments in energy efficiency, recycling, building improvements and others have the campuses on course to meet their goals.

During that same year, Governor Patrick filed Executive Order 484 on April 18<sup>th</sup> which established aggressive targets for state agencies including reducing greenhouse gas emissions 25% by 2012, 40% by 2020, and 80% by 2050 and reducing energy consumption 20% by 2012 from 2002 levels and 35% by 2020. It requires state agencies to reach targets through obtaining 15% of electricity from clean sources by 2012 and 35% by 2020 and reducing potable water use 10% by 2012 from 2006 levels and 15% by 2020. State universities are a key component of the state’s efforts to reduce energy use and greenhouse gas emissions as stewards of over 25 million square feet of property across the entire Commonwealth.

In an effort to gain traction on sustainability efforts, each campus has dedicated staff focused on environmental responsibility. The UMass Sustainability Committee, comprised of the campus Sustainability/Energy Managers and President’s Office Budget Staff has been meeting quarterly to discuss Sustainability/Energy Management topics ranging from clean energy and efficiency, to the reduction of greenhouse gas emissions as well as: waste reduction, water conservation, green buildings, alternative fuels, efficient transportation, and recycling. The group uses this collaboration to invite vendors and organizations to present on topics of common interest in particular areas. In April of 2012, the President’s Office hosted the first Sustainability



Symposium. It was geared toward Campus Administrators, Sustainability/Energy Managers, and Campus Operations & Planning staff with the goal of supporting and fostering new and existing connections between University and regional stakeholders by sharing information and resources.

In addition, the Strategic Energy Committee was created in FY13 to leverage system-wide volume for energy procurements, share and implement best practices and develop standard metrics to measure building efficiency and implement energy reduction strategies. In FY13, this effort completed a Solar Net Metering project which reduces the cost of power to our campuses and eventually the region. In addition, this effort is projected to save millions for the University and created internships at several companies to support the UMass student experience.

The following pages have been reported through each of the campuses Sustainability teams to provide updates on relevant topics, success and efforts that have been undertaken under the course of the last year. Topics include:

## **1. UMass Climate Commitment – Reduced Carbon Emissions Notable Energy efficiency and renewable energy projects**

Each campus has made its commitment and an effort to meeting carbon emissions through both large and small scale projects. In Amherst, overall campus emissions have been reduced by 34% since 2004 and in 2012, the campus published its Climate Action Plan which outlines its strategies to reach carbon neutrality by 2050. At the Boston campus, 2013 saw the completion of its Climate Action Plan and its third greenhouse gas inventory while the Dartmouth campus has reduced its carbon emissions by 20% since 2008 through installing a wind turbine and solar panels, among other efforts. At the Lowell campus, while its size continues to increase to accommodate enrollment growth, the campus has exceeded their carbon reduction target by updating their power plant and adding new controls to existing units. The Medical School in Worcester has reduced oil usage by 94% since 2007 by replacing its power plant for cleaner natural gas. Additionally, the Massachusetts Green High Performance Computing Center (MGHPCC) located in Holyoke recently received LEED Platinum certification. A significant component of the energy needs in any data center comes from its cooling footprint. The MGHPCC has been designed to minimize its cooling needs by using outside air to remove heat whenever possible, reducing the need for energy-intensive chiller operation. To further reduce energy consumption, the mechanical and electrical equipment has been designed to operate reliably at relatively high temperatures, further reducing cooling needs.

## **2. Green Building Certifications/Sustainable building practices**

In conjunction with the University's commitment to capital investments over the past several years, each campus has set a minimum requirement for LEED certifications for all new construction and major renovations which has resulted in the following outcomes:

- Amherst – 3 buildings reaching LEED Gold Certification
- Boston – Planning for LEED Silver Certification in 2 buildings currently under construction
- Dartmouth – LEED Certification for the newest building, the campus Library which is the largest building on campus



- Lowell – LEED Gold Certification for its Emerging Technologies and Innovation Center completed in September 2012
- Medical School – LEED Gold Certification for the Albert Sherman Center and LEED Silver for the Ambulatory Care Center

### **3. Notable Energy efficiency and renewable energy projects**

Many projects are currently underway to address energy efficiency including the E+ Project on the Amherst campus which completed over two dozen energy efficiency projects such as traffic light conversions, steam line replacements and other lighting controls. The Dartmouth campus has initiated a comprehensive energy performance contract to manage building and central plant upgrades in an effort to include sustainable design in all projects. On the Lowell campus, solar PV installations have occurred on four campus buildings and other efforts include conversion to natural gas, chiller replacements, lighting efficiency audits and sustainable transportation initiatives. At the Medical School campus, a partnership with National Grid allowed the campus to leverage incentives to offset the cost of investments in the power plant expansion, LED parking garage lighting, medical equipment and the Sherman Center energy.

### **4. Behavior Change and Student and Community Engagement**

The University's sustainability efforts could not be accomplished without the cooperation of the student and staff community. Each campus has experienced tremendous engagement from these stakeholders in the form of the Chancellor's Sustainability Committee on the Amherst campus comprised of over 80 students and 10 fellows who serve on sub-committees who evaluate and make recommendations on green building, food, master planning, transportation and energy, among other initiatives. At the Boston campus, transportation efforts including the ride share and bike share have become increasingly popular along with year-round outreach events that include students and staff to communicate faculty research, discuss current events and share activities. On the Dartmouth campus, students have become engaged through the NSE Program for Electricity Reduction and the Forest and Garden Project while in Lowell, campaigns sponsored by the Climate Action Plan sub-committees include the Residence Hall Electrical Challenge, the One Mug Program and tree plantings, among others. The Medical School's Growing Green effort continues to grow with the latest addition of a website that includes campus sustainability efforts such as the Doing My Part Pledge to encourage recycling and energy reduction.

### **5. Notable Waste Reduction/composting/recycling programs**

While continuing to promote sustainability and behavior change, each campus has achieved notable success in the areas of waste reductions including the composting of over 1,400 tons of organic waste each year on the Amherst campus, 30,000 pounds of food and dinnerware waste composted per year at the Boston campus, pre-production food waste sent to a chicken farm for recycling in Dartmouth, single stream recycling in Lowell and e-recycling, construction recycling and dining operations waste reductions efforts at the Medical School.

### **6. Academic programming (courses, majors, certificates, masters programs, etc)**

Given the University's commitment to sustainability, it is only fitting that there is a wide depth of course offerings in undergraduate, graduate and continuing education degrees in this field.



Across 4 out of 5 campuses, close to 400 courses are regularly offered. In Amherst, to ensure access to available courses, a Sustainability Course Finder which is an online, user-friendly list of courses. In addition, new course offerings at several campuses are currently under development.

## **7. Clean Energy Research**

As the Commonwealth's public research institution, the University has become a leader in clean energy research. At the Amherst campus, notable research includes the Center for Agriculture, the Climate System Research Center and the Water Resources Research Center while at the Boston campus, College of Management faculty organized a workshop to evaluate coastal risk and assessment and research projects are being developed based on this workshop. At the Marine Renewable Energy Center in Dartmouth research to assess the performance of tidal energy turbines is underway along with efforts at the Lowell campus at the Center for Electric Car and Energy Conversion. These efforts are just a sampling of the many research initiatives across the campuses.

## **8. Public Recognition of Efforts**

In addition to campus recognized initiatives, many grants and other forms of recognition have been awarded to our campuses. In 2014, the Amherst campus was named to the Princeton Review Green Honor Roll, Boston received the Corporation for National Service award as a 3 year grant to support the development of the Southeastern Massachusetts Time Exchange, Lowell was the first New England College to receive the Greenguard Certification and the Medical School was a finalist for the Second Nature Climate Leadership Award.

## **9. Future planned projects**

Even with the many accomplishments you will read to date in the following pages, there is still more to do. The Amherst campus has a new electrical substation in design that is scheduled for completion in 2015 to provide more reliable electrical power to the campus, Dartmouth is working to establish a Compost Project and Bike Share initiative and Lowell continues its Accelerated Energy Program to conduct energy assessments and improve operating systems.

## **10. "Help Needed Section" - climate preparedness**

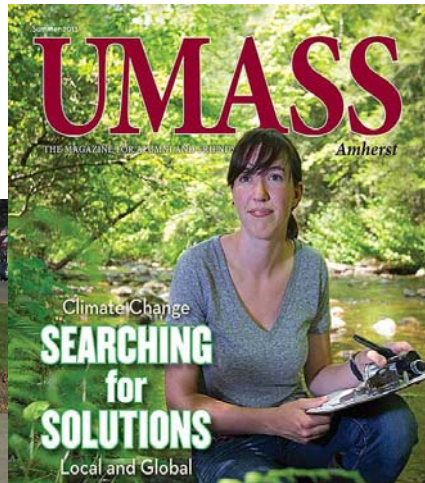
While each campus has made great strides in its attention to sustainability there continue to be opportunities to expand programs, share best practices, assess current practices and increase capacity. The working groups established to develop projects will continue to create new ideas and initiatives and seek engagement from the University's leadership, students and staff.



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## Amherst Campus





## **1. UMass Climate Commitment – Reduced Carbon Emissions**

### **GHG REDUCTIONS:**

Since 2002, UMass Amherst has reduced overall campus emissions by 34% from over 180,000 MTCO<sub>2</sub> down to 120,000. Since 2004, campus CO<sub>2</sub> emissions per person have been reduced from 36 pounds per year to 22 pounds per year.

### **CLIMATE ACTION PLAN:**

The Chancellor's Sustainability Committee published the 2012 Climate Action Plan Update: A Roadmap to Carbon Neutrality which outlines mitigation strategies such as renewable energy, reductions in individual energy consumption, building commissioning, and greener new buildings, to help the campus reach the ACUPCC goal of carbon neutrality by 2050.

(<http://scholarworks.umass.edu/csi/>)

## **2. Green Building Certifications/Sustainable building practices**

### **LEED CERTIFICATIONS:**

UMass Amherst mandates that all new construction and major renovations meet LEED Silver minimum. Three buildings have reached LEED Gold Certification (George Parks Marching Band Building, Police Station, and the CNS Research Greenhouses) and 12 projects are pending as LEED Registered and 5 more projects are in planning.

### **FUTURE LEED PROJECTS:**

The Life Science Laboratories have been designed to provide state-of-the-art research laboratory space for interdisciplinary teams engaged in cutting-edge research. The Commonwealth Honors College Residential Complex opening in September 2013 will be a new \$186.5 million residential and teaching complex in the heart of the campus to serve the Commonwealth Honors College. It will be one of the best public-university complexes of its kind in the nation. The New Academic Classroom Building will provide state-of-the-art classroom and academic space. Various classroom types are planned to encourage interactive and team learning, critical thinking, and trans-disciplinary learning and research.

### **GREEN BUILDING RESEARCHERS:**

Green Building Researchers (graduate students) working with Campus Planning and Design & Construction Management document all of the project's stated goals and achievements, inventory LEED credits achieved, and report how these achievements help the campus meet its climate action and sustainability goals. Green Building Researchers also developed and continue to update the UMass Amherst Green Building Guidelines, a specialized LEED guide for all project managers and design teams for each new project.

### **USGBC MA CHAPTER WEST BRANCH:**

UMass Amherst is home to the West branch of the USGBC MA Chapter. It welcomes individuals who are interested in sustainability for the built environment, and is committed to building partnerships and regional alliances with other Pioneer Valley organizations in supporting the green building community.





## **CONTINUOUS COMMISSIONING:**

A continuous-commissioning pilot program in two buildings resulted in energy savings of \$155,000 and inspired the local utility company to fund the continuous commissioning of two more buildings.

## **3. Notable Energy efficiency and renewable energy projects**

### **E+ PROGRAM:**

To follow up the building and utility efficiency measures of the 2006 ESCO, UMass Amherst created the E+ Program, which has funded and completed two dozen energy efficiency projects in 2012 (FY11 projects) that will cost almost \$2.5million and will produce \$400,000 in annual savings, provide more than 1.8million kWh in electricity savings, over 8,700 Mlbs in steam savings, and over 2,150 MTCO<sub>2</sub>e in avoided emissions. Projects range from traffic light LED conversions, to steam line replacements, to Library lighting controls, and a full list can be found in the attached spreadsheet. The E+ Program designates millions of dollars each fiscal year for energy conservation projects, which upgrade or replace inefficient physical structures or technologies on campus. Since the creation of the E+ program in 2005, the university has spent \$17 million for energy efficiency projects campus wide that have yielded yearly energy savings of \$6,600,000. E+ Projects such as steam line replacements to occupancy sensor installations have resulted in over 5,400 tons of CO<sub>2</sub> reductions.

### **SOLAR ENERGY:**

The University has 106 solar panels producing approximately 25kW of solar photovoltaic (PV) power at its South Deerfield Farm, where agriculture and solar energy production represent one of the first dual use experimentations of its kind. However, expanding solar energy and bringing it closer to the center of campus is crucial in demonstrating the University's commitment to renewable energy. The 131-acre Hadley Farm, home to UMass Amherst equine, sheep, swine and goat programs, may provide up to as much as 30 acres of land for the joint use of agriculture and solar power generation. It is designed to demonstrate potential benefits to the farmer and to the energy industry as an alternative to ground placement of PV panels, which removes the land from future agricultural use. This array will be 2.0 MW in size and will provide clean, renewable power to the utility grid, displacing other non-renewable grid-delivered power.

### **FUEL OIL REPLACEMENT:**

The Office of Administration and Finance is planning to replace 1.6 million gallons of ULSD fuel oil with Liquid Natural Gas (LNG) and possibly the remaining 500,000 gallons with sustainable wood fuel energy. Switching to LNG will save the University approximately \$2 million per year. This fuel switch went into service in December 2012. Switching to LNG and wood would reduce carbon emissions by an estimated 3,000 MTCO<sub>2</sub>e per year.

### **INCREASING ENERGY RELIABILITY AND GREEN CREDIT:**

A Gas Turbine Generator Inlet Air Chiller System has been installed for the Gas Turbine Generator located at the EPA Award Winning Central Heating Plant. This Inlet Air Chiller System will allow the Gas Turbine Generator to generate an additional 1 Mega Watt of electricity during hot and humid conditions. This system will result in increased electrical system reliability and significant decrease in electrical supply costs. This system was made possible by a



\$390,000 Clean Energy Grant from the Massachusetts Department of Energy Resources and a \$240,000 energy incentive from Western Massachusetts Electric Company. This project helps UMA generate over \$2.5 million in “Green Credit” revenue which is put back into repair and efficiency improvement of utility system infrastructure.

#### **LED REPLACEMENT PROJECT:**

In cooperation with DOER, NSTAR/WMECO, and Philips Lighting, UMA installed over 1,100 LED light bulbs across campus in early 2013. The bulbs were Energy Star qualified, dimmable, LED light bulbs.

#### **RECLAIMED WATER USE:**

In July the Central Heating Plant began using treated Reclaimed Water from the Town of Amherst’s Waste Water Treatment Plant as Cooling Tower make-up water. This is the first Class A Reclaimed Water permit issued in Western Massachusetts from the MA DEP. This has resulted in a reduction of 40,000 gallons per day of potable water usage at the Central Heating Plant.

#### **4. Behavior Change and Student and Community Engagement**

The UMass Amherst Budget Office and Vice Chancellor of Administration & Finance has approved a green revolving fund beginning September 2014. The fund will be called the Sustainability, Innovation & Engagement Fund and will set aside \$50,000 to fund the best proposals from the entire campus community that will engage the community in advancing sustainability and environmental conservation on campus. Projects will be reviewed by a committee of students and approved by the Chancellor’s Sustainability Committee made up of faculty and staff.

#### **STUDENT ENGAGEMENT:**

The Campus Sustainability Initiative includes the Eco-Rep Program of now over 80 students, the 10-student Sustainability Fellowship Program, and today's revamped EPAC, now called the Chancellor's Sustainability Committee. Directed by the Campus Sustainability Manager, the emerging Campus Sustainability Initiative is also home to paid student coordinators who organize campus-wide sustainability events to engage the entire campus community. Students now serve on each sub-committee of the Chancellor's Sustainability Committee, including Green Building, Food, Master Planning, Transportation, Energy, Waste Reduction, Communications, and Community Programming.

#### **STAFF & FACULTY ENGAGEMENT:**

The Green Office Program now has 39 certified offices participating on the UMass Amherst campus. This program aims to alter daily office practices by recruiting Office Eco-Leader staff members to take a positive leadership role in reducing everyday office waste and energy consumption through behavior change. Campus Sustainability Initiative student Fellows trained in the program act as sustainability consultants to these staff Eco-Leaders by providing resources and in return receive academic credit. The entire UMass Libraries system has become certified in addition to most of the College of Natural Resources department offices. In August, every department under Facilities & Campus Services will become certified under the guidance of the



Campus Sustainability Manager housed in the Physical Plant. The program is expected to grow even more in the second half of 2013 with all of Residential Life offices considering signing on.

## **ENERGY DASHBOARDS:**

The Campus Sustainability Manager and Johnson Controls are currently piloting an energy dashboard program to keep students involved and aware of their effect on the environment. In an effort to encourage students to modify their behavior, seven touch screen 42" monitors will be installed around campus that display the UMass Amherst Energy Kiosk and energy data of 82 buildings on campus. To this date, three of the dashboards, in Berkshire and Worcester Dining Commons, and Morrill Science Building are installed and displaying real time data. Three more dashboards are currently being sited for installment.

## **GREEN GAMES:**

The dashboards also feature the Green Games Residence Hall Competition Score Board. In Spring of 2012 UMA launched the Green Games sustainability competition; over 23 residence halls, representing over 9,000 students participated.

## **5. Notable Waste Reduction/composting/recycling programs**

### **COMPOSTING:**

UMass Amherst composts over 1400 tons of organic waste each year, the largest recycling stream on campus. Composting exists in all Dining Commons (pre-and post-consumer food waste), in all retail dining locations, outdoor bins centrally placed on campus, and in some of the Green Offices.

### **DINING SERVICES:**

UMass Dining Services, which has had all trayless dining since 2010, has discontinued the use of all plastic bags effective September 2013 and to date has given away over 10,000 reusable grab-n-go bags and 5,000 water bottles, eliminating over 600,000 bottles and cans from the landfill.

### **ELECTRONIC WASTE RECYCLING:**

The "Green Monstah" is an E-waste (electronic waste) center located in the entry of the W.E.B Du Bois Library. It is a place where students and faculty can conveniently recycle their obsolete or broken electronics and save them from being thrown in a landfill.

### **SINGLE STREAM RECYCLING:**

UMass Amherst has one of the highest recycling rates in the Commonwealth at 56%. To increase rates even more, the University is phasing into a single stream recycling system campus wide. Single stream (also known as "fully commingled" or "single-sort") recycling refers to a system in which all paper fibers, plastics, metals, and other containers are mixed and collected instead of being handled separately throughout the collection process.

### **SUSTAINABLE MOVE-IN:**

A waste and recycling system instituted at the end of the school year, providing students with a convenient and responsible system for disposing of unwanted materials during the move-out period.



## **EPA GAMEDAY CHALLENGE:**

At football games and hockey games, UMass Amherst has placed fourth nationally in diverting organic waste as part of the Environmental Protection Agency's Game Day Challenge.

## **6. Academic programming (courses, majors, certificates, masters programs, etc)**

### **MS IN SUSTAINABILITY SCIENCE:**

In October 2010 the Board of Trustees approved the creation of a new Master of Science program in Sustainability Science. This is one of the first graduate-level Sustainability Science programs nationwide. The program was approved by the Board of Higher Education in summer of 2011; 10 graduates have now completed the program and are working in various sectors of the New England green economy; a third cohort of students begins the program in September 2013.

### **COURSES & MAJORS:**

UMass Amherst has more than 300 sustainability courses. These courses are offered across 32 different disciplines and taught by over 100 faculty. We are one of the first campuses nationwide to develop a searchable [Sustainability Course Finder](#) (user-friendly online list of these courses). This academic advising resource helps students find out about UMass's environmental and sustainability programs and classes.

### **ACADEMIC DEVELOPMENT:**

Our Center for Teaching and Faculty Development in collaboration with the Library Sustainability Fund and the Campus Sustainability Initiative provides support to faculty who want to increase the sustainability content of their classes. For academic year 2013/14 we have awarded 11 curriculum grants to faculty through a competitive process to assist them enhancing their sustainability teaching. The Sustainability Education and Research Committee has also created a campus-wide set of sustainability-related learning outcomes with buy-in from a faculty across 19 different academic departments.

## **FACULTY**

There are over 150 faculty involved in various aspects of sustainability research -- almost 1 in 7 tenure system faculty. Starting in 2010 we began to convene regular meetings with faculty from different disciplines and areas of expertise to develop new interdisciplinary research and education opportunities.

## **7. Clean Energy Research**

### **ENERGY RESEARCH:**

UMass Amherst has emerged as a national leader in climate science and clean energy research. Innovative research, scholarship, and creative activity is leading the way for a brighter future for the Commonwealth and beyond. Notable research in energy include the Institute for Massachusetts Biofuels Research, Phase Energy Frontier Research Center, Environmental Biotechnology Center, Wind Energy Center, Fueling the Future Center for Chemical Innovation, Mass Center for Renewable Energy Science and Technology.

### **CLIMATE/ENVIRONMENTAL RESEARCH:**

Notable climate and environmental research include the Center for Agriculture, Center for Collaborative Adaptive Sensing of the Atmosphere, Climate System Research Center, Environmental Biotechnology Center, Large Pelagics Research Center, Northeast Climate Science Center, Transportation Center, and the Water Resources Research Center.

### **8. Public Recognition of Efforts**

- Awards:
  - 2012 White House Champions of Change Challenge Winners for Permaculture Initiative
  - 2012 Earth Day Network International Award: Most Acts of Green in Education & Awareness
- Grants
  - 2012 Clean Energy Grant from Department of Energy Resources
- Lists
  - Named to the 2014 Princeton Review Green Honor Roll (Top 22 in US)
  - STARS Gold University (Top 10 among research universities in US)
  - Received “Honorable Mention” status by the League of American Bicyclists – Bicycle Friendly University List

### **9. Future planned projects**

#### **ELECTRIC SUBSTATION:**

The University has a new electrical substation project in design and is scheduled for completion by September 2015. The project will provide the campus with more reliable electrical power and increased electrical supply capacity and will provide the University with the ability to install additional onsite electrical generation on campus.

#### **SOLAR ENERGY PLAN:**

The Campus Sustainability Manager has submitted a Solar Energy Plan for the UMass Amherst campus which highlights how UMA could achieve 30% renewable energy by 2020, which is a goal set by Governor Deval Patrick through the Executive Order 484, Leading by Example mandate. Carrying out the plan will help position UMA as a regional and national leader in sustainability amongst our peer institutions and help save the university millions of dollar in utility expenses by producing our own clean energy. The plan looks at roof mounted solar projects, expanding the ground mounted solar projects, and developing parking lot solar canopies.

#### **UTILITIES PARTNERSHIP:**

The University has entered into a strategic alliance with the local Electric Utility Company (Northeast Utilities) to continue the energy reduction work on campus. Northeast Utilities will be providing campus building energy audits at no cost to the University. These audits then will be used to determine future energy reduction projects.

#### **CAMPUS MASTER PLAN:**

The Master Plan (CMP) embodies sustainable development and will continue to refine the



University's approach to meeting the needs of the present while preserving options for future generations to do the same. The CMP focuses on land use and location of sites within the campus core that achieve a compact, walkable campus with a variety of activities and facility types that are tightly knit and fully utilized. It emphasizes building density, efficient utilities and district-level infrastructure solutions that reduce energy use, water use and stormwater runoff, and produce other benefits, such as improving indoor air quality and supporting locally sourced materials. Site planning and development locations within the core support buildings that emphasize human scale and preserve landscape and cultural assets.

### **ANAEROBIC DIGESTION:**

UMass Amherst has partnered with MassDEP, the MA Division of Capital Asset Management (DCAM), the Department of Energy Resources (DOER), and the Massachusetts Clean Energy Center (MassCEC) to identify a campus site suitable to siting an anaerobic digester. This technology will convert organic material (including food, fats/oils/grease, wastewater biosolids, and manure) into a methane rich renewable biogas that can be used for heat and electricity.



## Boston Campus





## **1. UMass Climate Commitment – Reduced Carbon Emissions Notable Energy efficiency and renewable energy projects**

### **ACUPCC COMMITMENT:**

UMass Boston has committed to the ACUPCC and completed its climate action plans and its third Greenhouse Gas Inventory (GHG) inventory in 2013.

## **2. Green Building Certifications/Sustainable building practices**

### **• INTEGRATED SCIENCE CENTER (ISC):**

Current, progress is being made for the Integrated Science Bldg., the UMB's first LEED Silver certified building.

[http://cdn.umb.edu/images/university/masterplan/Integrated\\_Sciences\\_Complex\\_Project\\_Fact\\_Sheet.pdf](http://cdn.umb.edu/images/university/masterplan/Integrated_Sciences_Complex_Project_Fact_Sheet.pdf)

### **General Academic Building No. 1 (GAB No. 1):**

UMB is hard at work at its General Academic Building No. 1 (GAB No. 1), - the second new academic building in the UMass Boston Master Plan. With a ground breaking in Spring 2013, it is anticipated that GAB No. 1 will open in mid- 2015. Funded by the UMass Building Authority, the \$113 million project is in the early phase of construction and is approximately 181,000 square feet. The four-story building will provide nearly 2,000 seats in state-of-the-art general purpose classrooms, faculty and staff offices, a café, a student lounge and study spaces, as well as space for three academic programs: art, chemistry, and performing arts. Designed by Wilson Architects, the new building is incorporating many sustainable design strategies and will seek LEED Silver certification. Gilbane Building Company is serving as the project's construction manager.

## **3. Notable Energy efficiency and renewable energy projects**

### **SOLAR PV:**

UMass Boston installed its first 74 KW capacity solar photo-voltaic installation on the roof of the Wheatley building. 350 panels were installed and connected to the grid in late 2011 with ARRA funds from DCAM and DOER. It is estimated to generate 85,000 kWh/yr. A real-time readout in Wheatley lobby informs viewers of the energy generated and is the campus's first renewable energy installation.

## **4. Behavior Change and Student and Community Engagement**

### **EARTH DAY, AMERICA RECYCLES DAY**

- Earth Day in Spring and America Recycles Day in the Fall frequently feature campus green careers forum, talks by eminent speakers on Climate Change, Global Food Security, award-winning Environmental Road Trip movies, travelling art/video shows, E-waste collection programs and green transit alternatives such as ZIPCAR and NuRide.





## HYDRATION STATIONS, STUDENT RESOLUTIONS TO DECREASE PLASTIC POLLUTION

- Student Governance at UMass Boston passed a resolution in Feb 2012 to limit the use of disposable bottles and hydration stations and currently the campus has installed hydration stations in every building to help reduce plastic pollution.

## GREEN TRANSIT AND HUBWAY

- UMass NuRide rideshare program is increasingly popular on campus while most of the shuttle bus fleet that carries close to half the campus community from the nearest JFK T station uses eco-friendly hybrid fuel technology.
- UMass joined the popular Boston bike-share program Hubway in 2012, leading to the expansion of green transit options available at UMass Boston. This also expands the network of Hubway stations beyond institutions in the downtown Boston-Cambridge area and allows UMB and the community to share bike along the beautiful Columbia Point Harborwalk. UMass Boston has a 19-dock solar-powered Hubway station UMass Boston with an additional kiosk at the JFK/UMass train station.
- **RENEWABLE ENERGY FEE:** Led by student Sustainability Club, the campus created an OPT-IN
- Renewable Energy Student fee 2007 onwards.

## FACULTY CONTRIBUTIONS, AMONG OTHERS

- UMass Boston Faculty Member David Levy, College of Management established UMB Chapter of Net Impact established 2012 within CM. The mission of NetImpact UMass Boston is to inspire, educate, and equip individuals to use the power of business to create a more socially and environmentally sustainable world.  
<https://www.facebook.com/netimpactumassboston>
- Green Internships and Job Opportunities
  - Full List: <http://www.umb.edu/serc/internships>
  - Green Internship Program was launched in November 2012 and posts openings on a weekly basis. Over 40 green internships and jobs have been posted since then.
- Venture Launch Competition - Entrepreneurship Center features businesses with sustainability and social change goals. Some competitors were:
  - Beeswax for Business: beeswax-driven products from Ghanaian honeybee farmers
  - Town Scribe: a cloud application that allows citizens of a municipality to gather in a virtual town hall to discuss and write their own laws.
  - Green Code: is a design firm that focuses on the integration of biotechnology in interior space.
- The Department of Management and Marketing launched the Organizations and Social Change blog in March 2013 as a way to communicate our research, translate research for practitioners, discuss current events and share activities – see:  
<http://organizationsandsocialchange.wordpress.com/>
- Outreach and events:



- September 2012 – Seminar: Designing Global Governance for Sustainability: UMass Boston Brings Research to Policy. In conjunction with Center for Governance and Sustainability.
- December 2012 – “Environmental Sustainability at State Street: Performance and Opportunities for the 21st century”, with Peter DeBruin, VP Office of Environmental Sustainability, State Street
- March 2013 – “Sustainability in the Supply Chain: Risks and Opportunities”, a panel discussion with Mark Buckley, VP Environmental Affairs, Staples, Cynthia Wilkinson, Director Sustainable Supply Chain, Staples and Rich Goode, Senior Manager Climate Change and Sustainability Services, Ernst & Young
- April 2013 – Green Careers Forum with former UMASS Boston Alumni and 15 participating companies and non-profits talking with students about how to prepare and land a career that involves sustainability.
- <http://blogs.umb.edu/gradcm/2013/04/17/reminder-green-careers-forum-today/>
- April 2013 - Entrepreneurship and Women’s Rights in Ethiopia: The Creation of a Women’s Bank (ENAT Bank). Lecture by Meaza Ashenafi. In conjunction with Center for Governance and Sustainability.
- April 2013 - Christiana Figueres, the Executive Secretary of the UN Framework Convention on Climate Change. From Climate Conflict to Climate Action: Capturing the Greatest Opportunities of Our Generation. In conjunction with Center for Governance and Sustainability.
- May 2013 Presentation by Brian Swett, City of Boston Chief of Environment and Energy. In conjunction with U. of Michigan, Erb Institute.

## **5. Notable Waste Reduction/composting/recycling programs**

- UMass Food service is one the earliest leading zero-waste cafeterias and has compostable foodware since 2004 composting more than 30,000 lbs. of food prep and post-consumer food and dinnerware waste per year.
- UMass Boston newly installed hydration stations in response to student resolution to minimize plastic bottle waste is available in every campus building and has saved more than 280,000 bottles from reaching the landfill since 2012!
- UMass Boston is the one of the Boston’s designated drop off point for Hazardous and Household waste recycling for Boston residents.
- Campus e-waste program “Don’t just Recycle – E-cycle!” has recycled more than 1000 lbs of e-waste and small office electronic recyclables since 2005.

## **6. Academic programming (courses, majors, certificates, masters programs, etc)**

- CM/SERC is launching a Sustainable Facility Professional credential program (SFP) in Fall 2013 in conjunction with the Greater Boston Manufacturing Partnership and the International Facility Management Association (IFMA).
- MBAMGT 671 Introduction to Environmental Management: 3 credit/hours
- MBAMGT 678 Environmental Management: Implementation Issues: 3 credit/hours
- MBAMGT 684L Climate and Energy: Law, Policy and Management: 3 credit/hours
- MBAMGT 688L Global Warming and International Business Management: 3 credit/hours



- MBA AF 631 Environmental Accounting and Finance: 3 credit/hours
- Undergraduate: MGT471 Introduction to Environmental Management
- Graduate and Undergraduate Certificates in Sustainability and Clean energy in collaboration with School for Environment
- The Clean Energy and Sustainability (CES) Program now offers workforce training in clean energy and sustainability at both undergraduate and graduate levels. The CES graduate certificate comprises 4 courses, including an internship/practicum component.
- MBA Environmental Management Specialization
- UMass Boston has traditionally had a focus on the environmental sciences with multiple academic offerings in the Biology, Green Chemistry (a UMB pioneered major, 1<sup>st</sup> in the country), School for the Environment, Center for Governance and Sustainability, the Urban Harbors institute and more.
- The Urban Harbors Institute is finalizing the Stage 2 proposal to create a master's degree program in Urban Planning and Community Development. One of the three specializations of that program is sustainable planning/development.

## 7. Clean Energy Research

- In conjunction with new School for Environment, College of Management faculty are working AIG on climate change, coastal risk assessment and adaptation. In April 2013 they organized a workshop held in Boston which included a wide range of local stakeholders. Research projects are being developed based on this partnership.
- David Levy, Stephan Manning, and Jo-Reese Williams: Clean tech clusters and regional economic development within global value chains. The clean energy cluster raises complex business and policy issues because of distinct characteristics: it comprises a diverse range of specialized firms with distinct technologies, from carbon software to biofuels; it is subject to a high degree of market, technological and regulatory uncertainty; parts of the cluster have rapidly become internationalized and commoditized. Research examines business strategies, unique cluster drivers, and policy implications. One paper already presented at a conference.
- Vesela Veleva, Eco-industrial parks as a tool to advance the green economy and business competitiveness. A joint research with Devens Enterprise Commission (the local government in charge of redeveloping former Fort Devens).

## 8. Public Recognition of Efforts

- UMass Boston was recognized in Princeton Review 286 greenest campuses in 2011, and then as 322 of the green campuses in the country in 2012 and 2013.
- UMass Boston green transit options were recognized with a Leadership level award by the Exec Office of Transportation in 2012 and 2013.
- **UMass Faculty member: Anamarija Frankic** – Green Harbors Project, UMass Boston School for the Environment
  - Initiated and helped organized with the School for the Environment, CAPS, and ReMain the first LivingLabs Semester on Nantucket; (Biomimicry on Nantucket: What would nature do?)
  - Initiated and helped organize with CAPS the first Global Biomimicry Conference at UMass Boston, June 22-24, 2013



- Schmidt Family Foundation awarded 100K for the first Biomimicry LivingLabs at UMass Boston (Savin Hill Cove area) = for teaching and learning by applying scientific and technological solutions for sustainable and resilient urban harbors; Partnered with Prof. Brent Constantz to apply his ‘green cement’ innovative technology to design and build the first green pier and floating island in Savin Hill Cove!
- Partnered with Jan Schlichtmann (oceaninnovation.com) and started the LivingLabs in Gloucester Harbor to support the sustainable environmental and socio-economic development in this area (Green Harbors Project).
- Wellfleet Harbor LivingLabs – USDA (2012) awarded 100K for sustainable restoration of oyster reefs and salt marshes to improve water quality and biodiversity; Cape Cod Commission (2013) awarded 100K for innovative technological approach in restoration of water quality; this project won two prestigious awards: MassRecycle: “Municipal Innovation” and American Council of Engineering Companies (ACEC): “Engineering Excellence” 2013 Silver Award;
- Partnered with Conservation Law Foundation (CLF) on the Mystic River fish advisory project recently awarded 40K by Governor Patrick’s Administration Grants for water protection, habitat restoration and education - <http://www.mass.gov/eea/pr-2013/12-grants-awarded.html>
- With EPA Region 1 initiated and organized the first ever Urban Waters Boston Area University Collaborative Forum (Jan 18, 2013) to begin a longer-term collaborative effort to restore and strengthen the resilience of urban watersheds and coastal areas;
- Frankic was awarded Fulbright Specialist grant to develop and establish Green Harbors project at the University of Zadar, Croatia, and teach biomimicry and sustainable coastal management courses at the CIMMAR (Center for Interdisciplinary Marine and Maritime Research); <http://ben.biomimicry.net/uni/2013/biomimicry-fellow-awarded-fulbright-grant/>
- In media: “Universities as LivingLabs for Sustainable Solutions”, including AASHE, NPR and ‘Living on Earth’: [http://www.umb.edu/ghp/in\\_the\\_media](http://www.umb.edu/ghp/in_the_media); <http://www.environmentalgovernance.org/blog/2012/11/public-radio-international-features-anamarija-frankic-on-biomimicry/>
- **UMass Faculty member: Professor David Levy:**
  - Aspen Institute 2011 Faculty Pioneer Award Winner
  - Enactus - University wide student group focused on environmental and social change. The UMass Boston group won the East Coast Regional competition, and are headed to finals. <http://www.enactusumassboston.org/>
- **UMass Faculty member: Professor Kamaljit Bawa**
  - Received the first-ever international GUNNERUS Sustainability Award, (widely considered to be the Nobel Prize for work in sustainability).
  - He was also elected to the American Academy of Arts and Sciences in the public affairs and journalism field, Professor Bawa has founded Ashoka Trust for Research in Ecology and the Environment (ATREE).



## 9. Future planned projects

- The Campus is implementing the first phase of its 25 yr Master Plan (2008 – 2017) and has included sustainability as one of the guiding principles of its master planning. The following projects are underway
  - Integrated Sciences Complex
  - General Academic Building No. 1
  - McCormack Hall and Wheatley Hall Renovations
  - Utility Corridor and Roadway Relocation
  - HarborWalk Improvements and Shoreline Stabilization
- As the campus begins its transformation, detailed planning for additional near-term projects include:
  - the second general academic building, (GAB. 2)
  - a parking garage,
  - a residence hall,
  - a trigeneration plant,
  - the demolition of the former Bayside Expo Center,
  - renovations to the university's facilities on Nantucket, planning for the re-use of the Calf Pasture Pumping Station, and the demolition of the Science Center and substructure.

## 10. Help Needed Section - Climate Preparedness.



## Dartmouth Campus





## **1. UMass Climate Commitment – Reduced Carbon Emissions Notable Energy efficiency and renewable energy projects**

20% carbon reduction from 2008 levels; 600 KW wind turbine installed; 260 KW solar panels installed; MW Cogeneration plant to be online in September

## **2. Green Building Certifications/Sustainable building practices**

Library expansion/renovation expected to be LEED certified, which is our largest building on campus

## **3. Notable Energy efficiency and renewable energy projects**

Comprehensive energy performance contract to manage building upgrades and central plant upgrade (NORESO)

## **4. Behavior Change and Student and Community Engagement**

- NISE! Pilot program for electricity reduction
- NORESO ECTBC
- Green Navigators
- Net Impact/GRI reporting for the Town of Dartmouth and City of Fall River
- Regional Sustainability Council
- Weatherization Training Program
- Forest and Garden Project

## **5. Notable Waste Reduction/composting/recycling programs**

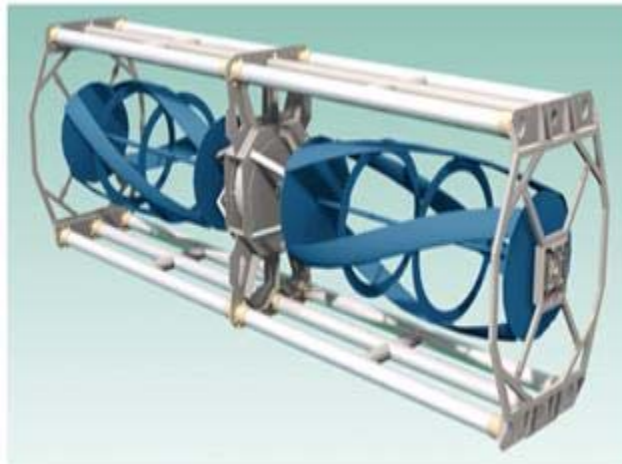
- Launching a dedicated recycling program, Fall 2013
- Pre-production food waste sent to a chicken farm
- Diversion of all lawn trimmings and leaves to mulch

## **6. Academic programming (courses, majors, certificates, masters programs, etc)**

- Sustainability Minor
- Liberal Arts Major with a concentration in Sustainability (New for Fall 2013)
- Graduate Certificate in Sustainable Development with a Graduate Degree in the work

## **7. Clean Energy Research**

- Marine Renewable Energy Center
- The National Science Foundation has awarded \$300K to SMAST Prof. Geoffrey Cowles and co-PI Prof. Luigi Martinelli of Princeton University, in cooperation with Ocean Renewable Power Company, to assess the performance of tidal energy turbines, including their interactions with the immediate marine environment. Marine kinetic energy is one of the most promising among the "green" energy candidates, but it's not clear what the most efficient turbine design would be for real ocean conditions, nor what the environmental impact would be.



- **Professor Brian Howes** - UMass Dartmouth and SMAST - *Expansion of Hydrokinetic Energy Programs to Chile*. This project builds on the campus's research strengths in marine renewable energy and the work of the New England Marine Renewable Energy Center, and follows Gov. Deval Patrick's 2011 trade mission to Chile, where he signed a joint memorandum of understanding with Florida International University and Pontificia Universidad Catolica de Chile (PUC) for research and education projects related to tidal research and marine renewable energy. Chile is considered one of the top international sites for hydrokinetic energy research globally, and has identified multiple industry and university partners as part of the coastal research to be studied. Amount awarded: \$90,000.

## 8. Public Recognition of Efforts

- 3 year award from the Corporation for National Service for 2 Americorps Vistas to support the development of the Southeastern Massachusetts Time Exchange.
- Creative Economy Award with UMass Amherst to develop permaculture gardens on campus and in the community
- Island Foundation award to map community gardens.
- Worked closely with the Green Communities Division of MA Department of Energy Resources on a series of educational seminars for municipalities. Keynote speakers who presented at UMD as part of the series were MA Secretary of Energy Rick Sullivan, MA Undersecretary of Energy Barbara Kates-Garnick, Commissioner of DOER Mark Sylvia, and MA Commissioner of Agriculture Greg Watson.

## 9. Future planned projects

- Compost Project
- NISE! Build out to include all residence halls
- Bike Share
- Secure Bike Storage
- Campus walking/biking path
- Outdoor Experiential/Adventure Course





## 10. “Help Needed Section” - climate preparedness

- Energy Buying
- REC's
- Renewable Energy PPA's
- Green Offices & best practices



## Lowell Campus





## 1. UMass Climate Commitment – Reduced Carbon Emissions

Part of Energy Project ID Subcommittee involvement includes the following:

- Total Reduction of Greenhouse Gas Emissions (GHG):
  - Per DOER, from FY 2004 to FY 2012 GHGs cut 12%
    - GHGs cut by 4,669 MTCO<sub>2</sub>E; while campus area increased 34% (2.5MM to 3.4MM SF)
  - From FY 10-12 Internal Projects: reduced 3,650 MTCO<sub>2</sub>E (metric tons of carbon dioxide equivalent)
  - In FY11 boiler improvements were made that reduced GHG emissions. This was done by converting from burning No. 6 Fuel Oil and natural gas (NG) to burning only NG. This was accomplished by :
    - North and South Campus Power Plant (SCPP) boiler fuel switch in FY 11 and 12 to NG from no. 6 Fuel Oil
    - Replacement of two old boilers with new High Efficiency boilers with economizers in the North Campus Power Plant (NCPP). Also NCPP replacement of boiler front for no. 3 Boiler with new controls, gas burner and FD fan with VSD (variable speed drive).
- Reduction relative to campus size – CO<sub>2</sub> emissions per square foot
  - The E.O. 484 goal was to reduce GHG emissions from FY04 – FY12, in MTCO<sub>2</sub>E /SF from state government operations by 25%
  - UML exceeded the E.O 484 requirement. In comparison with FY 2012 (2004 baseline), UMass Lowell reduced combined Scope 1 and 2 GHG Emissions per SF by 33%; while area increased from 2,522,911 SF to 3,385,280 SF during this period.
  - Overall energy consumption/SF in buildings reduced by 16 % from FY04- FY12
- Reduction relative to size of student population -- CO<sub>2</sub> emissions per student
  - Since 2010 to FY 12, reduced 670 lbs CO<sub>2</sub> per FTE

## 2. Green Building Certifications/Sustainable building practices

### Green Building Certifications

All new construction must be a minimum certified LEED Silver for new construction, meet all IECC 2009 standards and must exceed MA Stretch Energy Code by 20% (780 CMR 115.AA).

The University has a lot of ongoing new construction all of which meets the above criteria:

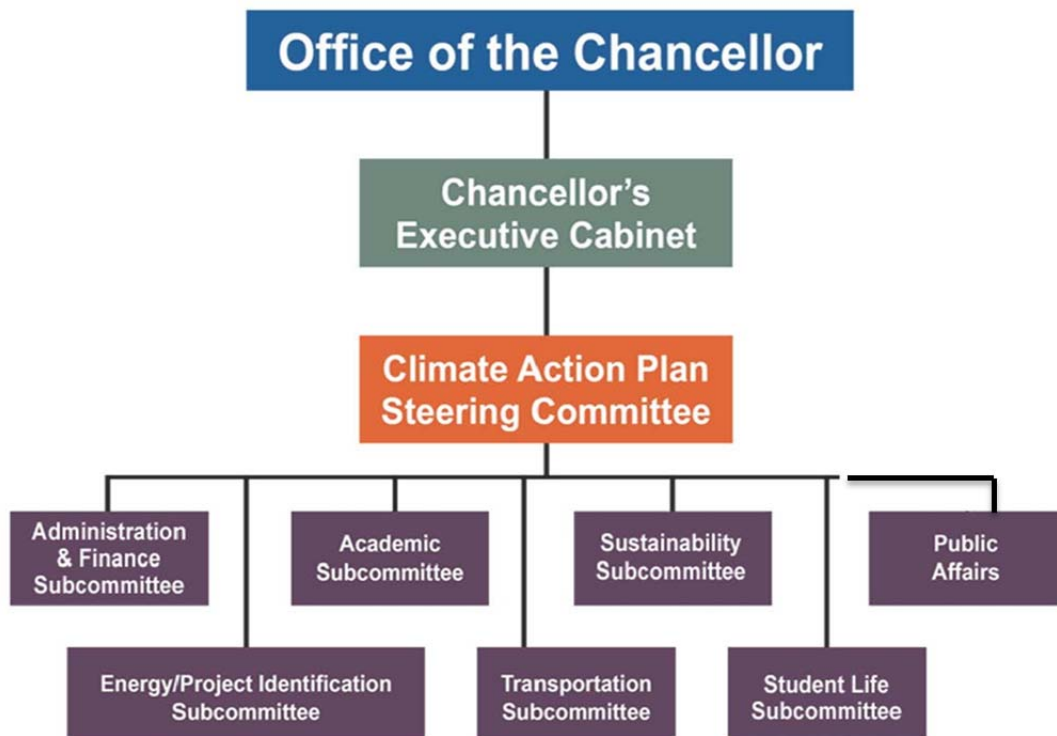
- Emerging Technologies and Innovations Center (ETIC), (*Completed Sept. 2012*)- **Certified GOLD by USGBC on 8/1/2013**
- Health and Social Sciences Building (HSSB), (*Completed April 2013*). Final certification is not finalized.
- University Suites, (*To be completed Fall 2013*)
- University Crossing, (*Currently underway*)
- Pulichino Tong Business Center, (*Construction has not been initiated – FY16 or 17 completion*)

When compared to ASHRAE baseline the LEED building projects in ETIC & HSSB (800 MTCO<sub>2</sub>E), University Suites (230 MTCO<sub>2</sub>E) and University Crossing (400 MTCO<sub>2</sub>E) total reductions of approximately 4800 MTCO<sub>2</sub>E are estimated when we include the demolition of former buildings that occupied the same space.



## Sustainable Building and Operation Practices

- UMass Lowell has Design Standards with Sustainable Requirements within the MEP sections of the standards. Also within the Design Standards is a separate list of the Sustainability and Green Guidelines.
- All cleaning chemicals are Green Guard certified as safe for use from an industrial hygiene and ecological manner.
- Requirement that Design Consultants work with National Grid and UMass Lowell Energy office to promote efficient equipment and systems.
- In 2013 UML hired a Climate Action Plan consultant to assist the Climate action Plan Steering Committee in meeting the goals of the plan.



- Since May, 2012 UMass Lowell has established the CAP Steering Committee consisting of seven subcommittees of faculty, staff and students and led by top management from Faculty and Staff with the goal to meet the objectives of the Climate Action Plan. This steering committee meets quarterly and the subcommittees meet on a more regular basis. These committees include students as well as faculty and staff.
- CAP Sustainability Subcommittee
  - Representation from Student Environmental Alliance and Student Government Assoc.; City of Lowell Recycling Dept.
  - Planned with food service vendor & waste/recycling contractor
  - Campus-wide single stream recycling



- Earth Week activities
- CAP Administration & Finance Subcommittee
  - Approved AEP financing methodology.
  - Created process for energy rebates and other incentives to be reserved for future conservation projects.
  - Reviewing procurement practices to incorporate Green Standards such as EnergyStar and recycled materials e.g. paper.
  - Incorporating a commitment to Sustainability and GHG reductions as part of everyone's challenge.
- CAP Student Life
  - Outreach to students: Educate and practice energy & carbon reduction
  - Close partnership with other sub-committees
  - Awareness Campaigns
  - General: Enhance Awareness sticker E&S campaign; Bike Share Program; partnership with MassPirg; Student Affairs Climate Action Team; Personal Climate Challenge; One Mug Program
  - Facilities: Increasing Campus Residency; Electric Challenge; Increase availability of energy saving power strips
  - Transportation programs
- CAP Energy ID, Transportation and Academic subcommittee roles are more deeply explained in Sections as follows:
  - Energy 1, 2 & 4
  - Transportation 4 and 5
  - Academic 5 and 7

### 3. Notable Energy efficiency and renewable energy projects

Some successful projects at UMass Lowell are as follows:

- UMass Lowell utilized ARRA grants in 2010 for PV arrays and EnerNOC EEMS software to initiate meeting E.O. 484 Renewable energy and EIS requirements,
  - *The ARRA project to install 250 KW DC Solar PV arrays on four campus building roofs; In total, their generating capacity is 205 kW AC and they have approximately reduced emissions by 100 MTCO<sub>2</sub>E annually in FY 12.*
  - *ARRA project EEMS EnerNOC Sub-Metering project for UMass Lowell Buildings, being used to compare monthly utility usage (steam, gas, electric) and bills; measurement and verification of reduced energy of building projects; will be used to conduct benchmarking of buildings; and determine where opportunities exist to reduce energy costs during peak hours.*
- UMass Lowell was the first UMass System campus to sign a net metering agreement with a third-party developer. This type of agreement reduces the cost of power to UMass Lowell and eventually to the region while at the same time helping to increase the market for large multi-megawatt commercial solar PV array development in the Commonwealth of Massachusetts.
- UMass Lowell has signed agreements that will increase our commitment to net metering credits to 10 MW DC as host and 6.3 MW DC non-host and this combined will reduce our



cost of electrical energy by a cumulative amount of over \$850,000 annually when all ventures are completed (scheduled on FY 2015).

- With the assistance of CES, the university was able to reduce its cost of power and natural gas cost by nearly \$1.2 million annually from FY 10 to FY 12.
- Fuel switch to natural gas from electricity for heating makeup air to all hotel / residence floors at the UML Inn and Conference Center.
- Chiller replacements on three South Campus buildings from inefficient steam absorbers to highly efficient magnetic levitation electrical chillers resulting in significant GHG emission reductions.
- Annual campus-wide steam trap survey and replacement resulting in reductions of nearly 500 MTCO<sub>2</sub>E.
- Installation of high efficiency lighting and occupancy sensors in several buildings.
- South Campus Boiler efficiency improvements – fuel metering combustion controls for all three boilers.
- The expansion of Building Automation Software to Weed, Sheehy, Donahue, Concordia, Wannalancit; O’Leary; Olney; Durgin; Tsongas.
- Tsongas high efficiency Ice Making Chiller system.
- The university is reducing its dependency of gas engines in the departments of Environmental & Emergency Management, and Operations & Services. Environmental & Emergency Management Department has an all-electric car with Electrical Engineering Academic Dept. The Operations & Services Department maximizes a hybrid Vehicle for staff transportation.
- Huge improvements in **sustainable transportation** initiatives on campus via the “Smart Trips” programs:
  - Shuttle Bus and River Hawk Roadster Bus Program –transports students (free of charge) between all three campuses, off-campus residences, and satellite parking lots through its shuttle bus program. Parking Policies - Since 2009, UMass Lowell has been charging for parking. A recent program has been designed to encourage commuters to shift to carpooling or other modes of transit.
  - MassRIDES Commuter Travel - The University partners with MassRIDES to offer a benefit to those who carpool called NuRideUMass Lowell Freewheelers Bike Share Program -The UMass Lowell Bike Share is open to all students, faculty, and staff free of charge.
  - The University published Pedestrian and Cycling Maps that guide commuters and intercampus travelers along safe routes to and from their destinations at UMass Lowell
  - ZipCar Program - The option of a short-term car sharing/rental makes car-free living a more convenient and feasible option for anyone at the University.

#### 4. Behavior Change and Student and Community Engagement

The Climate Action Plan sub-committees “Student Life”, “Sustainability”, “Academics” and “Energy Projects” all work on behavior change and student/community engagement. The four

sub-committees work together to run programs that educate, increase awareness, and promote energy and carbon reduction practices.

Some of the campaigns and programs held include:

- Climate Change Teach-in in October
- Enhance Awareness sticker E&S campaign
- Partnership with MassPIRG
- Student Affairs Climate Action Team
- Personal Climate Challenge
- One Mug Program
- Transportation programs
- Earth Week (coordinated with City of Lowell) which included:
  - Residence Hall Electrical Challenge
  - Dumpster Sort; Bike to School/Work
  - Student produced climate films
  - CAP/Sustainability Workshop
  - Beat the Heat Road Race
  - Waste Recycling Day
  - Tree plantings

The CAP Academic sub-committee's Climate Change Initiative (CCI) is a strong contributor to the task of increasing understanding, awareness, and engagement.

- Climate Change Initiative (CCI)
  - The goal of the Climate Change Initiative (CCI) is to address climate change through education, research, and developing solutions to transition to a more sustainable and resilient society.
  - Brings faculty, students, and communities together to carry out the goal.
- Composed of academic programs at the undergrad and graduate levels including:
  - Research in diverse fields ranging from modeling climate change to ecological impacts, clean energy, sustainability, education, and others
  - Campus events on climate change.
  - Outreach to the broader community to increase public understanding
- CCI Teach-In: Invites prominent speakers to address UML Students, Faculty and Staff as well as regional high schools

### **5. Notable Waste Reduction/composting/recycling programs**

UMass Lowell was the first Commonwealth of Massachusetts higher education agency to implement a campus wide Zero Sort solid waste recycling program, in 2008. UMass Lowell's recycling programs have continued to achieve further positive growth.

- UMass Lowell's FY-12 total recycling rate is 51.37%
- Note: The total recycling rate takes into account for the first time the solid waste tonnage of 237 tons from UMass Lowell sublet contracted and managed ICC & Tsongas Center Buildings. By UML recognizing this new tonnage the recycling rate that would have



increased 3.4% from FY-11 to an FY-12 57.9% regards a net decrease of 3.13% to total annual recycling rate of 51.37%.

- UMass Lowell generated 46.5 tons of electronic/computers in FY-2012 compared to 30.1 tons during FY-2011.
- UMass Lowell recycled 9.5 tons of vegetable oil from our cafeterias that is blended into bio-diesel fuel.
- UML disposed 2,090.95 tons of solid waste and recyclable materials. Of this total, 1,074.00 tons of material was recycled as “Zero Sort “ (paper, cardboard, glass, plastic, metals) and other recyclables including scrap metal, C&D waste, computers and electronics, oil, soil, batteries, ballasts, light bulbs, silver, empty metal drums, and lab glass. The total percentage of recycled material is 1,074.00/2,090.95, or 51.37%.
- DEP compliant pilot food waste recycling project involving campus food service vendor and the waste /recycling contractor begins at Fox Hall in Fall '13.

## 6. Academic programming (courses, majors, certificates, masters programs, etc.)

UML currently offers over 70 climate-related courses that incorporate sustainability, environment, health, energy management, renewable energy, or climate change topics.

UMass Lowell offers 120 fully-accredited academic programs in six colleges.

### Degree programs:

- College of Engineering: M.S & Ph.D. Energy Engineering
- Graduate Certificate Energy Conversion
- Minor in Energy Engineering
- College of Sciences: B.S. & M.S. Environmental Science: Environmental Studies Concentration
- B.S. & M.S. Environmental Science, Atmospheric Science Concentration
- B.S. Biological Science: Ecology Concentration
- School of Health & Environment: B.S. & M.S. Work Environment Policy
- B.S. Environmental Health
- M.S. & Ph.D. Cleaner Production & Pollution Prevention
- College of Fine Arts, Humanities, & Social Sciences: Concentration in Environment and Society – B.A. program with a concentration in Environment and Society

### Courses

Many courses related to climate change and sustainability are currently available at UMass Lowell. (Please note that: New academic programs in climate change are also currently under development)

## 7. Clean Energy Research

- The Center for Electric Car and Energy Conversion (EC&EC)
  - The Center for Electric Car and Energy Conversion (EC&EC) in the James B. Francis College of Engineering includes professors and researchers from the departments of Electrical Engineering and Mechanical Engineering. The Center is





composed of five laboratories: Renewable Energy Lab, Electric Car Lab, Battery Evaluation Lab, Power Electronics Lab, and Advanced Composite Materials and Textile Research Lab.

- The UMass Lowell Center for Sustainable Energy
  - The UMass Lowell Center for Sustainable Energy develops systems to provide energy for various end uses in an environmentally and economically sustainable manner.
- Past and present projects have focused on the following:
  - Solar water supply and purification
  - Service-learning in engineering core courses
  - Solar/electric/fuel-cell vehicles
  - Photovoltaic-assisted lighting
  - Thermal efficiency test methods
  - Solar crop irrigation and dryers
  - Solar design tools based on stochastic models
  - Solar resource databases
  - Green buildings case studies
- Wind Energy Research Group (WERG)
- The recently formed Wind Energy Research Group (WERG) at UMass Lowell has unique expertise and capabilities to conduct research in the advancement of wind turbine science and systems. The group consists of thirteen interdisciplinary faculty members whose research focuses on wind turbine manufacturing, reliability, energy storage, and design.

## 8. Public Recognition of Efforts

### Awards

- Leading by Example Award for Higher Education FY 2012
- MassDOT Excellence in Commuter Options Award 2012
- Tree Campus USA – 2011, 2012, 2013
- Greenguard Certification
  - *First New England College to earn certification*

### Grants

- Non-Academic
  - DOER Grant from AARA Funds for solar arrays and EEMS

### Academic \*

- \$1.6 Million Grant to Study Methane's role in Climate Change
- \$434,000 on atmospheric composition of multiple planets
- \$2.2 Million Grant for Climate Education (CoolScience)
- \$830,000 for wetlands influence on mercury contamination in arctic
- \$3 Million for artificial photosynthesis research
- \$614,691 grant for climate education in an age of media

\*This is by no means a comprehensive list of academic grants



## Major acknowledgements

- Recognized by the “2012 AASHE Higher Education Sustainability Review” for UMass Lowell Increases Recycling Rate by Nearly 17%:
  - Campus recycling efforts increased by 16.7% over the previous year thanks to a campus-wide campaign to reduce greenhouse gas emissions.

## 9. Future planned projects

**Accelerated Energy Program – Comprehensive:** The University in collaboration with an established DCAM program has committed to participating on an Accelerated Energy Program that will provide for:

- Extensive energy conservation assessment audits for all campus buildings and infrastructures.
- Upgrade and improve all operating systems (HVAC, BAS, energy recovery, efficiency, fuel switches, plumbing, electric, etc.) for greenhouse gas reduction.
- Significantly increase energy and resource conservation programs on campus.

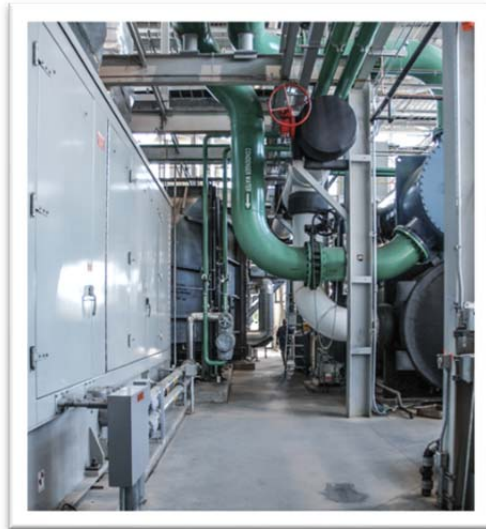
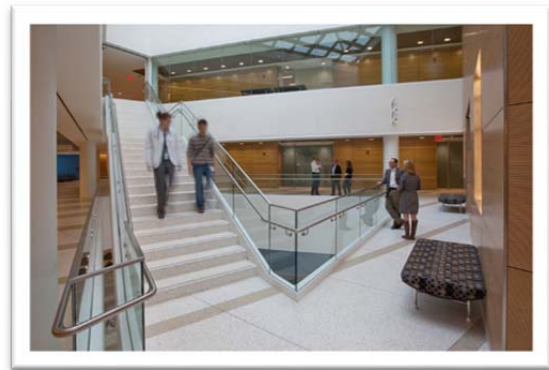
The University is assessing through consultant services for innovative technology projects, e.g., cogeneration and various renewable and alternative energies. Building Automation Software will continue to be utilized in more buildings and on more systems. The BAS has been extremely successful so far.

## 10. “Help Needed Section” - climate preparedness

- Establish a Climate Action Plan /Energy & Sustainability website
- Further integration of EEMS into both on campus operations and informational sessions of how to better integrate it in our day-to-day operations.
- Need to enlarge the Green Fund, a source of funding from a percentage from our energy savings to reinvest in new energy projects
- Further integration of BAS system to 100% of campus buildings
- Funding to continue updating MEP systems after DCAMM's AEP concludes
- Research Alternative Energy options: Biofuels, Cogeneration, Geothermal Heat, Hydro power
- Identifying larger scale energy projects
- Receive Assistance with project financing from as many sources as possible



## Medical School



**GROWING GREEN**  
Sustaining the UMass Academic Health Sciences Center



**1. UMass Climate Commitment – Reduced Carbon Emissions Notable Energy efficiency and renewable energy projects**

The University of Massachusetts Medical School (UMMS) prioritizes energy efficiency and sustainability in its mission to advance the health and well-being of people through pioneering education, research and health care delivery with its partner UMass Memorial Healthcare (UMMHC). This effort is broad-based, with participation from students, faculty and staff. UMMS continues to partner with UMMHC on campus, sharing its committees, coordinating events and education of its staff.

As a part of the UMMS strategy to reduce greenhouse gases, oil usage has reduced by 94% since 2007, replaced with cleaner natural gas for the power plant.

Through the President’s Office, UMMS is participating in three solar net metering contracts with the support of Competitive Energy Services.

**2. Green Building Certifications/Sustainable building practices**

***Ambulatory Care Center (ACC) achieves LEED Silver Certification***

The newly-completed Ambulatory Care Center (ACC) was the first UMMS building designed with sustainability in mind; the ACC includes a mix of clinical, educational and dry research departments.

***Albert Sherman Center achieves LEED Gold Certification***

In 2013, the Albert Sherman Center, an interdisciplinary, state-of-the-art research and education facility that will encourage interaction and collaboration among researchers and promote innovation and synergies across disciplines opened its doors. The Albert Sherman Center and supporting infrastructure will attract researchers, physicians, faculty, students and industry partners and enhance the UMMS position as a leader in medical research and education. A video on the energy efficient components of the Sherman Center is on the web here:

<http://www.youtube.com/watch?v=RuUSFN7YZMI&feature=edu&list=PLCAD76D0A7EF5BD4A>.

**3. Notable Energy efficiency and renewable energy projects**

UMMS has embraced energy efficiency on campus as a way to reduce greenhouse gas emissions and costs. Several key projects have been completed that will drastically improve the efficiency of the campus. These projects are listed below, along with estimated electricity savings. With these projects UMMS was able to partner with National Grid and leverage incentives to help offset the cost of investment.

Energy Projects	Electric Savings (kWh)	Metric tons of CO2	Leveraged Incentives	Simple Payback
<b>Combined Heat &amp; Power Plant Expansion</b>	58,123,243	40,079	\$5,625,000	2.4 years
<b>Electric Chiller</b>	3,002,858	2,071	\$750,000	3.1 years
<b>LED Parking Garage Lighting</b>	617,581	426	\$162,240	2.3 years

<b>Medical Equipment</b>	483,556	333	\$175,621	6.4 years
<b>Sherman Center</b>	4,127,556	2,912	\$1,590,547	1.2 years
<b>TOTAL</b>	<b>66,354,794 kWh</b>	<b>45,821 tons</b>	<b>\$8,303,408</b>	

### ***Combined Heat and Power Plant Expansion and Electric Chiller***

UMMS has shown its commitment to energy efficiency through the recent expansion of its combined heat and power central plant. The current plant, which serves the Worcester campus with steam, chilled water and electricity, was expanded to accommodate growth on campus, with the addition of a 7.5-megawatt, gas-fired combustion turbine. This system, including the chiller turbine, duct burner and Heat Recovery Steam Generator (HRSG) will increase the generating capacity of the power plant, in part to support the new 512,000 square foot Albert Sherman Center research and education facility which opened in 2013.

With the new cogeneration system in place, UMMS will increase its maximum electric output from 10 to 17.5 megawatts, allowing it to meet most of the electrical demand of the campus and provide all the steam and chilled water needed for heating and cooling. The new gas turbines replaces one of the plant's original gas and oil-fired steam boilers, which are now on reserve as an emergency back-up. Since natural gas burns cleaner than oil, and the new jet turbine is highly efficient, the expanded power plant will actually have lower green-house gas emissions, despite its added energy capacity. The Medical School will maintain a connection to the external utility grid to handle peak demand and for a backup resource.

In 2012, UMMS received recognition from the Northeast Energy Efficiency Partnerships and National Grid as a Massachusetts State Champion for energy efficiency for the power plant project and its Sustainability Initiatives. See this video for more on the project and the award <http://neep.org/neep-summit/summit-history/business-recognition-archive-2012/umms>

### ***Lighting***

- ***LED Lighting in Parking Garage:*** The lighting in the patient/visitor garage was upgraded in 2011/2012 to LED lighting, with an annual savings of 617,581 kWh per year. In the six months since the installation was complete, there has been a significantly reduced number of maintenance visits required and positive feedback on the quality of light in the naturally dark garage environment.
- ***Lighting upgrade and controls at the loading dock:*** The Medical School's loading dock lighting was updated in 2012 with new fixtures and a new schedule was implemented to reflect the operating hours of the dock. The lighting had previously been operating continuously, 7 days a week, 24 hours a day.
- ***Institutional Review Board (IRB) Offices LED lighting:*** In combination with new lighting controls, the LED fixtures installed in the research offices are expected to be 30 to 50 percent more energy efficient, and last up to seven years longer than the fluorescent lamps used elsewhere on campus. The LED fixtures are also dimmable, so each person can adjust the light in their office to their liking. This office renovation is expected to become a model for the Facilities Engineering and Construction group for future renovation projects.

### ***Medical Equipment***

In 2011, two medical vacuum systems and a medical compressed air system were installed in the hospital to replace an older system which used approximately 4 million gallons of water a year. The project will save 483,556 kWh per year, as well as water, and labor time.

### ***Training***

In 2012, three staff members within the UMMS Facilities department successfully completed the Building Operator Certification (BOC) training through the Massachusetts Facilities Managers Association. The training was comprised of eight different courses including, energy conservation techniques, O&M for Sustainable Buildings and others.

## **4. Behavior Change and Student and Community Engagement**

Growing Green continues to gain traction on campus since it was launched in 2009, to educate and motivate the campus to become part of the UMMS sustainability efforts. Growing Green includes a web site, signage, electronic newsletter, and various outreach campaigns.

Last year the [Growing Green web site](#) was revamped to include more information on the campus sustainability efforts and align with the look and feel of the newsletters. In addition, specific campaigns have been created for targeted messaging.

### ***Doing my Part for Growing Green Campaign***



### **[Take the Pledge Now!](#)**

The *Doing my Part for Growing Green* campaign launched in 2012 to encourage faculty, staff and students to recycle, turn off electronics and lights and other behaviors that have an impact on the campus energy usage and

waste reduction efforts. This multifaceted campaign included:

- **Doing my Part Pledge** which encourages staff to take five actions including recycling and taking part in energy reductions. Faculty, staff and students can take the pledge electronically through a web site and receive a printed pledge card (see below) to remind them in their workspace. To-date, nearly 400 have taken this pledge.
- **Video series** which features various staff discussing how they “do their part” here at UMMS and at home. The first video in the series is posted here: <http://www.youtube.com/watch?v=QI7wvzvdz5Y&feature=plcp>
- **Updated Growing Green signage** that references several of the actions in the Doing my Part pledge (see attached) has been posted in the main School Building.

### **I'm doing my part by...**

- Printing on both sides of paper
- Using my own mug, cup or water bottle at work
- Recycling paper, cardboard, containers and batteries
- Turning off lights when leaving a conference room or office
- Shutting off my computer, monitor and/or printer at end of the day



### *in the bin*

In 2013 with the launch of the new single stream recycling program, UMMS and UMMHC rebranded the effort to be called “in the bin”, with new signage, posters and stickers helping to educate the campus on the potential recyclable items.

### *Newsletter*

The Growing Green electronic newsletter continues to be the primary communication tool for sustainability and energy efficiency information for the campus, sent out to a distribution list of over 10,000 bimonthly. See the attached document for examples of the Growing Green newsletter. Articles from the newsletters are also available on the Growing Green web site here: [www.umassmed.edu/GrowingGreen](http://www.umassmed.edu/GrowingGreen). Growing Green also has launched a Facebook site in 2012, linked to here: <http://www.facebook.com/pages/UMass-Medical-School-Sustainability/155692801216385>.



### *Green Reps*

A new working group was formed in 2012 to further expand the reach of the Sustainability Committee. The goal is to have representatives from departments to communicate directly with their colleagues about various sustainability initiatives and events as well as to provide feedback to the Sustainability Committee. The new group continues to meet quarterly.

### *Commitment to Local Food Options*



UMMS has a commitment to bringing local food options to campus. A farmers market is held weekly from June through October on the campus green. In addition, UMMS is now a host site for the Massachusetts Local Foods Cooperative at UMMS ([www.masslocalfood.org](http://www.masslocalfood.org)). Both of these activities help to bring awareness to the value of food grown locally, including the reduced transportation emissions.

### *Earth Day Education Event*

More than 1,000 people from all corners of the University Campus and members of the public walked through the Earth Day event on April 24, 2012 where more than 40 local organizations and campus departments offered products, services and information to the community. Attendees had the opportunity to sign-up for carpooling with MassRIDES, learn about home energy audits and solar panels and view fuel efficient vehicles. A video of the 2012 Earth Day Event is online here: <http://www.youtube.com/watch?v=6bOcw5489xY>

### Links/videos:

- Sherman Center: <http://www.youtube.com/watch?v=RuUSFN7YZMI&feature=edu&list=PLCAD76D0A7EF5BD4A>.
- Doing My Part <http://www.youtube.com/watch?v=QI7wvzvdz5Y&feature=plcp> and <http://www.umassmed.edu/news/2012/community/doing-their-part-for-sustainability-part-ii.aspx>
- 2012 Earth Day <http://www.youtube.com/watch?v=6bOcw5489xY>
- Business Leaders State Champion: <http://www.youtube.com/watch?v=YfO5EyQOKN0>
- Growing Green newsletters: [www.umassmed.edu/GrowingGreen](http://www.umassmed.edu/GrowingGreen).
- Growing Green Facebook: <http://www.facebook.com/pages/UMass-Medical-School-Sustainability/155692801216385>.

### 5. Notable Waste Reduction/composting/recycling programs

**Resource Management Contract (2013)** UMass Medical School (UMMS) and UMass Memorial Healthcare (UMMHC) have partnered on a new Resource Management contract with E.L. Harvey of Westborough. This contract is a change from the previous contract for waste and recycling and encourages the vendor to partner with UMMS and UMMHC and increase recycling rates and reduce the amount of waste. In addition, in July 2014, the state will be enforcing a waste ban for food, which will impact UMMS and UMMHC at the larger cafeteria sites. The contract includes all of UMMHC hospitals, UMMS, Community Health Link, UMMHC affiliate hospitals and UMMHC Realty Group for a total of 65 locations in Massachusetts.

#### *Electronics Recycling*

UMMS has a comprehensive electronics recycling program through a partnership with Northeast Material Handling. Electronics, lab equipment, furniture, batteries and other items are now collected at the loading dock and picked up by Northeast Material Handling for recycling. In the last year, **26.57 tons** of electronics have been collected for recycling by Northeast from school operations.



**E-Recycling events** are now held twice a year at different locations for employees to recycle their personal items. Since these employee events began in 2010, the school has collected **48,450 pounds** of electronics from the staff.

**Construction Recycling:** throughout the construction of the Sherman Center, approximately 90% of the waste generated has been recycled.

#### *Dining Operations Waste Reductions*

In addition to recycling both in the kitchen, food waste from the Lazare Research Building Cafeteria operations is donated to a local farmer. Tyde Brook Farm (Holden, Massachusetts)





picks up the food waste each week and processes it for animal feed. Approximately 100 gallons of food waste is donated each week or approximately 10,000 gallons a year.

**SWAP Web site for Surplus:** at the Medical School there are a variety of items that become “surplus”, and are no longer needed. The Surplus with a Purpose (SWAP) internal web site offers a venue for the UMMS community to share furniture, office supplies and lab equipment and other various items to keep them out of the landfill while saving money.

## 6. Academic programming (courses, majors, certificates, masters programs, etc)

N/A

## 7. Clean Energy Research

N/A

## 8. Public Recognition of Efforts

### Awards

- Second Nature Climate Leadership Awards Finalist (2013)
- Northeast Energy Efficiency Partnerships State Champion for Energy Efficiency (2012)
- Leading By Example, MA DOER 2011, 2010

## 9. Future planned projects

### *Future Energy Projects*

**Laboratory Ventilation Optimization** in the Lazare Research Building. This large scale retro-commissioning project is underway and will be completed in FY 2014. The project includes:

- Testing and balancing of the building automation system
- Upgrading all fume hoods to high efficiency
- Installation of Aircurity in the laboratory spaces.

**Lab Ventilation Study at Biotech Park.** An energy study of the 5 Biotech buildings has started in the summer of 2013 and will help determine future energy efficiency opportunities. Also a lighting audit of the building is being completed.

## 10. “Help Needed Section” - climate preparedness

UMMS has several efforts to minimize disruption due to natural disasters including:

- Increased capacity of the Combined Heat and Power Plant with multi-fuel capability
- Backup generators on several buildings
- Within the last year, worked through a loss of water resulting from the City of Worcester water main failure with water supply trucks