University of Massachusetts Amherst
New Construction
Green Building Initiatives

The University is currently engaged in the construction of several new campus facilities with a total value of over $420M. When completed this construction program will add over 400,000 square feet of new academic space as well as 864 new beds in the Undergraduate Housing which opened in the Fall of 2006.

This new construction effort is different than previous campus development in that each project seeks to employ “green building” or high-performance design characteristics. Although the campus has not sought a LEED certification for any of these buildings, we have used the LEED rating system as the guiding principles for design decisions aimed at incorporating as many green building characteristics as possible.

LEED Certification has become synonymous with the term “Green Buildings”. However, there are different shades of green. We have chosen to target the items and resources on each site and within each building design. Not every site is ideal and not every design is best suited for the ultimate Green building. However, we are recognize what we can achieve and endeavor to incorporate the most beneficial green characteristics into each project within the parameters of the project budget and public process.

All of the new buildings include LEED Accredited Professionals and Commissioning agents in the design and construction process.

The following pages provide a summary of the “green building” or high-performance design characteristics employed in our new buildings.

Central Heating Plant

The University of Massachusetts CHP represents a model in economic, technical, architectural, operational, and environmental planning. The new $120M, 45,000 square foot Central Heating Plant will employ advanced energy generation and pollution control technologies. Replacing an older heating plant on campus, the new, combined heat and power plant will produce nearly twice as much energy, while emitting up to 7 times less green house gas emissions than the old plant. It is slated to be one of the cleanest burning facilities of its size and kind in the nation. The CHP will provide all of the steam and nearly all of the electric power required for a campus of 26,000 students, 250 buildings with 10 million square feet of heated space. The CHP will be operational March 2008.

The CHP will achieve optimum, efficiency with a combination of advanced technologies:

1. A 10 megawatt, jet engine derivative, combustion turbine generator.

2. A heat recovery steam generator that turns the 900-degree exhaust heat from the combustion turbine into 125,000 pounds of steam per hour.

3. Three auxiliary boilers each rated for 125,000 pounds of steam per hour, to augment CHP district steam capacity.

4. Both high and low pressure steam turbines using the steam produced for district heating to co-produce an additional 6.5 megawatts of electric power (combined cycle technology),

There are many distinct, green design features incorporated into the Central Heating Plant, in how the architectural elements work in concert with the siting of facility to conserve energy, in the selection of openings and use of glass and glazing, and in design of the power process systems to extract over 90% of the potential energy from each pound of fuel consumed (compared to an efficiency of around 35% achieved by large, electric utility power plants).

Green Characteristics:

1. A large eave overhangs all sides of the building, this “big roof” concept helps in terms of shading and reduction of summer heat load.

2. The building design reduces openings on the north side as a way to mitigate heat loss.

3. An expansive, south facing glass curtain wall incorporates as much natural day lighting as possible deep into the building to mitigate the requirement for artificial lighting. The curtain wall includes fritted glass to increase light while reducing heat gain.

4. A clear story runs the full length of the east and west sides to provide natural day lighting. Openings in the roof overhang allow for light to penetrate through the clear story deep into the building.

5. The heat recovery boilers and large, auxiliary boilers are equipped with both *selective catalytic reduction* and *oxidation catalyst* technologies that reduce the emissions of green house gases, specifically nitrous oxide and carbon monoxide.

6. The efficient fuel cycles and combustion of low sulfur transportation grade fuel oil and natural gas will significantly lower the emissions of green house gases when compared to the existing UMass heating plant.

7. An effluent treatment facility that recycles up to 200,000 gallons of municipal wastewater effluent from the Amherst Wastewater Treatment Plant to meet daily boiler makeup water demand, eliminating the need to use the town’s public drinking water supply for steam generation. This will also save the campus approximately $250,000/year in operating costs.

Integrated Sciences Building

The new $102M Integrated Science Building will provide new office and laboratory space for teaching and research. The building will provide over 175,000 gross square feet of new space, which consists of:

- All undergraduate Chemistry teaching labs (introductory, organic, physical, and analytical)
- Upper-division Life Sciences labs (molecular biology, cell biology, genetics, physiology)
- Research lab space for eight to ten principal investigators
- Laboratory support facilities
- An integrated Chemistry/Life Science computer resource center
- A teaching development lab, a 300-seat auditorium equipped with scientific demonstration facilities and active-learning technology, an 85-seat classroom, upper-division discussion/computer rooms, distance learning capability, and faculty and staff office space.

Green Characteristics:

1. Terra cotta bagettes are to be installed on the south façade of the atrium. The bagettes are sized and spaced vertically to allow for sun penetration (solar heating) into the atrium during the winter and for sun shading (solar protection) in the summer.

2. Operable windows are to be installed on the south façade of the atrium. When outside air temperature is 65-75F, the atrium windows begin to automatically open and the dampers on the smoke exhaust fans open for “natural” circulation. When the space temperature sensor in the atrium registers more than 90F a sequence of additional opening or windows & dampers starts and the smoke exhaust fans start operation to bring the temperature back down (75F target – obviously dependent on outside air temperature).

3. Rain water from roof area and from the underground foundation drainage system will be piped to an underground 20,000 gallon storage tank. The roof water is being collected to reduce the amount of storm water discharged to the campus storm sewer system. The collected water will be pumped to the chiller plant cooling towers located on the east side of Thatcher Way and will be used to supplement the make-up water that is lost to evaporation.

4. Effluent water, from the Town of Amherst water treatment plant, will be pumped to the cooling towers located on the east side of Thatcher Way. This effluent water will be used to supplement the make-up water that is lost to evaporation. The priority of make-up water for the cooling towers is:
    a) Water from storage tank
    b) Effluent from the Town campus system
    c) Amherst water system

5. During the winter heating season excess return air from the classroom wing will be ducted to provide heated air in the mechanical penthouse and to preheat the incoming air serving the lab areas

6. An enthalpy heat recovery wheel will be installed in each of the (4) air handling units serving the lab areas. The enthalpy wheel will remove latent heat in the summer and add moisture and sensible heat to the supply air during the winter. Heat wheel recovers 50% more heat and moisture that the previously proposed glycol loop

7. Use of an “intensive roof garden” over the chiller plant and an “extensive roof garden” over the loading dock. The intensive roof garden will consist of soil depths greater than 6” and less that 42” with a variety of plants including small trees and shrubs. The extensive roof garden will consist of soil depths no greater than 6” with plant materials restricted to withstand harsh growing conditions.

8. Use of (2) high efficiency water cooled electric centrifugal chillers and (1) steam absorption chiller in the regional chiller plant. The installation of both electric and steam chillers will help the University to “balance” steam and electric consumption and maximize the operating efficiency of the next Central Heating Plan. The electric chillers will utilize VFD controls to operate more efficiently at partial loads.

9. Use of variable frequency drives (VFD’s) on the cooling tower fan motors and oversize the cooling towers to provide more surface area and thereby require less airflow and fan energy to maintain the condenser water set point.

10. Use of plate and frame heat exchanger to provide chilled water for winter cooling loads without operating the electric centrifugal chillers.

11. Use of hot water radiant perimeter ceiling panels in labs and offices to provide perimeter heating while maintaining minimal airflow in unoccupied areas.

12. Use of low flow fume hoods in the teaching labs, 60 CFM instead of the standard 100 CFM fume hoods, to reduce heating, cooling and fan energy consumption. 100 CFM fume hoods will be used at dispensing and waste hoods and on the research floor. The savings in fan size for the building is approx. 30,000 CFM

13. To reduce air flow and energy consumption lower the fume hoods fan speed at night and during the summer while still maintaining negative pressure in the hood and lab areas

14. To reduce air flow and energy consumption in the laboratories during unoccupied periods (6 PM to 7 AM) reduce ventilation to 4 air changes per hour.

15. Use of CO2 sensors to modulate outdoor air dampers and control the amount of outdoor ventilation air being supplied to the 300-seat auditorium and 85 seat classrooms.

16. Use of thermally broken, low emissivity, insulating glass in the curtain wall and window units to reduce both heating and cooling energy losses.

17. To reduce the lighting watts for the same perceived light output, install in the office and lab areas, pendent mounted direct/indirect lighting fixtures in lieu of standard recessed parabolic fixtures.

18. Reduction in lighting energy consumption, install in the laboratory areas, offices, and other spaces, motion detectors sensors that will turn on and off the lighting fixtures.

19. Reduction in lighting energy consumption, install in corridors, atrium and other circulation areas computer controlled lighting that will turn on and off the lights at preset time intervals.

20. Provide bicycle racks and changing shower facilities within the building

21. Use of rubber flooring in the lab areas and use partially recycled content vinyl and ceramic floor tiles in the circulation areas of the building

22. Utilize bamboo (sustainable) wood on the lab casework, wood doors and wood trim.

23. Recycled 100% of the steel and concrete resulting from the demolition of Marshall Annex

24. Commission the following systems and equipment: mechanical, lab hoods and equipment, plumbing, electrical, life safety and building management

Studio Arts Building

The new $25M Studio Arts Building will provide 50,000 gross square feet of instructional studios as well as individual faculty and student studios. The instructional studios will accommodate several studio art functions including printmaking, sculpture, painting and ceramics.

Green Characteristics:

1. Reused existing pavers in front of Hills, requiring some extra work to remove the pavers by hand, clean each brick and stack themon pallets so they could be reused. The contractor pointed out that for the dollar cost of the pavers, it would be less expensive to throw out the old pavers into a landfill and purchase new ones. Reuse of the pavers both reduced the amount of material that would need to be trucked to a landfill site, and reduces the amount of raw materials required to produce additional bricks and transport them to the site.

2. Because the design of the building will not allow the collection or storage of the same quantities of hazardous and toxic materials as is currently on hand in the Art Department's various studios, the users of the building will utilize the EH&S

Reuse and Exchange program to recycle and reuse various chemicals, and keep them in very small quantities in the building. This is a substantial enhancement to the greenness of the Art Program, affecting many disciplines, especially Printmaking and Photography. It also reduces the cost of operation, as EH&S provides the chemicals for free to participating Umass units.

3. The landscaping of the project will feature low-maintenance, drought-resistant plant materials.

4. Storm water that is collected on the site from hard surfaces such as pavement and roofs will be detained in an underground 3,000 gal. tank to regulate the flow of storm water into the campus drain system, reducing the chance of overflow at the Pond. This will in turn help to mitigate the need for ever-larger storm water collection systems and waste water treatment facilities.

5. The building's mechanical and electrical systems will be constantly monitored and managed by the campus Energy Management System, providing real time information that will include alarms when systems are not functioning properly and when energy is being used unnecessarily.

6. The building will also employ occupancy and CO2 sensors to regulate the amount of ventilation air sent to specific spaces, and to automatically turn off lights when rooms are unoccupied.

7. Toilet room fixtures will feature hands-free faucets and flush valves, and utilize low gallon per flush toilets and urinals.

8. During construction, the Contractors are employing techniques to reduce the amount of dust and fumes emitted both inside the building and outside.

9. The contractors are also employing methods to reduce the amount of waste materials that are generated on the site, and collect recyclable materials to reduce the amount of debris sent to landfills.

10. Almost every room is equipped with an exterior window to allow daylighting when practical.

11. South-facing windows are equipped with louvered sunshading devices that allow winter sun energy to be brought into the building, but shade the building from summer heat.

12. Operable (opening) windows are provided throughout the building to allow natural ventilation to be used when weather permits, and to offer an alternate way to evacuate fumes.

13. The building houses many functions that produce various fumes dusts and waste heat during programmed activities. The building is equipped with special exhaust and 100% Outside Air ventilation systems to protect the occupants from exposure to these byproducts of the work. Typically, these types of systems waste a tremendous amount of energy, so to combat those losses, the exhaust air is sent through an Energy Recovery Unit (ERU) to recapture the energy that

would normally be lost in the ventilation process.

14. The use of walk-off mats at building entrances will reduce the amount of dirt, dust and pollens brought into the building.

15. Except for the building entrances, the building has hard polished concrete floors which will not collect dust, dirt and pollen, is easy to maintain with no use of solvent-based cleaning solutions, and does not emit any harmful gasses.

16. Concrete used in the building uses fly ash, a recycled byproduct of coal and oil combustion in place of some Portland cement. The use of fly ash improves concrete workability, and reduces the amount of water required in the concrete mix.

School of Nursing - Skinner Renovation

The $18.8 renovation for the School of Nursing includes a total renovation of the existing 38,000 square foot building and a new 12,000 square foot addition. This project will provide 50,000 gross square feet of modern office, classrooms and laboratories for Nursing instruction.

Green Characteristics:

1. Re-use of a previously developed site.

2. Community Connectivity – Site lies within ½ mile of a residential zone of average density of 10 units per acre and within ½ mile of 10 basic services. Pedestrian access is provided.

3. Public transportation access.

4. Open space exceeds building footprint.

5. Reduced impervious cover on the site.

6. In conjunction with adjacent Integrated Science Building, no increase in storm water run-off.

7. Building re-use – Maintained more than 95% of existing building structure, exterior walls and roof.

8. Asbestos removal.

9. Non-Roof heat island effect is minimized with the use of shade trees on 50% of the site, and the use of concrete pavement with a high Solar Reflectance Index.

10. Heat island effect-roof: Low-slope roofs – white membrane; Steep-sloped roofs – Solar Reflectance Index of 29.

11. VAV air handlers with full air-side economizer.

12. Variable speed drives for AHU fans and heating pumps.

13. Perimeter fin-tube heat that allows the central air systems to be turned off when building is unoccupied overnight.

14. Low-velocity duct system to reduce central fan horsepower.

15. CO2 sensors in assembly rooms to minimize unnecessary use of outside air for ventilation.

16. Lighting controls, including occupancy sensors in private offices and dual-level switching in classrooms.

17. Low-water-use plumbing fixtures.

18. Carpeting has IAQ (Indoor Air Quality) Green label.

19. Construction waste management reduction plan.

20. Environmental tobacco smoke control.

21. Low-emitting composite wood products, no urea formaldehyde content.

22. Low VOC-emitting sealants and adhesives.

23. Low VOC-emitting paints and coatings.

24. Storage and collection of recyclables.

25. Indoor chemical and pollutant source control.

26. Entryway foot cleaning systems (floor grates).

27. Daylight and views in 90% of regularly occupied areas of the building.

28. LEED accredited professionals on project team

Undergraduate Housing

The new Undergraduate Housing opened in the Fall of 2006 and provides an additional 864 student beds in four new structures totaling 325,000 square feet. The new student housing provides apartment style living quarters that includes 4 single occupancy bedrooms, two baths, a kitchen and living room in each apartment unit.

Green Charcteristics:

1. Building Envelope designed to provide a very tight envelope, with insulation on the exterior of the wall and a highly reduced thermal transmittance on the exterior walls. Also, the glazing was all low E, with high SHGC for clear glazing.
2. A large portion of the steel framing was recycled material.
3. Low emitting materials utilized on project to greatly reduce volatile organic compounds (VOCs) within the building. These included low VOC paints and water-based stains, low emitting carpets with backing that prevents mold and mildew growth.
4. Building design includes trash separation and recycling stations throughout the complex.
5. Bike racks provided throughout complex to encourage use in lieu of automobile travel.
6. Complex energy usage will be 20% to 25% less than a code minimum designed building. This is due to the above very tight envelope, high efficiency lighting and high efficient motors and mechanical equipment and design.
7. Air conditioning chiller system uses CFC free refrigerant for less ozone depletion of the earth's atmosphere.
8. High energy recovery wheels (30% more efficient than code) used on the 100% outside air ventilation systems for the apartments.
9. ariable speed drives for variable flow pumping provides only the amount of heating or cooling water to provide thermal comfort for the complex.
10. Ventilation air treated and dehumidified independent of other HVAC systems. This eliminates overcooling and reheat required on the main HVAC systems.
11. All HVAC equipment located within mechanical penthouses with ample room of proper maintenance. This greatly increases the equipments average service life.
12. Each apartment has two zones of temperature control of its space. One zone in the living room areas and one zone for the bedrooms. This minimizes overheating or overcooling of dissimilar spaces.
13. Building Automation System lets occupants know when it is advantageous to ventilate their apartments with natural ventilation via opening windows. This is accomplished via indicator lights at the lobby entrance vestibules of the buildings.

Recreation Center

The new $50M Recreation Center's provides 120,000 gross square feet of square feet of recreation space including weight and fitness, three court gym, multipurpose rooms, a juice bar and lounge, locker room facilities and administrative offices.

Green Characteristics:

1. Use of light colored roof membrane to reduce the heat load.

2. Use of sensor activated sinks, toilets, and urinals to conserve water.

3. Use of energy efficient lighting including motion/occupancy sensors to save electricity.

4. We are providing an energy management system that can program and ramp down the mechanical units during low occupancy periods and achieve minimum ventilation values.

5. Use of solar shading devices on the exterior of the building to reduce summer solar heat gain.

6. Use of fritted glazing to reduce the southern solar exposure thru the glass.

7. We are not utilizing any CFC-based refrigerants in the HVAC&R systems that may contribute to ozone depletion.

8. The facility will be supplied steam generated from the new high efficiency cogeneration Central Heating Plant.

9. We are incorporating a waste management plan to recycle and/or salvage 50% of non-hazardous construction and demolition components.

10. We are attempting to achieve the goal of extracting 10% of the processed materials for the project form regional sources within 500 miles.

11. We are implementing an Indoor Air Quality Management Plan in the pre-occupancy and construction phase to protect stored and absorptive materials.

12. We are only using adhesives and sealants on the interior of the building that comply with Green Seal Standard for VOC's.

13. Our carpeting and rug backing will comply with the VOC limit of 50g/L set by the Green Label Plus Program.

14. Recycling programs of product material and packaging during the construction is planned.