# 2011 UMass Wood Structures Symposium

# Green Building Certification Systems/ Energy Standards in US

Ludmilla Pavlova, AIA, LEED A.P. BD+C

Senior Facilities Planner

Campus Planning

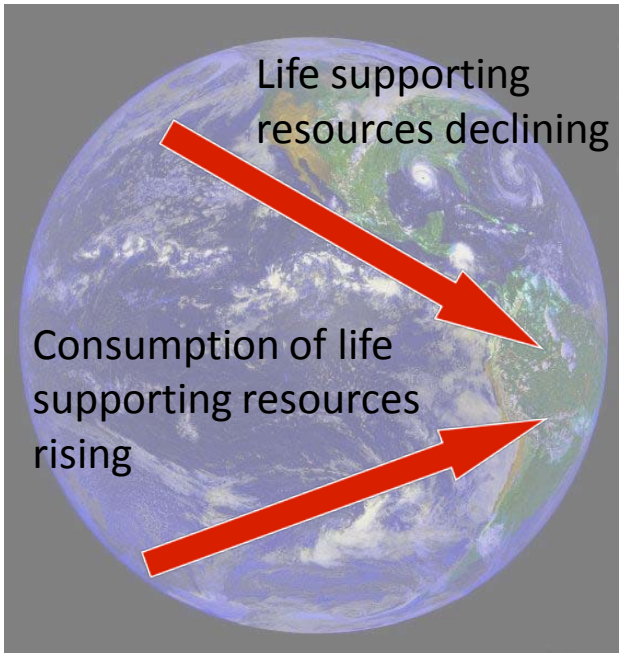
www.umass.edu/cp

# Outline

- Green Building in Context
- Overview of Building and Energy Codes
- Overview of Standards and Rating Systems
- USGBC LEED Rating Systems
- LEED for Homes
- UMass Sustainability Initiative

# Global Climate Change

Human activity is destroying life sustaining resources




**Earth Impacts**

Climate disturbance

Species extinction

Mineral and resource depletion

Ozone depletion

Air pollution

Water pollution

Scarcity and unreliability of rain fall

Depletion of soil quality

| Multifaceted Problem | | Multifaceted, Systemic Change |
|---|---|---|
| Knowledge and Attention | = | Advocacy |
| Technology and Design | = | Expertise in green building, energy, transportation, etc. |
| Time and Money | = | Business Development, Finance and Accounting |
| Skills and Capacities | = | Education and Training |
| Politics and Power | = | Leadership and Organizational Culture |
| Organizational Limitations | = | Social Marketing Techniques |
| Failure to Understand Systemic Reality | = | Systems Thinking |

Based on chart by Leith Sharp

# The Solution Must Be System Based

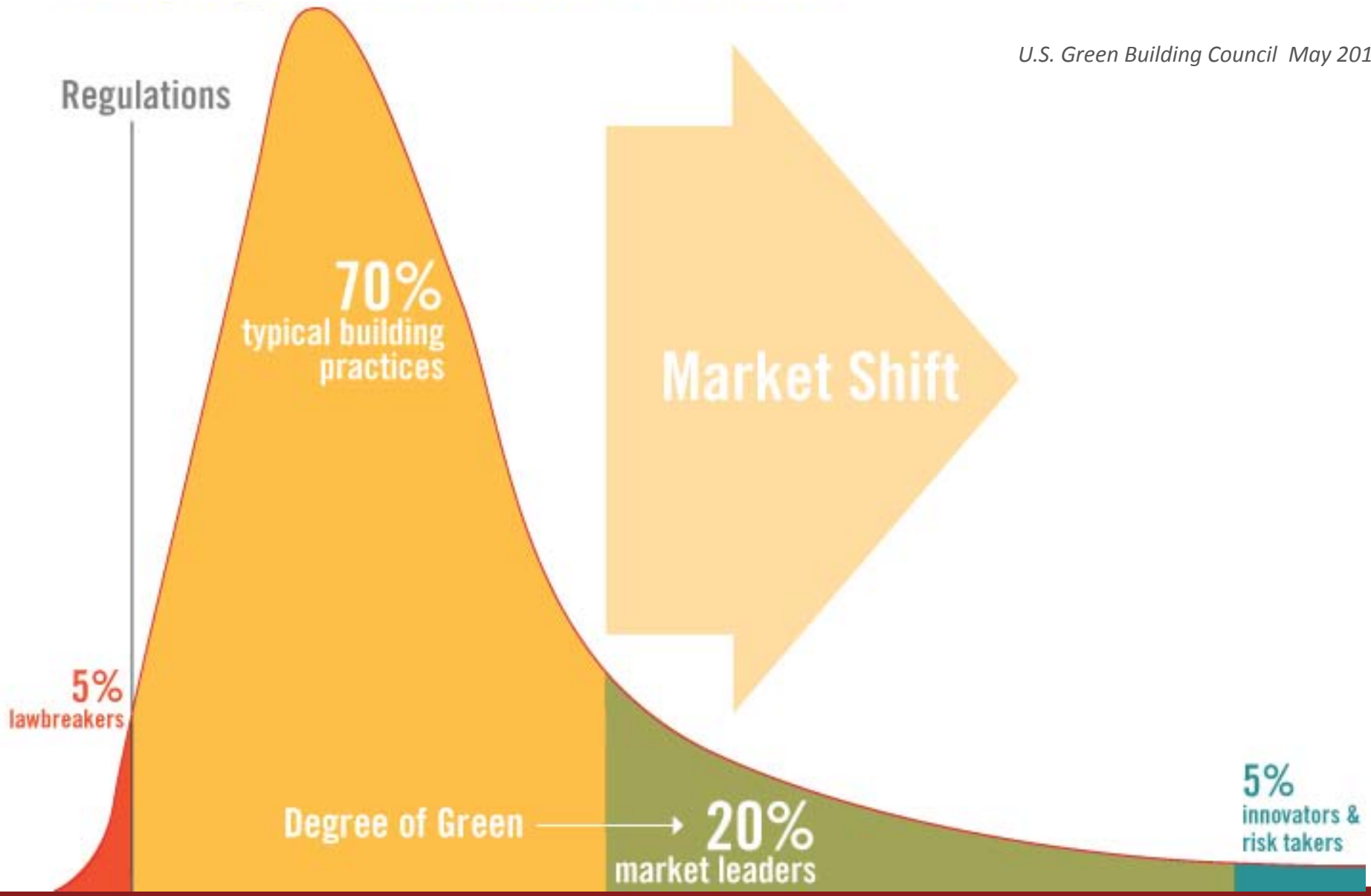
| Institutional Drivers | Institutional Systems | | Global Environmental Systems | Global Environmental Systems |
|---|---|---|---|---|

| Institutional Drivers | Institutional Systems | Create Relationship between Earth + Institution | Earth Systems | Earth Impacts |
|---|---|---|---|---|
| Mission | Material supply and disposal | Make hidden upstream & downstream environmental impacts known | **Ecosystems** | Species extinction, increase in infectious vectors |
| **Leadership** | Food supply | Develop learning organization capacities | **Climate systems** | Climate disturbance |
| Organizational Culture | **Energy supply and distribution** | Mission alignment between teaching, research & operations | **Oceanic systems** | Ozone depletion, air pollution |
| Finance/ Accounting Structures | Building Design and Construction, Mechanical systems, Occupancy | Align Finance & accounting systems to support long term health | **Geological systems** | Rising sea levels, deep ocean current changes, fisheries depletion |
| Decision Making Processes | Water supply | | **Water systems** | Desertification, land pollution |
| Human Resources | Transportation | REDUCE CONSUMPTION | **Nutrient systems** | Mineral and resource pollution |
| Building O & M | Non-vehicular circulation | SHIFT TO RENEWABLE energy and materials | | Water pollution, scarcity of rain fall |
| **Academic Planning** | Landscaping | ENHANCE ECOSYSTEM HEALTH in campus design | | Soil quality depletion |
| **Campus Planning** | | CLOSED LOOP SYSTEMS | | build up of toxins |

Based on work by Leith Sharp

# Green Building Progress Toward Sustainability

*U.S. Green Building Council May 2011*



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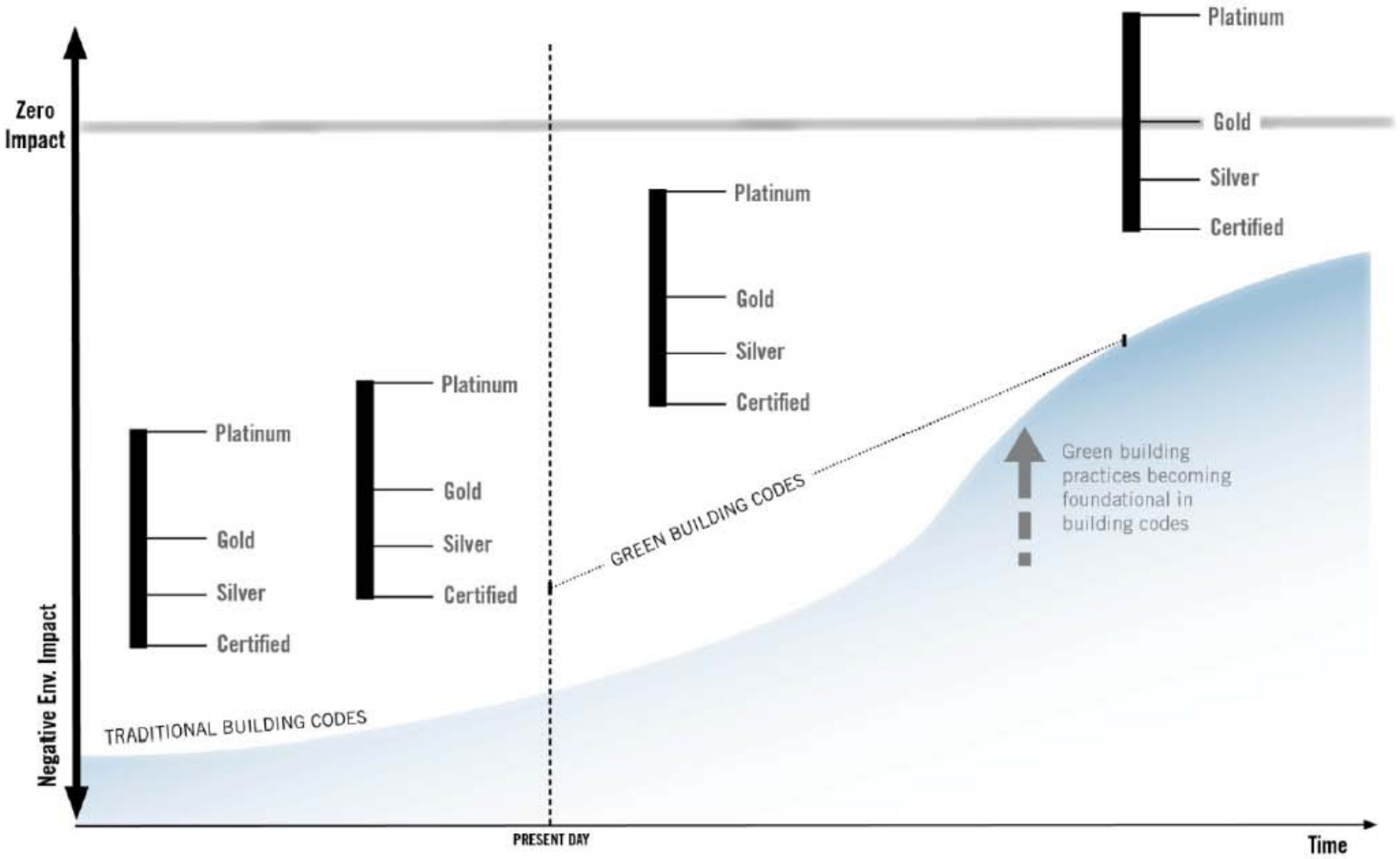


*U.S. Green Building Council May 2011*

# Traditional Building Codes

- Systematic statement of a body of rules that govern and constrain the minimum level of design, construction alteration & repair of buildings
- Based on requirements for safety, health, environment & quality of life of building users & community
- Model codes are developed by states, professional societies & trade associations
- State or municipal authorities adopt codes as law
- Examples: International Construction Code, Building Officials & Code Administrators Code (BOCA), National Building Code, Uniform Building Code, etc.

# International Code Council

- 50 states & DC have adopted a number of I-codes

- International Building Code
- International Energy Conservation Code
- International Existing Building Code
- International Fire Code
- International Fuel Gas Code
- International Mechanical Code
- ICC Performance Code
- International Plumbing Code
- International Private Sewage Disposal Code
- International Property Maintenance Code
- International Residential Code
- International Wildland Urban Interface Code
- International Zoning Code

# Green Building Codes

- International Code Council – International Green Construction Code (in final review, out in late 2011)
- 2010 California **Green Building** Standards (CALGreen) **Code** , mandatory provisions effective January 1, 2011.

# Energy Codes

- ICC– International Energy Conservation Code 2009 – model code; makes allowances for different climate zones
- CA Title 24 1978 – Energy Efficiency Standards for residential and non-residential buildings; updated periodically (CALGreen)

# Green Building Standards

- ANSI/ASHRAE 189.1-2009 Standard for the Design of High-Performance Green Buildings (ANSI Approved; USGBC and IES Co-sponsored)
- International Living Institute/ Cascadia Green Building Council: Living Building Challenge

ASTM INTERNATIONAL
Standards Worldwide

ASHRAE
Advancing HVAC&R to serve humanity and promote a sustainable world

LIVING BUILDING CHALLENGE™ 2.0

U.S. GREEN BUILDING COUNCIL USGBC

IES Illuminating ENGINEERING SOCIETY

# Energy Standards

- ANSI/ASHRAE/IESNA Standard 90.1 – 2007 Energy Standard for Buildings Low-Rise Residential, and Informative Appendix G, Performance Rating Method (performance)
- ASHRAE Advanced Energy Design Guide for Small Office Buildings (2006), Retail Buildings (2006), Small Warehouses & Self Storage Buildings (2008), K-12 School Buildings (prescriptive)
- New Buildings Institute – Advanced Buildings™ Core Performance Guide (prescriptive)

# Green Building Rating Systems

- USGBC Leadership in Energy & Environmental Design LEED™
- Green Point Rating System (for new & existing homes; CA Title 24, 2005 +15%)
- National Association of Home Builders: NAHB Green Guidelines
- Green Globes (Green Building Initiative in collaboration with NAHB)
- Collaborative for High Performance Schools (CHPS)


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Federal, Local, and State Governments
Building Owners
Non Profit Leaders
Planners
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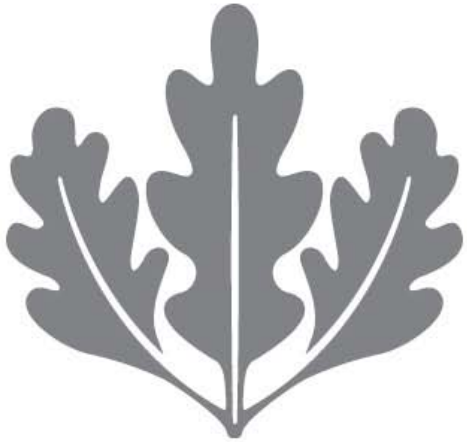


## MISSION

Buildings and communities will regenerate and sustain the health and vitality of all life within a generation.

## VISION

To transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy and prosperous environment that improves the quality of life.

# USGBC LEED™ Rating Systems

- New Construction (NC)
- Existing Buildings: Operations & Maintenance (EB: O&M)
- Commercial Interiors (CI)
- Core & Shell (CS)
- Schools (SCH)
- Retail
- Healthcare (HC)
- Homes & Multi-family Midrise
- Neighborhood Development (ND)


# LEED for Homes

# LEED for Homes Alliances

## National Programs




ENVIRONMENTS FOR Living

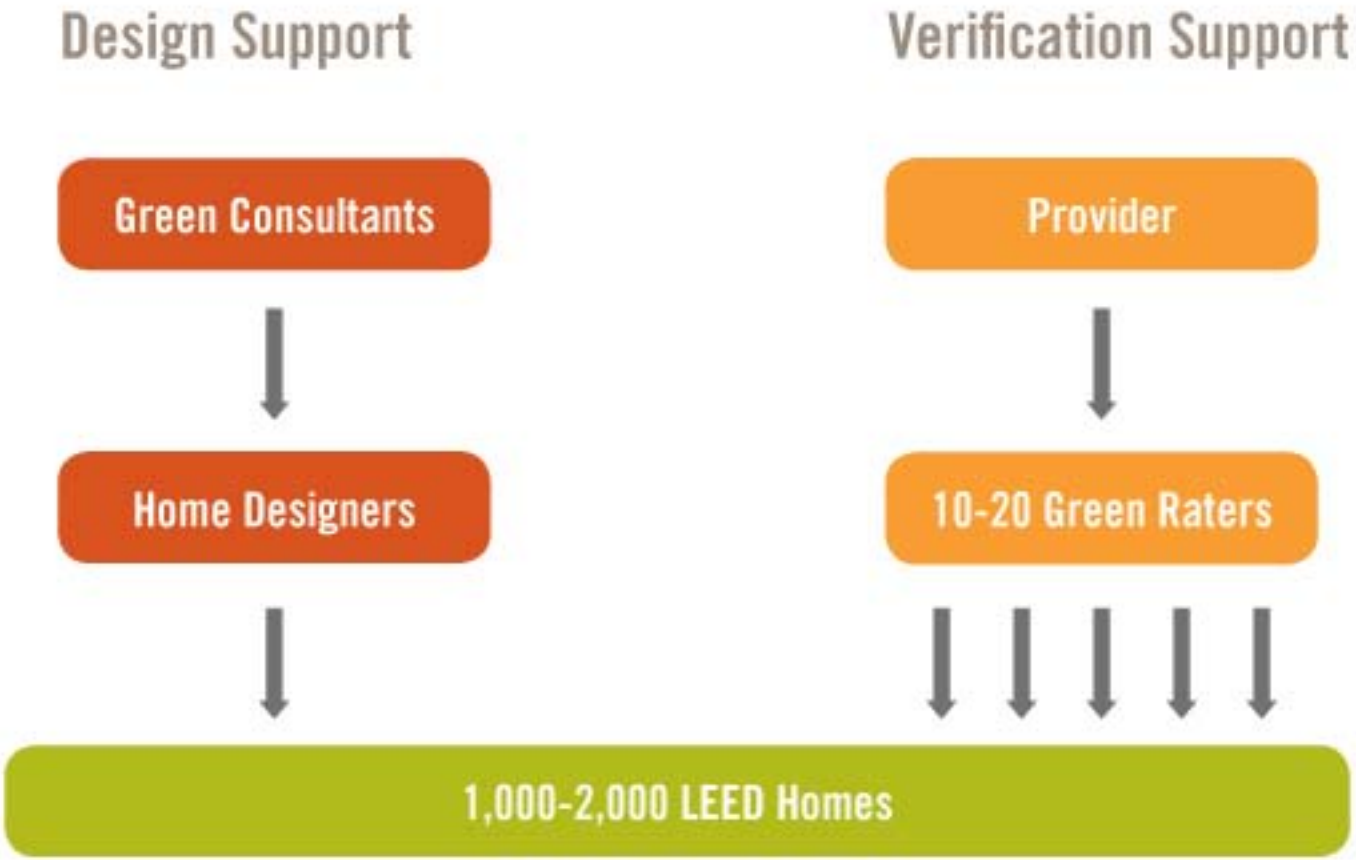
## Local and Regional Programs








# Local Delivery System



# The Rating System: Simple & Streamlined

**3** documents

**136** points

**45**-point entry

# Applicable Building Types

# UMass Amherst Sustainability Initiative

- 2007: ACUPCC Signatory
- 2008: Environmental Performance Advisory Committee (EPAC)
- 2009: First Sustainability Coordinator Hired
- 2010: Completed Climate Action Plan
- AASHE STARS Gold
- www.umass.edu/green

# Student Involvement is Key

- Student representatives on every subcommittee
  - Interns
  - Students-at-large
- Providing energy and institutional support
- Community Education
  - Eco-Rep Program

# EPAC Green Building Committee: Why Do it?

LEADING BY EXAMPLE

In April of 2007, Governor Deval Patrick signed **Executive Order 484** which mandates all new government buildings earn LEED certification and implement other sustainable design practices.

In November of 2007, President Jack Wilson signed the **Presidents' Climate Commitment** which includes the expectation that all new building projects achieve LEED Silver Certification or better.

The **UMA Campus Climate Action Plan** of 2010 aligns campus goals with those of the Commonwealth.

GOING BEYOND

LEED is one tool in the quest for a more sustainable built environment. The GBC is using LEED to help steer sustainable design and building on campus. However, the GBC is aware that LEED is a limited approach to sustainable building. For this reason, we continue to look beyond LEED, towards more integrative and holistic environmental design.

# UMass Green Building Guidelines


- http://www.umass.edu/fp/projectmanagement/designguidelines/
- http://www.umass.edu/fp/projectmanagement/sustainabledesign/

## LEED CATEGORIES


SUSTAINABLE SITES


WATER EFFICIENCY


ENERGY + ATMOSPHERE


MATERIALS + RESOURCES


INDOOR ENVIRONMENTAL QUALITY


REGIONAL PRIORITY


INNOVATION IN DESIGN

## PRIORITY LEVELS

**HIGH** = CREDIT STRATEGY SHOULD INFLUENCE DESIGN.

**MEDIUM** = CREDIT SHOULD BE PURSUED WHEN IT IS PRACTICAL FOR THE PROGRAM.

**LOW** = CREDIT IS ACHIEVED IF POSSIBLE.

## FEASIBILITY LEVELS

**EASY** = CURRENT POLICY/EXISTING INFRASTRUCTURE MAKES CREDIT COMPLIANCE AUTOMATIC.

**MODERATE** = MINOR ADJUSTMENTS TO THE STATUS QUO.

**DIFFICULT** = REQUIRES A SPECIFIC APPROACH DURING DESIGN/CONSTRUCTION AND/OR SIGNIFICANT CHANGES TO THE CURRENT CAMPUS STRUCTURE.

# Priority | Feasibility Checklist

UNIVERSITY OF MASSACHUSETTS AMHERST
GREEN BUILDING GUIDELINES
LEED-NC v3 2009
DECEMBER, 2010

| Priority | | | Feasability | | | | |
|---|---|---|---|---|---|---|---|
| Low | Med | Hi | Easy | Mod | Diff | | |
| **Category: Sustainable Sites** | | | | | | | **Points: 26** |
| Required | | | Required | | | Prereq 1 | Construction Activity Pollution Prevention | |
| 1 | | | | 1 | | Credit 1 | Site Selection | 1 |
| | | 5 | 5 | | | Credit 2 | Development Density + Community Connectivity | 5 |
| | 1 | | | 1 | | Credit 3 | Brownfield Redevelopment | 1 |
| | | 6 | 6 | | | Credit 4.1 | Alternative Transportation—Public Transportation Access | 6 |
| | | 1 | | 1 | | Credit 4.2 | Alternative Transportation—Bicycle Storage and Changing Rooms | 1 |
| | 3 | | 3 | | | Credit 4.3 | Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles | 3 |
| | | 2 | | 2 | | Credit 4.4 | Alternative Transportation—Parking Capacity | 2 |
| 1 | | | | | 1 | Credit 5.1 | Site Development—Protect or Restore Habitat | 1 |
| | | 1 | 1 | | | Credit 5.2 | Site Development—Maximize Open Space | 1 |
| | | 1 | | 1 | | Credit 6.1 | Stormwater Design—Quantity Control | 1 |
| | | 1 | | 1 | | Credit 6.2 | Stormwater Design—Quality Control | 1 |
| | 1 | | 1 | | | Credit 7.1 | Heat Island Effect—Non-roof | 1 |
| 1 | | | | 1 | | Credit 7.2 | Heat Island Effect—Roof | 1 |
| 1 | | | | | 1 | Credit 8 | Light Pollution Reduction | 1 |
| **Category: Water Efficiency** | | | | | | | **Points: 10** |
| Required | | | Required | | | Prereq 1 | Water use Reduction-20% | |
| | | 4 | 4 | | | Credit 1 | Water Efficient Landscaping | 2 to 4 |
| | 2 | | | | 2 | Credit 2 | Innovative Wastewater Technologies | 2 |
| 2 | | 2 | | | 4 | Credit 3 | Water Use Reduction | 2 to 4 |
| **Category: Energy and Atmosphere** | | | | | | | **Points: 35** |
| Required | | | Required | | | Prereq 1 | Fundamental Commisioning of Building Energy Systems | |
| Required | | | Required | | | Prereq 2 | Minimum Energy Performance | |
| Required | | | Required | | | Prereq 3 | Fundamental Refrigerant Management | |
| 4 | 10 | 5 | 5 | 10 | 4 | Credit 1 | Optimize Energy Performance | 1 to 19 |
| 6 | | 1 | | | 7 | Credit 2 | On-Site Renewable Energy | 1 to 7 |
| | | 2 | 2 | | | Credit 3 | Enhanced Commissioning | 2 |
| | 2 | | | 2 | | Credit 4 | Enhanced Refrigerant Management | 2 |
| | | 3 | | 3 | | Credit 5 | Measurement and Verification | 3 |
| 2 | | | 2 | | | Credit 6 | Green Power | 2 |
| **Category: Materials and Resources** | | | | | | | **Points: 14** |
| Required | | | Required | | | Prereq 1 | Storage and Collection of Recyclables | |
| | 3 | | | 3 | | Credit 1.1 | Building Reuse—Maintain Existing Walls, Floors and Roof | 1 to 3 |
| 1 | | | | | 1 | Credit 1.2 | Building Reuse—Maintain 50% of Interior Non-Structural Elements | 1 |
| | | 2 | | 2 | | Credit 2 | Construction Waste Management | 1 to 2 |
| 2 | | | | | 2 | Credit 3 | Materials Reuse | 1 to 2 |
| | 2 | | | 2 | | Credit 4 | Recycled Content | 1 to 2 |
| | 2 | | 2 | | | Credit 5 | Regional Materials | 1 to 2 |
| 1 | | | | | 1 | Credit 6 | Rapidly Renewable Materials | 1 |
| | | 1 | | 1 | | Credit 7 | Certified Wood | 1 |

| Priority | | | Feasability | | | | |
|---|---|---|---|---|---|---|---|
| Low | Med | Hi | Easy | Mod | Diff | | |
| **Category: Indoor Environmental Quality** | | | | | | | **Points: 15** |
| Required | | | Required | | | Prereq 1 | Minimum Indoor Air Quality Performance | |
| Required | | | Required | | | Prereq 2 | Environmental Tobacco Smoke (ETS) Control | |
| | | 1 | 1 | | | Credit 1 | Outdoor Air Delivery Monitoring | 1 |
| 1 | | | 1 | | | Credit 2 | Increased Ventilation | 1 |
| | | 1 | 1 | | | Credit 3.1 | Construction IAQ Management Plan—During Construction | 1 |
| | | 1 | | 1 | | Credit 3.2 | Construction IAQ Management Plan—Before Occupancy | 1 |
| | | 1 | | 1 | | Credit 4.1 | Low-Emitting Materials—Adhesives and Sealants | 1 |
| | | 1 | | 1 | | Credit 4.2 | Low-Emitting Materials—Paints and Coatings | 1 |
| | | 1 | | 1 | | Credit 4.3 | Low-Emitting Materials—Flooring Systems | 1 |
| | | 1 | | 1 | | Credit 4.4 | Low-Emitting Materials—Composite Wood and Agrifiber Products | 1 |
| | | 1 | 1 | | | Credit 5 | Indoor Chemical and Pollutant Source Control | 1 |
| | 1 | | | 1 | | Credit 6.1 | Controllability of Systems—Lighting | 1 |
| | 1 | | | 1 | | Credit 6.2 | Controllability of Systems—Thermal Comfort | 1 |
| | | 1 | 1 | | | Credit 7.1 | Thermal Comfort—Design | 1 |
| | | 1 | 1 | | | Credit 7.2 | Thermal Comfort—Verification | 1 |
| | 1 | | | 1 | | Credit 8.1 | Daylight and Views—Daylight | 1 |
| 1 | | | | 1 | | Credit 8.2 | Daylight and Views—Views | 1 |
| **Category: Innovation and Design** | | | | | | | **Points: 6** |
| Required | | | Required | | | | | |
| | | 5 | | 5 | | Credit 1 | Innovation in Design | 5 |
| | | 1 | 1 | | | Credit 2 | LEED Accredited Professional | 1 |
| **Category: Regional Priority** | | | | | | | **Points: 4** |
| Required | | | Required | | | | | |
| | | 1 | | 1 | | Credit 1.1 | Regional Priority: SS6.1 Stormwater Design Quantity | 1 |
| | | 1 | | | 1 | Credit 1.2 | Regional Priority: EA2 On-Site Renewable Energy | 1 |
| | 1 | | | 1 | | Credit 1.3 | Regional Priority: SS3, SS7.1, WE3, or MR 1.1 | 1 |
| | 1 | | | 1 | | Credit 1.4 | Regional Priority: SS3, SS7.1, WE3, or MR 1.1 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | 5 | 17 | 16 | 8 | 2 | Sustainable Sites | 26 |
| 2 | 2 | 6 | 4 | 0 | 6 | Water Efficiency | 10 |
| 12 | 12 | 11 | 9 | 15 | 11 | Energy and Atmosphere | 35 |
| 4 | 7 | 3 | 2 | 8 | 4 | Materials and Resources | 14 |
| 2 | 3 | 10 | 6 | 9 | 0 | Indoor Environmental Quality | 15 |
| 0 | 0 | 6 | 1 | 5 | 0 | Innovation and Design | 6 |
| 0 | 2 | 2 | 0 | 3 | 1 | Regional Priority | 4 |
| 24 | 31 | 55 | 38 | 48 | 24 | TOTAL | Points: 110 |

40-49: Certified
50-59: Silver
60-79: Gold
80-100: Platinum

High Priority Credit as defined by Green Building Guidelines

# MR 7: CERTIFIED WOOD

HIGH PRIORITY | MODERATE FEASIBILITY
1 POINT + 1 (EXEMPLARY)

## LEED CREDIT INTENT

To encourage environmentally responsible forest management.

## LEED CREDIT REQUIREMENTS

Use a minimum of 50% of wood-based materials that are certified in accordance with the Forest Stewardship Council's principles and criteria.

- structural framing
- dimensional framing
- flooring
- sub-flooring
- wood doors
- finishes

Wood purchased for temporary use (construction) on the project may be included at the discretion of the team.

An additional point can be earned if 95% or more of the project's new wood is FSC-certified.

## UMA CREDIT DISCUSSION

UMA is committed to sustainable forestry and building practices should reflect that commitment. The use of FSC certified wood throughout projects is a high priority. Research in the Building Construction Technology department is closely linked with local sustainable forestry efforts. This credit does not establish a minimum quantity of wood, and most UMA projects use very little wood. Therefore, the use of 50% FSC certified wood should be specified early in the design process.

# Massachusetts Woodlands Cooperative

BE A LOCAL HERO buy locally grown

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Strengthening farms and communities since 1993

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## Massachusetts Woodlands Coop in South Deerfield, MA

Founded in 1999, Massachusetts Woodlands Coop is run by .

1 Sugarloaf Street
South Deerfield, MA

map | farms nearby

1 miles from South Deerfield, 01373

(413) 397-8800 preferred

Web
www.masswoodlands.org

### Where You'll Find Us

- Our Farm Stand

### Farm Stand

- **Massachusetts Woodlands Cooperative**
  1 Sugarloaf Street
  South Deerfield, MA (map)
  (413) 367-8800

  Call for more information.

**A little about Massachusetts Woodlands Coop**

A cooperative of landowners responsibly managing their woodlands and strengthening the local economy through production and marketing of FSC-certified, HomeGrown Wood™ products.

### Wood

Flooring · Timber + Lumber · Wood products

**Bold foods are in season now** according to our Harvest Calendar. Call to find out exact availability. Every farm and every season are unique. Most farms are also residences. Unless Farmstand or Pick Your Own hours are noted, please be respectful and call ahead before going to the farm.

CISA regularly revises the Local Food Guide with new information.
Let us know if something is inaccurate.

# EA 1: OPTIMIZE ENERGY PERFORMANCE

HIGH PRIORITY | MODERATE FEASIBILITY
1-18 POINTS (+ 1 EXEMPLARY)

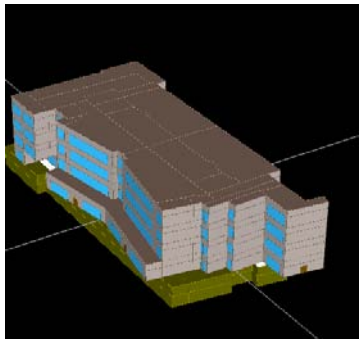
## LEED CREDIT INTENT

To achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

## LEED CREDIT REQUIREMENTS

Demonstrate a reduction in energy costs using 1 of 3 compliance options:

1) Whole Building Energy Simulation: ASHRAE 90.1 (1-19 points)
2) Prescriptive: ASHRAE Advanced Energy Design (1 point)
    - Only for offices, retail or warehouses.
3) Prescriptive: Advanced Buildings Core Performance (1-3 points)
    - Only for buildings under 100,000 sf, health care and labs are ineligible.



NLSB ENERGY MODEL

## UMA CREDIT DISCUSSION

The University favors the Whole Building Simulation (i.e. “energy modeling”) path for a number of reasons. First, energy modeling has the potential for optimizing building design in a way that a prescriptive path may not. Second, as an academic institution, the ability to compare predicted performance to actual performance is valued. Third, more LEED points are available to projects using this path.

Meeting the requirements of Executive Order 484 - a 20% reduction in energy costs - will earn projects 5 points under EAc1. Design teams are encouraged to go beyond the 20% reduction, although specific targets will vary by building type and function. More important than a numerical objective is the process by which project teams integrate the design and energy modeling to ensure that buildings are as energy efficient as possible within the project scope and budget. Designers and energy modelers should maintain a continuous cycle of designing and modeling that begins in the pre-design stage and has iterations through the final construction documents.

All campus projects must consider the future flexibility of building programming. The University recognizes that this requirement may at times impede attainment of the maximum energy cost reduction. However, it will help ensure that buildings have the longest lifecycle possible, one of the fundamental considerations in sustainable building and design.

# EA 2: ON-SITE RENEWABLE ENERGY



## LEED CREDIT INTENT

To encourage and recognize increasing levels of on-site renewable energy self-supply to reduce environmental and economic impacts associated with fossil fuel energy use.

## LEED CREDIT REQUIREMENTS

Use on-site renewable energy systems to offset building energy costs.

Use the building annual energy cost calculated in EA Credit 1 or the U.S. Department of Energy's Commercial Buildings Energy Consumption Survey database to determine the estimated electricity use.

Eligible systems include: photovoltaic, wind, solar thermal, bio-fuel electric, geothermal heat/electric, low-impact hydroelectric, and wave and tidal.

## UMA CREDIT DISCUSSION

All Commonwealth agencies are required to meet the target of 15% of annual electric usage procured from renewable sources by 2012[1], and the University is aligned with this goal.[2]

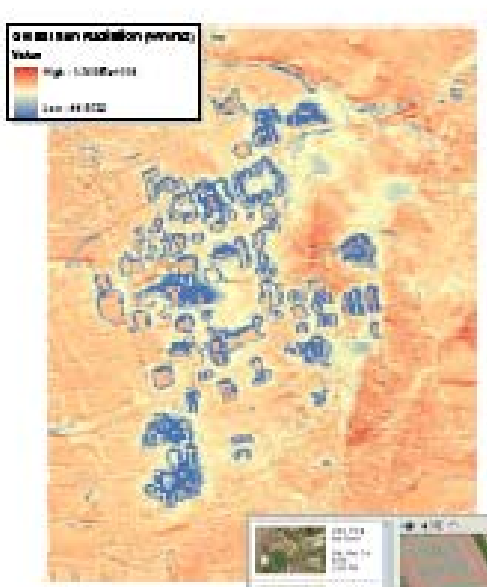
New projects are ideal candidates for renewables, the most viable options being photovoltaic and solar thermal. (There is not enough wind in the region to make wind power practical for the campus.) Design teams should consider integrating pilot projects featuring renewable technologies developed by faculty researchers. Building site and design should be assessed to ensure a best fit for the chosen technology. It is also expected that teams will incorporate strategies - such as day lighting - that reduce the overall energy load so that less energy generation is required. Consider alternatives to the standard applications of renewable technologies, for example, PV panels that also function as a shading system for windows or landscape. For roof-mounted installations, teams should coordinate closely with the roofing contractor to ensure guarantee of the roof warranty.

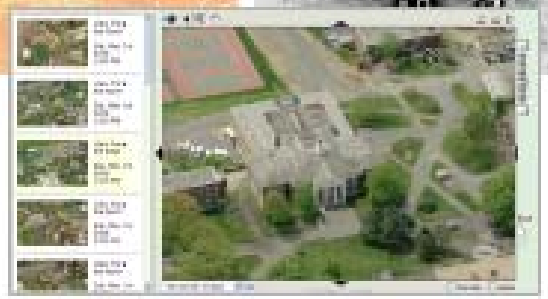
Creativity is encouraged when it comes to potential financial structures for the funding of renewable energy generation.

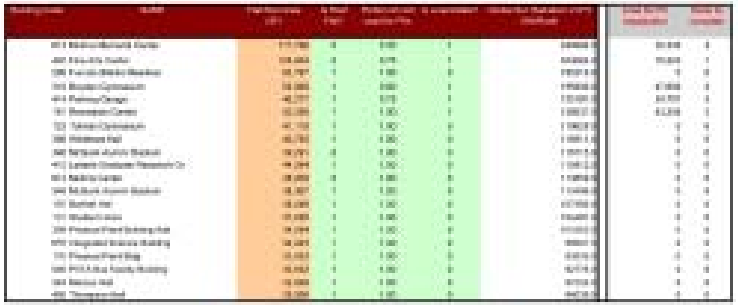
[1] Executive Order 484 [2] Climate Action Plan [3] Campus Solar Radiation Study

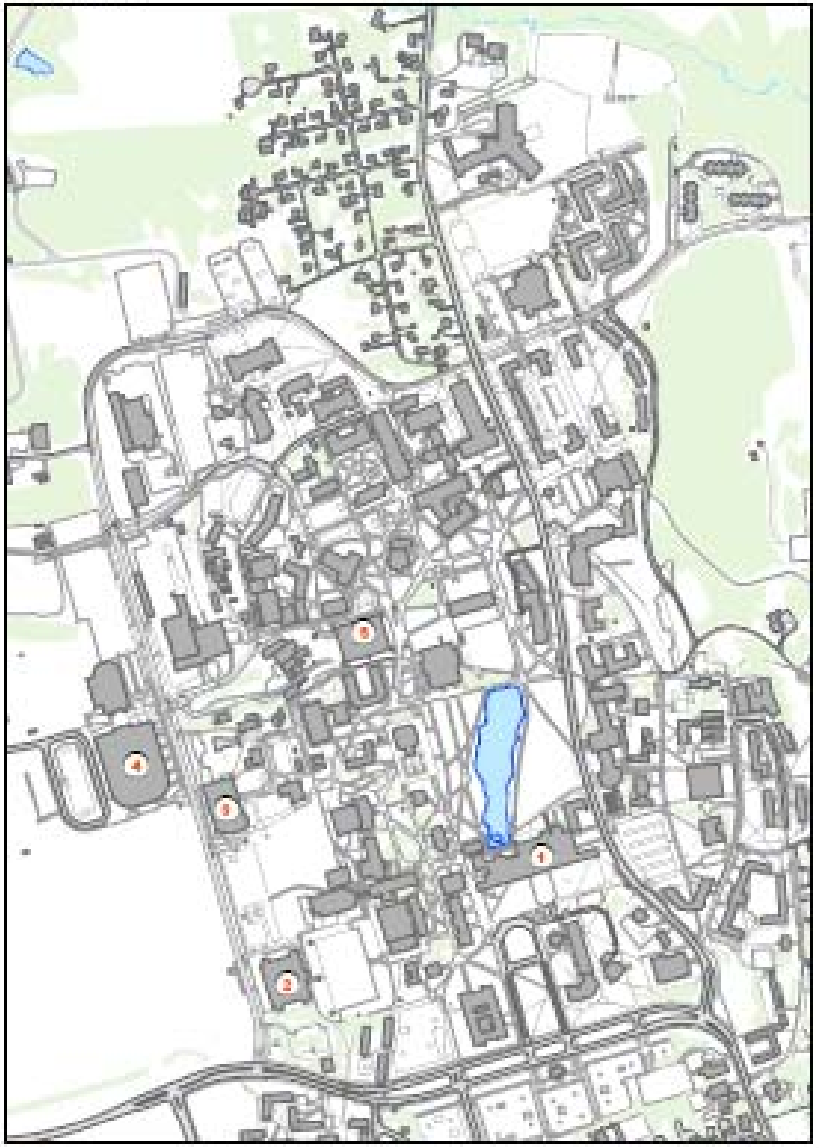
# Campus Analysis: Solar Potential

*Finding Potential Sites for Solar Panel Locations*

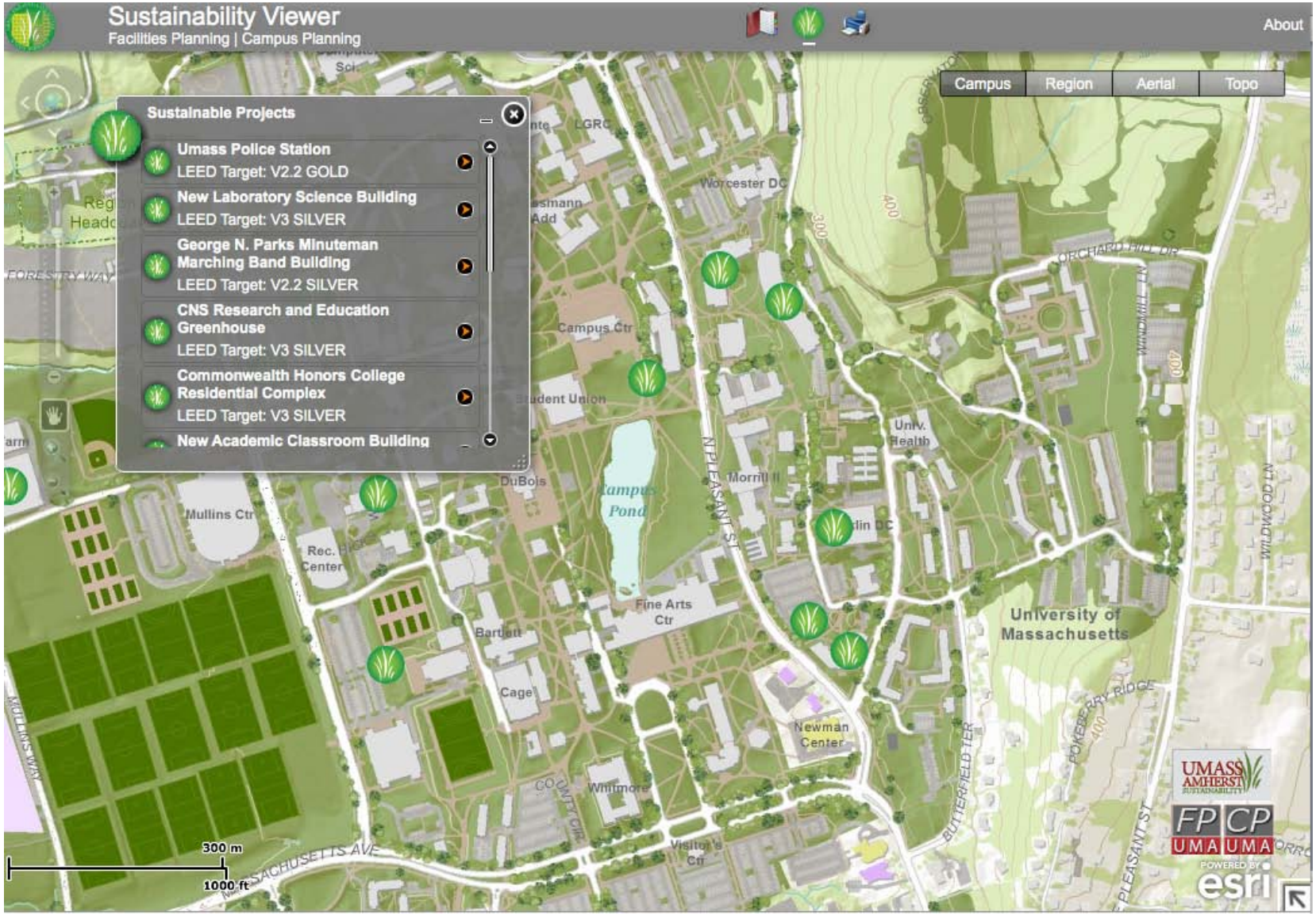






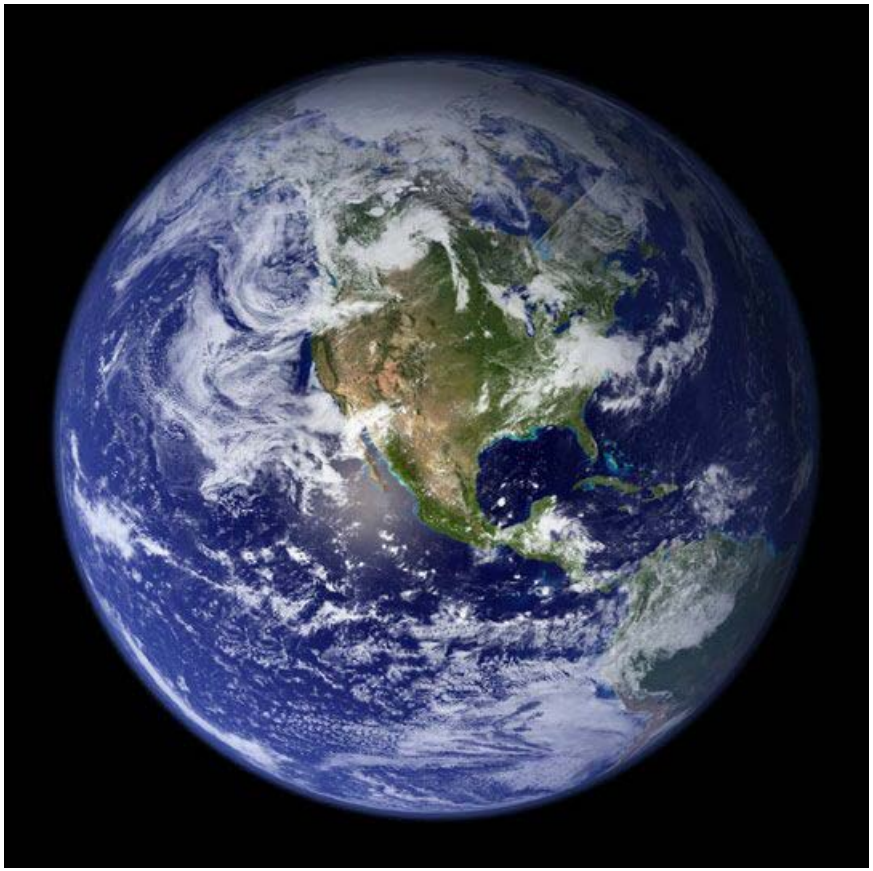


# UMass Sustainability Viewer (Work in Progress)



# Remember the Big Picture

- We have but one planet
- Reducing environmental impacts can be cost effective
- It is our job as thought leaders to find creative ways to serve both our organizations and our planet



# Questions?

**Contact Us:** josh.s@greeneru.com
lpavlova@facil.umass.edu
jquacken@facil.umass.edu