The Campus as a Living Lab: CSUEB’s Sustainable Construction Course Pilot

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California State University East Bay

Association for the Advancement of Sustainability in Higher Education

Portland, Monday October 27, 2014
Campus as a Living Lab: Sustainable Construction Course Pilot

Presentation Contents

- Cal State East Bay Institutional Background
- The Living Lab Grant
- ENGR 3999/6999 Pilot Course
- Student Projects Spring 2014
  - Parking lot lighting study
  - Pervious pavement assessment and demonstration
  - Solar parking canopy study
- Experience gained, reflections and next steps
CSUEB Sustainability Commitment

Shared Strategic Commitment

 “Contribute to a sustainable planet through our academic programs, university operations, and individual behavior.”

Institutional Learning Outcome

 “Graduates will be able to act responsibly and sustainably at local, national and global levels.”

Facilities + Faculty + Students = Living Lab

 Achieving our commitment through the curriculum
Trending In Sustainability For Higher Ed....

Campus landscapes can serve as living laboratories for reducing carbon footprints, conserving water and aquatic resources, supporting biodiversity, and building active, equitable social communities. Moreover, as learning landscapes, such campuses actively promote sustainable design by engaging faculty, staff, and students in the design and implementation process as a part of the pedagogy of place. This progressive focus positions universities as leaders educationally and environmentally (Way et al. 2012)

CSUEB Has Rich Landscapes For Change

- Hayward Campus
- Concord Campus
Living Lab Grant 2013-14

- Project Funding
  - Partnership: Divisions of Business and Finance, Academic Affairs, and Systemwide Academic Senate
  - 23 projects funded (7 new courses, 12 redesigned courses, 3 learning communities)
  - $250,000 in grant money (up to $12,000 per project)
  - $123,000 infrastructure & equipment (as requested)
  - 14/23 campuses got projects

- CSUEB Projects
  - Course redesign – PHYS Renewable Energies Lab Class
  - New course – CMGT Sustainable Construction and
New Course on Sustainable Construction

- **Course Title**
  - CMGT 4XXX/6XXX Sustainable Construction and Retrofitting of Buildings and Infrastructure

- **Objectives**
  - Extend and deepen CMGT students’ learning concerning sustainability
  - Expand on green building theory and other skill sets (CMGT 4300/6300 Environmental Issues and Green Building)
  - Focus on applied and practical aspects of sustainable construction management, life cycle analysis, and the retrofitting of existing buildings and infrastructure
Key Elements of Pilot Offering

- Buy-in from Facilities Development & Operations
  - Solicited ideas
  - Jointly developed targeted scopes of work & deliverables
- Support of Engineering program
  - Appropriation of existing “Special Issues” elective as pilot
  - Small class size for pilot offering (25 cap but 10-15 OK!)
- Project Management
  - Two faculty plus TA
  - Creative approach e.g. borrow equipment from PG&E
## Template

- **CSUEB intranet - Google Drive**
- **Standard template**
  - Project description incl. risks/mitigations
  - Time frame, equipment, etc.
  - Learning outcomes

### PROJECT PROFILE – SUSTAINABLE CONSTRUCTION & RETROFITTING OF BUILDINGS AND INFRASTRUCTURE

<table>
<thead>
<tr>
<th>Field</th>
<th>Note</th>
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</thead>
<tbody>
<tr>
<td>Person Suggesting Project:</td>
<td>Add your name here</td>
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<tr>
<td>Project Title:</td>
<td>Add title here</td>
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<tr>
<td>Organization:</td>
<td>California State University East Bay</td>
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<tr>
<td>Project Goal:</td>
<td>Describe project objective here</td>
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<td>Location(s):</td>
<td>Hayward Campus, Hayward, CA, or other</td>
</tr>
<tr>
<td>FD&amp;O Advisor(s):</td>
<td>List advisor(s) name(s) here</td>
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<td>Title/Position(s):</td>
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<tr>
<td>Assistant(s):</td>
<td>List student assistant(s) name(s) here</td>
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<tr>
<td>Department(s):</td>
<td>List student(s) department(s) here</td>
</tr>
<tr>
<td>Project Description: (to be completed prior to the project being started)</td>
<td>Provide short description here – describe the nature and the purpose of the activities to be performed, including any risks that must be prevented or mitigated through appropriate protocols and procedures in the implementation phase, etc. Detail the expected time frame, stakeholders/partners, equipment needs, target outcomes, etc. here. State the expected/intended learning outcomes envisaged for the student(s) here (what knowledge, skill, or experience the student will gain or enhance through the project)*.</td>
</tr>
<tr>
<td>Project Organization and Management: (to be completed after the project is completed)</td>
<td>Document the actual project organization, management and execution here – who did what, when, how, where? Describe the actual results/achievements of the project here.</td>
</tr>
<tr>
<td>Project Start Date:</td>
<td>Start date here Mo/Da/Yr</td>
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<td>Project End Date:</td>
<td>End date here Mo/Da/Yr</td>
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<td>Expected Budget:</td>
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<td>No of student hours:</td>
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<tr>
<td>Project expenses:</td>
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**CALIFORNIA STATE UNIVERSITY EAST BAY**
Projects for 2014 Pilot – Proof of Concept

- Nine potential projects proposed by collaborators
  - Solar canopy/net zero potential for EV charging
  - Parking lot LED lighting retrofit feasibility
  - Pervious pavement assessment and demonstration
Parking Lot LED Lighting

- Project Profile
- Field analysis
- Photometric modeling
- Efficacy (LSAE) analysis
Project Outcomes

- Does not/cannot meet IES recommendations
  - Would need configuration change
- LED performs better overall but not at margins
- LED would be cost-effective

<table>
<thead>
<tr>
<th>Parking Lot P Retrofit Economic Feasibility Analysis (LED)</th>
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<tbody>
<tr>
<td><strong>Project</strong></td>
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<tr>
<td>Discount Rate</td>
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<td>Inflation Rate</td>
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<td>Initial Savings</td>
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<tr>
<td>Initial Cost</td>
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Arturo Curiel, Ahmed Khan, Anthony Kuznetsov
Pervious Pavement (PP)

- **Project Profile**
  - Literature review
  - Criteria development
  - Campus screening (ADA mobility barriers) of PP retrofit opportunities
  - Demonstration site selection
  - Installation of first PP section on campus
  - Assistance to MS thesis research on PP

- **PP cost effective if a) larger scale, b) avoids drainage capacity**
Solar Canopy/Net Zero EV Charging

- Project Profile
  - Site analysis
  - Design concept
  - Design costing
  - PVWatts modeling
  - EV charge demand model
  - Economic analysis
    - NPV LCA
    - B/C Ratio
    - Payback
    - IRR

Roberto Alvarado, Chiran Joshi, Naveen Swam
Project Outcomes

- **Cost Effective**
  - <$2 per kWh capital cost
  - Paybacks of <10 years
  - Discount and inflation rates critical

- **Canopy above the 12 EV bays can’t be net-zero**
  - Equivalent sized panel at different site would be more productive/cost-effective

- **Policy of providing free charging not sustainable**
  - Will be > $20,000 per year at full capacity
Final Report and Dissemination Plans

- Three Project Reports
  - Will post in full on Dept. of Engineering website
  - Will display flip-book version to recruit for 2015 class on Valley Business & Technology foyer screens

- Report to Long Beach
Observations from our Living Lab experience

- **Observations**
  - 10 weeks goes by *really fast*
  - Quality TA was an invaluable asset
  - Keep projects simple, self-contained
  - Good Scopes of Work are critical
  - Can do it on small budget but funding source is nice
  - 100% teamwork format is a challenge
  - Team teaching hard to arrange
  - Must optimize student time by providing boilerplate, analytical tools (NPV, LCA, etc.) + focused instruction

- **Next steps**
  - Refine expectations
  - Submit new course proposal to curriculum committee
  - Develop project planning manual, boilerplate, standard financial tools to save time
  - Develop clear rubrics for learning outcomes + grades
  - Promote better to students
  - Plan projects 6-12 mo. ahead
  - Consolidate PG&E relationship
  - Refine learning outcome assessment process
Thank you for your attention

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Acknowledgements: Students of ENGR 3999/6999 (Spring 2014); Scott Battles, Esaiasi Piutau - CMGT program; Evelyn Muñoz, David Miller, Rick Walker, Chuck Copus – CSUEB Facilities Development & Operations; Elvyra San Juan, Meaghan Smith - CSU CO Long Beach; Ryan Stroupe - PG&E Energy Education Center, SF; Robert Betsch – LSI; David Liguori – Bay Area Pervious Concrete.