

REPORT OF THE MASTER PLAN TASK FORCE ON

SUSTAINABILITY



"Our commitment to sustainability is long-standing, and it is renewed by the fresh ideas of our students and our employees and the commitment of the chancellor and the leadership of the campus."

—Frank Bruno, Vice Chancellor for Administration

Sustainability Task Force

CU Campus Master Plan Revision Project

February 2010

List of Task Force Members: *Moe Tabrizi (Chair), Dave Newport, Paul Leef, David Cook, Jonathan Koehn, Lisa Barlow, Ed von Bleichert, Bryan Birozak, Richelle Reilly, Dan Omasta, Curt Huetson, Pat Kociolek, Lisa Bingham*

Executive Summary

The University of Colorado and the Boulder region have tremendous intellectual and operational resources related to sustainability, and CU-Boulder is rated among the greenest campuses in the United States. To consolidate and enhance that position, the revisions proposed for the Campus Master Plan move CU toward a new synergy of educational excellence and campus-as-classroom opportunities in facilities and operations, and thereby serve and prepare students for a rapidly changing world. While CU will continue to implement leadership policies and practices that further reduce our ecological footprint, this approach to campus development also seeks to prepare large numbers of students to do the same by merging the classroom with daily campus operations, design and planning, and community-building.

This report from the Sustainability Task Force of the Campus Master Plan revision project highlights a framework by which a more broadly synergized form of campus sustainability should be contemplated and assayed by STARS and LEED rating systems. Both are defined in greater detail later in the report.

The approaches recommended herein seek to balance the sometimes competing – and sometimes complimentary – drivers of conservation, cost, carbon and community within an educational platform enhanced by sustainability infrastructure and improved social connectedness on and off campus. The framework for contemplating this balance is informed by the STARS' sections relevant to campus planning: community engagement, education, funding and coordination. For the purposes of this report, this approach is outlined under the categories:

1. Materials Management
2. Transportation
3. Energy and Conservation
4. Buildings and Campus Design
5. Smart Growth
6. Funding and Coordination

Guiding frameworks

- **LEED:** As we design and build buildings to meet the growing need of our campus, significant care goes into our planning, design and construction to satisfy our growth as sustainably as possible. Our goal is to minimize our environmental and carbon footprint while constructing the most energy/water and cost efficient buildings.

In practice we have been following US Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) forward looking standards for sustainable and green building design and construction. This approach shifts the conversation from initial cost to overall cost of ownership. Our planning, design and construction phases of recent projects have placed special focus on sustainability features and producing comfortable, green and efficient buildings. Five LEED categories: Sustainable Site, Water Efficiency, Energy and Atmosphere, Materials and Resources and Indoor Environmental Quality are guiding our design and construction activities to consider all aspects of building systems.

Current campus policy of LEED Gold certification for new capital construction as well as major renovation has served us very well. The actual (energy and water) consumption data along with occupants' feedback from recent LEED certified buildings support our upfront investment with very good payback. Given our success with LEED standards for the new capital construction projects, we have internally created LEED Gold Plus level to help us focus more on the two major categories of LEED; Energy and Water.

LEED Gold + concept will help our design team to go deeper into the energy and water conservation categories and target higher efficiencies (more LEED credits) in these two long lasting LEED categories and therefore more energy and water efficient buildings. This higher level of LEED could serve as a good foundation for our future goal of Net Zero Energy buildings.



- [STARS](#): Over the last decade, campus sustainability has become a visionary leadership mission for thousands of forward thinking campuses across the nation. However, until recently, there has been little consensus over a definition of this mission or metrics by which to measure progress. Accordingly, practitioners have sought a comprehensive roadmap and common mileposts by which to direct and benchmark their headway.

With the advent of a national consensus around the Sustainability Tracking and Ratings System (STARS), campus sustainability professionals now have a de facto definition and metrics system that provides a framework and affirmation of campuses' comprehensive progress towards sustainability.

STARS is a checklist akin to the above described LEED system albeit with broader scope. Unlike LEED, an entire campus is assayed for an array of sustainability characteristics including academics, research, operations, policies, co-curricular activities, and human and community impacts.

CU has adopted this framework and interwoven STARS' implications in appropriate areas of the campus master plan. This has necessarily widened planners' review from a singular capital construction perspective to also contemplating policies and operational practices necessary to supporting broader sustainability outcomes.

Likewise, STARS has delivered a standard set of metrics by which CU's development will be judged by many credible outside observers in the years to come. Therefore, the recommendations that follow seek to align CU with best practices that will continue to support CU's leadership in the field of campus sustainability.

Benchmarks

- [Context](#)
 - UCB has included sustainability as one of the cornerstones of the revision process on the Campus Master Plan. To support this commitment, the Sustainability Task Force that was created as part of the review process engaged a new consulting program to aid in identifying best practices and strategies for advancing sustainable campus projects.

This benchmarking review [cite Appendix] examined best practices in an array of campus, corporate, and community settings, themselves seen as leaders in their respective sectors [see Appendix for full report]. The result of this review drove the task force to be mindful of the recommendations in its deliberations. The consultant's recommendations include:

"COMMUNITY INVOLVEMENT"

UCB has an opportunity to expand its involvement with the Boulder community. The campus could become a learning laboratory for sustainable practices, allowing interested

parties to tour facilities and view these initiatives in action. Facilities that can support the needs of both the university and local stakeholders are another way to build town-gown relations. Creating more residential space on campus, thereby freeing up rental space in Boulder, would also prove beneficial for community relations. This space could also accommodate more workforce housing.

ENERGY AND ENERGY EFFICIENCY

Energy efficiency programs are already well-established on the UCB campus. One challenge is managing older buildings on campus that have historic value. The Presidio has developed renovation standards that address this issue, and may serve as a guideline for UCB buildings.

Another challenge in managing energy use is energy-intensive facilities such as research laboratories. With much of the planned growth on East Campus devoted to improving UCB's research capabilities, this is an issue of particular concern. However, because these buildings will be new construction, UCB has an opportunity to make use of innovative design practices to reduce energy use from the outset (see Green Building below). Google's energy reduction as a result of their data center management is an example of what can be achieved through innovative approaches.

While implementing demand management strategies, UCB should also implement a more aggressive strategy for renewable energy. This is also easier to implement in the design of new buildings, so as to incorporate the proper wiring and facilities during construction. Buildings should be oriented to take advantage of southern exposures, and roof designs should be designed to incorporate space for solar panels, either for electricity or water heating. Financing for such projects can include power purchase agreements (PPAs), with an Energy Service Provider (ESP) or through grants. GEOS was able to negotiate a lower purchase price for solar panels due to the large number they agreed to purchase.

In addition, heating and cooling strategies for the campus should be discussed. As evidenced by the data in the Project Data Sheet (Appendix B), UCB has many more heating degree days than cooling days. Passive solar designs may not be optimal for research facilities, but could be incorporated into residential and office buildings. Biomass boilers and geothermal heat pumps are being used at several campuses to offset emissions.

GREEN BUILDING

UCB is one of the leaders in green building practices of the projects included in this study. Only three other projects have specified LEED Gold as the building standard, while Fort Carson has a goal for LEED Platinum buildings. The [Conceptual Plan for Carbon Neutrality] calls for UCB to use LEED Gold +, which calls for projects to achieve more points in energy efficiency.

However, UCB could go further by pushing for [Net Zero Energy Building] designs that incorporate a larger amount of energy to be produced on-site. This would be of great benefit in achieving UCB's energy reduction and emissions goals.



LOCAL FOOD PRODUCTION

Currently, 17 percent of the food budget is designated for local and organic foods to be incorporated into daily meal preparations in the campus dining halls. Many students are also pushing for a small farm on campus. This could be used to supplement purchased foods, and would also serve as a learning opportunity for the campus and city communities.

Several locations are available for this endeavor. Due to concerns about having family housing located in a flood plain, many are pushing to relocate these facilities, which could then be used for a community garden. East Campus and South Campus also have ample space for such a project. The location should consider accessibility for key stakeholders. The more people who can see and access the farm, the greater the impact the project would have.

TRANSPORTATION

RTD has consistently ranked high in the nation's public transportation systems, providing the Colorado Front Range with an extensive and reliable bus system. Plans for expanding the light rails system to include a northwest line from Denver to Boulder are currently under review.

As UCB develops East Campus, consideration needs to be given to how this area will be connected to the main campus. While parking is readily available, UCB should consider the impact of increasing parking availability. Improved or increased bus service to this area should be considered. This would also be a good opportunity to promote alternative modes of transportation. The 29th Street Mall provides a good example of how preferred parking spaces can be allocated to promote carpooling, car share programs and preferred vehicles, such as hybrids or flex-fuel vehicles.

It is also important to promote walking and biking access. [Colorado State University's] plan of moving parking lots to the outer edges of the campus reduces vehicle traffic in the interior and makes it safer for pedestrians and bikers to move about. In addition, the impact of campus growth and traffic in the area should also be considered for the streets surrounding campus. Improvements to pedestrian and bike access to and from East Campus could help in reducing vehicle miles traveled.

WASTE MANAGEMENT

UCB has a long history of recycling, and has recently undertaken efforts to improve its composting practices as well. The Green Stampede program at football games has garnered national attention for its comprehensive zero waste strategy. Expanding zero waste to incorporate the entire campus is a major undertaking, but should be considered. The City of Boulder is implementing a waste management plan that calls for diverting 85 percent of its waste away from landfills by 2017. As a member of the Boulder community, UCB should share in this responsibility. To implement such a strategy may call for improvements in the recycling center to handle an increase in recycled materials, as well as other infrastructure improvements to support this goal.

WATER MANAGEMENT

UCB is located in an arid climate and should be adapting its water management policies to suit this environment. Western water law and water rights can complicate these strategies, but should not hinder plans to reduce water use on campus. Raw water (also referred to as ditch water) is used for irrigation in most parts of campus (we will be at 99% of campus pending Williams Village IIa), but should be used for all irrigation rather than using treated potable water from the city. Landscaping can use plants adapted to this climate, and where possible, xeriscaping that requires little to no water should be used.

Water reduction projects have already taken place throughout campus, resulting in considerable savings. As new facilities are built, particular attention should be paid to water use, and water saving design elements should be featured as often as possible. This includes water use in research facilities. Closed-loop systems that capture and reuse water should be utilized whenever possible.

Stormwater management strategies, such as bioswales, rain gardens and pocket parks as retention basins should be implemented. GEOS, Stapleton and Village Homes provide good examples of what can be done. These strategies not only provide a means of managing storm water, they also provide green areas that can serve as natural habitats. Having such natural areas on campus allows people to enjoy the scenery and introduces aspects of biophilia to the project.”

The sustainability task force, mindful of these and other emerging best practices, incorporated elements from the benchmarking review into the recommendations that follow.



CU Sustainability Task Force Recommendations

1. Materials Management

- Guiding principle
 - *CU should eliminate waste generation and disposal practices that negatively impact under-represented communities and the environment*
- Context
 - As the University of Colorado continues to achieve progress towards the carbon-reduction goals outlined in the University's Conceptual Plan for Carbon Neutrality (CPCN), the campus must place greater emphasis on waste reduction programs in order to decrease its impacts on ecosystems and communities.

Under guiding documents supported by the Boulder City Council and Board of County Commissioners, as well as Governor Ritter's Greening the State Government Executive Order (Executive Order D0011 07), the Boulder community is actively pursuing zero waste operations, defined as a 90 percent diversion of municipal solid waste. The City of Boulder has committed to achieving the goal of 85% diversion by 2017 and the County has committed to beyond 90% levels by 2025.

Moreover, consistent with CU's adopted "Conceptual Plan for Carbon Neutrality" (CPCN), materials efforts must first focus on working with suppliers to reduce the amount of waste material coming to campus. This will serve the "reduce, reuse, recycle" protocol advised by materials management experts, and enhance CU's carbon position by helping go "beyond carbon neutrality" throughout the supply chain as advised in the CPCN.

- Goals
 - *It is recommended that CU increase its own solid waste diversion rate to at least 90% by 2020 as a continuous improvement benchmark in pursuit of a zero-waste goal.*
 - *CU shall prioritize materials management activities according to the time-honored maxim: “reduce, reuse, and recycle” that seeks first to work with suppliers to reduce or eliminate incoming supply chain materials.*
- Actions in support of this goal include:
 - Develop purchasing guidelines that specify low or no-waste packaging for supplies
 - Require and coordinate zero-waste food systems for all providers campus wide
 - Design and integrate zero-waste infrastructure into all new construction and renovations
 - Retrofit zero-waste collection systems in existing facilities and all outdoor containers
 - Site and construct a compost system capable of processing all campus-originated pre-and post consumer organics
 - Site and construct a materials management facility sufficient to integrate operational needs with emerging community engagement, research, and community engagement activities

2. Transportation

- Guiding principle
 - *CU should design and manage the campus for the maximum benefit to people and the environment by enhancing sustainable transportation systems*
- Context
 - Commuter transportation based on single occupancy vehicles generate significant carbon emissions and negative community impacts. Commuter transportation also diverts significant fiscal and human resources from the

campus' educational mission into non-value added activities and infrastructure.

Fortunately, about two-thirds of all commuter trips to the CU campus are made by bus, bike, walking, carpooling and vanpooling combined¹. Yet even the minority fraction of the campus community that drives a single occupancy vehicle to campus commands an inordinate allocation of capital funds and ongoing operations and maintenance of related parking facilities. Annual costs range from \$360 to \$546 per parking space per year. On the other hand, transit costs for a bus pass are contrasted at \$90.65/person/year. Accordingly, for CU to adequately resource sustainability, education-related facilities, and related carbon mitigation efforts, comprehensive transportation goals must be pursued.

- Goals
 - *Move toward a higher proportion of transportation fuels derived from renewable sources*
 - *Increase the number of passenger miles per vehicle-mile travelled*
 - *Reverse the growth in the average length of trips taken*
 - *Work to reduce the growth in the number of trips taken*
- Actions that support these goals include:
 - Plan for renewably powered electric vehicle charging facilities across campus, both for campus fleet and service vehicles and for use by faculty, staff, students and visitors to campus. Ideally, these charging facilities will be smart grid capable – meaning that power from the batteries of vehicles attached to them and any surplus locally generated power may be intelligently fed back into the grid with appropriate monitoring and crediting.
 - Develop a ten-year plan for expanding car sharing on campus as fast as demand and financing allows, both through the campus partnership with an independent provider and through campus fleet vehicles outfitted with the technology for web-based scheduling and billing. Allocate space for these shared vehicles with a goal in mind that by 2020 all major campus buildings will be within 300 yards (or less) of a car share vehicle location.
 - Continue the practice of having all new campus building projects and major renovations include bike parking per campus standards. Provide bike parking to meet bike parking demand at all campus destinations, including buildings (classroom, administrative, research and residential; existing, new and renovated), recreation fields, bus stops, etc. Develop and adopt an agreed-

¹ [2008 University of Colorado at Boulder Commuter Study](#)

upon method of calculating the amount of bike parking to be provided at each campus location² together with an agreed-upon logic for the placement of bike parking in proximity to campus destinations, weighing and balancing parking demand, aesthetics, enforcement costs, accessibility, sustainability, safety and other considerations.

- Develop a campus bicycle plan to support enhanced pedestrian and bicycle travel on campus by improving parking, pathways, signage and other facilities, policy, and funding through coordinated stakeholder planning. Include at the front-end of the planning process an analysis of the strengths and shortcomings of both the recent “ped safety zone” approach and the previous “dismount zone” approach so that any new approach will be able to address and overcome the barriers to the success of these two previous approaches.
- Review campus service vehicle parking needs and behaviors every three years to insure that adequate service vehicle parking is provided off-path and that it is used - to keep campus pathways open for the free flow of non-motorized traffic.
- Retain the concept of the “modal hierarchy” included in the campus master plan over the last two decades.
- Support pedestrian travel by planning classroom locations and scheduling to minimize the time and distance needed between classes for the largest number of students. Also by providing adequately sized pathways, full pedestrian connectivity between facilities, effective way finding as well as amenities along pedestrian pathways to encourage walking. Design pedestrian connections understanding that cyclist, transit and automobile users all become pedestrians once they leave their vehicles and that all modes, including transit stops, bike and automobile parking lots must be well connected by the pedestrian path network.
- To minimize transportation system capacity impacts, classroom sizing should be based on both physical as well as virtual students’ participation (rather than building 700-1,000 seat lecture halls). An abundance of extremely large class rooms/lecture halls will disproportionately tax all of our transportation and other campus infrastructures. We also need to experiment with the mix of physical/virtual classrooms to get ready for our future.
- Pursue options to green the campus fleet, including facility-related items such as: right-sizing both fleet make-up and on an individual vehicle-to-job basis; trials of both carsharing and telematics technologies; raising the fleet average

² From a quota perspective, my current approach is to recommend 0.75 bike parking spaces per bed for student residential facilities and to calculate estimated parking demand for other campus buildings on the basis of square footage, using a higher ratio for heavy student use buildings and a lower ratio for buildings with low student use (occupancy counts miss the different bike use rates between students and employees). For existing facilities a utilization approach can also be taken, adding parking where it is oversubscribed and relocating it where it is under-utilized. Much more detail is available on both methodologies.

MPG; increasing the proportion of renewably fueled vehicles and the use of pedal power. Centralized procurement and promotion of fuel-saving driving practices are non-facilities approaches that can also contribute to sustainability.



3. Energy, Efficiency and Conservation

- Guiding principle
 - *CU should continuously improve its energy sources so as to minimize carbon and costs by maximizing conservation and renewables*
- Context
 - The manner in which CU produces and/or consumes energy directly affects sustainability and carbon neutrality goals. About 80% of CU's reported GHG emissions are from the combustion of fuels for heat, power, and/or chilled water. Conservation, energy efficiency and renewable fuel sources are among the best methods to reduce these emissions. The utility infrastructure must strive for a balance between costs, conservation, and carbon through "greener" energy solutions.

The main campus energy system has the potential to become carbon neutral with the development of viable renewable energy fuel sources (e.g. cogeneration, solar PV, geothermal, syngas, and biomass).

- Goals
 - *Reduce energy consumption 20% by 2012*
 - *Reduce total GHG emissions 20% by 2020*

- *Reduce total GHG emissions 50% by 2030*
- *Reduce total GHG emissions 80% by 2050*
- Actions that support these goals include:
 - CU should designate 15 to 25 acres of land (five to seven acres on East Campus, the balance on South Campus) for the development of large scale renewable energy systems such as solar PV, solar thermal, and other emerging technologies. This site could be co-located with solar greenhouses used to produce local organic food for the campus while providing a research showcase and robust renewable energy facility.
 - Planners need to include utility corridors (land easements) for all utilities as well as designated land use for central plants.

4. Buildings and Campus Support

- Guiding principles
 - *CU must continuously improve its building stock to near net-zero carbon construction and operations*
 - *Sum (conserve + capture (heat recovery, geothermal) + create) = zero*
 - *CU should continuously strive to enhance the design and operation of campus facilities so as to synergize their integration into emerging pedagogical approaches that teach sustainability using the campus as a living laboratory*
- Context
 - In 2007, UCB was one of the original signatories to the American College and University Presidents' Climate Commitment (ACUPCC) and has drafted the Conceptual Plan for Carbon Neutrality (CPCN) for reducing greenhouse gas emissions that is currently undergoing public review. The CPCN calls for a phased reduction in greenhouse gas emissions based on guidelines set forth by Colorado Governor Ritter's Executive Order for The Greening of the State Government Goals, resulting in a total reduction of 80 percent by 2050. Because the vast majority of the campus' carbon footprint is a result of energy use in buildings, the CPCN focuses primarily on energy efficiency projects and new construction standards.

The Master Plan must align the goals of both *Flagship 2030* and the CPCN – grow the campus *and* reduce energy use and emissions. To accomplish this seemingly contradictory task, the Master Plan must incorporate green building

practices, energy efficiency methods and energy production strategies into nearly three million square feet of new growth.

Likewise, the efficiency of green buildings can be impacted based on the behaviors of building occupants. Behaviors can be hindered by internal (perceptual, preferential) and/or external (infrastructure) barriers. By including behavioral change considerations in the goals of the Master Plan, CU demonstrates that it seeks not only technological solutions, but also social efforts in meeting its goals.

- Goals
 - *By 2030, all new CU buildings shall be constructed consistent with the goals of the American Institute of Architects (AIA) that aspire to attain a 50% carbon emission reduction by 2010 and are carbon neutral by 2030*
 - *Incorporate behavioral change strategies, such as identifying and lowering external and internal barriers, in campus planning*
 - *Establish new synergy between the academic, operational and built environments of the University to better serve and educate students of the principles and practices of sustainability*
- Actions that support these goals include:
 - Establish and incorporate “Living Laboratory” standards into all future building designs and renovations, providing students, faculty, staff and visitors with more opportunities to see sustainability in action and therefore gain greater appreciation for its scope and potential.
 - All new and renovated facilities shall attain LEED Gold Plus certification, which is diving more deeply into the energy and water conservation categories of the LEED requirements, including projected performance at a minimum level of 45% better than ASHRAE standard.
 - All new and renovated facilities commenced (formal Program Plan approved) must be net-zero energy facilities, as defined: A net-zero energy facility collects as much energy from renewable sources as the facility uses on an annual basis while maintaining an acceptable level of service and functionality. Buildings can exchange energy with the power grid as long as the net energy balance is zero on an annual basis.
 - The design for the campus landscape will follow the seven Xeriscape principles; enhance biological diversity with selection of native and drought tolerant plantings and removal of invasive species. Designs will use storm water best management practices to use and purify site water

within the landscape to the extent possible. Irrigation is provided by the University's share of non potable water shares and is closely monitored by a computerized weather station, allowing water to be applied judiciously.

- Determining location of recycling, compost and trash containers, both indoor and outdoor, could serve to optimize behavioral compliance with these programs.
- Install highly visible energy metering devices in buildings to inform and help occupants track conservation behaviors.
- Locate public filtered drinking water stations in high use/visibility areas
- Include pre-design stage interviews in program planning process with future occupants of new buildings or renovated buildings to identify existing external barriers to behavioral change.
- Establish a working informational database of interviews and design features that serve as a resource for future program planning.



5. Smart Growth

- Guiding principles
 - *CU should continuously strive to design and manage the campus environment without reducing the structure or function of the natural environment*
 - *Growth should pay its fair share of the costs of growth*
 - *CU should abide by the principles of re-localization that support and enhance local communities, local governments, local agriculture, and local economies*

- Context
 - Campuses have a significant impact on the built and natural environment and are under increasing pressure from governments, students and community members to carefully mitigate their environmental footprint. CU is no exception. Nationally, campus development initiatives are factoring in the economic and social needs of surrounding neighborhoods and incorporating design elements that contribute to environmental health as well as architectural aesthetics. New approaches that infuse town-gown relationships with a sharper focus on sustainability are propelled by a valuable insight: What's good for the community is good for the campus.

Nowhere is this truer than in Boulder, Colorado. A strong component of Boulder's approach to smart growth turns on creating a sense of community. Community building includes efforts to foster social connectedness – the recognition that we are all in this together, regardless of our status or primary affiliation. Community is also strengthened by a sense of place; a connection with local natural surroundings.

Accordingly, CU's smart growth approach to the Campus Master Plan speaks to both on campus design elements and community partnerships.

- Goals
 - *CU-Boulder will seek opportunities to partner with City of Boulder, Boulder County, and appropriate private sector entities on joint solutions to campus needs.*
 - *Strengthen community ties through providing opportunities for connectedness in the design of buildings and outdoor spaces.*
 - *Explore and support efforts to expand the availability and procurement to local sources of food, material goods, and services.*
 - *To control costs and the perpetual outward expansion of the campus, CU-Boulder will design campus buildings in a way that facilitates renovation or reconfiguration for alternate future uses,*

incorporating flexible core and shell, infrastructure that does not require re-balancing, and systems and equipment that are flexible.

- *To reduce campus and community environmental impacts, CU-Boulder will attempt to locate new facilities with diverse heating and cooling load demands in proximity to take advantage of recovery options, such as geothermal systems (e.g. consolidated campus data center).*
- Actions that support these goals include:
 - Align with regional partners to design policies focusing on reducing resource consumption, promoting market transformation in the areas of renewable energy and alternative fuels, growing the number of qualified energy efficiency professionals to serve the public's increased demands for services, increasing alternative transportation options, and furthering a land use pattern that is compact and walkable.
 - Collaborate with the City and Boulder County on specific goals of various regional plans, such as the City's Climate Action Plan, Master Plan for Waste Reduction and Zero Waste Resolution, Boulder Valley Comprehensive Plan, the Boulder County Sustainable Energy Plan and the City and County climate adaptation plan being developed in 2010.
 - Collaborate with the City and Boulder County to prioritize collaborative efforts such as greenhouse gas emissions reductions and climate change adaptation planning, including identifying unified measures of carbon tracking and reporting; identifying large-scale renewable energy opportunities; pursuing initiatives to further our common zero waste goal; and exploring joint funding opportunities to further implementation.
 - Utilize our collaborative efforts to assist with attracting excellent students and faculty, new businesses, new sources of funding, and increased support from alumni and community members.
 - Incorporate designs for spaces that foster interaction and stronger ties among small groups of faculty, staff and students.
 - Incorporate designs for outside active and passive spaces and structures that allow any community member time with nature.
 - Create a Space Planning Commission to oversee all space allocation, maximization of space utilization, as well as develop space standards. Incentives and disincentives for efficient space usage will be considered.
- (1) Develop a structure and process to charge a using department for square footage

- (2) Implement a policy that all common space (e.g. conference rooms) are subject to use by all campus entities on a reservation basis
- (3) Implement a policy to allow only one primary office (additional requirements to be met by drop-in / hoteling office space)
- (4) Implement a policy requiring a space utilization audit be conducted for a department prior to granting additional space usage and/or construction
- (5) Examine day of week and time of day usage for all space (migrate toward multiple shift usage of space)
- (6) Track research dollars awarded and gross square footage used by entity (the space never contracts when research dollars decrease)
- Establish infrastructure that will allow virtual coursework across all CU campuses, allowing students to take classes virtually without travel between campuses.
- Incorporate into the planning and design for each new facility (or renovation of existing facility) the identification of the following:
 - (1) Is there any food or beverage service provided? Who is the provider? They must fund incremental waste and recycling operations, utility use, and adhere to any other applicable guidelines.
 - (2) Will housing or dining accommodations be required?
 - (3) Will parking accommodations be required, and how will it be funded? Will incremental bus or other transportation services be required, and how will it be funded?
 - (4) Are any other downstream operations affected?
 - (5) Is incremental IT infrastructure required, and how will it be funded?
 - (6) Is incremental utilities infrastructure (including civil utilities) required, and how will it be funded?
- Establish edible landscaping on non-field areas.
- Establish on-campus or near-campus composting facilities.
- Form statewide co-ops with farmers and food producers to pool products and insurance coverage.

- When feasible, explore and support local contractors for building, demolishing, and renovating buildings in both construction and interiors.
- Incorporate strategies to bring car-commuting faculty, staff and students closer to Boulder.
- Identify 15-25 acres of land on South Campus for the development and build out of a local food production facility such as solar powered greenhouses.



6. Funding and Coordination

- Guiding principles
 - *The entire CU campus benefits from sustainability; hence, the entire campus should be associated with implementing sustainability*
 - *Growth should pay its fair share of the costs of growth*
 - *The benefits of sustainability enjoyed by the entire campus should be funded in common*
- Context
 - Sustainability-related activities provide a common benefit to all areas and interests of the campus. In many ways, CU's sustainability features influence campus reputation, performance, competitiveness and responsiveness to the society we serve.

Likewise, sustainability requires integrative thinking and planning across all spheres of campus planning, operations, community engagement, and educational activities. While these ideals are crucial to broadly advancing sustainability principles and practices, the practical impact of this breadth and

scope presents coordination challenges that impact facilities designs, operations and the entire campus community.

Given the broad influence and benefits of sustainability, it is both equitable and essential that funding sustainability-related activities be broadly based as well.

The cost of sustainability functions cannot be disproportionately born by any one unit or a few units. That is neither a sustainable funding model nor a mechanism that promotes broad ownership of sustainability such that cooperation and support of sustainability programming is incentivized.

Accordingly, policies that promote equitable funding and broad-based coordination of sustainability functions are central to advancing leadership in this arena.

- Goals
 - *Promote the further emergence of broad based sustainability capacity through a coordination structure that honors frontline innovation while inclusively steering towards broadly held outcomes.*
 - *Develop broad-based financial models that accrue sufficient resources to address both ongoing demands and growth-based increments for additional capacity.*
 - *Develop fiscal planning models that contemplate reasonably-foreseeable future developments thereby hedging risks that could impede sustainability.*
 - *Develop fiscal accountability mechanisms that promote conservation.*
- Actions that support these goals include:
 - Establish a sustainability coordination structure inclusive of all relevant units charged with developing campus sustainability plans, steering, funding, development, messaging and oversight. Establish clear vertical lines of coordination and accountability across all operational, educational, research and support areas.
 - Establish a “Common Benefit Unit” (CBU) to help fund sustainability related activities. The CBU would be assayed of new capital projects that would demand incremental increases in related sustainability-support capacity and integrated into indirect cost recover charges thereby supporting ongoing operations and maintenance needs. The CBU should be administered by the Vice Chancellor for Administration Office in consultation with a campus wide sustainability coordination body as envisioned above. Activities that could be supported under the CBU include but are not limited to:
 - Materials management/zero waste
 - Sustainable transportation (e.g. Eco-Pass)
 - Energy conservation
 - Open space development

- Food production systems
 - Renewable energy
 - Campus planning
 - Water conservation
- Establish and use a capital planning fiscal model that contemplates reasonably-foreseeable realities such as a carbon tax or the direct impacts of climate change such as reduced rainfall, etc. These elements should be monetized and overlaid onto project pro formas so as to drive project decision making towards longer term evaluations instead evaluations trumped by first costs alone.
- Establish a fiscal accountability and billing policy such that discrete organizational units are involved in paying their assignable costs for energy. This will promote much greater cooperation with ongoing campus energy conservation initiatives. Mechanisms to convert saved energy resources into support for educational activities and other administrative needs within participating organizational units should be developed.

END





Sustainable Campuses **Models & Best Practices**

Z Lab at Renewable and Sustainable Energy Institute
University of Colorado Boulder



William Shutkin, Director
Lisa L. Bingham, Program Associate
Cindy Chang, Program Associate

Sustainable Campuses: Models and Best Practices

William Shutkin, Director
Lisa L. Bingham, Program Associate
Cindy Chang, Program Associate

February 24, 2010

This report was commissioned by the Office of Planning Design and Construction, University of Colorado Boulder, Paul M. Leef, AIA, LEED AP, Campus Architect and Director.

Table of Contents

Table of Contents	iv
Sustainable Campuses – Models & Best Practices	1
Executive Summary	1
Campus Research.....	3
<i>Identification of Projects.....</i>	<i>3</i>
<i>Summary of Findings</i>	<i>4</i>
Campus Summaries	8
<i>Arizona State University</i>	<i>8</i>
<i>College of the Atlantic</i>	<i>9</i>
<i>Colorado State University.....</i>	<i>10</i>
<i>Emory University</i>	<i>11</i>
<i>Evergreen State College</i>	<i>12</i>
<i>Fort Carson.....</i>	<i>13</i>
<i>Fort ZED.....</i>	<i>14</i>
<i>GEOS Neighborhood</i>	<i>15</i>
<i>Google Headquarters Campus</i>	<i>16</i>
<i>Harvard University</i>	<i>17</i>
<i>Kansas State University</i>	<i>18</i>
<i>Los Angeles Community College District</i>	<i>19</i>
<i>Masdar City</i>	<i>20</i>
<i>About the Campus.....</i>	<i>20</i>
<i>Microsoft Headquarters Campus.....</i>	<i>21</i>
<i>New York University</i>	<i>22</i>
<i>Oberlin College.....</i>	<i>23</i>
<i>The Presidio</i>	<i>24</i>
<i>Stapleton Community</i>	<i>25</i>
<i>University of California, Los Angeles.....</i>	<i>26</i>
<i>University of Nebraska, Lincoln</i>	<i>27</i>
<i>University of New Hampshire</i>	<i>28</i>
<i>Village Homes</i>	<i>29</i>
<i>Yale University Campus.....</i>	<i>30</i>
Recommendations	31
<i>Community Involvement.....</i>	<i>31</i>
<i>Energy and Energy Efficiency</i>	<i>31</i>
<i>Green Building.....</i>	<i>31</i>
<i>Local Food Production</i>	<i>32</i>
<i>Transportation</i>	<i>32</i>
<i>Waste Management</i>	<i>32</i>
<i>Water Management</i>	<i>33</i>

Appendices	34
<i>Appendix A: Environmental, Economic and Social Factors</i>	<i>35</i>
<i>Appendix B: Project Data Sheet</i>	<i>40</i>
Resources	50
<i>General Resources</i>	<i>50</i>
<i>Campus Resources</i>	<i>50</i>

Sustainable Campuses – Models & Best Practices

Executive Summary

The importance of incorporating sustainability in long-range community planning has never been as relevant or necessary as today. The University of Colorado at Boulder (UCB) recognizes this, and continues to further its efforts in leading campus sustainability planning. In its current process of updating the 2000 campus master plan (the “Master Plan”), UCB has taken the opportunity to embed sustainability as a cornerstone in the campus’ practices and policies. The Master Plan must align UCB’s seemingly conflicting goals of growing the campus and reducing energy use and emissions, with the ultimate objective of becoming a net zero energy (NZE) campus. This Report seeks to assist in this challenge by identifying best practices and strategies for advancing sustainable NZE campus projects.

Twenty-three exemplary projects were identified among higher education institutions, corporate and public sector campuses, and residential/community development projects. These campuses were selected based on leadership, innovative practices, and geographic similarity to UCB. A triple bottom line approach was used to consider social and economic factors in addition to environmental characteristics. A spreadsheet (Appendix B) summarizes and compares both internal and external factors that encourage or inhibit sustainable practices. These include climate, energy sources, and the wealth of the surrounding community.

The Report’s findings corroborate UCB’s widely recognized status as a leader in many aspects of sustainability practices and planning. Most significant is UCB’s policy of “LEED Gold Plus” (LEED Gold standards for buildings with extra points for energy performance) for campus buildings.

However, there are still significant opportunities for UCB to improve its sustainability practices and policies, identified through innovations on other campuses. Recommendations include:

- Community Involvement
- Energy and Energy Efficiency
- Green Building
- Local Food Production
- Transportation
- Waste Management
- Water Management

UCB has an enviable opportunity to make a significant and immediate difference not only in its own practices, but also those of campuses around the world. UCB’s commitment to sustainability, evidenced most recently in its effort to create an NZE Master Plan, is its greatest asset in facing the challenges of the future. With continued efforts in this direction, UCB is likely to achieve its NZE goals and to secure its position as a leader in campus sustainability for years to come.

Introduction

The University of Colorado at Boulder (“UCB”) is currently in the process of revising the *2000 Campus Master Plan* (the “Master Plan”) that outlines campus growth over a ten-year period. The Master Plan describes UCB’s long-term aspirations regarding the current and future needs of the campus. The review process is quite complex, involving the participation of faculty, staff, students, alumni, and community members. It is also regulated by the goals spelled out in other planning documents, such as UCB’s strategic plan, known as *Flagship 2030*, and carbon action plan.

Flagship 2030 creates a vision for UCB that maintains its status as one of the top research universities in the country. Integral to *Flagship 2030* is the development of state-of-the-art research facilities and the creation of a University Village to host students, faculty and visitors.

In 2007, UCB was one of the original signatories to the American College and University Presidents’ Climate Commitment (ACUPCC) and has drafted the Conceptual Plan for Carbon Neutrality (CPCN) for reducing greenhouse gas emissions that is currently undergoing public review. The CPCN calls for a phased reduction in greenhouse gas emissions based on guidelines set forth by Colorado Governor Ritter’s Executive Order for The Greening of the State Government Goals, resulting in a total reduction of 80 percent by 2050. Because the vast majority of the campus footprint is a result of energy use in buildings, the CPCN focuses primarily on energy efficiency projects and new construction standards.

*We can’t grow our
way to zero.
– Dave Newport*

The Master Plan must align the goals of both *Flagship 2030* and the CPCN – grow the campus *and* reduce energy use and emissions. Dave Newport, director of UCB’s Environmental Center, has said “We can’t grow our way to zero,” yet that is precisely what the Master Plan is expected to do. To accomplish this task, the Master Plan must incorporate green building practices, energy efficiency methods and energy production strategies into nearly three million square feet of new growth.

From the nation’s first college recycling program in 1976 to the first zero-waste football season in 2008, UCB has long been a campus sustainability pioneer. UCB was recently ranked as the greenest school in the country by the Sierra Club. In order to maintain its leadership position, UCB must continue to be innovative in its sustainability efforts. The Master Plan provides a singular opportunity to embed sustainability goals and measures even more indelibly into UCB’s practices and policies.

UCB has recognized this opportunity and has included sustainability as one of the cornerstones of the Master Plan. To support this commitment, a Sustainability Task Force (the “Task Force”) has been created as part of the review process. The Z Lab, a new consulting program based at UCB’s Renewable and Sustainable Energy Institute, has been engaged by UCB’s Department of Facilities Management (DFM) to aid the Task Force and DFM staff in identifying best practices and strategies for advancing sustainable net zero energy (NZE) campus projects. This *Sustainable Campuses: Models and Best Practices* Report (the “Report”) is the prime work product of this engagement.

Campus Research

Identification of Projects

Exemplary projects were identified among higher education institutions, corporate and public sector campuses and residential/community development projects. A total of 23 projects were selected for inclusion in the study based on several factors, including their established leadership in sustainability, innovative practices, and geographic similarity. Highlights from each campus are included in the Campus Summaries section.

Table 1. Exemplar Campus Projects.

Institutes of Higher Education	
Arizona State University	Tempe, AZ
College of the Atlantic	Bar Harbor, ME
Colorado State University	Fort Collins, CO
Emory University	Atlanta, GA
Evergreen State College	Olympia, WA
Harvard University	Cambridge, MA
Kansas State University	Manhattan, KS
Los Angeles Community College District	Los Angeles, CA
New York University	New York, NY
Oberlin College	Oberlin, OH
University of California, Los Angeles	Los Angeles, CA
University of Nebraska, Lincoln	Lincoln, NE
University of New Hampshire	Durham, NH
Yale University	New Haven, CT
Corporate Campuses	
Fort Carson	Colorado Springs, CO
Google Campus	Mountain View, CA
Microsoft Campus	Redmond, WA
The Presidio	San Francisco, CA
Residential Projects	
FortZED	Fort Collins, CO
GEOS Neighborhood	Arvada, CO
Masdar City	Abu Dhabi, UAE
Stapleton	Denver, CO
Village Homes, Davis, CA	Davis, CA

Recognizing UCB's opportunity to push the boundaries of sustainability, the Report used a triple bottom line approach that considers not only environmental factors, but also social and economic factors to provide a more holistic view of each project. A description of each factor is available for review in Appendix A. Data has been compiled into the Project Data Sheet (Appendix B).

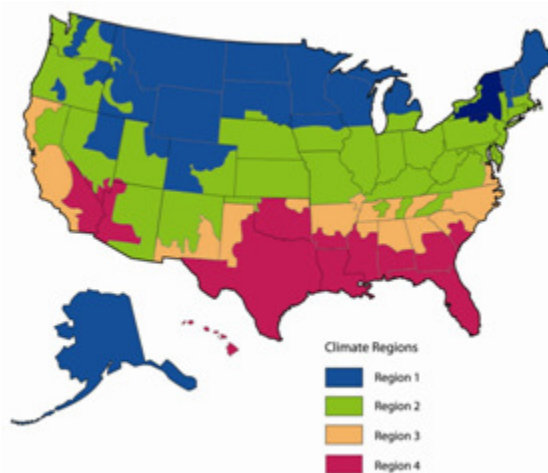
Summary of Findings

Environment

The 23 projects selected for this study are located throughout the country, representing 15 states and one country. Campuses range in size from 70 acres to more than 550,000 acres, although the average size of most campuses is approximately 700 acres (UCB has 786 acres). While many are located near the coasts, several projects are located in the country's interior, including five other projects in Colorado (Colorado State University, Fort Carson, FortZED, GEOS, and Stapleton).

UCB falls within the EPA's climate region 1, along with six other projects: College of the Atlantic, Colorado State University, FortZED, GEOS, Stapleton, and the University of New Hampshire. Nearly half of the remaining projects fall within region 2, but there are a comparable number of projects in region 3.

In terms of heating and cooling degree days, UCB is most similar to these interior projects. The heating degree days for these projects are all over 6,000 while the average for all the projects is 4,713. Cooling degree days for UCB are slightly below the average.



EPA ENERGY STAR regions.

Source: <http://www.energystar.gov/>.

Average annual rainfall for all the projects is 27.3 inches and the median is 19.6 inches. The maximum of 51 inches is Emory University; the minimum of 3.7 inches is Masdar City in the UAE. With 18.9 inches annually, UCB is below average, but not far off the median amount. It is most similar to the other Colorado projects, as well as those located in California: Google, Los Angeles Community College District, the University of California at Los Angeles, and Village Homes.

Based on the EPA's eGRID data on state energy sources, Colorado projects receive 71.7 percent of purchased energy from coal. The only projects with a higher amount of energy from coal are Kansas State University (75.2 percent) and Oberlin College (87.2 percent). Other major sources of energy generation are gas, particularly in California and New Hampshire. Roughly half of the projects receive more than 10 percent of their purchased energy from nuclear energy. Projects in California, Maine, New York, and Washington are able to take advantage of hydro power. New York provides the most evenly distributed portfolio of energy sourcing.

Based on data from NREL's PV Watts program, the average cost of energy (cents/kWh) is 9.7, while the median is 8.7, the minimum is 6.9 (Microsoft) and the maximum is 13.3 (University of New Hampshire). Colorado's rate is 8.5 cents/kWh and so is somewhat less than average.

Every project in the study has installed some type of renewable energy. Many are purchasing renewable energy credits (RECs) for wind energy, although a few, such as Fort Carson and Colorado State University, have wind farms planned so they can produce their own wind energy instead of buying RECs. Almost every project has included solar installations. Other projects have targeted geothermal (five projects), wind (four projects), and biomass (two projects), while

some projects are taking more innovative routes. For example, College of the Atlantic is taking advantage of abundant local biomass (wood pellets) in their approach to renewable energy production. The University of Nebraska has committed to purchasing a large amount of their energy from hydro and installing some geothermal heat pumps. The University of New Hampshire is taking advantage of methane from a near-by landfill to produce much of their energy.

Colorado is close to average in solar availability – 5.5 kWh/m²/day as compared to the average of 5.0 kWh/m²/day. The Microsoft campus in Redmond, WA has the lowest solar availability at 3.7 kWh/m²/day while Arizona State University has the best availability at 6.3 kWh/m²/day.

Green building practices are in use at all the projects. Out of 23 projects, 17 require some level of LEED certification while the remaining projects are using other practices, such as ENERGY STAR® or super-insulation. It should be noted that it is primarily the residential projects in the study that are using green building practices other than LEED. GEOS, for example, is designing net zero energy buildings (NZEBS), while Masdar City is using designs suited specifically for their hot, arid climate. FortZED is the only project that does not specifically address green building standards, although they are retrofitting existing buildings for energy efficiency. UCB's policy of building to LEED Gold + (LEED Gold standards with extra points obtained in energy) is the highest standard mentioned with the exception of Fort Carson, which has a goal of obtaining LEED Platinum.

Local food production is also quite common among the projects in the study, with more than half of the projects addressing the issue. Approximately 40 percent of the projects had policies that specified that a percentage of their food budget be used to purchase local, organic or sustainably grown foods. Four projects had programs to grow food



on the campus, while another four had both purchasing policies and on-site food production. The residential and corporate projects, with the exception of Google, did not have specific policies dealing with the purchase or production of food. It should be noted that there is likely more overlap than is indicated here due to difficulties in obtaining this information.

Water management policies are largely an issue of the project's location – those that are located in arid climates are more likely to face restrictions on water use. However, nearly three-quarters of the projects have addressed water management issues in response to overarching policies regarding sustainability. Most of the projects that do have some policy in place are addressing landscape irrigation. Other projects have innovative stormwater management incorporated into the project's design.

Economy

UCB has the seventh largest endowment of the higher education projects in the study. Harvard University and Yale University, both of which are private, Ivy League schools, have large endowments in the billions of dollars, while College of the Atlantic, the smallest school in the study, has the smallest endowment of \$15 million.

It is difficult to compare municipal budgets due in large part to the differences in population among the cities. New York City, for an example, has an annual budget in excess of \$60 billion, while smaller towns such as Durham, NH have budgets less than \$15 million. To provide a better comparison, we have provided a category for municipal budget per capita, from which it is easier to compare the relative wealth of each municipality. The average budget per capita is \$3,706, still inflated by some of the larger cities like New York. The City of Boulder falls exactly on the median with a municipal budget of \$2,667 per capita.

Larger municipalities, such as New York and Los Angeles, have higher rates of unemployment. Boulder has one of the lower rates of unemployment at 4.2, below average for the projects in the study. At the same time, Boulder has a higher than average median income – \$66,000 in comparison to \$60,000. Redmond, WA, home of the Microsoft campus, has the highest median income at \$87,000 and Manhattan, KS (Kansas State University) has the lowest median income at \$40,000. These numbers do not take into account any type of cost of living metric.

Social

UCB is slightly larger than average campus, with approximately 38,500 faculty, staff, and students. There is a great variety in the size and type of campus community. Projects range in size from 400 people (College of the Atlantic) to 121,000 people (Los Angeles Community College District). Boulder is one of the smaller cities in the study, with approximately 91,000 residents, compared to the average municipal population of approximately 845,000 residents. This includes large cities, such as Los Angeles and New York, as well as small towns like Bar Harbor and Oberlin.



The size of the municipality plays a substantial role in determining the characteristics of the community – from small college towns to suburbs to large urban campuses. This can also impact the amount of influence a project can have on the surrounding area. The University of New Hampshire, for example, has a larger population than the city of Durham in which it is located, indicating that the economic and social well-being of both communities are inextricably tied together.

All of the institutes of higher education have community outreach programs of various sorts that connect the many resources of the university with the community. Many focus on service learning opportunities that connect students with local communities. Several schools have

programs that support local agriculture or food pantries; others have programs to support local entrepreneurs.

Regional planning efforts are often not included on project websites, although many transportation initiatives are regional in nature. FortZED is a regional effort to promote zero energy goals (see the description of FortZED, page 14). To gain a better understanding of these initiatives, further research is needed.

Almost every project in the study has a program to promote alternative forms of transportation. Residential projects are not likely to provide incentives, but can incorporate design elements such as narrow streets and bike paths that discourage motor traffic. Because academic campuses that have signed the ACUPCC must find ways to reduce emissions from transportation sources, all the universities in this study are implementing programs to reduce the number of vehicle miles traveled (VMTs). These efforts are not limited to academic institutions, however, as evidenced by Microsoft's shuttle program. Bike programs are the most popular, and include bike shares, free rentals, or low-cost rentals. Just under half of the projects have access to a local transit system, such as buses, subways, and shuttles, and eight projects have instituted some type of pass program. Many campuses support carpooling through incentives like preferred parking spaces, as well as car share programs like ZipCar.



Campus Summaries

The following sections provides a summary of each project, including a brief description of the campus and a brief overview of the innovative practices.

Arizona State University

About the Campus

Arizona State University (ASU) is located in the metropolitan Phoenix area, with four campuses in Tempe, Phoenix and Mesa.

ASU is recognized as a leader in campus sustainability. ASU was ranked 13th in the 2009 Sierra Club's "Cool Schools" list and received a grade of A- from the 2010 College Sustainability Report Card. Support for environmental activities, sustainable development and local economies are incorporated into their Five-Year Strategic Plan for 2010–2014.



Lessons for UCB

Energy

ASU's recently completed Energy Conservation Project resulted in a savings of 53 million kilowatt hours of electricity per year and reduced demand by 13 megawatts. The project focused on campus infrastructure, such as lighting systems, HVAC systems, updating system controls and insulating pipes. They have also created an online monitoring tool – Campus Metabolism – that allows users to see real-time usage data for electricity, heating and cooling energy, and the amount of renewable energy being generated.

In addition, ASU is taking advantage of their sunny location by installing a 30 kW photovoltaic system on the roof of a parking garage. This system not only provides a source of electricity generation, it also provides a shade cover for the cars. ASU has plans for over 300,000 square feet of campus roof tops with solar systems.

Local Food Production

The Campus Grown Foods Program has been designed to take advantage of the many fruit trees and herbs grown on campus. The program is still in its nascent stages, with only one facility using this produce, but the ground services department will also benefit from a reduction in its waste volume.

In addition to supporting its own food production, ASU is also supporting local food production. The "Serving Sustainability to Sun Devils Award" recognizes local restaurants and food vendors that are reducing waste, saving energy, and implementing sustainable strategies in their businesses.

College of the Atlantic

About the Campus

Located in Bar Harbor, Maine, College of the Atlantic (COA) is a small, close-knit community of about 400 people. COA has a long history of environmental stewardship, being instrumental in introducing Maine's bottle bill (residents can redeem cans and bottles for a small deposit) and establishing a recycling center on Bar Harbor Island.



COA ranked 5th in the 2009 Sierra Club's "Cool Schools" report, and received a grade of A- from the 2010 College Sustainability Report Card. In 2007, COA was designated as the greenest of all colleges in the world by Grist.com.

Lessons for UCB

Carbon Neutrality

In 2007, COA became the nation's first carbon neutral college. They achieved this accomplishment by purchasing hydro-electric power, utilizing a wood pellet boiler for heat and hot water, installing a wind turbine, and purchasing offsets. New buildings use passive solar strategies and reduce energy loss through super-insulation. A conservation campaign has reduced energy use and minimized loss from existing buildings. The campus installed a heat recovery system in the kitchen hoods.

COA has further made a commitment to use only renewable energy by 2015. COA's electricity is currently obtained from low-flow hydroelectric projects in Maine. Heating energy is being shifted to biomass, primarily wood pellet boilers. COA recognizes that transportation fuels will be a major challenge, as neither the campus nor the community has a public transportation option.

Colorado State University

About the Campus

Colorado State University (CSU) is located in Fort Collins, Colorado. The area has historically been agriculturally-oriented, with both farming and livestock. CSU keeps this tradition alive as the state's land grant university.



CSU placed second in the 2009 RecycleMania competition, and is a signatory of the President's Climate Commitment, setting a goal to be carbon neutral by 2015.

Lessons for UCB

Community Involvement

CSU has partnered with a number of local and state organizations to support sustainability. Working with the U.S. Green Building Council's Colorado chapter, CSU has assisted in developing LEED products and resources. CSU has also partnered with the EPA *ENERGY STAR*® Program to develop building standards and has worked with the Governor's Energy Office in developing a green mortgage program.

Other local partnerships include the Northern Colorado Clean Energy Cluster, an organization that supports collaboration between energy entrepreneurs, technical experts, and local governments; and Climate Wise, a municipal initiative that helps local business address issues of sustainability in their operations.

Transportation

CSU supports the local public transportation system with passes for students, faculty, and staff, and also promotes carpooling through incentives such as preferential parking spaces. The campus also provides a free bike rental program. Most innovative, however, is CSU's strategy to promote a more pedestrian and bike friendly campus by relocating parking to the outer edges of campus.

Carbon Neutrality

CSU has undertaken many measures to reduce energy use on campus and to improve energy efficiency. Some of the larger projects include a wood pellet biomass boiler for heating and installing 31 kW of photovoltaic panels. The campus has made a commitment to developing renewable energy as part of their strategy, including additional solar installations, as well as additional improvements in efficiency in existing buildings.

Emory University

About the Campus

Emory University is located in the suburbs of Atlanta, Georgia and is known for its strong liberal arts curriculum and medical school. Emory has a strong commitment to sustainability, recognized by the Princeton Review, the Urban Land Institute Atlanta District Council, the Georgia Recycling Coalition and the Georgia Conservancy.



Emory has set a number of sustainability goals related to energy use, water, and food production. These goals provide deadlines and quantifiable goals that support the Emory's overall sustainability initiatives.

Lessons for UCB

Local Food Production

Emory has set a goal of obtaining 75 percent of the food served in the hospitals and school cafeterias from locally and sustainably grown foods. To accomplish this goal, the Sustainable Food Committee developed purchasing guidelines regulating 10 categories of food purchases. "Local" is defined in two tiers: farms within Georgia in the first tier, with the second tier consisting of seven states in the Southeast. In addition, Emory has created a number of small educational gardens throughout its campus and supports a local farmers' market on campus.

Energy Efficiency

Emory aims to reduce energy use by 25 percent per square foot by 2015 through a combination of operational and behavioral programs. Operational programs involve analyzing the campus to determine how to create closed system loops, retrofitting existing buildings, utilizing new technologies and constructing new buildings using LEED guidelines. Behavioral programs are designed to encourage energy-saving habits, such as turning off lights and equipment, as well as engaging learning opportunities during and after construction.

Transportation

Emory has committed to getting more cars off the road and supporting flexible work schedules to reduce vehicle miles traveled. Emory currently offers passes for the public bus system, supplemented with their own shuttle system. There are also plans to establish park-n-ride centers throughout the Atlanta metro areas to further promote ridership.

Evergreen State College



About the Campus

Evergreen State College (ESC) is located on the outskirts of Olympia, Washington. The city was recognized by the Environmental Protection Agency as one of the “Best Workplaces for Commuters” in 2008.

Evergreen is a major center for higher education in the region, and is becoming well-known for its sustainable practices. It was ranked 6th in the Sierra Club’s “Cool Schools” report, and helped to pilot the STARS program, a metrics-based system to compare sustainability on academic campuses.

Lessons for UCB

Campus Master Plan

ESC has incorporated sustainability into both its strategic plan and its campus master plan. The master plan is influenced by three primary foci: sustainability, learning, and community. The plan calls for education centers in the campus core, a stormwater monitoring facility, green building practices, residential buildings to help build community, energy production, and consideration of transportation patterns.

Carbon Neutrality

ESC’s Climate Action Plan includes many initiatives focused on improving energy efficiency and reducing waste on campus. Reducing ESC’s reliance on fossil fuels comes in part from purchasing green energy credits, but ESC is also looking into a biomass gasification plant for heating on campus. They are most interested in Middlebury College’s plant in Vermont because it combines educational opportunities for students and the community.

Local Food Production

Residential and Dining Services at ESC strives to create a community that values, cultivates, and maintains its human, natural, and physical resources. The Edible Forest Gardens project has created multi-level gardens designed to mimic a natural ecosystem. The campus also has a small number of raised kitchen beds at a sustainably oriented residential building.

In addition, Evergreen Dining Services – run by Aramark – has a goal of purchasing 40 percent of their food from local and/or organic sources by 2010. Supporting this initiative is The Evergreen Organic Farm, located on campus and run by students. Dining Services has also switched all of its disposable ware to compostable items.

Fort Carson

About the Campus

Fort Carson is a U.S. Army base located just south of Colorado Springs, and was established in 1942. There are currently 19,000 active duty personnel on-site with planned growth to 30,000 personnel by 2011.



Lessons for UCB

Sustainability Goals

In 2002, Fort Carson established twelve 25-year Sustainability Goals, initiating a on-going series of sustainability actions. These goals are broken down to 5-year goals and 2-year work plans, implemented through the Sustainability and Environmental Management System (SEMS). Its 2007 strategic plan establishes sustainability as one of five strategic goals. This creates an atmosphere of mainstreaming sustainability goals and distributing sustainability leadership.

Fort Carson has two challenges applicable to UCB. First, there is a planned 36 percent increase in population within a defined space in the next few years. Thus, the base will face housing and new construction challenges, while meeting their sustainability goals. As part of this planned growth, Fort Carson will increase vertical space use, increase usable space per acre and construct buildings closer together.

Secondly, the Army has “lowest cost” directives for buildings and infrastructure construction. While Fort Carson is now allowed an additional 2 percent per square foot costs to achieve sustainable design, they are still working within the demands of a constrained budget.

Community Involvement

A large part of Fort Carson’s sustainability strategy is business, non-profit, and government partnerships with the surrounding communities. Fort Carson holds monthly community meetings in addition to annual reporting and a yearly regional sustainability conference. They are currently developing the Southern Colorado Sustainable Communities Partnership which will include multiple stakeholders to provide sustainable education in its three adjacent counties: El Paso, Pueblo and Fremont.

Waste Management

Since many of the goals are only now being implemented, they have yet to be realized. A few activities should be closely monitored for applicability to UCB in the coming years. First, Fort Carson has a goal of Zero Waste by 2027, which includes solid, hazardous, and wastewater. To achieve this, Fort Carson has a number of initiatives that include building deconstruction procedures, setting aside space for fill that can be reused and reduction of hazardous waste generation.

Fort ZED

About the Campus

Located in Fort Collins, Colorado, Fort ZED (Zero Energy District) is a CSU demonstration project to study energy strategies and technologies to achieve net zero energy goals. The area of study provides energy to 7,000 utility customers.

Lessons for UCB

Energy

Fort ZED's goal is to produce all energy (200,000 megawatt hours per year) needed by program participants within a 50-mile radius. This represents about 10-15 percent of the Fort Collins Utilities distribution system. New smart grid technologies will allow integration and coordination of multiple energy sources, including various types of renewable energy generation, vehicle-to-grid vehicles and managing customers' energy demands.

Another critical component is energy efficiency to reduce overall energy demand by 20-30 percent. The focus is retrofits and upgrades of public buildings, including a pool and ice center. Fort ZED has many community programs planned as well. Last year, it launched a Green Restaurants program to help local restaurants reduce energy use.

Community Involvement

Fort ZED takes advantage of the area's thriving clean tech industry, providing a site for demonstration projects and potential commercialization of technologies. The City of Fort Collins has focused on clean energy technology as a strategy for growth, and the city-owned utility allows for control and support of the project. These partnerships not only allow for the expertise needed, but provided matching funds for the project and a collaborative atmosphere that helped the U.S. Department of Energy choose it as one of nine smart grid demonstration projects.



GEOS Neighborhood

About the Campus

The GEOS Neighborhood is a master planned sustainable community located on 25 acres in Arvada, Colorado. When completed, it will have 250 new homes, ranging between 860-3,683 square feet.



Lessons for UCB

Energy

The GEOS Neighborhood is a new, mixed-use planned community with an environmental ethos at its core. It features diverse options for homes (single family, live/work condos, townhomes, and co-housing) in a variety of price ranges and neighborhood layouts. The master plan also allows for accessible green space, trails, and parks for the entire community.

The most distinct feature of GEOS is its Net Zero Energy commitment, with demand met through solar (1.3 MW PV system) and geothermal energy (5,000,000 BTU), as well as built-in efficiency measures, including “passive house” features, optimal orientation and density for passive solar, superinsulation, and heat recovery systems. All homes are net metered and include an energy monitoring system.

Stormwater Management

The GEOS plan calls for an advanced stormwater management system to manage for 100-year floods. Instead of the traditionally large detention basins, GEOS has chosen a strategy of decentralizing the diversion system, using localized systems to reduce the need for a large storm sewer system. These strategies include: rain gardens that line each street to reduce the volume and concentration of rainwater and snow water while irrigating streetscapes, neighborhood parks that act as stormwater detention basins (rainwater is diverted to parks by drains), and local rain gardens on each parcel. The remaining stormwater is released slowly over 24 hours.

Google Headquarters Campus

About the Campus

The headquarters of Google is on a 26-acre, 20-plus building corporate campus located in Mountain View, California. This campus currently hosts 8,000 employees.



Lessons for UCB

Carbon Neutrality

Google pledged to become carbon neutral by 2007 and has accomplished this in part through installing 9,200 solar arrays (1.6 MW) on its roofs, meeting 30 percent of its peak electricity demand, and will install an additional 50 MW of renewable energy by 2012. When purchasing power, Google uses a “shadow price” for carbon, presumably to prepare for a carbon market in the U.S. in the near future.

Transportation

Google offers many alternative transportation options, including a Wi-Fi enabled bio-diesel shuttle from the Bay Area, a free car-sharing program with plug-in hybrids, a community bicycle program and additional incentives for human-powered transportation. Employees accumulate dollars they can then donate to their favorite charity.

Data Center Efficiencies

Google focuses on efficiency in design and reduced energy use in cooling, which can be the largest percentage of energy use in the data center. Design features include having enough space between servers to allow cool air to flow through, accessing cool outdoor air when available and running the data centers hotter than normal, at 80 degrees Fahrenheit. Google’s data centers use water evaporation through water towers, which allows them to take advantage of “free cooling” when the chillers are off.

Another efficiency strategy is moving from large, site-based distributed backup power systems to a battery-based uninterruptible power system (UPS) on each server. This “eliminates wastage as UPS capacity is matched to the number of servers and avoids unnecessary current conversion by typical UPS solutions. The Google server also features a 12-volt motherboard, which further minimizes power conversion of the components” (Chan, 2009).

Above all, Google advocates measuring the efficiency of the data center in order to understand where to best target efficiency activities. Using Power Usage Effectiveness (PUE), a unit created by the non-profit green tech organization Green Grid, each data center can measure its efficiency. The PUE is a ratio energy use between facilities and IT processing; a PUE close to 1 indicates high efficiency between energy use for cooling and energy use for IT itself. PUE is not a comparative number, but is the first step in identifying opportunities for improvement in one’s own data center.

Harvard University

About the Campus

Harvard University is one of many schools located in the Boston-Cambridge area. Over the past decade, Harvard has been making a name for itself as a result of its measures to promote sustainability. It was ranked 11th on the 2009 Sierra Club's "Cool Schools" list, and received an overall grade of A- from the 2010 College Sustainability Report Card.



Lessons for UCB

Green Building

To promote green building practices on campus, Harvard has developed Green Building Guidelines for all capital building projects, differentiated between those under or over \$5 million in cost. The guidelines specify LEED Silver certification, stipulating the inclusion of certain credits related to energy, indoor air quality and electrical use metering. The guidelines also call for life cycle cost analysis throughout the project, an inclusive team approach for design and ongoing commissioning for the life of the project.

In addition, the Existing Building Commissioning process analyzes the operation and performance of the engineering systems of existing buildings. A detailed report is generated that identifies energy saving projects, costs, simple payback and the potential energy savings related to each project. This list is then used to prioritize building renovations to improve energy efficiency in these older buildings.

Green Campus Loan Program

Harvard has a \$12 million revolving loan fund to support projects that promote sustainability on campus. Loans are repaid from the savings achieved by the project, such as energy consumption, waste reduction, or operating costs, and are expected to have a payback period of 5–10 years. To date, over 150 projects have been funded, achieving over \$4 million in savings for the campus.

Kansas State University

About the Campus

Kansas State University (K-State) is located in Manhattan, Kansas – a typical college town in the northeast portion of the state. K-State is the nation's first land grant institution with a strong and historic focus in agriculture, and is in the Big 12 conference.



K-State has recently undertaken a campaign to increase its sustainability initiatives. K-State received a grade of C- from the 2010 Sustainability Report Card, but has been making significant strides since 2006 in creating programs and initiatives.

Lessons for UCB

Community Involvement

K-State has a number of outreach programs that bring together university members, local citizens and organizations to create an environment that supports sustainability. These efforts promote collaborative research and educational outreach opportunities in such areas as agriculture, technology, renewable energy, transportation and adaptive reuse.

The Center for Engagement and Community Development takes advantage of university expertise and resources to address issues in the community. One such initiative is Rural Grocery Store Sustainability, which focuses on food availability in rural areas where many small grocery stores are closing due to economic hardship.

Los Angeles Community College District

About the Campus

Los Angeles Community College District (LACCD) is comprised of nine campus located throughout Los Angeles, the second largest metropolitan area in the United States. LACCD is the largest community college district in the U.S. and primarily serves older students.

LACCD has garnered a great deal of interest in sustainability circles as it undertakes a massive green building project. LACCD recently received an average grade of C- for all its campuses in the 2010 Sustainability Report Card.

Lessons for CU Boulder

Green Building

LACCD Sustainable Building Program is one of the largest green building projects in the United States, with over 90 buildings planned. Buildings are being designed and built to LEED certification standards, although no level is specified. However, several buildings have achieved Gold-level ratings. In addition to new construction, LACCD is also addressing existing buildings with efficiency retrofits.

The \$6 billion in funding for this massive project comes primarily from local bond measures approved by the voting public. The project serves to update, improve and expand the ability of LACCD to meet the requirements of its constituents. The Sustainable Building Program provides a unique opportunity for green collar jobs training and is providing a significant boost to the region's economy in part because of the scale of the project and also because local contractors are used as much as possible.

Energy

In reference to LACCD's ambitious goal of achieving energy independence, Larry Eisenberg, executive director of facilities planning and development, said "Unless you set an ambitious goal, you don't make progress." While it plans to remain connected to the grid, LACCD has several energy projects lined up. A solar farm is one such project, with more than a thousand solar panels over nearly 17,000 square feet that will result in energy savings of approximately \$80,000 a year.



Masdar City

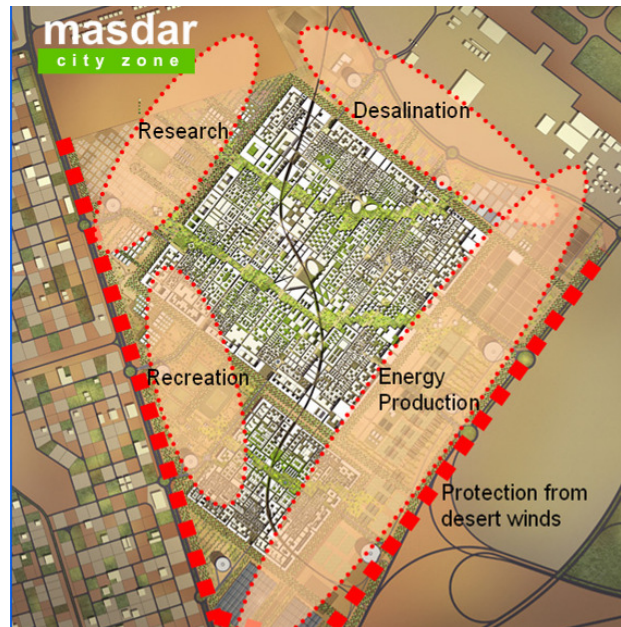
About the Campus

As part of the city of Abu Dhabi, UAE, this ambitious planned community is projected to host 60,000 employees/commuters and 45,000-50,000 residents in a 2.3 square mile area.

Lessons for UCB

Carbon Neutrality

When finished, Masdar City will be a carbon neutral, zero waste city, powered solely through renewable energy. This includes a 40-60 MW solar power plant, 130 MW solar PV on roof tops, geothermal, a 20 MW wind farm, and a hydrogen power plant. The growth of the city is planned in several stages, and energy production is planned to grow accordingly. Masdar City will include a solar-powered desalination plant and 80 percent recycled wastewater. Waste that cannot be recycled will be converted into energy.



City planners have taken design elements from ancient Arabic cities to reduce energy use. Diagonal, narrow streets, a perimeter wall (to keep out the hot desert wind) and shaded walks will reduce the need for air-conditioning, and allow for cool breezes to flow through buildings.

The first phase of Masdar City is underway, with Masdar Institute of Science and Technology, a new research facility, open on September 2009. Officials see Masdar City as being a place for demonstrating new technologies, driving research and providing the clean tech industry a new place to develop.

Transportation

Masdar City is a car-free, walkable city built around several public squares. Personal Rapid Transport systems (PRTs), solar-powered, driver-less cars running underground, are also available. The PRTs can be set to one of 85 stations in the city. Light Rail Transit will connect Masdar City with the rest of Abu Dhabi and the airport.

Microsoft Headquarters Campus

About the Campus

The headquarters of the Microsoft Corporation is located in Redmond, Washington, on a campus nearly 400 acres in size. The campus currently hosts 40,000 employees in 70 buildings.

In addition to the sustainability policies that drive their products and business, Microsoft is striving to lead the way in sustainability practices in their own operations. This includes renewable energy production and purchase, following LEED Silver building guidelines and robust printing and recycling programs on campus. Microsoft is working to design and build more energy efficient data centers, with its Dublin data center cooled with outside air.



Lessons for UCB

Transportation

Microsoft has focused much of its sustainability work on alternative transportation, after congestion woes attracted the attention and ire of the city government. Microsoft has taken multiple steps to reduce single-occupancy vehicle commuting to its campus. Most significantly, Microsoft runs its own private bus service, which offers free service in the mornings and evenings to residential neighborhoods. Public transportation options are encouraged through free passes and coupons. Biking, walking and carpooling are widely supported through many incentive programs (cash, prizes, and awards) and assistance programs (carpooling coordination, bike tune-ups, showers and lockers). Free on-campus hybrid shuttles connect employees to campus buildings. Finally, the Guaranteed Ride Home program offers staff six free cab rides each year for unexpected events on days when they use alternative transportation to get to work. These policies are offered not only to full-time employees, but also to contractors, vendors, and interns. These activities have brought Microsoft recognition as one of the best places to work for commuters by the EPA (2006).

Green Cafeteria

Microsoft recently worked with the Green Restaurant Association to implement green practices in their 35 cafeterias. This includes switching from Styrofoam to compostable dishware and utensils, upgrading to more efficient kitchen appliances and systems (exhaust, low-flow faucets and steam capture from dish machines to heat incoming water) and composting food waste. Finally, training kitchen staff to reduce food portions (thus reducing food waste) and educating diners about green practices have led to behavioral changes on both sides.

New York University

About the Campus

New York University (NYU) is located in New York, New York, centered around Washington Square and Union Square. It is the largest private university in the U.S. with more than 40,000 students and 14 schools and colleges. NYU is in the top 20 of the 2009 Sierra Club's "Cool Schools" list and received a grade of B from the College Sustainability Report Card.



Lessons for UCB

Local Food Production

NYU is taking part in a national pilot of the FoodPrint program. The project is designed to measure the carbon footprint of purchased food using detailed invoices and a comprehensive calculator. This information can then be used by administrators to make more informed decisions about their food purchases.

NYU has been piloting sustainable initiatives in its Hayden Dining Hall since 2007. Purchasing food from local, organic and sustainable sources, including 50 percent of baked goods, 40 percent of seafood, and 39 percent of dairy products. They have also switched to biodegradable to-go containers, reduced pre-consumer food waste and implemented recycling and composting of food waste.

Water Conservation

NYU's Green Grants program provides financial resources to support student and faculty research into sustainability initiatives. One project currently underway is a pilot of the AQUUS system, which reuses sink water to flush toilets. The system was installed in three bathrooms. The project not only helps reduce water consumption, but provides an excellent educational opportunity for students and residents.

Oberlin College

About the Campus

Oberlin College is located in Oberlin, Ohio, a small college town south of Cleveland. Oberlin is nationally recognized as a leader in sustainability. It received an A- from the 2010 College Sustainability Report Card, and is ranked 10th on the Sierra Club's "Cool Schools" list.



Lessons for UCB

Community Involvement

Oberlin values shared experiences and has several programs that bring together town and gown. The Campus Dialogue Center serves to resolve conflicts, while the "Experimental College" provides a unique learning experience where anyone can teach or take a class. There are also programs to support entrepreneurship and service learning experiences.

Oberlin is currently developing The Oberlin College and Community Green Arts District. This is a downtown redevelopment project that would incorporate green design, energy conservation and water treatment. Energy could come from the methane of a local landfill. Planned projects include an art library, classroom space, a hotel, conference center and retail space. The District would promote economic development and encourage community involvement.

Water Conservation

Oberlin's Adam Joseph Lewis Center for Environmental Studies was built to be a leader in green building design. The most innovative feature is the Living Machine, a wastewater treatment system that combines engineered water treatment systems with wetland ecosystem processes. Treated water is used in building systems and landscaping. The system also provides numerous learning opportunities for students and the community.

The Presidio

About the Campus

Located in San Francisco, California, The Presidio is a unique, 1,500 acre former military installation now transferred to the National Park Service. The area boasts nature preserve areas, historic, cultural, and environmental education centers, and leasing of buildings to private and non-profit residents. The campus hosts 2,500 employees and 2,700 residents and manages 800 buildings.



As a financially self-sufficient National Park, The Presidio encompasses a city-like campus that combines public natural areas, historic buildings, office space for the Trust and private organizations, and residencies (1,100 housing units). Residents include museums, academic institutions, the Thoreau Center for Sustainability, LucasFilm and the Tides Foundation.

Lessons for UCB

Sustainability Goals

The unique nature of this campus allows for opportunities to advance sustainable practices and policies and to develop partnerships with their tenants. Specifically, The Presidio has worked with the Federal Energy Management Program of the U.S. Department of Energy to create a sustainability plan, and has partnered with the San Francisco Conservation Corps, various local youth groups and the city of San Francisco for multiple sustainability efforts.

Green building guidelines are based on LEED but are specifically designed for historic buildings with an emphasis on recycled and sustainable materials and fixtures (new buildings are LEED Gold). Energy use is managed through solar PV incorporated directly into buildings and individual building energy management systems. The Presidio runs a free clean fuel shuttle, and all tenants are required to take part in the Transportation Demand Management program to increase the use of alternative transportation.

Waste Management

One of the unique ways that The Presidio reduces waste and fertilizer at the same time is through a closed loop cycle with their composting and regeneration program and their integrated pest management (IPM) program. Plant and animal waste is processed on site, and compost products are used in landscaping and reforestation efforts. Most significantly, the “compost tea” (a liquid product from the composting process) is used as fertilizer sprayed on The Presidio golf course. This practice has allowed the golf course to use 75 percent less pesticide than neighboring golf courses. Because of the nature preserve activities on campus, The Presidio is barred from using pesticides that are harmful to either people or the wildlife that resides at the park. Thus, the IPM program is necessary to control both indoor and outdoor pests, and more than half of indoor pest control requests are handled without chemicals.

Stapleton Community

About the Campus

Built on the former airport property in Denver, Stapleton is a planned, mixed-use community with a sustainable design. When completed, Stapleton will host 35,000 workers and 30,000 residents and include 12,000 homes (8,000 single family, 400 rental) on its 4,700 acres.



Lessons for UCB

Campus Master Plan

Stapleton encompasses a variety of residential properties, retail, commercial office space and natural areas in town center configurations. Alternative transportation is encouraged, and Stapleton will be linked to a light rail line in 2014. Homes meet *ENERGY STAR*® standards; office buildings meet LEED guidelines. Former airport runways are being recycled into sidewalks, roads and bike paths in the region.

Preservation of natural areas is vital to Stapleton's master plan, with 30 percent of land dedicated to open space. Neighborhoods are connected by greenways, and trail systems and parks are incorporated into the community. Natural areas include Bluff Lake and two creek corridors and are recreation-focused, meant to link residents to the natural environments. Trails are built using recycled concrete from the old airport's runways.

Stormwater Management

The irrigation system includes solar powered controls which are centrally managed and weather sensitive, using recycled water. Stormwater is routed to "constructed wetlands" rather than underground culverts, increasing runoff water quality and reducing flooding and erosion in Westerly Creek or Sand Creek. Other water management measures include native plants, sand-based filtration areas and elimination of curbs for natural flow and drainage.

Energy Efficiency

Public lighting in Stapleton balances the need to provide safety in a walkable community while reducing energy use by inefficient lighting. Lighting design incorporates durability and increased efficiency to reduce maintenance requirements. Lower wattages reduce "disability glare," and lighting studies inform decisions about placement of lights. Full cut-off light fixtures address Dark Sky issues. So far, efforts have reduced lighting needs at least 10 percent in retail areas.

University of California, Los Angeles

About the Campus

University of California, Los Angeles (UCLA) is one of ten campuses associated with the University of California system. It has the largest population of the UC campuses, but the smallest campus. UCLA is widely respected as a top research university, but is also earning a reputation for its sustainability initiatives. The campus ranks 8th in the 2009 Sierra Club's "Cool Schools" list, and earned a grade of B from the 2010 College Sustainability Report Card.



Lessons for UCB

Green Building

Capital projects are designed to LEED Certified standards, but are expected to achieve Silver or higher ratings whenever possible. In addition, buildings are to outperform California's energy efficiency standards by at least 20 percent. Recognizing the value of its laboratories for supporting research, as well as the heavy energy burden associated with these labs, UCLA uses the *Laboratories for the 21st Century (Labs21) Environmental Performance Criteria (EPC)* guidelines to improve energy efficiency and reduce energy consumption in these facilities. UCLA created the Laboratory Energy Efficiency Program (LEEP) that promotes energy saving behaviors and green purchasing guidelines.

Energy

As much as possible, purchased energy will be through green power credits from local utilities. The UC system has also chosen to follow the California Renewable Portfolio Standard, which requires that 20 percent of energy be procured from renewable sources by 2017. To this end, UC has a goal of producing 10 megawatts of energy through renewable sources by 2014. To accomplish this goal, UCLA is developing funding sources and financing options, including the sale of emissions credits.

UCLA's warm climate calls for significant energy use for cooling. To address this concern, UCLA has committed over \$16 million to upgrade its older HVAC systems. These upgrades have resulted in a savings of \$4.2 million in annual operating costs and have reduced its carbon emissions by 17,000 tons. UCLA also invested in a thermal energy storage tank that takes advantage of cheaper energy rates at night to make chilled water that is used for cooling during the day.

Water Conservation

UCLA collects water from air conditioning systems, laboratory equipment and other non-contaminating sources for use in the water cooling tower on campus.

University of Nebraska, Lincoln

About the Campus

The University of Nebraska, Lincoln (UNL) is the state's flagship campus located in the state's capital city and is in the Big 12 conference. UNL has recently instituted a comprehensive sustainability plan that incorporates transportation, purchasing, food production, landscaping and construction. The campus received a grade of C+ from the 2010 College Sustainability Report Card.



Lessons for UCB

Local Food Production

UNL's *Good. Fresh. Local.* Program connects local food with campus dining. The program has grown from 25 local producers in 2004 to over 70 in 2009, with more producers wanting to get involved. The program includes an educational component that informs diners about sustainable agricultural practices and its impact on local economies. A meal made entirely from local foods is served monthly, but some local ingredients are used daily.

Community Involvement

To promote local sustainability efforts, UNL hosted the Building Sustainable Partnerships forum that brought together town and gown. The purpose of the event was to create a dialogue about sustainability issues, such as renewable energy, energy efficiency and greenhouse gas emissions.

UNL is also developing the Nebraska Innovation Campus to promote a public/private collaborative environment and economic development. Companies benefit from the research capabilities of the university faculty, student internships and access to shared research facilities and equipment. The Innovation Campus will not only be a model of collaboration, but also sustainability. The project will use green building practices, sustainable landscaping and alternative transportation options with a goal of moving toward net zero energy and carbon neutrality.

University of New Hampshire

About the Campus

Located in Durham, New Hampshire, the University of New Hampshire (UNH) began as a school focused on agriculture and mechanics, one of the nation's early land-grant universities. UNH is also a sea-grant and a space-grant institution. UNH is currently reviewing its strategic plan, which will incorporate principles of sustainability.

UNH was instrumental in developing the Campus Carbon Calculator with the non-profit Clean Air, Cool Planet and has been involved in the pilot phase of the AASHE STARS program. The campus received a grade of A- from the 2010 College Sustainability Report Card and ranked 12th in the Sierra Club's "Cool Schools" ranking.



Lessons for CU Boulder

Green Building

UNH is committed to constructing to a LEED Silver standard, and also follows the EPA ENERGY STAR® guidelines for their residential halls. Renovations follow similar guidelines. All lighting in new construction utilizes energy efficient bulbs, and is transitioning older incandescent fixtures.

Energy

UNH is a signatory of the American College & University President's Climate Commitment, pledging to reduce their greenhouse gas emissions. Because UNH has eschewed purchasing energy credits, achieving significant reductions will necessitate considerable energy efficiency measures and addressing the source of their energy. A majority of its energy will come from landfill gas – up to 85 percent of total campus energy. This and other projects are being financed by the sale of renewable energy credits. Energy efficient projects are focused primarily on lighting retrofits and HVAC controls.

Transportation

UNH has created a framework for managing transportation demand on campus that uses an integrated approach. A recent construction project of the campus' main thoroughfare added bike lanes, bus pullouts and improved lighting. UNH operates a free on-campus shuttle that runs on compressed natural gas, and also an off-campus bus system run on B20 biodiesel that is used by both the campus community and the general public. UNH is also increasing the availability of on-campus housing.

Village Homes

About the Campus

Planned and built in the early 1970's, Village Homes is a sustainable residential community in the city of Davis, CA. It hosts 225 homes and 20 rental units on its 70 acres.

Lessons for UCB

Campus Master Plan

Stemming from its sustainably-focused master plan, a strong environmental ethos permeates the community of Village Homes. Most homes use passive solar designs, with some active solar and solar thermal installations as well. Streets and buildings are oriented to provide natural heating and cooling. Streets are narrow to minimize urban heat island effect and end in cul-de-sacs. Overall, this has discouraged driving and encouraged bike transportation throughout the neighborhood and to the city of Davis.



Above all, the neighbor-shared, environment-focused spaces and opportunities define the community. This includes garden areas, bike paths, and play areas, and most houses face common areas rather than streets. Community-shared amenities make up for small lot sizes and reduce the need to travel elsewhere for entertainment, and property values continue to stay high even during tough economic times.

Village Homes has utilized natural systems to support sustainable goals. As former agricultural land, Village Homes continues to have shared garden belts throughout the community, including vineyards. Fruit and nut trees provide edible landscaping throughout the community. One quarter of the produce consumed by residents is grown at Village Homes.

Water Conservation

Village Homes has also utilized natural systems for water conservation. Above-ground stormwater drains and filtration basins were controversial when initially proposed, but these “natural-looking swales” provide wildlife habitat and necessary flood control. Runoff is channeled into sand pockets instead of diverted into culverts, providing enough water for vegetation. When heavy rains tested the new stormwater system, Village Homes was one of the few areas in Davis that was not flooded.

Yale University Campus

About the Campus

Yale University is an Ivy League research university located in New Haven, Connecticut and the third oldest higher education institution in the United States. The 1,000 acre campus hosts a total population of 19,800 students, faculty, post-docs, and staff in its 439 buildings. Yale received an A- from the 2010 College Sustainability Report Card and ranked 14th in the Sierra Club's "Cool Schools" list.



Lessons for UCB

Energy

Most of the sustainability initiatives at Yale are led by its commitment to reducing greenhouse gas emissions 43 percent below 2005 levels by 2020. In order to do this while meeting growing energy demands, Yale has depended on energy efficiency, renewable energy use and conversion of the central power plant to a co-generation facility. Energy efficiency strategies within existing buildings include HVAC recommissioning, rescheduling of lab hours and replacing windows and lightning systems. Renewable energy includes 500 kW PV, 10 large solar thermal installations, micro-wind turbines, geothermal and fuel cells.

Local Food Production

The Yale Sustainable Food Project combines local, organic food and agriculture into learning, working, and eating experiences of students on campus. The dining system boasts more than 40 percent of its food as being local, sustainable and seasonal for its 12 dining halls (with an increased 7 percent overall dining services budget). The campus operates a small, year-round demonstration farm run by students that yields organic vegetables for the farmer's market and a local restaurant and offers educational opportunities to the Yale and New Haven community. These practical experiences are part of a larger educational component around sustainable agriculture: students may earn a concentration in Sustainable Agriculture through the undergraduate Environmental Studies major.

Green Building

Kroon Hall stands out as the most comprehensive green building on campus. Built as a "beyond" LEED Platinum building by Hopkins Architects, the 58,000 square foot building seeks carbon neutrality (100 KW solar PV, solar thermal, 3 geothermal wells, and passive solar). Building materials, such as the external stone and lumber, were sourced locally, with half of the interior wood paneling sourced from Yale's own forests. A rainwater collection system with surface treatment pond provides water for toilets and irrigation. The adjacent courtyard is actually a green roof, covering the underground delivery system that seeks to reduce pollution and noise to the upper campus.

Recommendations

Community Involvement

UCB has an opportunity to expand its involvement with the Boulder community. The campus could become a learning laboratory for sustainable practices, allowing interested parties to tour facilities and view these initiatives in action. Facilities that can support the needs of both the university and local stakeholders are another way to build town-gown relations. Creating more residential space on campus, thereby freeing up rental space in Boulder, would also prove beneficial for community relations. This space could also accommodate more workforce housing.

Energy and Energy Efficiency

Energy efficiency programs are already well-established on the UCB campus. One challenge is managing older buildings on campus that have historic value. The Presidio has developed renovation standards that address this issue, and may serve as a guideline for UCB buildings.

Another challenge in managing energy use is energy-intensive facilities such as research laboratories. With much of the planned growth on East Campus devoted to improving UCB's research capabilities, this is an issue of particular concern. However, because these buildings will be new construction, UCB has an opportunity to make use of innovative design practices to reduce energy use from the outset (see Green Building below). Google's energy reduction as a result of their data center management is an example of what can be achieved through innovative approaches.

While implementing demand management strategies, UCB should also implement a more aggressive strategy for renewable energy. This is also easier to implement in the design of new buildings, so as to incorporate the proper wiring and facilities during construction. Buildings should be oriented to take advantage of southern exposures, and roof designs should be designed to incorporate space for solar panels, either for electricity or water heating. Financing for such projects can include power purchase agreements (PPAs), with an Energy Service Provider (ESP) or through grants. GEOS was able to negotiate a lower purchase price for solar panels due to the large number they agreed to purchase.

In addition, heating and cooling strategies for the campus should be discussed. As evidenced by the data in the Project Data Sheet (Appendix B), UCB has many more heating degree days than cooling days. Passive solar designs may not be optimal for research facilities, but could be incorporated into residential and office buildings. Biomass boilers and geothermal heat pumps are being used at several campuses to offset emissions.

Green Building

UCB is one of the leaders in green building practices of the projects included in this study. Only three other projects have specified LEED Gold as the building standard, while Fort Carson has a goal for LEED Platinum buildings. The CPCN calls for UCB to use LEED Gold +, which calls for projects to achieve more points in energy efficiency.

However, UCB could go further by pushing for NZEB designs that incorporate a larger amount of energy to be produced on-site. This would be of great benefit in achieving UCB's energy reduction and emissions goals.

Local Food Production

Currently, 17 percent of the food budget is designated for local and organic foods to be incorporated into daily meal preparations in the campus dining halls. Many students are also pushing for a small farm on campus. This could be used to supplement purchased foods, and would also serve as a learning opportunity for the campus and city communities.

Several locations are available for this endeavor. Due to concerns about having family housing located in a flood plain, many are pushing to relocate these facilities, which could then be used for a community garden. East Campus and South Campus also have ample space for such a project. The location should consider accessibility for key stakeholders. The more people who can see and access the farm, the greater the impact the project would have.

Transportation

RTD has consistently ranked high in the nation's public transportation systems, providing the Colorado Front Range with an extensive and reliable bus system. Plans for expanding the light rails system to include a northwest line from Denver to Boulder are currently under review.

As UCB develops East Campus, consideration needs to be given to how this area will be connected to the main campus. While parking is readily available, UCB should consider the impact of increasing parking availability. Improved or increased bus service to this area should be considered. This would also be a good opportunity to promote alternative modes of transportation. The 29th Street Mall provides a good example of how preferred parking spaces can be allocated to promote carpooling, car share programs and preferred vehicles, such as hybrids or flex-fuel vehicles.

It is also important to promote walking and biking access. CSU's plan of moving parking lots to the outer edges of the campus reduces vehicle traffic in the interior and makes it safer for pedestrians and bikers to move about. In addition, the impact of campus growth and traffic in the area should also be considered for the streets surrounding campus. Improvements to pedestrian and bike access to and from East Campus could help in reducing vehicle miles traveled.

Waste Management

UCB has a long history of recycling, and has recently undertaken efforts to improve its composting practices as well. The Green Stampede program at football games has garnered national attention for its comprehensive zero waste strategy. Expanding zero waste to incorporate the entire campus is a major undertaking, but should be considered. The City of Boulder is implementing a waste management plan that calls for diverting 85 percent of its waste away from landfills by 2017. As a member of the Boulder community, UCB should share in this responsibility. To implement such a strategy may call for improvements in the recycling center to handle an increase in recycled materials, as well as other infrastructure improvements to support this goal.

Water Management

UCB is located in an arid climate and should be adapting its water management policies to suit this environment. Western water law and water rights can complicate these strategies, but should not hinder plans to reduce water use on campus. Raw water (also referred to as ditch water) is used for irrigation in some parts of campus, but should be used for all irrigation rather than using treated potable water from the city. Landscaping can use plants adapted to this climate, and where possible, xeriscaping that requires little to no water should be used.

Water reduction projects have already taken place throughout campus, resulting in considerable savings. As new facilities are built, particular attention should be paid to water use, and water saving design elements should be featured as often as possible. This includes water use in research facilities. Closed-loop systems that capture and reuse water should be utilized whenever possible.

Stormwater management strategies, such as bioswales, rain gardens and pocket parks as retention basins should be implemented. GEOS, Stapleton and Village Homes provide good examples of what can be done. These strategies not only provide a means of managing storm water, they also provide green areas that can serve as natural habitats. Having such natural areas on campus allows people to enjoy the scenery and introduces aspects of biophilia to the project.

Appendices

Appendix A: Environmental, Economic and Social Factors

Appendix B: Project Data Sheet

Appendix A: Environmental, Economic and Social Factors

Environment, Economic and Social Factors

The first phase of the CU Boulder Net Zero Energy Campus Master Plan (NZE Plan) is to research exemplar planning projects in order to identify key strategies, policies and elements of successful projects. Exemplar projects will be identified among institutions of higher education, corporate campuses and residential projects. As these projects will vary significantly in location, it will be important to have some means of evaluating how these projects in relation to the conditions in Boulder.

The project matrix has a worksheet for each category in order to record data for each criteria and to identify exemplary features on each project. The matrix is not meant to be exhaustive by any means, but should provide sufficient information for users to gain a fair sense of how the projects compare over a range of criteria. Below is an explanation of the categories and additional factors.

Environment

Location

This section provides basic information about the location of each campus. This includes the city and state of each project, as well as the size of the project.

Location – This section provides the city and state of each project, or in the case of international projects, the city and country.

Size of Project – The number of acres is a fair determinant of the size of the project, especially as developed square feet will not always be readily available for each project. It also can help to determine the types of development that are possible for each project.

Climate

Local climate is a major factor in determining what type of construction should be used for a project, as buildings need to withstand the elemental forces typical of the region. Variations in rainfall, heat, cold, wind and geological forces require different approaches for building design.

Heating Days – Heating and cooling are the largest sources of energy consumption, and are therefore important components in designing a NZE master plan. Regional differences in temperature can make a significant difference in the energy requirement of projects in different areas. Heating days is a measure of the average number of days some type of heating is required to maintain a comfortable indoor environment.

Cooling Days – This factor complements *Heating Days*, in that it identifies a major source of energy use that is largely controlled by regional climate. Cooling days are not simply an inverse of the number of heating days as a result of seasonal variations. The type of cooling system can also make a big difference in the energy consumption.

ENERGY STAR® Region – The Environmental Protection Agency and the Department of Energy have developed the *ENERGY STAR®* program to identify and promote energy efficiency. The *ENERGY STAR®* for Homes program identifies several climate regions

throughout the United States in recognition of the role climate plays in construction design.

Average Rainfall – The amount of rainfall an area receives can be helpful in determining landscaping and waste water mitigation strategies for a project.

Energy

The source of energy production (coal, oil, hydro, etc) impacts the production of greenhouse gases. Some regions have greater accessibility to less-polluting sources like hydro. This section provides an overview of each campus' energy profile.

Solar Availability – The number of sunny days an area experiences is a significant factor in determining the feasibility of a solar installation to offset the energy requirements of the project. This measure provides the daily average kilowatt hours per square meter (kWh/m²/day). NREL's PV Watts program provided this information.

Regional Energy Sources – The source of energy and how energy is generated can cause huge variations in carbon production, which is a concern for campuses attempting to achieve carbon neutrality. This is of particular concern when designing a NZE campus. This data was obtained from the EPA's eGRID data and provides the percentage of energy obtained from coal, oil, natural gas, hydro, nuclear, and alternative sources, such as wind and solar, for each state.

Local Energy Cost – Energy costs vary from place to place, dependent on local fuel sources, as well as state and local regulations. Traditionally, areas with cheaper electricity have had little incentive to include a larger percentage of renewable energy. This information was obtained from NREL's PV Watts program.

Local Energy Production – Because of concerns about rising energy costs and reducing greenhouse gas emissions, many campuses are installing renewable energy technologies. This category provides data on the type and amount of renewable energy generation on each campus.

Policy

The proper policies can create a supportive environment for sustainable practices. Policies that are of particular interest for the master planning effort include green building practices, local food production, waste management and water conservation.

Green Building – There are a number of green building rating systems in use today – LEED and *ENERGY STAR*® are two of the most well-known, but there are others. Areas that support such a system for new developments are likely to support other sustainability initiatives.

Local Food Production – The availability of space to allow for local food production on the UCB campus has been a topic of interest among several groups on campus. This category provides information about how other projects have incorporated this feature.

Recycling & Waste Management – Waste management is a growing concern, and many municipalities and institutions are looking into zero waste policies. This type of thinking is in keeping with NZE planning methods as it indicates a concern for the overall impact of the development on the environment. Places that incorporate strong recycling and waste management policies are likely to support other sustainability initiatives.

Water Conservation – Boulder is located in an arid region, and water use is becoming increasingly more important. With other areas also experiencing droughts and water restrictions, more campuses are implementing water conservation strategies. This category provides an overview of practices at other campuses.

Economy

The availability of economic resources can also have a strong influence on project outcomes. These factors are meant to provide a glimpse at the economic health of the areas in which model projects are located.

Campus Value

This section provides figures on the value of the academic and corporate campuses based on either endowment or corporate value. This information can provide some sense of the economic resources available for sustainability projects.

Endowment – This is a measure for institutes of higher education, and is an indication of the amount of wealth held by the institution. Those with larger endowments may have greater flexibility in the development of large-scale projects in terms of being able to incorporate innovative design elements.

Corporate Value – Just as the *Municipal Budget* gives a sense of the financial resources of cities, this factor gives a sense of the financial resources of corporate entities that are included in the study.

Regional Economy

Regional economies can vary in the amount of resources available for capital improvement projects. In addition, factors such as unemployment and median income can provide some sense of the health of the local economy.

Municipal Budget – The size of the municipal budget provides some insight into the economic health of the community. This could be considered in a per capita context to avoid giving greater weight to larger municipalities that would naturally have a larger budget. The factor provides some sense of the financial resources available for new development.

Municipal Budget per Capita – This factor calculates the resources available per person within each city or town based on the municipal budget and the size of the local population.

Unemployment – Unemployment statistics are one way to look at how robust the local economy is. Low unemployment rates, compared to a national average, indicate that the local economy is strong and able to provide steady employment for the local population. High unemployment rates may result in different priorities – perhaps placing greater emphasis on social programs other than sustainability initiatives.

Median Income – Area median income (AMI) can be used to determine the availability of wealth in an area. Areas with a lower AMI may have fewer resources to devote to large-scale planning projects, or AMI may influence the character of large-scale projects – a housing development in an area with low AMI is more likely to have smaller and mid-size homes than an area with a higher AMI.

Social

Area demographics provide a glimpse at the type of people who live and work there, and are important in determining what type of development will be most successful. We have already included AMI and employments statistics in other areas of the matrix. We now include other measures to gain a better understanding of the type of people who will be served by each project.

Population

A measure of an area's population can be useful in determining the population density of a given area. This information may also provide insight into other areas, such as the available workforce, environmental impact, daily traffic, etc. This measure could also be used to indicate the number and type of people who reside in, or commute to, the project on a daily basis.

Campus – This section provides the reported population on each campus, comprised of students, faculty, and staff. A large campus population in relation to the municipal population may provide some indication of the influence the campus has on the local community.

Municipality – The municipal population is the size of the municipality in which each project is located.

Type of Community – Some developments are commercial campuses, built in existing office parks, others are housing developments built as part of an urban infill program. This measure refers to the defining characteristic of the surrounding community – urban, rural, residential, commercial, etc. While this may be difficult to quantify easily, the characteristics of the area surrounding a given project can strongly influence the final look and feel of a project so that it can blend into the surrounding environs more easily.

Policy

Just as with environmental issues, a policy enabling environment is important in creating programs that support the local population and improving town-gown relations. Of particular interest are “Good Neighbor” policies, regional planning efforts, and transportation initiatives.

“Good Neighbor” – Good Neighbor policies indicate support for the local community that goes beyond the boundaries of the project itself. This may be in the form of charitable donations, the creation of public spaces such as parks or some other initiative that blurs community boundaries.

Regional Planning – One way to push the boundary of sustainable design is to look beyond the boundaries of the project to include the surrounding area. In a supporting policy environment, there will be cooperative planning efforts that include surrounding government agencies.

Transportation Policies and Incentives – Public transportation reduces traffic congestion, helps to reduce greenhouse gas emissions and provides an alternative transportation option for a number of people. The availability of public transportation is limited by several factors, such as population density, public support and available funds. This is another indicator that demonstrates support for sustainable initiatives.

Points of Interest

This category will allow us to call attention to particular features of interest from each case study. This might include net zero energy buildings, innovative design, energy production, etc.

As mentioned previously, this is not an exhaustive list by any means, and is instead meant to provide some criteria by which projects can be more easily compared. While regional climates will have a significant impact on the physical elements of the project, we also wanted to consider other elements that could support or hinder a NZE campus planning project. Economic factors are always an important consideration. An enabling policy environment that encourages innovation in design elements resource use will be important in developing a successful project. Managing town-gown relations by creating a sense of shared ownership and considering the needs of the local population and businesses is another important element for a successful project.

Appendix B: Project Data Sheet

Project Comparison Chart

Case Study	Environment													
	Location		Climate				Energy				Policies			
	Location	Size of Project (acres)	Heating Degree Days	Cooling Degree Days	Energy Star Region	Annual Rainfall (inches)	Solar Availability (kWh/m2/day)	Regional Energy Sources	Local Energy Cost (cents/kWh)	Local Energy Production	Green Building Policies	Local Food Production	Recycling & Waste Mgmt Policies	Water Conservation
University of Colorado	CO	786	6,020	679	1	18.9	5.5	Coal	8.5	solar	LEED Gold	purchase	recycling, compost	yes
Arizona State University	AZ	1,550	1,350	4,162	4	9.3	6.3	Coal	8.7	solar	LEED Silver	purchase, produce	recycling, compost	yes
College of the Atlantic	ME	0	4,522	371	1	46.0	4.2	Gas	12.2	biomass, wind	super-insulation	produce	zero waste	no
Colorado State University	CO	579	7,326	285	1	15.2	5.6	Coal	7.8	solar, biomass	LEED Gold	purchase, produce	recycling, compost	yes
Emory University	GA	700	2,991	1,667	3	51.0	5.0	Coal	8.4	solar	LEED Silver	purchase	recycling	yes
Evergreen State College	WA	1,000	5,655	101	2	50.7	3.7	Hydro	7.0	solar	LEED certified	purchase	recycling	no
Fort Carson	CO	377,000	6,415	419	2	16.5	5.7	Coal	8.7	solar	LEED Platinum	none	zero waste	yes
FortZED	CO	0	7,326	285	1	15.2	5.6	Coal	7.8	solar, geothermal		none	none	no
GEOS Neighborhood	CO	25	6,020	679	1	16.2	5.5	Coal	8.5	solar	NZEB	none	none	yes
Google Campus	CA	26	3,005	65	3	13.8	5.5	Gas	11.9	solar	LEED certified	produce	recycling, compost	yes

Project Comparison Chart

Case Study	Environment													
	Location		Climate				Energy				Policies			
	Location	Size of Project (acres)	Heating Degree Days	Cooling Degree Days	Energy Star Region	Annual Rainfall (inches)	Solar Availability (kWh/m2/day)	Regional Energy Sources	Local Energy Cost (cents/kWh)	Local Energy Production	Green Building Policies	Local Food Production	Recycling & Waste Mgmt Policies	Water Conservation
University of Colorado	CO	786	6,020	679	1	18.9	5.5	Coal	8.5	solar	LEED Gold	purchase	recycling, compost	yes
Harvard University	MA	380	5,641	678	2	41.7	4.3	Gas	11.6	solar, geothermal	LEED Gold	purchase	recycling, compost	yes
Kansas State University	KS	668	5,265	1,304	2	33.9	5.1	Coal	8.0	solar, wind	LEED certified	produce	recycling, compost	yes
Los Angeles Community College District	CA	564,480	1,458	727	3	14.8	5.8	Gas	10.5	solar	LEED certified	none	recycling	yes
Masdar City	UAE	1,472	NA	NA	NA	3.7				solar, wind, geothermal	architecture for local climate	none	zero waste	yes
Microsoft Campus	WA	388	4,611	167	2	38.6	3.7	Hydro	6.9	solar	LEED certified	none	compost	no
New York University	NY	0	5,027	921	2	45.4	4.6	Nuclear	13.2	cogen	LEED Silver	purchase, produce	recycling	yes
Oberlin College	OH	440	6,201	621	2	35.2	4.1	Coal	8.7	solar	LEED Silver	purchase, produce	recycling, compost	yes
The Presidio	CA	991	3,005	65	3	20.3	5.3	Gas	12.5	solar	LEED Gold	none	recycling, compost	no
Stapleton	CO	4,700	6,020	679	1	15.5	5.5	Coal	8.6	solar	Energy Star	none	recycling	yes
University of California, Los Angeles	CA	419	1,458	727	3	14.8	5.8	Gas	11.9	solar, cogen	LEED Silver	purchase	zero waste	yes

Project Comparison Chart

Case Study	Environment													
	Location		Climate				Energy				Policies			
	Location	Size of Project (acres)	Heating Degree Days	Cooling Degree Days	Energy Star Region	Annual Rainfall (inches)	Solar Availability (kWh/m2/day)	Regional Energy Sources	Local Energy Cost (cents/kWh)	Local Energy Production	Green Building Policies	Local Food Production	Recycling & Waste Mgmt Policies	Water Conservation
University of Colorado	CO	786	6,020	679	1	18.9	5.5	Coal	8.5	solar	LEED Gold	purchase	recycling, compost	yes
University of Nebraska, Lincoln	NE	613	6,278	1,134	2	28.4	5.1	Coal	7.2	hydro, geothermal	LEED certified	purchase	recycling	yes
University of New Hampshire	NH	0	4,522	371	1	42.5	4.3	Nuclear	13.3	landfill methane	LEED Silver, Energy Star	purchase	recycling, compost	yes
Village Homes	CA	70	2,749	1,237	2	18.4	5.5	Gas	11.3	solar	Passive solar	produce	none	yes
Yale University	CT	337	5,537	724	2	49.8	4.7	Nuclear	10.7	solar, wind, geothermal	LEED Silver	purchase, produce	recycling, compost	no

Project Comparison Chart

Case Study	Economy					
	Campus Value		Regional Economy			
	University Endowment (\$ millions)	Corporate Value (\$ millions)	Municipal Budget (\$1,000)	Municipal Budget per capita	Unemployment	Median Income
University of Colorado	\$828,000	\$0	\$242,700	\$2,667	4.2	\$66,000
Arizona State University	\$408,000	\$0	\$500,700	\$2,945	4.8	\$57,000
College of the Atlantic	\$15,000	\$0	\$40,100	\$8,020	6.0	\$48,000
Colorado State University	\$183,000	\$0	\$540,400	\$4,189	4.3	\$56,000
Emory University	\$4,500,000	\$0	\$541,000	\$1,113	6.4	\$61,000
Evergreen State College	\$183,000	\$0	\$97,300	\$2,162	5.0	\$60,000
Fort Carson	\$0	\$0	\$345,600	\$929	5.8	\$58,000
FortZED	\$0	\$0	\$540,400	\$4,189	4.3	\$56,000
GEOS Neighborhood	\$0	\$0	\$162,900	\$1,551	4.9	\$66,000
Google Campus	\$0	\$179,900,000	\$204,200	\$2,917	6.0	\$87,000
Harvard University	\$26,000,000	\$0	\$444,000	\$4,396	4.3	\$77,000

Project Comparison Chart

Case Study	Economy					
	Campus Value		Regional Economy			
	University Endowment (\$ millions)	Corporate Value (\$ millions)	Municipal Budget (\$1,000)	Municipal Budget per capita	Unemployment	Median Income
University of Colorado	\$828,000	\$0	\$242,700	\$2,667	4.2	\$66,000
Kansas State University	\$260,000	\$0	\$95,400	\$1,871	3.1	\$40,000
Los Angeles Community College District	\$0	\$0	\$7,113,000	\$1,848	7.5	\$55,000
Masdar City	\$0	\$0	N/A	N/A	N/A	N/A
Microsoft Campus	\$0	\$260,420,000	\$679,700	\$13,871	4.3	\$69,000
New York University	\$2,475,000	\$0	\$61,428,300	\$7,478	4.9	\$67,000
Oberlin College	\$534,000	\$0	\$25,400,000	\$3,175	7.0	\$53,000
The Presidio	\$0	\$0	\$6,586,800	\$8,853	5.3	\$72,000
Stapleton	\$0	\$0	\$1,500,000	\$2,646	5.5	\$45,000
University of California, Los Angeles	\$895,000	\$0	\$7,113,100	\$1,848	7.5	\$55,000
University of Nebraska, Lincoln	\$1,221,000	\$0	\$134,900	\$630	3.1	\$52,000

Project Comparison Chart

Case Study	Economy					
	Campus Value		Regional Economy			
	University Endowment (\$ millions)	Corporate Value (\$ millions)	Municipal Budget (\$1,000)	Municipal Budget per capita	Unemployment	Median Income
University of Colorado	\$828,000	\$0	\$242,700	\$2,667	4.2	\$66,000
University of New Hampshire	\$125,000	\$0	\$10,500	\$808	3.6	\$59,000
Village Homes	\$0	\$0	\$119,800	\$1,964	7.4	\$59,000
Yale University	\$16,300,000	\$0	\$641,100	\$5,170	6.3	\$62,000

Project Comparison Chart

Case Study	Social					
	Population			Policies		
	Campus	Municipality	Type of Community	"Good Neighbor" Policies	Regional Planning Policies	Transportation Policies and Incentives
University of Colorado	38,500	91,000	college town	education, business	DRCOG, RTD	bus, bike, pass program, carshare
Arizona State University	71,000	170,000	large city	food	Sustainable Cities Network	bus, bike, carpool, carshare
College of the Atlantic	400	5,000	small town	food, recycling		bike
Colorado State University	32,000	129,000	college town	business, food	FortZED, regional plan in place	bus, bike, carpool
Emory University	25,195	486,000	large city	health, education		bus, bike, carpool, pass program
Evergreen State College	6,000	45,000	large city	education	regional transit	bus, carpool, rail, pass program
Fort Carson	19,000	372,000	military base	community partnerships	Southern CO Sustainable Community Partnership	bus
FortZED	7,000	129,000	college town	community partnerships	CSU UniverCity Partnership	V2G
GEOS Neighborhood	N/A	105,000	mid-size city			
Google Campus	8,000	70,000	mid-size city			bus, bike, carshare, V2G

Project Comparison Chart

Case Study	Social					
	Population			Policies		
	Campus	Municipality	Type of Community	"Good Neighbor" Policies	Regional Planning Policies	Transportation Policies and Incentives
University of Colorado	38,500	91,000	college town	education, business	DRCOG, RTD	bus, bike, pass program, carshare
Harvard University	24,000	101,000	large city	education, housing		bus, bike, subway, rail, pass program, +
Kansas State University	25,000	51,000	college town	community partnerships		
Los Angeles Community College District	121,000	3,849,000	large city	education		
Masdar City	110,000	N/A	large city			car-free city
Microsoft Campus	40,000	49,000	small city			bus, bike, carpool, pass program
New York University	73,000	8,214,000	large city	community partnerships		bus, bike, subway, rail, pass program, +
Oberlin College	4,000	8,000	college town	business	Green Arts District	car share
The Presidio	6,000	744,000	large city			shuttle, bike paths, bus
Stapleton	75,000	567,000	large city	neighborhood		bus, rail planned
University of California, Los Angeles	48,000	3,849,000	large city	education, health		bus, bike, carpool, pass program

Project Comparison Chart

Case Study	Social					
	Population			Policies		
	Campus	Municipality	Type of Community	"Good Neighbor" Policies	Regional Planning Policies	Transportation Policies and Incentives
University of Colorado	38,500	91,000	college town	education, business	DRCOG, RTD	bus, bike, pass program, carshare
University of Nebraska, Lincoln	28,000	214,000	college town	business, food		carpool, pass program
University of New Hampshire	16,000	13,000	college town	food, transportation		bus, bike, rail, car share, pass program
Village Homes		61,000	small city			narrow streets, bike culture
Yale University	20,000	124,000	college town	urban forestry		bus, rail, carshare

The preceding pages show the highlights from the Project Comparison and include data found on a number of factors for each campus (See Appendix A: Environmental, Economic, and Social Factors).

Resources

General Resources

- Association for the Advancement of Sustainability in Higher Education. (2005-2009). Campus Sustainability Profiles. Available online at:
<http://www.aashe.org/resources/profiles/profiles.php>
- Bureau of Labor Statistics. (2009). Local Area Unemployment Statistics. Available online at:
<http://www.bls.gov/lau/tables.htm>
- City of Boulder. (2006). Master Plan for Waste Reduction. Available online at:
http://www.bouldercolorado.gov/index.php?option=com_content&view=article&id=1324&Itemid=450
- Climates of the World (2009). Available online at: <http://www.climate-zone.com>
- Countrystudies.us. (2003-2008). U.S. Weather. Available online at:
<http://countrystudies.us/united-states/weather/>
- Eisen, Ben. (Sept 29, 2009) Master Planning for Sustainability. National Wildlife Federation. Available online at
<http://www.nwf.org/campusEcology/climateedu/articleView.cfm?iArticleID=104>
- Mascarelli, Amanda Leigh. (Sept 10, 2009). How Green Is Your Campus? *Nature*.
- National Renewable Energy Laboratory. (2009). PVWatts Version 2. Available online at:
<http://mapserve2.nrel.gov/website/PVWATTS/LITE/viewer.htm>
- Sierra Club. (2009). Sierra Cool Schools: The Third Annual List. Available online at:
http://www.sierraclub.org/sierra/200909/cool_schools/top20.aspx.
- Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>
- U.S. Census Bureau. (2009). American FactFinder. Available online at:
http://factfinder.census.gov/home/saff/main.html?_lang=en
- United States Environmental Protection Agency. (2009). eGRID. Available online at:
<http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html>
- United States Environmental Protection Agency. (2009). State-by-State Climate Region Index. Available online at:
http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/ClimateRegionDesignPackageTables.pdf

Campus Resources

Arizona State University

- Arizona State University Global Institute of Sustainability. (2009). Campus Sustainability. Available online at: <http://sustainability.asu.edu/campus/>
- Arizona State University. (2009). Campus Metabolism. Available online at:
<http://cm.asu.edu/>

Arizona State University. (2009). Serving Sustainability to Sun Devils. Available online at: http://servingsustainability.asu.edu/?page_id=4

Association for the Advancement of Sustainability in Higher Education. (2005-2009). Campus Sustainability Profiles. Available online at: <http://www.aashe.org/resources/profiles/profiles.php>

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

College of the Atlantic

Association for the Advancement of Sustainability in Higher Education. (2005-2009). Campus Sustainability Profiles. Available online at: <http://www.aashe.org/resources/profiles/profiles.php>

College of the Atlantic. (2009). Net Zero: The Story Behind Net Zero. Available online at: <http://www.coa.edu/netzero.htm>

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

Colorado State University

Association for the Advancement of Sustainability in Higher Education. (2005-2009). Campus Sustainability Profiles. Available online at: <http://www.aashe.org/resources/profiles/profiles.php>

City of Fort Collins. (2009). Climate Wise. Available online at: <http://www.fcgov.com/climatewise/>

Clean Energy Cluster Northern Colorado. (2008). Northern Colorado Clean Energy Cluster, The Brendle Group. Available online at: <http://www.nccleanenergy.com/>

Colorado State University. (2009). The Green University: CSU's greenhouse gas footprint. Available online at: <http://www.green.colostate.edu/ghg.aspx>

Colorado State University. (2009). The Green University: Partnerships. Available online at: <http://www.green.colostate.edu/partnerships.aspx>

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

Emory University

Association for the Advancement of Sustainability in Higher Education. (2005-2009). Campus Sustainability Profiles. Available online at: <http://www.aashe.org/resources/profiles/profiles.php>

Emory University. (2009). Advancing Sustainability. Available online at: <http://www.emory.edu/home/about/rankings-successes/advancing-sustainability.html>

Emory University. (2009). Sustainability Initiatives. Available online at: <http://sustainability.emory.edu/index.html>

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

Evergreen State College

Association for the Advancement of Sustainability in Higher Education. (2005-2009).

Campus Sustainability Profiles. Available online at:

<http://www.aashe.org/resources/profiles/profiles.php>

Evergreen State College, The. (2009). Residential and Dining Services: Sustainability in

RAD. Available online at: <http://www.evergreen.edu/rad/sustainability/>

Evergreen State College, The. (2009). Sustainability: at Evergreen's Vision for a Sustainable

Future. Available online at: <http://www.evergreen.edu/sustainability/home.htm>

Evergreen State College, The. (2009). The Sustainability House: Kitchen Garden Project.

Available online at:

<http://collab.evergreen.edu/sustainabilityhouse/Kitchen+Garden+Project>

Fort Carson

SIGMA Project. (2001-2006). The Sigma Project. Available online at:

<http://www.projectsigma.co.uk/default.asp>

Smith, Eugene and Christopher Juniper. (Fort Carson Sustainability Partnerships: Bringing Sustainability to a Three-County Area. Powerpoint presentation. February 28, 2008.

Smith, Eugene and Christopher Juniper. Sustainability and Environmental Management System. Powerpoint presentation June 17, 2008.

United States Army. (2008). Fort Carson Sustainability Program. Available online at:

http://sems.carson.army.mil/sustainability/sustainability_program_home_page_default.htm

Wikipedia. (2009). "Fort Carson." Wikipedia. Available online at:

http://en.wikipedia.org/wiki/Fort_Carson

Fort ZED

Fort ZED. (2009). Fort ZED, growing to be the world's largest zero energy district.

http://fortzed.com/pdf/Longdescription_FortZED.pdf

Fort ZED. (2009). FortZED. Available online at: <http://fortzed.com/index.html>

Fort ZED. (2009). UniverCity Connections. Available online at:

<http://www.univercityconnections.org/12/Sustainable%20Energy%20-%20FortZED/>

Rocky Radar. (April 15, 2009). "Fort Collins Clean Energy Conference hosts RFK Jr." *Rocky*

Radar. April 15, 2009. Available online at: <http://www.rockyradar.com/cleantech/?p=211>

Tatti, Kristen. (December 12, 2007). Bioscience, Fort ZED, new owners for DAKO,

CoCreate all in Mix. *Northern Colorado Business Report*. December 12, 2007.

Tatti, Kristen. (September 24, 2009). Fort ZED lags due to funding issues, tech focus.

Northern Colorado Business Report. September 24, 2009.

GEOS Neighborhood

Basantani, Mahesh. (Aug. 7, 2008). GEOS: The First Fossil Free Community in the USA!

Inhabit. Available online at: [http://www.inhabitat.com/2008/08/07/geos-the-us-first-](http://www.inhabitat.com/2008/08/07/geos-the-us-first-fossil-fuel-free-community/)

[fossil-fuel-free-community/](http://www.inhabitat.com/2008/08/07/geos-the-us-first-fossil-fuel-free-community/)

Business Wire. (July 15, 2008). "Nation's Largest Net Zero Energy, Residential Community – Geos Neighborhood – Launches in Colorado. *Business Wire*. Available online at: <http://www.businesswire.com/news/home/20080715005687/en>

GEOS. (2009). GEOS Neighborhood. Available online at: <http://discovergeos.com>

"Michael Tavel Architects. (2009). GEOS Net Zero Energy Mixed-Use Neighborhood." Available online at: <http://www.michaeltavelarchitects.com/GEOS%20Presentation.pdf>

Google

Chan, Tony. (April 9, 2009). "Inside Google's Data Centre." Greentelecomlive. Available online at: April 9, 2009. <http://www.greentelecomlive.com/?p=470>

Helft, Michael. (June 4, 2008). "Google Plans Major Expansion in Its Backyard." *New York Times*. Available online at: June 4, 2008. <http://bits.blogs.nytimes.com/2008/06/04/google-plans-major-expansion-in-its-backyard/?em>

Keefe, Bob. (February 2008). "Meet Google's Chief Sustainability Officer (What a Cool Job!)." Divine Caroline. Available online at: February 2008. <http://www.divinecaroline.com/22277/44799-meet-google-s-chief-sustainability-officer>

Schwartz, James. (June 8, 2009). "Google's Commitment to Sustainability." June 8, 2009.. The Urban Country. Available online at: <http://www.theurbancountry.com/2009/06/googles-commitment-to-sustainability.html>

Strand, Ginger. (March 2008). "Keyword: Evil." *Harper's Magazine*. March 2008. Available online at: <http://www.harpers.org/media/slideshow/annot/2008-03/index.html>

Strickland, Jonathan. (August 4, 2008). "How the Googleplex Works." August 4, 2008. howstuff works. Available online at: <http://computer.howstuffworks.com/googleplex.htm>

Wikipedia. (2009). "Googleplex." Available online at; <http://en.wikipedia.org/wiki/Googleplex>

Wu, Olivia. (March 1, 2006). "Now Google's Cooking." *SFGate*. March 1, 2006. Hearst Publications. Available online at: <http://www.sfgate.com/cgi-bin/article.cgi?f=/chronicle/archive/2006/03/01/FDG32H9OF61.DTL>

Harvard University

Association for the Advancement of Sustainability in Higher Education. (2005-2009). Campus Sustainability Profiles. Available online at: <http://www.aashe.org/resources/profiles/profiles.php>

Harvard University. (2009). Sustainability at Harvard. Available online at: <http://www.greencampus.harvard.edu/>

Harvard University Office of Sustainability. (2009). Green Building Resource. Available online at: <http://www.greencampus.harvard.edu/theresource/guidelines/>

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

Kansas State University

Kansas State University. (2009). Center for Engagement and Community Development. Available online at: <http://www.k-state.edu/cecd/>

Kansas State University. (2009). K-State Sustainability. Available online at: <http://sustainability.k-state.edu/>

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

Los Angeles Community College

Association for the Advancement of Sustainability in Higher Education. (2005-2009). Campus Sustainability Profiles. Available online at: <http://www.aashe.org/resources/profiles/profiles.php>

Los Angeles Community College District. (2009). LACCD Builds Green. Available online at: <http://www.laccdbuildsgreen.org/>

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

Masdar City

Basantani, Mahesh. (February 6, 2008). Plans for Foster's Masdar Carbon Neutral City Debut. Inhabitat. Available online at: February 6, 2008. <http://www.inhabitat.com/2008/02/06/plans-unveiled-for-worlds-first-zero-carbon-zero-waste-city-masdar-city/>

LaMonica, Martin. (January 18, 2008). Masdar City in Abu Dhabi to lay claim to greenest city. Cnet News. January 18, 2008. Available online at: http://news.cnet.com/8301-11128_3-9853581-54.html

Masdar City. (2009). Masdar City. Available online at: <http://www.masdarcity.ae/en/index.aspx>

Palca, Joe. (May 6, 2008). Abu Dhabi Aims to Build First Carbon-Neutral City. National Public Radio. May 6, 2008. Available online at: <http://www.npr.org/templates/story/story.php?storyId=90042092>

Reed, Stanley. (December 24, 2007). Guess Who's Building a Green City. *Business Week*. December 24, 2007.

Wikipedia. (2009). Masdar City. Available online at: Wikipedia. http://en.wikipedia.org/wiki/Masdar_City

Microsoft

Gale, Sarah Fister. (Dec 7, 2008). Eat, Drink and Be Greener. Greenbiz.com. Available online at: <http://www.greenbiz.com/news/2008/12/07/eat-drink-and-be-greener?page=0%2C0>

Microsoft. (2009). Microsoft On the Topic: Environmental Sustainability. Available online at: <http://www.microsoft.com/about/corporatecitizenship/en-us/our-commitments/our-principles/environmental-principles.aspx>

Microsoft. (2009). Microsoft Smart and Sustainable Building Practices. Available online at: http://www.microsoft.com/environment/our_commitment/articles/building_practices.aspx

Microsoft. (Sept 6, 2007). Microsoft Unveils Regional Express Bus Service. Available online at: <http://www.microsoft.com/presspass/press/2007/sep07/09-06RegionalExpressBusPR.msp>

Romano, Benjamin. (Nov 23, 2007). Microsoft Campus Expands, Transforms, Inside and Out.. *Seattle Times*. Available online at: http://seattletimes.nwsourc.com/html/microsoft/2004007121_microsoft11.html

New York University

Association for the Advancement of Sustainability in Higher Education. (2005-2009). Campus Sustainability Profiles. Available online at: <http://www.aashe.org/resources/profiles/profiles.php>

FoodPrint. (2009). Sustainable Foodservice Solutions. Available online at: <http://www.foodprint.biz/index.php>

New York University Sustainability Task Force. (2009). *Environmental Assessment, FY 2007*. Available online at <http://www.nyu.edu/sustainability/assessmentreport09>

NYU Green. (2009). Energy Strategy. New York University. Available online at: http://www.nyu.edu/sustainability/campus_projects/strategy.html

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

Oberlin College

Association for the Advancement of Sustainability in Higher Education. (2005-2009). Campus Sustainability Profiles. Available online at: <http://www.aashe.org/resources/profiles/profiles.php>

Oberline College. (2009). Oberlin College AJLC Building Systems, Living Machine & Water Use. Available online at: http://www.oberlin.edu/ajlc/systems_lm_1.html

Oberline College. (2009). Oberlin Environmental Sustainability. Available online at: <http://www.oberlin.edu/sustainability/index.html>

Scott, Michael. (October 23, 2009). Q&A with Oberlin sustainability expert and author David Orr. Cleveland.com. Available online at: http://blog.cleveland.com/metro/2009/10/qa_with_oberlin_sustainability.html

Scott, Michael. (October 24, 2009). Oberlin professor David Orr plans \$300 million “green arts district.” Clevelan.com. Available online at: http://blog.cleveland.com/metro/2009/10/oberlin_professor_300_million.html

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

The Presidio

Federal Emergency Management Program. (2009). Greening Success Story: The Presidio of San Francisco, California. Available online at: <http://www.p2pays.org/ref/20/19633.htm>

Presidio, The. (2009). Presidio Environmental Sustainability Programs. <http://www.presidio.gov/nature/sustainability/>

U.S. Department of Energy. (2008). Greening Project Status Report: The Presidio. http://www1.eere.energy.gov/femp/pdfs/greening_presidio.pdf

Wikipedia. (2009). Presidio of San Francisco. Available online at:
http://en.wikipedia.org/wiki/Presidio_of_San_Francisco

Stapleton Community

Durfee West, Amy. (June 2, 2002). Sustainable Development. *Colorado Real Estate Journal*. Available online at: http://www.durfeewest.com/documents/Sustainable_Development.pdf

Forest City Stapleton, Inc. (2009). Stapleton Sustainability Master Plan. 2004. Available online at: http://www.stapletonresourcedirectory.org/Stapleton_Sustainability_Plan.pdf

Forest City Stapleton, Inc. (2009). Stapleton. Available online at:
<http://discover.stapletondenver.com>

Martin, Trevor. (2009). Building Sustainability into Stapleton. University of Colorado, Leeds School of Management. Available online at:
http://leeds.colorado.edu/About_Leeds/interior.aspx?id=2160

Smart Growth Network. (2009). Smart Growth in Action. Redeveloping Stapleton. Available online at: http://www.smartgrowth.org/pdf/cs_028_Stapleton.pdf

University of California, Los Angeles

Association for the Advancement of Sustainability in Higher Education. (2005-2009). Campus Sustainability Profiles. Available online at:
<http://www.aashe.org/resources/profiles/profiles.php>

Dynes, Robert C. (January 17, 2006). Policy on Green Building Design, Clean Energy Standards, and Sustainable Transportation Practices. Letter from Robert C. Dynes, President of the University of California, Available online at:
<http://www.sustain.ucla.edu/media/files/ucregentgreenbldg.pdf>

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

UCLA Sustainability. (2009). UCLA Sustainability: What UCLA is doing. Available online at: <http://www.sustain.ucla.edu/campus/>

University of Nebraska, Lincoln

Fedderson, Troy. (Nov. 6, 2008). Good. Fresh. Local. The Scarlet. University of Nebraska. Available online at: <http://scarlet.unl.edu/?p=629>

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card: Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

University of Nebraska-Lincoln. (2009). Nebraska Innovation Campus. Available online at: <http://innovate.unl.edu/>

University of Nebraska-Lincoln. (2009). University of Nebraska-Lincoln Sustainability Initiatives. Available online at: http://bf.unl.edu/downloads/20080418_sustainability.pdf

University of Nebraska-Lincoln. (Oct. 23, 2009). Innovation Campus governance, sustainability, land use proposed. Available online at:
<http://newsroom.unl.edu/releases/2009/10/23/Innovation+Campus+governance%2C+sustainability%2C+land+use+proposed>

University of New Hampshire

Association for the Advancement of Sustainability in Higher Education. (2005-2009).

Campus Sustainability Profiles. Available online at:

<http://www.aashe.org/resources/profiles/profiles.php>

Sustainable Endowments Institute. (2007-2009). The College Sustainability Report Card:

Report Card 2010. Available online at: <http://greenreportcard.org/report-card-2010/>

University of New Hampshire Energy Task Force. (2005). “WildCAP” The UNH Climate

Action Plan. Available online at: <http://www.unh.edu/etf/wildcap.html>

University of New Hampshire Office of Sustainability. (2009). Initiatives: Sustainable Transportation at UNH. Available online at:

http://www.sustainableunh.unh.edu/climate_ed/transportation.html

University of New Hampshire Office of Sustainability. (2009). Initiatives: Sustainable Buildings at UNH. Available online at:

http://www.sustainableunh.unh.edu/climate_ed/sustainablebuildings.html

Village Homes

Bainbridge, David. (2004). Sustainable Community – Village Homes, Davis, California.

Available online at: <http://www.ecocomposite.org/building/villagehomes.htm>

Davis Wiki. (2009). Village Homes Wiki. Available online at:

http://daviswiki.org/Village_Homes

Jackson, David. (February 22, 1999). Back to the Garden: A Sustainable Dream. *Time Magazine*. Available online at:

<http://www.time.com/time/reports/environment/heroes/heroesgallery/0,2967,corbett,00.html>

Smart Communities Network. (2009). Success Stories: Village Homes. Available online at:

<http://www.smartcommunities.ncat.org/success/village.shtml>

Uesugi, Takeo. (August 27, 1999). Sustainable Lifestyle Study. Available online at:

<http://www.csupomona.edu/~tuesugi/villagehomes/VH.html>

Village Homes. (2003-2008). Village Homes Davis, California. Village Homes Owners Association. Available online at: <http://www.villagehomesdavis.org/home>

Wack, Paul. (2005). Village Homes, Davis, California: Case Study. *FOCUS*, 2. Available

online at: http://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1001&context=crp_fac

Yale University

Conniff, Richard. (2009). Kroon Hall Rises. *Environment Yale: The Journal of the Yale School of Forestry and Environmental Studies*. Available online at:

<http://environment.yale.edu/magazine/spring2009/kroon-hall-rises/>

Yale School of Forestry & Environmental Studies. (2009). Kroon Hall. Available online at:

<http://environment.yale.edu/kroon/>

Yale University. (2009). Greenhouse Gas Reduction Measures. Available online at:

<http://www.yale.edu/sustainability/GHGReductionMeasures1.pdf>

Yale University. (2009). Some Facts and Statistics About Yale University. Available online at: <http://www.yale.edu/oir/factsheet.html>

Yale University. (2009). Yale Sustainable Food Project. Available online at:

<http://www.yale.edu/sustainablefood/index.html>