

**APPENDIX 2**

**FEASIBILITY STUDY  
for a  
GREEN BUILDING POLICY  
for the  
UNIVERSITY OF CALIFORNIA**

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## TABLE OF CONTENTS

### I. Executive Summary

- A. General
- B. Summary Findings and conclusions
- C. Summary Recommendations

### II. Charge

### III. Methodology

### IV. Feasibility Study

- A. Definition of Sustainability
- B. Existing Green Building Standards That Could Be Used by the University
- C. How UC Projects Might Rate According to These Standards
- D. Assessment of Probable Costs
- E. Relative Benefits of Internal Versus External Certification
- F. Recommend ways UC can work with external organizations involved in sustainable building issues
- G. Identify fundamental components of a UC sustainable building policy; identify implementation issues and strategies

### V. Conclusions and Recommendations

- A. General Recommendations
- B. Recommended Policy Framework
- C. Recommended Implementation Guidelines

### Appendices

- 2A Working Group Members
- 2B Selected State and University Sustainable Design and Construction Policy Statements

## **I. EXECUTIVE SUMMARY**

### **A. General**

At the December 13, 2002 meeting of the Grounds and Buildings Committee, The Regents requested that the President undertake a feasibility study and develop policy recommendations, for presentation at the May 2003 meeting, for the adoption of a Green Building policy and Clean Energy standard for all new construction and major renovation projects. The Regents also requested that this study evaluate the economic impact of the recommended green building policies and standards, and associated impacts on capital and building maintenance programs. Consistent with The Regents' request, the policies and standards presented here are based on input from and coordination with students, faculty, staff, government agencies, and other higher education systems, as well as non-governmental organizations.

This study developed a succinct definition of sustainability for use in policy development and evaluated the applicability, cost, and value of existing green building standards for use by the University. The study also examined the University's current capital program to determine what levels of certification appeared broadly achievable within capital funding levels and evaluated the relative drawbacks and advantages of internal versus external certification. The results of the study are a series of findings together with recommendations of policies and recommended standards, delegations, and implementation steps.

### **B. Summary Findings and Conclusions**

1. While the University already employs many sustainable practices in its construction, they vary widely in scope and nature from campus to campus and from project to project.
2. Given the projected increases in electrical consumption and energy rates, energy efficiency emerges as the most immediately compelling reason to employ sustainable practices in our construction programs.
3. The University has a long history of utilizing energy efficiency improvements and peak-shaving strategies within its existing inventory of buildings and infrastructure.
4. LEED 2.1 and Labs21 are the most universally known and used evaluation systems and, even though not developed with University use in mind, can form the basis for the development of a University measurement system.
5. The University has the opportunity to capitalize on its intellectual resources in developing a strategy for improving sustainable physical development and operating practices.
6. The University has the opportunity to substantially improve communication among campuses, and between campuses and the Office of the President, regarding

exemplary water and energy conservation strategies, transportation management, waste recycling, and sustainable building design.

7. A strong correlation exists between improved environmental performance, occupant satisfaction, and both direct and indirect economic benefits of green buildings. The University will reap these benefits by heightened awareness of sustainable principles for campus planning and building design, and by working to embody these principles in new and renovated facilities and campus environments.
8. The University has an historic opportunity to reevaluate customary methods of facilities capital investment, and over time, to reduce the operating cost structure embodied (explicitly or implicitly) in the design choices which shape our facilities.
9. Continued funding constraints on both capital and operating funds require renewed emphasis on cost-effective building and operating practices, based on a whole-systems approach to the issues and life-cycle assessment of resource use.
10. Many measures that benefit the environment also improve both direct and indirect life-cycle cost performance of facilities. There are great prospects for developing win-win strategies.
11. The small number of UC projects currently seeking external sustainable building certification indicates that cost-effective solutions to sustainable building design issues can be developed within available capital funding.

### C. Summary Recommendations

As a framework for implementation of this policy, the University should require that campus design standards incorporate a minimum number of sustainability attributes such that all new buildings will achieve the equivalent of a “Certified” rating using the LEED™ system, developed by the US Green Building Council, and require all new building projects (other than acute-care facilities) to outperform the required provisions of the California Administrative Code, Title 24 energy-efficiency standards by at least 20 percent. Building the minimum requirements for achieving the equivalent of a LEED™ ‘Certified’ rating into campus design standards is by far the most cost-effective way of achieving sustainability goals, as the means and measures become part of the project program and are incorporated into the fundamental design of the project from the outset. Adding sustainable building measures after the design direction of the project has been established, is typically far more expensive than incorporating them from the outset.

As the LEED™ system does not yet address the specific characteristics of laboratory buildings, laboratory projects should achieve the equivalent of a “Certified” rating based on the LEED™ system incorporating the Environmental Performance Criteria proposed and developed by the Lawrence Berkeley National Laboratory Labs21 program sponsored by the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA). Further study should be conducted before application of this requirement to new acute-care facilities.

In addition, the University should seek to maximize the level of sustainability achieved in all projects by striving for a rating equivalent to a LEED™ “Silver” rating whenever

possible, within the constraints of program needs and standard budget parameters. Specific measures and design strategies to achieve these goals should be described in project programming and budget-setting documentation. In the event that an individual project cannot meet the requirements of this policy, the reasons should be accounted for and documented in the project program.

Campuses should be encouraged to exceed the minimum standards described herein, and free to choose to achieve an externally-certified level of sustainability on any given project, for instance by using the LEED™ rating system and submitting a project for certification by the US Green Building Council.

The University should work closely with the US Green Building Council, Labs21, the DOE, the EPA, and other organizations involved in the development of green building evaluation methodologies and design strategies. Possible fruits of collaboration include improving evaluation methodologies, especially those which address campus physical planning contexts and campus infrastructure; energy-efficiency standards for laboratory equipment and building systems components; building maintenance and green housekeeping; and the possibility of adopting an external certification system when one becomes available that meets the University's requirements at an acceptable cost.

The time is right for the University to take action to address issues of sustainability in a systematic and coordinated fashion. The University supports an extraordinary breadth of academic programs that address issues such as environmental management, sustainability practices and environmental public policy. Faculty across many existing programs and campuses are engaged in research and public debate that inform the concepts and practice of sustainability. The University has the opportunity to capitalize on these intellectual resources in developing its own approach to sustainable physical development and operating practices.

Based on this, the University should also consider developing and implementing broader sustainable practices that deal with a wide range of issues, such as water and energy use, procurement policies, food service practices, recycling and waste management, space management, facilities utilization, facilities operation, sustainable construction practices and transportation programs.

Sustainability is more than designing "green buildings" or maintaining natural reserves. At its best, it reflects an institutional commitment to minimize the use and waste of non-renewable natural resources, recognizing the economic benefits as well as the ecological benefits of this commitment without compromising institutional mission and goals.

Individual UC campuses have addressed issues of sustainable operation and development, including exemplary water and energy conservation programs, transportation management, waste recycling and elements of green building design. However, there has been limited communication between campuses about these efforts and little Systemwide leadership to identify sustainable strategies which might prove useful to all campuses or which might leverage the strengths of the University system.

## **II. CHARGE**

In 2002, a student-led initiative resulted in the formulation of a Regents policy, which charged the President to:

1. Develop a feasibility study, for presentation to the May 2003 Regents meeting, for the adoption of a Green Building policy and Clean Energy standard for all new and renovated buildings. The study was to consider the economic impact, including capital and maintenance, of all sustainability policies and standards.
2. Recommend a Green Building policy and Clean Energy standard for approval by The Regents at its May 2003 meeting. This recommendation was to include input from and coordination with students, faculty, staff, government agencies, and other higher education systems, as well as non-governmental organizations.

In response to the Regents action, the Office of the President embarked on a feasibility study to examine the following issues:

- A. Provide a succinct definition of sustainability and/or green building design for use in policy development;
- B. Identify existing Green Building standards that could potentially be used by the University;
- C. Examine how a variety of UC projects might rate according to these standards given current campus design and construction;
- D. Considering the scope of LEED and Labs 21 rating criteria, determine what level of certification appears broadly achievable within available capital funding levels, including both hard and soft costs;
- E. Evaluate the relative benefits and drawbacks of developing an internal certification procedure versus using a procedure developed and administered by an external managing organization;
- F. Recommend the most appropriate way for UC to work with rating systems and their managing organizations; and
- G. Identify fundamental components of a UC policy for green buildings and outline an implementation strategy.

This study examined each of the seven questions presented in the charge, and explored their ramifications for a sustainable building policy for the University.

### **III. METHODOLOGY**

The University assembled a steering committee made up of officials from the California Energy Commission and the State and Consumer Services Agency, faculty members with expertise in these disciplines, and administrators from each of the ten campuses and the Office of the President. The Steering Committee met at least monthly from January through April 2003. Development of the feasibility analyses was carried out by a Working Group comprised of staff from campuses, the Office of the President, and the Lawrence Berkeley National Laboratory. During a Steering Committee meeting in late February, student representatives from each of the campuses met with the Steering Committee to share information and provide input with regard to sustainability policy. The Steering Committee also met with representatives from Greenpeace, the US Green Building Council, and the Center for Resource Solutions. Working Group members attended meetings at the Santa Cruz and Berkeley campuses called by students to discuss student objectives and input prior to meeting the Steering Committee.

This feasibility study was carried out by the sustainable buildings subgroup of the Working Group. The sub-group examined the LEED™ and Labs21 sustainable building evaluation systems for applicability to UC's capital program. The US Green Building Council made an in-depth presentation regarding the organization, goals, and implementation measures of the LEED™ rating system. The sub-group assessed publicly-available materials such as feasibility studies made by the State of California Sustainable Buildings Task Force, and those carried out by other states or local jurisdictions. Policy statements and implementation guidelines from a variety of sources were compiled, including material prepared by other university systems in setting their own policies and procedures. The sub-group conducted a survey of current sustainable building policies and efforts on individual projects by UC campuses.

### **IV. FEASIBILITY STUDY**

**A. Definition of Sustainability** - Sustainability refers to the physical development and institutional operating practices that meet the needs of present users without compromising the ability of future generations to meet their own needs, particularly with regard to use and waste of natural resources. Sustainable practices support ecological, human and economic health and viability. Sustainability presumes that resources are finite, and should be used conservatively and wisely with a view to long-term priorities and consequences of the ways in which resources are used.

On August 2, 2000 Governor Davis signed Executive Order D-16-00, which defines sustainable building objectives for facilities designed and constructed for the State of California: "...to site, design, deconstruct, construct, operate, and maintain state buildings that are models of energy, water, and materials efficiency; while providing healthy, comfortable, and productive indoor environmental and long-term benefits to Californians." The order goes on to state: "The objectives are to implement the sustainable building goal in a cost effective manner, while considering externalities; identify economic and environmental performance measures; determine cost savings; use extended life-cycle costing; and adopt an integrated systems approach. Such an approach treats the whole building as one system and recognizes that individual building features,

such as lighting, windows, heating and cooling systems, or control systems, are not stand-alone systems.”

Although higher education institutions are not mandated to adhere to the goals outlined in the Executive Order, the Order does state that “The Regents of the University of California, Boards of Governors of Community College Districts, Trustees of the California State Universities, the State Legislature, and all Constitutional Officers are encouraged to comply.”

In accordance with the Governor’s Executive Order D-16-00, a successful sustainability policy should:

1. Base resource decisions on life-cycle cost analysis that recognizes long-term avoided costs as well as the first costs of sustainable practices.
2. Incorporate sustainability goals at the beginning of the planning and budget-setting process, fostering integrated design solutions and minimizing implementation costs.
3. Employ a holistic, system approach to campus planning, design of new facilities, and facilities management that optimizes linked systems (e.g. new building construction, transportation strategies, waste management and recycling) to achieve multiple benefits, rather than a system that optimizes individual components for maximum performance.
4. Create better performance by employing measurement systems and tools that track achievement of specific and systemic objectives.

## **B. Existing Green Building Standards That Could Be Used By The University**

Efforts have been made in several European countries and in the United States to identify analytical methods for evaluating the environmental performance of buildings, and to codify these methods into standards that can be followed by the building industry. Examples of these efforts include England’s “British Research Establishment Environmental Assessment Method (BREEAM),” the US Green Building Council’s “Leadership in Environmental and Energy Design” standard (known as LEED™) and approaches developed by several states, such as New York’s “High Performance Building Guidelines” and Pennsylvania’s “Guidelines for Creating High Performance Buildings.” In the case of the State of New York, Executive Order 111 requires new State buildings to outperform the minimum requirements of State energy codes by 20% (substantial renovations of existing buildings must outperform the code by 10%), and to meet the criteria for a ‘Certified’ rating under the LEED rating system (although certification is voluntary).

A survey of members of the US Green Building Council identifies 67 current higher education members (not counting members which are departments or schools within a university), including the Santa Barbara, Merced, San Francisco and Berkeley campuses of the University of California. A comprehensive survey of efforts to address sustainable building policies by other institutions of higher education was beyond the scope of this

report in the time available. A table comparing selected policy statements by other States and institutions of higher education is included as Appendix 2.

Building types such as laboratory buildings which must protect building occupants against exposure to dangerous chemicals and microorganisms, and which contain large amounts of electrically-powered equipment consume far more energy and other resources than office buildings or housing. In an effort to improve the environmental performance of laboratory buildings, the US Department of Energy and the US Environmental Protection Agency funded the *Laboratories for the 21<sup>st</sup> Century* project (Labs21) at the Lawrence Berkeley National Laboratory. Labs21 has developed a supplementary package of additional measures and proposed these be added to LEED™ 2.1 for evaluation of laboratory buildings and other complex building types; it is under consideration by the US Green Building Council as “LEED™ for Labs.” This set of laboratory-specific measures was also evaluated. The University has the opportunity to collaborate with the US Green Building Council in the development of LEED™ for Labs to ensure its applicability to the UC system.

Due to their overwhelming familiarity within the building industry and their extension to laboratory buildings, the LEED 2.1 checklist and Labs21 environmental performance criteria were used by the working group to determine how UC projects might rate in accordance with existing design and construction practices. It should be noted that the LEED™ criteria were developed with a focus on application to a broad range of private and public buildings in urban and suburban settings, rather than to university campus buildings per se.

Both LEED™ 2.1 and Labs21 systems address six categories of evaluation:

- Sustainable Sites
- Water Conservation
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Innovations

Within these categories, both systems contain minimum prerequisites (measures that all projects must address), and discretionary measures. LEED™ 2.1 contains seven prerequisites and sixty nine discretionary measures, while addition of the Labs21 Environmental Performance Criteria to LEED™ 2.1 raise this to a total of twelve prerequisites and eighty five discretionary measures.

The Working Group also noted areas in LEED 2.1 (and by extension, in Labs21) that require modification to be more applicable in the University campus setting. The working group concluded that several areas of importance to UC in evaluating sustainability were missing from both evaluation systems; for instance, measures for evaluating long-term durability of capital projects.

The following table indicates the number of measures (points) required to achieve the different levels of certification under LEED™ 2.1. Labs21 measures are not yet incorporated into the LEED™ rating system, so they are not accepted as a basis for LEED™ certification.

**Table 1: LEED™ Certification Levels**

Certification Level	LEED 2.1	Labs21 (Proposed)
Total available measures:	69	85
Minimum for Silver	33	33
Minimum for Gold	49	49
Minimum for Platinum	52	52

Both the LEED™ and Labs21 systems were developed for evaluating the design of individual buildings, and do not explicitly address issues that arise when these buildings are situated in an infrastructure-rich campus setting. Adapting evaluation measures such as LEED™ and Labs21 to a campus setting requires attention to how individual building designs make use of systems and services available from the campus infrastructure, and the ways in which campus planning frameworks shape and support buildings located within them. In adopting specific measures, UC may incorporate LEED™ or Labs21 items as given, or may need to modify them to reflect the University’s specific conditions and objectives. Additionally, the US Green Building Council is actively considering these issues and is developing an application guide for multiple building settings. UC has the opportunity to collaborate with the US Green Building Council on development of LEED™ for Multiple Buildings to ensure its applicability to the UC system.

**B.1. Analysis of Resources Required to Implement LEED 2.1 and Labs21 –**

A subcommittee of the Working Group consisting of two engineers and three architects examined LEED 2.1 and Labs 21 to determine the cost impacts and the value attributes to building projects of each of the rating systems’ individual prerequisites and measures. The results of their examination are shown in Tables 2 & 3, below. Please note that some measures may score in more than one category. This analysis should be regarded as preliminary, as there has not been time enough to develop it in the context of a peer review process involving the campuses or outside consultants.

**Table 2: LEED and Labs21 Analysis: Resources Required to Implement**

Evaluation Components	Prerequisites / Points Available	Common Feature of UC Building Designs	Suggested by Policy/Standards	Changes Current Practice, Minor Design Tradeoffs	Implies Reduced Cost	Implies Additional Cost
LEED Prerequisites	7	5	0	2	0	2
LEED 2.1 Measures	69	15	2	33	3	21
Labs21 Prerequisites	13	2	1	3	0	0
Labs21 Measures	85	17	3	37	5	31

**a. Resources Required to Implement LEED 2.1**

- all 5 prerequisites are already common to UC building designs.
- 15 discretionary measures are already common features of UC building designs.
- 33 measures change current practice with minor design tradeoffs.
- 3 measures imply reduced construction costs.
- 21 measures imply additional construction costs.

**b. Resources Required to Implement Labs21 Environmental Performance Criteria**

- 2 prerequisites are already common to UC building design.
- 17 discretionary measures are already common features of UC building designs.
- 37 measures change current practice with minor design tradeoffs.
- 5 measures imply reduced construction costs.
- 31 measures imply additional construction costs.

**B.2. Assessment of Value to the University of Implementing LEED 2.1 and Lab 21**

The same LEED™ 2.1 and Labs21 measures were reviewed for their value to the University. (Each measure may score in more than one category of the analysis. This is the result of integrated or holistic design and points to the value of an holistic and integrative design process).

**Table 3: LEED and Labs 21 Analysis: Value to the University**

Evaluation Components	Points Available	Value to University						
		Measure Visible to Campus Community	Supports Environmental Health/Safety	Can Reduce Operating Costs	Supports Regulatory Compliance	Confers External Benefit to Society	Requires Common Strategy w/ Utility Co.	No Benefit in UC Context
LEED Prerequisites	7	1	3	4	6	5	2	0
LEED 2.1 Measures	69	24	13	27	33	45	5	1
Labs21 Prerequisites	13	1	2	3	4	3	0	1
Labs21 Measures	85	32	19	40	40	63	3	1

**a. Value to the University of LEED 2.1 Measures**

- 24 measures would be visible to the campus community.
- 13 measures would support environmental health and safety.
- 27 measures could reduce operating costs.
- 33 measures would support regulatory compliance.
- 45 measures would confer an external benefit to society.
- 5 measures would require a common strategy with a local utility company.
- Only 1 measure was considered to have no benefit to UC.

**b. Value to the University of Labs21 measures**

- 32 measures would be visible to the campus community.
- 19 measures would support environmental health and safety.
- 40 measures could reduce operating costs.
- 40 measures would support regulatory compliance.
- 63 measures would confer an external benefit to society.
- 3 measures would require a common strategy with a local utility company.
- Only 1 measure was considered to have no benefit to UC.

**C. How a Variety of UC Projects Might Rate According to These Standards Given Current Campus Design and Construction**

The University has a demonstrated history of dedication to long term stewardship; campus environments are models of dense sensitive ‘urban’ developments providing

unique balance of natural and manmade settings. University capital development tends to be long term – many campus buildings are older than 50 yrs; current buildings are most often planned and constructed with a projected life span of greater than 50 years. The University reuses its old building stock and goes to great lengths to renovate older buildings as long as appropriate and feasible.

The University maintains over 90,000,000 gross square feet of building space, and is projected to add approximately two million square feet annually for the next ten years to support a major surge in enrollment (estimated at close to 50% for the period 1998-99 through 2010-11) and related growth in academic and support personnel.

Project types range in complexity from major new acute care facilities at UC medical centers to simple office remodeling projects. Analysis of data submitted by the campuses for the 2001-2002 Major Capital Projects Implementation Report indicates that as of the end of FY 2001-2002 a total of 119 active new building projects were in process at UC prior to beneficial occupancy, totaling \$5,253,549,000 in approved budgets.

University capital development already incorporates many aspects of what is currently called ‘sustainable’ development. The University has made significant progress in energy efficiency on both the building and campus wide levels in the last 20 years. Thermal Energy Storage systems have been implemented at Davis, Irvine, Riverside, Los Angeles and San Diego. Extensive building lighting efficiency retrofits have been implemented at the Berkeley, Irvine, Los Angeles, Riverside, San Diego, San Francisco, and Santa Barbara campuses. Similar improvements to energy management systems and heating, ventilation, and air conditioning systems have been installed at all campuses. These efforts are ongoing, and are considered high priority aspects of new buildings. Irvine, San Diego, and Davis all maintain design standards that require energy performance to exceed the efficiency levels mandated by Title 24.

The California Environmental Quality Act (CEQA) requires that the University examine sixteen categories of environmental impacts, which are addressed in the environmental impact reports prepared during updates to Long Range Development Plans, and in the context of individual building projects if these are not entitled under an approved LRDP. CEQA focuses on the macro level, examining what effects the project is likely to have on the environment, and addressing issues such as indoor environmental quality. Conversely, evaluation systems such as LEED™ 2.1 target individual building designs, and do not deal with the cumulative effects of development, or environmental concerns in various environmental areas such as impact on historic, archaeological resources, geologic risks, or other large-scale issues.

### **C.1. Current UC Sustainable Building Projects**

Several campuses have designated individual projects as laboratories through which they can learn more about implementing sustainability concepts in the design process, and have shared the current ratings analysis with this study. Eight of these projects are at the Santa Barbara campus, three at the Merced campus and one each at the Berkeley, Los Angeles, and Davis campuses. In addition, UC Irvine plans to bid one (or more) projects

in the near future using bid alternates formulated to meet silver and possibly gold LEED™ standards, in order to determine the cost increments required.

**Table 4: Current UC Projects: LEED™ Ratings Analysis**

Current Projects - LEED Ratings Analysis											
No.	Project Name	Campus	Funding	Sustainable Sites	Water Conservation	Energy & Atmosphere	Materials & Resources	Indoor Envtl Quality	Innovation	Total Score	Possible LEED Rating
1	Residential Life Offices	UCSB	NS	10	2	9	8	12	1	42	gold
2	Life Science Bldg Labs	UCSB	S	8	5	5	4	6	4	32	certify
3	Intercollegiate Athletics Ofc	UCSB	NS	4	2			7	1	14	could certify
4	Recreation Ctr Expansion	UCSB	NS	6	4	2	3	5	4	24	could certify
5	Student Resource Bldg	UCSB	NS	10	3	12	6	15	4	50	gold
6	San Clemente Housing	UCSB	NS	10	3	3	5	11	3	35	silver
7	Marine Science Research	UCSB	NS	8	4	5	5	7	4	33	silver
8	Calif Nanosystems Institute	UCSB	S	4	4	3	3	5	3	22	could certify
9	Units 1 & 2 Infill Housing	UCB	NS	6	1	4	6	13	2	32	could certify
10	La Kretz Classroom & Office	UCLA	NS	8	3	6	2	8	3	30	certify
11	Vet Med Instructional Facility	UCD	S	6	1	3	3	11	3	27	certify
12	Science Building	UCM	S	8	1	7	4	13	2	35	silver
13	Library/Info Center	UCM	S	9	1	8	3	11	2	34	silver
14	Classroom Building	UCM	S	8	1	8	4	10	2	33	silver
<b>Averages:</b>				<b>8</b>	<b>3</b>	<b>6</b>	<b>4</b>	<b>10</b>	<b>3</b>	<b>32</b>	<b>certified/ silver</b>
Note: All projects are currently in design. Target LEED ratings shown here are the best estimate made by each campus and project design consultants, and final ratings will be determined at completion.											

Table 4 lists projects submitted by campuses to this feasibility analysis. Several projects intend to achieve a LEED™ rating, while for others campuses have conducted internal evaluations of the green content of these projects using the LEED™ rating system. These 14 projects averaged 32 LEED™ points, on the borderline between a ‘Certified’ and ‘Silver’ rating.

Interest in pursuing an explicit sustainable facilities strategy has been highest at the Santa Barbara, Berkeley, and Merced campuses. In the case of the new Merced campus, the LRDP planning process has established clear goals of leadership on environmental issues throughout the planning and design process. The Merced LRDP requires all new buildings to achieve the equivalent of a LEED™ ‘Certified’ rating, and by direction of the Chancellor all new projects will target LEED™ Silver ratings from the US Green Building Council (ratings are awarded after completion). The first three buildings are the Science and Engineering building, the Classroom and Office building, and the Library and Information Technology Center. Campus services including both infrastructure (consisting of a central plant, thermal energy storage tank, and distribution systems) and building services will be designed and constructed as an integrated system.

The Santa Barbara campus pioneered sustainable design and construction in the UC system with the recently-completed building for the Bren School of Environmental

Science and Management, which achieved a ‘Platinum’ rating under the LEED™ version 1.0 rating system. This project was the first University laboratory building to achieve a LEED™ certification. Subsequently, the Santa Barbara campus has started using LEED™ 2.1 to evaluate all new building designs, regardless of whether the campus eventually chooses to submit a project for certification.

The Berkeley campus has adopted a clear policy on sustainable design and planning as part of the campus’s New Century Plan (NCP). The New Century Plan adopts LEED certification as an interim reference standard while the campus investigates a customized approach, and requires that future projects achieve the equivalent of LEED certification.

In accordance with campus policy, Merced’s first three buildings are all projected to attain energy use and peak electricity demand at 62% to 70% of the maximum level allowed by the 2001 version of Title 24. These projects demonstrate that UC building projects can achieve significant energy savings above and beyond Title 24 within standard building budgets. Table 5 describes projected performance of the first three Merced buildings for each aspect of energy usage (analyses current as of the end of Design Development phase):

**Table 5: Projected Performance of Initial UC Merced Buildings Relative to 1999 UC Average Benchmark**

	Maximum Power *	Maximum Chilled Water **	Annual Electricity ***	Annual Natural Gas ***
<b>Classroom &amp; Office Building</b>	<b>52%</b>	<b>74%</b>	<b>51%</b>	<b>56%</b>
(Savings)	(48%)	(26%)	(49%)	(44%)
<b>Library &amp; Information Technology Center</b>	<b>58%</b>	<b>79%</b>	<b>75%</b>	<b>77%</b>
(Savings)	(42%)	(21%)	(25%)	(23%)
<b>Science &amp; Engineering (Laboratory) Building</b>	<b>77%</b>	<b>62%</b>	<b>58%</b>	<b>21%****</b>
(Savings)	(23%)	(38%)	(42%)	(79%)****
Target for Buildings Opening in:				
2004	80% <sup>1</sup>			
2005-2007	65%			
2008+	50%			

**1** The target for 2004 applies to all buildings listed above.  
**\*** Load After Cooling Load Shifted by Thermal Energy Storage Including Prorated Part of Small Peak (Pumping) Load at Plant  
**\*\*** Load on Plant  
**\*\*\*** Including Prorated Part of Plant Use  
**\*\*\*\*** Under Review

Table 6 describes projected overall energy savings achieved by the first three UC Merced buildings relative to the 2001 standards of Title 24 (which governed the design of the UC Merced buildings).

**Table 6: Projected Performance of Initial UC Merced Buildings Relative to 2001 Title 24**

<b>Building</b>	<b>Annual Energy Use ***</b>
<b>Classroom &amp; Office Building</b> (Projected Savings Relative to 2001 Title 24)	<b>63%</b> <b>(37%)</b>
<b>Library &amp; Information Technology Center</b> (Projected Savings Relative to 2001 Title 24)	<b>62%</b> <b>(38%)</b>
<b>Science &amp; Engineering (Laboratory) Building</b> (Projected Savings Relative to 2001 Title 24)	<b>70%</b> <b>(30%)</b>

**D. Assessment of Probable Costs**

To date, there has been no mandate in UC’s capital program to document the costs of specific design features meant to achieve green building ratings. Therefore, there are no comprehensive data reflective of the probable cost of specific green measures to UC projects. These data will be generated in the context of a Systemwide green building policy. Some evidence does exist to indicate that the equivalent of a LEED™ ‘Certified’ rating from the US Green Building Council or higher is achievable within the limits of current standard building budgets:

1. The first three Merced projects are currently projected to achieve ‘Silver’ LEED™ ratings. The budgets for these projects were formulated with standard procedures and are funded within standard limits. At completion of preliminary plans the building designs indicate that a substantial level of accomplishment is possible within available resources. UC Merced’s overall campus environmental strategy provides infrastructure support for features incorporated into these projects, such as the central utility plant and thermal energy storage tank. This interdependence of planning objectives, campus infrastructure, and building design is a model of responsible and environmentally-friendly campus development.
2. For the past 10 years, the Irvine campus has required that projects outperform Title 24 energy-efficiency standards by at least 20%, using a computer-generated analysis of building systems performance, comparing energy used per square foot per year for a standard energy code-compliant building and for the proposed building. This level of performance has been achieved within standard budgets for new facilities, which may involve value-engineering tradeoffs to achieve. The San Diego and Davis campuses mandate a 10% improvement over Title 24.

3. The Santa Barbara and Berkeley campuses use the LEED™ 2.1 rating system to evaluate sustainable design content of all projects currently underway. These projects have been funded within standard procedures and limits. Most projects could achieve the ‘Certified’ level were the campus to seek certification, and several projects would likely achieve LEED™ ‘Silver’ or ‘Gold’ certification levels (see Table 4).

Based on these experiences, there is clear indication that increased environmental performance of UC facilities can be achieved within current budget parameters. To assure this outcome, explicit guidelines should be promulgated to promote sustainability objectives in the development process, while maintaining an effective balance with competing academic program and architectural design goals.

Of the specific measures reviewed in the course of this analysis, energy efficiency and water conservation have the greatest impact on both initial capital costs and the cost of continued operation of facilities. The greatest benefit would accrue from reduction of long-term energy use and its costs. Improved water conservation has significant cost and environmental benefits as well as addressing an increasingly constraining factor in the growth of many of the University’s campuses.

In order to better target a green building policy, the University should develop a template for tracking costs and benefits for green building measures and initiatives. A number of specific measures, especially in the areas of energy and water conservation, can be made mandatory for all projects, and will lead to reduced operating costs. These are outlined in Section G (below). Many measures will be implemented through changes in building technology, such as aerodynamically-designed fume hoods that require lower rates of airflow to meet performance criteria, waterless urinals, evaporative pre-cooling in HVAC systems, and others. Many measures studied will not have a deleterious cost impact on projects, and could be implemented through improved design decisions.

#### **E. Relative Benefits of Internal versus External Certification**

Creating an internal measurement and certification procedure has many benefits. Any internally-generated certification system should draw from, and remain aligned with, external systems such as LEED™ and Labs21. The benefits of an internal system include the ability to better target sustainable features of individual building types common to UC, and to integrate the evaluation methodology with internal budgetary and environmental planning goals and procedures. Both internal and external systems provide a framework within which to nurture environmental ‘best practices’ in which innovations made at one campus may be adopted throughout the system. Because UC academic programs in architecture, engineering, environmental science, and public policy have addressed these issues for many years, the opportunity exists to make better use of UC-sponsored academic research to help shape real-world solutions.

External certification (such as by the US Green Building Council) can be expensive, requiring significant documentation submitted to an outside agency for analysis and acceptance. Campuses have reported a wide range of consultant fees proposed for preparation of LEED™ documentation, ranging from fifteen thousand to several hundred thousand dollars. There may be too few thoroughly trained and experienced professionals

in the architecture and engineering community at this time to satisfy the resultant demand were the University to make external certification a requirement.

The primary drawback to internal certification is lack of an independent third-party evaluation and consequently lower public visibility for University achievements. LEED™ 2.1 has a high level of public and industry brand identity, and if we were to develop an internal project evaluation and certification system, the University would have to make a concerted effort to convince a skeptical public and broader University community that this internal system was the equivalent of external systems such as LEED™ 2.1 (or future versions).

A stringent UC Green Building certification process could result in the creation of a UC ‘brand’ of sustainability, reflective of the guiding values promulgated in the LEED™ rating system, and could also offer the opportunity to develop a standard more in alignment with the University’s mission and fiscal realities. A UC Green Building self-certification process would offer a number of advantages:

1. Avoids the expense of the LEED/USGBC submittal process;
2. Permits UC to focus on efficacious sustainable measures tailored to a context of comprehensive campus infrastructure systems and urban development patterns rather than within a standard template developed for generic stand-alone buildings;
3. Avoids influence of industry marketing efforts developing around the LEED™ process and commissioning requirements;
4. Maintains control and management of recording and reporting requirements, rather than being controlled by an outside agency;
5. Promulgates sustainable building practices employed across many projects within the University.

A self-certification process would need to be rigorous in order to develop and sustain public credibility. The internal certification process should be published, and acknowledged through organizational level collaboration with reputable environmental/sustainability institutes and organizations.

#### **F. UC Relations with Rating Systems and their Managing Organizations**

The University should actively partner with or otherwise engage the US Green Building Council, Labs21, DOE, EPA, and other organizations involved in the development of green building evaluation methodologies and design strategies, with the goal of adopting an external certification system when one is available that meets the University’s requirements at an acceptable cost. The University should become a member of the US Green Building Council and should actively participate in two USGBC efforts, the development of LEED™ for Labs and LEED™ for Multiple Buildings. The University should also explore ways to partner with the Labs21 effort sponsored by EPA and DOE, especially in promoting the development of more efficient fume hoods, refrigerators and freezers, washers and sterilizers, and other laboratory equipment.

## **G. Fundamental Priorities of a UC Sustainable Buildings Policy**

The Working Group determined that the following measures have universal applicability to UC building projects, and are of importance for either their direct effect on lowering the costs of long-term operations (or give campuses the tools with which to do so).

1. Water Conservation: Prevent water from being used ‘once through’ unless it is required as direct contact process water.
2. Energy Conservation:
  - a. Follow fundamental best practice commissioning procedures.
  - b. Zero use of CFC refrigerants in new base building HVAC&R systems and zero use of halon in fire suppression systems.
  - c. Determine and document ways of meeting ventilation requirements comprehensively in an energy-efficient manner, including fume hoods and required ventilation and exhaust alternatives such as instrument exhausts. Develop a workable fume hood sash management plan, and outperform the minimum requirements of California Code Title 24 by at least 20% while paying close attention to energy efficiency for systems not addressed by Title 24.
  - d. Install continuous metering equipment for lighting, motors, boilers, chillers, cooling load, air distribution static pressures, process energy systems and equipment, and indoor water risers and outdoor irrigation systems.
  - e. Improve laboratory equipment efficiency.
  - f. Right-size laboratory equipment loads by measuring the actual energy expenditures found in comparable laboratories, and designing electrical distribution systems for either portable or permanent check metering of laboratory equipment electrical consumption.
3. Materials & Resources:
  - a. As a prerequisite, meet the standards set forth in American National Standards Institute Z9.5 or latest version. Provide monitoring and control of fume hoods and room pressure.
  - b. Develop a chemical usage management plan, to improve distribution and limit quantities, storage, and waste.
4. Indoor Environmental Quality:
  - a. As a prerequisite, declare the procedures set forth in ASHRAE 62-1999 (Ventilation Rate Procedure or Indoor Air Quality Procedure) and control smoking.

- b. Comply with thermal comfort standards (either ASHRAE 55-1992 or California High Performance Schools Best Practices Manual).

The Working Group found that energy efficiency and improved water usage are very high priority in view of both their environmental effects and potential for operational cost savings resulting from increased efficiencies. The measures listed in points 1-4 above are proposed as mandatory due to their ability to be addressed within all projects, and the importance of their contribution to operational cost savings.

The remaining majority of measures contained within LEED™ 2.1 and the Labs21 Environmental Performance Criteria were deemed to be discretionary. The most important differentiating factor is universality, whether reasonable grounds exist for mandating any given measure in all (or nearly all) building projects, or whether a measure only applies to certain building types, or in cases where support infrastructure is available. Many discretionary measures will have benefit to the University if implemented in appropriate projects, while some confer greater value to society at large.

For example, a class of measures that would benefit UC but which may not be applicable to every building project is commissioning of building systems. The largest share of new buildings underway at the University is high-technology laboratory buildings, which are expensive to operate and for which operating costs can spiral upwards if systems do not run optimally. The process of taking a laboratory building into use requires testing and tuning each system in the building, both separately and in conjunction with all other systems, in order to assure that the building runs efficiently and smoothly. This quality assurance process is called commissioning, and various levels of commissioning are either prerequisites or discretionary measures under both LEED™ 2.1 and Labs21. To further improve life cycle costs and minimize environmental impacts of complex buildings such as laboratories, the University should establish systemwide building commissioning procedures to improve built quality and project delivery, and to increase assurance that energy-saving systems and equipment function properly at completion. However, budgetary constraints dictate that this be done in a cost-effective manner without duplicating responsibilities and expenditures under present construction delivery practices. There is a strong consensus on the part of UCOP and the campuses that proper commissioning procedures should be defined and enforced in standard UC design and construction contracts, to avoid the unnecessary expense of additional consultants unless called for by specific project circumstances.

## **V. RECOMMENDATIONS**

### **A. General Recommendations**

The task force recommends that the University:

- 1) Articulate a common vision and framework for sustainable policies and practices throughout the University, highlighting the benefits to students, faculty, and staff.
- 2) Identify and quantify the positive, long-term benefits of implementing sustainability practices for the budget process.

- 3) Identify, recognize, and communicate information about existing campus practices and best practices from other institutions and organizations. This could be accomplished by conducting seminars and conferences with broad participation by other universities, colleges and research organizations.
- 4) Identify potential linkages between sustainable practices for campus development, operations, academic programs, and student life activities.
- 5) Identify barriers to implementing sustainable practices and solutions for removing those barriers.
- 6) Explore the full range of possible strategies for implementing new practices, both at the system level and campus-based. Identify strategies that leverage the strength of the system's influence and resources.
- 7) Provide practical implementation tools, such as general policy, and specific guidelines and procedures, for project and program directors.

## **B. Recommended Policy Framework**

The task force recommends that the University:

1. Adopt, as University policy for all capital projects, the principles of energy efficiency and sustainability in the planning, financing, design, construction, facilities renewal, maintenance, operation, space management, facilities utilization, and decommissioning of facilities and infrastructure to the fullest extent possible, consistent with budgetary constraints and programmatic requirements.
2. That the President be charged with developing and implementing this policy for all capital projects and existing facilities in the University, and provide an annual report to The Regents on conformance with this policy that tracks the effects of this policy on capital and operating costs, and on the effects of this policy on the capital program. The President may re-delegate this responsibility to the Senior Vice President – Business & Finance.

## **C. Recommended Aspects of Implementing Guidelines**

### Procedures & Responsibilities

- 1) The President should review these guidelines as appropriate, and amend them as required. Responsibility for further definition of implementation measures under this policy and for oversight of University sustainability policy should be delegated to the Senior Vice President – Business and Finance. Responsibility for implementation in the context of individual building projects and facilities operations should be delegated to the Chancellors.
- 2) University-wide guidelines and methods for implementation should be promulgated by the Senior Vice President – Business and Finance, in consultation with campus

organizations, the Vice President for Budget, and the University Provost, in order to make full use of expertise and resources within the University.

- 3) The Senior Vice President – Business & Finance should monitor progress of implementation and assess this policy in light of information gathered through reporting of results in the project design approval process and annual campus reports, and make recommendations to the President for strengthening or otherwise adjusting the provisions and promoting smooth integration of sustainable design principles within the capital program.
- 4) The President should report on an annual basis to The Regents on conformance with this policy in the context of each campus's capital program and operating costs. Every three years, re-examine this policy and report to The Regents with the intent of developing and strengthening implementation provisions and reviewing the influence of this policy on facilities capital and operating costs.

### Planning

- 1) Campuses should ensure that campus Long Range Development Plans (LRDPs) and physical plans incorporate the concept of sustainability, including water and energy usage, the minimization of resource consumption and pollution, and the careful use and reuse of all resources, where feasible.
- 2) Campuses should define cost effective ways to reduce consumption of water and energy, minimize resource consumption and pollution from transportation systems, and otherwise minimize waste of resources.

### Sustainable Building Practices

- 1) In consultation with the campuses, UCOP should develop an internal evaluation and certification standard based on the LEED™ and Labs21 measures, as well as other measures and application guidelines where necessary for the implementation of sustainable building principles within campus infrastructure and physical planning contexts. This standard should be called the UC Green Building Application Guide, and will be referred to as such in the text of this report even though it has yet to be developed in detail.
- 2) The University should work closely with the US Green Building Council, Labs21, DOE, EPA, and other organizations involved in the development of green building evaluation methodologies and design strategies. Possible fruits of collaboration include improving evaluation methodologies, especially those which address campus physical planning contexts and campus infrastructure, energy-efficiency standards for laboratory equipment and building systems components, and the possibility of adopting an external certification system when one becomes available that meets the University's requirements at an acceptable cost.
- 3) As a framework for implementation of this policy, the University should require all campus design standards to incorporate a minimum number of sustainability attributes equivalent to a "Certified" rating in the LEED™ system, developed by the US Green Building Council, and to require all new building projects (other than

acute-care facilities) to outperform the required provisions of the California Administrative Code, Title 24 energy-efficiency standards by at least 20 percent.

- 4) Due to the specialized requirements of laboratory buildings, the committee recommends that laboratory projects achieve the equivalent of a “Certified” rating using the LEED™ system and the extensions to that system developed for evaluation of laboratory buildings by the Labs21 program sponsored by the U.S. Department of Energy and Environmental Protection Agency. Further study should be conducted before application of this policy to new acute-care facilities.
- 5) Building the minimum requirements for achieving the equivalent of a LEED™ ‘Certified’ rating into campus design standards is by far the most cost-effective way of achieving sustainability goals, as the means and measures become part of the project program and incorporated into the fundamental design approach of the project. Measures which are added later, after the design direction of the project has been established, are typically far more expensive than those incorporated from the outset.
- 6) In addition, the University should maximize the level of sustainability achieved in all capital projects by striving for a targeted average equivalent to a LEED™ “Silver” rating whenever possible, within the constraints of program needs and standard budget parameters. Specific measures and design strategies to achieve these goals should be explicitly described in project programming and budget-setting documentation. In the event that an individual project cannot meet the requirements of this policy, the reasons should be accounted for and documented in the project program.
- 7) Incorporating sustainable design principles into campus design standards will also ensure that renovation projects will employ sustainable design measures where appropriate to the scope of the project.
- 8) Campuses should be encouraged to exceed the minimum standards described herein, and free to choose to achieve an externally-certified level of sustainability on any given project, for instance by using the LEED™ rating system and submitting a project for certification by the US Green Building Council.
- 9) All new building projects (other than acute-care facilities) submitted for incorporation into the State-funded capital program after the start of FY 2004-05 and Non-State-funded capital program after the start of FY 2003-04 should incorporate the universal measures outlined in the UC Green Building Application Guide. Campuses should incorporate these universal measures, especially in regards to energy efficiency, into projects currently in design to the extent feasible within approved funding.
- 10) After further data collection and study, determine in consultation with the medical centers the best ways to apply the intent of the UC Green Building Application Guide to new acute-care facility capital projects by July 2004.
- 11) Develop a standard methodology for analysis of facilities-related life cycle costs by July 2004 that can be customized to the economic and environmental circumstances of each campus. This should be used as a tool for assessing the life cycle cost implications in architectural and engineering design decisions, explicitly recognizing

the importance of this life cycle factor in the design process and leading to improvement of the life cycle cost performance of University facilities. Non-quantifiable factors, such as environmental benefits for the public good, should be recognized in the development of the standard methodology. The development of this standard methodology would be delegated by the President to the Senior Vice President-Business & Finance, who would work in collaboration with the Budget Office and the campuses.

- 12) Evaluate the sustainability of facilities management practices and develop policy and standards to apply to facilities operations within one year of the adoption of this policy. These policies and standards should address all aspects of building cleaning, maintenance, and operation to include things such as chemical usage, indoor air quality, utilities, and recycling programs.
- 13) The University should use its purchasing power to promote the availability of sustainable products in the marketplace by means that include pursuing systemwide contracts for building materials, building subsystems components, equipment, and supplies that promote sustainability and can be used in all new building and renovation projects, as well as sustainable facilities operations. Additionally, work with external agencies or entities to speed the development, approval, and implementation of products and technologies that improve energy efficiency and support sustainable design, construction, and operating practices. This can assist in building better relationships with local communities.
- 14) Develop a program of peer review of sustainability practices within the University that takes advantage of the University's expertise and promotes sharing of best practices. Incorporate a training program about the peer review program and the UC Green Building Application Guide into existing training, with the aim of promoting and maintaining the aims of this policy.

## REFERENCES

(For BOTH Green Building and Clean Energy Feasibility Studies)

Taylor Engineering 2002. *University of California, Merced Academic Building: Detailed Energy Analysis Report, UC Merced Energy Target Compliance, Savings By Design Documentation, LEED Energy Score*. Taylor Engineering. December 30, 2002.

Arup 2003a. *University of California Merced: Science + Engineering Building, Energy Analysis Report*. Ove Arup & Partners California LTD. January 27, 2003.

Arup. 2003b. *University of California, Merced: UC Merced Library and Information Technology Center, LEED Energy Analysis and Campus Energy Targets Report*. Ove Arup & Partners California LTD. February 2003.

UCOP. 2003. *University of California Green Building Policy and Clean Energy Standard Steering Committee Web Page*. University of California Office of the President. <http://www.ucop.edu/ucophone/busfin/greenbldgs/>

DGS. 2003. *Capitol Area East End Complex features Green Construction*. Department of General Services. <http://eastend.dgs.ca.gov>

SBTF and SCSA. 2001. *Building Better Buildings: A Blueprint for Sustainable State Facilities, Governor's Executive order D-16-00*. Sustainable Building Task Force and the State and Consumer Services Agency. December 2001.

CIWMB. 2002. *Capital Area East End Office Complex: A New California Standard. California Integrated Waste Management Board*. Publication #433-02-022. September 2002.

CIWMB. 2003. *Integrated Waste Management Board, Sustainable Building Case Studies, Donald Bren School of Environmental Science and Management*. <http://www.ciwmb.ca.gov/GreenBuilding/>

UCSB. 2003. *About Bren - Donald Bren Hall. Donald Bren School of Environmental Science & Management, University of California, Santa Barbara*. [http://www.bren.ucsb.edu/about/donald\\_bren\\_hall.html](http://www.bren.ucsb.edu/about/donald_bren_hall.html)

## Appendix 2A:

### Working Group Members

- 1) Mike Bocchicchio – Assistant Vice President, Facilities Management, UCOP
- 2) Colleen Nickles – Director, Business & Finance Operations, Immediate Office of the Senior Vice President – Business & Finance
- 3) Larry Aull – Director, State Capital Budget, UCOP
- 4) Lori Hoffman – Director, Non-State Capital Budget, UCOP
- 5) Karl Brown – Deputy Director, California Institute for Energy Efficiency
- 6) Geoffrey Bell – Senior Energy Engineer, Lawrence Berkeley National Laboratory
- 7) Maric Munn – Associate Director, Energy, Facilities Management, UCOP
- 8) David Gonzalez – Assistant Vice Chancellor, Facilities Management, UCSB
- 9) Dave Johnson – Director, Facilities Management – Energy Services, UCLA
- 10) Eugene Lau – Director, Environmental Health & Safety, UCSF
- 11) Hope Schmeltzer – General Counsel, UCOP
- 12) James Maguire – Coordinator, State-Funded Capital Program, UCOP
- 13) Mike Miller – Assistant Vice Chancellor, Facilities Management, UCR
- 14) Michael Bade – Assistant Director, Design & Construction Services, Facilities Management, UCOP
- 15) Johnny Torrez – Director, Facilities Management, UCOP
- 16) David Belk – Director, Environmental Protection, Facilities Management, UCOP

## Appendix 2B

### Selected State and University Sustainable Design and Construction Policy Statements

#### 1) State of Massachusetts

- Design to minimize life cycle costs, including the use of materials that will maximize durability and longevity.
- Use resources efficiently by designing buildings that exceed code minimums, including minimizing energy and water use and maximizing use of natural daylight.
- Use environmentally preferable products, including, (but not limited to) those without toxic ingredients and those which contain recycled content.
- Create healthy indoor and outdoor environments for building occupants, workers and communities.
- Minimize adverse impacts that site development may have upon natural and built systems.
- Make the building adaptable for future inclusion of innovative energy and environmental technologies as they become commercially viable.

#### Sustainable Design Program Features:

- Installing high efficiency HVAC equipment at most DCAM managed construction and renovation sites
- Utilizing energy modeling to optimize HVAC designs
- Maximizing available utility rebates for high efficiency equipment
- Specifying recycled content materials in many applications
- Developing 3rd party commissioning pilot program to ensure that project design criteria for efficiency and indoor environmental quality are achieved
- Implementing staff training program
- Conducting Life Cycle Analysis on all major building projects
- Recommend LEED certification as design requirement

#### 2) University of Massachusetts, Amherst

A green building design policy establishes a basis for incorporating the principles of environmental stewardship, energy efficiency and resource conservation into the design of new campus buildings and major renovation projects.

Its goal is to pursue holistic, integrative and collaborative design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants.

A green building policy has many benefits, including: i) reducing the impacts of natural resource consumption; ii) reducing a building's operating and life cycle costs; iii) enhancing occupant comfort and health; iv) improving occupant productivity; and v) minimizing the strain on local infrastructures and improving the regional quality of life. Finally, engaging students in the sustainable design of buildings and training faculty, staff and students on the impact of their behavior on resource conservation will help to reduce the campus's environmental impact.

University of Massachusetts, Amherst commits to a resource and energy conservation program based on continual improvement in the design and construction of new buildings and major renovations. University of Massachusetts, Amherst will:

- Design to minimize life cycle costs, including the use of materials that will maximize durability and longevity;
- Use resources efficiently by designing buildings that minimize energy and water use and maximize use of natural daylight, exceeding code minimums where appropriate and feasible;
- Use environmentally preferable products, including (but not limited to) those without toxic ingredients and those which contain recycled content;
- Create healthy indoor and outdoor environments for building occupants, workers and communities;
- Follow, to the maximum extent practicable, guidelines for the construction of green buildings, including the Massachusetts Division of Capital Asset Management Sustainable Design Program and the U.S. Green Building Council's LEED Rating System;
- Integrate building commissioning into the study, design and operations of campus buildings; and
- Provide training to all building occupants on energy conserving practices relevant to their building's operation.

### 3) Massachusetts Institute of Technology

(see: [http://web.mit.edu/environment/commitment/environmental\\_initiatives/task\\_force.html](http://web.mit.edu/environment/commitment/environmental_initiatives/task_force.html) )

MIT will become a leader in environmentally responsible operations, development of new and renewed facilities, and education. The initial, lifecycle, and environmental costs and benefits of projects and programs will be considered in order to reduce the impact of the campus on the environment within realistic parameters. The Institute will achieve these goals, and seek continuously to improve upon them over time, through the broad participation of the faculty, students, and staff. To begin this process, the following goals are articulated. We will work toward quantifying these goals and measuring progress toward achieving them.

Included among MIT's important long-range environmental goals are to:

- Conserve energy, seeking continuous reductions in our per capita energy consumption.
- Reduce campus air emissions, including those from transportation, of greenhouse gases and regulated pollutants.
- Reduce material and resource consumption, including office and laboratory supplies and water.
- Increase the recycling and conservation of materials.
- Increase the use of recycled content products.
- Reduce the volume of toxicity of our hazardous waste streams.
- Improve our indoor environment, including both the indoor air quality and the comfort and productivity of our work and living spaces, by considering sustainability in our design, operations, and maintenance policies.
- Improve the urban environment, including landscape quality and the site and pedestrian environment.
- Educate our students in sustainable concepts so that they may apply them in their professions.
- Support communitywide and regional sustainability efforts.

MIT is undertaking a significant capital projects program, presenting an immediate opportunity to make progress toward these goals in MIT buildings. Although many other projects and programs at MIT will work over time to achieve these goals, we will lose an important opportunity to make progress in MIT buildings if we do not act immediately in the capital projects program.

Consequently, as an interim measure to achieve a minimum standard and support progress toward these general environmental goals, MIT has determined that new projects (including, renovations and new construction) and programs will be designed to meet or exceed the "LEED Silver Plus" standard (the LEED Silver standard has been adopted — as soon as possible the "MIT Plus" will be added). The LEED Silver Plus standard is the LEED Silver standard enhanced to reflect additional requirements that are necessary to support progress toward MIT's environmental goals. Included are new projects and programs that are in early stages of design, are as yet to be designed, or are capable of being feasibly revised to meet MIT's environmental goals taking into account all factors and circumstances. MIT actively encourages the pursuit of environmentally innovative projects and use of innovative technology.

The LEED Silver Plus standard also will be revisited in the short term to determine whether further customization is necessary to meet MIT's long-term goals. MIT seeks to develop as quickly as possible a more performance-based standard that can be tailored to individual projects.

## Life-Cycle Cost

The total cost MIT incurs in any project involves funding from a variety of sources, including funding for initial capital development, for operating, repair and maintenance costs, and for replacements. MIT and the larger world of which we are a part also incur environmental costs from projects at every stage of development, use, and replacement. In order to incur as little overall cost as possible both in the interim and under MIT's ultimate standard, MIT must make integrated decisions involving all constituencies with concerns about any of these costs. During the interim, and under any ultimate standard, the following factors that affect total cost will be taken into account throughout all stages of projects and programs: initial investment; life cycle costs; and environmental costs that are neither initial investment nor life cycle costs. These include environmental costs such as greenhouse gas emissions, indoor air quality and use of nonrenewable materials.

It is a high priority for MIT to expeditiously develop a more comprehensive model for evaluating the total cost/benefit of project/program components, taking into account initial investment (including capital cost), lifecycle cost, performance, and environmental benefits and impacts.

MIT commits to undertaking consultation and review of projects among MIT experts, the MIT client team, and designers at the very earliest stages of design concept development, and periodically throughout the design process to incorporate objectives and mechanisms for achieving MIT's long-term environmental goals in projects and to evaluate total costs.

### 4) State of New York

In the design, construction, operation and maintenance of new buildings, State agencies and other affected entities shall, to the maximum extent practicable, follow guidelines for the construction of "Green Buildings," including guidelines set forth in Tax Law § 19, which created the Green Buildings Tax Credit, and the U.S. Green Buildings Council's LEED™ rating system. Effective immediately, State agencies and other affected entities engaged in the construction of new buildings shall achieve at least a 20 percent improvement in energy efficiency performance relative to levels required by the State's Energy Conservation Construction Code, as amended. For substantial renovation of existing buildings, State agencies and other affected entities shall achieve at least a ten percent improvement. State agencies and other affected entities shall incorporate energy efficient criteria consistent with ENERGY STAR® and any other energy efficiency levels as may be designated by NYSERDA into all specifications developed for new construction and renovation.

### 5) State University at Buffalo, New York (see: <http://wings.buffalo.edu/ubgreen/> )

In 1998, the UB Environmental Task Force proposed the development of a campus green building design policy to incorporate greater levels of energy efficiency and the principles of environmental stewardship into the design of new campus buildings and major renovation projects. In May 2000 UB President William Greiner approved the UB Sustainable Energy Policy which states that the University will "strengthen its

commitment to the principles of environmentally sustainable green building design for all new construction and major renovations." This commitment was reinforced by New York Governor Pataki when he issued Executive Order No. 111 on June 10, 2001. The Executive Order specially requires State agencies to follow guidelines for the construction of green buildings including guidelines set forth in green building tax credit law and LEED rating system. Effective immediately, State agencies are required to achieve a 20% improvement over Energy Code for all new construction. For substantial renovations of existing buildings, 10% improvement. Energy Star building energy efficiency criteria shall be incorporated.

On June 10, 2001, New York Governor George Pataki issued Executive Order No. 111, "Directing State Agencies to be More Energy Efficient and Environmentally Aware." This Executive Order reinforces UB's energy policies and requires all State agencies to do the following:

- Overall Energy Consumption - Achieve a 35% reduction of energy consumption in all buildings by 2010, compared to 1990.
- Existing Buildings - Undertake energy conservation measures, including but not limited to, shutting off office equipment; adjusting setting of space temperatures; turning off lighting in unoccupied spaces; inspecting, re-commissioning or re-tuning HVAC equipment; cycling and restarting equipment to reduce peak loads. Strive to meet Energy Star building efficiency criteria for energy performance and indoor environmental quality.
- New Buildings and Substantial Renovations of Existing Buildings - Follow guidelines for the construction of green buildings including guidelines set forth in green building tax credit law and LEED green building rating system. Effective immediately, achieve a 20% improvement over Energy Code for all new construction. For substantial renovations of existing buildings, 10% improvement. Energy Star building energy efficiency criteria shall be incorporated.
- Procurement of Energy-Efficient Products - Purchase only Energy Star compliant equipment or highly efficient equipment (in the case of non-Energy Star rated equipment).
- Purchase of Power from Renewable Sources - 10% of electric power purchases must be green power by 2005; 20% by 2010.
- Procurement of Clean Fueled Vehicles - Increasing percentage of new vehicles must be alternative fuel, including hybrid. 50% of new light-duty vehicles acquired by State agencies shall be alternative fuel by 2005; 100% by 2010. Operators of medium and heavy-duty vehicles must implement measures to reduce petroleum consumption and use alternative fuels.
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#### 6) City of Seattle

The City's Sustainable Building Policy was unanimously endorsed by the City Council and signed by the Mayor in February 2000. The policy uses the US Green Building Council's LEED™ Rating System to evaluate the City projects and sets a

policy goal of Silver Level performance for City-funded projects with over 5000 square feet of occupied space.

plan, design, construct, manage, renovate, maintain, and decommission its facilities and buildings to be sustainable. This applies to new construction and major remodels in which the total project square footage meets the criteria given. The US Green Building Council's LEED (Leadership in Energy and Environmental Design) rating system and accompanying Reference Guide shall be used as a design and measurement tool to determine what constitutes sustainable building by national standards. All facilities and buildings over 5,000 gross square feet of occupied space shall meet a minimum LEED Silver rating.

Design and project management teams are encouraged to meet higher LEED rating levels. A Mayor's Award for achieving a higher rating will be awarded.

It shall be the policy of the City of Seattle to finance, plan, design, construct, manage, renovate, maintain, and decommission its facilities and buildings to be sustainable. This applies to new construction and major remodels in which the total project square footage meets the criteria given. The US Green Building Council's LEED (Leadership in Energy and Environmental Design) rating system and accompanying Reference Guide shall be used as a design and measurement tool to determine what constitutes sustainable building by national standards. All facilities and buildings over 5,000 gross square feet of occupied space shall meet a minimum LEED Silver rating.

Design and project management teams are encouraged to meet higher LEED rating levels. A Mayor's Award for achieving a higher rating will be awarded. (See also Energy and Water Conservation Policy and Landscape and Grounds Management Policy.)

All capital construction which falls under this policy will be expected to budget to meet at minimum the LEED Silver rating. Budget planning and life cycle cost analysis to achieve a higher rating of gold or platinum is encouraged.

7) University of Oregon (see: <http://darkwing.uoregon.edu/~uplan/sustainable.html> )

The development, repair, maintenance and operations of the University of Oregon today have an impact on the local environment and the ability of future generations to thrive. The physical environment of the University – landscape and buildings – must also support and enhance the excellence of our academic programs.

Therefore: The University will strive to become a national leader in sustainable development. All development, redevelopment, and remodeling on the University of Oregon campus shall incorporate sustainable design principles including existing and future land use, landscaping, building, and transportation plans. Sustainable endeavors will support the University's missions of teaching, research, and public service.

(The following are selected from the University of Oregon's Sustainable Development Guidelines)

### Project Management

Effective sustainable development begins when the project is conceived. Management of the project design and construction process will affect the overall success of sustainable development.

Therefore: Integrate sustainable practices into the entire design and construction process.

### Performance Standards

Sustainable principles must be measured and enforced by a defined set of standards to ensure effective implementation.

Therefore: All new construction projects that are required to comply with the State Energy Efficiency Design (SEED) program shall be rated according to the LEED Green Building Rating System. These projects shall achieve the equivalence of the base level of LEED certification (and strive for a higher level) unless there is a compelling reason why this is not possible.

### Living Design

The people who occupy, operate, and maintain the completed building/site will determine whether sustainable principles embodied in the building/site design are successful over time.

Therefore: Design the building/site to encourage the people who occupy, operate and maintain the building/site to practice environmentally sustainable methods.

### Save Energy

The ongoing energy use is probably the single greatest environmental impact of a building. Decisions made during the design and construction of a building will affect the environmental performance of that building for decades to come through its energy consumption.

Therefore: Retrofitting existing buildings and designing new buildings for low energy use shall be a priority. Designs will maximize use of passive systems and take advantage of the interactions between separate building elements, such as windows, lighting, and mechanical systems.