

LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN™ (LEED™)

AND HIGHER EDUCATION:

PLANNING FOR DOCUMENTATION AND COMMUNICATION

AT THE

UNIVERSITY OF SOUTH CAROLINA

LIVING AND LEARNING CENTER

by

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## **DEDICATION**

This paper is dedicated to my husband Tom Cooper and my mother Gloria Lowery. Tom, you are my rock and I love you. Mom, every good thing I've done is because of your love, support and encouragement. Thank you.

## ACKNOWLEDGEMENTS

“You are welcome here. This is where you belong.” These were the words from Dr. Wally Peters the first time we talked about my goals in sustainable development at the USC Laboratory for Sustainable Solutions. Nothing could have made me feel better about my decision to enter graduate school at USC. I am grateful for his warm reception, encouragement to follow my interests, and open style of teaching. Thank you for serving as my advisor. University Housing and Student Life along with the Sustainable Universities Initiative (SUI) provided funding for this research project, and I am thankful for their support. Michael Koman, of USC’s Housing Department provided a great deal of insight into the USC West Quad Living and Learning Center project. He is a true champion for sustainable development and LEED. Thank you for sharing your knowledge with me. To the readers on my thesis committee, Dr. Bruce Coull and Dr. Gene Luna, congratulations on your efforts to incorporate sustainable building practices at USC and for implementing LEED into the West Quad Living and Learning Center. And thank you for your encouraging remarks along the way. I am also indebted to doctoral candidate, Jamie Russell for the patience and helpfulness he showed me. Thanks also to current and former students of the LSS, especially Lynn Odom, Ph.D., Patience Russell, Nadia Craig, Veronica Addison, Megan McKnight, Jackie Whitlock, and Bobby Radakovich.

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## **ABSTRACT**

The LEED certification program provides a measurement of sustainability for new buildings. At the start of this research in April 2002, four hundred projects were registered for certification, meaning once they are complete, they will request official certification by the U.S. Green Building Council (USGBC). Of these new projects, 77 include new buildings at institutions of higher education and multi-unit residential projects (most of which are campus residence halls). As of October 2002, there are over 500 registered projects. One such project is the University of South Carolina's West Quad Living and Learning Center.

In this thesis the process of planning, documenting and communicating LEED certification is discussed. Empirical data along with information from secondary sources are presented regarding: (a) the process of planning, documentation and communication of Leadership in Energy and Environmental Design (LEED) projects; and (b) a case study of the pre-construction process of the USC West Quad Residence Hall.

The data presented in this thesis is mainly derived from interviews and responses to two surveys that were developed in conjunction with the USGBC for this research project. The surveys were completed by the contacts listed for each registered

and certified project. In most cases the contact person is the lead-architect for the project.

The survey of registered projects in higher education and multi-unit housing found that the primary function of these projects is for classroom use, followed by offices and meetings/conference space. Most of the registered projects will seek certification for the Bronze and Silver ratings in 2003 & 2004, using Version 2.0 or the newly released 2.1. Many will use a custom software package, Excel spreadsheets, or Access database to coordinate documentation, while others will use the LEED template or a binder.

Paperwork was indicated as the biggest challenge to the LEED projects, followed by contractor and subcontractors. The majority of respondents are either unsure or not planning to use a communication plan to promote the project. Of those who are using communication tools to promote the projects, the majority of them are using a web site, followed by news releases, tours and education programs. Incorporating sustainable design practices into the projects targeted for this survey increased costs by an average of \$98,824. Incorporating LEED certification into the project increased costs by an average of \$91,364. An average of 226 work hours was dedicated to documentation for LEED. Incorporating LEED into the specifications was most commonly the responsibility of the in-house spec writer/architects, followed by consultants.

Most project owners incorporated sustainability into the project because of ethical and cost reasons, and incorporating LEED was due to the same reasons, as well as public relations, benchmarking, and third party certification. At the end of the survey, respondents were asked to give their advice to others considering sustainable and LEED projects. The key themes were: 1) start early; 2) educate all participants; and 3) dedicate time to documentation.

The work includes recommendations for planning, documenting and communicating the LEED certification process for institutions of higher education. It also includes recommendations for the USGBC from survey respondents as to how the process could be improved.

## **PREFACE**

This research is the union of my personal commitment to serving as a steward of the environment, as well as my experience working in the design and architecture industry specifically with the American Institute of Architects (AIA), the American Architectural Foundation (AAF) and the Mayors' Institute on City Design (MICD).

In 1996 AIA Washington Council Executive Director, Mary Mauerman, gave me the opportunity to serve as Communication Coordinator for the Council. This experience provided me with my introduction to the world of design and architecture while sharpening my administrative, writing, and planning skills. All this prepared me for a move to Washington, DC.

In 1998 The American Architectural Foundation won a contract with the National Endowment for the Arts to administer the Mayors' Institute on City Design (MICD) program, founded by Charleston, SC, Mayor Joseph Riley. An impromptu meeting with then AAF Executive Vice President Norman Koonce, FAIA and Director of the Accent on Architecture Program, Melissa Houghton resulted in my appointment as the Program Coordinator for the MICD. This program provided me with the opportunity to listen to, learn from, and interact with the country's leading architects, landscape architects, planners, economists and city leaders. I learned that a city mayor

more than any other person, must balance his or her community's economic, social and environmental networks. The leading issue for most cities today is decaying downtowns and urban sprawl. The absence of media allowed the mayors to let down their protective barriers and to pour out their real challenges relating to the design and planning of one specific area in their city. The leading answers from the design teams to most of the problems and issues presented by mayors included pedestrian-friendly streets, better public transportation, safer neighborhoods, reducing gridlock, increasing social interaction and access to services like shopping, restaurants, health care, and public space—all aspects of sustainability. This realization that the answer to many if not most problems faced by communities today could be either reduced or retired through the implementation of sustainable development elements cemented my determination to become an expert in an aspect of sustainability. As a result I began to prepare myself for graduate school.

The next step in the journey came when my husband was assigned to Fort Gordon, Georgia. Looking for schools related to sustainable development resulted in an extensive, which led me to The University of South Carolina's School of the Environment. I was accepted in December 2000 and within my first year I became LEED Accredited and had completed the certification course to be an ISO 14001 auditor. ISO 14001 is a management system requiring continual improvement. LEED is a tool that can be used by companies to fulfill their objectives listed in their environmental management system. These experiences helped me determine the need for additional research on the new LEED Green Rating System.

## TABLE OF CONTENTS

I. Introduction	1
II. Overview of Sustainable Development	5
a. Background	
b. History	
c. Definition	
III. The Built Environment	11
a. Case Studies in Sustainability	
b. Public Programs	
IV. USGBC and Leadership in Energy and Environmental Design (LEED)	21
a. Registered Higher Education and Multi-Unit Residential Projects	
b. Certified Projects	
V. University of South Carolina and the Living and Learning Center	38
VI. LEED Survey for Registered Projects	56
VII. LEED Survey for Certified Projects	84
VIII. Conclusion	89

## LIST OF FIGURES

1. Project Type as Registered with U.S. Green Building Council.....	58
2. Building Function.....	59
3. Seeking LEED Certification.....	60
4. LEED Version .....	61
5. Certification Level Sought.....	62
6. Responsible for Documentation.....	63
7. Software for Documentation.....	64
8. Challenges.....	65
9. Communication Plan.....	66
10. Communication Tools.....	67
11. Sum & Average Project Costs.....	68
12. Incorporated LEED Into Specifications.....	73
13. Penalties & Incentives.....	75
14. Phase for Sustainability.....	76
15. Phase for LEED.....	76

## LIST OF TABLES

1. List of LEED Registered Projects in Higher Education.....	30
2. LEED Registered Multi-Unit Residential Projects at Institutions of Higher Education.....	33
3. Expected year of LEED certification.....	61
4. LEED Green Building Rating System Certification Credit Chart.....	63
5. Budget Responses.....	70
6. LEED Certified Projects.....	84

## **SECTION I**

### **INTRODUCTION**

“Our global future depends upon sustainable development. It depends upon our willingness to dedicate our intelligence, ingenuity, and adaptability—and our energy—to our common future. This is a choice we can make” (Our Common Future, 1998).

The purpose of this thesis project is to review and analyze the process of planning, communicating and documenting the Leadership in Energy and Environmental Design (LEED) certification process for registered and certified projects around the country, as well as the Living and Learning Center at the University of South Carolina.

#### **Research Methods**

Research included an overall review of the sustainable development industry including a general overview of various green building programs and certifications. Particular attention focuses on the USGBC’s LEED certification with a comparison and analysis of two surveys for projects already certified by, or registered with the USGBC.

Specific consideration was given to Higher Education and Multi-Unit Residential projects.

Primary emphasis focuses on the planning, documentation and communication of the pre-construction process for the Living and Learning Center at the University of South Carolina Housing Department.

Two surveys were developed with the insight of advisors as well as Tom Dietsche of the USGBC. The first survey is for registered LEED projects in Higher Education and Multi-Unit Residential (Appendices), while the second survey is for all LEED certified projects, including all commercial building types.

The findings from this research may serve as a resource for planning future LEED projects by USC, USGBC and a multitude of other organizations that take on LEED certification in their construction projects especially institutions of higher education.

### **Benefits**

This document may serve as a key resource for USC's Student Development and University Housing Department and may provide concepts and programs to assist in fulfilling its mission to provide a living and learning community that promotes the academic success and personal development of students.

The final report will serve as a marketing tool for USC. This report could be shared with other universities planning to construct LEED certified buildings. In addition, this report will provide important information for the U.S. Green Building Council on Higher Education and Multi-Unit Residential categories of LEED certification. Realizing the information gathered would be valuable to the survey respondents; they were informed of my intention to share the results with them. Respondents were also assured privacy in order to encourage open and honest responses. Therefore respondents' names are not used in this paper except in cases where permission was granted.

### **Limitations of the Study**

The "Registered" survey was sent to contacts for projects registered as higher education and multi-unit residential. Examples of projects excluded from this first survey include industrial, local government and K-12 education. The distribution of the Registered and the Certified Surveys were designed to achieve representation from all relevant projects. However, the data is not meant to be subject to tests of statistical significance. Both the quantitative and qualitative data provide insight on the perspectives of those implementing the LEED program for certification and those who have recently completed the certification process with the USGBC.

### **Use of Findings**

This document may serve as a resource for future LEED projects at USC. The report is intended to serve as a resource for fulfilling the Environmental Management

System requirements for the Department of Student Development and University Housing and USC. The report will provide information about how Housing and USC can work towards continual improvement through planning, documenting and implementing the LEED process.

## SECTION II

### OVERVIEW OF SUSTAINABLE DEVELOPMENT

#### **Background**

Envision a younger you, taking advanced courses in higher education at your favorite University. You reside in a comfortable room with windows that provide enough daylight so you don't have to turn on the lights during the day while reading. While studying a refreshing breeze comes in through your window. On your way to class you walk along tree-shaded paths near a pond. In class, the professor leads class standing in front of a window. Behind her lies a water retention pond where the building's gray water is being processed and filtered by lush green plants. On weekends, you take in the warm spring air while sitting in the grassy courtyard area located on the roof of your residence hall. At night, you get on the electric shuttle bus with your friends to head downtown. While this scenario seems idyllic, it is not impossible to create. Today, a growing number of institutions of higher education are redesigning their classrooms, offices and other campus buildings to provide a more sustainable existence for students, faculty, staff and the community.

In the mean time, most students are trapped in dark residence hall rooms with inoperable windows. They're late for class, lost in busy traffic looking for a parking spot. They spend 80-90% of their time indoors because there are no pleasant common

areas outside where they can socialize with their neighbors. In addition to this dangerous and toxic materials are used in constructing and maintaining the buildings where they are to live and learn.

## **History**

"Then I say the earth belongs to each ... generation during its course, fully and in its own right, no generation can contract debts greater than may be paid during the course of its own existence." -- Thomas Jefferson, September 6, 1789

The International Institute for Sustainable Development recently published its third edition of the Sustainable Development Timeline (2002). Of the ninety-two entries stretching over the last forty years, the initial milestone begins in 1962 with Rachel Carson's book, Silent Spring. Considered a pivotal moment for the understanding of the interrelationships between environmental, economic and social issues, the book provided one of the first insights to linking agricultural pesticides to damaging human health and animal species. Within the same decade the Environmental Defense Fund (EDF) and Friends of the Earth were formed, and the National Environmental Policy Act was passed creating a council and national policy for the environment.

The 1970s began with the First Earth Day where nearly 20 million people peacefully demonstrated while participating in a national "teach in" on the environment. This decade brought many new environmental organizations including the Natural

Resources Defense Council, Greenpeace, International Institute for Environment and Development, and Worldwatch Institute. In addition many new movements took rise including the Polluter Pays Principle, Greenbelt Movement, U.S. Endangered Species Act and the OPEC oil crisis. Important firsts in global meetings and conferences were also held during this decade including Habitat, UN Conference on Desertification, and the Convention on International Trade in Endangered Species (CITES). A report released by F. Sherwood Rowland and Mario Molina in the scientific journal, Nature, indicated that continued use of CFC gases at the then current rates would critically deplete the ozone layer. In the 1994 book, Pale Blue Dot, scientist Carl Sagan underscores the importance of this report by stating that every school child should know of Rowland and Molina.

The 1980's brought about a new wave of studies like the Global 2000 Report, World Conservation Study, World Resources Assessment and the U.N. World Charter for Nature. Significant environmental events also occurred during the 1980's including the Bhopal, India toxic chemical leak, Ethiopian drought; identification of climate changes, discovery of the Antarctic ozone hole, the Exxon Valdez oil spill and the Chernobyl nuclear crisis.

In 1987, the World Commission on Environment and Development issued the report, Our Common Future. It defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Cowan & Van Der Ryn, 1996, p. 5). This report wove together

the issues of social, economic, culture, environment and global solutions. As a result, the term “sustainable development” became accepted and popularized.

The 1990’s were marked with several new groups focusing on aspects of sustainability including the Earth Council, UN Summit for Children, International Institute for Sustainable Development, the President’s Council for Sustainable Development and the World Trade Organization. In addition, several significant summits and conferences were held including the first meeting of the UN Commission on Sustainable Development, World Conference on Human Rights, the World Summit for Social Development, The Summit of the America’s, Third World Trade Organization Ministerial Conference and the Fourth World Conference on Women. The signing of the Kyoto Protocol, adoption of ISO 14001 an environmental management system, and the launch of the first global sustainability index are just some of the other events of significance in the 90’s. It is the author’s hope that the International Institute for Sustainable Development will include the 1993 establishment of the U.S. Green Building Council in future additions of its timeline as well as the 1999 implementation of the LEED Green Rating System.

From 2000 through 2002, sustainability was addressed at events like The Second World Water Forum and Ministerial, United Nations Millennium Summit and the World Summit on Sustainability in Johannesburg, South Africa. In addition, increasingly severe environmental conditions continue from droughts to flooding to extreme temperatures.

## **Definition**

Although the concept of sustainable development began just over forty years ago the initial definition of sustainable development, established in 1987, has already been updated and refined over the years. For instance, the definition is updated by Stuart Cowan and Sim Van Der Ryn, in their book Ecological Design: “any form of design that minimizes environmentally destructive impacts by integrating itself with living processes. This integration implies that the design respects species diversity, minimizes resource depletion, preserves nutrient and water cycles, maintains habitat quality, and attends to all the other preconditions of human and ecosystem health” (1996).

In her thesis former Tufts University graduate student Miriam Landman defines sustainable development this way, “sustainable building is the design and construction of buildings using methods and materials that are resource efficient and that will not compromise the health of the environment or the associated health and well-being of the building’s occupants, construction workers, the general public, or future generations” (1999). The City of Austin’s Sustainable Communities Initiative sums up the many definitions, “Ultimately, the goal of sustainability is to enhance people’s well-being while living within the eco-system’s carrying capacity; so while the concept insists that we acknowledge many natural limits that we are currently denying, it also identifies many opportunities that we have overlooked” (City of Austin, 2002).

According to the International Institute for Sustainable Development, “To be sustainable, development must improve economic efficiency, protect and restore ecological systems and enhance the well-being of people. This is today’s agenda, not a far-off goal. It means that business as usual is no longer an option for government, private enterprises, communities or individuals” (City of Austin, 2002).

### **Section III**

#### **THE BUILT ENVIRONMENT**

"Sustainability is an economic state where the demands placed upon the environment by people and commerce can be met without reducing the capacity of the environment to provide for future generations." – Paul Hawken, The Ecology of Commerce, 1993.

Being that human structures are not part of the natural environment, it is evident that our built environment will unavoidably have an impact on the natural environment. However, it is up to us to determine to what degree it will take. Furthermore, it is also up to us to determine what materials will be used as they affect the health of building inhabitants as well as the environment. More recently, indoor environments are being created to enhance our lives, providing enough light to increase productivity—providing enough fresh air to keep us alert.

According to University of Illinois professors Brian Deal and Donald Fournier, “There are more than 76 million residential buildings and nearly 5 million commercial buildings in the U.S. today. Each year the construction, renovation and operation of these buildings consume: 40% of the raw materials, 32% of the total energy produced, 17% of all fresh water and 25% of the global wood harvest” (The Architecture of Sustainability, 2002). This level of consumption cannot go on at such unprecedented

rates. This is best reflected in the comments of John Tillman Lyle, in his book, Regenerative Design for Sustainable Development, “The moral and philosophical implications of diminishing natural resources through development are enormous. While development is necessary to provide habitat and sustenance for our society, it also alters natural systems. In most cases, this change is significant” (Lyle, 1994). Perhaps such significant change will bring humans to a new level of awareness of our surroundings, as described in Ecological Design, “Imagine attending to water, energy, waste, and land as carefully as you would attend to your garden, your children’s education, or your money. If these skills are part of the fabric of everyday life, building sustainable communities is possible” (Cowan & Van Der Ryn, 1996, p. 63). The book goes on to describe how involvement from every community’s diverse citizenship is vital to the redesign of our built environment. We cannot blame the engineers, the architects, or big businesses rather we need to take initiative to make changes in the processes around us.

“Everyone can participate in the design process. Such participation, with its rich tangle of theoretical knowledge, manual skills, and communication, is at the core of a culture of sustainability” (Cowan & Van Der Ryn, 1996, p. 154.). They continue, “Listen to every voice in the design process. No one is participant only or designer only: Everyone is a participant-designer. Honor the special knowledge that each person brings. As people work together to heal their places, they also heal themselves” (Cowan & Van Der Ryn, 1996, p. 146.). Increasingly, there are examples of sustainability where

participants are joining forces as designers of a sustainable future. Institutions of higher education are highlighted in this research document.

### **Case Studies of Sustainable Buildings at Institutions of Higher Education**

#### **Wendy & Malcolm McLean Environmental Living and Learning Center, Northland College, Ashland, Wisconsin**

Located in Ashland, Wisconsin, the Wendy & Malcolm McLean Environmental Living and Learning Center at Northland College is considered one of the most predominant green residence halls. Featuring living space for 114 students, the 40,000 square foot Center was completed in 1998. While the environmental performance of the building was not officially rated, a review by project participants determined that if it were LEED Version 1.0 certified, the building would meet enough credits for the Bronze rating (i.e., 26-32 credits). LEED is a green rating system of the US Green Building Council for new commercial buildings. Projects earn one of four levels of certification by fulfilling credit requirements. Possible credits needed for certification range from twenty-six to sixty-nine.

This model residence hall project incorporated sustainable materials including recycled content furniture; low Volatile Organic Compounds (VOC) paint and carpet; and regionally harvested cedar shingles. A wind generator, photovoltaic solar panels and solar thermal water pre-heating were integrated into the renewable energy systems. Some of the energy-efficient design features included natural ventilation, passive solar

design, cellulose attic insulation (R-value of 45) and heat recovery units in the ventilation system.

According to staff, the Center's project costs were \$4.2 million or \$105 per square foot of gross floor area. Of this, approximately \$3.7 million went toward construction costs with design and other project costs accounting for the remaining \$.5 million. Project participants indicated that the "marginal cost for green design and construction was \$230,000 or slightly more than five percent of total project costs" (Program Evaluation, page v). One advantage of the energy efficient aspects came from reduced operating expenses. In fact, "energy savings (compared to Wisconsin energy code) were approximately \$18,900 during a one-year monitoring period" (Bensch, 2000, p. v).

A Wisconsin Energy Center report on the efficiency of the Center concluded, "The building appears to be serving Northland College well, both as a student residence and a symbol of the college's environmental mission... While the building's renewable systems contribute only modestly to its energy performance, they provide a visible icon of the building's green design" (Bensch, 2000, page I). Project consultants considered the most significant challenges and possibly missed opportunities of the venture to be associated to the lack of experience with sustainable projects by other team members; miscommunication; undeveloped markets for sustainable products and shortcomings in the commissioning effort. In conclusion, the project has resulted in positive public

relations for Northland College and its consultants, both of which are pursuing other sustainable projects” (Bensch, 2000).

### **Catawba College Center for the Environment, Salisbury, North Carolina**

Another model of sustainability on a campus is the Catawba College Center for the Environment in Salisbury, North Carolina. Conference rooms, workshops, classrooms, offices and a library are all housed in the 20,000 square-foot Center. John Wear, Director of the Center, said that since LEED wasn't in place when the project began Catawba didn't seek certification. Once LEED guidelines were available the College did use the materials and methods recommended in LEED as a guide for the project along with other resources. According to Wear, “We [Catawba] looked at other projects” as models. The design plans were also reviewed by Rocky Mountain Institute a nationally recognized, “entrepreneurial, nonprofit organization that fosters the efficient and restorative use of resources to create a more secure, prosperous, and life-sustaining world” (Rocky Mountain Institute, 30 July 2002). Wear indicated the design team focused on one “ruling tenant,” which was to utilize on materials and methods that were “tried and true rather than leading edge.” He continues, “If we were going to be a good example for other colleges or businesses, then it [the materials and methods] needs to work appropriately” (Telephone interview, 30 July 2002).

Even in the design phase, Catawba's team incorporated the project into the schools curriculum. Wear and project architect, Karen Alexander taught a course on sustainable development whereby students researched building materials recycling and

sustainable design technology for the project. According to Alexander, “The building actually provides a framework in which this program and partnerships will work, the design is integrated into the program, and the curriculum will use the building as a teaching tool.” (Catawba, 22 May 2002). In fact, Catawba students even implemented a waste-recycling plan, resulting in an 86 percent reduction in construction waste (Catawba, 22 May 2002).

Catawba’s Center for the Environment, a \$5.7 million project, was completed in September 2001. Center Director Wear admits there were additional first costs with the project. However, lower operating costs are anticipated due to energy saving features like occupancy sensors, natural lighting and a geo-exchange heating and cooling system. In addition, Alexander says, “We looked at life-cycle costs as well as initial costs. We also looked at what happens to the product after its useful life has ended. We made sure that the product could be recycled after its use” (Catawba, 22 May 2002). Chairs, insulation, upholstery, rubber and carpet are some of the recycled content materials used in the Center. Photovoltaic energy from the sun provides ten percent of the electricity for the building and solar panels are used to power water heaters. Rapidly renewable bamboo wood—harvested in less than five years without slaying the tree—is used in the flooring.

### **Joseph Lewis Center for Environmental Studies at Oberlin College, Ohio**

The Adam Joseph Lewis Center for Environmental Studies at Oberlin College in Ohio is another example of sustainability in higher education. According to David Orr,

“The Adam Joseph Lewis Center will serve as part of the larger education of the Oberlin community aimed to promote the practical skills and analytic abilities necessary to reweave the human presence in the world” (Oberlin College, 2002).

Completed in January 2000, Oberlin’s Center is used for a wide variety of classes within the environmental studies program as well as others disciplines. It is also rented for community meetings and special events. A three-year design process incorporated ideas from students, faculty, community members and design experts. A practicum class provided Oberlin student involvement in the development and research for the project. In addition to this, thirteen public design charrettes were held to solicit community participation.

There were many energy efficient features incorporated into the building including an east-west axis orientation to optimize passive solar lighting and heating. Thermal mass concrete floors and exposed interior masonry walls amplify heat retention and re-radiation throughout the building. The majority of heating and cooling needs are provided by closed-loop geothermal wells. Radiant coils located under the concrete slab in the atrium supply additional heat. An earthen berm along part of the north wall and high insulation roof assemblies (R30-R40) minimize heat loss in the facility. An energy efficient electrical lighting system incorporates occupancy sensors in halls, bathrooms, classrooms and offices minimizing energy usage.

In April 2002, the American Institute of Architects (AIA) Committee on the Environment (COTE) listed The Adam Joseph Lewis Center for Environmental Studies

as one of its Top Ten Green Projects. “The Center project demonstrates how state-of-the-art thinking applies to readily available state-of-the-shelf materials and building systems. Throughout, the design team remained mindful of how even the most advanced system still must serve the needs of the building’s occupants.” (AIA, April 2002).

The upfront or first-costs of incorporating sustainable design features is often times used as a reason for not implementing them. Most experienced with sustainability agree there are first-costs associated with these features however, they are quick to point out that these costs are quickly paid back and result in operating and maintenance savings that far exceed the first-costs. The previously described projects serve as proof.

### **Public Programs**

Local, regional and national government agencies are also finding this to be true. For instance, “When the City of New York’s Office of Sustainable Design recently did a rough comparison of projected lifecycle costs for green versus conventional construction; it also found only a 1% increase in first cost. They also found more than 30% savings in operating costs for the use of the green building practices. Overall, their estimate of average lifecycle savings came out to 11% for new green building projects and 5% for green renovations over conventional.” (Landman, Miriam. 1999)

The International Council for Local Environmental Initiatives web page provides information and links to U.S. municipalities undertaking sustainability

initiatives. Highlighted programs include the Austin Sustainable Communities Initiative, featuring their Capital Improvements Projects Sustainability Matrix; Sustainable Purchasing Resources; resources on education and training for sustainability and resources on codes and ordinances for sustainability. Burlington Vermont's highlighted programs include the Legacy Project, Climate Action Plan and Urban Forestry Master Plan. The Los Angeles Environmental Affairs Department features a Sustainable Building Guide, Climate Action Plan and a Greening Resources Guide. Minnesota's Sustainable Development Initiative provides model ordinances for Sustainable Development. And more widely known is the Portland Office for Sustainable Development, providing publications including: Benchmarking Sustainability, Building for the Future and an Environmental Review of City Operations. Portland has also recently adopted LEED into city-funded projects. Other less known, but still valuable local initiatives are happening in many cities across the country including Chattanooga, TN, Oakland, CA, Olympia, WA; Racine, WI, Salt Lake City, UT, Seattle, WA and Ventura, CA.

Other initiatives include the *City of New York's High Performance Building Guidelines* (April 1999) and *Green Building for Pennsylvania's Future, Guidelines for Creating High Performance Green Buildings: A Document for Decision Makers* (1999). This manual defines green design systems and processes, and includes case studies like the Department of Environmental Protection Southcentral Regional Headquarters, Audubon at Beechwood, Woman's Humane Society and Penn Center West.

Taking these programs one-step further the North Carolina Triangle J Council of Governments joined with other local governments, school systems and universities in the region to produce a uniform document to guide design professionals and facility managers in creating high performance public facilities. By incorporating the USGBC's LEED rating system, along with the two stated earlier (New York City and Pennsylvania DEP), a new document was developed, *High Performance Guidelines: Triangle Region Public Facilities*.

In January 2001, Seattle Mayor Paul Schell made a landmark announcement regarding the city's commitment to building sustainably. He proclaimed the city's intentions to meet or exceed the silver rating of LEED Green Rating System on all of its public buildings over 5,000 square feet, "While we all share responsibility for protecting the environment, government does have a special role. We can make change happen through new codes and other regulations. But far more meaningful, and in the long term, powerful, approach is for government to lead by example. The actions we take reverberate," Schell stated (Environmental Design + Construction, 2001).

## **SECTION IV**

### **U.S. GREEN BUILDING COUNCIL & LEED**

In 1993, the USGBC was formed, its mission statement reads, “The U.S. Green Building Council is the nation’s foremost coalition of leaders from across the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work” (USGBC 25 September 2002).

Soon after the creation of the USGBC its membership concluded that there was a demand from the sustainable building industry to have a system of measurement for “green buildings.” Within one year a committee comprised of select, industry-diverse professional members was convened to begin research on potential opportunities. As a component of their research, the committee investigated existing green building rating systems including BREEAM (Building Research Establishment Environmental Assessment Method) and BEPAC (Building Environmental Assessment Criteria).

Finally, three options were considered: 1) accept the BREEAM rating system and use it in the U.S. market; 2) tailor the BREEAM system to the U.S. market, or 3) create a separate U.S. green building rating system. Based on a strong belief for the need of a green building measurement specifically suitable for the U.S. the committee chose option three (LEED Reference Guide 2.0, July 2001).

According to the USGBC, LEED was created to: define "green building" by establishing a common standard of measurement; promote integrated, whole-building design practices; recognize environmental leadership in the building industry; stimulate green competition; raise consumer awareness of green building benefits; transform the building market.” (LEED, 2002)

The USGBC began the LEED Green Rating System in December 1998 with Version 1.0, also known as the Pilot Project. Then in March of 2000, Version 2.0 was released (LEED Credit Trends, 2002). In August 2002, the USGBC released a Version 2.1. Considered the benchmark for sustainable design, the LEED Green Rating System certifies building projects that meet a specified list of prerequisites and then additional credits based on a pre-selected list of goals. Projects accumulate credits in order to meet one of four levels of certification, certified, silver, gold and platinum. The system targets five key categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources and indoor environmental quality.

Starting with site selection and planning LEED requires an erosion and sedimentation control plan for all construction sites. Credits are then given for projects that incorporate any one of a menu of options including locating new buildings into dense urban areas where infrastructure is already in place and for selecting a brown field site. The intent is to reduce over-consumption of green space and sprawl. These choices then provide opportunities for additional credit including providing access to public transportation. Other credit opportunities are given when bicycle storage, alternative-fueling stations, reduced site disturbance and storm water management plans

are provided. Storm water management plans will also earn additional credit in this category as will landscaping with native, drought-resistant plant species and light pollution reduction.

One example of an effective storm water management program is found at the Ford Motor Company, Ford Rouge Center Truck Plant in Dearborn, Michigan. This new building will include a section of green roof, where nearly one half of the one million plus square foot surface will be planted with a blanket of Sedum, a succulent ground cover, with a drainage layer and water storage fleece beneath. While this green roof added \$13 million in additional costs, it provided an immediate return on investment of \$40 million due to avoided Clean Water Act charges (LEED Credit Trends, 2002). Each of the other four categories of the LEED Green Rating System has related prerequisites as well as a list of additional credit earning opportunities.

For instance, in the Water Efficiency category projects can earn up to five possible credits. One opportunity is for implementing water efficient landscaping that result in a reduction in water use by fifty percent, and an additional credit is granted if no potable water is used for landscaping. Other points are awarded for water reductions by factors of twenty and thirty percent.

There are seventeen possible points in the Energy and Atmosphere category, although three prerequisites must first be achieved including fundamental building systems commissioning, minimum energy performance and chlorofluorocarbons (CFC)

reduction in heating, ventilation, air conditioning, ventilation and refrigeration (HVAC & R) equipment. Additional credits are awarded with optimized energy performance of twenty to sixty percent for new buildings. Utilizing renewable energy and green power, additional commissioning, taking measures to prevent ozone depletion and implementation of monitoring, measuring and verification practices are other ways of achieving credits in this category.

The Materials and Resources category has only one prerequisite for the collection and storage of recyclables and then provides thirteen possible points. These credits can be achieved by maintaining a minimum percentage of an existing building's shell, implementation of a construction management program to divert waste from landfills, reusing resources from the site, specifying recycled content materials, utilizing local and regional materials as well as rapidly renewable materials and certified wood into the project.

The category of Indoor Environmental Quality provides the most opportunities to earn credits with fifteen possible points available. Minimum indoor air quality performance and an environmental tobacco smoke control program are prerequisites. Additional credits are awarded for monitoring carbon dioxide levels, increasing ventilation effectiveness, and implementation indoor air quality plans during construction and prior to occupancy. Installing low VOC emitting materials in products like adhesives, sealants, paint, carpet and composite wood will also result in earned credits. Controlling indoor chemical and pollutants to designated locations is another

means for being awarding credits, as are providing opportunities for thermal comfort, controllability of systems and daylighting and views.

Registered projects will also receive one credit for having a LEED Accredited Professional on the design team. In an effort to promote advancements in sustainable development methods the USGBC also awards up to five credits for innovation and design processes. This can be for going above and beyond the set requirements in a category, or it can be a creative new method of achieving sustainability.

The advantages brought on by LEED certification include reduced initial costs in certain areas. For instance, increasing a building's energy efficiency from traditional standards to LEED specifications can result in downsizing cooling or heating equipment requirements. Furthermore, reduced operating costs from energy and water saving designs can result in lower utility costs by .60 to \$1.20 per square foot (Paquette, 2002). The improved amenities of LEED buildings provide greater comfort for occupants. In addition, building valuations and tenant retentions are increased with LEED certification.

### **Accreditation**

The USGBC's membership and LEED program have grown exponentially in the last two years. In fact, "Since the release of LEED 2.0 in March 2000, over 350 project teams have registered their buildings, thus expressing their intent to apply for official LEED Certification by the U.S. Green Building Council" (Advanced LEED Training

Workshop Booklet, 2002). As of March 11, 2002 there were 20 Certified Projects. In September 2002, there were over 500 registered projects representing approximately 70 million square feet of commercial floor space. These numbers currently represent about 3% of commercial space built each year (Environmental Design + Construction, 11 July 2002).

The USGBC membership has doubled within the last year and now includes over 1,700 firms. Over 5,000 people have taken LEED training since its inception, with 1,500 of them going on to take the LEED Professional Accreditation exam.

According to an article by USGBC President, Christine Ervin, the single most important LEED metric is its impact on the environment and economy, “With rough approximations today, projects already registered for certification can be expected to reduce key air contaminants (ozone and smog precursors) by about 170,000 tons during the next 50 years compared to conventional buildings and carbon dioxide emissions by more than 15 million tons” (Environmental Design and Construction, 11 July 2002).

LEED documentation is considered one of the most time consuming and confusing aspects of the certification process. The USGBC is working to streamline the process so it is more comprehensive and usable. In July 2002 the USGBC released the updated Version 2.1, its intent is to simplify documentation. Nigel Howard, a USGBC vice president and director of the LEED program says, “We want design and construction teams to spend time making the building green, rather than on the submittal process.” (Howard, N., & Watson, R. (2002), 15 July 2002).

According to USGBC estimates, “an experienced design and construction team can complete documentation at a cost of \$8,000 to \$14,000 in additional design fees” (Gonchar, 2002). Many proponents of the program ascertain that these additional costs reflect the necessity of continuing education by the design profession. Problems arise however when the costs are passed on to the building owner, which is considered a barrier to sustainable building and the LEED rating system. What many building owners fail to realize that these relatively small first costs are quickly regained through lower operating costs.

Version 2.1 will include: a software tool for performing required calculations and substitution of certain submittals with a declaration from a “responsible” project team member that certain requirements were met. It will also provide letter templates for convenience to users and standardized wording for LEED auditors. In an article by USGBC vice president Nigel Howard and former board member Robert K. Watson, they state, “...Most teams are working on their first LEED project and often report costs in the range of \$30,000-\$60,000. We anticipate that average documentation costs will be cut in half as a result of the 2.1 update” (Environmental Design + Construction, 7/12/02).

According to Dr. Malcolm Lewis, PE, member of the LEED Steering Committee and former member of the Board of Directors at the USGBC, there are numerous benefits from LEED certification that are not possible from simply building sustainably.

They include:

- Third party validation of green features
- Enforcement of complete implementation of designed green features
- Third party rating of degree of sustainability
- Benefit of LEED 'brand' association
- Incentives from Public Agencies (Environmental Design + Construction, 11 July 2002).

In his article, Dr. Lewis provides examples of incentives sponsored by agencies in the form of grants, tax credits, expedited permitting processes or exemption from specific zoning restrictions. The California city of San Jose provides financial incentives, awards and streamlined permitting processes for projects seeking LEED certification. In Oregon, a Business Energy Tax Credit Program grants tax credits for projects earning a Silver rating or better. In Arlington, Virginia projects that earn LEED certification are rewarded with reduced restrictions for height or density limitations.

As of May 14, 2002, there were no certified LEED buildings in South Carolina. There are however, six registered buildings and one certified building within the Georgia and South Carolina area including:

1. Herman N. Hipp Hall, Furman University, Greenville, SC
2. Duke Library Addition/Renovation, Furman University, Greenville, SC
3. Technology Square, Atlanta, GA

4. Science 2000 Phase II, Emory College, Atlanta, GA (Certified in September 2002)
5. South Campus Housing III – Living Learning Center, University of South Carolina, Columbia, SC
6. Rosewood House of Recovery, Greenville, SC

**Registered Projects in Higher Education and Multi-Unit Residential**

At the start of this research in May 2002, the list of LEED Registered Projects in Higher Education consisted of forty-seven projects.

**Table 1: LEED Registered Projects in Higher Education (USGBC, 5 May 2002)**

1. Desert Vista Campus, Pima Community College, Tucson, AZ
2. Student Center, Seattle University, Seattle, WA
3. Herman N. Hipp Hall, Furman University, Greenville, SC
4. Science 2000 Phase II, Emory College, Atlanta, GA
5. Technology Square, Atlanta, GA
6. Tillinghast Addition & Renovation, Riverdale, NY
7. School of Nursing and Student Community Center, UT Health Sciences Center, Houston, TX
8. Vermeer Science Center Renovation & Addition, Central College, Pella, IA
9. Computational Sciences & Engineering, Old Dominion University, Norfolk, VA
10. Lynn Business Center, Stetson University, DeLand, FL
11. Northwest Campus, Pima County Community College District, Tucson, AZ
12. Swarthmore College Science Center, Swarthmore College, Swarthmore, PA

<b>Table 1: LEED Registered Projects in Higher Education (USGBC, 5 May 2002) continued</b>
13. Duke Library Addition/Renovation, Furman University, Greenville, SC
14. <u>Rinker Hall, University of Florida, Gainesville, FL</u>
15. Campus Life Recreation Center, University of Cincinnati, Cincinnati, OH
16. <u>Swift Hall Renovation, University of Cincinnati, Cincinnati, OH</u>
17. Student Life Center, University of Cincinnati, Cincinnati, OH
18. Winship Cancer Institute, Emory University, Atlanta, GA
19. Tangeman University Center, University of Cincinnati, Cincinnati, OH
20. Social Sciences Building, Lewis & Clark College, Portland, OR
21. New Environmental Learning Center, Merry Lea Environmental Learning Center of Goshen, Wolf Lake, IN
22. Lewis Center for Environmental Studies, Oberlin College, Oberlin, OH
23. Raystown Field Station Dining Hall, Juniata College, Penn Township, PA
24. Center for Learning and Technology, Pacific Lutheran University, Tacoma, WA
25. Seminar II Building, Evergreen State College, Olympia, WA
26. College of Law, University of Denver, Denver, CO
27. Phase I Science Building, Seattle Pacific University, David Church, Seattle, WA
28. West Campus Renovation and New Construction, Pima County Community College and District, Tucson, AZ
29. <u>First Year Residence Hall, Carnegie Mellon University, Pittsburgh, PA</u>
30. Chino Valley Agribusiness/Science Technology Center, Yavapai Community College, Chino Valley, AZ
31. Addition to Carrington Hall School of Nursing, UNC-Chapel Hill, Chapel Hill, NC

<b>Table 1: LEED Registered Projects in Higher Education (USGBC, 5 May 2002) continued</b>
32. Inn and Conference Center Addition, University of Maryland University College, Adelphi, MD
33. <u>Lincoln Hall, Berea College, Berea, KY</u>
34. <u>Residence Halls, Western Maryland College, Westminster, MD</u>
35. Engineering B1, Oregon State University, Corvallis, OR
36. Social Sciences Building, Lewis & Clark College, Portland, OR
37. New Science Building, Western Connecticut State University, Danbury, CT
38. ECO Office, Cornell University, Ithaca, NY
39. Technology Building, Ocean County College, Toms River, NJ
40. New Sciences, and Classroom Building, Eastern Connecticut State University, Willimantic, CT
41. S.T. Dana Building Renovations, University of Michigan, Ann Arbor, MI
42. WCI Green Building Demonstration & Learning Center, Florida Gulf Coast University, Ft. Meyers, FL
<b>Unlisted Projects:</b>
43. Boston, MA
44. Kalamazoo, MI
45. Hanover, NH
46. New York, NY
47. Boise, ID

**Table 2: LEED Registered Multi-Unit Residential Projects at Institutions of Higher Education**

1. <u>House A-2, Lewis &amp; Clark College, Portland, OR</u>
2. <u>South Campus Housing III – Living Learning Center, University of South Carolina, Columbia, SC</u>
3. <u>Somerset Street Student Residence, Suffolk University, Boston, MA</u>
4. <u>New Replacement Housing, Portland State University, Portland, OR</u>
<b>Other</b>
5. 20 River Terrace, River Terrace Associates, LLC, New York NY
6. Traugott Terrace, Traugott Limited Partnership, Seattle, WA
<b>Unlisted Projects</b>
7. Santa Monica, CA

**LEED Certified Projects**

**Bachelor Enlisted Quarters Great Lakes Training Center, Great Lakes, IL**

The only Multi-Unit Residential project to become LEED certified (Pilot Project), as of July 2002, is the Bachelor Enlisted Quarters Great Lakes Training Center in Great Lakes, IL. Completed in September 1999, the U.S. Department of Navy project contains 365,000 gross square feet of building space. This \$55.2 million project is sited on 10.2 acres and is comprised of seven buildings ranging from 3 to 5 stories. In order to earn the Version 1.0 Bronze (26-32 credits) Certification, the project incorporated a variety of sustainable design and construction elements. The project is located on the site of outdated recreation facilities and barracks in a pedestrian friendly environment

on the base and is within 100 feet of two bus lines. Additionally, a train station is within 1.1 miles. Native trees were planted to provide a water efficient landscape. Energy and atmosphere related elements include exceeding the ASHRAE 90.1-1989 prescriptive envelope standards for the Chicago area by 24% through use of R-23 Wall and R-30 roof insulation and a reflective roof. No CFC's are used in the HVAC system and windows are operable by the residents. Building meters are monitored monthly to determine energy and water consumption for optimal performance. Steam serves as the power source for hot water heating and glazing (windows) was increased to maximize daylighting opportunities. Finally, 31% of the materials (by cost) were produced locally, including all of the concrete. Minimal use of volatile organic compounds ensured indoor air quality (USGBC, 2002).

This project won numerous awards including: winner of the White House Closing the Circle Award 2000 as "Model Demonstration Facility," Chicago Building Congress Finalist, DBIA Award for Sustainable Design and the 2001 Federal Energy Saver Showcase Award.

### **Emory University, Atlanta, Georgia**

At the 2002 Greenprints Conference in Atlanta, a panel from Emory University discussed their experience with LEED certification. Based on notes taken at the event, along with electronic correspondence with a design team member, the following summary of the lessons learned from the project was compiled. The panel indicated the implementation of a construction waste management plan was difficult. They said there

was a need to continually verify LEED prerequisites while constructing the project. In addition, they recommended conducting periodic LEED credit assessments to identify and discriminate the ‘low-hanging fruit’ from the less feasible credits. Waterless urinals were used as a method of reducing water consumption, although they were considered only a very small portion of the overall water conservation strategy. According to one team member, “The largest component of our water strategy is a closed-loop cooling system, saving an estimated 2,800,000 gallons a year.” The University installed two water quality devices to treat storm runoff for quality (suspended solids) before the water enters the stream. In addition, they incorporated LEED requirements into the specifications dedicating an entire section on environmental design. The Emory panelists indicated the importance of maintaining documentation in order to provide a benchmark to judge success. Emory used GreenPro software to guide and automate the entire LEED business process. It is a web-based database and software application that guides building industry professionals through the LEED certification cycle. Emory also used ‘soil nailing’ during excavation to reduce site disturbance and erosion control (insitu reinforcing of the soil while being excavated from the top down). In addition, the Emory team is applying for an innovation credit because of the educational components of the building (i.e., environmental technologies as teaching tools). Here is some advice given by the Emory panelists at the 2002 Greenprints Conference in Atlanta:

- Write a good specification (sample in LEED Reference Guide)
- Make a spreadsheet available for contractors to breakout all costs
- Include waste management when going to bid with sub-contractors

- Look for companies that specify their products by LEED credit (e.g. Interface website)
- Innovative credit given for education video and for significantly exceeding requirements

Regarding quality control it was suggested to incorporate it into subcontracts and then schedule inspections and reports to enforce the specifications. The panelists stressed the importance of educating the workforce with weekly safety meetings. It was also helpful to graph a LEED point's line with costs, calendar and construction. Panelists strongly suggested the use of lifecycle-costing. Steel is one example of an easily obtained post-consumer recycled content product for 'weighted cost value' under 'Materials and Resources' LEED requirements. The Emory University project ended on budget, in part because of their effort to continually track the critical elements: budget, credits and schedule.

**Donald Bren (Hall) School of Environmental Sciences and Management at the University of California, Santa Barbara**

The Donald Bren (Hall) School of Environmental Sciences and Management at the University of California, Santa Barbara is a LEED Pilot Project (Version 1.0) Certified with the USGBC. The goal of Donald Bren Hall was to be "the highest performance, sustainable building created to date, and one of [the] very best among buildings for teaching and research anywhere" (University of California, 2002).

Bren Hall is a \$22 million four-story building completed in March 2002. Also part of the LEED Pilot Program (Version 1.0), the project earned 37 credits to meet the Platinum Level Certification. Beginning with site planning, the designers were dedicated to preserve existing landscape and habitats. As result many of the original trees were protected and maintained throughout the project. Since the former site was mainly a parking lot, 100% of the concrete curbing, asphalt and demolition waste was recycled and used as base. Hay bails and fencing were used at each drainage outlet to control sediment and reduce soil erosion.

The structural construction including steel and rebar and fireproofing material were all made with high-content recycled materials. Other interior features using high-content recycled materials included carpets, lab casework, rubber flooring, fabrics, wallboard, tiles, ceiling tiles, furniture, countertops and bathroom partitions. Rapidly renewable resources were also used in materials like the linoleum flooring. Energy efficient measures include natural lighting and flow-through ventilation using the breeze coming off the Pacific Ocean, eliminating the need for air conditioning in the office wing. Motion controls, ambient light and daylight harvesting are incorporated into the energy efficient lighting plan. In the building's office wing, windows are operable and have a sensor in the frame that automatically turns the heat off when the windows are opened. A multi-building chilled water loop is connected to the laboratory wing to provide cost-effective cooling. To keep energy costs low a light colored roofing material was installed to reduce heat-island effects and the University plans to install a roof-integrated photovoltaic system that will generate 7-10% of the buildings power.

The building surpasses the new Title 24 requirements for energy efficiency standards by more than 31%” (University of California, 24 September 2002).

Bren Hall designers incorporated many water-saving features including low-flow fixtures throughout. Each of the waterless urinals installed on the buildings first floor are saving an estimated 45,000 gallons of water per year (UC, Santa Barbara web site 9/24/02). First floor toilets use reclaimed water and all toilets have automatic flush valves.

Bren Hall’s landscaping includes native, drought-tolerant plants, providing shade for the structure. Tree bases are protected by grids made from 100% recycled content materials and the fire road around the perimeter of the building uses permeable turf-block. In addition to these design features the building is also being used as a living laboratory. Metering installed in the building allows students and faculty to monitor energy loads for the different laboratories and offices.

**SECTION V**  
**UNIVERSITY OF SOUTH CAROLINA (USC) AND THE LIVING AND**  
**LEARNING CENTER**

Founded in 1801, USC is one of the oldest public universities in the nation. More than 35,000 students are enrolled at eight campuses around the state with the largest enrollment at the Columbia campus (University of South Carolina, 2000. p.3). The University recently adopted a master plan to preserve the historic campus atmosphere while providing new academic, residence and campus life facilities.

The curriculum at USC provides classes in English, economics and numerous sciences that focus on environmental issues. Campus organizations like Students Allied for a Green Earth (SAGE) also promote environmental awareness and recycling receptacles are provided in each building. For the past five years The School of the Environment, SAGE, USC Facilities Management, the Housing Department and the Sustainable Universities Initiative (SUI) organize an Earth Day festival to build awareness of environmental issues and to recognize students and faculty.

USC adopted an official environmental policy in 2000. This policy illustrates a University-wide commitment to improving environmental education, research and operational performance. In 1999 then USC President Palms appointed an

Environmental Advisory Committee (EAC) comprised of faculty, operations staff and students to oversee these programs and policies on campus. The goals of the policy include:

- Incorporate environmental and sustainability issues into the University curriculum
- Increase opportunities for informal learning about environmental issues for students, faculty, staff and public
- Encourage research that aids in understanding of issues and solutions to environmental problems
- Increase service activities by faculty, staff and students that enhance environmental awareness within the institution and foster sustainable thinking within the larger community
- Conserve resources through waste reduction, recycling, energy and water use minimization
- Minimize negative impacts of the University on the environment
- Think globally and act locally by promoting and using recycled or remanufactured goods, locally-generated products and native species in natural landscapes where possible
- Make a commitment to compliance with environmental, health and safety regulations to ensure the protection of the environment and the people living within it.

- Implement an Environmental Management System for auditing inputs and outputs and quantifying savings from sustainable practices
- Produce an annual “Environmental State of USC” report under the leadership of the Environmental Advisory Committee

The University will evaluate and monitor progress toward these goals on a continuing basis (USC Environmental Advisory Committee, 2002).

### **USC Department of Student Development and University Housing**

In 1997 a private European foundation provided funding to start the Sustainable Universities Initiative (SUI), a partnership between Clemson, Medical University of South Carolina and USC (since then, SUI has expanded its membership to thirteen schools). Its purpose is to educate students and faculty and to provide models for sustainable design and operations within each school. The goal of the SUI is to serve as a mechanism for activities that will make the State's three research universities, other educational institutions and finally, the state as a whole more sustainable. It will also result in a new model for multi-disciplinary and multi-institutional cooperation within South Carolina's higher education community. Lastly, it is hoped it will serve as a model for other state-assisted colleges and universities across the country.

In 1999, the Housing department determined that a new residence hall was needed on campus for undergraduate students. This was a pivotal time for Housing and in which a partnership with SUI culminated with the new sustainable residence hall

concept. This new allegiance is evident by the following statement on the Housing web page:

“University Housing is committed to protecting the environment and is working with the Sustainable Universities Initiative (SUI) and the School of the Environment (SOE) to make Housing a national leader in developing a sustainable community. The goal is to develop University Housing into a sustainable community and to use its success as an example of sustainability for the rest of campus and other schools in the region. These efforts are also supported by the commitment and work of Housing’s custodial staff, maintenance personnel, residence life and other campus departments such as facility services. Efforts towards sustainability include recycling, purchasing environmentally sound products, energy and water conservation, alternative fuel vehicles, greening of residence halls and annual efforts such as ‘Move In’ and the ‘Give It Up’ program during move out and the new ‘Green Residence hall’” (USC Housing, 2002).

The “Move In” program includes recycling of all boxes, while the ‘Give It Up’ program provides locations for moving students to place unwanted clothes, cinder blocks, non-perishable food, wood and other items. These items would otherwise be thrown into the garbage, using valuable landfill space and would result in increased disposal fees for the University. In turn USC recycles much of the materials and donates the clothes, furniture and food to local non-profit organizations like Habitat for Humanity and the food bank. USC Housing established a draft Environmental

Management System (EMS) in 2002. It is one of only two departments at the University to create its own EMS in conjunction with the University's Environmental Policy. The other department to implement an EMS is the Environmental Health and Safety Department, which recently became ISO14001 certified.

“De-natured environments ignore our need and our potential for learning. Making natural cycles and processes visible, brings the designed environment back to life. Effective design helps inform us of our place within nature”  
(Cowan & Van Der Ryn, 1996).

As members of the Environmental Advisory Committee (EAC), Dr. Bruce Coull (School of the Environment) and Dr. Gene Luna (Department of Student Development & University Housing) began a dialogue on implementing sustainable features to the proposed residence hall. Exactly what those elements would be was unclear. SUI, directed by Trish Jerman, became involved and provided funding for a position to help the Department of Student Development and University Housing initiate an environmental coordinator. Michael Koman, former Regulatory Affairs Manager for Browning-Ferris Industries was hired in late 1999 in part due to his familiarity with sustainable development programs including LEED. Since the specific design features of the new residence hall were still undecided Koman pushed to register the new residence hall with the USGBC LEED rating system.

The West Quad – Living and Learning Center for Sustainable Futures ‘The Green Dorm’ is a complex comprised of three residence halls and an 8,000 square-foot learning center, as well as a café and convenience store. The project’s mission statement reads, “Attract 500 students in fall of 2004 with an inclusive community that is cost effective and environmentally friendly, providing opportunities for learning” (Sustainable Design Services, 2001). Sited within the perimeter of Sumter, Wheat and South Main Streets in Columbia, this complex will be constructed on the USC campus where the University police station and band field were formerly situated. The project will integrate technology, design, sustainability and learning as it seeks LEED certification as a green building. The complex is expected to be among the first LEED certified buildings in South Carolina and one of only a handful of certified residence halls in the world.

The purpose of the Learning Center is to serve as a model of how sustainability can be successfully incorporated into the living and learning environment. The Center will incorporate interaction among students, faculty and staff from a variety of disciplines and departments including: engineering, information technology, biology and environmental studies. It will include classrooms, offices, learning stations and building energy-consumption meters. The Center will facilitate new interactions among students and faculty. This is intended to provide a more meaningful and favorable appreciation for the college experience. As a result of these efforts the Center is expected to promote retention and academic standing of students involved with the Center.

Together, the residential buildings and Learning Center will be associated with curriculum aimed to serve as a model for sustainability in South Carolina, the Southeast, and the U.S. It is also intended to serve as an example “for constructing smarter buildings and improving quality of life for the residents and the community to ensure sustainability” (USC Housing, May 2002). Plans are also being developed to partner with various academic units in promoting the concepts of sustainability with students, the campus, and the greater Columbia community. Other potential learning themes may include the Congaree and Columbia watersheds.

The West Quad project budget was set at \$29 million dollars prior to it becoming designated as LEED Registered. Since fewer than thirty buildings have become LEED certified to date, it is difficult to project the extra costs associated with LEED certification for a specialized project like the residence hall. “The USGBC estimates that a well-planned sustainable design building may range from a 5 percent increase in total costs to potentially reducing project costs. Payback from some strategies can fund the cost of other elements” (Paquette, 2002). The USC project budget did not increase once LEED registration began. Therefore, it is the intention of USC and the design team to build the project within the initial budget of \$29 million.

Jim Gleeson of Little & Associates Architects registered the project with the USGBC. Initially the building was registered to meet the minimum LEED Certification level of 26 to 32 credits. As of July 2002, the project is anticipated to fulfill 33 or more

credits, thereby meeting the Silver certification level. In order to achieve the next category, the Gold level, the project would have to earn 39 to 51 credits and there are no plans to meet this requirement at this time. The on-going design team consists of Housing, architects (building, design and landscape), engineers (mechanical, electrical and civil), USC construction services and architect, and Southern Management. During the schematic phase of the project, the design team held a series of meetings to get input from the students, faculty, staff and community. Originally, the design team also included representatives from communications, information technology, facilities, energy services, parking services, waste management and recycling, grounds and landscaping.

According to USC's Michael Koman, many of the team members met early in the design process to determine what credits to pursue in order of achievability. First they listed the credits they knew were certain, then the credits they thought they may be able to obtain and finally, the ones that were in a sense, out of reach based on factors including budget and levels of acceptability by the Board of Trustees. "This helped to set the direction for our efforts," says Koman. One significant aspect to the USC project is the budget was set at \$29 million prior to seeking LEED certification. According to Koman, "This forces us to build a green building at no more than it would cost to build a traditional building. That is asking a lot and will force us to make some tradeoffs". In the early stages of the project team members agreed to use lifecycle costs, however a shortened timeframe in which to build and a limited budget prevented this from occurring, at least to any significant extent. Koman describes how the team made

tradeoffs, “There are some areas that require an initial up front charge and we limit those to the ones that will have the largest impact on the project.” For instance, the West Quad project will incorporate daylighting and light shelves to achieve efficient use of energy with limited up front costs. Another example is solar pre-heating of domestic hot water. While this will initially cost significantly more than traditional methods, it will help with efficiency and is expected to provide notable paybacks. As a result of these and other design elements, Koman says, “We do expect to save tremendously in maintenance and have a building that is 30-50% more efficient. We have also designed suites so that they may be changed from four-person to two-person apartments as the market may dictate in the future. By designing them for this now, we will save hundreds of thousands down the road when we do the conversion” (Koman, 19 March 2002). Gene Luna, Director of Housing at USC was committed to the idea of sustainability early in the process and as Housing develops a model for sustainability and LEED certification he hopes the rest of the USC campus and other universities in the region will adopt it.

In 1999, the University’s construction management firm, Southern Management Group, sent out a Request for Qualifications (RFQ) from design firms. It was not difficult to get proposals from LEED certified architects, meaning at least one person on their team was a LEED accredited professional. In fact, thirteen firms submitted their qualifications. However, since the program is still so new it was difficult to find an architect who had actually designed a LEED project certified by the USGBC. Only one architect of five interviewed had actually designed a LEED certified building, but they

were not selected for the project. Of the five short-listed design teams architects, Little and Associates of Charlotte, NC was selected along with the local firm Boudreaux and Associates, neither of which has completed a LEED certified building.

Once the design team was assembled, it took time for the group to embrace the commitment to meet the LEED rating system requirements. In fact the entire LEED certification was almost abandoned at a meeting early in the design process. This was due in part to the lack of understanding of the benefits such a project would bring to the University; specifically lower operating costs, increased attention from the higher education community, as well as the media. If it weren't for a couple staunch supporters of the program it could have easily been sidestepped for a less stringent, far less effective and less significant project. Some members of the team were more excited about it than others, while some considered it a burden. There is consensus from the team that this new project will require a steep learning curve. From 1999 through 2002 the process gained increased support, understanding and enthusiasm about LEED certification. Through education of the benefits of LEED certification, design team member collaboration has progressed and many members are exhibiting initiative to meet LEED credit requirements. According to one individual working on the project, the biggest challenges to getting the design team on the same page included education and ignorance, time and costs. To date, the project has already resulted in positive outcomes including increased support and enthusiasm from students, faculty and staff as well as the design team.

The improved familiarity of sustainable elements has resulted in team building among the design team and different departments within the University. For instance, the Department of Engineering was brought in to discuss how the building can be part of the curriculum, thus fulfilling the goal to become a “living and learning environment” not only for West Quad residents but also for University students and faculty. For instance, a prospective fuel cell created a great amount of interest by the Department of Engineering as a means to appeal to prospective students and to further expand the education of current students at USC.

Convincing University leadership to buy into the benefits of sustainable development has been a slow but progressing process. For instance, the first costs of building a sustainable structure can often times be slightly higher than a traditional building with a payback time in operating costs (i.e., energy cost savings, water savings and life-cycle costs of materials) of 3-5 years. These lower operating costs continue well into the future. Without this knowledge, it is often an instinctive reaction to object to sustainable elements because of their increase in first costs. Design team members believe that educating decision-makers as to the reasons behind sustainable elements will help them to understand how these measures will reduce operating costs for the University into the future.

According to one of the design team members the project has been slowed by second guessing the benefits and reasons for seeking LEED certification on specific credits and for the project as a whole. Professional design leaders who are adamant

advocates for LEED are necessary to keep the decision-making process flow smoothly. The most knowledgeable LEED professionals are also needed to educate those decision-makers who are not familiar with the process and benefits. One recommendation was made to provide decision-makers with a cost-benefit analysis for implementing certain design features in an effort to promote well-informed decisions.

The predominant partnership focus of the project will be between the students and faculty at USC. The intent is to develop an interdisciplinary learning program that would incorporate the traditional arts and sciences with business, information technology and other interested disciplines.

University partnerships include the School of the Environment, Sustainable Universities Initiative (SUI), University Housing, Student and Alumni Services as well as a variety of departments, especially engineering and biology.

Dr. Martone, professor of biology attended a site work meeting with architects and engineers to discuss the storm water runoff and retention plan. USC Biology students will work with the landscape architect to prepare a design plan, including native plantings to absorb storm water runoff and toxins. In addition the students will grow and plant the selected species as a part of their hands-on learning curriculum This will be one method in which the project will serve as a living and learning center for students and the community. USC is planning to apply for an innovation credit for

incorporating biology students and their curriculum into the water retention plan at the Center.

Other partnership opportunities with local businesses are being developed. One idea that came out of the discussions with SCANA (the regional utility company) was to fund the Living and Learning Center with corporate funds for the purpose of using the facility as an emergency communication center. In this scenario, SCANA and other local corporations would, in the event of an emergency, have access to the facility for planning strategy and communications. For instance, the emergency preparedness plan would call for key staff to report to the USC Living Learning Center in the event that a fire or tornado destroyed their existing facilities.

The USC Housing Department is also working with the Carolina Energy Office in a partnership focusing on the Center's energy needs. In June 2002, the Carolina Energy Office awarded USC with a \$50,000 grant for a fuel cell to be used in conjunction with the Learning Center and \$99,000 from U.S. Department of Energy via the South Carolina Energy Office for a fuel cell program to include classes and instruments. Other opportunities, while meaningful did not result in a partnership.

One example is with the initial fuel cell plan. In May 2002, Logan Energy made a presentation to USC representatives regarding the sale of a used 200Kw fuel cell. It was first sold to a company and installed in 1999 accumulating 7,500 in operating hours but shortly thereafter the company moved its offices to a location and abandoned the

fuel cell. It had approximately five years or 40,000 operating hours left in it, extended warranties were available and Logan energy offered to sell or lease the fuel cell to USC. Since the fuel cell was not in the budget the most likely way for USC to obtain it would be through a lease agreement. USC opted not to purchase or lease this particular fuel cell from Logan Energy for a several reasons. First, the fuel cell is somewhat dated and only has a limited number of operating hours left in it and it would also require approximately \$30,000 in annual maintenance. Finally the key reason for the fuel cell was based on its use as a demonstration and educational tool and there are other, smaller, more affordable fuel cells on the market with longer lifecycles. In addition, the technology is changing so fast the fuel cell from Logan would quickly become outdated. Finally, with the anticipation of new funding sources, another fuel cell was selected.

To obtain LEED certification, USC joined the membership of the USGBC through the SUI. USGBC serves as a resource on LEED certification through their materials, resources and events. One of the project architects is a LEED accredited professional, as well as USC's Student Development and University Housing environmental coordinator, Michael Koman. Successful completion of a computer-based exam is necessary to become a LEED Accredited Professional. Tom Battenhouse, Director of Facilities, Housing attended the Advanced LEED Training Seminar in May 2002, with Michael Koman (they are the key USC personnel involved in the day-to-day implementation aspects of LEED into the project) and project architect Mike McMurphy of Boudreaux & Associates.

The architect of record for the USC project is The Boudreaux Group, Inc., a Columbia-based firm. Little & Associates was hired in 1999 as the design architect for the project. This Charlotte, NC architecture firm includes LEED Accredited Professional Jim Gleeson. Hired to design many of USC's projects, the Boudreaux Group will oversee the design and development of the project; however as mentioned earlier neither the Boudreaux Group nor Little & Associates has previous experience designing a LEED certified building.

Southern Management Group is USC's owner's-representative and was selected from a group of six management firms to coordinate the construction of the project. Other project consultants include the landscape architecture firm, Grimal Cotterill & Associates; civil engineering firm, Stantec; structural engineers Johnson & King; mechanical engineers, McCracken and Lopez; and Belka Engineering Associates serves as the electrical engineering firm for the project.

Other important partnerships will be formed with the following: contractors and subcontractors, suppliers and regulators and additional involvement is anticipated with internal groups from USC. The USC Board of Trustees gives all final approval of the designs and budgets for construction projects like the Living and Learning Center. The Trustees support the new project and it is hoped they will encourage and approve similar projects in the future. Other important internal partnerships will involve the following: students, potential and existing residence hall occupants, the Residence Hall Association (RHA), non-residents, faculty, staff and a variety of departments.

Outside of USC, the Housing Department hopes to promote the project to a variety of external audiences in the hope of forming additional partnerships. Local and state government agencies, already involved in the project include the South Carolina Energy Office and the Department of Health and Environmental Control (DHEC). The success of the project may provide an opportunity to partner with other regional and national agencies and universities.

According to Koman, one of the biggest lessons so far in the process of first-time LEED certification is “to educate the decision-makers before you take anything to them.” Koman is compiling a list of hurdles and lessons learned from USC’s first LEED certified projects. Here are some of the entries:

### **Costs**

- Fees: Establish fees early so they do not eat up your budget. Be sure to factor research and education time into this amount.
- Life Cycle Costs: Should be committed to prior to establishing budget, otherwise up-front costs will rule all decisions.
- Plan in advance for money for a green building.

### **Communication**

- Educate everyone, especially the decision makers. Anyone who presents designs and concepts to decision makers should be committed, aggressive and serve as a champion for the project.

- Gain a commitment from as many people as possible. State your plans early so it is difficult for those who may be unsure to waiver.
- The more [initial] input you obtain up front and during the process the better. Everyone from students, faculty, custodial, maintenance, [and] energy and so on will be able to contribute. For certain ideas (especially from faculty), request a commitment from them (e.g., students, curriculum) to gain support and strengthen the owner's dedication to the project. It also saves costs on part of the project they will take over.
- Group sessions should include a limited number of groups (per meeting) and a mediator to keep participants on track.
- Designate one person on the owner's staff to serve as a catalyst to keep on track with the progress, ideas and goals. They should be vocal and willing to fight while being aware of the political issues related to the project.
- Promote the project as much as possible—this will help to gather support and funding. It will also ensure the owners commitment to the project.

### **Experience**

- Select architect and engineers that are aggressive and experienced with green building. You want them to help lead you and not the other way around.
- RFP's: Should require architects and engineers to be experienced with green projects and include LEED accreditation for architects. LEED certification should be stated as a major requirement for the project.
- Have as many team members as possible gain LEED accreditation. This will help put weight behind ideas, suggestions and efforts.

- Research other similar projects.

### **Planning**

- Commissioning: Plan early for it. Utilize an outside group hired by the school [owner] not the architect or contractor. The more you require the better the building's performance.
- Start forming partnerships with funding sources (i.e., power companies) early, as it requires time to build relationships and develop ideas.
- Document and keep copies of everything from the start. It will make it easier to develop a certification package and remind people of past decisions.
- Allow for time to explore new areas such as fuel cells, solar and other systems (Koman, 25 March 2002).

As of October 7, 2002, the USC Living and Learning Center site is under construction and many of the LEED requirements are being implemented. It is anticipated that students will move into the building in the fall of 2004. Throughout the construction process, USC Housing staff will continue to build partnerships and programs to increase the understanding of the benefits the building will offer to students, faculty, staff, and the community.

## **SECTION VI**

### **LEED SURVEY FOR REGISTERED PROJECTS**

Since the LEED Certification program is still in its infancy, the learning curve is enormous and ongoing adjustments are being considered by the Steering Committee. As a part of this thesis research, two surveys were developed. One for all Higher Education and Multi-Unit Residence projects registered with the USGBC and another for all LEED certified projects. Tom Dietsche of the USGBC served as a resource and liaison for the surveys approval. Mr. Dietsche's coordination helped to ensure the surveys were thorough and applicable to the projects.

#### **Methodology**

The first survey identified Higher Education and Multi-Unit Residential projects after it was observed that many "residence hall" projects were being registered in either of these two categories. It was not evident how a school would pick their residence hall to be registered as Higher Education rather than Multi-Unit Residential. In the future the USGBC may want to consider specifying how they would like "residence hall" projects to be registered, as it may help in comparison of projects. Since residence halls provide a unique design element related to LEED, there seems to be an opportunity for institutions of higher education to learn from each other's experiences. For instance,

how can students and faculty be involved with the project from the pre-design process to occupancy? The survey focused on the planning (e.g., software, staffing, budgeting) documentation, and communication processes. The second survey was sent to all LEED Certified projects. The list provided by the USGBC included 11 projects (Table 6).

After coordination and approval of the surveys the registered projects survey was individually emailed to the contact person for 74 registered projects on August 20, 2002. There were some contact people listed for multiple projects meaning their firm, in most cases were working on more than one LEED project at a time. The certified Projects survey was individually emailed to eleven contact people.

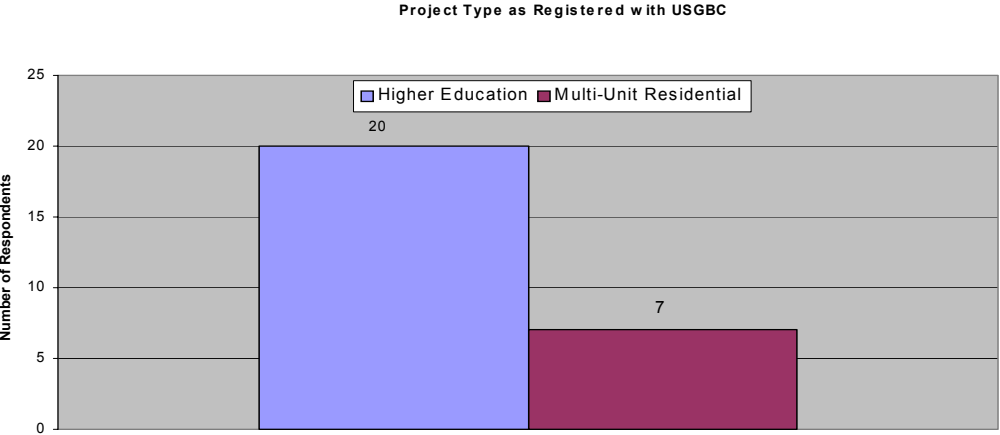
A second email request was sent to those contacts that did not respond by the initial deadline date. In all 27 surveys for registered projects and five certified projects were returned with at least some portion completed. Responses were also received for four registered projects that are not higher education or multi-unit residential; therefore, they were not incorporated into the results.

The purpose of the surveys was to ascertain how the buildings were being used and how LEED certification documentation is being handled. Other information sought by the survey included: costs, challenges and communication for LEED projects.

**Results**

Of the projects represented, twenty were registered with the USGBC under the category of ‘Higher Education’ while seven registered under the category of ‘Multi-Unit Residential’ (Figure 1). Since some of the projects registered under the category of multi-unit residential were at institutions of higher education, it was revealed that there may be some uncertainty as to how a project at a university for example should register with the USGBC (i.e., higher education or multi-unit residential). Based on this potential for confusion, the USGBC should consider clarifying how institutions of higher education should register their projects, especially residence halls. Perhaps one way of making this clarification would be to register all residence hall projects as Multi-Unit Residential and all non-residential projects as Higher Education. Another way would be to use to subcategories for projects registered by Higher Education. Still

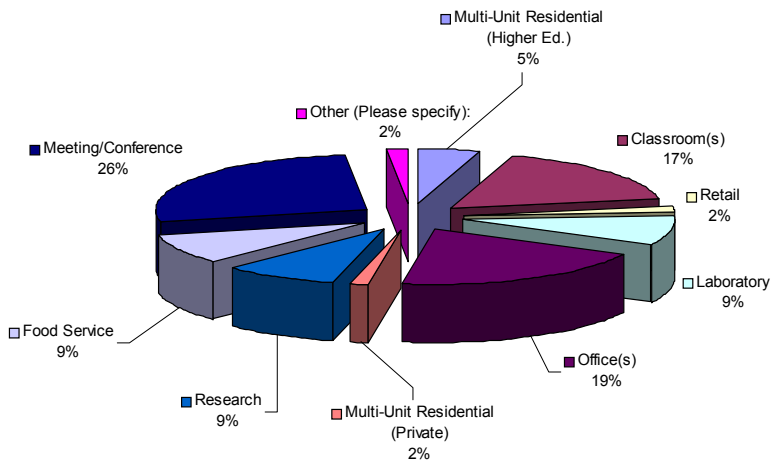
**Figure 1: Project Type as Registered with the USGBC.**  
Survey respondents represented twenty-seven projects. Twenty were registered with the USGBC under the category of ‘higher education’ while seven were registered in the category of ‘multi-unit residential.’



another approach may be to provide one category for Higher Education-Academic and another for Higher Education-Residential.

Figure two compares the different functions of the registered buildings. The top three ranked primary uses for the LEED registered projects were: meeting/conference, offices and classrooms. Other building functions specified were laboratory, research, food service, multi-unit residential (higher education), retail, multi-unit residential (private) and a performance hall.

**Figure 2: Building Functions of Registered Projects**  
 Survey respondents indicated the primary functions of their project.

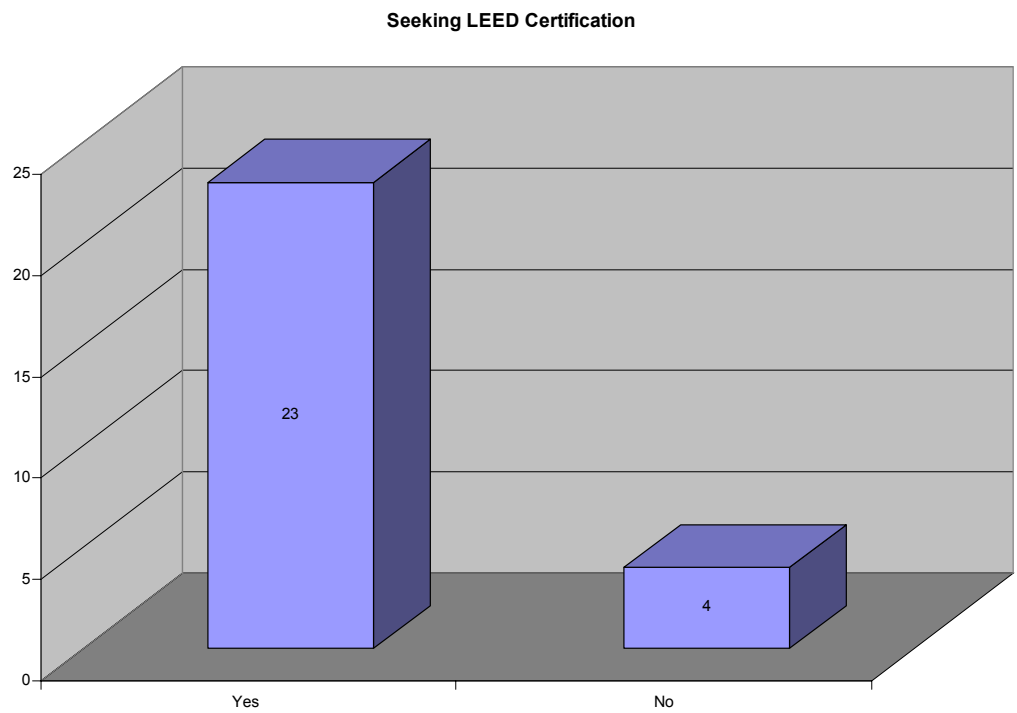


Multi-Unit Residential (Higher Ed.)	Classroom(s)	Retail	Laboratory
Office(s)	Multi-Unit Residential (Private)	Research	Food Service
Meeting/Conference	Other (Please specify):		

Respondents were asked if they were planning to submit the project for LEED certification (Figure 3). The majority indicated that certification would be sought. The four projects not being submitted for certification indicated that cost was the main factor. One respondent said, “The building will have many green elements but it is

being designed by an internal design team and built in a design-build method. There are, for example no written specifications. This method of design and construction is not supportive of the LEED process. In the end with a tight budget it was elected to use all available money to make the building 'green' rather than to document the 'greenness' or worry about the specific rating. That is the current plan and we will not be proceeding with a formal application for a rating." Another respondent indicated "the owner didn't see cost benefit in LEED certification costs."

**Figure 3: Number of Respondents Seeking LEED Certification**  
Survey respondents indicated whether or not they would seek certification of their registered project by the USGBC.



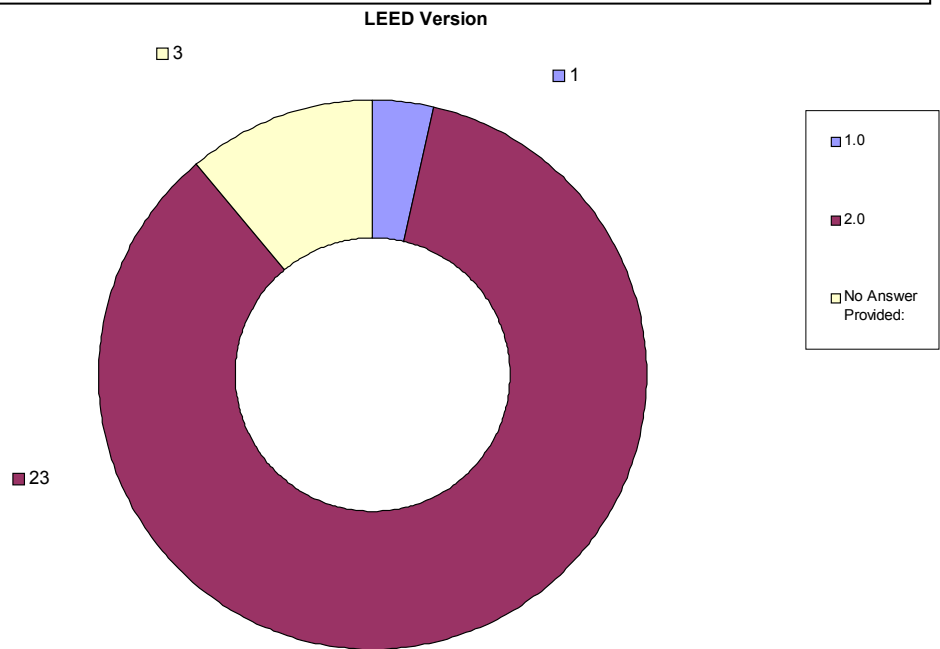
As table three indicates, of the projects seeking LEED certification most expect to achieve it in 2003.

**Table 3: Expected Year of LEED Certification**  
 Survey respondents indicated the year in which they expected to receive LEED certification by the USGBC.

2002	2003	2004	2005
3	10	8	2

The USGBC began the LEED Green Rating System in December 1998 with Version 1.0, also known as the Pilot Project. Then in March of 2000, Version 2.0 was released (LEED Credit Trends, 2002). In August 2002 the USGBC released a Version 2.1. Since this release occurred during the implementation of the survey, Version 2.1 was not an option for a response within the survey. As a result the majority of

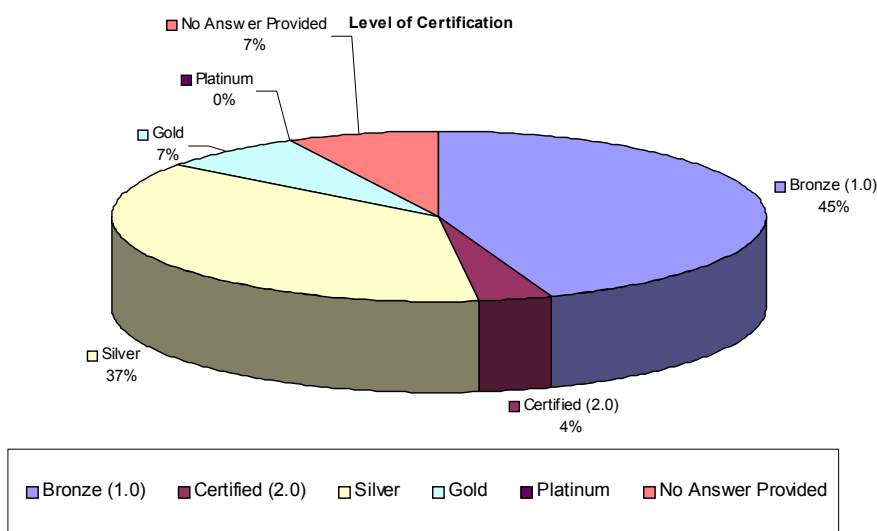
**Figure 4: LEED Version**  
 Survey respondents indicated the version of LEED they would use during the certification process (only version 1.0 and 2.0 were available when the survey was distributed).



respondents indicated they were using Version 2.0, although a few commented they would use Version 2.1 (Figure 4). As mentioned earlier this latest revision was a response from the USGBC Board of Directors to practitioners who gave them feedback regarding documentation. This newest version is considered a radical simplification of the documentation requirements (Environmental Design + Construction 7/12/02).

Figure five represents the different certification levels sought by survey respondents. Of the responding projects representatives, thirteen are seeking the Bronze (1.0)/Certified 2.0 level, in anticipation of earning 26-32 credits, while ten are aiming to earn Silver (33-38) and the remaining two are set for Gold (39-51). None of the respondents intend to achieve Platinum (52-69).

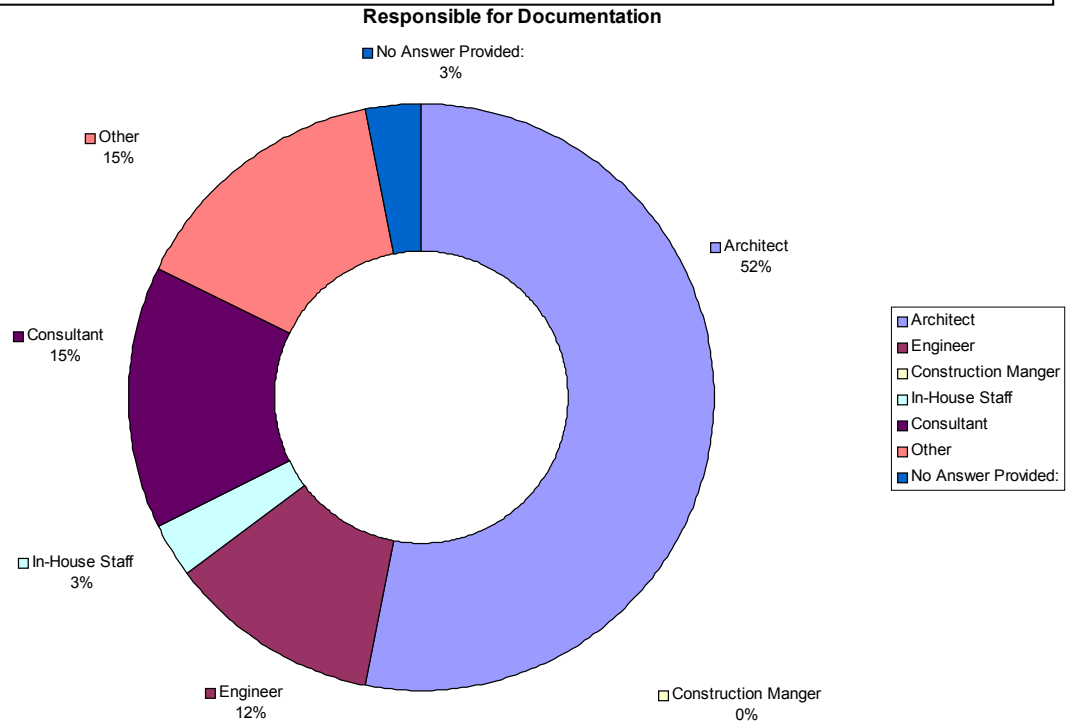
**Figure 5: Certification Level Sought**  
 Survey respondents indicated which of the four levels of certification they were attempting to achieve.



**Table 4: LEED Credit Chart**  
 LEED Green Building Rating System Certification Credit Chart indicates the number of credits necessary to earn each rating level.

Rating Level	Certified (2.0) or Pilot Project/ Bronze (1.0)	Silver	Gold	Platinum
Credits Needed	26-32	33-38	39-51	52-69

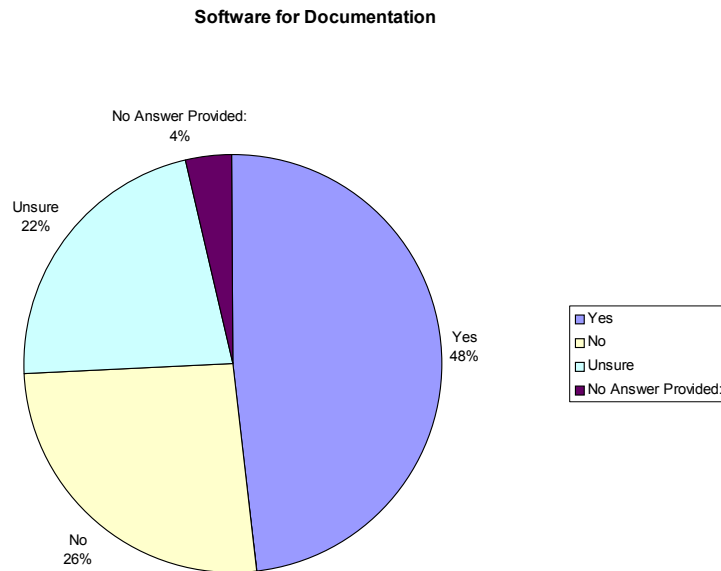
**Figure 6: Responsible for Documentation**  
 Respondents indicated the party/role responsible for documenting the LEED credits. Documentation is a requirement of the USGBC in order to earn certification.



Architects were rated as the primary party responsible for documenting LEED certification (Figure 6). The remaining respondents indicated someone other than the architect, engineer, construction-manager, in-house staff or consultant was responsible.

In a couple cases, more than one party was responsible. Comments on this subject included, “Contractor is compiling information from Contractor and Design Team” and, “Researcher on architect’s staff, LEED accredited professional,” and also, “We are contemplating having graduate engineering students complete the application--possible innovation credit”. Other responses cited contract manager, commissioning agent, design-builder, and LEED consultant as responsible for documentation.

**Figure 7: Software for Documentation**  
 Respondents indicated whether or not they would use a software program to coordinate documentation for LEED certification. Documentation is a requirement of the USGBC in order to earn certification. However, the use of a software program to coordinate it is not necessary.

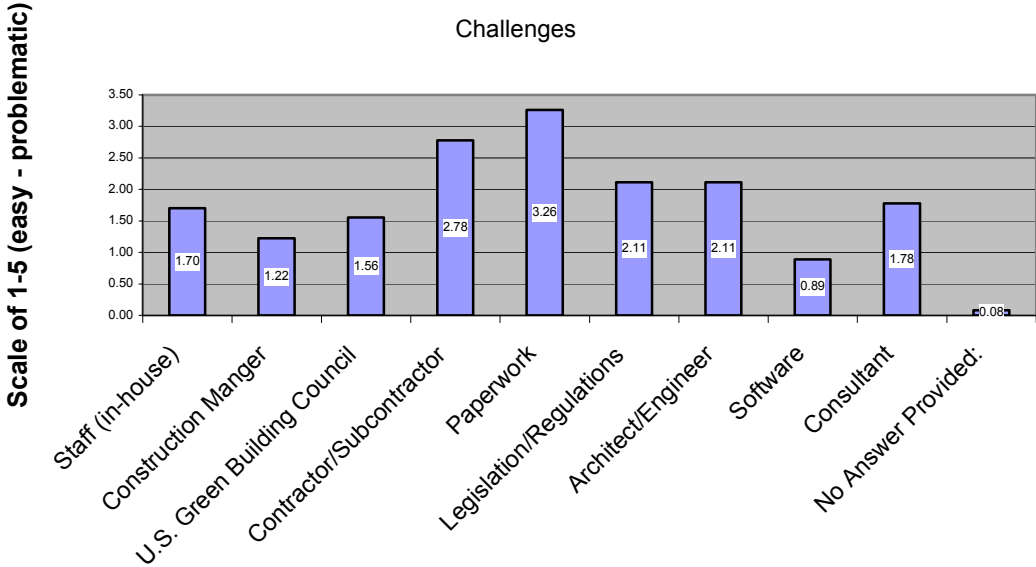


When asked whether software would be used to coordinate documentation, just under half said yes, while seven said no, six were unsure, and only one did not respond (Figure 7). Custom software programs and Microsoft Excel were cited as the most used software programs, followed by USGBC LEED Template, Access and Adobe Acrobat.

Of the seven who were not using software, methods of documentation included files, notebooks and in tabbed binders as suggested by the USGBC.

Since documentation is such a significant aspect of LEED certification, it seems as if there is room for improvement in this area so those responsible for documentation can be sure of their method. It would be interesting to learn how much time was used to create the custom software programs. It appears that Version 2.1 makes the process less time consuming, therefore it will be necessary for those responsible for documenting current registered projects to quickly become familiar with the newest version. Since many of the respondents indicated they made a custom software program to track the documentation USGBC may consider obtaining examples or templates to share with other registrants.

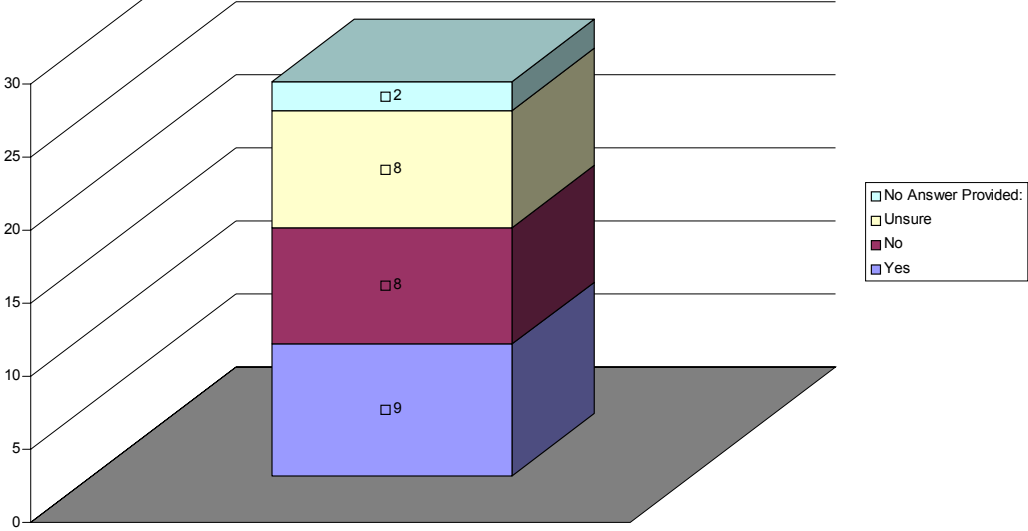
**Figure 8: Challenges**  
 Respondents indicated the level of challenge each factor had on the project.



The USGBC appears to be on top of the issues and challenges facing practitioners regarding documentation since the most commonly cited challenge to survey respondents was paperwork (Figure 8). The other most significant existing or anticipated challenge to projects was contractor/subcontractor. All other categories had an average score under 2.1.

Regarding a communication plan, the majority of respondents either said no communication plan would be used to promote the LEED project, or they were unsure or they didn't respond (Figure 9). One-third indicated that a communication plan would be used. One indicated that their college might use a communication plan for future funding requests. Other responses included:

**Figure 9: Communication Plan**  
 Respondents indicated whether or not a communication plan would be implemented to promote their LEED registered project.

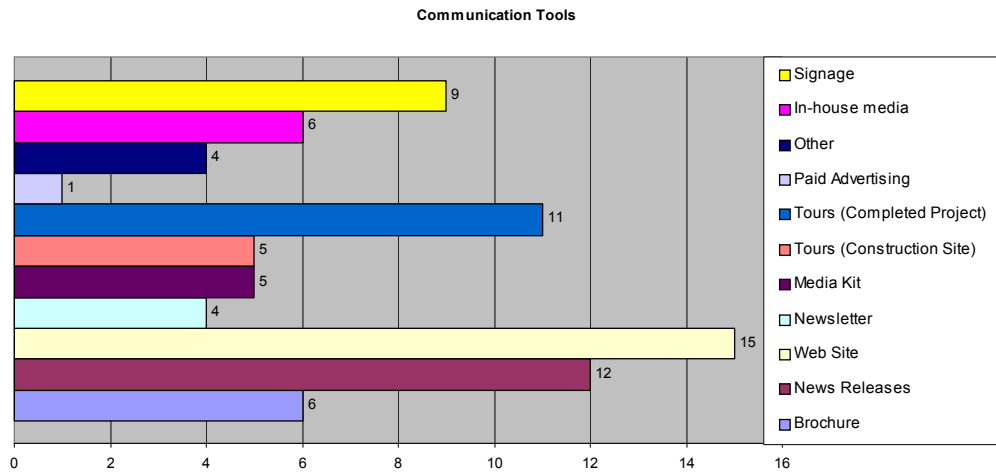


- The University has hired a full-time sustainability position for this and other projects, and;

- [The University] has an elaborate internal public relations system including press releases and internal publications, which will be used to publicize any efforts at greening or environmental protection included in the building design. No specific programs have been determined.

As figure ten indicates, the most commonly used communication tools are: web site; news releases; tours of completed project and Education Programs. These results may

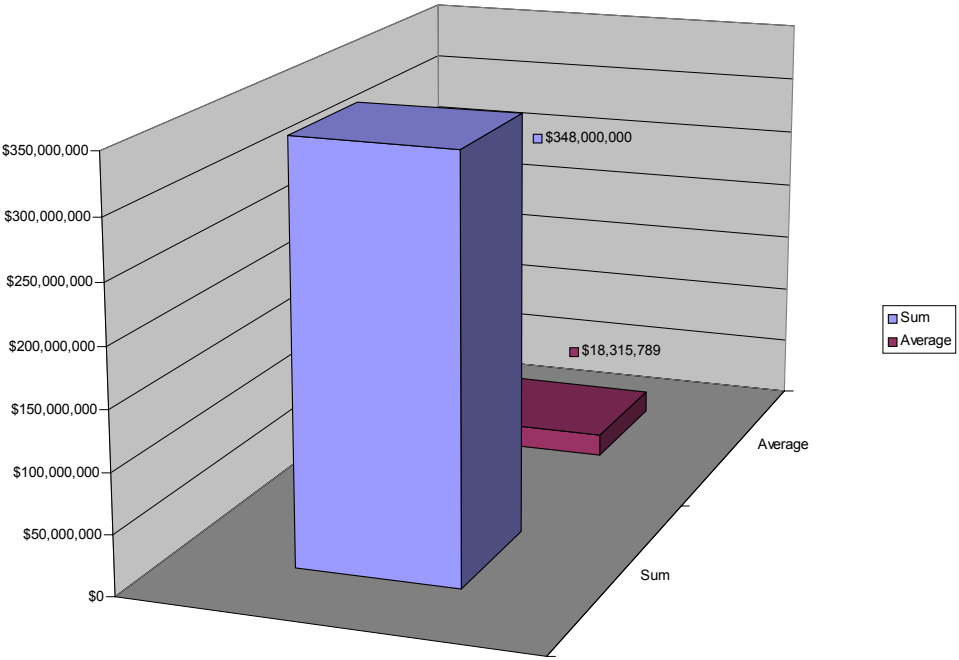
**Figure 10: Communication Tools**  
 Respondents indicated the tools they would use to promote their LEED project.



indicate an opportunity to promote these LEED projects in order to increase awareness of the projects and benefits of LEED certification as well as to gain support and funding for future projects.

One question in the survey that received the most feedback asked, “From an organizational and/or local level, how could the LEED certification process be more efficient for you to implement?” Most responses discussed the lack of understanding

**Figure 11: Sum & Average Project Costs**  
The survey represented \$348 million in new construction with an average cost of just over \$18 million per project.



of LEED, the need for guidance and expertise from the USGBC and reduced documentation requirements. Comments included:

- Do away with the onerous paperwork. A recent application on another job weighed 13 pounds!
- Greater accessibility to LEED personnel for specific guidance in obtaining LEED certification. This is improving, as the LEED documentation becomes

more refined, though there is very little information on how to document the submittal.

- Better access to a USGBC LEED contact person for questions and inquiries.
- We are looking forward to LEED 2.1 with simplified documentation as well as sample spec language to incorporate LEED credits.
- I feel the USGBC needs to do a better job giving projects an example submittal package that shows an example of every credit and every piece of documentation that is required. Also providing a list of approved materials and/or technologies.
- Early interpretation as a resource on specific project initiatives, without [financial] penalty.

Table five represents the various costs related to incorporating sustainable development and LEED into a project as indicated by survey respondents. The expected final project costs from surveys ranged from \$400,000 to \$65 million. From the nineteen responses to this question, the survey represented over \$348,000,000 in project costs averaging at \$18,315,789 per project. Comments on the topic of budget increases for LEED included: “Contractor included an estimated cost of \$50,000 to administer their responsibilities in the documentation and submittal to LEED.

Architect/Design Team costs have been close to \$50,000 as well. Part of the Design Team’s expense has been in adjusting the delivery in response to the changing LEED requirements. We started with LEED in 1999 with the Pilot Version 1.0 and requirements and documentation have changed drastically since then.” “This project’s

sustainable features have been affected significantly by budget problems.” Another said, “In the process of making cost reductions...we are still holding tight to the silver rating...if we can.”

**Table 5: Budget Responses**  
 Survey respondents were first asked what the estimated budget changes for incorporating sustainability. Then they were asked for estimated budget changes for their LEED certification effort. Finally, respondents were asked to indicate the estimated costs contributable to LEED certification in the following areas: design fees, construction fees, documentation, consulting, and other expenses.

Budget	Total \$ for Survey	High	Average \$	Average %
Sustainability	\$ 1,680,000	\$500,000	\$98,824	3%
LEED Certification	\$1,046,300	\$250,000	\$91,364	7%
LEED Design Fees	\$408,000	\$100,000	\$29,143	6%
LEED Construction	\$302,000	\$270,000	\$84,000	5%
LEED related Documentation	\$377,000	\$70,000	\$29,000	Average Hours: 226
LEED related Consulting	\$138,889	\$50,000	\$18,889	.12%
Other Expenses	\$91,000	\$85,000	\$8,273	N/A

Estimated budget increases for incorporating sustainability ranged from zero to \$500,000 with average increase of \$98,824 for incorporating sustainability. One particular comment suggested, “sustainability' costs have lifetime, productivity or efficiency paybacks. [The] client [is] not paying 'extra' for a 'sustainable' building.”

After asking for cost changes due to incorporating sustainability, the survey asked for estimated budget increase or decrease for LEED certification efforts. The amounts given went up to \$250,000 however the average response was \$91,364.

Respondents were also given the opportunity to include a percentage. According to the survey, the average percentage for LEED costs was 7%. Since the survey provided a choice of indicating the dollar value, or percentage, it should be noted that this percentage might not be in proportion to the dollar values given. In addition, there was uncertainty in reading the responses as to whether respondents simply left some boxes blank or they were indicating no cost changes applied. As a result, it could be interpreted that in many cases, there were no cost increases were indicated for incorporating sustainability or LEED. By providing the highest dollar value given, readers can make their own interpretation of the increased costs associated to each category.

A comparison of the average increase in project costs attributable to LEED certification (\$91,364) to the average project cost by survey respondents (\$18,315,789) indicates that additional costs due to LEED certification represent an increase of only .5%. This is in contrast to the average 7% increase indicated by survey respondents. Similarly, a comparison of the average increase in project costs attributable to incorporating sustainability (\$98,824) to the average project cost by survey respondents (\$18,315,789) was quite different. This comparison indicates that additional costs due to incorporating sustainability represent an increase of only .54%. This is in contrast to the average 3% increase indicated by survey respondents. Clearly, further research is necessary in order to more accurately measure costs related to sustainability and LEED certification.

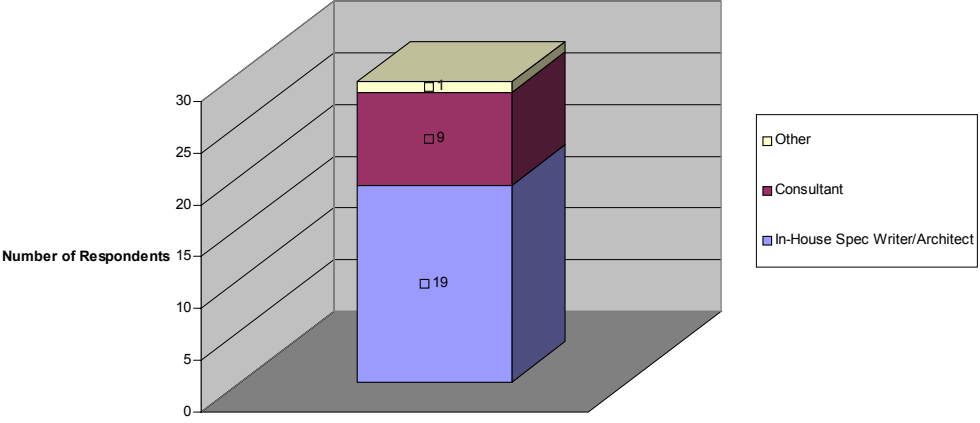
Design fees attributed to LEED certification was another budget item addressed in the survey. The highest value given for estimated costs contributable to LEED certification was \$100,000 and the average amount given was \$29,143. When asked about the estimated costs contributable to LEED certification for construction fees the average response given was \$84,000 or 5%. For documentation costs the survey total was \$397,000 with the highest amount given being \$70,000 and the average costs for LEED related documentation was \$29,000. The average number of hours dedicated to documentation was 226. Again, the USGBC has taken steps to address this issue in Version 2.1. It will be interesting to compare the average number of hours from this survey with future survey of respondents who will have implemented Version 2.1. Consulting expenses for LEED averaged at \$18,889 or a mere .12%; with the highest consulting fees given were \$50,000. Although this particular respondent did not provide the total project cost, they did indicate that \$50,000 was .2% of the budget. Therefore, if their estimates were correct, it can be assumed that the project budget was approximately \$25 million. It is important to note again that the cost percentages were based on the responses in the survey not the dollar values. Only three respondents indicated any additional costs for their project. The highest amount given was \$85,000 for commissioning. The other two amounts totaling \$6,000 were for printing and LEED registration and certification fees.

Respondents were also asked to provide comments related to costs. One such comment reflected the acknowledged weakness of the study in that requested costs were either not shared with survey respondents or they were unsure of the categories

provided, “It is difficult to calculate the costs associated with LEED as broken down above as it was not tracked that in-depth. As consultants, we do not have the information on the design/construction fees for the rest of the project team. For energy modeling, green building consulting and LEED coordination the associated costs are .009% of the total project budget.” Again, in averaging the figures provided it appeared that some respondents may have left the box empty (not because there were no costs) rather they either didn’t know, included it in another category, or skipped it altogether. Another respondent said, “Do not have final numbers at this time, but will probably spend \$200-300K extra”.

When asked to indicate how LEED was or will be incorporated into the specifications, nineteen respondents marked in-house specifications writer/architect, another nine used a consultant and a third used someone from the owner-school’s staff

**Figure 12: Incorporated into Specifications**  
 Respondents indicated the party/role responsible for incorporating LEED requirements into the projects specifications.  
**Incorporated into Specifications**

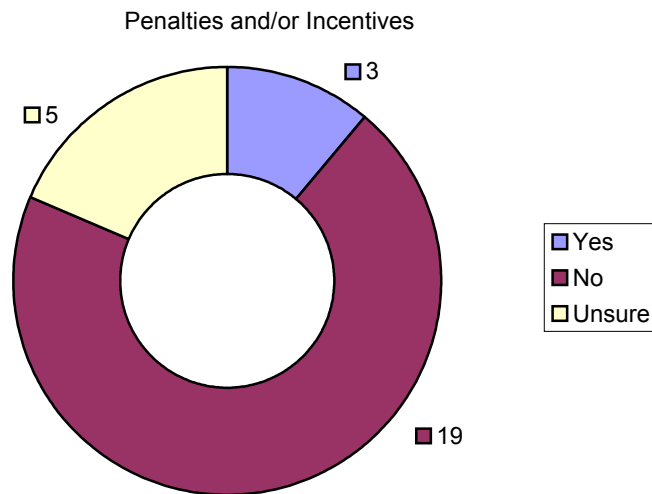


(Figure 12). It can be assumed that in more than one case an in-house spec writer, architect, or consultant worked as part of a specifications-writing team. This assumption is reinforced with provided comments like these, “Consultant spec-writer is incorporating LEED in collaboration with architect,” and “Our specifications consultant has been working with us to incorporate LEED into the specs.” Respondents commented on needed assistance from the USGBC, “LEED coordinator to provide some assistance and sample specs from USGBC would be helpful.”

Figure thirteen shows that a majority of respondents are not incorporating penalties or incentives for LEED certification in any contracts. It also indicates many others were unsure, while only three indicated that penalties and/or incentives were included in contracts. One project providing incentives indicated that their contract states that LEED Silver must be achieved and that an additional \$50,000 incentive would be granted if Gold were achieved. Another said, “Construction waste recycling, materials information and invoices [are] required before progress payments [are] paid to general contractor”. Another mentioned that documentation submittals were tied to pay applications. Still another stated, “All LEED related work is either an add-alternate or mandatory.” There seems to be a great opportunity for LEED project contracts to provide incentives to contractors and subcontractors, especially since they were cited as the second highest challenge to LEED projects in this survey. Adding incentives for contractors and subcontractors may ease the reluctance to incorporate new sustainable techniques, materials and products.

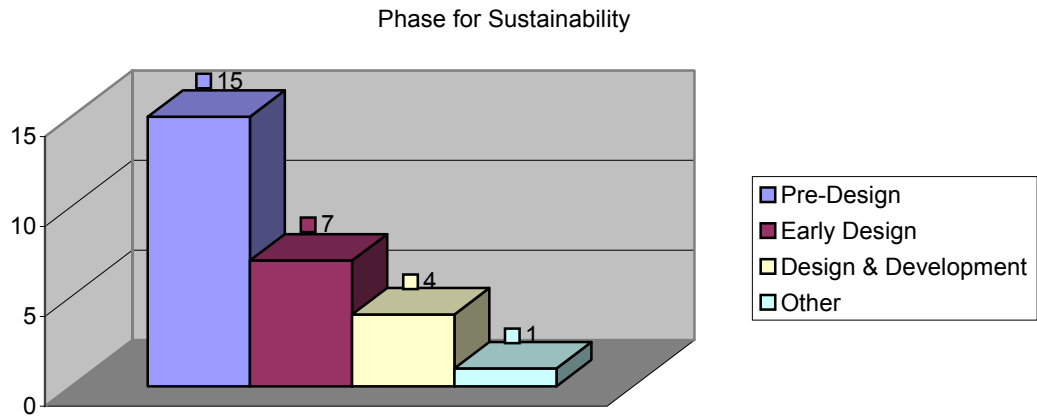
**Figure 13: Penalties and/or Incentives**

Respondents indicated whether or not penalties or incentives were included in contracts with contractors and subcontractors.

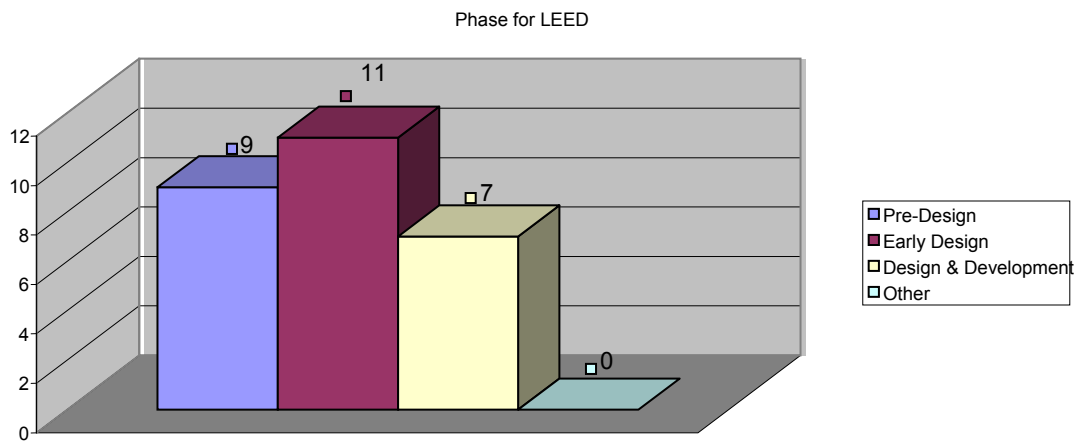


As Table fourteen indicates, a majority of the projects incorporated sustainability as a goal during the pre-design phase while seven made it a goal in early design. This seemed to benefit the team as indicated in the following responses, “I would like to think that it helped us to get the project, by discussing sustainability and LEED in the project interview,” and “Required by contract starting with owner's DB selection process.” Others indicated that a very committed client group was important and another stated that sustainability is a part of every project their firm designs.

**Figure 14: Phase for Sustainability**  
 Respondents indicated at which phase of the project sustainability became a goal.



**Figure 15: Phase for LEED**  
 Respondents indicated at which phase of the project LEED certification became a goal.



Of the twenty-seven respondents, nine indicated that LEED certification became a goal during the pre-design process of the project, while eleven stated it occurred during the early design phase, and seven projects didn't focus on LEED certification until design and development (Figure 15). One respondent commented, "Started

considering doing LEED in schematic design committed to it during design development phase.”

The end of the survey asked for the owner’s main reasons for building sustainably and then for using LEED. All but one respondent gave a reaction to one or both of these categories. The responses included reasons related to ethics, costs, public image, and reduced energy consumption. Here are some of the comments regarding building sustainably:

- Doing the right thing.
- Model appreciation of environmental issues to our students.
- Saving energy and operating costs; public image.
- Personal choice.
- State incentives.
- Energy cost & student issues.
- Demonstrates cultural sensitivity to the building users.
- Operational costs, and to “do the right thing.
- School mission.
- Reinforcement of university policy; educational value.
- Save money in operating expenses.
- It is the responsible thing to do.
- Provide model for K-14 education facilities, cut energy use, [and] create a building that is consistent with environmental curriculum.
- Campus Mandate. Academic Mission.

These are the some of the reasons given for using the LEED Green Energy Rating System:

- Great set of guidelines to measure level of Green.
- Public display of our campus goals in this regard.
- Widely accepted and available measuring tool. Third-party confirmation.
- State incentives.
- Long term operating efficiencies.
- It is a good way to show definite goals for sustainability.
- Verification that in-house staff is doing a good job.
- Certification. Recognition of achievement.
- School mission.
- PR.
- Recommended by Sustainability Consultant.
- Benchmark and guideline for certifying green building.

In closing the survey respondents were asked to give their advice to others considering sustainable design, construction and LEED. The predominant theme was to start early. Here is some of what they said:

- Start early in the design process. Identify a LEED “champion” to focus efforts.  
Inform the owner of potential impacts and rewards for LEED certification.
- Start early and determine benefits to owner early.
- Start early, communicate often, and don't put off the documentation process.
- Be prepared to spend LOTS of time with the learning curve.

- It's the right thing to do & it really is easier than other[s] think.
- Sustainable design is essential. LEED is good objective standard, but need to go far beyond it.
- Get everyone on board; if there is a weak link it can seriously undermine your efforts. Start early! Review LEED checklist for feasibility, schedule and cost with consultants EARLY and get their responses in writing so that they don't surprise the owner with additional services fees later in the project.
- Go for it!
- Make sure owner/occupants are committed to the idea before you start.
- Start early in the design process. Identify a LEED "champion" to focus efforts. Inform the owner of potential impacts and rewards for LEED certification.

To summarize, the survey results of the registered projects in Higher Education and Multi-Unit Housing indicated that the primary function of these projects is for classroom use, followed by offices and meeting/conference. As mentioned earlier it may be beneficial to distinguish how universities should register their residence hall and non-residence hall projects. For instance, a new residence hall project should register as multi-unit housing even when it is being built at an institution of higher education.

Most of the representatives of the registered projects will seek certification for the Bronze and Silver ratings in 2003 and 2004, using LEED Version 2.0, or the newly released 2.1 (an update requiring less documentation to prove credits are adequately fulfilled). While the survey did not ask why Gold or Platinum was not a priority, it may

be helpful to find out why project teams are not seeking a higher certification level. Perhaps state, federal or USGBC incentives would increase the number of registered projects seeking a higher level of certification. It is assumed by the author that since many project teams are seeking LEED certification for the first time, it may be that once they have a project ‘under their belt’ they will be more confident or likely to set their goals higher.

Many will use a custom software package, Excel spreadsheets or Access database to coordinate documentation, while others will use the LEED template or a binder. It is the authors’ opinion that there is room for improvement in the area of coordinating documentation by the USGBC, beyond the current template offered. Perhaps experienced project teams would have a means to share or sell their planning templates via the USGBC web site as one respondent suggested.

Paperwork was indicated as the biggest challenge to the LEED projects followed by contractor and subcontractor issues. As mentioned earlier, the newest Version 2.1 is expected to significantly improve the issue of paperwork. In order to reduce the challenges posed by contractors and subcontractors, it seems as if there is a great opportunity to provide incentives for meeting and surpassing LEED credit goals. Contractors and subcontractors may also become less of a challenge to project teams if they are included earlier in the design process. Perhaps another way to improve cooperation for LEED requirements from contractors and subcontractors would be in promoting their success stories of sustainable materials and methods by the project team

and/or owner. This could be in the form of signs at the site, employee newsletters or news releases for the media. Marketing and implementation of USGBC training courses may be another way to educate the contractors. Another incentive is to award projects to contractors who included LEED accredited professionals on their staff, much like LEED provides credit for design teams with LEED accredited professionals. Finally providing regular updates, feedback and education programs for site workers may be another way to increase understanding, enthusiasm and ultimately support by contractors and subcontractors. For instance, a sign posted at the site with a thermometer indicating the percentage of recycled deconstruction and construction materials may serve as an incentive for workers to continually improve. For projects in higher education (and even private projects), students and faculty may be able to play an instrumental role with these projects. Using the thermometer example, a class may administer measurement readings for a project. In turn they will gather data and reflect changes on the sign each week.

The majority of respondents are either unsure or not planning to use a communication plan to promote the project. Of those who are using communication tools to promote their projects the majority are using a web site, followed by news releases, tours and education programs. Again, the site signage is critical. It is an incredible lost opportunity when projects do not even include simple signage at the site informing passers-by of the sustainable design features being incorporated into the site. Public involvement and outreach are essential factors in making LEED more commonplace. Another way to involve the public with the project is by providing

updates and photos on a web site. Live camera views of the project would allow for up-to-date coverage for the community and people involved with the project. Architecture and engineering firms, and construction companies usually have marketing departments already in place where the sustainability concept could be incorporated into their existing promotional efforts. Further research is needed in this area as to why more firms are not promoting their work in sustainability to the public. Students at institutions of higher education may be able to assist with these efforts.

Incorporating sustainable design practices into the projects targeted for this survey increased costs by an average of \$93,684. Incorporating LEED certification into the project increased costs by an average of \$91,364. Unfortunately, the survey did not specify whether the LEED costs were part of, or in addition to the costs of incorporating sustainable design practices. Considering that LEED certification will lead to a reduction in energy consumption, it would be interesting to know how quickly these first costs can be recovered. A follow up to this question may have allowed respondents an opportunity to indicate what specifically these costs represent (e.g., consulting, materials, etc.).

An average of 226 work hours is dedicated to documentation for a LEED project. Once more, the newest Version 2.1 addresses this issue and future research will help to identify exactly how significant of an impact it has on time dedicated to documentation.

Incorporating LEED into specifications was most commonly the responsibility of the in-house spec writer or architect followed by consultants. Perhaps a more representative number would have been provided if the in-house spec writer were listed as a separate option from architect.

Most project owners incorporated sustainability into the project because of ethical principals and life cycle costs. Incorporating LEED was due to the same reasons, in addition to public relations, benchmarking and third party certification and validation. Since many owners may avoid committing to LEED certification due to perceived additional costs, there is extensive opportunity for education as to the cost benefits (i.e., reduced operating and maintenance costs). With hard data on first-cost returns, owners reluctant to implement sustainability and LEED may reconsider.

Respondents were requested at the close of the survey to provide advice to others considering sustainable and LEED projects. The essential themes were to: 1) start early; 2) educate all participants; and 3) dedicate time to a learning and documentation.

## SECTION VII

### LEED SURVEY FOR CERTIFIED PROJECTS

As of August 26, 2002, there were twenty-four LEED certified by the USGBC. The survey was sent electronically to eleven of them (Table 6). The 13 pilot projects for Version 1.0 were excluded at the request of the USGBC. Five representatives completed and returned the survey indicating a 45% response rate. Two were industrial projects, two were commercial and the fifth was governmental.

<p><b>Table 6: LEED Certified Projects</b></p> <p>This list represents projects that earned LEED certification from the USGBC. The certified project survey was distributed to a representative for each project listed.</p>
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LEED Rating Version	Company	Project Name	Certification Date	Rating
Version 2.0	PGE Green Building Service	Ecotrust Natural Capital Center	12/11/2001	Gold
Version 2.0	Office of General Service	625 Broadway Office Complex	6/11/2002	Silver
Version 1.0	Steelcase Wood	Steelcase Wood Furniture Manufacturing Plant	9/28/2001	Silver
Version 2.0	JVB Consulting Inc.	Vancouver Island Technology Park	2/4/2002	Gold
Version 2.0	PGE Green Building Services	Viridian Place	11/26/2001	Certified
Version 1.0	Pharmacia	Q Building Lab	3/14/2002	Gold
Version 2.0	CTG Energetics, Inc.	Premier Automotive Group North American HQ	11/9/2001	Certified
Version 2.0	Gastinger Walker Harden Architects	EcoWorks 1 & 2	7/5/2002	Certified
Version 2.0	CTG Energetics, Inc.	InterGen Cottonwood Administration Building	4/17/2002	Certified
Version 2.0	PA DEP Bureau of Office Systems and Services	Cambria	12/3/2001	Gold
Version 2.0	L.D. Astorino Companies	PNC Firstside Center	10/1/2000	Silver

Four of the respondents used a software program for coordinating documentation including: LEED template, Microsoft Excel and Adobe PDF and a custom program, while the fourth didn't use any software to coordinate documentation.

Nine pre-selected challenges to the projects were rated on a scale of one to five, with one considered 'easy' and five considered 'problematic'. The three highest rated challenges to the LEED certified projects were paperwork and construction manager both with an average score of 3.25, and contractor/subcontractor with a 3.0 average. Regarding challenges, one respondent remarked, "The challenge was making sure that during the design process the goals of the LEED credits were not lost." The majority of the certified project respondents utilized a communication plan consisting of brochures, news releases, web site, tours and signage. One project's grand opening event included USGBC President Christine Ervin and was covered by local media. Other promotional tools helped bring attention to the certified projects including a documentary video program on building green in Pennsylvania. It focuses on the lessons learned during the design, development and construction of the Cambria office building ([www.ggc.state.pa.us](http://www.ggc.state.pa.us)). Project representatives were also asked to give their opinion of how the LEED certification process could be more efficiently implemented. Once again Version 2.1 was mentioned, "Simplify documentation requirements" and "Version 2.1 will smooth out the process." There were also suggestions directed at the USGBC, like these: "The main issue was the getting in touch and speaking to someone on how to interpret the criteria," and "USGBC should respond quicker to questions from

members!” Yet another one referred to the intense level of analysis from USGBC reviewers during the certification process.

While there wasn't enough financial data provided for comparison of certified projects in this survey, there were some thoughtful comments provided on the subject. One respondent described their experience with “cost savings and trade offs associated with integrated design and planning where costs may be more in one area but reduced in another.” They added, “...design options, commissioning and modeling added some \$60,000 [to their costs], although savings from subsequent right-sizing and elimination exceeded this. On the subject of documentation costs, a respondent described how their firm had to absorb a large portion of costs due to a fixed-price contract. Another addressed cost related questions with this response, “The costs were above the market value of a typical building. We estimate we spent approximately 5% more for the added features to acquire the LEED certification. Productivity of the occupants will never be addressed unless the individual tenants volunteer productivity statistics based on previous locations”.

When asked about how LEED was incorporated into the specifications, the Cambria office project representative described new legislation mandating specific standards, “[The] Building Green in Pennsylvania program requires LEED Silver and meeting Commonwealth's Performance Standards.” None of the respondents included penalties or incentives for LEED certification in their contracts. In giving reasons for the owner's main reasons for building sustainably, respondents replied with the following remarks,

“Marketing [and] promoting sustainability,” “Promote public policy and demonstrate leadership,” “Guilt complex...” and “[It’s the] right thing to do!” Reasons given for using LEED certification included: “LEED forms the basis of integrated design and planning,” “Marketing, ” “To prove owner was really doing something better than usual,” and a repeat of “[It’s the] right thing to do!” In the survey’s conclusion project representatives were asked to share their advice to anyone considering sustainable design and construction and LEED. Here are their responses:

- “Do it. It makes a big difference from a marketing perspective. Have a green champion.”
- “Know what you want and demand it at cost effective process. Be prepared to insist on and manage change from the way most professionals do business.”
- “The costs are high the first time through. Second projects should be less expensive once teams learn what they need to do. Hopefully the process will be similar to learning ADA (disabilities act) rules years ago. ADA is not perceived to add cost now”.
- “Have a person who understands the LEED process and has a good working knowledge of sustainable design. In considering LEED do it as early as possible in the process and document everything”.

In conclusion the certified projects survey provided many similar results as the registered projects survey. There were a few notable differences. For example, representatives of certified projects identified the construction manager as one of the highest challenges to the LEED project (average score 3.2), whereas the registered

project respondents placed a much lower ranking on the challenge presented by the construction manager (average score 1.22). This may be attributable to the element of completion of construction of certified projects whereas many of the registered projects have either not yet begun or completed construction. Future research may find that the construction manager poses an increased challenge to the projects as they progress through the construction process. Certified project representatives were also more likely to have implemented a communication plan for the project. Again, this is most likely due to the completion of the project and they may serve as model for the soon-to-be certified projects. Since the certified project survey did not provide as much detailed financial data as the registered projects survey it was not possible to constructively compare them.

The certified projects survey did however reiterate many of the points made by respondents of the previous survey. Both sets of survey respondents seemed to acknowledge a learning curve and resulting costs for implementing LEED specifications and documentation on first-time projects. They both also indicated a need for additional improvements to the rating system especially in terms of documentation. There was also a consistently indicated need for improved response time and support from the USGBC. And finally respondents from both surveys acknowledged how LEED truly serves as the ‘national standard’ for sustainable development.

## **SECTION VIII**

### **CONCLUSION**

“We can create an Ecological Revolution every bit as profound as the preceding Industrial Revolution. The pieces are well understood, from energy efficiency and sustainable agriculture to ecological wastewater treatment and bioregional design” (Cowan & Van Der Ryn, 1996).

One step forward in the ecological revolution described by Cowan and Van Der Ryn is applying sustainable development elements into every project. Many forward-thinking leaders in universities and businesses around the country are taking sustainability one leap further, by implementing a third-party, certified rating programs like LEED. The University of South Carolina is one such example. Hopefully the information shared by survey respondents and others interviewed in this research will give some foresight to others who commit to sustainable development principles. Implementing LEED projects seems to start with hurdles and challenges from project teams, contractors and owners, and end with a positive snow ball effect, including positive press and outcomes. It will be interesting to read about research projects regarding planning, documenting and communicating LEED projects in the future. Hopefully, there will be many more registered and certified projects than there are today.

Those considering LEED certification, who use the advice and recommendations provided by the survey respondents and project representatives, may find the process to be more efficient, and with fewer barriers.

Three new revisions and programs are in progress at the USGBC. As mentioned earlier, the Version 2.1 is an administrative update intended to simplify documentation requirements for new commercial and high-rise residential buildings. Currently in pilot testing, LEED for Commercial Interiors (LEED-CI) expands the scope of projects qualified for LEED certification. Designed to accompany the updated LEED Green Building Rating System (Version 2.1), LEED-CI is intended to address tenant improvement projects primarily in office and institutional buildings. Released in January for pilot testing, LEED for Existing Buildings (LEED-EB) is intended to provide guidelines for ongoing sustainable operations and maintenance practices in existing buildings. Public release of LEED-EB is expected in mid-2003.

Perhaps increased voluntary and mandated participation in the LEED Green Rating System will result in a more sustainable way of life and the next revolution: The Ecological Revolution.

## LIST OF REFERENCES

American Institute of Architects, Committee on the Environment (COTE) Selects Top Ten Green Projects. American Institute of Architects. (April 2002).

Barlow, Logan. "South Campus is seeing green". The Gamecock (April 29, 2002).  
University of South Carolina.

Bensch, Ingo. Program Evaluation: Northland College's Environmental Living and Learning Center: Energy Center of Wisconsin, Madison, Wisconsin, 2000.

City of Austin – Sustainable Communities Initiative. 1 May 2002  
<<http://ci.austin.tx.us/sustainable/sustdev.htm>>.

Cowan, Stuart and Sim Van Der Ryn. Ecological Design (p. 18). Washington, DC:  
Island Press, 1996.

Deal, Brian and Fournier, Donald. (2002). *The Architecture of Sustainability*. The  
School of Architecture/Building Research Council at the University of Illinois at  
Urbana-Champaign. 19 June 2002 <  
<http://brc.arch.uiuc.edu/aia/ces/sustainabletwo.htm>>.

Ervin, Christine. Special LEED Section: Measuring the Success of the LEED System.

*Environmental Design & Construction Magazine*. 11 July 2002

<[http://www.edcmag.com/CDA/ArticleInformation  
/features/BNP\\_Features\\_Item/0,4120,80479.html](http://www.edcmag.com/CDA/ArticleInformation/features/BNP_Features_Item/0,4120,80479.html)>.

Frequently Asked Questions. Adam Joseph Lewis Center for Environmental Studies,

Oberlin College. 22 May 2002

<<http://oberlin.edu/newserv/esc/MainMenuPages/FAQS.html>>.

Gonchar, J. (15 July 2002). "Green Building Ratings Get Easier". Engineering News

Record. 10.

Halcomb, Jacob S., Group Six Consulting, LLC. "Subject: LEED Survey." Email to

Gina Cooper. 13 October 2002.

Howard, Nigel, & Watson, Rob. "Special LEED Section: An Update on LEED

2.1", Environmental Design + Construction Magazine. 13 August 2002

< [http://www.edcmag.com/CDA/ArticleInformation  
/features/BNP\\_Features\\_Item/0,4120,80479.html](http://www.edcmag.com/CDA/ArticleInformation/features/BNP_Features_Item/0,4120,80479.html)> 2002.

International Council for Local Environmental Initiatives. 1 May 2002

<[http://www.iclei.org/us/la21\\_initiatives.html](http://www.iclei.org/us/la21_initiatives.html)>.

Koman, Michael. "Re: USC Green Residence hall." Email to Lisa Rich. 19 March 2002.

Koman, Michael. "Subject: Green Building Hurdles." Email to Patricia Jerman. 25 March 2002.

Landman, Miriam (1999). Breaking through the Barriers to Sustainable Building: Insights from Building Professionals on Government Initiatives to Promote Environmentally Sound Practices, Master of Arts in Urban and Environmental Policy, Tufts University. 28 Sept. 2002 <<http://www.egret.net-mlandmanthesis.pdf>>.

Lewis, Malcolm. "Special LEED Section: Explaining the Need for LEED". Environmental Design + Construction Magazine (11 July 2002). 13 August 2002 <[http://www.edcmag.com/CDA/ArticleInformation/features/BNP\\_Features\\_Item/0,4120,80479.html](http://www.edcmag.com/CDA/ArticleInformation/features/BNP_Features_Item/0,4120,80479.html)>.

Lyle, John Tillman. Regenerative Design for Sustainable Development. New York: John Wiley & Sons, Inc. 1994.

Model Green Building Symbolizes Essence of Catawba Program. Catawba College, Center for the Environment. 22 May 2002  
<<http://ecoconnections.catawba.edu/greenbldg.htm>>.

Orr, David. The Nature of Design. New York: Oxford University Press Inc., 2002

“Our Common Future: The report of the World Commission on Environment and Development”. Journal of Professional Issues in Engineering Education and Practice (April 1998).

Paquette, Julie. (2002) “Creating A ‘Green’ Building Through Sustainable Design.”

Mass High Tech Magazine, April 29, 2002

<[www.vanderweil.com/html/news/masshightech20020429.htm](http://www.vanderweil.com/html/news/masshightech20020429.htm)>.

Pennsylvania Department of Environmental Protection (1999). Green Buildings,

Guidelines for Creating High Performance Green Buildings,

Rocky Mountain Institute. 30 July 2002 <<http://www.rmi.org>>.

Sagan, Carl. Pale Blue Dot: A Vision of the Human Future in Space. Brilliance Corporation, 1994.

“Seattle Adopts LEED.” Environmental Design + Construction (23 February 2001). 24

May 2002 <<http://www.edcmag.com/CDA/ArticleInformation>

/features/BNP\_Features\_Item/0,4120,21314,00.html>.

Sustainable Design Services. October 2001. Little & Associates, The Boudreaux Group.

University of California Donald Bren School of Environmental Science &

Management. 24 Sept. 2002

[http://www.esm.ucsb.edu/about/donald\\_bren\\_hall.html](http://www.esm.ucsb.edu/about/donald_bren_hall.html)

University of South Carolina Graduate Studies Bulletin, (2000). Columbia, SC:

University Publications. University Housing, University of South Carolina.

20 June 2002 <<http://www.housing.sc.edu/uhsustainability.asp>>.

University of South Carolina Environmental Advisory Committee. 6 October 2002

<<http://www.sc.edu/EAC/AboutEAC.htm>>

U.S. Green Building Council. Advanced LEED Training Workshop Booklet, 2002.

U.S. Green Building Council. LEED Credit Trends. Washington, DC, 2002.

U.S. Green Building Council, 30 July 2002. <<http://www.usgbc.org>> .

Wear, John. Telephone interview. 30 July 2002.

## **APPENDICES**

- A. Survey for Certified Projects
- B. Survey for Registered Projects
- C. LEED Green Rating System Levels

**Appendix A**  
University of South Carolina  
**Survey of LEED Certified Projects**

Purpose: To gather data on LEED registered projects for comparison and analysis. Findings will be incorporated into a report and, upon request, shared with survey respondents. The report will focus on planning and documentation strategies for LEED certification.

1. **Project Type as Registered with USGBC:**  Higher Education  Commercial  Multi-Use  K-12  Government  Industrial  Laboratory  Retail  Non-Profit/NGO  Other: *(Please specify)*

2. **Project Name:** \_\_\_\_\_

3. **Indicate how each function applies to the LEED building:** *(1=primary; 2=secondary; X=doesn't apply)*

Housing (Higher Ed.)  Classroom(s)  Retail  Other *(Please specify):*  
 Laboratory  Multi-Family Housing (Private)  Food Service  
 Office(s)  Meeting/Conference  Research  Manufacturing

4. **When was the project Certified by the USGBC?**

5. **Indicate which Version of the LEED Rating System you used:**  1.0  2.0

6. **Indicate which Certification Level you achieved:**  Bronze (1.0) or Certified (2.0)  Silver  Gold  Platinum

7. **Who was responsible for coordinating the documentation for LEED Certification?**

Architect  Engineer  Construction Manger  
 In-house Staff  Consultant  Other *(Please specify)*

8. **Was documentation be coordinated using a software program?**  Yes  No  Unsure

If so, please specify the type of software, or if custom: \_\_\_\_\_  Unsure  
 If not, please describe how documentation will be coordinated:

9. **Rate each item below based on the level of challenge it brought to the LEED Project?**  
*Rate each on a scale of 1 (easy) - 5 (problematic)*

Staff (in-house)  Construction Manger  U.S. Green Building Council  
 Contractor/Subcontractor  Paperwork   
 Legislation/Regulations

Architect/Engineer  Software  Consultant

Other *(please specify):* \_\_\_\_\_ ***Please elaborate on the challenges you encountered:***

10. **Was/is a communication plan used to promote the LEED project?**  Yes  No

Unsure *Please explain: (e.g., We hired an ad agency for this.)*

11. **What tools are being or will be used to promote and/or respond to inquiries about the LEED project?** *(check all that apply)*

Brochure  Media Kit  In-house media (television/radio/newspaper)  
 News Releases  Tours (Construction Site)  Signage  
 Web Site  Tours (Completed Project)  Education Program  
 Newsletter  Paid Advertising *(Please specify)*

Other *(Please specify)*

Contact Person/Department: Name \_\_\_\_\_ Phone: \_\_\_\_\_ Email: \_\_\_\_\_

12. From an organizational and/or local level, how could the LEED certification process be more efficient for you to implement?
13. Final Project Cost:

14. Estimated budget increase/decrease, if any, for incorporating sustainability: \$      or      %  
 (Compared to a conventional building)  increase     decrease

15. Estimated budget increase/decrease, if any, for LEED certification effort: \$      or      %

**Estimated costs contributable to LEED Certification:**

16. Design Fees: \$      or      %
17. Construction Fees: \$      or      %
18. Documentation: \$      or      %      # Hours:
- \$      or      %
19. Consulting: \$      or      %

20. Other Expenses: *Please Specify:*

21. Indicate how LEED was incorporated into the specifications:

- In-House Spec Writer/Architect     Consultant     Other (*please specify*):

22. Were penalties or incentives for LEED certification included (or will be) in any contracts?  
 Yes     No     Unsure

23. At which phase of the project did sustainability become a goal?  Pre-Design  Early Design  
 Design & Development  
 Construction     Other *Please Specify:* \_\_\_\_\_

24. At which phase of the project did LEED become a goal?  Pre-Design       Early Design  
 Design & Development  
 Construction     Other *Please Specify:* \_\_\_\_\_

25. What are the owner's main reasons for:  
 (a) Building sustainably:  
 (b) Using LEED:

26. What advice would you give to anyone considering sustainable design/construction and LEED?

27. I would like the survey findings sent to the email address provided:  Yes  No: Email Address:

Please **save and return** this survey (by **September 9th**) via email: [gcooper@environ.sc.edu](mailto:gcooper@environ.sc.edu) or fax to (803) 777-0106. *Thank you for taking time to complete this survey!*

**Appendix B**  
 University of South Carolina  
Survey of LEED Registered Projects

Purpose: To gather data on LEED registered projects for comparison and analysis. Findings will be incorporated into a report and, upon request, shared with survey respondents. The report will focus on planning and documentation strategies for LEED certification.

1. **Project Type as Registered with USGBC:**  Higher Education  Multi-Unit Residential

2. **Project Name:** \_\_\_\_\_

3. **Indicate how each function applies to the LEED building:** (1=primary; 2=secondary; X=doesn't apply)

- Multi-Unit Residential (Higher Ed.)  Classroom(s)  Retail  Other (Please specify):  
 Laboratory  Multi-Unit Residential (Private)  Food Service  
 Office(s)  Meeting/Conference  Research

4. **Will the project be submitted for LEED Certification by the USGBC?**  Yes  No *If not, why?*

5. **If yes, what is the expected date of LEED application/certification?**

6. **Indicate which Version of the LEED Rating System you are using:**  1.0  2.0

7. **Indicate which Certification Level you are seeking:**  Bronze (1.0) or Certified (2.0)  Silver  Gold  Platinum

8. **Who is responsible for coordinating the documentation for LEED Certification?**

- Architect  Engineer  Construction Manger  
 In-house Staff  Consultant  Other (Please specify)

9. **Will documentation be coordinated using a software program?**  Yes  No  Unsure

If so, please specify the type of software, or if custom:  Unsure

If not, please describe how documentation will be coordinated:

10. **Rate each item below based on the level of existing or anticipated challenge it brings to the LEED Project?** Rate each on a scale of 1 (easy) - 5 (problematic)

- Staff (in-house)  Construction Manger  U.S. Green Building Council  
 Contractor/Subcontractor  Paperwork  Legislation/Regulations  
 Architect/Engineer  Software  Consultant  
 Other (please specify): \_\_\_\_\_ **Please elaborate on the challenges you encountered:**

11. **Will a communication plan be used to promote the LEED project?**  Yes  No

Unsure *Please explain: (e.g., We hired an ad agency for this.)*

12. **What tools are being or will be used to promote and/or respond to inquiries about the LEED project?** (check all that apply)

- Brochure  Media Kit  In-house media (television/radio/newspaper)  
 News Releases  Tours (Construction Site)  Signage  
 Web Site  Tours (Completed Project)  Education Program  
 Newsletter  Paid Advertising (Please specify) \_\_\_\_\_

Other (Please specify) Contact Person/Department: Name \_\_\_\_\_ Phone: \_\_\_\_\_ Email: \_\_\_\_\_

13. **From an organizational and/or local level, how could the LEED certification process be**

more efficient for you to implement?

14. Expected Final Project Cost: \$

15. Estimated budget increase/decrease, if any, for incorporating sustainability: (Compared to a conventional building)  \$ or %  increase  decrease

16. Estimated budget increase/decrease, if any, for LEED certification effort:  \$ or %

17. Estimated costs contributable to LEED Certification:  \$ or %

18. Design Fees:  \$ or %

\$ or %

19. Construction Fees:

20. Documentation:  \$ or % # Hours:

\$ or %

21. Consulting:

22. Other Expenses: Please Specify:

23. Indicate how LEED was, or will be incorporated into the specifications:

- In-House Spec Writer/Architect
- Consultant
- Other (please specify):
- No current plans

24. Are penalties or incentives for LEED certification included (or will be) in any contracts?

- Yes
- No
- Unsure

25. At which phase of the project did sustainability become a goal?  Pre-Design  Early Design

- Design & Development
- Construction
- Other Please Specify: \_\_\_\_\_

26. At which phase of the project did LEED become a goal?  Pre-Design  Early Design

- Design & Development
- Construction
- Other Please Specify:

27. What are the owner's main reasons for:

- i. Building sustainably:
- ii. Using LEED:

28. What advice would you give to anyone considering sustainable design/construction and LEED?

29. I would like the final report sent to the email address provided:  Yes  No: Email Address:

Please **save and return** this survey (by **September 5th**) via email: [gcooper@environ.sc.edu](mailto:gcooper@environ.sc.edu) or fax to (803) 777-0106. **Thank you for taking time to complete this survey!**

## Appendix C

### LEED Green Rating System

<b>Rating Level</b>	<b>Credits Needed</b>
Certified (2.0) Pilot Project/ Bronze (1.0)	26-32
Silver	33-38
Gold	39-51
Platinum	52-69