An Exploration of the Advantages and Challenges to Sustainable University Buildings

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AN EXPLORATION OF THE ADVANTAGES AND CHALLENGES TO
SUSTAINABLE UNIVERSITY BUILDINGS

By

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To my Family and Friends for believing in me,
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ABSTRACT

This study began with the assumption that universities have an influential impact on their students and surrounding community, and that this influence can be used to spread awareness of sustainability through “green design”. Therefore, the advantages and challenges of creating sustainable university buildings were explored. The primary research question focused on the sustainable design features of three buildings, the motivations for designing those sustainable buildings, and the advantages and obstacles of sustainable design in those buildings.

Three university buildings were chosen as research sites, each having a different orientation and a different impact on the university and its students. The sites include a residence hall, a library and a classroom. Interviews with key players, as well as building tours were conducted, photos were taken, and Leadership in Energy and Environmental Design (LEED) documentation was examined. Key players were asked questions focusing on the role they played in the construction of the building, the motivations and attitudes surrounding the design of each building, the reactions and awareness that resulted from the building itself, and the advantages and challenges regarding the design of the buildings. During site visits, the sustainable features were noted, and multiple photographs were taken. After gathering the data from the interviews and site visits, the interview data was organized and categorized into emergent themes.

One of the main themes that emerged from the study included the belief that LEED is a good start for building sustainably, but it may not be enough. The key players thought that the LEED registration process did not have enough requirements for maintaining eco-efficiency after construction was complete, and that more emphasis needed to be placed on the “life-cycle of sustainability”. Another reoccurring theme was that the main motivation for building a sustainable building was because “it’s the right thing to do” and that universities should be involved with sustainability to be a good “role model” who is “leading the way”. Universities were found to already have an advantage in becoming sustainable and LEED certified, because numerous LEED requirements are already developed on a universities campus in what they call “exterior campus points”.

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All of the key players agreed that in order to become a successful “sustainable campus” that support from the higher administration is essential.

A clear definition emerged from this study in that sustainability and “green building” are the future of design and construction. As an influential and intricate part of our society, universities have the ability and the obligation to be involved and progressive in the sustainable movement.
CHAPTER 1

INTRODUCTION

Today, universities hold the knowledge of the next generation as well as the largest amount of square footage in new construction and renovation in the U.S. (Gabrielli, Hamrick & Harland, 2003). A university is defined as “an institution of higher learning providing facilities for teaching and research, and authorized to grant academic degrees” (Mish, 1993). However, this definition does not begin to describe the extent of the status universities hold today. “Around the world, universities have long been centers for political discourse and catalysts for political action” (M’Gonigle & Starke, 2006, p.7). This statement illustrates the potential of universities to influence and create innovative and progressive ideas.

Sustainability is becoming an issue of extreme importance in our society. As a result of a lack of concern and knowledge regarding the limits of the ecosystem, an overwhelming number of environmental problems have arisen (Orr, 2002). Construction and the evolution of cities have played a major role in the steady climb toward the degradation of the natural environment. As a result, the architecture and design industry is advancing toward “greener” construction. The U.S Green Building Council (USGBC), a non-profit organization, has been working toward creating “greener”, more sustainable buildings. In 2000, the USGBC created a rating system which has become a nationally accepted benchmark for the design, construction, and operation of green buildings. This system is known as LEED certification, with LEED standing for Leadership in Energy and Environmental Design. LEED determines the performance of a building by focusing on five key environmental categories. The benefits of LEED include the ability to determine and define what a “sustainable building” is, the ability to bring awareness to green design, and the growing recognition that LEED has had within the design world (Gabrielli, Harland, & Hamrick, 2003).

Sustainable practices used in university construction and renovation projects have the potential to have a significant impact on design as well as sustainability awareness. With this knowledge as a basis, this study will further research sustainable design in university buildings.
Purpose of the Study

The purpose of this study is to explore sustainable design in university buildings with specific focus on the sustainable design features, the motivation for designing a sustainable building, and the advantages and obstacles of sustainable design in a university setting.

Justification of the Study

Numerous studies have been conducted on the condition of the environment. The situation has been progressively worsening, and while many are petitioning for an improved ecosystem, others are simply denying that anything is wrong (Orr, 2002). It is through this study that I hope to better understand the potential of universities to work toward solutions to help solve some of the environmental problems. The study will also explore the benefits of LEED, as well as the advantages and obstacles that universities face when designing sustainable buildings.

This study was not written to argue against those who are resistant to sustainable design, but to discourage wasteful practices and promote eco-efficiency. It is also meant to educate and to be used as a guide for those who want to further research in sustainable practices.

Assumptions and Limitations

This study will involve visits to university buildings, examination of LEED-related documents, and meetings with university officials. It is assumed that the information made available will be accurate, and the university officials will answer questions honestly and to the best of their ability. It is also acknowledged that each of the officials interviewed have a unique point of view which influences their reflections. This study involves the exploration of three buildings on three different university campuses. The study is not intended to be generalized to all university settings. Rather, it is exploratory in nature, and will shed light on three different university buildings and the advantages and obstacles to designing sustainable, LEED certified buildings.
Research Questions

Primary Question

When designing sustainable university buildings, what are the sustainable design features, the motivations for designing a sustainable building, and the advantages and obstacles of sustainable design?

Secondary Questions

1) How is sustainability integrated into the culture and philosophy of the universities selected for the study?
2) What is the primary motivation of the universities when deciding to utilize sustainable design practices and seek LEED certification for the selected buildings?
3) Who are the key players in implementing sustainable design principles on campus?
4) What are the advantages of designing LEED certified buildings on university campuses?
5) What are the obstacles to designing LEED certified buildings on university campuses?
6) What sustainable materials are used during the construction of these buildings?
7) What are the long-range plans of the universities in terms of sustainable design?
### Definitions

**Abiotic**
Nonliving elements of the planet, such as sunlight, the atmosphere, soil, minerals, and water (Winchip, 2007, p. 339).

**Biomimicry**
A method that examines how nature functions and then identifies ways the natural processes can be adapted to human needs (Winchip, 2007, p. 339).

**Carbon Footprint**
A measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide (Carbon footprint Ltd., 2008).

**Cradle-to-Cradle theory**
A system which imitates nature’s highly effective natural system of nutrient flow and metabolism, in which the very concept of waste does not exist (McDonough & Braungart, 2002).

**Eco-lawn**
A cost-saving, durable and eco-friendly alternative to a conventional residential lawn product. The advantages of an eco-lawn is that it is created from its mix of fescue grasses which grows about four times slower than regular grass meaning that you don’t have to mow it as often. It also has a longer root system which means that no fertilizers are needed and it can be watered less frequently (Gurvich, 2007).

**Eco-Efficiency**
Essentially means “doing more with less” and creating products which waste fewer resources and are more
economic and environmentally friendly (McDonough and Braungart, 2002, p. 51).

**Ecological Design**

Any form of design that minimizes environmentally destructive impacts by integrating itself with living processes and creating an effective “integration with nature’s processes” (Van der Ryn & Cowen, 1996, p. 18).

**Ecology**

The science that studies the interrelationships between and among organisms and their interaction with an environment (Winchip, 2007, p.340).

**Ecosystems**

An organizational level that includes an interacting community and its abiotic elements. Ecosystems are specific to a geographic area and place in time (Winchip, 2007, p. 340).

**Environmental Footprint**

(see *Carbon Footprint*)

**Greenwashing**

A term used to describe the act of misleading consumers regarding the environmental practices a company uses or the environmental benefits of a product a company sells (Winchip, 2007).

**LEED**

(Leadership in Energy and Environmental Design) a program designed by the USGBC Council, is a nationally accepted benchmark for the design, construction and operation of green buildings (USGBC: LEED Requirements for Campus Development, 2003).
Residence Hall  Also known as a “dorm”, it is a “housing or unit of housing provided for students” (Mish, 1993).

Renewable resources  Biological elements that have the potential to be replenished, such as water, trees, or soil (Winchip, 2007, p.342).

Source Reduction  “the practice of designing, manufacturing, purchasing, or using materials (such as products and packaging) in ways that reduce the amount or toxicity of trash created” (Environmental Protection Agency: Source Reduction and Reuse, 2008).

Sustainable Development  A development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Van der Ryn & Cowen, 1996, p. 5).

Sustainability  Comes from Sustain which means: to give support or relief; to supply with substance; and a method of harvesting or using a resource so that the resource is not depleted or permanently damaged (Mish, 1993).

The Three R’s  (Reduce, Reuse, and Recycle) a strategy which emphasizes eco-efficiency in the workplace and at home. This is done by minimizing destructive impacts on the environment using restorative materials, minimizing resource depletion, preserving nutrient and water cycles, and maintaining habitat quality (McDonough & Braungart, 2002).
**University**
An institution of higher learning providing facilities for teaching and research, and is authorized to grant academic degrees (Mish, 1993).

**USGBC**
(United States Green Building Council) the nation’s foremost coalition of leaders from across the building industry working to advance buildings that are environmentally responsible, profitable, and healthy places to live and work (USBGC: About USGBC, 2007).

**VOC’s**
(Volatile Organic Compounds) harmful gases that are emitted from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects (Environmental Protection Agency, 2007).
CHAPTER 2

REVIEW OF LITERATURE

Introduction

Sustainability is an issue of increasing importance as the evidence continues to mount regarding the deterioration of the planet (Orr, 2002). With the industrial growth of the eighteenth century, the economy and technological advances flourished. Unfortunately, it was this same expansion of industries and cities that negatively impacted the environment (McDonough and Braungart, 2002, p. 45). The economy has continued to grow, people have continued to consume, and the planet has continued to degrade (Orr, 2002). It is through sustainability and its eco-efficient practices that the economic system can be reestablished to be “eco-friendly” and avoid further damage (Van Der Ryn, & Cowan, 1996). In this review of literature sustainability will be examined including the history of past practices through the most current ideas. The primary focus will be sustainability and its effect on university campus buildings. It is important to note the impact universities have in our society; they currently hold the largest amount of square footage in new construction and renovation in the nation and that number is constantly growing (Gabrielli, Hamrick & Harlan, 2003). Because of this, sustainable practices used in university construction and renovation projects have the potential to have a significant impact on design practices (M'Gonigle & Starke, 2006). In addition, building on university campuses has the ability to raise awareness of sustainability among university students.

Background

This review of literature will examine existing research on sustainability, LEED certification, and sustainable university campus construction. By understanding the background and history of sustainability as well as the current state of sustainable design,
knowledge can be used to inform future projects. Social and political issues related to sustainability will be examined, as well as possible solutions on how to create a more sustainable society. LEED certification will be summarized because of its current standing as a benchmark for projects to gain the status of a “sustainable” and “eco-friendly” building (USGBC: About LEED). Finally, information on the feasibility and impact of sustainable university building will be addressed as well.

**Search Techniques**

Many forms of literature sources were sought for this review. They include research articles, websites, books, government documents, and various secondary sources. Searches were acquired both manually and electronically, all of which were very useful. Online articles were very helpful in acquiring current information on sustainability. The USGBC website proved to be the most useful in locating current information on LEED certification. Books on eco-efficiency, ecological design, and environmental university design were also used.

**Sustainability / Ecology**

**Definition**

The definition of sustainability comes from the word “sustain” which according to the *Merriam Webster’s Collegiate Dictionary* (1993) means “to give support or relief; to supply with substance; and a method of harvesting or using a resource so that the resource is not depleted or permanently damaged”. According to Van der Ryn and Cowan (1996), “sustainable development is a development that meets the needs of the present without compromising the ability of the future generations to meet their own needs” (p.5). The Brundtland Report of 1987 stated:

“Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable
development does imply limits – not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activities. But technology and social organization can be both managed and improved to make way for a new era of economic growth” (WCED, 1987, p.24).

Most of the definitions regarding sustainability have some kind of focus on the future, and that in order to have a stable future environment the ideals of sustainability must be used.

**History**

The concept of sustainability originated in the early stages of the Industrial Revolution when factories were so destructive and created so much pollution that they had to be controlled in order to prevent sickness and death. Unfortunately, the industries never came up with a solution to fix the problem completely. Instead, they developed a “less bad approach” which has become a central idea used by most industries regarding “environmental agendas” (McDonough & Braungart, 2002, p. 45).

One of the very first environmentalists was Thomas Malthus, who warned “at the end of the eighteenth century humans would reproduce exponentially, with devastating consequences for humankind” (as cited in McDonough & Braungart, 2002, p. 45). Many did not agree with Malthus and viewed their growing cities as triumphant; they were excited by the increasing ability to mold the earth to fulfill their purposes. They even viewed population growth as an added benefit. Malthus may have been one of the first and few who objected to the industrious growth, but over time others also began to notice the change in the way society treated nature. English Romantic writers focused on the description of the “spiritual and imaginative depth that nature could inspire and they spoke out against an increasingly mechanistic urban society that was turning even more of its attention toward getting and spending” (McDonough & Braungart, 2002, p. 45). Further into the 19th and 20th centuries other writers continued to describe the beauty and importance of nature. One well known example was Henry David Thoreau (1862) who
wrote “in wildness is the preservation of the world”. These writers created some of the first “conservation societies” that were used to “preserve wilderness and keep it untouched by industrial growth” (McDonough & Braungart, 2002, p. 47). Two examples of these societies were the “Sierra Club” which was founded in 1892, and the “Wilderness Society” which was founded in 1935 (The Wilderness Society, 2008). Even Henry Ford, founder of the Ford car industries in the early 1900’s, was one of the first to be adamant about this idea of conserving resources. He saved his company millions of dollars by producing less waste and using his famous “time-saving assembly line”. He once wrote “you must get the most out of the power, out of the material, and out of the time” (McDonough & Braungart, 2002, p. 51).

It was the publication of Rachel Carson’s Silent Spring in 1962 that turned the romantic appreciation of nature into a scientific basis of concern. Prior to this writing, environmentalism meant protesting the “obvious damage [which included] deforestation, mining destruction, factory pollution and other visible changes” (McDonough and Braungart, 2002, p. 47). Carson explained that man-made chemicals were destroying the natural world. As a result of this concern, a decade later the United States and German governments banned the use of the pesticide DDT. This was the spark that began the debate and controversy over the dangers of industrial chemicals. More environmental groups were created, but their focus was directed toward the destruction of natural resources that had been impacted by pollution and waste, creating a toxic environment. Throughout the years more and more environmentalists and scientists have emphasized Malthus’ original warning: that we need to slow down our population growth, and fix our “destructive” ways. In their book Use Less Stuff: Environmental Solutions for Who We Really Are, Lilienfield and Rathje (1998) suggested ways industries could reduce their negative impact. They stated, “The best way to reduce any environmental impact is not to recycle more, but to produce and dispose of less” (p. 74).

In 1973 the oil embargo imposed by the Organization of Petroleum Exporting Countries (OPEC) significantly impacted the amount of petroleum that was available for transportation. This act resulted in “high prices, hours of waiting in long lines, theft by siphoning gas from cars, and on occasion gasoline pumps that were totally empty” (Winchip, 2007, p. 15). In light of this, the general public became very aware and
concerned with energy and the environment. It prompted “consumers to conserve all forms of energy, including gasoline, fuel for heating, and electricity” (p.15). Fuel efficient cars became desirable, and research was focused toward developing technologies for “passive solar energy, improved building insulation, and energy-efficient windows” (p.15). Unfortunately after the oil prices were lowered the general public lost interest in conservation and returned to their old habits.

The 1987 World Commission on Environment and Development (WCED) report titled “Our Common Future” is noted as being the origin of sustainable development. The report is also often called the Brundtland Report, named after the chairperson of the commission, Gro Harlem Brundtland. This report is credited with reviewing some of the most “critical issues related to sustainability: identification of common concerns that threaten our future; the role of the international economy; equality; managing the shared oceans, space, and Antarctica; security; and institutional and legal proposals” (Winchip, 2007, p.5). The report connected many of the concerns through common themes of “poverty, inequality and environmental degradation” (Winchip, 2007, p.5).

In 1992 a Canadian businessman, Maurice Strong, organized the Rio Earth Summit as a way to examine the progress of the Brundtland Report’s recommendations. Approximately thirty thousand people attended with representatives from 167 countries and more than a hundred world leaders. Unfortunately, no official agreements were made, but the industrial participants devised a new strategy, called eco-efficiency, to make their companies more environmentally friendly. Eco-efficiency essentially means “doing more with less” (McDonough and Braungart, 2002, p. 51). The industries who participated in the Summit redesigned their machines to have cleaner, faster, quieter engines that would waste fewer resources and be more economic and environmentally friendly. The group of forty-eight industrial companies that created the term “eco-efficiency” called themselves the Business Council for Sustainable Development. This group also created the report Changing Course, which “stressed the importance of eco-efficiency for all companies that aimed to be competitive, sustainable and successful in the long term” (McDonough and Braungart, 2002, p. 52). The eco-efficiency movement caught on more than anyone could have predicted and has saved companies millions of dollars in the process.
Van der Ryn and Cowan (1996), authors of *Ecological Design*, also wrote that eco-efficiency is an effective process, and that through this process it becomes necessary to reevaluate how “agriculture, shelter, energy use, urban design, transportation, economics, community patterns, resource use, forestry, the importance of wilderness and our central values” are viewed and handled (p.5). They suggested that this be done by minimizing the destructive impact to the environment, using restorative materials, minimizing “resource depletion, [preserving] nutrient and water cycles, [and maintaining] habitat quality” (p.18). The major emphasis of this strategy, which emphasized eco-efficiency, has become a common phrase used both in the workplace and at home. This phrase, known as the “Three R’s”, includes efforts to reduce, reuse, and recycle (McDonough and Braungart, 2002, p.52).

**Leaders in Sustainability**

Throughout the years many people have contributed their knowledge, time, and effort toward creating a better environment. The following are a few of the many who have made a significant impact on issues of sustainability.

In the nineteenth century environmental activists used books and paintings as a way to communicate to the public. One of the first was James Audubon, an artist and ornithologist who during the 1830’s became famous for his paintings of birds in their natural habitat. He catalogued numerous species of North American birds. Another, an author named Henry David Thoreau, wrote about living simplistically with nature, and the natural beauty it offers in his 1854 *Walden* (Winchip, 2007). George Perkins Marsh is said to have been responsible for “initiating ecological discussions” through his 1864 book, *Man and Nature*. In 1864, John Muir, an explorer and conservationist, wrote a series of articles titled *Studies of the Sierra*. In these articles Muir described the “beauty of the Sierra” which is said to have inspired many people to appreciate the natural beauty of nature. Muir was also involved with developing national parks including the Grand Canyon. It was through Muir and other “naturalists” that the Sierra Club was founded in 1892. Because of the Sierra Club and the focus that Muir had toward preserving nature, President Theodore Roosevelt became involved and created a federal conservation program. As president, Roosevelt made conservation a central policy issue for his
administration, and during his presidency he created five National Parks, four Big Game Refuges, fifty-one National Bird Reservations, and the National Forest Service (Filler, 2008).

It is important to list Rachel Carson as an environmental leader again here. As a biologist, writer and ecologist, she was a leader who was extremely influential with her book *Silent Spring* published in 1962. By exposing the serious health and environmental hazards of pesticides, Carson sparked a revolutionary debate that altered the course in history. This outbreak led to the banning of the pesticide DDT as well as other changes in laws affecting the environment. Today, *Silent Spring* still serves as influential research for environmentalists.

R. Buckminster Fuller, an architect, inventor, and engineer, had a lifetime goal of developing his concept for a *Comprehensive Anticipation Design Science*. This concept revolved around Fuller’s attempt to “anticipate and solve humanity’s major problems through the highest technology by providing more life support for everybody, with less and less resources” (Buckminster Fuller Institute, 2005, p.2). Fuller invented many products and building systems, but his most famous is the geodesic dome (see Figure 2.1). “The dome is the strongest, lightest, and most cost-effective structure ever designed” (Winchip, 2007, p.14).

![Figure 2.1: The Montreal Biosphère, formerly the American Pavilion of Expo 67, designed by R. Buckminster Fuller, on Île Sainte-Hélène, Montreal, Canada.](image-url)
Today there are over 300,000 geodesic domes. Fuller’s other research focused on renewable energy solutions. It was his belief that sources of solar, wind, and wave energy could generate enough power to meet the world’s demands, without having to resort to fossil fuels. He described his work as “an experiment to discover what the little, penniless, unknown individual might be able to do effectively on behalf of all humanity” (Buckminster Fuller Institute, 2005, p.2).

More recently, authors such as Janine Benyus, Sarah Susanka, and William McDonough with Michael Braungart have been very influential. Janine Benyus described how the science of biomimicry can be applied toward the problems of sustainability. Benyus defines biomimicry as “a new science that studies nature’s models and then imitates or takes inspiration from these designs and processes to solve human problems” (Benyus, 1997, Introduction). Benyus also explained that biomimicry is the new way of “viewing and valuing nature” which will introduce an “era based not on what we can extract from the natural world, but what we can learn from it” (Introduction).

In their book *Cradle to Cradle*, McDonough and Braungart denounced industries that use and produce what they call “Cradle to Grave” products, and encourage the use of eco-effectiveness. “Cradle to Grave” essentially means once a product has been used it can no longer be recycled into anything else; the product essentially goes to waste (McDonough and Braungart, 2002). McDonough and Braungart discussed five eco-
effective processes which involve eliminating “waste” by converting it into nutrients that are beneficial to the environment, or rather applying the Cradle to Cradle theory. These five processes are:

- “Get free of known culprits”, in other words: removing harmful substances.
- Follow “informed personal preferences” by determining eco-effective design solutions.
- Creating a “passive positive list” which includes substances that are healthy and safe for use.
- Activating the “positive list”.
- Reinventing products and processes that will generate “nutritious effects on the environment” (McDonough & Braungart, 2002, p. 166-180).

Sustainability Issues

Only a human being can consciously oblige himself to go slowly in order to consider whether he is doing the right thing, doing it the right way, or ought in fact to be doing something else … Speed and efficiency are not in themselves signs of intelligence or capability or correctness (Saul, J.R. as cited in Orr, 2002, p. 43).

This section is going to discuss the rising issues of sustainability while focusing on the politics and denial of those issues based on the opinions of a few professionals.

Denial

David Orr (2002) wrote that it has become increasingly apparent, through recent actions by the U.S congress, that they are ignoring the large amount of scientific data regarding the “deterioration of the earth’s vital signs” (p. 85). The U.S culture demands “unreasonable standards of proof [that] are required to establish the existence of environmental threats” (p.85). Orr expressed concern that until the stage of utter environmental destruction has been reached, due to the lack of understanding of the physical limits of the earth, nothing will be done by the government. Winchip (2007)
noted in her *Sustainable Design for Interior Environments* that many times after a crisis has occurred the environmental issues become forgotten or ignored. One of the examples she gave was the water shortage in southern California. While the local community helped the problem by removing excess pollutants in the water, it still did not solve the problem because the source of the pollution was not removed. Winchip stated that there must be constant “plans for continuous improvement” and that “the world can not be sustainable without planning for the future” (p. 5). Her opinion is similar to that of Fuller when he stated “There is no energy crisis, only a crisis of ignorance” (Buckminster Fuller Institute, 2005, p.2).

**Politics**

The modern era of “environmental regulations” began in the early 1970’s when the threat of government regulations were used as the “main instrument of steering the behavior of economic agents in industrial production” (Parto & Herbert-Copley, 2007, Introduction). This was originally done as a way to try to persuade production companies to internalize “environmental costs of production” (Introduction). Unfortunately, the industrial firms argued that these ‘regulations’ were not conducive to innovation, because “the very nature of innovation is its unpredictability [and] future innovations cannot be directed by bureaucrats” (Introduction).

As noted earlier, Orr (2002) suggested that the government has done very little in promoting energy efficiency. Based on his belief in the lack of involvement and acknowledgement by the government, he suggested three courses of action to handle the environmental situation. The first is to “turn the management of our environmental affairs over to a kind of permanent technocracy – a priesthood of global managers” (p. 104). In other words, global experts should manage the situation. Orr however believed that the consequence of an administration of “technocrats” would have an outcome that contradicts the values of ecology. He foresaw a result in which these “planet managers” would focus more on improving just the management of our economy instead of the end product of an eco-efficient society. Thus in the end, he feels that this course of action would fail due lack of “knowledge, foresight, and wisdom necessary for planetary management” which is “beyond human grasp” (Orr, 2002, p. 105).
The second possibility Orr (2002) suggested is “to admit that all politics is really about economics anyway, and [we should] turn things over to business corporations and the market” (p.105). Orr suggested that because of our current problems and the lack of efficiency in our government, we should in fact turn things over to “people who know how to get things done” (p.105). Unfortunately, as Orr noted, capitalism hasn’t been known to protect the environment or serve to the public’s interest. Orr (2002) suggested that one of the ways control of the environmental situation could actually be attained, is by creating industrial ecologies in which every waste product can be used somewhere else. Tax exemptions would be used as incentive for companies to promote green and energy-efficient products, while taxes would be levied on items that create pollution. Most importantly, an “ecologically solvent capitalism would have to account for all of its environmental and social costs” (p. 106). He believed that if this were to happen it would be the best way to improve our present system. The role of the government would be minimal and little would be required of the public. This “logic of enlightened economic self-interest” would drive us toward a “sustainable relationship with nature” (Orr, 2002, p.106).

The problem with this course of action however is getting the current system, “based on ruthless pursuit of short-term self-interest”, to embrace these changes (p.107). In other words, it is not that our industrial capitalists lack the knowledge of the “full ecological costs of what they do,” rather they have a completely different value system that aims toward a different outcome then an ecological system (Orr, 2002, p.107). Orr explained, the current global system of free trade is more “powerful and less restrained then ever” (p.107). It is also very unlikely considering the number of cars, shopping malls, dams, mines, and factories, that industries would be willing to let go of their unrestrained corporate power. Orr (2002) also exclaimed that “a reformed capitalism is still capitalism – a system that thrives only when people buy and buy more then they need” (p. 108). In other words, even a reformed system that makes green products and recycles, still works at its best when people “confuse who they are with what they own” (p.108). Orr (2002) stated “capitalism is no more likely to transform itself into ecotopia than lions are to become vegetarians” (p.108). He stressed the philosophy that the economy can serve as “a means, not an end” (p.108).
The third option, which Orr (2002) suggested as “our only real choice” is to “create a better kind of politics and political institutions better suited to ecological realities” (p. 107). Doing this would require changing the political life and the public’s role in it. Politics would have to reevaluate the basics and add ecological factors into it. Orr stated that our challenge is going to be a design problem in which we will need to create a “civilization that fits harmoniously into the ecology of North America over the long term” (p.109). History shows us that the belief that humans dominate nature and that economic growth is the “supreme value” has dictated our system. Orr stated that we need to revive our democracy and rebuild a country with ecological sustainable communities. He suggested we do this through “agility, the capacity to respond quickly, adaptability, and the principles of resilience” (Orr, 2002, p.116).

Desai (2002) in his book *Environmental Politics and Policy in Industrialized Countries* expressed a different opinion from Orr (2002), that focused on the United States as having some of the most “comprehensive environmental programs of any nation” (Desai, 2002, Forward). Although Desai admitted that the U.S is the largest polluter and energy consumer in the world, he stated that the U.S has “made significant progress in controlling air and water pollution and managing the disposal of hazardous waste” (Forward).

It is important to mention Susan Winchip’s (2007) textbook *Sustainable Design for Interior Environments*, which reported the federal government has made conserving energy a “significant priority”(p. 65). An example of this is in the International Energy Agency (IEA), an energy policy advisor for 26 countries, whose purpose is to “ensure reliable, affordable and clean energy for their citizens” (IEA, 2005). Another organization used to help conserve energy is the U.S ENERGY STAR, a program supported by the U.S federal government that “assists businesses and individuals to reduce energy costs” (Winchip, p. 65). Winchip also noted that larger populated cities can “present opportunities and challenges” (p.66). An example of one of these cities is Chicago, which has its own “Department of the Environment” (DOE) and a mission of “protecting human health and the environment, improving the urban quality of life, and promoting economic development in Chicago” (Chicago Department of Environment, 2005).
One of the most influential organizations in the sustainability movement in the early twenty-first century has been the U.S. Green Building Council (USGBC) (Winchip, 2007). The USGBC has conducted their own research, by looking into the federal government budget and comparing how much the government spent on environmental “green” building research. What they found was a percentage that appeared “disproportionate to the benefits that can be gained by improving the efficiency and the health and environmental quality of buildings” (Baum, 2007, p.9). Those findings are illustrated in Figure 2.3.

![Figure 2.3: Green Building Research](Baum, 2007, p.9)

According to Figure 2.3 an estimated .2 % of the federal budget between 2003 – 2005 was assigned to green building research. According to Mara Baum (2007), the author of *Green Building Research Funding: Current Activity in the United States* which reported the USGBC’s findings, this percentage is roughly equivalent to .02% of the estimated value of annual U.S building construction, “despite the fact that the construction industry represents 9% of the U.S. GDP” (p. 11). Baum also notes that the construction industry only uses .6% of its sales to continue research, “significantly less then the average for other U.S industries” (p.11). The USGBC researched this in an effort to “create a national green building research agenda identifying critical gaps in scientific and technical information. [This was] needed to drive market transformation towards the
adoption and evolution of sustainable building design, construction, and operations practices in the United States” (Baum, 2007, p. 9).

Solutions

According to McDonough and Braungart’s (2002) *Cradle to Cradle* theory, the three R’s of Reduce, Recycle and Reuse are not enough. Instead, McDonough and Braungart stress the importance of a system where there is no waste. Many industrial and environmental professions view products as having a “life cycle”, the time it takes for a product to be “born” or created to the time it takes for it go to the landfill; a process that McDonough and Braungart define as “cradle to grave”. In today’s society, the majority of people prefer to have “new” products made out of “virgin” materials. Industries today acknowledge this mindset and use it to their advantage. McDonough and Braungart (2002) stated that if we as humans are truly going to prosper we need to change the “cradle to grave” to a “cradle to cradle” system which imitates nature’s “highly effective” natural system of nutrient flow and metabolism, in which “the very concept of waste does not exist” (p.104). In order to eliminate the concept of waste they suggested that products be designed from the very beginning of their production with the concept in mind that waste does not exist and that these products must be made out of materials that contain “valuable nutrients” in which “form follows evolution” (McDonough and Braungart, 2002). For example, “products of consumption” such as packaging, can be made of biological materials in which they can be tossed on the ground and safely decompose, or they can even be used as fertilizer, “bringing nutrients back into the soil”. In other words, products need to be created which actually “support the balance of the ecosystem” (McDonough and Braungart, 2002).

Another possible solution is from Winchip’s (2007) *Sustainable Design for Interior Environment* which suggested that the “principles of sustainable design require an understanding for economics” and it is the economics which depleted the natural resources deriving “decisions and investments” (p.93). This statement means that economics has a huge effect on the principles of sustainability, and to fully understand how the ideology of sustainability works, people must understand basic economic theories. Winchip also stated that “source reduction is better than recycling, because the
life cycle of a recycled product requires resources and burdens the environment” (p.93). Source reduction is defined as “the practice of designing, manufacturing, purchasing, or using materials (such as products and packaging) in ways that reduce the amount or toxicity of trash created” (EPA: Source Reduction and Reuse, 2008).

The Environmental Protection Agency (EPA) suggested an “integrated waste management plan” as a way to handle multiple solid wastes. The plan consisted of three multiple points:

1) Source reduction
2) Recycling
3) Waste consumption

(EPA: Source Reduction and Reuse, 2008).

USGBC Council

The USGBC was founded as a non-profit organization with the goal of monitoring the growing number of construction projects within the U.S. The USGBC describes itself as “the nation’s foremost coalition of leaders from across the building industry working to advance buildings that are environmentally responsible, profitable, and healthy places to live and work” (USGBC: About USGBC, 2007). The USGBC was founded in 1993 and as of this writing, has 8,033 member companies and organizations. It has been fulfilling a vision of transforming the building industry into a high-performance and yet “green” focused trade. The membership of this organization is as diverse as the industry it serves, and includes building owners, real estate developers, subcontractors, product and building system manufactures, government agencies and non profit organizations. The USGBC is a large supporter of education and research and sponsors Greenbuild, one of the largest international conferences and expos which focuses on green building.

One of the main foci for the USGBC is their LEED (Leadership in Energy and Environmental Design) Green Building Rating System. This LEED program details are accessible on-line and are supported by workshops and an accreditation program (USGBC: About USGBC). With the addition of this LEED program USGBC
LEED

The Leadership in Energy and Environmental Design (LEED) program was created by the USGBC Council in 2000. It is a nationally accepted benchmark for the design, construction and operation of green buildings. LEED determines the performance of a building by focusing on five key environmental categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality. There is also a sixth category of Innovation and Design process which focuses on environmental issues that do not fall under the previous categories. Some of these “Innovation and Design” issues include acoustics, community enhancement, education, and expertise in environmental design (USGBC: LEED-NC Application Guide, 2005).

The LEED program was created for multiple reasons which include:

- Creating a standard definition of the term “green”.
- To prevent “greenwashing” (which is a false or exaggerated claim of a product or building to be environmentally friendly).
- To create a guideline in design to make all buildings environmentally friendly.
- To promote a “whole-building” (by integrated design processes).
- To recognize leaders.
- To stimulate a “green” competition.
- To establish a market value with a recognizable “national brand”.
- To raise consumer awareness.
- To transform the design industry marketplace.
- To optimize environmental and economical factors.

(Gabrielli, Harland, & Hamrick, 2003, p.3).
The USGBC is a government approved independent agency which creates a “whole-building” approach. This approach encourages a “collaborative, integrated design and construction process” (Gabrielli, Harland, & Hamrick, 2003).

LEED is a “certification [which] offers third party validation of a project’s green features and verifies that the building is operating exactly the way it was designed to” (USGBC: FAQ LEED, 2007, p. 1). It is based on a credit system in which a project will earn a credit by satisfying specific green building criteria. There are six “LEED credit categories”, each with prerequisites that are required to be considered for the LEED certification. The number of credits the project has earned will determine the level of certification the building will receive (USGBC: FAQ LEED, 2007). LEED does not normally specify specific product materials in their requirements. However, in some of the credit requirements certain type’s of sustainable resources, for example water soluble adhesives or low VOC finishes, are required in order to create a “sustainable” building.

LEED for New Construction and Major Renovations, also know as LEED-NC is the most widely used guide for LEED certified projects. The LEED-NC is designed to “guide and distinguish high-performance commercial and institutional projects, including office buildings, high-rise residential buildings, government buildings, recreational facilities, manufacturing plants and laboratories” (USGBC: LEED for New Construction).

The following shows the four progressive levels for LEED New Construction and the point values needed to achieve those levels:

<table>
<thead>
<tr>
<th>Level</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEED Certified</td>
<td>26 – 32 points</td>
</tr>
<tr>
<td>Silver Level</td>
<td>33 – 38 points</td>
</tr>
<tr>
<td>Gold Level</td>
<td>39 – 51 points</td>
</tr>
<tr>
<td>Platinum Level</td>
<td>52+ points (69 possible)</td>
</tr>
</tbody>
</table>

(Gabrielli, Harland, & Hamrick, 2003).

The types of buildings that can qualify for LEED certification include:

- LEED for New Construction and Major Renovations
- LEED for Existing Buildings: Operations & Maintenance
- LEED for Commercial Interiors
- LEED for Core and Shell
LEED for Homes
LEED for Neighborhood Development

LEED for Commercial Interiors is a certification guide which focuses mostly on the interior tenant improvement market. LEED-CI is the “recognized system for certifying high-performance green interiors that are healthy, productive places to work; are less costly to operate and maintain; and have a reduced environmental footprint” (USGBC: LEED for Commercial Interiors). LEED-CI provides a framework within which tenants and designers, who do not always have control over whole building operations, can make sustainable design decisions (USGBC: LEED for Commercial Interiors).

The following shows the four progressive levels for Commercial Interiors and the point values needed to achieve those levels:

- **LEED Certified**: 21 – 26 points
- **Silver Level**: 27 – 31 points
- **Gold Level**: 32 – 41 points
- **Platinum Level**: 42+ points (57 possible)

(Winchip, 2007, p.120).

The credit rating system for LEED New Construction, which breaks down what is required to earn a point, can be found in Appendix F, as well as the credit rating system for LEED for Commercial Interiors in Appendix G. More explanation regarding how to achieve each of the credits can be found in the Green Building Rating System for New Construction Guide Version 2.2 which can be found on the USGBC website.

LEED distributes the points through five credit categories. Figure 2.4 is a pie chart showing each category and the distribution of their significance.
Figure 2.4: Distribution of the LEED five credit categories
(Gabrielli, Harland, & Hamrick, 2003)

**LEED Benefits**

There are multiple benefits to creating a LEED certified building. Some of these benefits include:

- Lower operating costs and increased asset value.
- Reduce waste sent to landfills.
- Energy and water savings.
- Healthier and safer for occupants.
- Higher productivity of personnel using the space.
- Reduce harmful greenhouse gas emissions.
- Qualify for tax rebates, zoning allowances and other incentives in hundreds of cities.
- Cost effective design solutions.
- Demonstrate an owner's commitment to environmental stewardship and social responsibility (Gabrielli, Harland, & Hamrick, 2003, p.12-15).

According to LEED, energy savings for a LEED certified building will have a return of about 10-15% on investments with a 5-7 year payback (Gabrielli, Harland, & Hamrick, 2003). LEED certified buildings also maximize the amount of daylight in classrooms and offices, which has been shown to improve performance by 26% (Gabrielli, Harland, & Hamrick, 2003). One of the most effective solutions LEED provides is a cost effective design. By minimizing the size of HVAC systems and
creating a “high performance building shell” with smaller mechanical systems, the cost and long term savings are produced from the inside. Many times recycled content is used for building materials which can be both less expensive and environmentally friendly compared to their “new material” counterparts (Gabrielli, Harland, & Hamrick, 2003).

Doug Smith, an associate principal and senior mechanical engineer who works for Interface Engineering, reported that after five years of the USGBC’s LEED program they were able to show (through post-occupancy studies) that LEED certified buildings are “truly saving money and the environment” (Smith, 2008). The studies showed that energy savings were “30 percent better then other new construction and 50 percent better than existing buildings” (Smith, 2008, p.1). Smith admitted LEED still had a few areas they need to work on, especially when it comes to water efficiency and acoustics, and that more post-occupancy studies are needed.

**LEED Benefits to the Government**

According to the *USGBC State and Government Tool Kit*, it is beneficial for the government to use LEED for the following reasons:

- LEED provides all the benefits of a national market transformation system while affording built-in flexibility for accommodating state and local priorities, including unique circumstances. While some jurisdictions find that LEED works well “off the shelf,” others prefer to create official applications within the context of their overall green building efforts. The LEED system allows both.
- LEED reduces technical and administrative uncertainties because it has been produced by the nation’s leading coalition of leaders from across the building industry.
- LEED saves time and resources by providing a comprehensive set of tools for local application and use.
- LEED avoids the need to establish local certification bodies.
- Government entities that join the USGBC as members have the opportunity to shape LEED by being involved in committee work and voting on LEED ballot issues.
• LEED provides a tool for benchmarking with jurisdictions across the country. See the LEED Web site for a current list of projects registered for certification.

• LEED already has tremendous momentum due to its design elegance. The growing number of public-private partnerships with federal, state and local governments enhances LEED’s credibility.

• Since the performance level of the building industry gradually improves over time, LEED evaluates performance thresholds every three to five years, saving the jurisdiction money and time to change statutes (USGBC: LEED Tool Kit, 2002, p. 9).

Campus LEED

LEED for a University Campus or a multi-building setting is a “sub-category” under the LEED for New Construction. Therefore, the rating system for New Construction and Major Renovations (LEED-NC) is used to provide direction in applying LEED certification toward university buildings (USGBC: LEED NC Application Guide, 2005).

In LEED there are five key environmental categories to which each credit relates. While using the LEED for New Construction (LEED-NC) as a guide for creating LEED certified university buildings, opportunities for new interpretations arose because the guide did not specify specific guidelines which related directly to university buildings. Because of these interpretations on the LEED-NC, a new subcategory application guide, the LEED-NC Application Guide for Multiple Buildings and On-Campus Building Projects, was created to avoid any misconceptions and keep the same requirements for each project. This guide, created by the Multiple Buildings and Campus Committee, was meant to be used specifically for higher education facilities. At the time of release, this guide was used in 7% of all LEED registered projects, indicating that higher education development is used often and currently makes up about 7% of all LEED registered projects (USGBC: LEED NC Application Guide, 2005).
Applying for LEED Certification

The first step to applying for LEED certification is registering a project. This is done by applying through the USGBC online process or by completing the electronic version of the form and sending it to the USGBC headquarters. After the registration has been filed, USGBC will send information and tools that will help guide the participant through the rest of the certification process. An example of the registration form, as of April 2008, can be found on the USGBC website at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=65& . This is something that should be done early in the planning period to achieve a better chance of receiving the certification. Once a project is registered, the design team must collect information to satisfy the credit requirements. This information should be gathered throughout the design and construction process. There are currently two options when submitting information to satisfy the credit requirements. Either the information gathered regarding the credit requirements can all be turned in at the end, or it can be submitted through designated design phase credits. Design phase credits are credits that the USGBC can “reasonably adjudicate based on design phase documentation” (USGBC: New Construction, 2006). Also worth noting is that LEED credits are not awarded at design review stage, but after the construction stage has been executed in accordance with the design phase plans. Verification must also be submitted proving that the design elements were executed as planned. Only one design phase review is allowed. When the construction is completed the design team must document and submit to the USGBC the balance of “attempted” credits, verification of design phase credits, and any additional documentation that might have changed. Each credit is then “anticipated or denied”, which then determines if the project has the “likelihood of credit achievement, and requires [a] follow through, to ensure the design is executed in the construction phase according to design specifications”. Once the USGBC has received the complete application (and fee) it will then have a formal rule on the full application (USGBC: New Construction, 2006).

As of 2005 there were approximately 260 certified projects and more then 2,000 registered projects in the United States (Winchip, 2007, p. 119).
Fees Associated with LEED

In order to become LEED certified there are certain fees that the USGBC charges for the certification process. Companies that are already USGBC members receive a member discount, while projects that are awarded LEED platinum receive a rebate for all of the certification fees (USGBC: Project Certification, 2007). As of April 2008 the fees relating to each project can be found on the USGBC website at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=65&.

LEED Plaque

With each building that earns a LEED certification, a LEED plaque is awarded. This plaque is not meant to be a trophy, but rather it is a representation of an “intrinsic difference in thinking, design and construction of a built space” (USGBC: LEED plaque guidelines, 2007). The plaque is made of recycled content glass which is cut and then sandblasted (not etched). This is done because it is “less- energy intensive than cast metal, and sandblasting does not involve toxic chemicals”. Other customized styles allow participants to incorporate the plaque into the project design, making it an “intrinsic part of the certified project”. For example the plaque can be incorporated right onto the building itself, either in the glass windows or can be attached into the structure of the building in a piece of stone or a metal disk. It can even be incorporated into the ground either inside or outside of the building. In all cases however the plaque is meant to be appear “tone-on-tone” in the color of the natural material surface it is being applied to. There should be no additional or contrasting color added to it (USGBC: LEED plaque guidelines, 2007). Figure 2.5 is an example of the plaque, which incorporates the key design elements of the USGBC logo.

Figure 2.5: Example of LEED Certification Plaque
(USGBC: LEED Plaque Guidelines, 2007)
LEED AP

A LEED Accredited Professional, also known as a LEED AP, is an individual who has “the knowledge and skills necessary to participate in the design process, to support and encourage integrated design, and to streamline the application and [LEED] certification process” (USGBC: LEED Candidate Handbook, 2007, p.4). The LEED AP must first pass an examination, to show their familiarity with LEED requirements and understanding a green building practices and principles. As of 2007 there are three different exam tracks that are offered toward achieving LEED AP status (LEED AP: Candidate Handbook, 2007, p 5). They include:

- LEED for New Construction (Version 2.2)
- LEED for Commercial Interiors (Version 2.0)
- LEED for Existing Buildings (Version 2.0)

It is only necessary to pass one of the exams in order to earn the status of LEED AP. A few of the benefits of becoming a LEED Accredited Professional include:

- By being a LEED AP one extra credit is added toward the total green building credits for each project you work on.
- It provides a marketable credential to an employer, prospective employer or client.
- All LEED Accredited Professionals are listed on a USGBC website directory. (LEEDAP: Candidate Handbook, 2007, p 5).

Verifying Green Products

With attention recently directed toward “green buildings” consumers are also starting to take notice of “green products”. Unfortunately, many producers are misleading consumers into thinking their products are environmentally friendly, when they may not be. They do this by stating unfounded ecological claims regarding the attributes of a sustainable product, a process known as ‘greenwashing’ (Winchip, 2007, p.129). Because there are so many procedures and attributes that make up a “green product” it is difficult to determine which products are in fact sustainable. The U.S government defines a sustainable product as having “a lesser or reduced effect on human health and
the environment” when compared to other products that serve the same function (Whitemyer, 2008, p. 14). Penny Bonda, a LEED AP and co-author of *Sustainable Commercial Interiors* stated that the most important thing to know about green material certification is the “source of that rating” (Whitemyer, 2008, p.18). When it comes to certifying products there are three different types of certifiers: a first, second and third party. The first-party certification involves a dealer or manufacture claiming that their products have certain attributes. A second-party certification is when a trade association or vendor says that another manufacture’s product has certain attributes. However, Bonda (2007) stated that “unless it’s third-party certified, it doesn’t hold much weight” (p.18). A third party certification is done by a credible testing agency that is non-profit and has no direct connection with the material or the manufacturer. It is these third party testing procedures that insure a product is “true to it’s claim” (Winchip, 2007, p. 129). There are two basic testing procedures: one is to examine and test the stages of a products life cycle, and the other specializes in testing a specific product or a specific attribute of a product (Winchip, 2007). A few reputable agencies include: GreenGuard, Green Seal and the Forest Stewardship Council (FSC), and the Cradle-to-Cradle system (Whitemyer, 2008).

**University Buildings**

After reviewing the history and impact of sustainability and possible environmental solutions such as the USGBC and their LEED program, the attention will now be focused toward universities and their green building practices. As stated earlier, *Merriam Webster’s Collegiate Dictionary* (1993) defines a university as “an institution of higher learning providing facilities for teaching and research”. However, as a broad definition it doesn’t begin to define the critical role that universities play within our social economy. The lineage of a university extends back over 900 years and throughout history students have been involved with the most pressing issues of their time. M’Gonigle & Starke, authors of *Planet U*, argued that the issue of sustainability can create a “new role of the university – to be not just a site for making protests, but for
creating precedents” (2006, p.23). Wals and Jickling (2002) agreed with that idea in their statement:

“The fact that “sustainability” is a messy, ill-defined concept gives universities an opportunity to grapple with the concept and develop new ways of thinking about the concept. Sustainability provides colleges and universities an opportunity to confront their core values, their practices, their entrenched pedagogies, the way they program for student learning, [and] the way they think about resources and allocate these resources and their relationships with the broader community.” (Wals & Jickling, 2002, p.230)

M’Gonigle and Starke (2006) claim that the university’s “role is still not well understood, its functions usually just taken for granted, [and] its social role and potential unappreciated” (p.23). They claim that people rarely consider the larger place of the university within society, and that a university is usually viewed as a producer of technical experts, rather then a producer of citizens. Universities also establish immediate relationships with the communities surrounding it. Universities are unique in that although they are rooted in one “local” place, they are globally connected in networking (M’Gonigle & Starke, 2006). It is through this networking that education on environmentalism can spread and be introduced into each generation that passes through universities. “Around the world, universities have long been centers for political discourse and catalysts for political action” (M’Gonigle & Starke, 2006, p. 7). This statement emphasized one of the many roles of universities, in which they have the potential to influence and create innovating and progressive ideas. M’Gonigle & Starke’s book Planet U suggested that it is through universities that a campus sustainability movement can be produced and that it is the “missing key to global sustainability”.

An example of the relationship between sustainable design and university buildings was evident in the 1990 International Conference located in Talloires, France. This conference had representatives from universities in Africa, Brazil, China, Costa Rica, India, France, Ghana, Lebanon, Mexico, Nigeria, South Africa, Thailand, the former USSR, and the United States. At this conference university administrators declared that they were “deeply concerned [with] the unprecedented scale and speed of environmental pollution and degradation and the depletion of natural resources”
As a result of this conference, the first official statement regarding higher education’s commitment to environmental sustainability, called the Talloires Declaration, was created (Winchip, 2007, p. 66). The Tallories Declaration was part of a “10-point action plan” which included the following:

1) Increase awareness of environmentally sustainable development
2) Create an institutional culture of sustainability
3) Educate for environmentally responsible citizenship
4) Foster environmentally literacy for all
5) Practice institutional ecology
6) Involve all stakeholders
7) Collaborate for interdisciplinary approaches
8) Enhance capacity of primary and secondary schools
9) Broaden service and outreach nationally and internationally
10) Maintain the movement (Talloires, 2005).

A large part of the focus for the Tallories Declaration was directed toward the idea that all citizens would have an understanding of sustainable practices, including children in primary and secondary schools (Winchip, 2007). It was the belief that by implementing sustainable processes in the earlier stages of learning that it would “set the stage for expecting sustainable design throughout their lives” (Winchip, 2007, p.66). Today the Talloires Declaration continues to be supported by more than 300 universities (Winchip, 2007).

Influenced by the Talloires Declaration, universities throughout the United States have been developing sustainability policies on their campuses, many of which have made significant progress and have developed successful strategies. One of the more successful sustainability programs at a university is that at Yale, a private university located in New Haven, Connecticut (Yale University, 2008). Yale’s Office of Sustainability which was developed in 2004, was created to “generate increased momentum and facilitate the process of developing and implementing best sustainable practices at Yale” (Yale University, 2008). This strengthened the school’s commitment and Yale has committed to a process that:
• Engages students, faculty and staff in gaining understanding of current patterns and consequences of behaviors.
• Calls upon creative dialogue to explore desirable sustainable characteristics and means to achieve them.
• Incorporates sustainability principles into operational functions and educational framework in order to influence actions from a local to a global level (Yale University, 2008).

Yale’s strategy shows a university campus which is focused on the environmental issues of transportation, energy, facilities, waste management, land, water, food, and preparing the leaders of tomorrow. Julie Newman, the current Director of Yale’s Sustainability office, also presented facts which were used to help present an image of why higher education should be focusing on sustainability issues. The following facts were presented:

• Higher education is a permanent long-term institution within society.
• In 2002 two million students were enrolled in both two and four year degree programs in the United States.
• Universities hold a “global sphere of influence” that prepares the leaders of tomorrow.
• Universities have a built environment, research and scholarships, education, and operational systems (Newman, 2007, p. 14-15).

According to Newman, Yale’s strategic framework will focus its environmental principles toward its commitment “to developing best practices that balance economic viability with ecosystem health and human health in its operational practices, the built environment and institutional decision making while contributing leading scholarship, research and educational models to a global dialogue” (Newman, 2007, p. 22).

This framework will use the following as a way to implement this strategy:

• Curriculum
• Research and Scholarship
• Governance
• Community engagement
• Employee responsibility
• Sustainability benefits
• Media outreach

Improvement has already taken place at Yale, which can be seen in Figure 2.6

**Greenhouse Gas (GHG) Emission Reducing “Wedges”**

![Greenhouse Gas Emission Reducing “Wedges”](image)

*Figure 2.6*  
(Newman, 2007, p. 37)

Figure 2.6 describes the causes for reduction of greenhouse gas emissions. Greenhouse gases are “gases that trap heat in the atmosphere” which contribute to the global temperatures that are creating the “greenhouse effect” (EPA: Greenhouse Gas Emissions, 2008).
Another university that has created a successful sustainability program is Harvard University. Through its mission of “research, education and outreach, Harvard’s faculty has made significant advances in science, economics, public policy, design, medicine and public health” (Harvard University, 2008, p.1). Harvard has had a positive record of safety and environmental regulations which has “proven [to be an] effective system of environmental management accountability” (p.1). As a result of the university’s “academic preeminence and respect throughout the world,” Harvard has the opportunity and responsibility to consider the example it sets by its “economic, human health, and environmental performance of its campus” (p.1). Harvard also has the potential to influence students “whose future behaviors and decisions are shaped by what they learn from their campus experience and the actions of the university’s leaders” (p.1). As a result of its commitment toward developing and maintaining an environment that enhances health and promotes awareness toward sustainability, Harvard has focused on the following sustainability principles:

- Demonstrating institutional practices that promote sustainability
- Promoting health, productivity and safety
- Enhancing the health of campus ecosystems
- Encouraging environmental inquiry
- Establishing indicators for sustainability (Harvard University, 2008, p.1).

In 2000, the Harvard Green Campus Initiative (HGCI) was created to help implement these principles. Since then Harvard has been known to have “the most extensive green-campus initiative of any university in the country”, said HGCI director Leith Sharp (Brown, 2003, p. 2). The HGCI has helped to facilitate the LEED certification process of 26 buildings (new or renovated) at the university to be considered for LEED certification. Figure 2.7 shows the numerous buildings on campus that have been or are in the process of becoming LEED certified.
Sharp also notes that one of the most important facts regarding this program is that all of the projects are paid for through the money the university saved from previous projects. Sharp noted that to date this initiative has saved the university over $7 million dollars a year in reduced utility costs (Brown, 2007, p.2). Another HGCI venture included teaching 9,000 students how “to reduce the waste of food, paper, energy, and water in residential environments; conducting long-term peer training” (Brown, 2007, p.3).

As of April 2008 there are already “regional” organizations committed to “developing regional sustainability indicators”. These organizations are made up of some of the most influential universities in the world which have the potential to influence other universities and their perspective communities to become involved. The Northeast Campus Sustainability Consortium is one of these regional leaders which consist of:

- Yale University (Chair, Founder)
- Harvard University
• Bowdoin College
• Bates College
• University of New Hampshire
• Keene State
• Princeton University
• Columbia University
• Skidmore College
• Allegheny College
• Brown University
• University of Vermont

Another group with international influence is the International Association of Research Universities, whose goal is to create a set of sustainability principles and collaboration. This association to date consists of:

• Yale University
• University of California, Berkley
• Australia National University
• ETH Zurich
• University of Tokyo
• Peking University
• National University of Singapore
• University of Copenhagen
• Cambridge University
• Oxford University (Newman, 2007, p.17).

Conclusion

Throughout this review of literature information has been gathered that has focused on sustainability, eco-efficiency, LEED, and sustainable university buildings. This information is relevant due to the overwhelming evidence that the planet’s environment is in trouble. Multiple solutions to this problem are presented within this literature, and by understanding these solutions, along with the background and history of sustainability, more resourceful practices can be created and related to future building projects.

The number of benefits that were found regarding the LEED certification process was overwhelming (USGBC: About LEED). These benefits could be applied to any building type, but in the case of this study the benefits of sustainability in university
buildings have been emphasized. Universities have the potential to influence local and
global communities as well as society today and in the future. By raising the awareness
of sustainability and LEED building certification on university campuses, the benefits
have the potential to spill over to the general population. This could then be passed down
to future generations and applied into the everyday life of individuals, making a
significant impact on the surrounding environment.

The next chapter will describe the procedures that will be taken to interview and
visit university sites in order to gather information regarding the advantages, obstacles
and motivations regarding LEED and how it is applied or not applied in university
sustainability policies. The information will then be gathered and the data will be applied
to answer the primary and secondary questions of this research.
CHAPTER 3

PROCEDURE

Introduction

Sustainable Design is becoming an issue of increasing importance, not only in design, but also in transportation, business practices, and day to day activities. The need for sustainability is overwhelming and with the condition of the ecosystem it is something that should be considered seriously (M’Gonigle & Starke, 2006). Sustainable practices used in university construction and renovation projects have the potential to have a significant impact on design as well as enhancing awareness of sustainability solutions (M’Gonigle & Starke, 2006). It is through this awareness that sustainability can become a standard of future decision making. This exploratory study is qualitative in nature and uses techniques of interviews, site visits and visual documentation.

Purpose

The purpose of this study is to explore sustainable design in university buildings with specific focus on the sustainability design features, the motivation for designing a sustainable building, and the advantages and obstacles of sustainable design in a university setting.

Research Questions

Primary Question
What are the design features and implications as well as the motivations, advantages and challenges when universities design buildings using sustainable design practices?
Secondary Questions

1) How is sustainability integrated into the culture and philosophy of the universities selected in the study?

2) What is the primary motivation of the universities when deciding to utilize sustainable design practices and seek LEED certification for the selected buildings?

3) Who are the key players in implementing sustainable design principles on campus?

4) What are the advantages of designing LEED certified buildings on university campuses?

5) What are the obstacles to designing LEED certified buildings on university campuses?

6) What sustainable materials are used during the construction of these buildings?

7) What are the long-range plans of the university in terms of sustainable design?

Methodology

The following procedures were used to answer the research questions. First, the review of literature was addressed, looking at past and present research regarding sustainability practices. Research has indicated that at this point in time (2008), the most widely used qualifications for a sustainable building is the LEED certification, developed by the United States Green Building Council. Therefore, the LEED criteria was used as a guide to determine three suitable sites to analyze and use for my research. During the site visits, I will take multiple photographs and meet with key personnel to answer questions that will allow me to answer the primary and secondary questions. An interview checklist will be developed to guide the questions during the interviews with key personnel. The three university buildings that were used in this study all have a different orientation and a different impact on the university and its students. They include a residence hall, a library and a classroom. Institutional Review Board approval from Florida State University has been fulfilled.
Originally I was going to focus on Residence Halls alone as sites for this study, but there was only one LEED certified residence hall within traveling distance. After reviewing the constraints of travel and money, I refocused my research more broadly to university buildings in general and used a convenience sample in selecting the three sites that were within traveling distance. I have chosen a residence hall, a university life science building, and a university library. These sites are meant to represent a broad spectrum of research on universities in general, the specific design features leading to LEED status, and the advantages and obstacles faced in designing sustainable buildings.

Development of Instruments

Interview Checklist
This checklist will guide the interviews with university campus design personnel.

Interviewee Information
- What is your position within the university?
- What was your role in the planning, building, or oversight of the (name of building)?

Building Information
- How long did the entire construction process take?
- What specific features (including materials) did you include that led to LEED points?
- Were there any other sustainable design considerations used that did not lead to LEED points?
- Where there things you wanted to do that you could not do?
- Did any problems arise during construction in relation to the sustainability factors?
  - What were they and how did you solve them?
- Are there things that are unique that maintenance staff must know to properly care for the building?
  - Are specific cleaning products used?
Motivation, Attitudes, Reactions, Awareness

• What was the primary motivation to build a LEED certified building?
• Is there an overall sustainability policy at the university?
• What do you see as the advantages to creating LEED certified buildings on university campuses?
• What do you see as the major obstacles to creating LEED certified buildings on university campuses?
• Are there any other design features that you think should be included that are not part of the LEED requirements?
• Has there been or will there be a post occupancy evaluation of the building?
• What has been the general reaction to the building by others?
  o The students’ perspective?
  o The university administration?
  o The public perspective (PR element)?
• Do you feel the building has impacted the awareness of sustainability on campus?
  o With the students?
  o With the faculty?
  o With the administration?
  o With maintenance staff?

Selection of Data

LEED Checklists

LEED (Leadership in Energy and Environmental Design) is a nationally accepted benchmark for the design, construction and operation of green buildings. It is for these reasons that I chose the LEED certification process as a basis for determining a suitable sustainable site. It promotes a “whole-building” approach to sustainability and uses five key areas of human and environmental heath to recognize a buildings performance. The five key areas are: sustainable site, development, water savings, energy efficiency, materials selection and indoor environmental quality.
Data will be gathered from each site regarding the point system that they acquired from their LEED certification. These points verify the actions they took during the construction phase that make the building sustainable and more “eco-friendly”.

**Financial Savings**

Data will be gathered regarding the initial costs of the construction and renovation. The Life Cycle Analysis, which is information gathered to determine at what point some of the initial costs will be recovered from the amount saved, will also be gathered.

**Products Used**

Information regarding materials used during construction and renovations will be gathered. Data available regarding the maintenance and sustainability of these products will also be documented.

**Institutional Review Board Approval**

The interview checklist (see above) will first require proper approval from the Florida State University Institutional Review Board.

**Selection of the Sites**

The three university buildings that I will be using in this study will all have a different function and impact on the university and its students. They will include a residence hall, a library and a classroom. These sites are a convenience sample but are also meant to represent a broad spectrum of research on universities in general. The following are the sites that will be used for the study; more details regarding the sites themselves will be found in Chapter 4.
Residence Hall

The recently renovated Weatherford Hall located on the Oregon State Campus will serve as the residence hall site. The hall underwent a $20 million renovation in 2004 and received LEED certification.

Library

The library that will be used is the recently renovated Library West of University of Florida which finished completion in 2006. The Library added on 60,000 sq. ft. to its original 117,000 sq. ft. and received the Gold LEED certification, which is the second to highest LEED award.

Classroom

The last example that will be used is the newly built Life Science Building at Florida State University. This 90,000 sq. ft. building is projected to be completed in spring 2008 and is expected to receive LEED certification, with the possibility of achieving Silver Certification.

Gathering Data

I will personally meet with the appropriate personnel including design planning managers, residence hall directors, and facility director and view the three determined sites. I will first tour of each of the sites noting the sustainable features and take multiple photographs. After the tour I will then interview with the personnel who were involved with the building construction and/or administration of the building to ask them the interview questions and gather the data needed. I will further analyze the answers given to me and determine if there are any other questions.

Reporting Data

After acknowledging the purpose of the study by exploring sustainable design at three different university sites, the information and research gathered from the
corresponding interviews will be coded and categorized into emergent themes. These themes will be obtained from patterns and connections organized based upon the interview responses. That information will then be applied to answering the primary and secondary questions. Qualitative data can be expected from the responses.

The following chapter (Chapter 4) will introduce the sites and give a more detailed background of the universities they are located on and the roles they have played in bringing sustainability to university campuses. The chapter will then discuss the emergent themes mentioned in the Reporting Data which will apply to answering the primary and secondary questions.
CHAPTER 4

FINDINGS

This chapter reports on findings related to the motivation, advantages and challenges to using sustainable building practices in three university buildings. The findings were collected through several qualitative methods including interviews, site visits, and visual documentation. The three sites, a residence hall, a university life science building, and a university library, were chosen using a convenience sample of sites that were within traveling distance for the researcher. These sites provided the opportunity to study sustainable policies and practices on three university campuses. LEED certified buildings were selected in order to take advantage of a previously established system of assessing sustainable buildings. Interviews were conducted with the appropriate personnel including design planning managers, a residence hall director, and facility directors who were involved with the building construction and/or administration of the building. They were asked questions focusing on the role they played in the construction of the building, the motivations and attitudes surrounding the design of a LEED building, the reactions and awareness that resulted from the building itself, and the advantages and challenges regarding the design of LEED certified buildings. Each building was toured, the sustainable features were noted, and multiple photographs were taken. The complete transcriptions of interviews can be found in Appendix B-D.

After gathering the data from the interviews and site visits, qualitative analysis and content analysis were used to interpret the data throughout this chapter. The interview data has been coded and categorized into emergent themes. Patterns and connections have been organized based upon the interview responses.

In this chapter findings will be presented in two sections. The first section will describe each of the sites, followed by a summary of the interview sessions. This will be followed by a discussion of the themes that emerged from the site visits and interview data, which will answer the primary and secondary questions.
The Sites

The following is the description of each of the three sites used for this study. The first is a residence hall on the Oregon State University campus, the second is a classroom and laboratory building on the Florida State University campus and the third is a library on the University of Florida campus. Each of the buildings has acquired, or is expecting to acquire, at least the basic level of LEED certification.

Weatherford Hall, Oregon State University

![Figure 4.1: Weatherford Hall at Oregon State University](Image)

Oregon State University, located in Corvallis, OR, is known for having a tradition which focuses on teaching, research and “service to the people of Oregon and the world” (Oregon State University: About OSU, 2008). The last part of this statement stresses their dedication to environmental awareness, which is exemplified by their latest recognition as one of the top 25 schools listed in the 2008 “College Sustainability Report Card” (Oregon State University, Corvallis, News and Communication Services, 2007). On this list, OSU was noted for their “campus management categories of Administration, Food and Recycling, Green Building and Transportation” (Oregon State University, Corvallis, News and Communication Services, 2007).
The university has 15,599 students enrolled in undergraduate programs, 290 of which are part of the Weatherford Hall “living and learning” entrepreneurship program (OSU: Virtual Advisor, 2008). Weatherford Hall, which was originally opened in 1928 as a dormitory for men, has remained as a significant icon for Oregon State University throughout its history. In 1994 the hall closed for renovations, but due to lack of funds the process was delayed until 2002. Today Weatherford Hall acts as a living and learning facility which incorporates the residence hall and an entrepreneurship program (Oregon State University, 2003).

An image of Weatherford Hall during a site visit on December 18, 2007 can be seen in figure 4.1. Although a gloomy day, the historical context of the building can still be seen and emphasized in the structure, which still has the same primary architectural characteristics as the original building which can be seen in Figure 4.2.

![Figure 4.2: Original Weatherford Hall during the 1930’s](http://alumni.oregonstate.edu/eclips/carry/images/102502_weatherford_hall.JPG)

The original building was separated into four different units with a central tower, each of which was originally named after a different person. However, in 1966 the Oregon State Board of Education decided that each building should only have one name and therefore they dropped all of the other names except for James K. Weatherford, for whom the central tower was named (Blum, 2002). Figure 4.3 is an image of the floor plan of the original building and Figure 4.4 is an image of the current first level plan.
A few changes that occurred during the 2002 renovation included:

- The walls that separated the four individual units was torn down to allow for traffic to flow between the units without going outside and to make the building into one unit.
- The cafeteria, which was behind the building (as a separate unit) was torn down and the space is now a large grassy area.
• Libraries and conference rooms were added.
• Bricks from original structure were reused in the renovation.
• Dying elm trees were torn down and turned into furniture for the building.
• The basement, which was under the cafeteria, was filled with debris from construction.

Dan Larson, Associate Director of Housing at Oregon State University stated “The intent of the project is to restore and preserve much of its original design, while adding a variety of modern amenities such as phone and cable lines” (Chappell, 2002).

During the visit to Weatherford Hall, the tour began with Brian Stroup, Resident Director of Weatherford Hall, who supervises eight resident assistants and acts as a liaison between the entrepreneurship program and the University Housing and Dining Services. The following photographs were taken during the tour with Stroup through Weatherford Hall on December 19, 2007.

![Figure 4.5: Study/sitting area inside Weatherford Hall](image)

A unique feature about Weatherford Hall is that there are recycling containers everywhere throughout the hall. An example of these containers can be seen in Figure 4.5 and 4.6.
Figure 4.6: Recycling center in Weatherford Hall

Figure 4.7: Weatherford Hall LEED plaque

Figure 4.7 shows the LEED plaque hanging on the wall. According to Stroup it was placed in a common area so that everyone could see it.

In addition to the tour of Weatherford with Stroup, an interview was also conducted with Dan Larson, Director of Housing at Oregon State University. During this
interview, Mr. Larson explained his interesting perspectives on the advantages and challenges they experienced when designing a LEED certified building, as well as their unique contributions to minimizing the environmental footprint. One of the interesting aspects of their building processes included filling the basement (which was under the dining services building they decided not to keep) with debris from the demolition and reusing bricks from the old building into the new building construction. Other sustainable construction processes include the method they used to strip the old lead paint and that they used old elm trees that were dying in front of the building to create tables for the space. They also added an eco-lawn (which will be defined further in the chapter). Some sustainable materials they used included low VOC materials in carpets and paints. Interface carpet was used throughout the space; a product which Larson states is “phenomenal” due to the sustainable practices they have while making the carpet and the sustainable practices they use when getting rid of the carpet after it needs to be replaced. The goal of Interface is to have zero negative impact on the environment.

Oregon State University is in the process of creating a standard for sustainability and eco-efficiency on campus. There is currently no permanent policy, but Larson notes that the university and its students just naturally do the right thing and are involved. He credits some of this to the mindset of Oregonians, many whom believe in sustainable policies. This could also be part of the reason Larson notes that he does not believe LEED has created any extra awareness of sustainability on campus, because they are already in the mindset of “well shouldn’t we have been doing this anyway?” However, OSU has declared that any new construction will be at least LEED certified.

Larson brought up a number of good points in his interview, including the potential of LEED dictating our future and our building management techniques. He notes that there are much more productive ways to be sustainable than just following the LEED criteria, and his point is to make sure that designers and architects don’t get lost in the search for points, but really focus on how a building can minimize its environmental impact.
Florida State University located in the heart of Florida’s capital, Tallahassee, is constantly renovating and growing its campus. With 41,065 students attending this university in fall of 2007, it is no surprise that FSU is trying to expand its campus. Known as a “comprehensive, national graduate research university” FSU has an objective of putting “research into action for the benefit of [their] students and society” (Florida State University, 2008). The campus has grown continuously over the years and whether a building was new or renovated, FSU has tried, in most buildings, to maintain a Collegiate Jacobean architectural style. A few buildings from the 60’s – 80’s were designed in a modernist style, but more recent construction has gone back to the original Jacobean influence. Even with this historical style, FSU has still designed with the environment in mind, focusing on low energy mechanical systems, efficient building practices (such as recycling materials), low VOC finishes and more energy efficient lighting. They started this focus on sustainable building about 3-4 years ago when more
sustainable resources started to become available, offering better insulation and water consumption. In 2007, Florida State decided to go through the formal process and register for LEED certification for two of their buildings. One of these buildings is the newly built Life Science Building which was recently completed in February 2008, and is in a close race to be the first FSU building to receive LEED certification. FSU’s Track and Field Building, which should be completed May 2008, is also trying to be the first to acquire LEED certification.

The Life Science Building is a newly constructed building, which will allow the science departments to expand their research and permit them to teach students in a better environment with top laboratory equipment. Larry Rubin, Director of Facilities in Facilities Design and Construction, accompanied me on a tour of this state-of-the-art facility. The Life Science Building is approximately 90,000 sq. ft. and will offer a 150 seat auditorium, biology teaching laboratories, collaboration areas, and more then 30 research laboratories.

Figures 4.9 and 4.10 are good representations of the sitting and study lounges that can be used by students, which can emphasize collaboration. The large windows which provide natural light and day-lighting, show a feature that not only conserves energy but also provides sunlight and views to the outside.
Figure 4.11 shows one of the laboratories which not only emphasizes state-of-the-art facilities, but also the large windows which stress energy savings with the use of daylighting, as they did in the lounge areas. Although specific materials such as chemically resistant surfaces had to be used for the laboratories, they still used products that had low VOC finishes. They also used terrazzo flooring in the entrance area of the building, which is a very durable and sustainable material.
Figure 4.12 shows the 150 seat auditorium, which was built with acoustics and convenience in mind. Each seat has a power outlet, which shows the building’s innovative focus on accommodating the technological generation. The lighting used is also very important, so they used energy conserving lights throughout the building.

*Figure 4.13: Green Roof (still in construction phase)*

*Figure 4.14: Green Roof (still in construction phase)*
Figures 4.13 and 4.14 show the beginning work on the green roof which sits above a cage wash area (which is used by the Biology and other Science departments) that acts as underground connection between the Life Science building, the Psychology building and Medical building. This ‘green roof’ area is a transition space between other buildings and provides a space for students to relax or study. A more detailed definition of a green roof can be found later in the chapter.

On April 7, 2008 an interview was conducted with Larry Rubin, Director of Facilities in Facilities Design and Construction, where the recent construction of the new Life Science building was discussed. One of the first things mentioned about this space is that it originally wasn’t intended to be LEED certified. It wasn’t until after the planning process was finished that they decided to go through the LEED process. What they found however was that the university design and construction guidelines they had been using were effective enough to have them three quarters of the way to LEED certification. So their goal, and challenge, was how to get the few extra points to make certification possible and complete the appropriate documentation.

The sustainable features included in the building are low VOC finishes (carpet and paints), a green roof, efficient lights, energy efficient mechanical systems and low flow water fixtures. Lighting for this building was a challenge because they needed to appeal to the scientists working in the space, while at the same time make it as energy efficient as possible. For example, they couldn’t have photo-cell lighting (also known as automatic light switches) in all of the laboratories in case someone was working on something intricate and making little movement as it could cause the lighting to just turn off suddenly. Therefore, their compromise was to place the photo-cell lighting in all of the administration offices and classroom settings. They also focused on the type of lighting that was used and emphasized day-lighting in all of the spaces.

Currently (as of Spring 2008) there is no sustainable policy on the FSU campus, but Rubin insists that they’re trying to do “Facilities Sustainable,” which they also refer to as their “green initiative plan,” meaning that they want to include sustainable thinking in the planning, utilities and utility loops, and when they are done, they want to make it easy for the maintenance personnel to continue maintaining it in an efficient manner. The spaces can also be used to eco-efficiency, for example with the Life Science building
recycling centers are used throughout the building. Rubin stated “that’s part of it … [getting] people used to turning off lights, used to turning things off, or used to recycling and separating their own trash.” Rubin also stated that he’s noticed a growing initiative from students and faculty who want to get involved. He expressed a need for more leadership from upper administration, maybe even delegating a few positions “who could lead a university effort and everybody does their part.”

One of the other challenges that FSU faces when building new construction is that they are a historical campus, and they try to maintain the historically significant buildings and stay true to the original style. So when creating a LEED building they have to make sure that ‘green’ materials, which may appear to be more modern, don’t interfere with the historical context of the building. However, like Oregon State University, they’ve solved many of these problems by focusing on the energy efficient mechanical systems and lighting while still allowing the traditional architecture to be used.

Rubin hopes that they will have future LEED projects, and that as long as they continue receiving the funding they will continue to build more “green” buildings. Rubin added, “I think that each time you do something along the line of sustainability you help get a little closer to it. And I think the biggest thing on campus is just changing the mindset.”

Library West, University of Florida

![Library West, University of Florida](image)

*Figure 4.15: Library West taken of the newly added construction*
One of the nation’s five largest universities, University of Florida is a major public and research institution (University of Florida, 2005). It is also the oldest and largest university in Florida, and is one of the 17 public universities to be part of the Association of American Universities. The campus includes over 2,000 acres and 900 buildings, 170 of those buildings are classrooms and laboratories. UF had the first gold LEED certified building in the state of Florida and in 2007 they had a total of two gold LEED certified buildings, eight LEED certified, six projects in the process of submitting for completion, and nine projects in the LEED registration process (UF, 2007).

Below are some of the major milestones University of Florida has accomplished in terms of LEED:

- In 2003, UF hired the first LEED accredited professional on staff, Bahar Armagani, who was one of the first five LEED Accredited Professionals (LEED AP) in the state of Florida to become LEED accredited.
- In 2004, UF developed an in-house LEED administration. Bahar Armaghani, a LEED AP took on the responsibility of LEED administration and some LEED credit calculations for all UF projects.
- In 2005, UF determined that LEED certification can be obtained with no additional hard cost, and that they needed to take the “next step”.
- On January 2006, UF renewed its commitment to sustainable construction and delivering greener buildings by raising the bar and making Silver LEED certification its minimum level for all its new construction and major renovation.
- In 2007, UF initiated LEED Campus Standards application for the whole main University campus.
- In 2007, started LEED-EB Portfolio Pilot program (Find out more in interview with Bahar Armaghani, Appendix D) (UF, 2007).

One of University of Florida’s gold certified buildings, the Library West, was the third site visited for this study (Figure 4.15). The Library project, which had a $30.6 million dollar budget, included 7 floors and 177,000 GSF (Gross Square Footage). Some
of the sustainable features include: low-flow water fixtures (including waterless urinals), insulated walls, and use of materials with low VOC’s in all of their interior finishes (including sealants, paints, carpets, and adhesives) (Burke, 2007). The University of Florida is also an advocate of day-lighting and the Library West occupants have access to views and day-lighting in 90% of the space. Bahar Armaghani, Assistant Director for Facility Planning and Construction and LEED coordinator for all of UF’s projects, stated that green buildings can “increase productivity, reduce absenteeism and improve performance” (Burke, 2007).

The site visit began at the building entrance, which operates on a revolving door that is not only energy efficient, but convenient for the constant inflow of students. Cork flooring, a sustainable material, and other natural materials (such as wood paneling) make up the interior of the initial entrance, along with a coffee bar and small study area that is open twenty four hours, seven days a week. One of the first things explained during the tour was that the cork flooring was already badly damaged and needed to be replaced. This was caused from the lack of a correct felt that should have been under the legs of the chairs used in the space. Another important feature is the exposed duct system. This not only added an interesting architectural feature, but it also saved on construction costs and building materials. In many areas, lighting made of recycled content glass, hangs over the ductwork, somewhat disguising it.

*Figure 4.16: Study area on first floor*
As the visitor ascends the escalator they are immediately placed in front of the check out area. The surrounding space consists of individual and group study areas, book displays, and huge windows which allow day-lighting to penetrate the entire space. Figures 4.16 – 4.21 show some of these areas within the library.

*Figure 4.17: Entrance into Library West*

*Figure 4.18*
Figure 4.19 and 4.19 Show the check out counter located on the second floor

Figure 4.20: Shows the entrance and exit to/from the second floor to the first floor entrance
Figure 4.22 is an example of the study areas which has an abundance of daylighting.
The movable bookshelves which are throughout the space use an automatic system to slide the bookshelves away from each other, and allow for access to the books. When the bookshelves are opened, motion censored lighting turns on as the user walks down between the shelves (Figure 4.23).

During an interview with Bahar Armaghani on April 14, 2008, Armahani noted that University of Florida started building LEED buildings before many people knew what LEED was, and since then they have been “leading the way” in green building for universities. Inside Bahar Armaghani’s office LEED plaques lay everywhere, even out in the hall, just waiting to be placed inside their prospective buildings.

Emergent Themes

The following describes the data collected from the site interviews and the emergent themes that surfaced, which will answer the primary and secondary questions. These themes focus on the motivations and attitudes surrounding the design of a LEED building, the reactions and awareness that resulted from the building itself, and the advantages and challenges regarding the design of LEED certified buildings.
The Integration of Sustainability in Universities

A common theme that emerged from each of the interviews was that the universities were doing some type of sustainable construction before LEED came along. They did this for multiple reasons: because it’s “the right thing to do” (a quote that appeared in each of my interviews), and because it saved resources and lowered utility costs. Universities are multi-million dollar “businesses,” which consume a huge amount of resources each year. By using better resources and constructing more insulated and energy efficient buildings they can save a significant amount of money and lower their footprint on the environment. Florida State University, for example, has what they call a “green initiative program” which they have used for 3-4 years. It’s only been recently that they’ve decided to go through the LEED certification process. However, because they had already done most of the sustainable processes that LEED suggests on their own, they were three quarters of the way to LEED status, and going through the certification process was not as difficult as they might have earlier presumed. In fact for all three of the university sites, which were already practicing sustainable procedures and producing energy efficient buildings, certification was relatively easy. Since most universities are relatively large they are already set up for most of the resource conserving requirements of LEED. For example they have multiple “exterior campus points” which they get for being on bus routes, being part of a chilled water loop, having bike parking, pedestrian walkways, and day-lighting. In fact Bahar Armaghani, Assistant Director for Facility Planning and Construction and LEED coordinator at University of Florida, stated that “we just looked at it to make it energy efficient, friendly, comfortable place to study and to work”, “not to get the points”, and “with that the points just fall into place”. This idea from Bahar Armaghani is one which could be (and should be) applied to all universities. Currently the University of Florida is “leading the way” when it comes to LEED certified university buildings (as stated by Bahar Armaghani). They currently have a requirement of at least silver certification on all of their future projects. Similarly, Oregon State University has a requirement of at least the basic LEED certification on all of their future projects.
Primary Motivation of Universities

As stated previously, all of the interviewees agreed that building sustainable eco-efficient buildings is “the right thing to do”, but what may be even more important for this study is that they also all agreed that it is imperative that universities be involved with this sustainable movement. Universities are huge organizations, and as such they leave a large “footprint” on the environment and consume an enormous amount of energy. Building more sustainable and efficient buildings is one way that universities can reduce their negative impact on the environment. However, the belief is that universities can do more than just minimize their impact on the environment, they can also be proactive and involved with the issues of environmentalism. Further, because universities are learning facilities they can set a good example for their students and society, influencing them to be proactive as well. I believe Bahar Armaghani said it best when she said:

“We want to be proactive. We need to show examples to the students that come and go, who are going to be [the] future consumer and conserver, how to do it, what needs to be done, and how we can do it. Just show them, and they can take something away from here, when they leave, they make the difference, we know for sure they will. …. and then besides that universities are an educational institution in the community, and people look at us for leadership, and what we’re doing and how we’re doing it.”

The University of Florida, among others, thoroughly believes in the philosophy, that universities can make the difference and influence their students, to do the same. Armaghani explained that one of the features in place at the University of Florida is called “Case Studies”. After the completion of a building they review everything they did on the project and invite students, faculty, administration and the community to come and learn more about the processes they went through, the lessons they learned, and the pitfalls that should be avoided. Then they offer tours of the space and show all the sustainable features that make the building efficient, because as Armaghani stated, “that’s the only way you educate people, is to show them”.

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Key Motivation and Players

From all of the interviews a common theme arose surrounding the motivation to design LEED certified buildings on university campuses. The first was that it was “the right thing to do” with the focus being on the well-being of the environment. The second motivation was the public relations, or “PR” that is created from the recognition of having a “certification”. Based on reflection from some of the interviews it has been argued that some universities go through the certification process just for the “good PR”, but that really can not be proven, and likely will be argued that it is only a “secondary motivation”. Through public relation efforts however, universities can increase awareness and advertise their school as an advanced, environmentally aware and proactive school. Another motivation is that “green building” is the future of construction and the direction the industry is going, and as a university they should be involved.

Unfortunately, one of the biggest challenges to creating a LEED certified building is getting the budget to complete the construction within LEED guidelines. All of the interviews revealed that in order to get a university involved with the LEED program you need to have help from higher administration officials who are willing to approve the extra upfront cost and become key players in the sustainability movement. When a university like University of Florida has support, interest and involvement from administrators who are urging the movement further along, more opportunities arise and projects are able to move through the completion process faster. Other key players include faculty, staff and students who can influence and be influenced by the LEED practices. The more people who know and understand sustainable practices and green products, the higher the interest the community will have in pursuing further into “green building”.

The Advantages and Obstacles of LEED

Another common theme that emerged was the question of whether “LEED is even necessary”, or “is it enough?” Dan Larson, Associate Director of Housing from Oregon State University, approached LEED from the perspective that most of the requirements of LEED are already included by most universities, and noted that LEED doesn’t go far
enough. He stated that “even though a building may be LEED certified [it] may not really be sustainable”. This viewpoint originates from the idea that LEED really focuses on the construction of the building, and that the construction processes and materials are sustainable. Larson’s point is that a building is more sustainable when you focus more on its operations and what the building is generating or collecting. Larson did agree that LEED is a good start, noting that “it gives you structure”, but a disadvantage is that it does not require the building to remain a ‘long-term’ sustainable building.

Currently going through the commissioning phase of the certification process (as of March 2008) for the Life Science Building, Lawrence Rubin, Director of Facilities in Facilities, Design and Construction at Florida State University, noted that the certification process can tend to be expensive, but the commissioning team is there to make sure that all of the mechanical, electrical and plumbing designs are done correctly. He notes that this is especially important because that’s where “the real money can be lost”. So although the commissioning may be viewed as an added cost, it really can be a benefit since it double-checks to make sure everything is running as it’s supposed to. After the completion of both the Life Science building and the Track building, FSU is going to reevaluate the advantages and disadvantages of LEED and decide if they want to further pursue it on future projects, or just maintain the “green initiative plan” they’ve been using.

A definite advantage of LEED is that it provides a framework for designing sustainably. For many who are unsure how to start, this is a great way to understand what goes into making a more energy efficient building that not only reduces the buildings carbon footprint on the environment, but also saves money on energy and water consumption. Through an energy model that the University of Florida used, which compared the energy and water consumption from one of their LEED buildings to another older building with similar square footage and use, UF found that the LEED building saved 37% more energy and 97% water!

Other advantages of LEED can include the awareness it can bring to a university campus. University of Florida has gained national and international recognition for their work in sustainability. It is the belief of the interviewers that this movement can have a
definite effect on its students, faculty and administration in terms of their desire to get involved and become more knowledgeable on energy efficiency and sustainability.

Materials

All of the buildings visited used many of the same sustainable features in their projects. The most common materials found were those that had low volatile organic compounds (VOCs), for example, with the paints and finishes. Water soluble adhesives, photo-cell lighting, low flow water fixtures, and energy efficient mechanical systems are other common materials. University of Florida and Florida State University both included a “green roof” in their building. A “green roof” is a roof that has live growing vegetation on top of it. This is possible through the use of shallow-root plants (usually indigenous to the region which will require less maintenance), the correct soil, and an extensive sealant that protects the water from leaking through the roof. Oregon State University added an “eco-lawn” on Weatherford Hall grounds. An “eco-lawn” is a cost-saving, durable and eco-friendly alternative to a conventional residential lawn product. The advantages of an eco-lawn is that it is created from its mix of fescue grasses which grows about four times slower than regular grass meaning that you don’t have to mow it as often. It also has a longer root system which means that no fertilizers are needed and it can be watered less frequently (Gurvich, 2007).

Long Term Durability

According to Dan Larson from Oregon State University, there are times when “green products are just not as durable” and “you’re back in a year striping and refinishing because the green product just didn’t hold up to commercial use”. His point being that sometimes you have to take into consideration “long term maintenance costs associated with sustainable products”. Larson insisted that he is very committed to using sustainable products, but there are certain applications (for example flooring) in which you have to consider all of the variables. An example of this is in Weatherford Hall where particle board was used as the base for flooring, and then flooring tiles were glued to the particle board using a water-based adhesive. The problem occurs when the tiles are flooded when they are stripped (as a cleaning process), the water trickles down past the
water soluble glue seeping into the particle board, which then expands and causes tiles to “pop loose”. If concrete was used instead of particle board, or a different type of adhesive, this problem would not have occurred. However, as Larson stated sometimes you have a combination of bad things that were not anticipated. Likewise in the University Florida Library West, cork flooring was used on the entrance level, but due to the lack of the correct felt on the chair legs, the flooring was not durable enough to handle the everyday wear and tear. Therefore the floors need to be replaced.

**Historical Context**

In much the same way, special circumstances must be considered when renovating or constructing a new building within a specific context. For example a major factor for Florida State University was to maintain the historical ambiance of the campus, which mostly focuses on the Jacobean Style, in the new building. The same was an important consideration when renovating Weatherford Hall on Oregon State University’s campus. As stated earlier, they solved many of these problems by focusing on the energy efficient mechanical systems and lighting while still allowing the traditional architecture to be used. An example of a compromise by the designers at OSU was to create a lighting fixture with the historical style, but then place a modern energy saving light within it. Making more of the energy saving features that are often not seen can have great benefits in energy savings.

**Life Cycle Sustainability**

In each of the interviews, the importance of continuing sustainable and eco-efficient principles after the building has been LEED certified was stressed. Larry Rubin made a poignant statement when referring to the Life Science building at FSU when he said, “We’re just a part of the process. Design and construction, we build it to a certain point, and then we turn it over to the scientists to use, to maintenance to maintain, and to the buildings services to clean and do landscaping. So, what we try to do in our plans and specs, is to incorporate those things, knowing that we have to hand it off.”

The University of Florida has training for all of their maintenance personnel after the completion of a building where they show employees all of the systems and
equipment and how to take care of them. They even video tape the whole process so that maintenance can show it to future employees. Bahar Armaghani, of the University of Florida, notes that it is especially important not only to use green cleaning products, but also to understand the control systems, mechanical systems and lighting control systems. As said previously LEED certification doesn’t necessarily account for how the building performs after construction and commissioning is complete. It’s left up to the maintenance and university staff to make sure that the building continues to conserve energy and other utilities. Dan Larson, from Oregon State University, suggested that a system that uses rainwater for flushing toilets, or a timer that let’s you know when you have showered too long, are smart efficient devices that might be more effective as a whole on conserving resources versus just a LEED certification.

**Long-range plans of Sustainability on Campus**

Each of the universities selected for this study was either in the process of creating, or already had, a sustainability policy on their campus. It is important to note that in each of the interviews the participants agreed that universities should be more involved in the sustainable movement. Many universities are still in the process of experimenting with green design and LEED certification. As the process becomes more commonplace it will likely evolve, making it easier to become eco-efficient. As this continues to happen, and more universities that are involved with green design continue to gain national attention (as UF has) the consensus is that other universities will want to become involved as well. It’s all about creating further awareness, and universities that act as a home to future generations, and as a public icon for its surrounding communities, have the ability to further educate and influence other universities to get involved.

**Conclusion**

In summary, this chapter expanded on the detailed information that was gathered through three interviews regarding three different university buildings that were LEED certified. The information was then categorized into emergent themes which answered the primary and secondary questions. The next chapter will summarize this study and
note on the most important emergent themes and how they can affect our society. Suggestions for further research will also be mentioned, as well as an opinion on the actions of universities, the future of LEED, and the impact sustainable campuses can have on students.
CHAPTER 5

CONCLUSION

This study explored the advantages and challenges to sustainable university buildings. It began with defining and looking back through the history of eco-efficiency and sustainability. Then key leaders, issues and solutions were presented to give an expanded background on the impact of sustainability. The USGBC (United States Green Building Council) and LEED (Leadership in Energy and Environmental Design) were then defined and utilized as sources for selecting the sustainable buildings for this study. University campuses and their impact on society were also researched.

The research focused on the primary question which involved exploring the sustainable design features, motivations, advantages and obstacles were when designing sustainable buildings. The study also focused on seven secondary questions, which focused on how sustainability is integrated into universities, primary motivations to building LEED buildings on university campuses, advantages and obstacles to designing LEED buildings on campuses, the key players who are implementing sustainable design principles, and long-range plans of universities in terms of sustainable design.

Several conclusions can be drawn from the research and interview data in regards to answering these questions. First, there is almost always more than one ‘motivation’ to creating a LEED certified building on university campuses. The two most common motivations are because “it’s the right thing to do” and the Public Relations that comes with building a LEED building. A few good points were made that LEED is a great start and helpful for anyone new to ‘green design’, but it may not be the best possible option to creating a sustainable building. Comments like this raise the question “is LEED enough?” LEED is a great guideline for ‘green construction’ but LEED does nothing to guarantee that the building is going to maintain ‘green’ efficient practices. Instead, it is left up to the people who maintain the property. A second conclusion that was continuously presented was that the advantages of sustainable buildings completely
outweigh the obstacles. Energy and water savings have been proven, which has not only saved resources but money as well.

The impact of higher administration on the design of sustainable buildings on campuses was another important finding. It was found that universities seeking to be ‘green campuses’ must involve administration. Fortunately for universities, most are already set up to receive many LEED points for what they call “exterior campus points” which they get for being on bus routes, being part of a chilled water loop, having bike parking, and pedestrian walkways. Overall, through the research and interviews that took place in this study, the advantages of green design overwhelmingly out weighed the challenges. Universities not only have the ability, but the obligation to be leaders in our society, and they should embrace this new direction for sustainable buildings.

**Recommendations for Further Research**

Sustainability is a growing issue that should be researched further so that more efficient resources can be developed and readily available to the public. My recommendation is to take another step beyond what I have researched, look further into the development of LEED and compare it to what really defines sustainability and eco-efficient ideals. Essentially, to answer the question: “is LEED really enough?”

I received an email recently from Rick Fedrizzi (President, CEO and Founding Chairman of the USGBC) who commented on the impact that LEED has had in sparking “a revolution, articulating a new set of integrated, measurable goals that changed the way we approach the design, construction and operation of our offices, schools, hospitals and homes”. However, he also noted that even after all of their efforts, buildings still account for 39% of the United States CO2 emissions. The USGBC decided that this number was not good enough and decided to redirect their focus with LEED and center its requirements more on the “total building performance, while at the same time, incorporating technical advancements such as bioregional credits that would enable LEED to continue to evolve as a better, more refined tool for green building” (Fedrizzi).

This new version of LEED will come into effect in their new version LEED 2009, which will focus on key environmental and human health impacts based on the best available
science. This version will be united with an “expanded third-party certification program” and an enhanced LEED online system. They named this “multi-faceted initiative” as LEEDv3. The point of this e-mail was to notify the public of this change and to ask for public comments on their process of the LEED 2009. As of May 2008 they are still going through that process and it will only be a matter of time until we see this version of LEED that the USGBC hopes will “reset the bar for green building leadership” (Fedrizzi).

Taking it a step further, I would suggest more research exploring practices that could minimize a building’s carbon footprint. Looking beyond just construction processes and building resources but even into what the building produces. Dan Larson brought up an excellent point in his interview when he suggested that instead of having multiple distributors (which each might deliver something different to the same building, like cleaning products, light bulbs, paper, etc.) that you maybe only have one distributor. That would truly minimize impact on the environment.

A final suggestion for further research would be with regard to universities specifically and the impact they have had on their students. Right now the process is just beginning for universities who are becoming involved with sustainable policies. It would be interesting to see a few years from now how sustainability has grown on campuses, and to research if the students did in fact take these eco-effective practices further in life with them.

What to Expect from Tomorrow

It is my personal belief that sustainability is the future of design and construction. There is no reason that we can’t use better, more efficient resources in our designs. To be frank, it just makes sense. The only thing we are missing is further research. Many claim that the durability of sustainable products is not nearly up to the same standard as their predecessors. Personally, I feel that this is just because there has not been enough research in developing sustainable products so that they can meet the highest level of durability. We have the technology; we are just not taking the time to apply it. “Tomorrow” I see the growth of the USGBC and their LEED program. I believe they will go through several versions that will only continue to develop and encourage
sustainable practices. My hope is that we will reach a stage in which the LEED program is no longer necessary, and that sustainable construction and building processes are applied as a standard, not as an added benefit. It is my belief, which has been affirmed after further research from this study, that universities are a good place to encourage awareness on eco-efficiency. By educating students on the benefits and necessities to being sustainable, and incorporating it into a students every day life, sustainability can become a ‘habit’ which student’s can carry with them through life.

**Final Note**

This study was not written to argue against those who are resistant to sustainable design, but to discourage wasteful practices and promote eco-efficiency. This study is meant to educate and to be used as a guide for those who want to further research in sustainable practices. Sustainability has so many advantages, not only environmentally but economically, that not taking advantage of these ideas is a waste. By creating sustainable buildings and utilizing resources we are one step closer to ‘saving our environment’, which as much as people want to deny it, it needs saving.
APPENDIX A

HUMAN SUBJECTS APPROVAL LETTERS
APPROVAL MEMORANDUM

Date: 1/28/2008

To: Michelle VanderDoes

Address: 1111 High Rd 202B Tallahassee FL 32304
Dept.: INTERIOR DESIGN

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
Advantages and Challenges to University Buildings Using Sustainable Design Practices

The application that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and two members of the Human Subjects Committee. Your project is determined to be Expedited per 45 CFR § 46.110(7) and has been approved by an expedited review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 1/21/2009 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor
is reminded that he/she is responsible for being informed concerning research projects
involving human subjects in the department, and should review protocols as often as
needed to insure that the project is being conducted in compliance with our institution
and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection.
The Assurance Number is IRB00000446.

Cc: Lisa Waxman, Advisor
HSC No. 2007.911
APPENDIX B

TRANSCRIBED INTERVIEWS FROM OREGON STATE UNIVERSITY
Interview with Dan Larson
Associate Director at OSU
Housing and Dining Services
December 19, 2007

Michelle VanderDoes: If you could please state your name and position within the university.

Dan Larson: Associate Director of Housing. There are multiple directors and we all have our areas, mine is in construction application, contract sales, planning, family housing, maintenance, that stuff.

MV: What was your role in the planning, building and oversight of Weatherford Hall?

DL: I’ve been in this role for about a year. And prior to that the person who was in this role would have been what I guess you would call a program manager, verses a project manager. A project manager would have had a more detailed why of choosing certain products what the overall designs would have looked like and have had more of a say in all of that. Where as mine was to make sure that the foundation which was doing some fundraising for the college of business and the college of engineering and housing were all planned well together, kind of sharing that vision. At the same time I also acted as a sort of tour guide during the construction of the building mainly because the more people we brought into the building potentially the more money people would donate to the renovation. At this point though we still have the exterior which we are still renovating, and so now I’m considered kind of the “owner”, and then there’s a project manager, an architect, an engineer and then you have the contractor. So my role as the “owner” I say “I like this”, or “I don’t like this”, “I want to do this”, “I don’t want to do this”. Then the project manager says this to the architect because the owner says so, and so on down the line.

MV: It progresses down?

DL: Yes, and then it goes back up the same way.
MV: So it’s my understanding that you raised a lot of money for this.

DL: It’s a 20 million project all said and done, 5 million was from donations. The college of engineering wanted an entrepreneurship minor because they felt that their students didn’t know how to take their ideas and turn it into a business. So they wanted the college of business to create a minor. So they did funding initially to get funding for the entrepreneurship [program]. So a bulk of the donations came from them, 4 million.

MV: I know I’ve already sent you a few questions previously and I took your answers from that and developed further questions that coincide with those. One of the questions I did ask previously talked about the construction process and you said that it began when the building closed down in 1994.

DL: Yes but to clarify, the building went through a period where it sat vacant and we went through a period of what are we going to do with it, where are we going to get the money. There were a lot of schematics and ideas that were thrown out on paper. It wasn’t until probably 2002 when the money came in, and we said OK let’s go ahead and take these schematics and turn it into design documents. Once what we got the money we wanted to start during the summer and we took a year process into a 6th month process so we went right into construction documents. So when you ask how long the construction process took, it really took more realistically 8 months to a year.

MV: I know in another one of my previous questions I had asked what type of materials you used that led to the building becoming sustainable and you had mentioned water soluble adhesives and low VOC paint. Are there any other products that really contributed? I know that Brian had mentioned the reuse of the brick, the eco-lawn, and I know that since it’s a renovation that all of that contributed. Is there anything else even along those lines?
DL: Well to be honest I’m not exactly sure about that, I’m not really sure with the whole LEED certification process, I do know that it’s based on points, but the specific details I’m not really sure. I know that Brandon is more knowledgeable on the LEED requirements. I do know that doing things like by filling in the basement, which was under the dining services that we decided to not keep in the renovation, with the ruble of the demolition. And things like lead paint and the process that they used to strip the paint and dispose of it are really requirements for LEED and the state so I don’t know if it adds [points] to LEED. They’re more common practices. I think using water based products, like the glues, is really the root to significant problems. When we get to challenges I’ll mention that as a problem. I don’t think we did anything in terms of reusing a lot of things. There were old elk trees that were dying in front of Weatherford, and they had to come out. And instead of sending them off to someone else, we used them to create tables for the hall. So those types of things that you take from the site and then you reuse it. We installed certain types of lighting, compact fluorescent, and I’m not sure that it added to the tax credit but I believe it might have added to the LEED certification.

MV: And from what I understand the certain lights help reduce utility costs, which I’m sure helps to gain the initial money back.

DL: Yeah, you could buy a fixture that uses T8’s verses the 12’s, fluorescent tubes, and those can cost $10. So part of the process is the design and how much money you put in to making it look pretty verses long term maintenance costs. And that typically is where sustainability and LEED come into conflict, like water soluble type things. Or floor finishing. Sometimes the green products are just not as durable as something that has a whole lot of VOC’s in it. So you’re back in a year striping and refinishing because the green product just didn’t hold up to commercial use.

MV: I can see that as part of the challenges to creating a LEED building which is one of my questions that I have further on.
DL: Well that’s pretty much it, it comes to long term maintenance costs associated with sustainable products. At the same time I’m very committed to using all sustainable products, but there are just certain applications that you have to consider.

MV: My other question was if there were any other sustainable design considerations used that did not lead to LEED points, which you’ve already answered… I know that I had previously asked this before, but are there any unique things that maintenance must know to care for the building? I know you had mentioned that some of the green cleaning products were less effective. Do you still end up using these products? Is it necessary for the building?

DL: Two things there, lets talk about floors, carpet tile, you can get interface, if you want to know more about sustainable products do some research on interface flooring. When the old goes out what do you do with it? The reclamation process, do you send it to a landfill, or do you take it apart and use the nylon fiber. So the building has interface carpet, which is a phenomenal product, I don’t think there’s anything better then that product for carpet. So that’s where it’s a good thing, so it’s not just that the product is really good, but they use sustainable practices while they’re making the product. And it’s what they do with the old product when they’re replacing it. So that’s where it’s really good. When it’s not good, it’s not that a water based adhesive is a bad thing, it just in the particular application. So we’re currently in discussion about what we’re going to do about this problem, because they put particle board down and then water based adhesive and then the tile on top of that. So what happens when water gets to the particle board? It expands and as it expands it pops the tiles up. So you have a combination of bad things. Water soluble adhesive, there’s nothing wrong with that, but for example if your striping a floor typically you want to flood it with the water and the stripper, and if you do that then it seems into the cracks and gets into the particle board and pops the tile. So I think this is a combination of poor choices, so it’s not that the water based product is interferer it’s just that by doing that with the combination of sub-strength that’s not approved for VCT or that I would say isn’t approved, other’s may disagree, but tests sheets show that you don’t want to use particle board. You’ve now made a combination that when ever
you strip the floor you’re dislodging tiles and now you have a long term maintenance problem. Now, so that it is the effort to be sustainable added to the problem. If it was super glue that won’t dissolve with anything, that was really bad for the environment, we wouldn’t have that problem, so it’s not a better solution, it’s just reality. Now in terms of cleaning it, a way of being sustainable is you would use less water, you would do a smaller section at a time. So what we’re trying to do is try and find a way to clean the floor so that it wouldn’t over saturate the tile, therefore getting into the tile, loosening the glue and pooping the tile. So strippers as I understand it, there really aren’t a green stripper. So it’s not that it is sustainable that caused the problem, and I don’t want to infer that an architect or engineer didn’t think of the big picture, but in this case I don’t know that that happened. The particle board has a lot of Formaldehyde in the production of that product. But when they decided to use more of a green adhesive with the particle board, the use of the sustainable product wasn’t a bad one, but using it with the particle board was.

MV: But in another case let’s say if they used concrete instead of particle board then the adhesive would be OK?
DL: Absolutely, if they had used concrete we wouldn’t be having this problem.

MV: My next few questions will discuss the motivation and challenges and disadvantages to creating LEED buildings. Which I’ll start off with what was the primary motivation to build a LEED certified building?

DL: Our director takes a lot of pride in the LEED certification, and takes it very seriously. We just got the plaque and he wants to have a ceremony. Where I would perhaps be on the side it’s just want you do. You want to save as much as possible, recycle and reuse, sustainable products. So I think on one end it’s the show and tell and the other I think it’s just the right thing to do. I’m not exactly sure where the push is coming from, whether it’s the university or the state, but it’s becoming pretty standard that any new construction needs to be at least LEED certified. If anything it’s still looked at as a tax credit.
MV: Well that actually goes into my next question on whether OSU has a sustainable policy? You had stated that they really didn’t have an official. Do you see one in the future? Something that the school would promote to the students, and the alumni?

DL: Well actually I just got an email, that they’re working on campus standards for upgrades, new construction. So we’ll be able to look and say “ok, all new lighting needs to be, not only in keeping with the historical visual but also energy conserving.” I think that they might be unveiling something soon.

MV: Ok, what do you see as the advantages to creating a LEED certified building on campus? I’m also going to be asking about the challenges if you would like to compare and discuss the two at the same time.

DL: I don’t want to speak out of school, b/c I’m not completely knowledgeable about LEED certification, and I think anything that you do to minimize the impact on the environment is the right thing to do. And LEED helps people get there. It gives you a structure. Instead of points that you get I would rather see guidelines of how you should do it, and not so much of an award but when you do an upgrade or a renovation that you have to adhere to these specifications. Right now it’s more like a “look at what we did”, we got a plaque, and we’re certified. So that’s the advantage, its forcing people who want the “look at me”, to do the right thing. Now I guess the disadvantage is I don’t know if it covers all of the things that we could be doing. Even in the building maintenance. Once you receive LEED certification you put that up on the wall and they you could use products that aren’t green, and you “could” take all of the light bulbs that are efficient and put incandescents in there. You still have the plaque. So I guess that’s the advantage that it forces some of those things to happen, but I feel it misses the boat in setting up real guidelines, “here’s what you have to do to create a long term sustainable building.” And another thing is that even though a building may be LEED certified but may not really be “sustainable”. Sustainable would be you collect all the rain water and then that’s what you use to flush the toilets. That’s great, that’s smart, that’s the right way to go, and
that’s what makes a sustainable building, its operating based on what it’s generating or collecting. So just because its LEED doesn’t mean that it’s a sustainable building and I think that that’s a disadvantage, that there are things that you do to make a building LEED certified and then there are ways to maintain a building to leave less of an impact on the environment, and I think those are two different things.

MV: I’ve heard that from other sources, opinions, as well, “does being LEED certified really make a building sustainable”, almost exactly what you’re saying. I’ve heard that many people don’t really agree with it, but at least it’s a start

DL: And to really get to it, how many flow restrictors do you have in a shower, or a timer, that says you’ve gone your three minutes now stop, verses the 30 minute showers that some people are taking, That’s way more impactful on the environment, or rather less impactful on the environment. Mind you I’ve only been doing this for a year now, so I'm really not an expert.

MV: No this is fantastic because you’re actually working with and dealing with all of these situations.

Going onto the next question, as I understand it you’re still renovating the exterior, when that’s done do you think there will be a post occupancy evaluation on the building?

DL: Well we’re supposed to. But when you think about an office building and your doing a build out, it would be very easy to go and ask the person sitting in the office “how’s the lighting working for you, how’s the air flow? Are you comfortable?” and do that post occupancy type thing. But for me, everyday is a post occupancy, we get work orders, complaints, we get information from the staff that is in there, so as long as you’re getting some information on how effective the building is, that’s your post occupancy. I don’t believe that my predecessor did anything for the post occupancy survey; I think we got this less formally. Our HVAC technician can see everything that is happening from his computer, and our staff members report any problems, so we know. Where as in an office building that may be LEED certified, if someone is in their office and the lighting isn’t
too good they might just say oh “I don’t care I’m not going to say anything”. So Yes we did a post occupancy but not in the formal way of "here’s a survey please fill it out". However, I do think that it would be good measure to have something on record during your program stage that says what you want, you should have the outcomes of what you hope to get, and then at the end you should have “did you receive those out comes”. In my opinion that’s what should be done, I just want to clarify.

MV: Previously you stated that the sustainable factors are not visible to the occupants, has there been any other advertisement to the campus, other then the LEED plaque, explaining what LEED is?

DL: I think we’re trying very hard to be sustainable, but I don’t know, to be honest, I think a lot of the things we do is a no brainer and people, at least in OR, if your not doing it, shame on you, and to bring attention to it is in a way to me, why are we gloating about it, of course you should be doing that, why aren’t you doing this, this and this. So, I probably won’t, but if I’m told to, then I will. Typically you’d want to get your LEED certification right after occupancy so the fanfare is still there, and were two years out and we just got the plaque. So to say hey we’re LEED certified many would be like “did we renovate”, so it’s normal now. But if I’m told too then I would.

MV: And that kind of goes along with my next question, do you feel that the building has impacted the awareness of sustainability on campus?

DL: I don’t think so; I think probably it would have far more impact if we started using potato product paper in our dining service, that gets more notice. How you use the fill, no one sees that, in fact I think they may be slightly disturbed to know that in fact that’s all gravel underneath there.

MV: Ok, well that’s actually all of my questions. Was there anything else that you can think of that you would like to add?
DL: Well I think the interesting distinction to make is new construction verses renovation. I think you’ve made the distinction b/w a residence building and commercial building and what you can achieve and trying to make sense of what the points mean. And I think another good point to make is how does LEED dictate your future? Your building management techniques. So to really say we have a sustainable residence hall I think is so far in the future, I’m not even sure how we would do that, there’s so much waste, we all waste so much. The other thing for me, is to have a sustainable building we wouldn’t have soda machines in the residence of halls, because those bottles go straight to the landfill because we don’t have a recycling plant for plastic bottles. So I think as you’re doing your research and really getting down to the bottom of it, even if they say that we’re sustainable how does it really minimize the impact on the environment and the carbon footprint. All the waste and pollution that gets it to your location is also your fault. And how do you minimize that? Maybe instead of having three different distributors, your cleaning products, paper, your soaps, your light bulbs and maybe having three different trucks bringing you those products. Instead maybe having one distributor that you have a contract with. That really creates a sustainable building. So, that’s the only thing I would add that during your research to maybe think about not only the LEED and what points they can give a building and the plaque that says “hey look at us”. But more what a business is doing to minimize its impact.

MV: I really think that I’m becoming more aware on how different a sustainable building can be from a LEED certified building. Through interviews like this and the research I’ve been doing, I’ve mostly noticed that those who have really used the LEED certification process don’t really like it. Compared to the people that know about it and think it’s a great new idea.

DL: Well I think you hit on it when you asked your question “Why did you do it”. It’s a good one, to know, was it done because you were told to do it, was it a way to ensure that you were being more sustainable, or so that you could have that pretty plaque that says we’re keeping up with the “Jones” in terms of our renovation projects. And I’m not suggesting that’s what we did I wouldn’t want to call it that, but I think we should get a
place where we’re doing it because it’s overall reduced impact on the environment, verses the glory that you get with the certification, and that’s the risk that comes with when you do certification. Now tax credits that makes more sense because there’s a reward at the end of it.

MV: Some of the other things I’ve found with a benefit towards LEED. Is that it creates a guideline of what minimal we should be doing. Where someone could say “oh I have a sustainable building” when it may not be, and this give a minimal requirement to give a building that title.

DL: And that’s two different things. If you have a LEED certified building, good for you, that means your methods for renovation and construction adhere to this set of standards. Good job. Now let’s talk about a sustainable environment, that something that is completely different.
Well good luck with your research….
Interview with Brian Stroup
Head Staff at Weatherford Hall, OSU
December 19, 2007

Michelle VanderDoes: Thank you again for meeting with me. Just to start out can I have your exact position within the university.

Brain Stroup: Sure, I’m a Resident Director for the University Housing and Dining services and I work in the Weatherford Residential College.

MV: And what is your exact oversight of Weatherford Hall as its Head Director?

BS: Well, I supervise the eight resident assistants in the building as well as the student developer that I work with for our website. I also act as a liaison with the entrepreneurship program and I’m apart of that partnership.

MV: Was that program here before the renovation?

BS: No that was since it opened, [the entrepreneurship program] was part of the whole residential college, they wanted to have a partnership between the entrepreneurship and engineering colleges along with the Housing and Dining. And I’m part of the Housing and Dining.

MV: Most of my questions are going to be directed to the building itself. So I don’t have as many questions for you, it will be mostly focusing on the attitudes and motivation regarding the building.

BS: Ok, Great.

MV: Are there things that are unique that maintenance staff must know to properly care for the building?
BS: I think a lot of our floors. When we do the waxing of the floors during our break time in what we call ‘incubator rooms’. The floors have different tiles then any of the other halls because they don’t have rooms such as those. So that is one thing that they have to be aware of. But as far as the resident’s rooms and the hall ways, that’s all pretty much the same.

MV: Great, and then moving onto the overall attitude toward the building. Do you know of any overall sustainable policy at the university?

BS: The campus as a whole is increasing their drive to work toward that. As a department we just developed a sustainability initiative. And this is a part of that, is the work in Weatherford and the LEED certification. There’s a sustainability house on campus that’s run by students. There are also student fees that the students agreed to last year, I think it was an additional $6 to have alternative energy and more green on campus. So sustainability as a whole on campus has definitely increased in the last two years, that I’ve noticed.

MV: What do you see as the advantages to creating LEED certified buildings on university campuses?

BS: I think that there are cost advantages over time. That’s the one thing; usually it costs a little bit more up front. But, the benefits are not only environmentally friendly but cost wise. Over time they are cheaper to maintain based off the increased revenue you get from the energy savings over the years. Beside from that fact I think that it helps, hopefully it will eventually create a concept in the students head that live in the halls, that “oh I did good to have minimal impact”, and it’s good to reduce their carbon footprint and thinking more outside of their own little rooms.

MV: Do you see any major obstacles to creating a LEED certified building?
BS: I think one obstacle is the extra cost upfront, I think that is an extra detergent for a lot of schools, and also too sometimes the quality of the products. Especially when you think of a residence hall you have to have something that’s going to be industrial and long lasting. Where a lot of times with green products, it’s good, but it may not have the same industrial strength as other products have that aren’t green. So that might be an obstacle.

MV: What do you think might be the general reaction of the building by others?

BS: They love the building; they think it’s a beautiful building. When alumni are polled from OSU the one building they remember the most is Weatherford. So they use it a lot on their campaign ads. Just as the esthetic look, people love it. As far as the [LEED], a lot of people probably wouldn’t know, honestly, that it’s a LEED certified building, because to them it just looks like this really pretty building. But there’s a lot that went into it to make it, just the fact that it was renovated, not LEED built, that was something that definitely added toward the certification points from the very start. A lot of people don’t know that the brick in the back was reused from the old dining center to create the amphitheater look. And the lawn in the front and the back are eco-lawns, people don’t really know what it is, I didn’t even know what it was. So people probably really wouldn’t think about it, but when they do kind of hear about it, they think it’s kind of “cooler” if that’s the right word to describe it.

MV: Well that was actually leading into my next question. Were there any advertisements that told the student population and the faculty that it is a LEED building, maybe even educated them a little bit on what LEED actually is?

BS: Were actually going there next. We just got our LEED certification plaque, and so we just displayed that 2 or 3 weeks ago. And we’re going to put the certificate below it describing what LEED is. And then we really hope to educate a little bit as the school year goes on, in the spring term. That we have received that certification and what it means, and really in the fall I think we’re going to have an official ceremony. So in the
fall it would kind of be the extra help to get the students aware of what we have. So we’re just about to go there. It took a while for all of the paper work to become final.

MV: Well that will be fantastic. And I guess this kind of reiterates itself and that this will probably come more in the future, but the impact of awareness on sustainability on campus as a whole. Do you think that will come more after you’ve done the LEED ceremony? And do you see anything else coming in the future?

BS: For the halls specifically I think the sustainability initiative within the department will hopefully trickle down and some stuff that we can share with the students to help them become more aware. Actually one thing that we have in the café area is that you can receive 20cents off your coffee if you bring your own mug. So there’s some little things like that we’re starting to do, so that student will be able to see. And then the campus as a whole, I really do think that sustainability in general will become bigger and bigger of an issue that students are concerned about and get passionate about. So hopefully this is just another piece of that. Because we do have another LEED building on campus. It’s not a hall it’s an engineering building, and they definitely have been promoting that. And most students have heard the term because of that. We hope that this will be another way to educate.

MV: Well I really hope that works well. And that’s really it for my questions. Did you have anything else that you wanted to add?

BS: Not that I can think of.
APPENDIX C

TRANSCRIBED INTERVIEW FROM FLORIDA STATE UNIVERSITY
Interview with Larry Rubin
Director of Facility Management at Florida State University
February 22, 2008

Michelle VanderDoes: For interview purposes could you please state your name and position within the university.

Lawrence Rubin: Well, I am Lawrence Rubin, I’m the Director of Facilities in Facilities Design and Construction at Florida State University and I oversee all of the design and construction on campus.

MV: With the Life Science building have you achieved the LEED certification yet, or do you plan to receive it?

LR: Yes, we plan to achieve it at the end of the project, we are just finishing construction right now. So we are compiling all of the paperwork of all of the things that we’ve done during design and construction and we will submit it when we’re ready.

MV: What your role in the planning, building or oversight of the Life Science building?

LR: Well the Life Science project is a very complicated science building for basic sciences, biology buildings. I helped through the design and the construction process with my project manager, worked with the design team and the construction team to resolve issues to try to find what it would take during that time to make this a LEED project. And we didn’t start out initially with that goal, because this project has been going on for a long time. But what we found out was our guidelines were strong enough throughout campus that we were ¾ of the way to certification on any of our projects, anyway. So we were designing fairly well constructed energy efficient buildings before LEED even became. So our challenge was how do we get from there through the LEED process, to get those few extra points to make them certified. And that’s what we’ve been doing, not only with Life Science, but all of our projects.
MV: When did the actual construction process of the Life Science Building start?

LR: We started in December of 06 on Life Sciences.

MV: And how long do you expect the entire process to take, or rather when do you expect to finish?

LR: February of 08, this month we should finish. We’re punching it out; they’re putting in the site work. Cleaning. Going through one of the big things with LEED, which is commissioning, and that’s what we’re starting to do now is to commission the building.

MV: Well what specific features including materials, if that’s the case, were used to gain LEED points?

LR: Well, some of the things we’ve done, there’s exterior campus points that you get, for being on bus routes, being part of a chilled water loop, bike parking, pedestrian ways, day-lighting, those kind of things, which we started to get. In addition to the specific project, which are some of the finishes, low VOC finishes, carpet, paints. We had a real challenge with the lighting because laboratory lighting and general lighting are very specific and sometimes there were conflicts in what the scientists wanted. For instance, in some of the administration areas we put in the photo-cell so when you’re not in the room the lights will turn off. But they can’t have that in the laboratory because if you’re working on something and the lights click off you could be in big trouble. So that was a compromise, to put it in some of the area’s that were less critical. So we have energy efficient lights, balance switches, automatic switches on some, we have energy efficient mechanical systems and low flow water fixtures. So those are things, features, that we normally put in our buildings.

MV: Were there any other sustainable design considerations that were used that did not lead to LEED points?
LR: Well, I don’t know, I’d have to think about what we did that we didn’t get points for, I’m sure there’s a few I don’t know off the top of my head what they may be. During construction, we did the things that the contractor has to do to separate recyclables. Since it was a new building we didn’t do much recycling, and we didn’t reuse many things, but on renovation projects we do.

MV: With this project where there things you wanted to do that you couldn’t do?

LR: Well, we probably would have liked to have gone for a silver certification for this building, but we couldn’t get some of the laboratories… it would have been nice had we been able to get the laboratories to be a little bit more energy efficient. But laboratories are on their own. So I think that would be just it, just a little bit more energy efficiency through out the process.

MV: Did any problems arise during construction in relation to the sustainability factors? And if so how did you solve them?

LR: Well, really by the time we started construction we had this goal to do this building, it wasn’t really in the planning stages, so we had to adjust some of the design things to meet LEED. Through out the process though, we really didn’t. We got the design team on board to make the adjustments, and construction team to make the adjustments that were not wide spread, or incredibly complicated to achieve. And then we had a third party commissioning team, which is a third party engineer, and they started looking at the shop drawings because the real challenge on these projects…you know it’s one thing to do the shell, but the real money can be lost in the mechanical, electrical and plumbing designs. So that’s really where the energy consumption takes place. So we had that third party look close at those kind of things and tweak them. And now that it’s installed their coming back and checking to make sure everything’s working properly. And so that’s where a lot of money can be lost too, is if something is put in backwards and you don’t detect it, then it’s using more energy.
MV: Are there things that are unique that maintenance staff must know to properly care for the building? For example, specific cleaning products?

LR: Yes, in fact, we’re just a part of the process. Design and construction, we build it to a certain point, and then we turn it over, to the scientists to use, to maintenance to maintain, and to building services to clean and do landscaping. So, what we try to do is in our plans and specs, is to incorporate those things, knowing that we have to hand it off. And so the products that we put in, we want the maintenance folks to be able to change the right filters, to those standards, and the cleaning folks are using sustainable or greener types of cleaning products, in the carpet cleaning, the tile cleaning. So their doing their part which is way beyond what we do. It will last a lot longer, because we’ll have it for two years or three years, they have it for the next thirty.

MV: Right, well some of the things I’ve heard is that is part of the controversy with LEED, because it only goes so far. Only with the actual construction of the building.

LR: Well, we’re trying to do “Facilities Sustainable” so when you start with the planning and the master planning and the utilities and utility loops and then we take it and do our part and then we turn it over so they can continue. One thing I didn’t talk about was the recycling centers within the building. That’s part of it, is to have that when they pick up the trash. They get people used to turning off lights, used to turning things off, or used to recycling and separating their own trash and having a collection spot for it. So those are features that that building has.

MV: The next few questions I have focus on the motivations, attitudes and reactions toward the building. So, the first question I have is what was the primary motivation to build a LEED certified building?

LR: Well, there are a couple of them. First of all in facilities we felt it was the right thing to do. It’s the right thing to conserve resources and to build environmentally friendly facilities. But, the other part of it is, there’s a little bit of a political motivation, because
it’s a nice thing to say you have LEED buildings. One thought we were talking about was saying well hey we can do a LEED equivalent building, because we’re doing all of those things anyway. And we figure, well let’s take a few of them through the official documented process and let’s see how it goes. You know, it’s the right thing to do, the politicians and the administrators will all be happy that we’re doing this, and then we can tell the students, you know interior design students, that we’re a university, we’re leading the way, and we need to be leaders in the industry, so other people can follow what we do, because it’s the right thing to do.

MV: That’s actually what made me want to go this direction with my thesis. Because of that idea that the university is an area for learning...

LR: and ideas and promoting those kind of thoughts, and good ideas and that’s what we’re trying to do.

MV: Then along those lines, is there an overall sustainable policy at the university?

LR: Well, not yet. I think right now there’s a grass roots campaign going on. And I got a call from a women in oceanography and they wanted to know what they could do to help. So I know there are some folks who are working on some initiative through either civic education, or through their departments, doing what they can do to recycle, to turn lights off, or to talk to our energy department. So I think what’s happening is, right now everybody is kind of wanting to do it, and I think if we had any leadership up above, and had a couple of positions who could lead a university effort and everybody does their part, I think it would really take part. And I think it’s happened at other universities where people really wanted to do it.

MV: I believe that at University of Florida it was the president’s wife that really took the initiative and started the movement there.
LR: She did it. And when they started, I happened to talk to her about that very thing; she said it kind of fell into her lap. But when she started it, and got a couple of positions, it exploded. Because everyone was doing kind of what were doing now, they started and with a little bit of leadership at the upper level, it could really take hold. And we could be leaders as well.

MV: It’s actually funny that you mention that, because myself and two other students that were in one of my graduate classes, were given a project where we had to take something in our building and improve it, and I realized that we didn’t have a recycling program. Which I found so odd, because our program, which preaches sustainability at every turn, didn’t even have recycling. So we made bins and started a recycling “program”. We were told to keep the project up for two weeks, but that was last semester and the bins are still being filled to the top every week. It’s become permanent.

LR: Good. And that’s a requirement too, is to have those centers on campus, and then we work with the centers that come and pick them up.

MV: Ya, it was actually easier then I though it was going to be to get them to agree to come to the Johnston building. But moving onto my next question: what do you see as the advantages to creating LEED certified buildings on university campuses? I know you’ve already talked about this slightly...

LR: Well, as a university should be cutting edge and leading the way, I think that’s the big thing, it’s the right thing to do, and universities should lead by example. And I think by us doing it, we’re showing that we can do it on sometimes complicated projects, that it can be done. And we’re trying to do it on some tricky renovation projects. And sometimes it’s even a bigger challenge for us since we have a historical campus, you don’t want to pluck down, really some of the gold certified buildings look like space ships because they’re more engineering oriented. Well we’re not quite ready for that. Now at Innovation Park, we can go a little more high tech with water systems and some
of the collection devices, and some of the unfinished concrete. But right now we’re trying to do both. Get them certified and keep the historic feel, and life sciences does do that.

MV: I’ve seen construction process of the building and the final product is really turning out to blend well with the other buildings on campus. But going into the next question, do you see any major obstacles to creating LEED certified buildings on university campuses?

LR: I really don’t, as long as the funding we receive for these projects can accommodate the programmatic needs of the user group and meet the needs of the university as well, fit in our guidelines, and are energy efficient. I don’t see that there are any major obstacles and that’s what our job is, to try and do it all.

MV: Has there been or will there be a post occupancy evaluation of the building?

LR: Well we won’t do a POE until probably 6 months after we move in, and that’s part of it too, is to go back. And we do that anyway. But, that’s just part of what we do, we go back within the first year and go through everything and check it while it’s still under warranty. And we’ll probably do that at 6 months with this building. Which will be sometime in the fall of this year.

MV: And what’s the general reaction of this building, I know it’s a little preemptive since it hasn’t finished yet. But what’s the general reaction with the administration and the public, maybe with the PR element, since you are bringing LEED to FSU.

LR: Well, I haven’t heard anything negative at all regarding it. I think the community, when we had our green conference here in October, they were thrilled that the university was doing it. The faculty are thrilled, because the faculty are generally creative cutting edge kind of people, who want to learn, and they love the space and the facility, and it’s kind of a bonus that it’s going to be LEED certified. The administrators have been thrilled with this facility. And I will anticipate that the students will be, once they get in
and the students and researchers really start using it. We created some great “people spaces” too. The courtyards around the building. So one of the nicest parts of a university are the collaborative spaces within a building and exterior to the building. Where people can take a break, get out of what you’re doing or chat about something you’re working on, and those kind of spaces kind of knit the university together, and that separates us from other types of institutions. That quad of campus will be full of them. One of the coolest features of that building is we have a roof top plaza, it’s a green roof. So we put in plants that didn’t require irrigation, which is air escaping, put in indigenous plants, but we created it on the roof top to create a green roof plaza. And so that’s one of the cooler innovations that we’ve done. It’s on the cage wash area which will support life sciences, psychology and the med school. So subterranean all these buildings connect to it, but on the roof it’s a great people space.

MV: My final question is: Do you feel the building will impact the awareness of sustainability on campus? With the students, the faculty, the administration and the maintenance staff?

LR: I think that each time you do something along the line of sustainability you help get a little closer to it. And I think that the biggest thing on campus is just changing the mind set. So I think when people start to see that they’re being energy efficient, that light’s turn off, that there’s recycling. I think it really just catches on and people want to help. It’s like have you ever driven a Prius?

MV: No but I’ve been in one.

LR: Well I drove one the other day, and the way the gauges are you can see what your consumption is. So while you’re driving it you want to be lighter on the gas because you want to get more. And so I hope we can do those kind of things in these buildings where people want to do more.

MV: Thank you again for your time I really do greatly appreciate it.
Transcribed interview with Bahar Armaghani  
Assistant Director for Facility Planning and Construction and LEED coordinator for University of Florida  
April 14, 2008

Michelle VanderDoes: Could you please state your name and position within the university?

Bahar Armaghani: Yes, my name is Bahar Armaghani and I am Assistant Director for Facility Planning and Construction and LEED coordinator for all of our projects.

MV: What was your role in the planning, building, or oversight of the Library?

BA: Well, I’m usually involved with LEED for all the projects, so in terms of LEED I got involved from the very beginning. Then half way during construction I became the project manager, because the project manager left and I took over. But in terms of LEED I was involved from the first meeting with design and construction.

MV: And I noticed you’re LEED accredited correct?

BA: Uh huh.

MV: Which accreditation process did you go through, there are three different ones correct?

BA: Yes, there are three, the LEED CI, NC, and EB. But anyone of them you take you can be LEED accredited professional for any project. I did mine with the NC.

MV: How long did the entire construction process take?

BA: Oh, gosh, it’s about three years.
MV: OK, and what specific features, including materials did you include that led to LEED points?

BA: Well, first we looked at it not to get points, we just looked at it to make it energy efficient, friendly, comfortable place to study and to work. And with that the points just feel into place. When you look at a LEED building, when you’re walking through, the first thing you want to do is do the right thing, and then once you do the right thing for the environment and for the people, then actually the points come with it. So, we knew we wanted to do a green building, and we knew that the library is a really important place to look at it and see how to make it energy efficient, because libraries are designed differently then classroom buildings and office buildings, and anything else, because of the humidity and temperature control because of the archives and books and everything else there. So we just tried to do the right thing, make sure we’re making more open space, bringing the outside in to introduce a lot day-lighting, a lot of view. And with the materials, using materials that doesn’t have any negative impact on the environment and the people that are going to be occupying that building, both the students and the staff.

MV: My next question you already answered so I’ll skip that, was there anything that you wanted to do but couldn’t? In terms of design, construction, or materials?

BA: mmm. Well, we got Gold certified so we did a lot of things, but we could have designed it to be more energy efficient, but at that time, I don’t know, some of the ways of thinking or methods of saving more energy, they were not out there, and readily available or cost effective to do it, so maybe that was one of the things, but we could have done much better in saving energy.

MV: Ok, well did any problems arise during construction in relation to the sustainability factors?

BA: No, when we did this building, we were over the learning curve of doing green buildings, because we’ve been doing them since 2000. At this time, and even when we
started building that building, the materials were more readily available. And because of the supply and demand, more people wanted it, especially us, we started doing that early on, and then people started providing those materials. Maybe not back in 2000, but for this project I never heard of any problems to get any materials.

MV: Are there things that are unique that maintenance staff must know to properly care for the building? Specifically cleaning products?

BA: Definitely. I think the important thing with LEED projects too, is at the end of construction, after completion, as part of the commissioning we do training for all of our maintenance to show them all of the systems and equipment that needs to be taken care of, and we actually even video tape that training and give it to the maintenance office, they take care of the building, because you know people come and go, and the tape is there so people will know how to do it. And that includes the control systems, mechanical systems, the lighting control systems, that’s involved with most of the LEED projects, and of course like you mentioned, green cleaning products, what you use for the floors, for the glass and everything else, what you’re going to need to be doing. So yes we did that and I think it’s working well at this time.

MV: The next few questions I’m going to ask are going to be directed toward the motivations and attitudes toward the building. The first is what was the primary motivation to build a LEED certified building?

BA: Because, we want to do the right thing. I think we are a huge organization, we have a big footprint on the environment. And we are trying to minimize that foot print that we have, minimize that impact that our footprint has on the environment. We consume a lot of energy and we’re trying to see what we can do to minimize that. And then reduce our negative impact. And besides that we want to be proactive, we need to show examples to the students that come and go, who are going to be future consumer and conserver. How to do it, what needs to be done, and how we can do it. And just show them, and they can
take something away from here, when they leave, they make the difference, we know for sure they will.

MV: That’s exactly the direction I’m trying to go with my thesis is putting sustainability toward university buildings and how it can impact future generations.

BA: Exactly, and then besides that universities are an educational institutional in the community, and people look at us for leadership, and what we’re doing and how we’re doing it. We want to do that and take that leadership, and to be the first ones doing it, and walking the talk, you know?

MV: That’s great, because that’s definitely my thesis, and to hear it from someone else, a professional actually doing it, it’s nice to hear I’m on the right track. And then obviously, this has been answered, but you have an overall sustainability policy on campus correct?
BA: Uh huh.
MV: And is it a requirement for all future buildings on campus to become LEED?

BA: Back in 2000, we started our first LEED building, and in 2001 we adopted LEED for all of our major construction, any construction over $1 million dollars. And then we started to do a lot of buildings, and we found out, we can do basic certification with not much effort, really, because we were already doing the right thing, a lot of things that we used to do to be green and to be proactive about the environment we knew to do it. So, in January 2006 we raised the bar so that any building we do, it has to be minimum Silver certified.

And that’s what we’re kind of going through now. There are a bunch of projects in the pipe and under construction, it takes a couple years and construction after it’s finished, so we will see the next generation, minimum silver, are going to be coming through in the next 6 months or so to be finished or completed.
MV: Well, what do you see as the advantages to creating LEED certified buildings on university campuses? And then if you wanted to answer it together, do you see any major obstacles to creating LEED certified buildings on university campuses?

BA: I think we said about why we wanted to do it, because we want to save energy, we want to lead, we want to educate, we want to be proactive developers, and we want to minimize our impact and footprint on the environment. These are the things. But then have we seen any obstacles? No. And I think we were lucky from the beginning because a lot times things happen in changing the culture of doing something new, it’s kind of difficult a lot of times, but for us it was easy because we had support from the “top”. And when you have support from the top it makes things much easier. We still sometimes hear or see some obstacles from the maintenance when they don’t want to do something new. Like we did a green roof and then everyone said “we don’t want to do a green roof because it doesn’t work, it’s going to leak” they had some concerns about it because they haven’t seen it, but then we did one, and nothing has happened. People kind of warm up to the idea once you prove to them and show them, “hey it works”. But as of major obstacles, no we did not have anything. Because, the students were very good and the faculty that was involved was very proactive, and they wanted to do. And just like you, I get a dozen calls from people that want to get involved. And another thing that we do that helps the students and faculty is that we use our projects like a lavatory for them, so students that are in intro design, building construction, engineering, and architecture, they come and work with me. But then at the same time they learn what we’ve done, they sit through the project meetings and see how things are conducted, they come to the job site and see how things get done. So we’re using it as another vehicle to communicate and educate the students about that. And also the students, some of them, are already getting ready to take their LEED AP exam to become LEED accredited before they leave. And usually I get calls and emails from students saying “I got this great job because I learned these things from you guys and then I took my exam, and I was exposed to it”. Because the market, that’s where it’s going. So you have to prepare students who are interested, so they have a leg up on other students.
MV: Have you had a post occupancy evaluation on the building yet?

BA: We are in the process of optimization of all of our utilities to come into a data base and compare it with how the building was supposed to be performing. So when you design a LEED building you do an energy model until you get to a point when you say “ok this how much I want this building to be efficient” and then based on that the model is going to tell “when this building is completed it should consume this much water, this much power, and so on, and that’s going to be your best line. So when the building is occupied and completed then the monthly billing which you generate, which we have meters in every building for every utility, and we read all of these meters on a monthly bases and we try and compare that rating with the energy model that we did. And the first 9 months, after you go a couple of seasons, hot and cold and go back and tweak all of the things after the building is occupied, then that becomes the baseline from then on. But we monitor it in terms of the utilities that’s consumed on a monthly bases with the baseline that we generated after the building is occupied from the energy model. We have monitored Rinker Hall which is another gold certified building on campus. But that is classrooms and offices, not a library and we compared it with another exact building function, and very close square footage, it’s very difficult on one campus to find the exact same building, so we found another building on campus that was similar to Rinker Hall and we found about 37% savings, in terms of energy savings.

BA: We have been monitoring it in terms of utilities, so for example with the water we’re getting about 97% savings. Because we’re using reclaimed water for all the irrigations, we’re doing warm water harvesting; we have a cistern that we’re using, so we use that water for flushing toilets. We have waterless urinals, sensor faucets and things like that, so that water consumption is very low if you look at all these aspects of measurements that you’re doing in the building to save water.

MV: And then what was been the general reaction of the building from others, for example, the students, faculty, administration, and the public?
BA: I think it’s been really good and positive. I mean you see all those plaques there.. (numerous LEED plaques are in the room and in the hallway).

MV: I noticed them all when I came in, it’s quite impressive how many you have just in your office.

BA: Once we finish the building we do a case study. We go from A-Z on what we did for the project. And all the project team members get involved with that. And we invite people on campus, and the community. And tell them how to do a green building, and show them lessons that we learned, and the pitfalls they should avoid, because that’s the only way you educate people is to show them, and make it easy on them. So when we do the test study it helps out really how you show people what you do with green building, how to build a green building. And we’re doing some coming up on the 22nd, and one on the 8th, so we have a couple more coming up. And I think I lost track of the question..

MV: Oh, the general reaction of the building…

BA: Yeah, and that’s when the people come and we give tours of the building. So for example a group of people come and want to tour the building and we arrange that. We have templates for each building, what credit we went for and then when we go though we point out the things that we did and how we did them. And Green buildings draw a lot of positive reaction, because of day-lighting and view that plays a big role, and peoples moral, attitudes, demeanor, productivity, all of those things.

MV: And then kind of along the same lines has it impacted the awareness of sustainability on campus, have more students tried to participate?

BA: Yeah, I think it has. Sometimes I even get people from school of architecture saying they want to do a small barn, can we make it “green”. And I say OK, but it doesn’t really apply because they really don’t have air conditioning and things like that, but you can still do the right thing. Really, you don’t have to go get LEED certified as long as you
know in your heart you’ve done the right thing for the environment and for the people. And that’s what really counts. So yes it has actually, and not only that but for us it has actually gotten us some PR nationally, internationally.

MV: I have heard from numerous sources that UF really is leading the way when it comes to sustainable design

BA: When we started, no one even thought.. I was one of the first three, in the state of Florida to get my LEED AP, and we were the first one to say “we have to do it”. And even after we had 8 or 9 projects a lot of people didn’t even know what LEED was. So we started really early, and it has really given us a good advantage in way of leading the movement. And I think it’s important to do that with the students and being in education, I think it’s our job. So now what we’re doing… and this is for new construction and major renovations, you know we have more existing buildings then new buildings, so last year just started to do a new portfolio program for existing buildings, on how to make them green. Because, you know, old buildings were built with old codes, old equipment, old materials, so their not as efficient, so we’re looking at how to actually make them green. And we have about 32 existing buildings that I’m working on to make green.

MV: That’s really great. Well, that’s all the questions I have, but was there anything else that you wanted to add?

BA: No I think there’s so much information, that if you need any other specific information, once you get into writing, I would be happy to provide.

MV: Well, thank you so much, this has been extremely helpful…
APPENDIX E

OREGON STATE UNIVERSITY: WEATHERFORD HALL
ACHIEVED LEED CREDIT SHEET
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30
APPENDIX F

UNIVERSITY OF FLORIDA: LIBRARY WEST
ACHIEVED LEED CREDIT SHEET
**LEED for New Construction v2.1**

**Registered Project Checklist**

**Project Name:** Library West Additions & Renovations  
**Project Address:** University of Florida

### Sustainable Sites

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<td>Credit 3.1</td>
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### Energy & Atmosphere

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<td>CFC Reduction in HVAC&amp;R Equipment</td>
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### Materials & Resources 13 Points

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<th>Description</th>
<th>Points</th>
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<tbody>
<tr>
<td>1.1</td>
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<td><strong>Building Reuse</strong>, Maintain 100% of Shell</td>
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<td>1.3</td>
<td><strong>Building Reuse</strong>, Maintain 100% Shell &amp; 50% Non-Shell</td>
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<td>2.1</td>
<td><strong>Construction Waste Management</strong>, Divert 50%</td>
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<td>2.2</td>
<td><strong>Construction Waste Management</strong>, Divert 75%</td>
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<td><strong>Resource Reuse</strong>, Specify 5%</td>
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<td><strong>Resource Reuse</strong>, Specify 10%</td>
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<td><strong>Recycled Content</strong>, Specify 5% (post-consumer + ½ post-industrial)</td>
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<td><strong>Recycled Content</strong>, Specify 10% (post-consumer + ½ post-industrial)</td>
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<td><strong>Local/Regional Materials</strong>, 20% Manufactured Locally</td>
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<td><strong>Local/Regional Materials</strong>, of 20% Above, 50% Harvested Locally</td>
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<td>6</td>
<td><strong>Rapidly Renewable Materials</strong></td>
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### Indoor Environmental Quality 15 Points

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<th>Description</th>
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<tr>
<td>1.1</td>
<td><strong>Minimum IAQ Performance</strong></td>
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<td>2.1</td>
<td><strong>Environmental Tobacco Smoke (ETS) Control</strong></td>
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<td>3.1</td>
<td><strong>Construction IAQ Management Plan</strong>, During Construction</td>
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<td>3.2</td>
<td><strong>Construction IAQ Management Plan</strong>, Before Occupancy</td>
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<td>4.1</td>
<td><strong>Low-Emitting Materials</strong>, Adhesives &amp; Sealants</td>
<td>1</td>
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<td>4.2</td>
<td><strong>Low-Emitting Materials</strong>, Paints</td>
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<td>4.3</td>
<td><strong>Low-Emitting Materials</strong>, Carpet</td>
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<td>4.4</td>
<td><strong>Low-Emitting Materials</strong>, Composite Wood &amp; Agrifiber</td>
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<td><strong>Indoor Chemical &amp; Pollutant Source Control</strong></td>
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<td>6.1</td>
<td><strong>Controllability of Systems</strong>, Perimeter</td>
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<td><strong>Controllability of Systems</strong>, Non-Perimeter</td>
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<td>7.1</td>
<td><strong>Thermal Comfort</strong>, Comply with ASHRAE 55-1992</td>
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<tr>
<td>7.2</td>
<td><strong>Thermal Comfort</strong>, Permanent Monitoring System</td>
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<td>8.1</td>
<td><strong>Daylight &amp; Views</strong>, Daylight 75% of Spaces</td>
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<td>8.2</td>
<td><strong>Daylight &amp; Views</strong>, Views for 90% of Spaces</td>
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### Innovation & Design Process 5 Points

<table>
<thead>
<tr>
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<th>Description</th>
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<tbody>
<tr>
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<td>1.2</td>
<td><strong>Innovation in Design</strong>: Provide Specific Title</td>
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<td><strong>Innovation in Design</strong>: Provide Specific Title</td>
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### Project Totals (pre-certification estimates) 69 Points

- **Certified**: 26-32 points, **Silver**: 33-38 points, **Gold**: 39-51 points, **Platinum**: 52-69 points
# LEED for New Construction v2.2
## Registered Project Checklist

### Sustainable Sites

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
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<tbody>
<tr>
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<td>Construction Activity Pollution Prevention</td>
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<tr>
<td>2</td>
<td>Site Selection</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Development Density &amp; Community Connectivity</td>
<td>1</td>
</tr>
<tr>
<td>4.1</td>
<td>Brownfield Redevelopment</td>
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</tr>
<tr>
<td>4.2</td>
<td>Alternative Transportation, Public Transportation Access</td>
<td>1</td>
</tr>
<tr>
<td>4.3</td>
<td>Alternative Transportation, Bicycle Storage &amp; Changing Rooms</td>
<td>1</td>
</tr>
<tr>
<td>4.4</td>
<td>Alternative Transportation, Parking Capacity</td>
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</tr>
<tr>
<td>5.1</td>
<td>Site Development, Protect or Restore Habitat</td>
<td>1</td>
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<td>Site Development, Maximize Open Space</td>
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<td>Stormwater Design, Quantity Control</td>
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<td>6.2</td>
<td>Stormwater Design, Quality Control</td>
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<td>Heat Island Effect, Non-Roof</td>
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<td>Heat Island Effect, Roof</td>
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### Water Efficiency

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<td>1.1</td>
<td>Water Efficient Landscaping, Reduce by 50%</td>
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<td>Water Efficient Landscaping, No Potable Use or No Irrigation</td>
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<td>2</td>
<td>Innovative Wastewater Technologies</td>
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<td>3.1</td>
<td>Water Use Reduction, 20% Reduction</td>
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<td>Water Use Reduction, 30% Reduction</td>
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### Energy & Atmosphere

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<td>Minimum Energy Performance</td>
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<tr>
<td>3</td>
<td>Fundamental Refrigerant Management</td>
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*Note for EA1c: All LEED for New Construction projects registered after June 26th, 2007 are required to achieve at least two (2) points under EA1c.*

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<th>Description</th>
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<td>31.5% New Buildings or 24.5% Existing Building Renovations</td>
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<td>38.5% New Buildings or 31.5% Existing Building Renovations</td>
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<td>42% New Buildings or 35% Existing Building Renovations</td>
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### Materials & Resources 13 Points

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<th>Credit</th>
<th>Description</th>
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<tbody>
<tr>
<td>1.1</td>
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<td>1.3</td>
<td>Building Reuse, Maintain 50% of Interior Non-Structural Elements</td>
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<td>2.1</td>
<td>Construction Waste Management, Divert 50% from Disposal</td>
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<tr>
<td>2.2</td>
<td>Construction Waste Management, Divert 75% from Disposal</td>
</tr>
<tr>
<td>3.1</td>
<td>Materials Reuse, 5%</td>
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<td>Materials Reuse, 10%</td>
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<tr>
<td>4.1</td>
<td>Recycled Content, 10% (post-consumer + ½ pre-consumer)</td>
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<tr>
<td>4.2</td>
<td>Recycled Content, 20% (post-consumer + ½ pre-consumer)</td>
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<td>5.1</td>
<td>Regional Materials, 10% Extracted, Processed &amp; Manufactured Region</td>
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<td>Regional Materials, 20% Extracted, Processed &amp; Manufactured Region</td>
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<td>Rapidly Renewable Materials</td>
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<tr>
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### Indoor Environmental Quality 15 Points

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<tr>
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<tbody>
<tr>
<td>1</td>
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<td>Increased Ventilation</td>
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<td>Construction IAQ Management Plan, During Construction</td>
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<td>3.2</td>
<td>Construction IAQ Management Plan, Before Occupancy</td>
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<td>4.1</td>
<td>Low-Emitting Materials, Adhesives &amp; Sealants</td>
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<td>4.2</td>
<td>Low-Emitting Materials, Paints &amp; Coatings</td>
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<td>4.3</td>
<td>Low-Emitting Materials, Carpet Systems</td>
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<td>4.4</td>
<td>Low-Emitting Materials, Composite Wood &amp; Agrifiber Products</td>
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<td>Indoor Chemical &amp; Pollutant Source Control</td>
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<td>6.1</td>
<td>Controllability of Systems, Lighting</td>
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<td>6.2</td>
<td>Controllability of Systems, Thermal Comfort</td>
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<td>Thermal Comfort, Verification</td>
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<td>8.1</td>
<td>Daylight &amp; Views, Daylight 75% of Spaces</td>
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<td>Daylight &amp; Views, Views for 90% of Spaces</td>
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### Innovation & Design Process 5 Points

<table>
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<tr>
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<th>Description</th>
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### Project Totals (pre-certification estimates) 69 Points

LEED for Commercial Interiors v2.0
Registered Project Checklist

Project Name:
Project Address:

### Sustainable Sites

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<th>Credit</th>
<th>Description</th>
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<td>OR Locate the tenant space in a building with following characteristics:</td>
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<tr>
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<td>Option 1B</td>
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<td>Option 1C</td>
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### Water Efficiency

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### Energy & Atmosphere

<table>
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<th>Credit</th>
<th>Description</th>
<th>Points</th>
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<td>Credit 1.1</td>
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<td>Option A: Reduce lighting power density to 15% below the standard</td>
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<td>Option C: Reduce lighting power density to 35% below the standard</td>
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<tr>
<td>Credit 1.2</td>
<td>Optimize Energy Performance - Lighting Controls</td>
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<td>Credit 1.3</td>
<td>Optimize Energy Performance - HVAC</td>
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</tr>
<tr>
<td></td>
<td>Option A: Equipment Efficiency and Zoning &amp; Controls</td>
<td>1 to 2</td>
</tr>
<tr>
<td></td>
<td>Option B: Reduce Design Energy Cost</td>
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</tr>
<tr>
<td>Credit 1.4</td>
<td>Optimize Energy Performance - Equipment and Appliances</td>
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</tr>
<tr>
<td></td>
<td>70% of ENERGY STAR eligible equipment is ENERGY STAR rated</td>
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</tr>
<tr>
<td></td>
<td>90% of ENERGY STAR eligible equipment is ENERGY STAR rated</td>
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<tr>
<td>Credit 2</td>
<td>Enhanced Commissioning</td>
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<tr>
<td>Credit 3</td>
<td>Energy Use, Measurement &amp; Payment Accountability</td>
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</tr>
<tr>
<td></td>
<td>Case A: Projects with area less than 75% of total building area</td>
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</tr>
<tr>
<td></td>
<td>Case B: Projects with area 75% or more of total building area</td>
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<tr>
<td>Credit 4</td>
<td>Green Power</td>
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### Materials & Resources 14 Points

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<table>
<thead>
<tr>
<th>Credit</th>
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<tbody>
<tr>
<td>1.1</td>
<td>Tenant Space, Long Term Commitment</td>
</tr>
<tr>
<td>1.2</td>
<td>Building Reuse, Maintain 40% of Interior Non-Structural Components</td>
</tr>
<tr>
<td>1.3</td>
<td>Building Reuse, Maintain 60% of Interior Non-Structural Components</td>
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<tr>
<td>2.1</td>
<td>Construction Waste Management, Divert 50% From Landfill</td>
</tr>
<tr>
<td>2.2</td>
<td>Construction Waste Management, Divert 75% From Landfill</td>
</tr>
<tr>
<td>3.1</td>
<td>Resource Reuse, 5%</td>
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<tr>
<td>3.2</td>
<td>Resource Reuse, 10%</td>
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<tr>
<td>3.3</td>
<td>Resource Reuse, 30% Furniture and Furnishings</td>
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<tr>
<td>4.1</td>
<td>Recycled Content, 10% (post-consumer + 1/2 pre-consumer)</td>
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<tr>
<td>4.2</td>
<td>Recycled Content, 20% (post-consumer + 1/2 pre-consumer)</td>
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<tr>
<td>5.1</td>
<td>Regional Materials, 20% Manufactured Regionally</td>
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<tr>
<td>5.2</td>
<td>Regional Materials, 10% Extracted and Manufactured Regionally</td>
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<tr>
<td>6</td>
<td>Rapidly Renewable Materials</td>
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<tr>
<td>7</td>
<td>Certified Wood</td>
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### Indoor Environmental Quality 17 Points

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<thead>
<tr>
<th>Credit</th>
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<tbody>
<tr>
<td>1</td>
<td>Minimum IAQ Performance</td>
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<td>2</td>
<td>Environmental Tobacco Smoke (ETS) Control</td>
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<tr>
<td>3.1</td>
<td>Construction IAQ Management Plan, During Construction</td>
</tr>
<tr>
<td>3.2</td>
<td>Construction IAQ Management Plan, Before Occupancy</td>
</tr>
<tr>
<td>4.1</td>
<td>Low-Emitting Materials, Adhesives and Sealants</td>
</tr>
<tr>
<td>4.2</td>
<td>Low-Emitting Materials, Paints and Coatings</td>
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<td>4.3</td>
<td>Low-Emitting Materials, Carpet Systems</td>
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<tr>
<td>4.4</td>
<td>Low-Emitting Materials, Composite Wood and Laminate Adhesives</td>
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<td>4.5</td>
<td>Low-Emitting Materials, Systems Furniture and Seating</td>
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<tr>
<td>5</td>
<td>Indoor Chemical and Pollutant Source Control</td>
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<tr>
<td>6.1</td>
<td>Controllability of Systems, Lighting</td>
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<tr>
<td>6.2</td>
<td>Controllability of Systems, Temperature and Ventilation</td>
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<tr>
<td>7.1</td>
<td>Thermal Comfort - Compliance</td>
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<tr>
<td>7.2</td>
<td>Thermal Comfort - Monitoring</td>
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<tr>
<td>8.1</td>
<td>Daylight &amp; Views - Daylight 75% of Spaces</td>
</tr>
<tr>
<td>8.2</td>
<td>Daylight &amp; Views - Daylight 90% of Spaces</td>
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<tr>
<td>8.3</td>
<td>Daylight &amp; Views - Views for 90% of Seated Spaces</td>
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### Innovation & Design Process 5 Points

<table>
<thead>
<tr>
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<th>No</th>
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<tbody>
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<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Innovation in Design: Provide Specific Title</td>
</tr>
<tr>
<td>1.2</td>
<td>Innovation in Design: Provide Specific Title</td>
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<tr>
<td>1.3</td>
<td>Innovation in Design: Provide Specific Title</td>
</tr>
<tr>
<td>1.4</td>
<td>Innovation in Design: Provide Specific Title</td>
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<tr>
<td>2</td>
<td>LEED™ Accredited Professional</td>
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### Project Totals (pre-certification estimates) 57 Points

Certified: 21 to 26 points, Silver: 27 to 31 points, Gold: 32 to 41 points, Platinum: 42 to 57 points
APPENDIX I

INFORMED CONSENT FORM (AUDIO RECORDING)
Informed Consent Form for Interview

I freely and voluntarily and without element of force or coercion, consent to participate in the research project entitled, “Advantages and Obstacles to University’s Creating Sustainable Buildings.”

This research project is being conducted by Michelle VanderDoes, a graduate student at Florida State University. I understand the purpose of her research is to explore sustainable design in university buildings with attention to the design features as well as the motivation, advantages and challenges of these practices. The findings of this study will further the knowledge of the interior design profession regarding sustainable design in university settings. I understand that if I participate in this study, I will be asked questions about the University’s sustainable building in question and feelings toward that place. The interview will assist Michelle VanderDoes in accurately recording information on the advantages and obstacles of sustainable university buildings.

I understand if I agree to an interview with Michelle VanderDoes it will take about 45 minutes. I also understand that, if interviewed, I will be audio-taped. These audiotapes will be used by Michelle VanderDoes only, stored in her office, and destroyed upon completion of the project, July 30, 2008

I understand that my participation is totally voluntary and I may stop participation at any time. All my answers to the questions will be kept confidential to extent allowed by law. Although quotes from my interview may be reported in the research, my name, or any other identifying characteristics, will not appear on any of the results.

I understand that I may contact Michelle VanderDoes at 407-902-5931 mdv03c@fsu.edu, or her directing professor, Lisa Waxman at lwaxman@fsu.edu for answers to questions about this research or my rights. If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the FSU IRB at 2010 Levy Street, Research Building B, Suite 276, Tallahassee, FL 32306-2742, or 850-644-8633, or by email at jjccoper@fsu.edu.

I have read and understand this consent form.

Subject _______________________________ Date _______________

Witness
APPENDIX J

FSU CONSENT FORM
FSU Consent Form

Advantages and Challenges to University Buildings Creating Sustainable Buildings

You are invited to be in a research study of Advantages and Challenges to University Buildings Creating Sustainable Buildings. You were selected as a possible participant because of the position you hold within the university. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Michelle VanderDoes, FSU Interior Design Grad Student.

Background Information:

The purpose of this study is to explore sustainable design in university buildings with attention to the design features as well as the motivation, advantages and challenges of these practices.

Procedures:

If you agree to be in this study, we would ask you to do the following things:

- Participate in an interview, which should last no more then an hour while being audio taped (with your approval).
- If possible provide the LEED certification point checklist that brought the building to LEED status.

Risks and benefits of being in the Study:

This study has no risk. The findings of this study will further the knowledge of the interior design profession regarding sustainable design in university settings. Participants will be emailed the web link to the completed thesis so they might benefit from the findings.

Confidentiality:

Approval to use the name of the university, the name of the building, and the job title of the interviewee will be requested for each of the participants. However if they do not wish for this information to be made public, the records of this study will be kept private and confidential to the extent permitted by law. The university name will be left out of the report and the name of the employee with be also be removed. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records and tape recordings will be stored securely.
Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

Contacts and Questions:

The researcher conducting this study is Michelle VanderDoes. You may ask any question you have now. If you have a question later, you are encouraged to contact her at (407) 902-5931, mdv03c@fsu.edu. The researcher’s advisor is Lisa Waxman whom can be reached at lwaxman@fsu.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the FSU IRB at 2010 Levy Street, Research Building B, Suite 276, Tallahassee, FL 32306-2742, or 850-644-8633, or by email at jjccoper@fsu.edu.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

_________________________  ______________________
Signature                                          Date

_________________________  ______________________
Signature of Investigator                    Date
REFERENCES


BIOGRAPHICAL SKETCH

Michelle VanderDoes was born in Torrance, CA in 1985. She graduated from Florida State University in the spring of 2007 with her Bachelors of Science degree in Interior Design with a minor in Psychology and Art History. Directly following, she started the Florida State University Interior Design Masters program, and she will graduate with a Masters of Science degree in the summer of 2008. She plans on pursuing a career and becoming licensed in the Interior Design profession.