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The LEED Guidelines:
A Framework for the Development of Green Buildings and Sites

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The LEED Guidelines:
A Framework for the Development of Green Buildings and Sites

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Abstract

A future with a diminishing supply of nonrenewable resources is raising concerns in every aspect of our lives. The phrase 'sustainable' or 'green' development is being used to describe a wide variety of issues that take these concerns into consideration during the planning, design, and implementation process. In an effort to increase the number of green buildings developed throughout the country the United States Green Building Council (USGBC) established the Leadership in Energy and Environmental Design (LEED) Guidelines. The guidelines are a framework which assists members of a development team to quantify whether or not a project is in fact 'green' or 'sustainable'. The guidelines provide a step by step approach within several categories associated with green development. The goals of this paper will be to explore how the guidelines have already been implemented on a city level in an effort to encourage the development of green buildings. Along with an understanding of how the guidelines have been used to promote green development, there will be a discussion of what the potential benefits of green development would be if implemented on a county level and why such practices have not already occurred.

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Chapter 1: Problem Statement

A future with a diminishing supply of nonrenewable resources is raising concerns in every aspect of our lives. The phrase 'sustainable' or 'green' development is being used to describe a wide variety of issues that take these concerns into consideration during the planning, design, and implementation process. One area of concern is in the construction and use of buildings and their related sites. Buildings account for over 50 percent of the energy used in the U.S. and slightly less than fifty percent in the rest of the world (Hammel 2001). To reduce this number it is necessary to conceive better practices and building designs that use fewer resources and create truly sustainable development projects.

Reducing the demand on energy sources, natural resources, while creating better indoor environments are the goals of green building. Green buildings have been in existence for several decades, but have found new support in recent years. This support is seen in both the public and private sectors due to the numerous benefits which include increased worker productivity and reduced energy bills.

In an effort to increase the number of green buildings developed throughout the country the United States Green Building Council (USGBC) established the Leadership in Energy and Environmental Design (LEED) Guidelines. The guidelines are a framework which assists members of a development team to quantify whether or not a project is in fact 'green' or 'sustainable'. The guidelines provide a step by step approach within several categories associated with green development.

The goals of this paper will be to explore how the guidelines have already been implemented on a city level in an effort to encourage the development of green

buildings. Along with an understanding of how the guidelines have been used to promote green development, there will be a discussion of what the potential benefits of green development would be if implemented on a county level and why such practices have not already occurred. With the knowledge gained from the "Data Collection" chapter, the "Findings and Recommendations" chapter will provide recommendations and analysis of how the guidelines could best be implemented in Hamilton County, Ohio.

Chapter 2: Review of Literature

The Literature Review is divided into four main subject headings: the LEED Guidelines, Green Design and Development, Benefits of Green Development, and Financing Green Development. These four subheadings provide a base of knowledge essential for understanding how the green development process takes place and its associated pitfalls.

1. LEED Guidelines

In recent years, to help determine if a building is in fact green, guidelines were created to provide interested parties with the means to quantify their achievements. These guidelines are known as the LEED (Leadership in Energy and Environmental Design) Guidelines, and were developed by the U.S. Green Building Council (USGBC), in cooperation with the U.S. Department of Energy, Energy Efficiency and Renewable Energy, to provide a framework for the development of energy efficient and environmentally sustainable commercial buildings and sites.

The USGBC was formed in 1993 as a nonprofit organization with the goal of promoting green building practices. In 1995 the USGBC under contract with the Energy Department composed the first rendition of the LEED Green Building Rating System. Since 1995, the rating system has evolved with version 2.0 currently available for use and version 2.1 under review. The guidelines are a continuously evolving document and are expected to become more stringent with future versions. The USGBC currently has over 2,800 members worldwide with new chapters continually forming.

The USGBC defines the goals of the LEED guidelines as follows:

- define "green building" by establishing a common standard of measurement
- promote integrated, whole-building design practices
- recognize environmental leadership in the building industry
- stimulate green competition
- raise consumer awareness of green building benefits
- transform the building market

The guidelines focus on every aspect of commercial building construction including: sustainable sites, water efficiency, energy and atmosphere, indoor and environmental quality, materials and resources, innovation, and design process (Leibowitz 2001, 24). The rating system looks at sixty-nine criteria in six separate categories associated with development of a commercial buildings awarding a point for each one that is accomplished. The overall score determines if a building is not certified, or is certified and given one of the following designations: Certified, Silver, Gold, or Platinum.

A minimum of 26 points is necessary for certification, with 52 or more points required to achieve the highest level, platinum certification. The main goal of the guidelines is to help city officials, developers, architects, engineers and contractors quantify the numerous aspects in the construction of a sustainable building.

2. LEED Credits

A. Sustainable Sites: 14 Possible Points.

Projects receive points in this section for taking advantage of in-fill and brownfield sites. These sites are important to providing a green development by not

using greenfields or other sensitive areas such as steep slopes and wetlands. Other points are available for reduced site disturbance, proximity to alternative transportation, reduced stormwater runoff, light pollution reduction, and the use of landscaping to reduce the urban heat island effect.

B. Water Efficiency: 5 Possible Points.

Points are available for water efficient landscaping, for example the use of collected rain water or recycled site water for irrigation. The use of native plants is also recommended to reduce the demand for water. Other points are awarded for the use of high-efficiency plumbing fixtures, and graywater for irrigation and the flushing of toilets.

C. Energy and Atmosphere: 17 Possible Points.

This section has the largest number of points available. Prerequisites for points include: commission buildings to assure building systems are properly engineered, satisfy minimum energy consumption criteria established by building codes and industry standards, and use no ozone-depleting, CFC-based refrigerants in any building equipment (Lewis 2001). After meeting the prerequisites, points are then given for reducing energy costs. Points increase based on the percentage of energy cost savings calculated using the Energy Cost Budget Method (ECBD). ECBD is a whole building method of determining energy consumption. It requires sophisticated hourly energy use analysis to show how the proposed building compares to a standard building of the same size and the amount of energy consumed.

This analysis can be demanding and can require a substantial amount of time and knowledge to complete.

http://www.dnr.state.la.us/SEC/EXECDIV/TECHASMT/programs/commercial/code.htm

Points are also available for using alternative energy sources such as wind, solar, and geothermal. It is required that these energy sources and all mechanical equipment can be monitored and adapted to meet demand. This monitoring allows fine-tuning to create a building that meets the needs of the users with the lowest demand on energy sources.

D. Materials and Resources: 13 Possible Points.

The prerequisite of this section are providing areas for storage and collection of recycled materials (Lewis 2001). Points in this section are available for the reuse of existing materials and structures, rapidly renewable materials like wool and linoleum, and the use of wood from properly managed forests. The recycled content of the building can also provide points based on the percentage of materials that are recycled. Points are also available for a plan that limits the amount of material that enters a landfill. Finally, the use of Local/Regional materials earns points, as this aids the local economy and reduces transportation energy.

E. Indoor Environmental Quality: 15 Possible Points.

Prerequisites of this category are to meet minimum standards for air quality set by building codes and to prevent exposure to tobacco smoke by non-smokers (Lewis 2001). Points are then available for increased air quality, day lighting, and

indoor comfort. Points are also given for the monitoring of air quality, prevention of contact with hazardous materials, and individual temperature control.

F. Innovation and Design Process: 5 Possible Points.

In this category bonus points can be received for new design achievements not yet included in the guidelines. These credits give the architects and engineer's flexibility to create innovative tools and techniques that can benefit green development. These innovation credits continuously push the boundaries of green development and provide techniques that increase the knowledge base in the field. These credits can include new computer modeling techniques, local environmental or site specific concerns.

The following is a list of available credits in each subcategory:

Sustainable Sites

Credit 1	Site Selection
Credit 2	Urban Redevelopment
Credit 3	Brownfield Redevelopment
Credit 4.1	Alternative Transportation, Public Transportation Access
Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms
Credit 4.3	Alternative Transportation, Alternative Fuel Refueling Stations
Credit 4.4	Alternative Transportation, Parking Capacity
Credit 5.1	Reduced Site Disturbance, Protect of Restore Open Space
Credit 5.2	Reduced Site Disturbance, Development Footprint
Credit 6.1	Stormwater Management, Rate of Quality
Credit 6.2	Stormwater Management, Treatment
Credit 7.1	Landscape and Exterior Design to Reduce Heat Islands, Nonroof
Credit 7.2	Landscape of Exterior Design to Reduce Heat Islands, Roof
Credit 8	Light Pollution Reduction

Water Efficiency

Credit 1.1	Water Efficient Landscaping, Reduced by 50%
Credit 1.2	Water Efficient Landscaping, No potable Use or Irrigation
Credit 2	Innovative Wastewater Technologies
Credit 3.1	Water Use Reduction, 20% Reduction
Credit 3.2	Water Use Reduction, 30 % Reduction

Energy & Atmosphere

Credit 1.1 Optimize Energy Performance, 20% New/10% Existing (2 Points)
Credit 1.2 Optimize Energy Performance, 30% New/20% Existing (2 Points)
Credit 1.3 Optimize Energy Performance, 40% New/ 30% Existing (2 Points)
Credit 1.4 Optimize Energy Performance, 50% New/40% Existing (2 Points)
Credit 1.5 Optimize Energy Performance, 60% New/50% Existing (2 Points)
Credit 2.1 Renewable Energy, 5%
Credit 2.2 Renewable Energy, 10%
Credit 2.3 Renewable Energy, 20%
Credit 3 Additional Commissioning
Credit 4 Ozone Depletion
Credit 5 Measurement & Verification
Credit 6 Green Power

Materials & Resources

Credit 1.1 Building Reuse, Maintain 75% of Existing Shell
Credit 1.2 Building Reuse, Maintain 100% of Existing Shell
Credit 1.3 Building Reuse, Maintain 100% Shell & 50% Non-Shell
Credit 2.1 Construction Waste Management, Divert 50%
Credit 2.2 Construction Waste Management, Divert 75%
Credit 3.1 Resource Reuse, Specify 5%
Credit 3.2 Resource Reuse, Specify 10%
Credit 4.1 Recycled Content, Specify 25%
Credit 4.2 Recycled Content, Specify 50%
Credit 5.1 Local/Regional Materials, 20% Manufactured Locally
Credit 5.2 Local/Regional Materials, of 20% Above, 50% Harvested Locally
Credit 6 Rapidly Renewable Materials
Credit 7 Certified Wood

Indoor Environmental Quality

Credit 1 Carbon Dioxide Monitoring
Credit 2 Increase Ventilation Effectiveness
Credit 3.1 Construction IAQ Management Plan, During Construction
Credit 3.2 Construction IAQ Management Plan, Before Occupancy
Credit 4.1 Low-Emitting Materials, Adhesive & Sealants
Credit 4.2 Low Emitting Materials, Paints
Credit 4.3 Low Emitting Materials, Carpet
Credit 4.4 Low Emitting Materials, Composite Wood
Credit 5 Indoor Chemical & Pollutant Source Control
Credit 6.1 Controllability of Systems, Perimeter
Credit 6.2 Controllability of Systems, Non-Perimeter
Credit 7.1 Thermal Comfort, Comply with ASHRAE 55-1992
Credit 7.2 Thermal Comfort, Permanent Monitoring System
Credit 8.1 Daylight & Views, Daylight 75% of Spaces
Credit 8.2 Daylight & Views, Views for 90% of Space

Innovation & Design Process
Credit 1.1 Innovation in Design
Credit 1.2 Innovation in Design
Credit 1.3 Innovation in Design
Credit 1.4 Innovation in Design
Credit 2 LEED Accredited Professional

At present time the use of the rating system is completely voluntary, but has been implemented on projects across the country, in 36 states, and six countries outside of the U.S (Ostrowski 2002). Because the guidelines cover a wide variety of issues associated with green development, they allow developers to pick and choose which criteria they want to meet. By allowing flexibility developers can determine on a case by case basis which criteria are most cost effective and most effective for their individual project. Although flexible certification requires that at least one criteria in each category must be met. This fact is important in looking at a project from a whole building approach.

It should also be pointed out that the existing LEED guidelines are not a final document, but will evolve and overtime become more and more demanding. The document is currently in its second generation, Version 2.0, with a version 2.1 in the works. The USGBC are also working on versions for residential projects as well as a version solely based on the interiors of buildings.

The guidelines also provide communities, architects and others a definite way of labeling a project backed by quantifiable numbers. Without guidelines could call a building green by simply including a few add-on features have been included in the design. These may meet some of the guideline's criteria, but not necessarily go far enough to creating a truly sustainable building. Dr Malcolm Lewis, a member of the

LEED Steering Committee, and president of CTG, an energy efficiency and sustainability firm lists the benefits of LEED as follows:

- Third party validation of green features
- Enforcement of complete implementation of designed features.
- Third-party rating of degree of sustainability.
- Benefit of LEED "brand association.
- Incentives from public agencies.

The degree of importance to an individual associated with the development of a green building differs. Developers will be more concerned with the financial incentives, while owners and occupants of the building will be most concerned with the complete implementation of designed green features. The upfront saving and financial incentives help keep the cost down for developers; while implementation of green features will help keep operating cost down for owners and provide an excellent environment for the occupants.

3. LEED versus Other Rating Systems

Other systems have been created to rate buildings. The most popular of these is the Energy Star Rating System. The Energy Star Rating System is more popular with residential projects due to its rating of appliances and many materials associated with the construction of buildings. Many of the materials and systems rated by Energy Star are unique to residential projects, such as water heaters, air conditioning units, and other appliances. This system is criticized because it looks at individual

products instead of utilizing a whole building approach. The LEED takes a whole building approach to rating, which helps to promote a truly sustainable building.

4. Criticisms

Presently the main criticism of the LEED guidelines is that the certification process is a major technical and financial hurdle. This criticism comes directly from the developers of the guidelines. Nigel Howard, Director of the LEED Rating System, comments on the process saying, "Documentation is now an epic task…We want design and construction teams to spend time making the building green, rather than on the submittal process" (Gonchar 2002, 10). The goal with future versions of the guidelines is to streamline this process and help reduce design costs. In some architecture firms as well as construction companies positions have been created and filled by experts to oversee the implementation of green building principles. The USGBC is currently working on a software program that will help architects-engineers to easily calculate scoring. Under the present system some calculations can become complicated, as is the case in determining the percent of recycled materials used and transportation costs. The hope is that the new software will alleviate many of these problems.

Another major criticism of the guidelines is that many of the credits do not always relate to a given site, or are not required in a particular buildings design. Architects and engineers are concerned that unneeded features will be included in an effort to become certified. An example of this potential problem is the credit for bathrooms for bicycle commuters. The inclusion of bathrooms may not be feasible, or are available in an adjacent building. Adding on features to meet credits goes

against the very essence of the guidelines, which are to provide the most efficient building while using the smallest amount of resources.

5. Green Design and Development

This section discusses how the design of a building can lead to a sustainable structure that reduces energy consumption and provides a healthy work/living environment. The section will also discuss how analysis of building materials is essential to determining the total life-cycle cost of a building. Along with the design of the building, development projects have a lengthy approval process that is sometime a deterrent to green development.

A. Whole Building Design versus Add-ons

The objective of creating sustainable building is more easily achieved by looking at a building as a single entity and not in individual pieces. This differs from the idea of value engineering a building. Value engineering looks at individual sections of a building and the associated gains or losses from different designs. On the other hand a whole building approach looks at how changing one design aspect affects the rest of the building. For example, increasing air circulation by using vents and operable windows the building's air conditioning system can be reduced in size. The whole building approach results in a reduction in capital costs and future utility bills.

B. Life Cycle Analysis

Life Cycle analysis using a whole building framework helps to define differences in a green building design compared to a normal building design. Each design decision affects the whole building and the final goal should not be to reduce the cost of a development, but to reduce the cost of every aspect of a building over its entire lifetime.

The four sections of a life cycle analysis are Raw Material Collection, Manufacture and Transportation, Tenure in Building, and Disposal and Reuse (Malin, 1999).

I. Raw Material

The use of materials that come from renewable or well regulated sources is a major component of green design. Wood from managed forests and fly ash concrete are examples of materials that are considered eco-friendly. Materials of this type reduce the total demand of a resource and provide that resource for future generations. For instance, by using fly ash concrete the amount of Portland cement is reduced and the amount of fly ash entering landfills is reduced.

II. Manufacture and transportation

The manufacturing of materials such as glass, concrete and steel is extremely energy intensive. The energy used in the manufacturing process emits CO2 into the atmosphere. Reduction of CO2 can be accomplished by recycling materials and replacement of materials in the manufacturing process. CO2 is released during the creation of concrete from the Portland cement used in the process (Malin, 1999). As

mentioned in the raw material section a majority of this limestone can be replaced by slag from steel mill furnaces and fly ash, the by-product of burning coal.

The use of local materials reduces transportation cost and also benefits the local economy. The Athena Institute, a Canadian organization that researches environmental concerns, estimates that between 10 and 30 percent of the energy associated with the manufacture of wood, concrete, and steel is related to the transportation of raw and finished materials. The LEED guidelines provide credit for the use of materials that are from local sources and for the use of materials with recycled content.

III. Tenure in the Building

Durability, ease of replacement, and effect on indoor air quality are important considerations in determining the best materials to use in new building construction. Materials that require constant upkeep and replacement do not meet the criteria for green building. For a building to be sustainable it should not require a large amount of replacement of materials. Materials chosen should be durable with low toxicity. Low toxicity is very important to providng a quality indoor environment. Many materials, such as carpet, emit volatile organic compounds (VOCs) into the air that provide poor air quality. Materials that reduce these compounds are recommended to provide a healthy environment (Malin, 1999).

IV. Disposal and Reuse

Many materials found in existing buildings can potentially be reused in new construction projects. The reuse of material reduces the total amount of new material

taken from the land, while reducing the amount of material that enters landfills. A current barrier to the reuse of materials is the treatment of wood with preservatives. Wood treated with chromated copper arsenate is durable during its tenure in a building, but reduces the potential for reuse after demolition (Malin, 1999). Materials need to be thought of having more than one life to be sustainable and have the potential for use in future projects.

C. Approval Process

The approval process is often identified as one of the most frustrating barriers to developing green buildings. Many of the design aspects do not fit normally into existing codes and are often times not as well known with review boards. These problems lead to a longer than normal approval process, and makes developers hesitant of green development. Alex Wilson, of the Rocky Mountain Institute, states, "Blanket zoning and prescriptive codes mean that the approval process is often ill-equipped to deal with projects that incorporate unconventional land-use patterns, building forms, or technologies" (Wilson 1998, 195).

One problem encountered when developing green sites involves proposed road systems. Most cities have ordinances requiring wide streets that allow for movement of safety vehicles and the like with minimal interference. One developer ran into this problem stating, "For example, the wide radius required for cul-de-sacs exists because in the early days, fire engines needed much more space to maneuver than do the modern fire trucks" (Wilson 1998, 212). At the Village Homes in Davis, California, which is one of the first green developments built in the mid 1970's, the developers wanted to have narrow roads to reduce the impervious surface. They were

told by city officials that the submitted design did not meet code. To prove that their roads were safe, they had two full size fire engines unload next to each other as they would in the case of an emergency. The distance needed was within the proposed width of the road and a variance was given.

Another hurdle, overcome at the Village Homes in Davis, California, was the storm water run-off system. The developers proposed a system that used vegetated swales instead of the normal system of drain inlets and buried pipes. This design did not meet city code and required a variance to be constructed. The developer recalled the resistance stating, "They all said it wouldn't work; that it would require continual maintenance and wouldn't significantly reduce the amount of runoff. The planning director said it would harbor vermin-an engineering term for wildlife I suppose" (Wilson 1998, 192). The developers continued to fight for their design and in the end put up a performance bond to receive the variance. Several years after the completion of the system Davis, California had a hundred year storm. During the storm all of the other storm water systems malfunctioned and caused extensive flooding in the area. The system installed at Village Homes was the only one that remained operable and did not flood. Following this incident the developers were refunded their bond.

These types of hurdles make developers wary of presenting designs that are outside of the zoning regulations. A variance for one project does not guarantee it for all future developments. Alex Wilson of the Rocky mountain Institute states, "Unfortunately the process of obtaining variances does not make it any easier for future development to get approvals (i.e., it does not change the code), but it does establish precedent that developers of future projects can point to" (Wilson 1998,

213). A true overhaul of building and zoning codes are necessary to truly open the door to green development. Zoning and building codes have failed to keep pace with new technologies which constantly being introduced.

Other problem areas are storm water run-off, sewage treatment, and parking requirements. These issues all have new technologies associated with them but do not meet minimum calculation requirements found in building codes and zoning ordinances.

6. Benefits of Green Development

The development of green projects have several benefits that are not always easily quantifiable. This is due in part to the fact that the savings may not be directly seen in the construction cost of the building. The savings may take place as reduced operating costs, free advertising, and the ability to delineate oneself in a market. Developers need to look past the initial cost of a building and take the long term view of the financial benefits.

A. Cost Savings

Cost savings is used as a major selling point for the development of green buildings. The savings created by green development can encompass every section of the development process. Savings can be found in upfront capital cost, approval process, operating cost, and human cost.

Many people associated with the development process have the misconception that Green Development will cost more than the status quo. In the past this may have been true, but as more developments go Green the necessary materials and skills have

become more prevalent. As mentioned earlier, past projects were deemed green by using lower energy HVAC systems or high insulation windows. These elements are merely add-ons and are not based on the whole building approach that is the true essence of green development. By using a whole building approach costs can be very competitive with buildings using normal construction techniques. The USGBC council has concluded that a LEED Silver Rated Building should not cost more than a conventional building and still provide substantial savings over the lifetime of the building (Rocky Mountain Institute 2002). To achieve a platinum certification capital output will be more, but will be recaptured quickly in reduced operating costs.

B. Free Publicity

Another benefit of green development is that normally this type of development will receive free press. The uniqueness of the project engenders pride within a community and becomes a showcase project. An example of this cost savings is the Denver Dry Good Building located in downtown Denver. The development is a mixed use project that includes both market rate and affordable housing with commercial uses on the lower floors. The project focused on its location to mass transit and energy and water efficient design. Jonathan Rose and Company, LLC, the developers of the project, estimated the savings from free press to be around $96,000 (Rocky Mountain Institute 2002). As a result of the publicity surrounding the project all office and commercial space was pre-leased and the housing units were leased within six months. Because of the green building techniques implemented the project also saves $75,000.00 in operating cost a year.

As a byproduct new developments incorporating affordable housing have become more prevalent in Denver.

C. Increased Productivity and Human Benefits

With any building a goal is to provide an environment where humans live and work. The average person spends close to 90 percent of his or her day indoors. The indoor environment cannot be underestimated in its ability to affect human productivity (Hawkins 1999, 100). In buildings following green principles, studies have documented increased worker productivity through a reduction in absenteeism and an increased level of work completed over a period of time.

Numerous examples of this cost savings have been found through out the world. One of the most researched and referenced cases is ING, a bank based in Amsterdam, that created a green building for its new headquarters. The building was designed so that the entire floor space had access to daylight and incorporated many other LEED guideline criteria. After construction ING recorded that absenteeism in the new facility was down 15% compared to its old headquarters. William D. Browning, of the Rocky Mountain Institute, explains in financial terms how important this can be stating:

> "Comparative cost of rent in a building on an annual basis is $21 square foot. Total energy costs are a $1.81 square foot. Meanwhile office work salaries are $130 a square foot. If I add in the equipment, benefits, and insurance, the cost grows to over $200 per square foot a year. Let's flip that around. Ten times the rent or a hundred times the energy bill. A 1% gain in productivity is equivalent to eliminating the entire energy bill. What we discovered in a series of case studies is that companies that were driving down energy use through daylighting, better lighting design, and better thermal comfort, significantly raised worker productivity. And they just weren't temporary effects."

Another example of this type of increased productivity occurred with Verifone, who renovated their distribution center by creating skylights in the roof. As a result, eighty percent of the time there was no need for electric light on the warehouse floor. After completion of construction absenteeism in the facility was down 47% (A New View of Real Estate, 1997). The renovated facility not only reduced the utility costs, but increased worker productivity.

7. Financing Green Development

Obtaining financing for Green Developments is a major hurdle that sometimes results in green projects being stalled before they can even begin. The perception of lenders is that so called experimental projects and technologies are an investment risk. Banks and investors are normally concerned with cash flow and not with a how a green roof will help to reduce storm water rates. This disconnect reduces the chance that a Green Project will receive the necessary funding.

There are various financial incentives used to promote the development of green buildings. These range from tax credits and low interest loans through to providing grants for the payment of extra architecture-engineering fees associated with green development.

A. Tax Credits

Tax credits are one of the more popular programs being used to promote green developments. These are one of the more straight forward incentives available and need the least oversight to be implemented.

B. Low interest loans

Low interest loans are being used in the state of New York to promote the development of green buildings. Qualifying buildings are able to obtain loans 250-350 basis points below market rates for the first $500,000.

C. Increased rate of depreciation

The depreciation of buildings/structures and not the land are used for tax deductions. The normal length of time for a building to be written off is over 27.5 years. With an increased rate the result is that an owner is given a larger amount available for deduction each year.

D. Architecture-Engineering Grants

The city of Seattle offers grants to developers of green buildings. These grants are to be used for the extra architecture-engineer fees associated with the development of green buildings. At present time finding architects-engineers knowledgeable in green architecture is a major hurdle. This program helps to offset some of this extra cost. The program also provides technical assistance from the city's Green Building team that includes members from the public utilities and other energy related companies. A Requirement for the grants are that the cost of the project is over $5 million. Another requirement is that the developers must hold one design charette to help everybody involved in the project to become more knowledgeable which advances the base of expertise on the subject of green

development. The grants range from $15,000 to $20,000 which is in direct relationship to the level of LEED certification reached by the project.

E. Density Bonuses

Density bonuses are currently being used in the city of Arlington, Virginia to promote the development of green buildings. The requirement is that at a minimum a building becomes certified LEED Silver. If a building is at the lower end of the spectrum of the Silver certification a bonus of .15 square foot is given for every foot of building that meets the certification requirements. The maximum density bonus is .25 square feet. For example, a building of 100,000 s.f. that is LEED Silver Certified would be given a density bonus of 15,000 s.f. The potential building size would then be a total of 115,000 s.f.

An example of this programs use was the development of the Navy League Building in Arlington. The building is 213,000 square feet, with the Navy League occupying 20,000 square feet. The rest of the space will be rented out as office and retail space. Because of the commitment to become LEED Silver Certified the new building is bringing in lease revenue of about $350,000 a year (Kunkle 2002).

F. Creative Mortgages

Energy efficient mortgages have been created to allow individuals purchasing an energy efficient home to obtain larger mortgages. In most instances mortgages are approved by assessing an applicant's ability to meet monthly mortgage payments and monthly utility expenses. With the energy efficient mortgage a "stretch' of 2% can be achieved (Wilson 1998, 267). This system indirectly affects developers by

creating a larger pool of qualified buyers. It allows people to purchase larger homes that would not have been possible under the normal system.

G. Utility Companies and Energy Financing

Demand Side Management (DSM) Programs provide "financing for front-end design work or incremental cost of installing highest efficiency equipment." (Wilson 1998, 272). These programs are beneficial to utility companies because of potential cost savings. The program acts as an intervention to the normal use of power, since it acts as a substitute to building new generation plants. The programs help to reduce strain on existing power plants and reduce the need for the construction of expensive power plants.

Chapter 3: Methodology

1. Intro

The overall goal of the project is to provide recommendation on how the LEED Guidelines can be implemented in Cincinnati and Hamilton County, Ohio. This chapter describes the process that will be used in Chapter 4, "Data Collection" and in Chapter 5, "Findings and Recommendations". Other expected findings will include why the use of the guidelines is important and necessary in Hamilton County, and finally why such measures are not already in place in Hamilton County. To achieve this goal extensive research into the guidelines and how they have already been implemented will be necessary. The researching of existing city level programs will provide the basis for the possible implementation of a program in Cincinnati and Hamilton County. The two programs that have been chosen are the city level programs in Portland, Oregon and Seattle, Washington. These two programs are based on extensive research into the implementation of the LEED Guidelines and both have created additional programs and financing schemes to promote the use of the guidelines.

Following the research into these programs it is essential to understand what barriers exist in Hamilton County and how they can be overcome. These programs can serve as examples of how LEED's could overcome barriers in other communities to provide a framework for the development of green buildings and sites.

Before analyzing existing programs it will be necessary to identify the potential benefits to Hamilton County. The literature review has provided a base of

knowledge on the effects of green design on single buildings and sites. But how this translates to a county wide level is important in determining if using the guidelines is beneficial to the region.

In many situations, the use of these guidelines and green development principles may be market driven without the need for government support. This raises the question of why cities or states feel it is necessary to implement such programs. Are these programs implemented only because it is the 'right thing to do', or are there other benefits to a city or state.

After the analysis of existing programs the "Findings and Recommendations" chapter will provide a set of recommendations on how to best promote the guidelines in Hamilton County. This section will also provide analysis of the various financing schemes and which ones have been most successful in promoting green development.

The subsequent steps describe the various topics that will be researched and analyzed in the "Data Collection" chapter.

2. Benefits to Hamilton County

Without measurable benefits to Hamilton County, it will be difficult to persuade officials that such a program is necessary. The county will need quantifiable numbers of what sections of a community will be effected by the guidelines. To determine the possible benefits of using the LEED Guidelines and how individual credits can influence environmental and economic concerns, a qualitative analysis of the guidelines will be conducted.

3. Analysis of Existing Programs

Analysis of existing implementation programs will provide information on how a similar program could be implemented in Cincinnati and Hamilton County. This analysis will focus on programs in Portland, OR and Seattle, WA. Researching these programs will provide an understanding of what changes are needed to existing codes and ordinances in order to be successful. Problem areas may be found in building codes and zoning ordinances in Hamilton County, the City of Cincinnati, and the state of Ohio.

A. City Level Implementation

The green building departments of Portland, Oregon and Seattle, WA provide valuable information on the subjects of green building and the LEED Guidelines. To obtain this information interviews will be conducted with critical persons within their respective departments. The respondents were chosen because of their direct involvement in the creation of the city departments in charge of their respective LEED based incentive programs, as well as the various reports they played a vital role in producing. These respondents are known as key informants and were chosen because of their position in the organization, and their broad knowledge of the subject. These interviews also provide a way of gaining knowledge that is not observable at present time. All interviews were conducted by telephone (http://www.msue.msu.edu/msue/imp/modii/iii00004.html).

4. Local Architects and Other Interested Parties

Questionnaires were distributed to local architects, engineers, government entities, and material suppliers in an effort to better understand the current green building environment in Hamilton County. The Respondents contact information was obtained through the local chapter of the United States Green Building Council (USGBC). Ninety questionnaires were distributed to professionals in these various fields. Because of the respondents interest in the subject of green building they are considered key informants. All questionnaires were distributed via email and returned through the same process. Comparison of responses will help to determine if the local concerns and problems were similar to those found in Portland and Seattle.

5. Analysis of Existing Codes and Potential Problems

A. State of Ohio Building Codes

Many of the design aspects associated with green development are considered to be experimental in nature. Because of this view some of the techniques and materials used in green building may not comply with existing building codes. This problem can cause delays or their omission in a design. An understanding of the local building code and the process for approving products will supply information on how to streamline the process.

6. Findings and Recommendations

The "Findings and Recommendations" chapter will include discussion on how the LEED guidelines could best be used in Hamilton County. The "Data Collection"

chapter provides various alternatives and potential benefits that may be useful in Cincinnati and Hamilton County.

In conjunction with how a program could be implemented, discussion of why a LEED based program has not been implemented will be provided in this Chapter. This discussion will look at how local officials/architects perceive the guidelines and their potential in Hamilton County. This chapter provides various schemes for the implementation of the guidelines as well as potential financing/incentive programs that would assist in promoting green development in the region.

Chapter 4: Data Collection

1. Intro

This chapter provides the various forms of data that were collected during the research phase. The first section discusses the possible benefits to Hamilton County if a LEED program was enacted. These benefits range from environmental issues to the potential for job creation. After defining potential benefits to the region, interviews were conducted with employees of the departments in charge of green building development in Seattle, Portland, and the University of Cincinnati.

The next research phase was to determine the potential problems with existing building codes. As researched in Chapter 2, building codes have proven to be a problem with past green developments and can cause delays and added cost to projects. The last section obtained information through questionnaires distributed to local architects, engineers, and material suppliers. All of this information will be used to make recommendations in the next chapter.

2. Potential Benefits of Green Development to Hamilton County

A. Air quality

Air quality is a major concern throughout the United States and is heavily regulated with minimum standards set by the Environmental Protection Agency (EPA). Prior to 2000 Hamilton County and surrounding counties were designated "moderate non-attainment" by the EPA. The "non-attainment" designation is caused by the burning of fossil fuels for vehicles and electric power (www.epa.state.oh.us/pic/nr/2000/june/cinciair.html). In 2000 the Cincinnati metropolitan

area was upgraded to the level of "attainment". Even with this upgrade there is still need for continued progress towards better air quality due to the more stringent ozone standards that are currently proposed.

New, more stringent air quality standards are currently under examination in the Supreme Court, and if enacted Hamilton County would have difficulties meeting. This problem was seen in May 2001, when air quality reached the "Unhealthy" category for the proposed EPA Standards (Conte, 2001). If enacted Cincinnati would again most likely be designated as "non-attainment" costing local businesses millions of dollars in fines and other taxes (May, Donovan, 1998).

The LEED Guidelines provide several credits that address this problem. The credits are the individual points available under the guidelines that are then combined to give a building its total score. Depending on the number of points obtained the building is then given a title of Certified, Silver, Gold, or Platinum. The credits relating to air quality include transit oriented development, alternative transportation, and reduction of energy consumption from solar power and energy efficient HVAC systems. LEED Credits that can benefit air quality include:

1. Urban Redevelopment Credit
2. Brownfield Redevelopment Credit
3. Alternative Transportation Credit
4. Landscaping and Exterior Design to reduce Heat Islands Credit
5. Ozone Depletion Credit
6. Low-Emitting Materials

B. Water Quality and Consumption

Water demand in Hamilton County and the surrounding region has the potential to develop into a major problem in the near future, especially in relation to ground water. The two major basins in the region are the Great and Little Miami

Rivers. In these basins the average water use was 745 million gallons per day. Fifty-two percent of this water, or 387 million gallons, came from the buried aquifers associated with the two basins (Debrewer 1999). With such a large percentage of the regions water coming from the buried aquifers it is apparent that protection of these resources is necessary.

The smaller, related aquifer of Shaker Creek provides evidence of potential problems when an aquifer is overused. Since 1970 this aquifer has dropped 27 feet due to the growth of Mason, Ohio, the second fastest growing city in Ohio (Aldridge, 1999). As more development takes place, demand on the buried aquifers of the region will continue to increase. Along with depletion of the buried aquifers the amount of contaminants entering the water due to agriculture, urban-run-off, and the disposal of solid and hazardous waste has increased (Debrewer 1999). Green development, and integral parts of LEED's, can reduce this demand by the use of gray water for irrigation of plant material and the flushing of toilets. Other techniques include green roof and bio-swales to allow infiltration of rain water into the ground water. The LEED Guidelines provide credits for each of these techniques.

1. Water Efficient Landscaping Credit
2. Innovative Water Technologies Credit
3. Water Use Reduction Credit
4. Stormwater Management Credit
5. Measurement and Verification Credit

C. Hillside/Landslides

The Hillside Trust, a local organization involved in the protection of Cincinnati's hillsides has found a significant percentage of Cincinnati and Hamilton County are hillsides. According to the Hillside trust,

> "Of the 80 square miles that comprise the incorporated area of Cincinnati, 15 square miles, or 18%, represent hillsides. Of the 264,849 acres that comprise Hamilton County, within which Cincinnati is located, 60,043 acres, or 23%, consist of hillsides."

These numbers show that an important/significant percentage of the region is hillsides, and can lead to hazardous conditions when developed. Because of development, the Cincinnati area has one of the highest per capita costs due to landslide damage in the United States (www.ohiodnr.com/geosurvey/geo_facts/geo_f08.htm). The landslides result in millions of dollars in damage per year in the Cincinnati Region. Available credits include:

1. Reduced Site Disturbance Credit

D. Energy Demand and Consumption

Increased demand for electricity has several associated problems. In many instances increased demand means that new power plants and other infrastructure is required. The increased demand also leads to poorer air quality from the burning of coal for power. The LEED Guidelines promote the use of alternative energy sources and reduced demand on fossil fuels. Potential credits available that meet these goals include:

1. Renewable Energy Credit
2. Green Power Credit

E. Under-Utilized Land within the CBD and Surrounding Neighborhoods

The city of Cincinnati has been losing population and business to the surrounding suburbs over the last thirty years. This problem has left many abandoned buildings and sites within the CBD and adjacent neighborhoods. The LEED

guidelines promote the use of brownfield sites and existing structures, providing several credits that would benefit inner city neighborhoods. Potential credits include:

1. Urban Redevelopment Credit
2. Brownfield Redevelopment Credit
3. Building Reuse Credit

F. Job Opportunities

A spin-off of green building is the creation of new technologies that are used in demolition, design, and construction phases. The city of Portland considers the opportunity for job creation to be a very important aspect of green building. Due to the newness of green building, new techniques are continually being developed providing the opportunity for new businesses. The city of Portland is working directly with Portland State University on several of these business opportunities.

A local example of this type of opportunity is the use of fly-ash in the production of concrete. Fly-ash is a by-product of coal burned for energy production. The region has several coal burning power plants in close proximity and provides an excellent opportunity for the creation of new jobs and industries. Fly-ash concrete can be used to produce large amounts of concrete or in the construction of pavers and bricks. The fly-ash replaces a portion of the Portland cement required in the process and yields a concrete that is harder than that based on conventional techniques. Possible credits that relate to local materials include:

1. Local/Regional Material Credit
2. Innovation Credit

3. Northwest Regional Sustainable Building Action Plan

A conference in 1997 brought together over 500 people from around the Pacific Northwest region, from varied professions. The motivation behind the region wide conference was that many of the professions associated with design, construction, and management of buildings work in several municipalities and in various states, and were finding it difficult to have green building techniques approved and implemented. Out of the conference came the idea, along with the necessary funding to create the *Northwest Regional Sustainable Building Action Plan.* The Task force charged with writing the plan included participants from Washington, Oregon, Idaho, Montana, and British Columbia with backgrounds in architecture, engineering, development, construction, planning, and other consulting fields. The plan, once completed, listed the goals for the region as:

1. Create a commonly accepted definition and language for sustainable building for the region.
2. Create a vision/message for sustainable building that will motivate people.
3. Increase demand for sustainable building services/products/projects by increasing awareness and understanding, and by providing incentives.
4. Increase the supply of sustainable building services/products/projects by providing industry professionals with information, tools, resources, incentives, and rewards to enable them to undertake sustainable building practices.

   Source: *Northwest Regional sustainable Building Action Plan*

The plan provided a way of expressing goals in terms that can be presented to municipalities and elected officials. The plan presented seven strategies to achieve the goals of the plan. These strategies are stated as:

1. Shared Vision. Develop a vision of sustainable building for the citizens of the Pacific Northwest that includes a definition and goals.

2. Regional Guidelines. Develop regional guidelines for sustainable design and construction that will serve as a benchmark and design tool for the marketplace.
3. Analytical Models. Identify and promote the use of analytical models that will encourage, guide, and assess the financial and performance comparisons of sustainable design and construction.
4. Financial Incentives. Research, adopt, and develop financial incentives in the public sector to encourage sustainable building.
5. Awards Program. Develop an awards program that focuses on sustainable, holistic approaches to building projects.
6. Industry Education. Develop a curriculum and conduct training to educate key sectors of the building industry on sustainable building and the shared vision for the Pacific Northwest.
7. Public Education. Develop a comprehensive public education and communication program, based on the shared vision, to build support for sustainable building with the general public.

The overarching goal of the plan was to completely transform the building community throughout the Pacific Northwest. The plan states, "The action plan is intended to serve as a road map for the region-to identify the most critical and practical steps needed to make sustainable building the standard practice in the Northwest". By reaching the listed goals the task force believed that the necessary changes would take place on a regional level.

The theory behind the plan is that the development/building community will begin to use the best green building practices available through a regional wide education and promotion program. The plan understood that the development/building community is not confined by municipality boundaries, and are normally regional companies. By acting on a regional level the creation of green building programs will not be piece-meal and the implementation of green designs will become an easier process.

4. Introduction to City Programs

The City of Portland, Oregon and its sister city of Seattle, Washington have been at the forefront in the development of policies and programs to promote the development of green sites and buildings. Their programs have been successful in developing green buildings in both the public and private sectors and provide valuable information on how a similar program could be implemented in Cincinnati and Hamilton County.

Both cities' departments and respective programs were created following the development of the *Northwest Regional Sustainable Building Action Plan*. The idea for this plan was developed during a 1997 conference hosted by the City of Seattle and Public Technology, Inc. (www.ci.seattle.wa.us/light/conserve/sustainability/NWBAP.pdf).

Research into the LEED program at the University of Cincinnati was also conducted. Due to the complex nature of a University it provides similar concerns and programs to those found in a city environment. The information on these departments and programs was obtained during key informant interviews. The interviews were conducted with employees of the offices charged with overseeing the various green building programs.

A. City of Portland

Portland, Oregon is home to 538,000 people with a metropolitan area population of over 1.7 million (http://www.or-homes.com/portland.htm). Portland is known for its progressive views toward planning, transportation and the environment and has been willing to implement plans that are viewed by some as risky. The city of Portland has created a program that requires all publics work and publicly financed

projects to comply with the LEED Guidelines. This program has been in existence since 2000 and was the first city to implement such a program. This case study will help to provide an understanding of how a similar program could be implemented in Cincinnati. Portland has done extensive research into the validity of the guidelines and how a program could be implemented. A report entitled "Green City Buildings: Applying the LEED Rating System", was prepared for the city of Portland and provides detailed information in regards to how the LEED guidelines work and the possible savings associated with green development.

I. Key Informant: Rob Bennett

The following information was obtained during a telephone interview. Rob Bennett works for the office of Sustainable Development in Portland and is the Manager of Green Building Division and Sustainable Practices and Technology Division. He has been with the department since its inception and was instrumental in the creation of the various green building programs. Mr. Bennett describes the largest hurdle to creating the department as, "there was no department". Mr. Bennett was starting from scratch and needed a significant amount of information to make recommendations.

Mr. Bennett also felt that none of this would have been possible without public input and support from local politicians. "Going from nothing to something, it took staff and a coherent process that got people involved and that it politically made sense, so when you took it in front of city council there was reason to support it." People are always skeptical of new processes that will require them to change their way of working or the possibility of added work load. The early discussions

Figure 4.1: Jean Vollum Natural Capital Center, Portland, Oregon Source: Green Building Services

with other departments varied. Mr. Bennett says that early discussions "varied from disinterest to some cases resistance…there was no one in other bureaus saying, 'this is great' other than individual staff people". Mr. Bennett felt that it was very important to have a comprehensive plan before presenting to public officials.

To enhance the plans credence, Mr. Bennett felt it was important to show how the new department would help to speed up the development process. To accomplish this Portland decided to bundle various Conservation departments into the Office of Sustainable Development. Mr. Bennett says, "We were trying to make the case for expedited delivery of services to the community…The way the user sees it that it is a coherent program". This fact is very important, especially with new technologies. Having the various departments associated with green development under one roof aids the free movement of knowledge to move freely, and allows for quicker changes to policies. To help with technical issues the department has two specialists, an architect and a building specialist. The two specialists consult on projects and assist architects-engineers in complying with LEED Guideline requirements.

To promote the development of green buildings and sites Portland created the Green Development Fund. The fund consisted of a one-time contribution from the city totaling $800,000. The funds were available to private developers that agreed to become LEED Certified. LEED Silver designation provided the developer $15,000 and LEED Gold $20,000. Smaller amounts of money were available to residential projects and small innovative technologies. The smaller projects did not have to become LEED Certified.

Figure 4.2: Viridian Place, Oregon

Source: Green Building Services

These funds were available to cover the marginal cost associated with registering and documenting a building to become LEED Certified and secondly to increase the public knowledge of the guidelines and its associated benefits. By providing these funds architects could become more familiar with the use of the guidelines and in the future decrease the cost of becoming certified. The program was very popular and all the funds were distributed within two years. At present time Mr. Bennett believes that 68 of the 78 funded projects will be completed. Most of the projects that will not be completed are residential projects. Mr. Bennett says this is due to residents moving or other problems associated normally with residential projects. He feels that these incentives do not work as well with residential projects and should be focused on commercial, institutional and larger scale multifamily projects.

Another use of the Green Development Funds is to promote emerging technologies. These include new construction techniques and can lead to the growth of new businesses in the region. An example of this is at Portland State University where they are working on a monitoring system for green roof systems. A green roof system consists of plant material planted on a roof. The system helps to cool the building and the surrounding air while reducing the amount of run-off into storm waters systems. The cooling of the air is a way of reducing the urban heat island effect in urban areas. The system will monitor the health of the roof and reduce the need for human monitoring and replacement of plant material. The hope is that this will become a marketable and patentable system that will be available for use across the United States and worldwide.

B. City of Seattle

In 2000 the City of Seattle had a population of 563,374 and has been growing over the last three decades. The city of Seattle followed Portland in the creation of its LEED Based Incentive Program. Many of the programs offered by Seattle are similar to those pioneered by Portland. Since Seattle is in close proximity to Portland there was substantial opportunity for communication between the two cities. This communication continues today as they refine program details.

Seattle, Washington has also been a leader in the use of the LEED Guidelines. The city requires municipal buildings to obtain some level of "greening" and offers incentives to private developers who follow the guidelines. The incentives offered by Seattle are similar to Portland's, but with different requirements. Seattle and Portland are similar in that they have the same end goal of transforming the entire building and development community.

I. Key Informant: Peter Dobrovolny

Peter Dobrovolny, who works for Seattle City Lights, the public electric company, has been a vital member in the creation of the cities LEED based program. It has a variety of programs to reduce energy consumption and pollution in addition to the LEED program. Mr. Dobrovolny has been with the city of Seattle and the Seattle City Lights Department since 2000.

Since the inception of the program in 2000 the city has 14 projects registered with the USGBC and 2 completed. The City of Seattle has been very aggressive in requiring new public works projects to become LEED Certified. Seattle feels that the

Figure 4.3: Seattle Justice Center, Seattle Washington

Source: City of Seattle

best way to promote green development is by doing it themselves. By developing their own projects they increase the knowledge base and learn lessons that can be then passed on to the private market.

Mr. Dobrovolny states that the Seattle Program was very closely based on the incentive program created by Portland. He feels that these incentives are important to the growth of green building practices. Mr. Dobrovolny says that private developers need incentive. "They don't see value added at this point, and this is a way to get around part of it". A benefit Mr. Dobrovolny sees to the city by offering these incentives is, "There are things we want to learn from these projects too. That is one of the reasons for doing it, is to learn what the practical difficulties are, to see how we can facilitate the process"

During the creation of the department Mr. Dobrovolny felt that it was very important to have the support of a wide variety of people and departments. He stated it was important to have, "A group of very dedicated and talented people throughout a lot of city departments, who are advocates for green building" and the "same commitment at the elected level". Without the support of elected officials the project would have been stopped before it even started.

C. University of Cincinnati

The University of Cincinnati has been a leader in the development of green buildings and sites in the City of Cincinnati. As of April 2003 the University has eight projects registered with the United States Green Building Council (USGBC). Registration of projects shows the intent that the projects will become certified once constructed. Due to the large number of projects in the development pipeline the

University of Cincinnati provides valuable information on the benefits and problems associated with starting a green building program.

I. Key Informant, Joel Stout

Joel Stout is an architect with the University of Cincinnati. Mr. Stout is a member of the University's Sustainable Design Work Team that reports to the Sustainable Building Committee and has been with the University since July 2000. He is interested in green building and other techniques that reduce energy consumption and waste, and provides consultation to other organizations in the region interested in green building practices.

In 1999, to determine the level of 'green' new buildings should reach the University began to analyze how to create its own rating system. During this analysis the University determined that it would be more cost effective and less time consuming to use an existing system. The University decided that the LEED System fit its needs the best.

With the amount of new construction under way at the University it can be compared to a small city in its complexity and potential cost savings associated with green development. Mr. Stouts says, "Universities are great (for use with the LEED Guidelines), they own their buildings for hundreds of years". Along with the benefits of the guidelines in a University atmosphere come the associated problems and complex management requirements. Mr. Stout says, "An institution like this is extremely complex and there are a lot of goals for projects and requirements going on simultaneous and some of them conflict, you've got schedule and budget and then

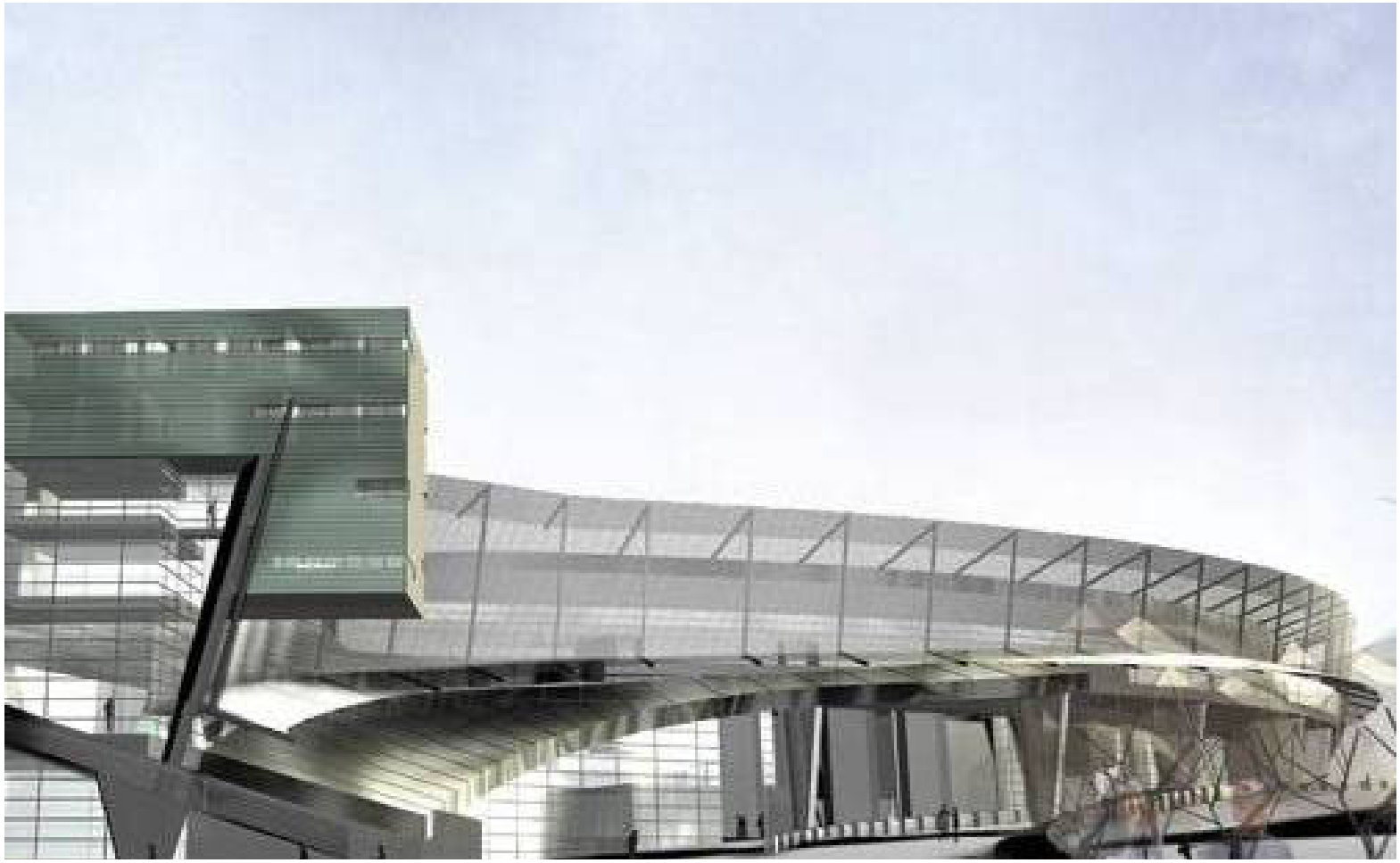

Figure 4.4: University of Cincinnati Campus Life Recreational Center Source: USGBC

you have different occupant needs. Recreation center needs are a lot different than an academic building."

Mr. Stout does see some problems associated with the guidelines. "LEED was written around a spec office building 4- 6 stories in height". This fact does not always mean that the Guidelines are a good fit for all projects. Mr. Stout sees it as a problem when additions are made to a site just to receive a credit. He says an example of this is, "Providing changing rooms and showers for cyclist, you get a point. Most of our buildings are near buildings with shower /changing facilities. But if you weren't and we said we want that point, so we are going to throw in a changing facility that traditionally we wouldn't have done. The cost adds up". The guidelines should not be about becoming certified, but reducing dependence on energy sources and providing a better environment for its users.

Mr. Stout would like to promote green building as best practices and high technology. He says it is just not about being environmentally sensitive. "It doesn't have to be about environmental protection, this is smart building for the dollars and cents aspect, human health and productivity. All these issues are covered in sustainable design…what we are trying to do is move our building industry to the current best practices…It is really technology driven".

5. Building Codes

Information regarding local building code regulations was presented by Amit Ghosh of the City of Cincinnati, and Martin Simon of Hamilton County Department of Building Inspection, at a USGBC Southwest Ohio Chapter meeting on January 23, 2003.

The Hamilton County Department of Building is in charge of regulating all unincorporated areas of the county. All other municipalities are regulated individually. Building codes provide a major barrier for the implementation of green products and practices. The two major problems are having products approved and the numerous jurisdictions in Hamilton County that enforce building codes. In Hamilton County there are 38 separate jurisdictions that enforce their own codes. In most instances these codes are very similar, but at present time would require revision of each one separately to include new materials and techniques.

Many building codes base their material qualifications on being approved by an independent testing company. The building codes in Hamilton County are updated every three years and any newly approved materials will be included in these updates. This update procedure does give architects and engineers the opportunity to include new practices and materials in future versions of the building code.

This problem was overcome in Portland by involving the building department in the early phase in the development of the city level LEED program. To make the process smoother Portland's Sustainable Development Department has a green building expert on staff as well as an architect. These staff members are available for use on green building projects and act as an intermediary between project architect-engineers and the local building department.

6. Local Architects, Engineers, and other Interested Parties

The returned questionnaires consisted of responses from two architects, one engineer, two material suppliers, and one employee of the Hamilton County Waste Management District. The respondents are key informants and are a judgmental

sample because of their direct association with the local chapter of the U.S. Green Building Council (USGBC). Of the six returned questionnaires four of the respondents had previously worked on LEED projects or are currently involved in a LEED project.

Several concerns were expressed, the two most common being added cost and getting clients interested in green development. These two concerns are directly related to each other and need to be solved as a single problem. Increased cost is a valid concern and has been a problem in both Seattle and Portland. The added cost often times causes private developers to lose interest in green building practices. This problem can potentially be solved through education and financial incentives. Private developers need to begin looking at a building not as a short run investment, but as a long term one where the potential energy savings will easily outweigh the added upfront cost.

Another major concern with the local respondents is that some of the available credits are very difficult to achieve in Hamilton County. This concern was addressed by Joel Stout, an architect with the University of Cincinnati. Mr. Stout says an example of this problem is in attempting to meet the criteria for construction waste recycling credits. He states, "Local contractors did not know how to bid this. Contractors pulled numbers out of the air. There was no bad intent. It is just a struggle because this is so new to them"

Architects are creative by nature and prefer to control as many aspects of a project as possible. One architect discussed his concern over the guidelines by comparing them to the American Disability Act (ADA). The ADA guidelines are

now law and require substantial analysis for buildings and sites to meet the requirements. Some architects feel the same could happen with the LEED guidelines and would become another layer of requirements and reduction in control. Even with these concerns the architect respondents did express that they are ready to work on projects that pursue LEED certification, it was just a matter of getting clients to become interested in the process and understand the potential benefits.

It is apparent that respondents do feel that the guidelines are a good tool for quantifying the level of greening a building has achieved, as well as increasing the knowledge base on green building practices in Hamilton County and the region. The concerns expressed by the respondents are valid, but as seen in other cities they can be overcome through coordination and support at the various levels of government.

Chapter 5: Findings and Recommendations

1. Intro

The "Findings and Recommendations" chapter discusses how to best affect change in Cincinnati and Hamilton County through the implementation of a LEED based program. The first section, "Differences and Similarities of Portland and Seattle" analyzes the city departments in order to distinguish what areas of their programs were similar, including what programs would be of benefit in Hamilton County.

The benefits to Hamilton County could be substantial if the use of the LEED Guidelines became more prevalent. Major problems to be overcome include existing building codes, lack of knowledge in the industry, and translation of LEED credits in Hamilton County. The chapter provides recommendations of how these problems can be overcome to develop environmentally sensitive, cost effective projects. Finally, the chapter discusses potential incentive programs, along with the organizations best equipped to oversee the LEED program.

2. Differences and Similarities of Portland and Seattle

The main difference between the Portland's program and Seattle's is where their time and funds are concentrated. Portland has chosen to push the use of the LEED Guidelines in the private market. Mr. Bennett says this is partly caused by the city not recently having any large scale public projects that the guidelines would benefit. His department has worked on a few projects in an effort to become more

'green', but none to the level that would meet certification requirements. Another reason for the lack of public buildings pursuing LEED certification in Portland is that the city has had financial constraints in recent years, limiting the number of public works projects planned and constructed. Even with this constraint, they feel that the benefits from private are great. Most building development does occur in the private market and emphasis in this sector may prove more beneficial to Portland and the region.

On the other end of the spectrum, Seattle has been in the position to have several public works projects that were prime candidates for the guidelines. This difference has allowed Seattle to have direct input into the design and development process.

To facilitate input and learning, Seattle has included the requirement for receiving grant money that developers and architects facilitate a charette in the early stages of the design process. A charette is essentially a brainstorming session used to kickoff a new program or project. The charette includes the developer, architects, engineers, facility designers, government officials, and the end user of the building. The thinking behind this program is to create a cohesive plan where the needs of all parties are met, and at the same time increasing the number of professionals educated in green building design.

3. Local Initiative

Locally, a group of architect, engineers, elected officials, contractors, developers, and materials suppliers have formed a local chapter of the United States Green Building Council (USGBC). The chapter states its missions as,

> "The Southwest Ohio Regional USGBC Organizing Group will establish a coalition of local leaders from all aspects of the building community to provide education, professional development, and the promotion of building projects that are environmentally responsible, healthy, and cost-effective places to work and live."

Formed in December 2002, this group will be an essential member in the transformation of the development industry and lobbying for services and programs in the political arena. The group can also help to educate themselves and others through workshops and other educational opportunities. The education process is important because it forms a group of local architects that are educated on the subject of green building. The knowledge gained through education opportunities can then be implemented on real world projects.

Similar to the development of the *Northwest Regional Sustainable Building Action Plan,* the Southwest Ohio Chapter of USGBC needs to take the lead in creation of programs in Southwest Ohio with the goal of providing interested parties a framework for implementing change in their individual community. Potential programs and their associated goals should not only benefit Cincinnati and Hamilton County, but the entire region. Statewide initiatives should be coordinated with other USGBC Chapters in Columbus and Cleveland. Coordination with these other chapters could prove beneficial when lobbying the state for building code revisions and funding for programs.

4. Recommendations

A. State-Wide Building Code Review

At present time to have a new technology or building product approved for use it must be submitted to each individual municipality in Hamilton County. In order to streamline this process the creation of a state wide building code review would prove beneficial. New materials or techniques would be presented to the review board and if accepted would be available for use state wide. Building codes are a major hurdle on several levels. Architects are more prone to use techniques that they are familiar with using, as well as being acceptable by local codes on a regional level.

Architects do not normally work in only one municipality and need to be guaranteed that techniques will be accepted before the time and effort is put into designing a building or site. The statewide review board will streamline the process and make it easier for architects and engineers to push the boundaries of green building.

To start this process, building codes should be reviewed in relation to the existing LEED Guidelines. The review process would provide existing areas of the building codes that do not mesh with the LEED guidelines. The *LEED Guidelines, Version 2.0* are not a final document, and are meant to be only a starting point where local innovation and continual national review will increase the quality and the breadth of the guidelines. Recurrent review of new versions of the LEED guidelines in relation to the Ohio Building Code will be essential to reducing time spent in the approval process.

B. Local Innovation Credits

The creation of points that address local problems and concerns can have several benefits. The benefits of local innovation credits include making it easier for new developments to become certified and allow local issues and concern to be more easily addressed. The guidelines allow for up to five innovation points. As mentioned earlier there are several local problems that can benefit from the guidelines. These include hillsides, aquifers and water quality, air quality, and under utilized land within the CBD. While these problems do have a relationship to existing credits they could be enhanced through the creation of local innovation credits.

I. Hillside Credit

A hillside credit would be awarded for the protection of any area on a site over a specified slope. The Hillside Credit would benefit from discussion with the Hillside Trust about major areas of concern and other potential hillside credits. The Hillside Trust should be consulted to determine slope percentage for protected hillsides.

II. Cincinnati Neighborhood Zones Credit

Another possible credit could be for the development of projects within certain zones of the city. These can include areas that are under utilized or ignored by developers, such as Over-the-Rhine, a low income neighborhood in Cincinnati. This

credit would benefit the city by promoting development in neighborhoods with low tax revenues.

III. Local New Technology Business Credit

This credit would be available to projects that take advantage of local products that promote green technologies. An example is the use of fly-ash concrete at some set percentage compared to the normal pure Portland cement concrete. This credit can help to create increased synergy between local businesses and the construction community.

Each of the credits alone is not that significant, but when teamed with existing LEED credits it can provide the needed credits to allow a project become certified. An example of this teaming would be the use of a brownfield site adjacent to public transportation within a Cincinnati neighborhood zone. This site would receive three credits instead of two because of the local innovation credits that was developed.

C. Materials/Recycling

Locally and state wide tipping fees at landfill are cheaper than recycling costs. (Interview, Christmann). The low cost even leads to construction and demolition material from Kentucky and other state being dumped in Ohio. Ohio is a net importer of general trash and construction material. To promote recycling of building material and the use of recycled material tipping fees at landfills for construction-demolition materials should be raised. Along with the higher tipping fees new recycling location should be established. Many of the materials associated with building demolition have the potential to be recycled and could lead to new industries in the region.

D. Types of Projects

Green building design has proven to create environments that improve work output and learning for students. In the private sector schools are a perfect fit for LEED certified buildings. The improved indoor environment has created better test scores compared to students in traditionally designed buildings. Because of these outcomes schools provide an excellent opportunity for the use of the LEED guidelines.

Along with the educational benefits there are the decreased utility expenses associated with green development. This benefit is further increased when taking into consideration the fact that school districts normally inhabit buildings for long periods of time. Because of these benefits new school construction should be required to follow the guidelines. A major hurdle to overcome is that normally government projects are required to accept the lowest qualifying construction bid. Changing this requirement to a whole building/life cycle approach will better provide for school districts and provide benefits over a longer period of time.

E. Private Developers

Private developers may be the most difficult to convince of the benefits of green buildings and the use of the LEED guidelines. The main concerns of private developers are costs and the amount of time to complete a project. Certification alone does not entice developers to pursue LEED. Edward Caulkins, a developer and member of the U.S. Green Building Council, even admits that presently certification "can be very costly, and at the end of the day you get a plaque" (Brick c5, 2003).

The concern of costs has been substantial with green building in the past. Many projects were 10-15% more costly than a similar sized conventional designed building. These problems were mostly associated with the use of add-ons instead of taking a holistic approach the LEED Guidelines promotes. As the guidelines have been improved and many of the technologies are better understood difference in cost are now found to be much less. Peter Dobrovolny, of the City of Seattle has found that projects are now cost neutral to one-half of one percent higher for a LEED Silver Certified building. He says much of these costs are now found in soft costs associated with architectural-engineering services and LEED documentation.

To advance the benefits of green building within the private development community it is important to promote the benefits of green building, not only as environmentally friendly, but as high technology. The high technology benefits equate to cost savings in the construction and ownership phases. The term "high technology" also is a term that is easier for some people to identify with.

F. Incentives

A. Grants Program

To offset the upfront soft cost of having a building LEED certified an incentive program similar to the ones in Portland and Seattle would be beneficial. These grants would be available for the development of commercial and multi-story residential properties throughout the county. As mentioned by all three key informants the LEED Guidelines do not currently translate well to single family

residential projects, but incentives should be available for multi-story residential projects. The incentive program should only be available for a limited time.

The goal of the grant incentive program is to increase the knowledge base in the region and to initially promote green building practices. After architect, engineers, and others become more comfortable with the LEED process the cost difference will become negligible. This was seen in Seattle where new LEED projects are found to be cost neutral to one-half of one percent higher than a conventionally designed and constructed building.

The charette requirement in Seattle is very important part of the process and should be an element of the Hamilton County program. The charette program allows individuals in every aspect of the development process to be involved and exposes people to the design process and green building practices who are not normally given a voice. This process provides a learning opportunity for architects, engineers, as well government agencies. The charette process directly relates to the goals of a LEED Based Incentive program, which is to transform the entire building community. The goal is achieved by bringing as many different groups as possible together and exposing them to green design techniques through a group learning process.

B. Utility Incentives

In conjunction with incentives offered on the county level, an incentive program offered through Cinergy, the local electric and gas utility company would compliment and enhance the potential of the LEED Guidelines. This type of program is known as demand side management and benefits utility companies through reduced

demand on existing utility infrastructure. Any equipment associated with the use of energy, such as the HVAC, solar panels and even high insulation windows could be financed through the utility company at a reduced rate. This program benefits both the developer and the utility company financially and can be used as promotional opportunity for both groups within the community. Cinergy currently has an "Environmental Leadership Pledge" that discusses this topic as a potential way of meeting the needs of the community.

C. Density Bonuses

The use of a density bonus program is a way of promoting green development with minimal direct financial support from the county. These density bonuses should be available for both commercial and multi-story residential developments. Density bonuses have been successful in Arlington, Virginia and are very popular with private developers. Density bonuses make it much easier for a green development to be profitable. For bonuses to be available it would take coordination between the various municipalities in Hamilton County. Coordination is crucial to creating a county wide change in building practices, and not individual municipalities offering incentives. The development of green buildings should not create competition between various municipalities providing density bonuses.

G. Program Management

For the incentive program to be successful a county wide agreement will be necessary. Along with the cooperative effort of the numerous municipalities it will require coordination of diverse departments within Hamilton County. To oversee the

program the Hamilton County Regional Planning Commission (HCRPC) has the best understanding of the region as a whole. The HCRPC states its vision as:

> "To assist Hamilton County and its communities, agencies and citizens in planning and achieving sustainable development and related community and regional goals." (www.hamilton-co.org/hcrpc/RPC/About/mission.asp).

Along with this vision, the mission of the HCRPC is:

D. To build planning partnerships for creating and implementing community plans in the context of the region.
E. To provide data management and analysis for effective planning and decision-making in Hamilton County governments.
F. To promote an equitable balance of local, county and regional perspectives and interests in community planning forums.

At present time the HCRPC does not have a specific department in charge of green building, but does have interest in creating a sustainable region through smart growth and the protection of natural resources. The HCRPC also has the necessary influence and contacts within Hamilton County, as well as surrounding communities to promote the use of the LEED Guidelines. Currently HCRPC is mostly involved in long range planning, but their involvement in coordination of this program and as a potential mediator between the various municipalities would give it the needed support to be a success. Comparing the goals of the USGBC to the vision and mission statement of HCRPC they are very similar and have several overlaps. The main difference between the two organizations even with the similar visions is the scale of the projects they are involved in producing. Both organizations are concerned with creating better environments for people to live and work and provide ways of reaching this goal.

For technical support on building issues and codes the Hamilton County Department of Building would provide the best support. They currently oversee development and plan review within unincorporated areas of Hamilton County. The department currently has several architects on staff for plan review and consulting and with the necessary training could do the same for green buildings.

A coordinated effort between the HCRPC and the Hamilton County Department of Building provide the necessary skills and power to implement a LEED program in the region. The Hamilton County Department of Building would provide the technical skills while the HCRPC would provide the political power and connections within the individual municipalities. As emphasized by both the Portland and Seattle programs, coordination between the diverse departments makes the process proceed smoothly and reduces bureaucracy.

Chapter 6: Conclusion

The goal of the United States Green Building Council is to transform the design, development, and construction communities in an effort to move toward the best building practices available. These practices include the reduction of materials used, amount of energy consumed, and providing the healthiest environment possible to users of buildings.

In Hamilton County the goal for implementation of the LEED Guidelines and potential incentive programs should not just be to produce green buildings, but ultimately a complete makeover of the building community. Interest in green building is growing everyday, as can be seen by the creation of a local chapter of the USGBC. This group has the necessary expertise and leadership to begin implementing the USGBC goals in Hamilton County and the surrounding region. The response from local architects in the data collection phase was a small percentage in relation to the number of questionnaires distributed, but as seen through the creation of the local chapter of the USGBC there is interest in green design and the use of the LEED Guidelines in Ohio.

This transformation of the building/development community can be greatly enhanced through the use of the incentive program that produces a framework where the public and private sector increase the knowledge base and push the limits of green building. Green buildings design needs to be marketed not only as environmentally sensitive, but as high technology. Many of the techniques used in green building are cutting edge and take advantage of powerful computer modeling to determine the most energy efficient designs.

While there are substantial differences between cities like Portland and Seattle compared to Cincinnati, in terms of political climate and views toward the environment, these should not be reasons for ignoring green design. Green design makes both financial and environmental sense, and as seen by the University of Cincinnati is a perfect match for educational buildings and institutions that own its buildings for long periods of time.

A major problem that will take substantial coordination and effort to overcome is getting the numerous municipalities within Hamilton County to work together in the implementation of the LEED Guidelines. In Hamilton County there are 38 separate municipalities with 38 separate building codes. Further research into this coordination would provide valuable information on how the implementation process would occur. If coordination between these municipalities is possible there are no limits to the potential of green building in Hamilton County.

Architects, engineers, and others are ready to take on the new challenge, but are now only held back by the fear of substantial added costs and finding clients interested in the added benefits of green development. As green building practices increase nationwide the cost will decrease as new material manufacturers and techniques are created to meet the demand. Even today, with a knowledgeable design team these costs are minimal and can easily be overcome through incentive programs that reduce the risk in the minds of the developers or owners. The transformation of the building community is not something that will happen overnight, but the benefits to a community are numerous and should not be overlooked.

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Appendix #1

City Departments
University of Cincinnati Thesis Questionnaire

The purpose of this questionnaire is to obtain information that will support recommendations for a LEED based program in Cincinnati and Hamilton County. The questionnaire can be returned by email. Thank you for your help.

Name
Name of Organization

How long have you been with the department? Identify department

What would you consider the major hurdles were to the creation of the department? If respondent came after dept formed, how would he/she know? Might want to ask what the single greatest challenge was in forming the department, followed by another question on other secondary problems. See examples below.

In total, How many buildings has the department played a part in producing? Under LEED guidelines, or in general? Need to specify a time period for this question.

Have you encountered any problems while implementing (applying, using) LEED guidelines in your city? If so, what was the single greatest problem? Any others beside this one?

Have private developers started using LEED Guidelines? Do they use other green building practices in addition to or in place of LEED's guidelines?

Does your city offer developers financial incentives to follow LEED's guidelines and obtain certification? If so, what are they?

What particular types of projects, if any, do you think LEED Guidelines can most benefit. What is the most important reason why these projects are helped? Are there other reasons as well

Compared to a conventional building, has it been harder to keep projects within budget when using the LEED guidelines? If so, what is the most important reason? Are there other reasons as well?

Summary question: What single most important lesson would you say your department/city have learned from the LEED's program so far.

At the end, you should thank each respondent and ask for the opportunity for a quick follow up interview, if necessary.

Appendix #2

Local Architects and Other Interested Parties

The purpose of this questionnaire is to obtain information that will support recommendations for a LEED based program in Cincinnati and Hamilton County. The questionnaire can be returned by email. Thank you for your help.

Name:
Name of Organization:
Type of Work:

Have you worked on a project that has used the LEED Guidelines?

If no, have you considered using the LEED Guidelines on a project and what were the reasons you did not go forward with using the guidelines?

If yes, what benefits do you see to using the guidelines? What are the negatives? What are the most difficult sections/points to meet?

Prior to the use of the guidelines, what were your preconceptions/concerns? Have those concerns changed?

Has it been difficult to keep projects within budget when using the LEED guidelines compared to a conventional building? What were the main problems?

What types of projects do you think that LEED Guidelines can most benefit?

What would be your major concerns, if any, with using LEED Certification as a basis for providing financial incentives/assistance?

What problems do you think private developers might perceive with using the guidelines?