

Green Building Ordinances: Municipal Experiences from Across America

Prepared for:
City of Portsmouth, New Hampshire

December 2007

Prepared by:
Rockingham Planning Commission
156 Water St.
Exeter, NH 03833



Rockingham
Planning
Commission



Preparation of this report was funded in part by a technical assistance grant through the NH Coastal program, NH Department of Environmental Services with funding from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration

Table of Contents

Section 1: Introduction	1
Section 2: Green Building.....	2
Section 3: Benefits and Costs of Green Building.....	3
Section 4: Green Building Ordinances: Summary.....	8
Section 5: Community Profiles	10
Section 6: Conclusions & Recommendations.....	30
Section 7: References.....	31
Section 8: Appendix	33

Section 1: Introduction

Through funding from the New Hampshire Coastal Program, the City of Portsmouth commissioned the Rockingham Planning Commission to research green building development in the U.S. The goal of the report is to help support efforts already underway by the city to strengthen their green building requirements. Currently the City of Portsmouth encourages green development by offering a density bonus to private projects in Central Business A District. The standard used is the US Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating system.

The focus of the report is to look at what communities have done to encourage green building development by implementing higher energy efficiency and sustainability requirements through an ordinance. A key aspect is to look at the communities' successes and challenges they have experienced by adopting a green building ordinance. Important questions the report plans to answer include:

- Were national green building standards used and did the community customize the standards?
- Were the ordinances incentive-based or mandated?
- What type of development did the ordinance apply to?
- Did the communities feel that the cost of green development was an issue? How did they manage the concern?
- Was there opposition to the ordinance and how did the community garner support for it?
- How are the green building requirements enforced and did they create an added cost to the municipality?
- What lessons can be learned from the communities who have adopted green building ordinances?

The report will first provide a short background on green building, by defining it and discussing the benefits and costs. Second will be a summary of the green building ordinances in the U.S., highlighting what type of development is required to adhere to their green building standards. The majority of the report will be centered on the results from interviews with the 10 communities. The report concludes with final thoughts on the survey results and a list of recommendations. Following the conclusion is a list of reference sources the community can use to learn more about green building and an appendix of the green building ordinances for the communities.

Section 2: Green Building

The built environment in the United States is a consumptive industry, representing:

- 65% of electricity consumption
- 36% of energy use
- 30% of greenhouse gas emissions
- 30% of raw material use
- 30% of waste output
- 12% of potable water consumption

As people have become familiar with these consumptive patterns, a movement has occurred to construct buildings in a more efficient and sustainable manner by reducing energy/water use and the costs associated in operating and maintaining the building. This movement is often referred to as green building.

At the forefront of green building in America is the US Green Building Council (USGBC). Begun in the early 1990's, they have developed comprehensive programs to promote green development and to create industry standards. One such program is the Leadership in Energy and Environmental Design (LEED) Building Rating System. It is a national standard used to evaluate the performance and sustainability of a building. There are six LEED standards, categorized by the type of development. These six standards are:

- LEED-NC: New Construction & Major Renovation Projects
- LEED-EB: Existing Building Operations
- LEED-CI: Commercial Interior Projects
- LEED-CS: Core & Shell Projects
- LEED-H: Homes
- LEED-ND: Neighborhood Development

All of the rating systems use a scorecard to allot points to projects for meeting certain green development standards. These standards include reuse of site infrastructure, access to public transit, type of materials used in construction, stormwater management, and reduction in water usage, among others. The LEED-NC is applied most commonly and has a total number of 69 achievable points. Buildings are given one of four ratings depending on the number of points they receive. The four ratings and their respective point values are as follows:

- Certified (26-32 points)
- Silver (33-38 points)
- Gold (39-51 points)
- Platinum (52-69 points)

There are three terms which will be used when discussing the LEED certification process. Those terms are:

- 1) Projects meeting the requirements for LEED certification, but that are not registered or certified;
- 2) Projects that are LEED registered; and
- 3) Projects that are LEED certified.

These differences are subtle but important to understand when reading this study. For the purposes of this study, a building that meets LEED certification signifies that a LEED scorecard was used to assess the number of points the building achieves towards the LEED rating system (certified, silver, gold, platinum). The certification of the project can either be done internally by staff, often referred to as self-certification, or by an independent third party. Such a project meets the requirements for LEED certification, but has not been registered or certified.

LEED registered refers to the requirement that the project is registered with the USGBC and requires an additional level of review by their agency.

The final term, LEED certified, means that a project has met and has been certified as meeting the lowest level of the LEED building rating system.

Section 3: Benefits and Costs of Green Building

Benefits

Green building offers a host of environmental, economic, and health and community benefits. USGBC notes the following benefits:

Environmental Benefits:

- Enhancement and protection of ecosystems and biodiversity
- Improvement of air and water quality
- Reduction of solid waste by using recycled building materials
- Conservation of natural resources

Economic Benefits:

- Reduction of operating and energy costs
- Enhancement of asset value and profits
- Improvement of employee productivity and satisfaction by reducing indoor building environmental characteristics that may lead to Sick Building Syndrome
- Optimization of life-cycle economic performance

Health and Community Benefits:

- Improvement of indoor air, thermal, and acoustic environments
- Enhancement of comfort and health for employees, tenants, students, and customers
- Minimization strain on local infrastructure by using less energy, water, and reducing solid waste
- Improvement of overall quality of life for employees, tenants, students, and customers

Costs

Typically building costs include the cost of design, materials, construction, and permitting and approval costs. Green buildings must also include these costs in the budget process, and if green building elements are incorporated early on, green buildings can be built within the same cost range as non-green buildings. Green buildings differ from conventional buildings, however, in that many of the financial benefits will be realized over the long-term life of the building. The following section attempts to quantify the costs and benefits of green buildings.

Measuring the cost of green buildings is more complex than simply measuring the costs of materials and construction for a green building versus the costs of materials for a conventionally built building. The costs and benefits of green building not only affect the builder's bottom line, but also affect the workers, tenants, or other occupants of a building as well as society as a whole. Studies measuring the costs of green building compared to conventional building approaches have generally considered the following main issues:

Construction Costs

These studies compare the cost to the builder, including materials, construction, and permitting. These studies consider green building side by side with conventional building.

Long-term energy and operations/maintenance costs

These studies consider whether savings in operations and maintenance costs, and energy use outweigh or compensate for any initial increased costs of green building. The main argument of these studies is that if green buildings cost more in materials to build, this difference will be recouped due to the savings in infrastructure, maintenance, and energy use over the life of the building. These savings are often recouped within the first three to five years of a building's operation.

Lower costs to society due to environmental benefits

These studies consider whether societal benefits of green building can be quantified, and if so, whether those benefits are worthy of encouraging through legislation or other policy or economic measures. For example, because green buildings utilize materials that include recycled materials as well as materials that will be less harmful to the environment, the "costs" of these materials is lower due to a reduction in disposal costs and lower costs of remediation actions. This benefit will primarily accrue to society as a whole but there may also be lower costs to the builder or owner of the building due to less chance of litigation or of potential future environmental remediation actions due to environmental contamination.

Health and productivity benefits due to green building

For many businesses, the costs of salaries and benefits far exceed the costs of energy. Several studies explore whether green building can significantly increase worker productivity and improve worker health, as well as improve worker recruitment and retention, thus lowering labor costs for employers. This benefit would not accrue to the builder, but would accrue to the business owner or corporation that might be considering whether to build green. A subset of these studies considers

the impact of green building on the performance and health of school children. These costs could be measured both as societal costs in terms of reduced burdens on the health care system, but also as costs to individual employers, whose workers must utilize greater numbers of sick days to care for sick children.

Green building marketing/branding

This appears to be an emerging area of research. Over recent years, builders have used their experience in green building as a tool to advertise their organization and to separate themselves from their competitors. Depending on the cost of construction and the ability of builders to market their homes or subdivisions as green, green homes may be more marketable than conventional homes due to potential energy savings but also due to consumers' preference to buy a product that is branded as green. Although not as well studied as other areas, market data on the price and assessed value of green homes versus their alternatives should be relatively easy to collect as more programs are implemented. Other factors to consider when comparing green homes versus conventional homes would be the long-term energy savings that would benefit owners of green homes and statistics on the overall health and consumer satisfaction of residents in a green subdivision versus a conventional subdivision.

The corporate world is also beginning to consider the benefits of branding their company or building as green. Large and small corporations alike are building green buildings not only to reduce their energy costs but also as a recruitment tool to attract employees who want to work in an environment that is more comfortable and healthier than a conventional building due to indoor environmental conditions such as temperature, lighting, and ventilation.

Several nationwide studies have considered the above issues. We have chosen to highlight four major studies due to their comprehensive nature and geographic diversity.

Davis Langdon. *Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption*. 2007.

This study is the most extensively-quoted study on the cost of green building. It analyzed 221 buildings, 83 of which were selected based on some level of USGBC LEED certification. The remaining 138 projects were buildings of similar type that were not designed to meet LEED certification. The study examined three types of buildings: academic buildings, including laboratories and libraries, community centers, and ambulatory care facilities. All costs were normalized for time and geographic location of the buildings. Cost per square foot was compared between all projects- LEED certification seeking and non-LEED. The report further breaks down the cost analysis in each of the six categories for LEED New Construction: Sustainable Site, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation and Design Process.

The major finding of the study, which updates its own 2004 version, is that “there is no significant difference in average costs for green buildings as compared to non-green building. Many project teams are building green buildings with little or no added cost, and with budgets well within the cost range on non-green buildings and similar programs.” Another important finding from this study is that those wishing to encourage green building must fight the perception that green building is an added feature or cost, rather than something that can be integrated early on into the design process,

and that can result in multiple levels of savings. According to the report, one way to fight this perception is to illustrate that costs are not necessarily cumulative. For example, incorporating a design feature that results in a project meeting one of the sustainable design criteria and scoring credits may also allow that project to meet other criteria without additional cost.

Kats Study: *The Costs and Financial Benefits of Green Building: A Report to California's Sustainable Building Task Force*

In 2003, Greg Kats wrote a well documented report on the topic. The study compares cost and benefit data from 33 high performance green buildings nationwide. This study found that the average cost premium over conventional construction is less than 2 percent. Twelve of the buildings surveyed were constructed at standard per square foot costs with no premium for green features. The study notes many other benefits of green building, including lower energy costs, lower waste disposal costs, lower environmental and emission costs, lower operations and maintenance costs, and savings from increased productivity and health of occupants. This study concludes: “the total financial benefits of green buildings are over ten times the average initial investment required to design and construct a green building.”

Fisk Study: *Health and Productivity Gains from Better Indoor Environments and Their Relationship with Building Energy Efficiency*

In 2000, William Fisk wrote a very comprehensive study examining the existing literature on green building and health and productivity of occupants. The study investigates four aspects of indoor environments: associations of building characteristics with communicable respiratory illness, allergies and asthma, sick building syndrome symptoms, and direct impacts of indoor environments on human performance such as impacts of temperature and lighting.

The major finding of the study is that “for the United States, the estimated potential annual savings and productivity gains are \$6 to \$14 billion from reduced allergies and asthma, \$10 to \$30 billion from reduced sick building syndrome symptoms, and \$20 to \$160 billion from direct improvements in worker performance due to green building that are unrelated to health.”

The study emphasizes that these savings, though often overlooked, are very important in considering costs because potential savings and productivity gains are a much larger portion of an employer's budget than other costs and are larger for example, than the total estimated cost of energy used in buildings.

Boston Green Building Task Force: *Everyone Benefits from Green Building*

A final study that is a little closer to home is the report by Mayor Menino's Green Building Task Force from Boston, completed in 2004, entitled “*Everyone Benefits From Green Building*”. The task force, a multi-disciplinary body surveyed green building programs nationwide, then held a series of meetings and interviews with experts around the country to develop a report and recommended actions. The report includes several case studies that assess building performance data over time. For example the Gilman Ordway Campus of the Woods Hole Research Center in Falmouth has been tracking building performance data since its opening in February of '03, and found that the green building has reduced energy consumption by 73 percent compared to the previous building.

The Costs and Benefits of Green Building: Conclusions

These studies illustrate that if green building design is incorporated early on in the design process, it does not necessarily increase the total building cost of a project. Green building can result in short and longer-term financial benefits to the building owner, the business owner, and the employer due to longer-term energy savings, increased employee productivity and health, and lower maintenance costs. Green building may be an effective branding strategy for homebuilders and businesses. Green building may also provide a host of health and quality of life benefits that accrue to employers as well as individuals.

Section 4: Green Building Ordinances: Summary

Green ordinances can be sorted into six categories. They are dependent on the regulatory authority (mandatory or incentive) and the type of development (Commercial, Residential, and Public). According to the USGBC, there are 72 municipal and county jurisdictions in the U.S. with some version of a green building requirement.

Table 1
Jurisdictions with Green Building Programs
United States

Category	Commercial	Residential	Public
Total Green Programs		72	
Programs in Respective Areas	33	26	60
Mandatory Program			
LEED Certified	8	6	21
LEED Silver	3	n/a	36
LEED Gold	n/a	n/a	4
Other Standard	5	2	4
Incentive Program			
Tax Credit or Other Financial Incentive	8	5	n/a
Increased Density/Building Code Variance	6	7	n/a
Priority Plan Review	8	6	n/a
Permit Fee Reduction	3	2	n/a
Staff Support	2	2	n/a
Voluntary/Education Program	3	4	n/a

* Due to many jurisdictions having multiple programs, the totals do not add up.
Source: USGBC, 2007

Table 1 offers a summary of what type of requirements each jurisdiction offers. The requirements on development are broken into three categories: Commercial, Residential and Municipal development. This is further classified into communities who have chosen to mandate the requirements and those offering incentives to encourage green development. Of the 72 communities, 33 have regulations which apply to commercial development, 26 to residential development and 60 communities have regulations applicable to municipal buildings. Research on the established green building programs yields the following summary comments.

- **Municipal Projects:** Communities favor mandating green development for municipal projects over mandating that private development meet the requirements. Most municipal projects choose LEED Silver as the standard. Many of the ordinances require that a USGBC Accredited Professional be a member of the design team.

- Commercial Development: Mandating green development standards for commercial development is favored over residential development.
- Residential Development: Most of the mandatory programs apply only to multifamily residential dwellings. Single family residential programs have few mandates but instead are encouraged through voluntary programs and incentives.
- Incentive Programs: There were an equal number of communities that mandated green standards for commercial developments compared to communities who prefer to offer incentives.
- LEED Standard: The LEED rating system is the preferred standard to evaluate the level of green performance. However, there is a growing trend to allow projects to comply with customized standards developed by the jurisdiction in lieu of meeting LEED certification.
- LEED Certification: The majority of the jurisdictions require projects to meet LEED certification but do not require projects to be LEED registered.
- Exemption Clause: The majority of the communities include a provision to exempt buildings from the performance standard in certain circumstances. Additionally, newer ordinances have included a tiered program, stating if the payback period is greater than a specified period of time (5 or 10 years), then the project is exempt or the next lowest level of LEED will be encouraged.
- Minimum Threshold: Almost all of the communities with mandates offered some sort of minimum threshold that development must meet before the green building standards are applied. This varied from community to community and included minimums on square footage between 5,000 sq. ft to 100,000 sq. ft. Others had a monetary value on projects. An example is New York City, which required all nonresidential projects valued at \$2 million or more to adhere to their green building standards.
- Sunset Provision: Communities that may be reluctant to require green standards have opted to establish a trial period by including a sunset provision.

Locally, the NH Office of Energy and Planning (OEP), along with the NH Department of Environmental Services (DES), have developed the Regional Environmental Planning Program (REPP). One of the programs within REPP is the Innovative Land Use Planning Techniques Guide with a chapter devoted to energy efficiency ordinances. A model green building ordinance has been included in the guidebook. It details the relevant NH statutes and offers insight on how buildings can exceed NH State Building Code requirements.¹ Within the seacoast region, Epping has used the REPP model ordinance for energy efficiency as a foundation in creating Article 22, Energy Efficiency and Sustainable Design Ordinance. Epping was one of the communities interviewed for this study and a detailed outline of their experience follows in the Community Profiles.

¹ A copy of the ordinance has been included in the appendix and is cited in the reference section.

Section 5: Community Profiles

For this study, Rockingham Planning Commission surveyed 8 communities from across America that have adopted Green Building Ordinances. The communities were chosen based on geographic location, size of population and their type of Green Building Ordinance. Surveys were e-mailed to all of the municipalities.² Once the surveys were completed, a follow up phone interview was scheduled to clarify statements and collect more detailed information regarding the successes and challenges the community had with implementing their Green Building Ordinance. The municipalities interviewed and their populations include:

- Arlington County, Virginia (pop. 203,000)
- Austin, Texas (pop. 700,000)
- Boston, Massachusetts (pop. 590,000)
- Cambridge, Massachusetts (pop. 101,000)
- Cranford, New Jersey (pop. 22,000)
- Epping, New Hampshire (pop. 6,000)
- Normal, Illinois (pop. 50,000)
- Pleasanton, California (pop. 66,000)

² A copy of the survey has been included in the appendix.

Community:

Arlington County, Virginia

Lessons Learned:

If the project team is trained in green design and construction and has experience with LEED, the upfront costs are minimal. Commissioning does cost more, as does energy modeling, but the payback on both of these investments is very quick. If green components are incorporated from the very beginning, then it is very difficult to separate out the specific green costs.

Energy efficiency is the biggest bang for the buck. Looking at the whole building from the very beginning is key. Enhancing the building efficiency can allow one to install a smaller, less expensive HVAC system, which will save money over the life of the building.

Community Background:

Arlington County is located directly across the Potomac River from Washington, DC. The County has a population of 203,000. At 26 square miles, it is geographically the smallest self-governing county in the United States. Arlington National Cemetery, Washington National Airport, and the Pentagon are located in Arlington.

Ordinance:

To encourage projects to achieve formal LEED certification from the U.S. Green Building Council, Arlington has established a green building density incentive program. The program allows developers to request a slightly larger building than would normally be allowed by County Code if the project receives official LEED certification at one of the four LEED award levels. The amount of additional square footage allowed varies depending on the project and on the LEED award sought.

Arlington’s green building program applies to any project that seeks a special exception to the zoning ordinance. Typically, this is any large office, multi-family residential or mixed-use project. The zoning ordinance generally allows only lower-rise buildings, so anything that is a high rise is subject to a series of community reviews and “proffers” one of which is incorporation of LEED credits. The expectation is that the project will include at least 26 LEED credits. This is not mandatory, but the County Board expects that projects will achieve this level of environmental compliance at a minimum.

Bonus density is offered to projects willing to commit to formal LEED certification through the USGBC. The amount of density a developer can request increases with increasing levels of LEED certification (i.e., .15 FAR (floor-area ratio) bonus density for LEED Certified, .25 FAR for LEED silver, .35 FAR for LEED gold). The bonus density approval is not automatic. Staff review the project to make sure the additional density is appropriate for the neighborhood and the project.

(Arlington County, Virginia, continued)

The County has a Green Building Fund that is calculated at \$0.03 per square foot. This is equivalent to the amount the project would pay to the USGBC for review and certification. All projects pay this unless they are going to the USGBC for certification, in which case they pay the fee to the USGBC and don't owe the County.

In the case of the bonus density program, the developer posts a bond to ensure that LEED certification is achieved. When evidence of USGBC certification is provided, bond is released. If for some reason they don't achieve the promised certification, the bond goes to the County. The bond is calculated based on the site of the bonus density space.

Arlington also has a voluntary green building program for residences, called Green Home Choice. Builders must submit an individual scoring worksheet. An Arlington Green Home Choice Certification Award requires 175 points. Building projects are rated in the following environmental impact areas: site use, energy, indoor air quality, building materials, solid waste, and water. Each home must also have appropriate documentation and a final Inspection by an Arlington County Green Home Choice Inspector. The builder must also prepare a comprehensive Homeowner's Manual describing the environmental features of the home, including, but not limited to, the Arlington Green Home Choice Scorecard and Guidelines, manuals, Warranties, and operating instructions.

Incentives for developers and builders include advertising at the job site indicating that the site is an Arlington Green Home choice, promotional packages for builders and developers, certification of the home, press releases and news articles, and recognition of builders on the Green Home Choice website.

Operation Experience:

The County started asking for LEED components in 2000. In 2003, the county began to ask for more credits and enhanced the density incentive program. LEED scorecards are reviewed by county staff initially and each time the developer applies for a building permit. The County requires a bond that is released when the USGBC certification is issued. If the developer misses the promised number of LEED credits by 1-3 credits, they lose half the bond; any more than 4 credits, they lose the whole bond. The developer also loses the whole bond if they achieve fewer than 26 credits.

Community Experience:

Developers were resistant at first, but now know that LEED is expected. There are many LEED resources in the DC area and many LEED experienced professionals are available.

Community:

Austin, Texas

Lessons Learned:

- Created tiered program system based on building type, size and zone district.
- Amended IECC 2006 Code to improve energy efficiency on all buildings.
- Uses two rating systems for mandated program. LEED rating system and the Austin Energy Green Building (AEGB) Rating System.
- Holds quarterly Green by Design Workshops for consumers.
- Austin, Texas found that review of green building requirements is best done through planning board and/or staff who are experienced in green building. The building inspector/code enforcement officials should not be used.
- Project costs have generally been 1-2% more in upfront capital, and the payback is in 1-2 years.
- Affordable housing projects have been built green below traditional mortgage costs.

Community Background:

Austin, Texas is located in the central area of Texas and has a population around 700,000. It is often referred to as the fastest growing metropolitan area in the nation and it is heavily influenced by the University of Texas-Austin. Austin is powered through a municipal utility, Austin Energy. It is within this branch of government that the Green Building Program (GBP) is housed. GBP has a staff of 15 and is expected to add 5 more members over the next year. The city has been working on energy efficiency since 1985. The Green Building program began in 1991 with a voluntary residential rating tool and has advanced to include commercial, residential and municipal programs.

Ordinance:

Austin uses LEED accreditation standards and a customized Austin Energy Green Building (AEGB) rating system as metrics for their Green Building Program. The AEGB rating system uses a five star rating system. Even at their minimal rating of 1 star, these requirements are above the already stringent Austin Building Codes, which exceed International Energy Conservation Codes.

There are mandatory and voluntary green building programs in Austin. They are as follows:

Mandatory Programs

The following programs are required on new construction or major renovations. Austin does not use LEED- EB (Existing Buildings).

1. LEED Silver for all Municipal Buildings
2. Austin Energy Codes: Adopted the IECC 2006 but with more stringent local amendments

(Austin, Texas, Continued)

aimed at reducing energy usage for their climate.

3. Five zones require an AEGB rating of 1 star out of 5, including: Central Business District, Downtown Mixed Use District, University Neighborhood Overlay, Planned Unit Development District and Traditional Neighborhood District.

Incentive/Voluntary Programs

1. Residential Educational Campaign/Support: They offer a large marketing campaign to encourage green development. Programs include:
 - Quarterly Green by Design Workshop Sessions
 - Free Home Energy Audits, Free Programmable Thermostats
 - Online Directory of Green Building Contractors
 - Load Shedding Program

Operation Experience:

The green building ordinances are enforced during the public plan review process for those projects requiring a site plan review. Projects not requiring site plan review are inspected for compliance by the GBP staff prior to the issuance of an Occupation Certificate. The Building Inspectors do not do the review of the Green Building Standards. They highly recommend green building standards be run through planning review and/or separate staff with experience in green building.

The GBP's review of projects is split evenly between mandatory reviews and voluntary compliance reviews. They believe there is a large voluntary participation because of their extensive marketing/education campaign and rebates available through Austin Energy. Funding for these programs is achieved through demand reduction for electricity, similar to the forward capacity market of the ISO New England Power Grid.

Costs: GBP feels that there is a large misperception about costs of green development. In their experience, the upfront capital costs have only been 1%-2% more than traditional means for a project at their 4 star level. These costs are generally paid off for in 1-2 years. A key aspect of reducing costs of green building is to have a green building professional involved early on in the project design. Their largest success story is with affordable housing where the increase in mortgage payments caused by the increase costs for green building standards is less than the increase costs of energy if it were traditional construction. He noted that it is important to mention in the ordinance that any projects that are currently in the pipeline should be grandfathered in and not be required to meet green building guidelines. Their next step is to work on incorporating LEED standards for industrial buildings.

Community Experience:

The city started a Green Building Program in 1991 with the creation of a voluntary program for residential buildings. Throughout the 90's they added on to this program and created a formal Green Building Department underneath the municipal power company, Austin Energy. It wasn't

(Austin, Texas, Continued)

until 2000 that the city began mandating standards. The first standard was to require all municipal buildings to achieve a minimum LEED Silver certification. In 2003 they created a new downtown plan and required development to meet at least 1 star out of 5 from their local rating tools or to meet LEED certification. This has been expanded to include Austin's airport district and all government subsidized affordable housing developments.

In formulating their rating system, Austin used the basis of LEED criteria but adjust it for local concerns. Specifically their rating system was adjusted to improve electric energy efficiency, increase water quality requirements and mandate 50% of the construction waste be either recycled or offset by using recycled material in the construction.

The experience from the developers has largely been positive. There has been a difference between developers who plan to own the building once constructed and the spec. developers. Initially, spec. developers were hesitant with the green building standards because they wouldn't reap the long term rewards. This sentiment has subsided. Many developers are now using their green projects as a marketing plug for their companies.

Since the implementation of LEED Silver requirements on municipal projects, nine projects have been built. Two were built to LEED Certified standards, five were LEED Silver, and two were LEED Gold. Commercially, 15.1 million square feet of space have been built to green building standards.

Community:

Boston, Massachusetts

Lessons Learned:

- The green building ordinance was developed over a two year period of time. This allowed developers, city officials and its citizens time to become familiar with the idea and ease concerns.
- The city had past experience with private developments using green practices. This helped ease concerns.
- Created a separate subcommittee, Interagency Green Building Committee, to advise the Boston Redevelopment Authority on proposed project's compliance with the green building ordinance.

Community Background:

With its close proximity to Portsmouth, Boston is a familiar city. It has a population of approximately 590,000 and a metropolitan area encompassing 4.4 million people. It is the hub city for New England both culturally and economically. With strong ties to academia and large businesses, Boston is poised to continue strong developmental growth.

Ordinance:

Municipal:

Enacted in 2004, all municipal buildings were required to be LEED certifiable. By 2007, the regulations were increased to require municipal buildings to be LEED-Silver certifiable. Projects are not required to register with LEED, simply to be certifiable.

Commercial:

Boston's green building ordinance, Article 37, was adopted on January 10, 2007. It requires all projects over 50,000 square feet, also referred to as Large Projects, to meet LEED certification requirements. Up to 4 of the required points may be obtained from the Boston Green Building credits. Credits are awarded for projects that use distributed generation, combined heat and power, historic renovation, transportation demand management practices, recharge groundwater, among others. Projects are not required to register with USGBC for their LEED certification.

(Boston, Massachusetts, Continued)

Operation Experience:

The adherence to the ordinance is done through the review process at the Boston Redevelopment Authority (BRA) as allowed by Article 80. The applicant will submit a LEED Scorecard along with the plan for the review by the BRA. They will also supply information pertaining to any Green Building Points they are applying for. The process is a self certifying program where the BRA determines whether the project is meeting the requirements of the green building ordinance. A third party provider is not used.

After the submission of the plan, there is an advisory board, the Boston Interagency Green Building Committee, which will review the application for the BRA. No additional building inspectors or planning staff have been hired to adhere to the new requirements.

Community Experience:

The green building ordinance was developed through the city's Green Building Task Force. The task force was formed in 2003 by order of the Mayor. The group had approximately 25 members with backgrounds in banking, development, public officials, architecture, unions, academia and law. In its first year, the task force developed their first report emphasizing the benefits and addressing concerns. One key concern developers noted was from the developers who will build a building but do not plan on owning the building. They pay the upfront capital costs without realizing the benefits of reduced energy costs. The task force feels that as education for green development continues, there will be a built up demand for green buildings and consumers will be willing to pay a premium for green building. The report cites that this has already been the case in Seattle, which passed green building requirements in 2000.

As mentioned earlier, the projects that are required to meet the green standards are large projects, over 50,000 sq. ft. The review process for these projects is generally long, lasting usually 1 to 1 ½ years. Because of this long process, the BRA didn't feel that adding another requirement, green measures in this case, would prolong the review process. Since the ordinance was enacted earlier this year, no projects have been constructed yet. However, the expected impact will be 6-7 million sq. ft. of building in Boston.

For municipal projects, no municipal buildings have been built. However, there are a number of projects that are in the planning review stage. These include the Charlestown Neighborhood Police Station (40,000 sq. ft.), Mattapan Library (30,000 sq. ft.), B-2 Police Station (40,000 sq. ft.) and a Municipal Service Building (200,000 sq. ft.).

Community:

Cambridge, Massachusetts

Lessons Learned:

There is a mixed view regarding the proposed regulation for private developments. There are concerns about the cost of LEED documentation. (The City has not collected local level data on cost, but cites two studies, the Cost of Green study by Davis Langdon and the Capital E Report done for the state of California). Other developers who prefer to build green but are concerned about competition and cost are interested in “leveling the playing field” so that green design requirements apply to all.

Community Background:

Cambridge, Massachusetts has a population of 101,355, (2000 census), and is a metropolitan community that is home to Harvard University and the Massachusetts Institute of Technology. The City has a reputation as a diverse academic and professional community and a center for high-tech innovation and technology start-up corporations. The City has a comprehensive Climate Change Strategy, of which the Green Building Policy is one of many parts.

Ordinance:

The City currently has a provision in its zoning ordinance that encourages projects subject to review to use LEED to demonstrate that impacts on infrastructure and environment will not be significant. This provision generally applies to projects of 25,000 s.f. or larger. (Article 19, Cambridge Zoning Ordinance). Although there is no mandatory requirement in place currently, a zoning amendment is under consideration to require private development to be LEED certifiable. This requirement, if passed, would apply to projects 25,000 s.f. and larger.

It is City policy, per City Council order, that all new construction and major renovations follow the U.S. Green Building Council’s LEED rating system.

(Cambridge, Massachusetts, Continued)

Operation Experience:

Cambridge City Hall Annex was the City's first green building and achieved a LEED Gold rating. There are currently four projects in design or construction that intend to achieve LEED certification including the Cambridge Public Library expansion, Robert W. Healy Public Safety Facility, West Cambridge Youth & Community Center, and the War Memorial renovation. In addition, the proposed renovation of Cambridge Rindge and Latin School has received a \$100,000 green schools design grant from the Massachusetts Technology Collaborative. In addition, out of several completed projects, three are LEED Certified, two are LEED Silver Certified, two are LEED Gold Certified, and two are LEED Platinum Certified.

The Community Development Department staff review submitted plans and information. Planning Board permit applicants have been cooperative regarding the voluntary requirement.

Community Experience:

The current voluntary provision in the zoning ordinance has created greater awareness of green design and the City's desire that developments follow this course. The City Environmental Planner states that most green buildings are being developed by institutions or businesses with a long-term view, such as universities and government. Commercial developers are rarely pursuing green design, with some exceptions.

Community:

Cranford, New Jersey

Lessons Learned:

- Their ordinance required the Township to incorporate life-cycle and total cost accounting, methods used to determine not only the costs of materials but also savings that could be realized using recycled materials in the design, construction and maintenance of town owned buildings.
- The ordinance encourages redevelopment projects in Areas of Need of Redevelopment to use LEED standards by offering a Density Bonus Incentive.
- Reasons for lack of participation or compliance with the green building ordinance include:
 - Minimal public education; lack of buy in from the community
 - Lack of specific performance standards in Density Bonus Incentive
 - Unclear definition of major construction
 - Lack of mandatory compliance for private projects

Community Background:

Cranford, NJ has a population of approximately 22,000 and is a suburb of Newark, NJ. Largely a residential community, Cranford also has a downtown area serves as a retail shopping district. The community is mostly developed and few open parcels remain. Instead, developers are choosing to redevelop parcels with older structures. They have created a Special Improvement District (SID) for a business area to create an economic incentive for developers to redevelop the neighborhood.

Ordinance:

Municipal:

Cranford’s ordinance was enacted in November 2005. Under the ordinance, all new municipal buildings or municipal buildings with major renovations need to meet LEED Silver standards. The ordinance also requires all existing municipal buildings comply with LEED- EB (Existing Building). Other notable inclusions were the requirement for the Township to consider lifecycle cost and total cost accounting in the design, construction and maintenance of town owned buildings.

Private:

The ordinance also created an incentive for developers constructing in an Area in Need of Redevelopment, as outlined underneath NJ state law. Developers who chose to build a LEED certified building receive a Density Incentive Bonus. As the ordinance states “The incentive allowed will vary depending on the project and on the LEED award sought.”

(Cranford, New Jersey, Continued)

Operation Experience:

There has been little experience of a project utilizing the green building ordinance going through a review process. For municipal buildings, the Zoning Officer will be responsible for insuring LEED compliance.

Community Experience:

The green building ordinance has only been in effect for two years. During this time, no new municipal buildings have been proposed or built. Additionally, no developers have used the density bonus incentive to construct. The town feels that one of the reasons their green building ordinance hasn't been applied is because little development has occurred during this time period.

On the municipal side, no new buildings have been proposed and no new buildings are being planned. The ordinance also mandates the existing buildings to be LEED-EB, however the Township has taken no action towards implementing these standards.

On the private development side, there has been one redevelopment project in which the developer has sought a density incentive bonus. The process has not progressed far enough to determine whether it is effective.

Community:

Epping, New Hampshire

Lessons Learned:

- Customize program to fit community.
- Allow for innovative ideas to be implemented and earn points.
- Have a large educational component with stakeholders about the implications of the green building ordinance.
- Highlight successful examples of business using energy efficient design standards in town.
- Consider an impact fee developers can pay in lieu of compliance with energy efficient requirements.

Community Background:

Epping, New Hampshire has a population around 6,000 and is largely a residential community, with an increasing amount of commercial development at the intersection of Route 101 and 125.

Ordinance:

Article 22 was passed at Town Meeting in March of 2007 by a vote of 700-606. Its purpose is to get developers to think about energy efficiency at the pre-design stage. The LEED accreditation program and the NH Office of Energy and Planning’s energy efficiency model ordinance were both used to create an ordinance that would work for Epping.

The ordinance requires all non-residential development to receive a certain number of points depending on the square footage of the development. The larger the square footage, the more points the building will need. The green points are separated into two categories, Energy Production (EP) and Sustainable Design (SD) requirements. Requirements are as follows:

Sq. Ft. in development	Required EP & SD score
0-5,000	5
5,001-10,000	10
10,001-20,000	15
20,001-50,000	20
50,001 & up	25

Points are awarded on a variety of energy efficient recommendations. Some examples include HVAC efficiencies, building orientation, reduction in water usage, source of building materials, daylighting and production of onsite electricity. Specifically onsite electricity generation was a high priority. For example, a development which includes a wind turbine or a photovoltaic panel would earn between 10-15 points. If the project were to reuse existing materials and recycled content, they could receive 1-3 points. Steps were taken to simplify the point system for a small community. By

(Epping, New Hampshire, Continued)

simplifying the point system, it would be easier for residents to understand and for developers to adhere to.

Several of the ways to earn green points require post development inspection. In these situations, the onus of proving compliance of these measures lies with the developer. Prior to receiving a certificate of occupancy the developer must submit a filing to the Planning Board to ensure the measures are achieved to the board's satisfaction.

Operation Experience:

The planning board is charged with ensuring projects meet requirements through the review process. One project, TD BankNorth branch, located on Route 125 on W/S Development's site known as Epping Crossing, has gone through the planning review since the adoption of Article 22. The experience was that the project far surpassed the requirements of the green building ordinance. When completed, the building will incorporate the following components:

- Installation of 7-10 KVA PV system.
- Installation of a rainwater recovery system on site to capture grey water for use by restroom toilets.
- Installation of energy efficient CFL light bulbs.
- Use of recycled contents in construction materials.
- Use of local and regional materials.
- Installation of a high efficiency HVAC system.
- Installation of "green" refrigerant and plumbing systems.
- Installation of "cool" roof products.

There have been no additional costs for the municipality to enact the ordinance. The review process is done by the planning board and building inspector has not been affected.

Community Experience:

The Planning Board felt it was their duty to enact a green building ordinance based on the recommendations stated in the energy chapter of their master plan and RSA 672:1(III-a), 155-A:2(VI), 674:17(I) and 674:21. In researching the issue before the ordinance was placed on the warrant, the Epping Planning Board looked at two developments in town, the Toyota Dealership and the Goodrich Brick Company. Both organizations saw a benefit in energy cost savings which will benefit them in the long haul. They also met with people from Jordan Institute and with Steve Winter, former chair of the US Green Building Council. Additionally a review of tax incentives for energy efficiency as found in the internal revenue code was done.

The community was largely behind the idea of a green building ordinance but there was some hesitation based on the unfamiliarity the community had towards green building ordinances. Specifically, some of the concerns included:

- Developers would shy away from commercial development in town.
- Project costs would increase to meet compliance.

(Epping, New Hampshire, Continued)

- The ordinance should be an incentive program rather than a mandate.
- The environmental benefits would be small.
- Epping is a small town and all of the other towns who have enacted a green building ordinance are large communities.
- Oil would be banned as a source of heat.
- Residential development would be affected.

To get the ordinance passed, there were two important aspects which allowed the ordinance to be accepted. 1) Two companies in town (Goodrich Brick and Toyota Dealership) were implementing energy efficient and sustainable designed buildings. 2) There was a large education component to the ordinance.

The education component began in November. At least one planning board meeting every month till the town meeting was geared towards the green building ordinance.

Another next step is to consider some sort of credit system. Essentially developers can opt to purchase credits which will suffice for the points they need to adhere to the measure. Money generated by the town through the sales of these credits would be earmarked for energy efficient measures that they could construct in municipal buildings.

Community:

Normal, Illinois

Lessons Learned:

According to town planners, the experience of building the Children’s Museum to LEED standards made them appreciate how difficult it would be to force a private development through the LEED process. It is felt that the process of going through the USGBC reviews will become easier as more local developers get experience with LEED projects.

Community Background:

The Town of Normal is a growing university community spanning 17.04 square miles, located in Central Illinois. The population is 50, 519. Illinois State University, Heartland Community college and Lincoln College are located in Normal.

The downtown or B-2 Central Business District is undergoing significant redevelopment, including a tax increment financing district to assist developers with the cost of land assemblage, demolition, and redevelopment.

Ordinance:

Section 15.17-4, Environmentally Sensitive Design, applies to the B-2 Central Business District. In this section of the building code, the Town adopts LEED rating system 2.0 for new construction. The Town mandates that all new construction with more than 7,500 square feet at the ground level in the B-2 District at least achieve enough LEED points to attain LEED Certified status. Exempted from this requirement are stand-alone parking decks and portions of a building that serve as parking decks.

(Normal, Illinois, Continued)

Operation Experience:

The code was enacted in 2002. The first green building constructed was the Town-owned Children's Discovery Museum. Although the planning and construction process was generally positive, the energy models utilized for predicted costs were inaccurate, and the LEED review process seemed arbitrary and inconsistent due to changing of review team members. There has been one additional LEED building constructed since the museum, which was the Bank of Illinois which achieved a LEED Silver Certification.

The Town requires the United States Green Building Council to certify the buildings.

The Town received a \$100,000 grant from the Illinois Clean Energy Community Foundation to cover the cost of additional green design fees and extra commissioning for the Museum. The total cost of construction was \$4.6 million. The cost impact of building to LEED standards was estimated to be in the range of 1-3%, which the city anticipates will be recouped within three years due to energy savings.

Community Experience:

The community has been generally receptive, perhaps due to the fact that it has only been required on "special" public/private projects and it has generated a lot of construction work. Many of the contractors involved in the Museum have now been able to advertise their LEED experience.

Community:

Pleasanton, California

Lessons Learned:

- Allows projects to be LEED self certified and does not require the projects to be registered with the USGBC as LEED compliant.
- Used StopWaste.org guidelines for residential development.
- Eased into the residential requirements by offering them as a condition of approval on proposal. When the codes were mandated in 2006, there was no opposition from the developers in the community because they were already familiar with the concept.
- There one word of advice, get buy-in from all Departments prior to going live with the code.

Community Background:

Pleasanton, California is a community of 66,000 and is a suburb of Oakland California. It is known as an affluent community. It has a strong commercial economy with numerous large businesses such as Safeway, Oracle and Ross Stores having major headquarters in Pleasanton. Retail business is well represented with one large regional mall and a pedestrian friendly downtown area with a number of local restaurants, bars and small retail outlets.

Ordinance:

Their green building ordinance is categorized into three areas. All of the categories are mandatory and no incentives are offered. The categories include:

Municipal:

Enacted in 2003. All municipal buildings are required to meet LEED certified rating but they are encouraged to meet LEED Silver rating when it's feasible.

Commercial:

Enacted in 2003. All commercial buildings greater than 20,000 sq. ft. of conditioned space must meet LEED certified rating. All projects within their Downtown Specific Plan are exempt from meeting the requirements, however, they are encouraged to use green building measures.

Residential:

Enacted in 2006. Projects must meet StopWaste.org guidelines. There is a minimum point requirement dependent on the project. No modifications were made to the guidelines by StopWaste.org.

(Pleasanton, California, Continued)

Operation Experience:

The municipal and commercial aspects of the ordinance are administered in the plan review process. The initial checklist/scorecard is reviewed by the Planning Board during the development application review. During the Building Permit process the checklist/scorecard is reviewed with the plans by the Planning Department to ensure all claimed points are being obtained. Throughout the project construction phase, the Building inspectors are reviewing the measure to make sure the requirements are being done. To administer the program, each project takes approximately an additional 6 hours from the staff. All of the costs for training and implementation of the program have been covered by a grant from a local not-for-profit agency. Pleasanton is considering hiring a 3rd party reviewer but no such requirement has happened to date. Implementation of a green building ordinance is best if it occurs in an organizational structure where the planning staff and the building inspector staff are underneath the same director, or boss.

Pleasanton's program is unique to other green building ordinances because they do not require projects to register their building with USGBC LEED program. Instead the projects simply need to use the LEED scorecard to self certify the program. Compliance is done through the design review, as mentioned above.

Community Experience:

All of the categories are mandatory and no incentives are offered. The code does offer a provision to allow an applicant to petition for an exemption due to hardship. However, to date no exemptions have been granted.

For their residential program, they opted to use the StopWaste.org guidelines. StopWaste.org is the Alameda County Waste Management Authority and the Alameda County Source Reduction and Recycling Board operating as one public agency. Guidelines are available online at www.buildgreennow.org.

Since the implementation of the LEED certification requirements on municipal projects, two projects have been built. A fire station and a public restroom. The fire station met LEED Gold certification. The public restroom was a small project and there is no LEED certification for this type of project but they incorporated as many green measures as possible. There is also an Art Museum that is in the queue; they are planning on meeting LEED certification equivalent.

Regarding the costs, the general feeling is that life cycle cost accounting should be used, and if used, the upfront costs can be offset by incorporating green building earlier in the development process, and reduction in maintenance/operation costs. For the two municipal projects, the public works inspector felt that the upfront costs were roughly 10% more. They noted that the increase in costs is a variable that is dependent on what green measures are chosen. For example if photovoltaic measures are chosen, there will be a substantial increase in construction costs. However if a green measure for recycled carpet is used, there is minimal additional costs.

(Pleasanton, California, Continued)

Another unique aspect of the Pleasanton ordinance is the voluntary compliance in the Downtown Specific Plan. Most of the development in this zone has been remodels of old buildings, and it is not requested for this type of development to meet green standards. Three new buildings have been built, and all of them incorporated green measures. This was due to the strong encouragement by the city staff and the planning board for the developers to use green measures. If it weren't for the strong persuasive requests by the city, the developer would not have built a green building.

The developers have had no reaction to civic and commercial aspects of the ordinance. On the residential side, the staff has placed conditions of approval on new homes to be built green since 2003. Therefore, when the code amendment came through in 2006, developers were already accustomed to the requirement.

The primary systems being impacted are HVAC, plumbing, landscaping, stormwater and wastewater systems.

Section 6: Conclusions & Recommendations

This study illustrates the diversity of green building ordinances in the United States. Despite this diversity, many communities have experienced similar challenges in implementing their individual ordinances and programs and the lessons learned in these communities may be helpful to the City of Portsmouth. Based on this study, we offer the following recommendations.

- **Use LEED as the standard:** The USGBC LEED building rating system is the national standard to evaluate the performance of green development and should be used as the standard in Portsmouth. While customized standards are increasingly used, this is being done by larger municipalities that have dedicated staff working on green development.
- **LEED Self Certification:** Projects should be self certified through the public plan review process. Self certification does not require developers to register projects with USGBC. Self certification reduces the burden on municipal employees (building inspectors and planning departments) and minimizes the costs to the developer.
- **Municipal Building Standards:** Most municipalities with a Green Building Program are leading by example by adhering to LEED standards for new municipal buildings. Of these communities, LEED Silver is the standard most used. The City of Portsmouth has recently completed a new LEED certified (silver) public library, and two additional new green buildings (fire station and water treatment plant) are in design. The City may wish to consider adopting a resolution relative to green building standards for municipal facilities.
- **Minimum Thresholds for Private Development:** If a green building standard is sought for private development, minimum thresholds should be set that would require green building standards be met. The discussion should consider the type of use, (for example non-residential versus residential), the square footage, and construction value of the project.
- **LEED Accredited Professional:** Portsmouth should require a LEED Accredited Professional (AP) be part of the design team working on private projects that must comply with any green building standards the City adopts.
- **Incorporate LEED Elements Early in Design Process:** Studies note that projects that incorporate green building elements early in the design process are more successful in keeping the project within budget.
- **Green Building Education:** Incentive programs have had varying levels of success, largely determined by the level of buy in of the development community. Mandating standards will have definitive results but may take longer to pass. Educational outreach to builders, the business community and residents on green development standards will help to improve the success of any green building program.

Section 7: References

Arlington County, Virginia. Department of Environmental Services.
www.arlingtonva.us/Departments/EnvironmentalServices/epo/EnvironalServicesEpoGreenBuildings.aspx. Contact: Joan Kelsh (703) 228-3599, jkelsch@arlingtonva.us.

Austin, Texas. Austin Energy: Green Building Program.
<http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/index.htm>.
Contact: Richard Morgan (512) 482-5309, richard.morgan@austinenergy.com.

Boston, Massachusetts. Boston Redevelopment Authority.
<http://www.cityofboston.gov/bra/gbtf/gbtfhome.asp>. Contact: John Dalzell (617) 918-4334,
john.dalzell.bra@cityofboston.gov.

Boston Society of Architects, Case Studies in New England,
http://www.architects.org/portals/index.cfm?doc_id=123#case_studies.

Center for Green Building Research. Electric Power Research Institute' Lawrence Berkeley
National Laboratory, Palo Alton, CA. www.epri.com.

Cranford, New Jersey. Conservation Commission. Contact: Nelson Dittmar, (908) 276-7909,
candndittmar@cs.com.

Langdon, Davis. 2007. Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of
Sustainable Design in Light of Increased Market Adoption. (attached as an appendix to this report).

Edwards, Brian. 2003. Green Buildings Pay. New York: E & FN Spon.

Environmental Building News. (monthly) www.buildinggreen.com.

Environmental Design and Construction (bimonthly) www.edcmag.com.

Epping, New Hampshire. Planning Board. Contact: Clay Mitchell, (603) 679-1202 x 105,
clayaz@comcast.net.

Fisk, William J. 2000. Health and Productivity Gains from Better Indoor Environments and Their
Relationship with Building Energy Efficiency. Annual Review of Energy and Environment 25: 537-
66.

Johnston, David. 1991. Building Green in a Black and White World: A Guide to Selling the
Homes Your Customers Want. Washington DC: Home Builder Press.

Kats, Greg. 2003. The Costs and Financial Benefits of Green Buildings: A Report to California's
Sustainable Building Task Force.

Mayor Menino's Green Building Task Force. 2004. Everyone Benefits From Green Building. Boston.

McDonough, Bill, and Michael Braungart. 2002. Cradle to Cradle: Remaking the Way We Make Things. New York NY: North Point Press.

McLennan, Jason. 2004. The Philosophy of Green Design. Kansas City: Ecotone Publishing LLC.

Pleasanton, California. Department of Planning and Community Development, <http://www.ci.pleasanton.ca.us/business/planning/>. Contact: Rosalind Rondash, (925) 931-5600, rrondash@ci.pleasanton.ca.us.

Portland Energy Office, Portland Oregon. 2000. Green Buildings: Applying the LEED Rating System.

Regional Environmental Planning Program (REPP), NH Dept. of Environmental Services, NH Office of Energy and Planning, Innovative Land Use Planning Techniques Guide, Energy Efficient Development, <http://www.des.state.nh.us/REPP/index.asp?go=ilupth>.

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

Romm, Joseph and William D. Browning. 1994. Greening the Building and the Bottom Line: Increasing Productivity Through Energy-Efficient Design. Snowmass CO: Rocky Mountain Institute.

U.S. Green Building Council. LEED Building Rating System and many other resources. www.usgbc.org.

Wilson, Alex, Nadav Malin, Tori Wiechers and Larry Strain. 2003 and updates. The Green Spec Directory: Product Directory with Guideline Specifications. www.BuildingGreen.com.

Yates, Alan. 2001. Quantifying the Business Benefits of Sustainable Buildings. Center for Sustainable Construction, Building Research Establishment Ltd. Project Report number 203995.

Yudelson, Jerry and Alan Whitson, 365 Important Questions to Ask About Green Buildings. 2004. Portland, OR: Corporate Realty Design and Management Institute.

Section 8: Appendix