THE ROLE OF SUSTAINABILITY IN REAL ESTATE FINANCE AND INVESTMENTS

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THE ROLE OF SUSTAINABILITY IN REAL ESTATE FINANCE AND INVESTMENTS

A Thesis

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Abstract

of

THE ROLE OF SUSTAINABILITY IN REAL ESTATE FINANCE AND INVESTMENTS

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Statement of Problem—Conventional real estate development practices and the operation of existing buildings create significant negative externalities. New practices collectively known as "green building" or "sustainable development" offer mitigation for these externalities. However, the proliferation of green buildings has been hindered by, among other things, a lack of understanding of how property-level sustainability affects building valuation and investment and analysis.

Sources of Data—I used the LEED New Construction rating system as framework for evaluating property-level sustainability's interaction with building value. Various studies and market data provided the basis for assumptions about the value of various sustainable attributes. Personal communications with investment analysts provided insight into the trends, attitudes, and analytical framework employed by large investment funds with respect to sustainable properties.

Conclusions Reached—Conventional financial analysis techniques such as discounted cash flow analysis can be modified to account for sustainable building features. Each property is unique and has a unique interaction between sustainability and value. Using the exercises presented in this thesis can help guide the process of underwriting sustainable property investment. Investment funds can encourage sustainable development by prioritizing funding for sustainable projects, but will should develop an institutional understanding of how to analyze sustainable property investment in order to avoid tradeoffs between sustainability and profitability.

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INTRODUCTION

Statement of Problem

Buildings in the United States consume 40 percent of our energy and are responsible for 39 percent of CO2 emissions (USGBC 2009). Transportation accounts for another 33 percent of CO2 emissions in the US, most of which is produced by passenger cars—a result of sprawling development patterns (Ewing, Bartholomew et al. 2008). Buildings also consume vast amounts of resources in the form of building material inputs, and require extensive infrastructure for energy and water delivery and sewage removal.

Recent years have seen an increasing awareness of the impacts of buildings on the environment, and change has begun to occur in the way that the public, professionals, and politicians view the built environment. "Green building," or "sustainable development," has been called "the lowest-hanging fruit you can find"(Majumdar 2009) in the battle against climate change. It is increasingly being referenced in political rhetoric, from speeches to legislation such as California's AB 32, and SB 375, as a way to fight climate change while creating jobs and economic growth (2006; 2008). However, significant change to building and development practices will not occur through policy actions alone; the market must understand and accurately value green building projects for sustainable development practices to achieve widespread proliferation.

These sustainable development practices must go beyond the building itself and include contextual and locational factors in order to have the maximum benefit to the environment. Furthermore, there is increased recognition that environmental concerns are not the only

dimension of sustainability and considerations about social amenity and economic equality should be incorporated into land use design and decision-making.

Successes in Implementing Sustainability

Scientific studies and other investigations published during the last decade or so have thoroughly documented the diverse impacts of buildings on the environment (Ewing, Bartholomew et al. 2008). In response, the fields of planning, architecture, engineering, and construction have produced many new theories, practices, and technologies that collectively attempt to mitigate many of the unsustainable aspects of building location design, and technology. The contributions from these fields have been immense, and significant changes in the way that the built environment is formed, constructed, and composed have begun to occur.

Challenges with Implementing Sustainability

While these theories, practices, and technologies are the underlying foundation of a movement toward a more sustainable built environment, there remain some obstacles to large-scale implementation of these measures. Firstly, there is still a significant lack of understanding of sustainable development practices within the aforementioned fields, although the knowledge base is rapidly expanding. Second, there are obstacles imbedded in local, regional, national, and even global public policies that inhibit the proliferation of new sustainable development patterns. Lastly, there is a lack of understanding about how to value—and incorporate into investment decisions—the public and private benefits of sustainable development projects (Turner 2009).

Purpose of This Thesis

This thesis seeks to further the policy priority of increasing the sustainability of the built environment by helping to narrow the gap in understanding between building professionals and

finance professionals. It will do so by providing information, analysis, and a set of tools with which to evaluate and communicate the perceived and quantifiable value that sustainable development practices can add to can real estate, and investment portfolios.

Need for Study

While there is a robust and growing body of knowledge about sustainable building practices within the building professions, there is still a lack of knowledge about how sustainability measures may affect the profitability of a building, since most building professionals are not directly involved with evaluating the return on investment of real estate development projects. While the developer or financier of a project will generally have a dialogue with the designer about controlling costs, they might not typically have a conversation about how sustainable building features might affect return on investment. Most of the investment analysis and building valuation on a project takes place in the real estate finance sector, not within the building professions from which most sustainable building theory and innovation occurs. Unfortunately, within the finance sector there is a basic lack of understanding of what makes a building sustainable, much less how to value the public and private benefits of sustainable building features. This lack of understanding means that investments and loan decisions presently must be made without the tools to accurately value sustainable buildings. As such, investment and loan capital is likely currently being under or over allocated with respect to sustainable development projects.

Real Estate as Socially Responsible Investment

Additionally, despite the significant impact that buildings have on communities and on the environment, the real estate sector has until recently been largely overlooked as a vehicle for Socially Responsible Investing, or SRI (Pivo 2005). SRI has proliferated in the corporate world

as a model for evaluating the impacts of investments on not only economic returns on investments, but also the social and environmental impacts of those investments. The "triple bottom line" of investment has received widespread attention and significant acceptance in the corporate world, but is just beginning to make inroads into the real estate sector (Odell 2008). As such, there is presently no standard for evaluating real estate investments for adherence to Socially Responsible Investment practices, and few real estate funds targeted specifically to SRI. These two facts present another significant challenge to funding sustainable development.

Thus, in addition to integrating sustainability into financial models aimed at quantifying the value of sustainable development, it is critical that project proponents be able to communicate the social and environmental aspects of their project to potential investors (Boyd and Kimmet 2004). This thesis will examine role of sustainability in financial modeling, as well as discussing trends in sustainable real estate investment and offering advice on how value can be underwritten and communicated.

Closing the Knowledge Gap

The gap in understanding between the real estate finance sector and building professionals can only be closed by a deeper examination of the interaction of sustainable development factors and design features with the risks and returns of real estate investment and lending. Furthermore, this increased understanding will only be of worth if it can be communicated to financiers and fiduciaries in a language that will aid them in the investment and lending decision process.

Methodology

In order to do this, this paper will examine the various elements of sustainable development practice—from water efficiency, to site selection near public transit—and how each aspect of sustainable development interacts with investment risk and value. In addition, this thesis will evaluate the public benefit of a real estate development project in terms of the triple bottom line of social, economic, and environmental value, and how these public benefits might affect investment decisions in light of Socially Responsible Investment (SRI) and the sub-discipline of Responsible Property Investment (RPI).

The remainder of this first chapter will describe the target audience for this thesis, the framework for understanding different types of value, and the metrics that the thesis will use to evaluate buildings in terms of those different types of value.

Applicability/Audience

Bankers and fiduciaries are ultimately the ones who make decisions about where to allocate investment and loan funds, and what risk premium to assign when issuing a loan or analyzing an investment. However, real estate developers who are seeking funds for new construction projects, or acquisition and retrofit services, can play a key role in informing the bank or investor about financial and other benefits of RPI and sustainable design. While developers may intuitively see the value of building green, that intuition will have to be translated into more tangible and substantiated projections of cash flow before their project can be funded. As such, it is important that they have the ability to effectively communicate the differences

between sustainable and conventional projects, and how those differences impact investment value and risk.

Furthermore, since it is in the developer's interest to convey this information when seeking funding, they may serve as the most effective conduit to communicate this new paradigm to lenders and investors. As the finance sector grows in its understanding of the value of sustainable real estate, there will be an increased interest in investing in these products, creating investor demand, and furthering the sustainable development movement. In addition, since developers are the link between building professionals and the finance sector, they are particularly well positioned to bridge the informational gap by communicating the value of sustainable features to investors and lenders.

Consequently, this paper is directed at helping developers to assess and communicate the potential for increased value when seeking funding for sustainable development projects. By focusing on the relationship between developers and financiers, this paper can most directly address one key obstacle to creating a more sustainable built environment: project funding. It is in this way that the policy objectives involved with sustainable development may be advanced through the creation of a more informed capital market. By providing information and tools that help builders, lenders and investors more accurately value sustainable property, and to understand dimensions of sustainability which contribute to the triple bottom line, this paper seeks to reduce information asymmetry between the two parties, creating an environment where financial resources are more likely to be allocated toward sustainable property investment.

Framework—Public vs. Private Value

Sustainable development has public and private value, both of which should be assessed and considered when attracting financing for a project. Public value will likely be of more interest to investors than to lenders, as their motivations may go beyond those of lenders, as discussed later. Public value includes, among other things, slowing the rate of climate change through reduced energy consumption. Private value includes, among other things, operating cost savings associated with reduced energy consumption. In the above example the same aspect of sustainable building design—reduced energy consumption—has both public and private value. In fact, since sustainability is inherently important to the continuation of life as we know it, all aspects of sustainable design have public value. However, in many cases the benefit of certain sustainable building features, such as recycled content, are enjoyed by the public, while the private owner shoulders the cost. As Kimmet and Boyd (2004) note "Performance codes (e.g. LEED) address a range of environmental efficiency based criteria, while implicitly raising broader questions about social responsibility and the distinction between public and private goods" (p. 1)

Correcting Market Failure—The Coase Theorem

In the case where the cost of a public value such as recycled content is paid by a private owner there is a positive externality enjoyed by the public. The Coase theorem suggests no government intervention is necessary to correct this market failure. Under the theorem, in the presence of property rights and in the absence of excessive transactions costs, those who benefit from the positive externality will find a way to compensate the party who is providing that externality. Generally this theorem is viewed in light of a negative externality, and the compensation would come from some sort of legal action, such as a class action lawsuit. (Munger

2000) In the case of sustainable real estate, the compensation for the positive externality comes in the form of increased rents or sales prices for LEED certified and other sustainable property. Conversely, property owners who do not achieve LEED certification will pay for the negative externality their buildings create by losing tenants and having to discount rent in order to compete. In fact, LEED certification plays a crucial role in correcting this market failure, by communicating to building tenants the level of public value through certified, silver, gold, and platinum ratings, and allowing the market to set a price for this public value. In order for building tenants to be willing to pay for the public value of green building they must understand what the public benefits of green building are, and then make a determination about how much those benefits are worth to them. In the case that tenants and homebuyers undervalue the benefits that society reaps from green building, it will be the government's job to help correct this market failure through regulation or incentives.

Regulation and Incentives

To compensate for lack of public understanding of the value of green building, and for the lack of willingness of businesses and the public to pay for green building, many different levels of government have already imposed regulatory measures such as green building codes and incentives such a reduced permit fees or density bonuses for developers. However, these regulations or incentives are challenging to impose or provide in today's economic climate. In my personal experience developing green building policy for my employer, the City of West Sacramento, regulation has been difficult to impose because it creates an additional burden on developers who are already facing a very challenging economic environment. Furthermore, most incentives involve some sort of government subsidy, and most local and state governments are presently facing budget shortfalls, making subsidies impractical. Thus, while regulatory action may eventually be necessary, it is my belief that a significant obstacle to the proliferation of green

building is informational. This thesis supposes that correcting the informational asymmetry between the financial and construction industries can correct a failure in the market for capital. Similarly, correcting the informational asymmetry between space-users and the construction industry—by educating the public about the benefits of green building—can correct a market failure by increasing the demand for green real estate.

Distinguishing the Value of Different Green Features

As mentioned above, "in many cases the benefit of certain sustainable building features, such as recycled content, are enjoyed by the public, while the private owner shoulders the cost." Unlike recycled content, energy efficiency has a clear private value as well as a public value. However, only the private value of reduced energy consumption can be easily quantified and relayed to the finance sector—in the form of lower power bills. On the other hand, the public value of energy efficiency, even if quantified in tons of carbon, for example, is not of concern to loan underwriters because it does not directly impact the operating costs or value of the building. Investment fund managers, however, are showing increasing interest in public value considerations in their investment decisions, creating a demand for investment in real estate projects that address issues of broader public concern (Woon 2009). Public value also has indirect, but measureable, impact on both building value and building investment decisions through space user demand, as explained below.

The Concept of the Triple Bottom Line

While private value is the more directly quantifiable aspect of sustainable development, there is an increasing trend towards accounting for public value through concepts such as the "triple bottom line" in business. The triple bottom line in business is the idea that managers should not only evaluate their business performance against the financial bottom line, but also

against environmental and social bottom line (Elkington 2007). While the triple bottom line concept has been slow to infiltrate the real estate business, it has had far more exposure in many other industries, including some of the world's largest corporations (Odell 2008). This trend toward corporate social responsibility and accountability affects building values because corporate tenants are more and more demanding sustainable property; increased demand that increases rents and consequently drives up the value of green buildings. Thus, as awareness of the public value of sustainable building increases, demand for sustainable space will likely increase, pushing rents higher, vacancy lower, and selling prices upward. In this way the public value of sustainable design features can be tied to assumptions about future cash flows and investment risks. In short, the public value of sustainable development—to the extent that it is recognized and demanded by the space user—can impact rent and occupancy assumptions that are used to determine the value of a proposed or existing project.

While research shows clear trends towards increased space-user demand for sustainable building, especially in office properties (Miller, Spivey et al. 2008), the underlying motivation of individuals and businesses who rent or buy green buildings is less clear. Homebuyers or renters who rent or buy property for their own use may be altruistically willing to pay a premium for sustainable housing, while businesses cannot usually afford to be altruistic, or risk losing a competitive advantage. However, many companies seem to believe they can "do well by doing good". Commercial real estate firm Jones Lange LaSalle suggests that "companies that proactively address sustainability on a strategic, portfolio level will not only reduce their organizations environmental footprint, but will also gain competitive advantage through reduced operating costs and an enhanced corporate image" (Shinter and Vrkic 2007) (p. 5).

Attracting Investment

Beyond space-user (tenant) demand, another interaction between public value and project feasibility is in the process of attracting investment. Many real estate investors—from pension funds, to corporations, to individuals—are increasingly assessing and reporting the social and environmental dimensions of their investments (Woon 2009). As a result, the developer's ability to find financing for a project may in part depend on the investment priorities of the fund manager or other interested party. Even if the financial model that the investor is using to evaluate a property has not been modified to account for cost savings or increased rents due to sustainable features, the investor or fiduciary may show a preference for sustainable properties simply because that type of investment is aligned with the values of the organization that fiduciary represents. The investor may have a Responsible Property Investment (RPI) strategy, or other direction from stakeholders that requires a portion or all investments must meet certain standards for environmental responsibility. Understanding the motivations and priorities of SRI investors, and being able to communicate the public value of a real estate investment to the SRI community can open up new sources of funding to developers. This understanding and ability to communicate may be of benefit even when independent of any financial modeling of the private value of sustainability, although the two may complement each other. As such, Chapters 2 through 4 of this thesis will each contain two sections: one on financial underwriting and one on investment trends and communication strategies.

Remaining Chapters

The literature I review in the next chapter will be divided into two sections, as mentioned above. However, nearly all of it will address the private (monetary) value of sustainable building. After reviewing the literature, I will develop a methodology for evaluating many of the concepts

from the literature. Due to the difficulty in aggregating a broad set of meaningful data, I will instead retain a relatively narrow focus by evaluating the affects of various aspects of sustainability on the financial model for a typical office building. While this may not provide the type of policy insight that broader data analysis would, it will help to illustrate the interaction between sustainability and value that is at the core of appraisal and investment decisions.

As a means of gauging investor sentiment toward green building, I will interview two real estate investment professionals from two of the world's largest investment funds. While this sample group is obviously too small to use for data analysis, the perspective of these two professionals should help reveal any trends or biases that project proponents should be aware of when seeking financing. Finally, I will compare my research to that of others and explore the implications of my findings in Chapter 5, the conclusion.

Chapter 2

REVIEW OF LITERATURE

This literature review investigates research and theory on the interaction between sustainable building practices and building value and investment decisions. First, I will distinguish between the two main types of writing on the subject, as described below. Second, I will conduct a thorough examination of the definitions of sustainability as they vary between authors and studies.

In Pivo's 2005 paper "Is There a Future for Socially Responsible Property Investments?" he notes, "Some investors may be willing to accept lower financial returns in exchange for the knowledge that their investments are helping to address leading social or environmental issues of the day. Other investors, however, consider it their fiduciary responsibility to avoid such tradeoffs" (Pivo 2005) (p. 22)

The above statement is useful in understanding a division in the literature on sustainable property valuation and investment. On one side, there is literature aimed at quantifying the value of sustainability in a way that allows investors to avoid tradeoffs between lower returns and environmental responsibility. On the other side is literature that discusses ways to integrate Socially Responsible Investment practices into real estate investment, and may or may not make explicit claims about financial returns.

Two Perspectives on Sustainable Property Investment

In order to get an accurate picture of investment decisions with respect to sustainability, both of these perspectives are examined in this chapter, and tested in the following chapter. Due to the complexity of the topic, I have chosen to separate the literature and methodology from

these two perspectives into two different sections within each chapter. The first part of this chapter will be dedicated to exploring the definitions and methodologies used by academics and professionals to determine the value of sustainable property. The second part of this chapter will be dedicated to exploring the definitions and methodologies used by authors to evaluate investment trends and ways of communicating unquantifiable (public) value to investors concerned with issues broader than monetary profit.

Part 1: Review of Literature for Valuing Sustainable Development

Researchers have approached the connection between real property sustainability and property valuations and investment decisions from several different angles. The differences in these approaches can be attributed to the motivation of the researcher, or the type of data that they have available. Academic research tends toward scientific methods such as regression analysis or toward policy driven analysis involving triple bottom line concepts. Industry research tends more toward case studies or modification to existing appraisal and valuation techniques. This section of chapter 2 is primarily focused on industry research, as those reports are most applicable to property valuation.

Defining Sustainability in the Context of Valuation

Although the central topic of nearly all of the literature review for this thesis is "sustainability", the word itself is used in many different ways by different authors. As such, I will investigate the differences between studies by looking at how each one defines sustainability. Further, I will develop a working definition of sustainability for this thesis, which will be a first step toward developing a methodology.

While some studies fail to define what they mean by sustainability, most offer a clear definition, although those definitions vary widely. On one end of the spectrum are explicit discussions about the environmental, social, and economic dimensions of sustainability. At the other end of the spectrum are implicit assumptions that LEED may serve as proxy for sustainability, even in defining the relationship between sustainability and value. As such, the relationship between LEED and sustainability will be a primary focus of the literature review.

Triple Bottom Line Definition of Sustainability

Ellison and Sayce (2006) offer a relatively detailed definition by using triple bottom line (environmental, social, and economic) metrics to define and measure sustainability with respect to property value. Their 2006 Sustainable Property Appraisal Project notes that triple bottom line accounting "enables the economic sustainability that is fundamental to property investment to remain at the forefront of the appraisal process…" (p. 4). Within this context they have developed a set of nine indicators to serve as criteria for a project's sustainability. These criteria are: 1. Energy efficiency 2. Pollution 3. Waste management 4. Water management 5. Climate control 6. Accessibility 7. Adaptability 8. Occupier and 9. Contextual fit.

The authors point out that some of these criteria, such as energy efficiency and water management, share common ground between the sustainability agenda and property investment performance, while others may be divergent. For example, when viewed from the investor's perspective, accessibility might mean accessibility by car, since automobile access is critical for economic short-term property performance (economic sustainability). It would therefore be divergent with the broader sustainability agenda that promotes public transit and pedestrian alternatives to automobile accessibility.

What the authors fail to mention is that economic sustainability is a concept that inherently requires considerations about the future. For a property to have long-term economic

sustainability, it will need to accommodate changes in transportation patterns, preferences and fuel costs. When these factors are considered, a building that is only accessible by car should be considered less economically sustainable than one served by transit, walking and automobile. Long range considerations such as the one discussed above may not be considered by an investor who plans to own the building for a shorter period than the period in which the predicted changes in transportation patterns would occur. However, since the predicted selling price (at the end of that holding period) plays into the present value considerations, it can be dangerous to assume the next building owner will not consider the same concerns in their investment decision. In fact, in the white paper "Driven to the Brink; How the Gas Price Spike Popped the Housing Bubble and Devalued the Suburbs", the author argues that during the 2007 spike in oil prices, those who did not adequately assess the risk of changes in fuel costs suffered losses in real estate value than those owning properties in central and transit oriented locations. The lesson learned is that if the appraiser or investor has significant evidence that transportation patterns will change within the holding period of a building, then a property with automobile-only access carries additional risk of obsolescence and should have a lower appraised value.

Rating Systems as Proxy for Sustainability

Some studies, such as the CoStar study "Does Green Pay Off?" (Miller, Spivey et al. 2008) focuses exclusively on building rating systems, including LEED and Energy Star. The CoStar study, as it is also know, implies that the LEED for New Construction Rating System is a usable definition of building sustainability by using the language "green" "sustainable" and "LEED" interchangeably.

As one of the first studies to analyze the impact of LEED on building value, the results of the CoStar study were widely disseminated. As discussed in this thesis, LEED captures a limited dimension of sustainability, and should not serve as a definition of sustainability. Additionally,

there are some significant methodological issues with the CoStar study further confusing the issue of determining the value of sustainability in buildings.

Challenges with Using LEED Rating Alone to Determine Value

The issues with this study were significant enough for Muldavin (2008) to issue a critique of the study called "Quantifying "Green" Value: Assessing the Applicability of the CoStar Studies." His critique is helpful in understanding why sustainability and LEED should not be used interchangeably. As he notes, a sales premium of 64percent for a LEED building over a comparable non-LEED building is not realistic, accurate, or valuable in appraising buildings of either type. The published results of the CoStar study used a Peer Building Selection Approach, which is similar to a comparables approach. This approach is complicated by the lack of comparable buildings within close proximity to each other, and the variation in date of sale. The dramatic increase in commercial real estate values between 2002 and 2008 means that two otherwise comparable buildings that were sold five years apart would not have comparable values. Since the stock of LEED certified buildings are generally newer than others are, many of their sales occurred in the latter part of the study period, causing and artificial inflation of price. As these challenges are difficult to rectify in a peer comparison approach, it is unlikely that any study will emerge giving LEED a reliable dollar figure. It is for this reason that Muldavin (2008) argues that Discounted Cash Flow, or DCF is a more appropriate way to value green buildings, since it allows a more detailed approach that accounts for each sustainable building feature individually, instead of a broad measure of sustainability such as LEED.

The Triple Bottom Line and LEED

A report from Chappell and Corps (2009) titled "High Performance Green Building: What's It Worth?" does a good job of outlining valuation methods including peer comparison, as

discussed later. However, a misstatement in their report about the aim of LEED further confuses the reader's ability to distinguish between broad measures of sustainability and the narrowly focused LEED rating system. Their report says, "Based on criteria that consider not only economics but also the environmental and social impacts of development, the LEED certification has become the de facto standard of building excellence and sustainability in the US and beyond" (Corps and Chappell 2009) (p.11).

It is true that it has become the *de facto* standard, however, a closer examination of the original LEED for New Construction rating system version 2.2 (the one referenced in the Corps report) shows that it is focused only on the environmental performance of a building and fails to consider social dimensions of the built environment. In addition, LEED does not consider the economics of a project, as the author suggests. LEED assumes that economic considerations are at the forefront of any development project, and does not incorporate metrics to ensure that buildings are economically viable.

Aligning the TBL with LEED

Fortunately, the USGBC (2008) has acknowledged these shortcomings, stating in its 2009-2013 Strategic Plan that the USGBC "seeks to elevate social equity as a value and outcome integral to sustainable built environments." It further states that "because this dimension of sustainability and the triple bottom line has received too little attention both by USGBC and the green building community at large, we have added Foster Social Equity as a Guiding Principle" (p. 3).

This change in focus is reflected in the 2009 version of LEED for New Construction by the addition of new categories that represent context and location factors. Furthermore, the USGBC has developed an entirely new rating system that balances economic, social, and environmental considerations. It is called LEED ND or LEED for Neighborhood Development.

With the development of LEED ND, the LEED rating systems are becoming a better proxy for triple bottom line sustainability. In fact, due to its broad measures of sustainability, including social and economic equity, LEED ND has attracted interest from various levels of government looking for a way to implement sustainability into planning and development. To help governments understand how to use LEED ND, the USGBC published a Local Government Guide to LEED for Neighborhood Development. This paper affirms the integration of the triple bottom line definition of sustainability, claiming that projects receiving LEED ND certification "will be contributing to your community's triple bottom line—economic development, environmental protection, and increased equity" (USGBC 2010) (p. 5).

Green Building as Mandate

LEED ND, like the rest of the LEED rating system, was designed as a market-based mechanism to certify and advertise projects as sustainable. The Local Government Guide to LEED for Neighborhood Development recommends four ways that local government can encourage projects to pursue LEED ND:

1. Lead By Example
2. Remove Barriers and Pave the Way
3. The Case for Incentives
4. Technical Assistance and Education

Notably absent is "mandate compliance" with LEED ND, although the document does include some language about updating green building ordinances to include LEED ND. The relationship between market-based green building certification systems and government mandates for green building is a complex one, and for the most part it is beyond the scope of this paper. That said, a quick look into the recent debate over the viability of the new CalGreen building code can help illustrate the nature of this relationship.

CalGreen Code vs. LEED and Other Rating Systems

CalGreen code is a new building code that was developed by the California Building Standards Commission in 2008, and is scheduled to go into effect on Jan 1, 2011. It will have some mandatory measures, but be mostly voluntary at first. The code, is largely inspired by LEED, but is written in the same format as building code in order to integrate with existing code. The emergence of CalGreen code has been met with resistance by both the USGBC and other market-based rating systems as well as some policy makers. While opposition from the USGBC looks suspiciously like fear of competition, the USGBC was joined by the Sierra Club and the NRDC in writing a letter of opposition to the development of CalGreen code. The letter claims, "The marketplace does not need a new government quasi rating system, particularly one that lacks adequate verification. The existing private sector rating systems are working successfully and have been adopted by many local jurisdictions across the state. Their rigorous benchmarks and verification mechanism are driving innovation in California by leading industry to develop new products, services, and green jobs. If the state introduces a new quasi rating system, it will cause disruption and confusion in the marketplace, hindering the tremendous progress California is making on green building." (Dixon 2010)

The question of whether government mandates are necessary to promote green building is obviously still up for debate. To the extent that the market has already moved toward green buildings, and that more informed capital markets will further assist that shift, it is my belief that providing this information is a more practical and effective way to rapidly promote the greening of our built environment. As such, this thesis is focused on the role of capital markets and financial analysis in green investment, and does not thoroughly investigate other measures, such as government mandates, taxes, or incentives.

Further Challenges with LEED and Valuation

While the LEED rating system, especially LEED ND, has moved toward a triple bottom line approach, the LEED rating of a particular building may still not be appropriate as the sole measure of sustainability with respect to value. This is because the flexibility of the rating system leads to numerous different outcomes. The LEED point system is designed such that each point represents roughly the same contribution to environmental sustainability, such that two buildings with the same number of points, or corresponding level of certification, should be equivalent in their impact on the planet. However, the building attributes that contributed to the LEED certification can vary greatly between buildings, and as such may impact the buildings value in many different ways. That it not to say that the level of LEED certification has no value on its own, as Muldavin (2009) points out "While certifications like LEED and other leading certification systems around the world cannot be the sole basis for analysis, they have significant value independent of the attributes or performance of the certified property. (p. 24)

Muldavin Definition of Sustainability with Respect to Valuation

Muldavin (2009) has written what is arguably the most robust resource for financiers and appraisers of green buildings in his 144-page book "Underwriting Sustainable Property Investment." Muldavin is the president of the Green Building Finance Consortium, a research group funded by "the real estate industry, select governmental and non-governmental organizations, and by the efforts of non-paid contributors, independent of green building or product companies." His book aims to increase the accuracy with which real estate appraisals integrate sustainable building features. Instead of presenting any new research on the connection between values and sustainability, Muldavin creates a framework with which to evaluate

individual properties, based on the characteristics of the particular property and the priorities of the investor.

Muldavin provides two definitions of sustainability, each one different, depending on the perspective of the interested party. The distinction he makes between the financial definition and the general definition of sustainability provides insight into the approach he takes to analyzing the value of sustainable buildings. Muldavin claims that in terms of building valuation, it does not matter what he or anyone else says sustainability is. From a financial perspective, the only thing that matters is what regulators, potential space users, and investors in the subject property say. From a general perspective, Muldavin sites the oft-used 1987 United Nations definition, "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." but also offers a definition from YourBuilding.org, which is more focused on real estate:

> *A sustainable commercial building can be defined as a building with planning, design, construction, operation, and management practices that reduce the impact of development on the environment. A sustainable commercial building is also economically viable and potentially enhances the social amenity of its occupants and community.*

Working Definition for this Thesis

Since the above definition incorporates the triple bottom line concepts of environmental, economic, and social responsibility, while also identifying the internal and external factors that contribute to reduce environmental impact, I will use it as the basis for my working definition in this thesis. I have made some minor modifications to the above definition to account for the following:

First, a building need not be commercial to fit the criteria in this definition. Residential and public buildings also meet these criteria, although the homeowner may perform residential

operation and maintenance. Second, the location of a building has a significant role in whether or not it will be truly sustainable, so location will be added to the list. Third, since present-day economic viability is a prerequisite for any project, the new definition will clarify that long-term economic viability is the key to sustainability. Fourth, since the term "potentially enhances" marginalizes the social aspect of sustainability, the word potentially will be removed from this paper's definition of sustainability. Lastly, projects that balance the needs of diverse groups enhance social sustainability, so social equity will be added to the definition. Therefore, the working I will use in this paper will be:

A sustainable building can be defined as a building with location, planning, design, construction, operation, and management practices that reduce the impact of development on the environment. A sustainable building is also has long-term economic viability and enhances the social amenity and equity of its occupants and community.

Public Value as Driver of Private Value

Muldavin's (2009) division between financial and general definitions of sustainability highlights the fact that there are aspects of sustainability that can create private value, while others provide value that is enjoyed by society, but may not be as easily quantified, or integrated into financial analysis. However, to the extent that the public values are integrated into the SRI practices of an investor or CSR (Corporate Social Responsibility) practices of a tenant, they will still influence building value..

Tenants as Drivers of Value

According to an October 2008 presentation by Roger Krage of Gerding Edlen, a progressive real estate developer, "Gerding Edlen believes the fundamental driver of the building's value is the tenant. [However], building value is traditionally expressed in the context of price, which ignores the drivers behind a tenant's willingness to pay that price. Understanding

these drivers is critical to understanding how sustainability is changing the value proposition in real estate" (Krage 2008) (p. 6).

This theme--that tenants' demand drive a building's value, and that sustainable buildings are becoming increasingly more attractive to tenants--is one that recurs throughout the literature. However, it is one that has only recently emerged. Earlier works not reviewed for this thesis have focused on cost savings attributed to green features, but have put far lest focus on tenant demand, increased rents, decreased turnover, and decreased time to let. In fact Nelson (2009) of RREEF research asserts in his 2009 paper "How Green a Recession?—Sustainability Prospects in the US Real Estate Industry," that tenant demand for sustainable buildings is growing so fast that "…many major markets will reach the critical mass when green buildings account for enough of the building stock that tenants have a choice. At this point, the performance premiums for green buildings will flip to a discount for older, less efficient, conventional buildings. We are already at or near this point in the mature economies of Europe and developed Asia, and getting closer in the major money centers of the US. Ignoring this impending market transformation would be risky and imprudent, and the current recession will provide little cover to owners failing to adapt" (Nelson 2009) (p. 8).

Avoiding this scenario is what many authors refer to as future-proofing ones building. As part of financial due-diligence, Ellison and Sayce (2006) offer a future-proofing questionnaire. Applying this questionnaire will better able owners and investors to value their building by looking forward to determine what additional expenses or losses in occupancy they may incur on a property that has not adequately addressed sustainability (Ellison and Sayce 2006).

Other Parties that Influence Value

Muldavin shares the perspective that tenants are the primary drivers of a building's value, although he sees space users, (tenants) as one of three parties who influence the value of

sustainable design. He states, “Proper financial analysis of a property requires explicit consideration of the potential benefits that will accrue through meeting regulator, user, and investor thresholds for sustainability” (p. 43). Furthermore, he feels that despite the differences between traditional and sustainable buildings, traditional valuation methods are appropriate for the valuation of sustainable buildings, although they must be modified.

Connecting the Literature with this Thesis

Chapter 3 will give examples of how financial models might be modified to account for sustainable building attributes, while chapter 4 will run those models to test the magnitude of different impacts on building value. It should be noted that while tenant demand has moved to the forefront of the valuation discussion, cost savings are still a significant component and will be included in the financial models in chapter 4. A further consideration that is beyond the scope of this paper is that the way tenant leases are structured determines who receives the cost savings from energy efficiency or other operational savings. These new “green leases” ensure that those benefits accrue to the party who has made the investment.

Review of Methodologies Within the Literature

Since the literature I am reviewing for this paper is varied in its purpose and approach, comparing methodologies is a bit of an apples and oranges comparison. In the more traditional, academic approaches, the researchers apply relatively straightforward data analysis, including hedonic regression. However, many of the papers I have reviewed do not apply a methodology that arrives at a particular conclusion. Rather, the methodology is aimed at creating frameworks and engaging in analysis about how a fiduciaries and appraisers can reach their own conclusions about sustainable value. This approach is closest to the methodology that I will use to examine

the relationship between investment value and sustainability in this thesis. As such, it does not attempt to draw as specific conclusion, but rather illustrate a process by which readers can better understand relationships between value and sustainability, and the process that they should work through in order to integrate that understanding into appraisals and pro-formas.

Additionally this paper will investigate investor attitudes toward sustainable property investment. Papers concerned with this broader investment market for green building are discussed in part 2 of this chapter. These papers restate the business case for green building and analyze investor interest and obstacles to Responsible Property Investing.

What Questions Does the Literature Answer?

The majority of the literature I reviewed for this thesis deals with the private value of green building, and for the most part excludes discussion of public value—except to the extent that investors or tenants are willing to pay a premium for public benefit. A separate body of literature—one that is beyond the scope of this thesis—addresses the public value of green building in terms of how much environmental benefit is gained from various sustainable building strategies. Within literature reviewed for this thesis—that which is primarily concerned with the private value of green building—there are two distinct questions that the papers attempt to answer:

1. Are green buildings more valuable than conventional buildings?
2. How should valuation methods be modified to account for the differences between green buildings and conventional buildings?

While most papers acknowledge that these are two separate questions that cannot be answered by any one method, some papers attempt to answer both questions at once. As discussed previously, this can be challenging due to the unique nature of each property.

The methodology employed by the author is largely determined by which of these questions he is attempting to answer. If it is the first question, "whether or not green buildings are more valuable, and by how much", regression analysis or case studies are the most commonly employed methodologies. If the question is the latter, "how does sustainability change the way that buildings are valued", the methodology is more difficult to identify, although these studies may actually be of more value and application in the real world. Studies of this nature—those that attempt to identify the changes to valuation strategies--are really describing methodologies more than they are employing them. The theme of Ellison and Sayce's (year) "The Sustainable Property Appraisal Project" and Muldavin's "Underwriting Sustainable Property Investment" is to assist appraisers, loan underwriters, investors and fiduciaries to understand the way that sustainability on all levels interacts with investment value. These studies generally do not include assumptions based on data analysis, as conclusive studies about the value of one or more aspect of sustainability are far and few between, and do not apply uniformly to all situations.

As such, while the methodology used to arrive at general conclusions about the value of green building is relatively straightforward, the methodology used to arrive at a systematic framework for evaluating individual properties is less so. The first step toward developing a new framework for valuation of sustainable property is a good working knowledge of conventional property valuation and investment analysis methods.

An Overview of Conventional Property Investment Analysis

Brueggeman and Fisher (2008) provide a detailed description of these methods in their text Real Estate Finance and Investments. They also provide good background on different vehicles for real estate investment. While the type of loan or investment does not usually determine what valuation method will be used, the motivations and intents of the investor or

lender, and the nature of the property that will be financed do impact the financial model used to determine a property's present value.

Valuation of Proposed vs. Existing Buildings

One important distinction clarified by Brueggeman and Fisher is between the development of new buildings and the acquisition of existing buildings. New construction finance usually involves more than one lender, since there may be loans needed for land acquisition, construction, and "permanent" financing if the developer intends to retain ownership of the property. Also, new construction pro-formas typically include construction cost estimates as well as cash flow projections designed to determine the value of the project on completion. Since this thesis is focused on the value of sustainability, rather than the cost of constructing a LEED certified building, construction cost will not be evaluated. Numerous case studies are available to those interested in learning more about the added costs (if any) involved with green building, but they are beyond the scope of this thesis. This thesis will focus on the methods used for property valuation, which are roughly the same whether valuing a proposed project or an existing structure.

Lenders and investors must be sure to make accurate assumptions about two interrelated but distinct things when underwriting an investment. First, they must be sure to accurately value, or appraise a property, as discussed below. Second, they must do their best to calculate the risk that the investment will perform as they assume it will. Higher risk properties carry higher investor demands in terms of the returns that the investor will expect if investing in a property. Since return on investment is a function of price, this also means lower transaction price than a similar property with less risk.

For-Sale vs. For-Lease Properties

When it comes to valuation and risk assessment methods for newly constructed or retrofitted property, one essential difference is the difference between for-sale and for-lease properties. If it is the intent of a developer to sell a project to an end user, such as a homeowner, then it is known as a for-sale product, and the capital that the developer will seek will likely be for land and construction, not long-term ownership. As such, the analysis that goes into lending decisions about for-sale products only has to do with the market for housing of that type, location, and quality, and not projected cash flows. The lender or investor in the construction of that housing must determine the likelihood that the units will sell for the amount that the developer assumes they will. In this case, the projections about the market for this product are relatively short-term, and projections about operating costs are most likely left out of the equation, since those costs will be borne by the housing consumer. Although held for a longer period than construction loans, residential mortgages also fall into this category. The basis for underwriting residential mortgages for existing homes has more to do with the applicant, and their ability to make mortgage payments than it does with the property itself. Although many of the factors driving the value of sustainable for sale property are the same as those driving sustainable for-lease properties, this thesis will focus on the Discounted Cash Flow method of valuing for-lease properties, which cannot be applied to for-sale product.

The Cost Approach

Chappell and Corps (2009) offer a discussion of different valuation methods, and later discuss the questions that investors, analysts, and underwriters should be asking when using one of those methods to evaluate sustainable property investment. The cost approach is based on the idea that market participants relate value to cost. In this model, the most significant factor in

determining a price for an asset is the cost of construction, so it would be most applicable to newly constructed properties. Valuing existing properties with this approach would present challenges with depreciating value of the improvements, while accounting for appreciation in land values. The authors note that this would be further complicated when incorporating green features that often have a longer life and lower level of obsolescence than conventional buildings. Consequently, they conclude that using a cost approach in today's market would be "viewed with some skepticism."

The Sales Approach

The second valuation method reviewed by Chappell and Corps (2009) is the Sales Comparison Approach. Sales comparisons can be made when there have been recent sales of buildings with many similar qualities to the one being valued. This approach, however, suffers in periods where there is low transaction volume of commercial properties, as has occurred in the last two years. Using sales comparisons to value sustainable properties is further complicated by the fact that there are fewer such properties in existence, and thus even lower transaction volumes. Furthermore, properties that an appraiser might compare would have to have many similar sustainable characteristics, which is unlikely even when properties have the same level of LEED certification, as discussed earlier. Thus, the authors conclude that using sales comparisons as the primary means of determining building value is less reliable indication of market value when compared to the third and final approach to valuation.

Income Capitalization Approach—Discounted Cash Flow

Most real estate brokers and investment professionals today determine the value of income producing property, such as office, retail, or for-lease housing by using the Income Capitalization Approach (Brueggeman and Fisher 2008). Chappell and Corps (2009) assert that

this approach also provides the "most reliable indication of market value for a high performance green building." The Income Capitalization Approach employs a technique called Discounted Cash Flow (DCF) analysis, which Muldavin (2009) refers to as the standard approach used by real estate investors to t assess commercial property value and financial potential. This is because for lease properties have a long series of cash inflows, in the form of rents, and a series of cash outflows, in the form of initial acquisition or development, operating, maintenance and retrofit costs. Also included in the DCF analysis that determines the buildings current value is the buildings future value, or the projected sales price at the end of the holding period for which an owner believes he or she will keep a property. Circularly, that projected future selling price is determined by assumptions about how much cash flow and capitalization rates will be at the time of sale.

Cap Rates

A capitalization rate, or cap rate as it is commonly know in the commercial real estate industry, is a function of a property's yearly income and selling price. The capitalization rate for a property is determined by dividing the NOI, or Net Operating Income, of a property by the transaction price of a property. The NOI is the annual amount of income that the owner receives after receiving rent and paying expenses.

Since the cap rate can be determined by the NOI and price, we may instead determine the price of a property by rearranging the cap rate formula. If we want to solve for price the formula is: Value = NOI ÷ R, where R is the capitalization rate. If a the cap rate used to value a particular building is .08, for example, and that building has an annual NOI of $100,000, then the estimated value would be 100,000/.08, or $1,250,000. However, in order to apply the same cap rate to two comparable buildings, they must be highly comparable in age, condition, location, etc. Cap rates are variable across the commercial real estate market, and change with market conditions. Lower

cap rates lead to higher building valuations, and as such are often associated with greater availability of capital, or lower investment risk.

This concept is important to understand in relation to financial analysis of sustainable properties because there is evidence to suggest that there is less risk involved with the acquisition or development of sustainable properties than there is for conventional properties. As such, it may be appropriate to use a different cap rate on a sustainable property investment (Hugins 2008).

Discounting and the Time Value of Money

The word "discounted" in DCF analysis refers to the concept of the Time Value of Money, or TVM. The entire world financial system operates on this premise—that money is more valuable today than it is tomorrow, or next year. Since income-producing real estate investments represent a series of cash flows, some in the present, some in the near future, and some in the distant future, it is appropriate to adjust for the Time Value of Money when analyzing investments. This adjustment is made by discounting future cash flows to make a determination about their present value, and the associated return. Essentially, the DCF analysis assumes that $100 earned today is worth $100, while $100 earned in the future is worth less. The discount rate represents how much less that future $100 is worth. Depending on how far into the future the $100 will be received, it may only be worth $80 or $65 of today's money. The rate at which future cash flows are discounted depends upon the risk that they will not be received at all (Brueggeman and Fisher 2008).

Pricing Risk in Property Investment

Risk in property investment affects discount rates, capitalization rates, and ultimately the underlying value of a property. If it is highly likely that the money will be received in the future,

there is very little risk, and the discount rate and cap rate will be low. Since US Treasury Bills are considered zero risk, they pay very little interest. In real estate investment, a building leased to a major company with good credit on a long-term lease carries little risk that the owner will not receive future cash flows, so the owner or investor will likely be willing to apply a lower discount rate to the future cash flows. If, however, the investment is more speculative, the future cash flows will have to be discounted more heavily to account for the fact that they might never materialize. Here, again, assumptions about future tenant demand and regulatory pressure tend to indicate that sustainable, energy efficient buildings represent a lower risk, and discount rates should be adjusted downward to reflect this reduced risk (Muldavin 2009).

Advantages of DCF for Integrating the Value of Sustainability

As Muldavin (2009) notes, "While the specific type of financial model will vary based on the type of decisions being underwritten, the logic and structure of a DCF model provides the conceptual framework needed for interpreting how sustainable features influence return and/or value. Even if perfect data is not available, by thinking through the specific assumptions within a DCF model, users can gain important insights about the magnitude of the financial implications of sustainable property investments" (p. 94)

Sensitivity Analysis Using DCF

While Muldavin asserts in his book that "insights about the magnitude" can be gained by "thinking through" the DCF model, he admits in person that more "sensitivity analysis" is needed to better understand the relationship between building value and the varied impacts that sustainable building features may have (Muldavin 2009). Brueggeman and Fisher describe sensitivity analysis as a "what-if analysis" of a property. Sensitivity analysis starts with a base case, and then involves changing one or more assumptions about income and expense. These

factors may include expected market rental rate, vacancy rates, operating expenses, and the expected resale price. In order to determine how sensitive a property may be to changes in the level or type sustainability features that it possesses, one must first examine the relationship between each feature, and the potential impact on value. One may then estimate how that additional feature might change assumptions about rents, occupancy levels, or costs related to new regulations, for example. These estimates can then be plugged into the DCF model to see what the total change in building value might be. While it is impossible to know exactly what impact a particular feature will have on monthly operating costs or rents, performing sensitivity analysis can reveal the magnitude of an estimated impact on total building value. In Chapters 3 and 4 I will describe and perform sensitivity analysis to observe the interaction with various sustainable building attributes on overall building value.

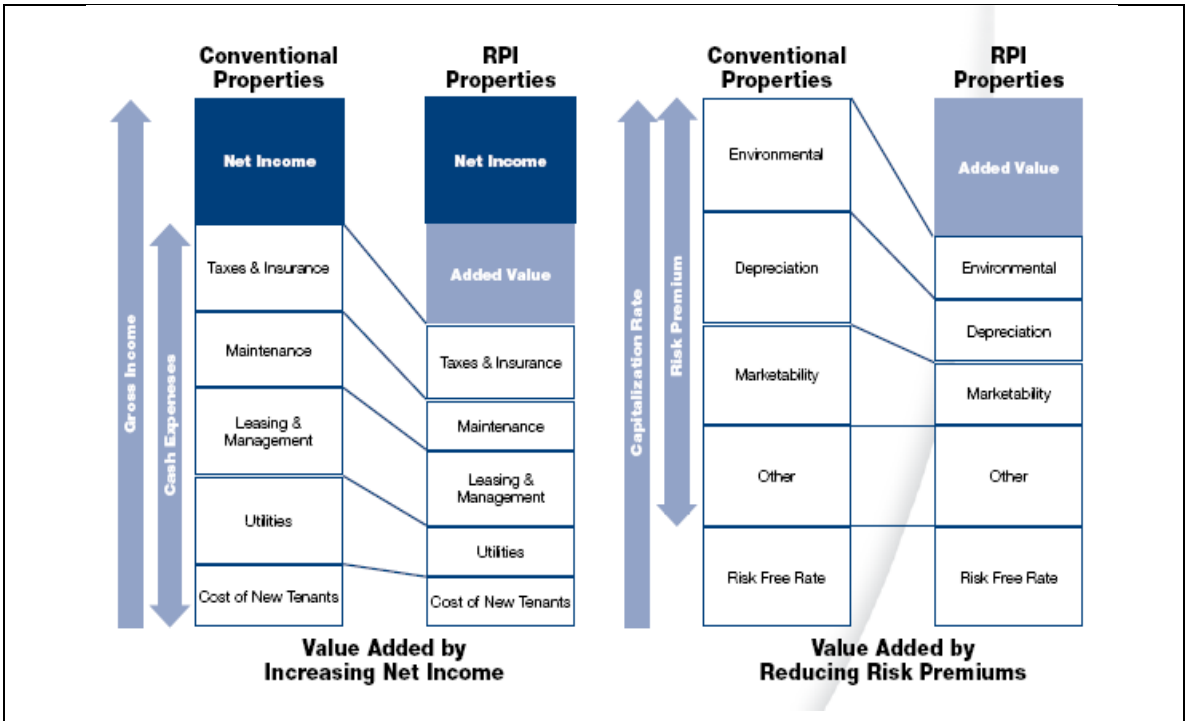

Figure 1. Income/Risk—Two different means of adding value to by incorporating sustainable features. (Pivo 2009)

Part 2: Review of Literatures for Evaluating Investor Attitudes

While the previous section is intended to quantify green value in a way that can be understood and appreciated by any investor, there is an emerging sector of the investment world that is concerned with measuring their investments against the triple bottom line of financial profitability, social equity, and ecological integrity. In "Is There a Future for Socially Responsible Property Investments?" Pivo (2005) explores the policies and priorities of funds and firms that are motivated to "do well while doing good." He cites the Social Investment Forum's 2003 Report on Socially Responsible Investing Trends in the United States, which claims there were 2.16 trillion dollars in socially responsible investing of all kinds in that year. Their most current report, from 2007, says that number had risen to 2.71 trillion by the end 2007, with an increase of 18percent between 2005 and 2007 alone. The report also notes that between 1995 and 2007, SRI assets rose 324 percent, compared to an overall growth in professionally managed assets grew "only" 260 percent (Pivo 2005). In Chapter 4 I will investigate whether this change has been driven by public pension funds like CalSTRS whom have made a choice to sacrifice higher returns for social value, since they are a government entity, or if they see socially responsible investments as revenue neutral or revenue positive choice.

SRI Funds and Property Investment

The most popular type of SRI funds are screened funds, in which individual investments within the fund are evaluated and included or excluded based on environmental and/or social criteria. At the time of publication of Pivo's paper, clear criteria for screening real estate investments for SRI funds has not been established and as such SRI funds did not include any real estate holdings. Despite this fact, Pivo's research shows that many fund managers were interested in diversifying their funds by including real estate, which further underscores the need

for developers to more effectively convey project sustainability. Pivo notes that if only 10percent of SRI funds were to be allocated to real estate, the investment equal nearly 75percent of the entire REIT equity market capitalization, REITs being the largest vehicle for equity investment in real estate.

The Need for Responsible Property Investment Vehicles

Despite the desire of SRI funds to diversify by investing in real estate, fund managers realize that they cannot satisfy that desire by simply acquiring conventional real estate investment products. As Pivo (2005) states, "depending on how a property is sited, designed or managed, it can produce either harmful or beneficial consequences for society and the natural environment" (p. 14). Unfortunately, the demand for SRI real estate investments has not been met. While green building design and technology has proliferated over the last decade or more, Pivo was at the time of publication unable to find a single one, of the more than 300 real estate investment trusts in the US that made sustainability or social responsibility an explicit goal (2005).

The Emergence of Investment Fund Interest in Sustainable Property

However, several large pension funds, including CalSTRS and CalPERS, have developed policies aimed at increasing the social and environmental benefit in their real estate investments. According to Pivo, both funds set goals in 2005 to reduce the energy use in their buildings by 20percent over the next 5 years, and the December 2009 report "Energy Efficiency and Real Estate: Opportunities for Investors" confirms that CalPERS was on track to meet that goal by the end of 2009 (Carpenter and Meyer 2009).

That same report, which also lists best practices for leveraging energy efficiency in real estate investments, advises indirect property owners who invest in real estate related funds or stock ownership to: "Seek funds with s specific mission of creating or acquiring energy efficient

properties, or with specific goals for energy efficiency improvements in existing holdings" (p. 8). Several funds specifically targeted at investing in green building and smart growth have emerged since Pivo surveyed the REIT market in 2005. Baue (2006) in "The Growth of Green Building Funds" notes the emergence of the $120 million Hines CalPERS Green Development Fund and the $100 million Rose Smart Growth Investment Equity Fund, which focuses on urban green building. The Ceres Mercer paper also notes the 2008 launch of the $180 million Thomas Properties Group High Performance Green Fund (Baue 2006).

While these funds are only in the millions and relatively small when compared to the $363 billion TIAA-CREF private retirement fund, changes in the investment strategies of funds like PERS, STRS and TIAA-CREF mean that property level sustainability may eventually be a key factor for developers seeking investment in new projects. While much of the focus of TIAA-CREF and the two California pension fund giants had previously been on one dimension of sustainability--improving energy efficiency in existing buildings--TIAA-CREF has recently pledged that all new development it funds must be LEED certified—a broader measure of sustainability.

Gerding Edlen—Communicating Triple Bottom Line Value to Investors

Progressive developers such as Gerding Edlen have recognized the change in demand from both investors and space-users, and have developed almost entirely LEED certified buildings. Gerding Edlen has now developed more LEED buildings than any other developer, with over 40 buildings to its name. Perhaps more significantly, at least in terms of attracting financing, is Gerding's ability to communicate the value that their projects create for communities they are located in and the world as a whole.

During the recent real estate downturn, Gerding Edlen has temporarily reinvented itself as a real estate investment manager. In this role they incorporate many of the principles that

drove the design of their new projects into the way the evaluate real estate investments for their clients. They have also developed a consulting arm aimed at helping building owners retrofit and improve the performance of existing buildings. Despite multiple attempts, I was unable to reach Gerding Edlen for comment on their investment strategies or their ability to attract capital during the current recession.

Gerding Edlen has developed an ingenious system of metrics to measuring the performance of their buildings in terms of the triple bottom line, which they refer to as the

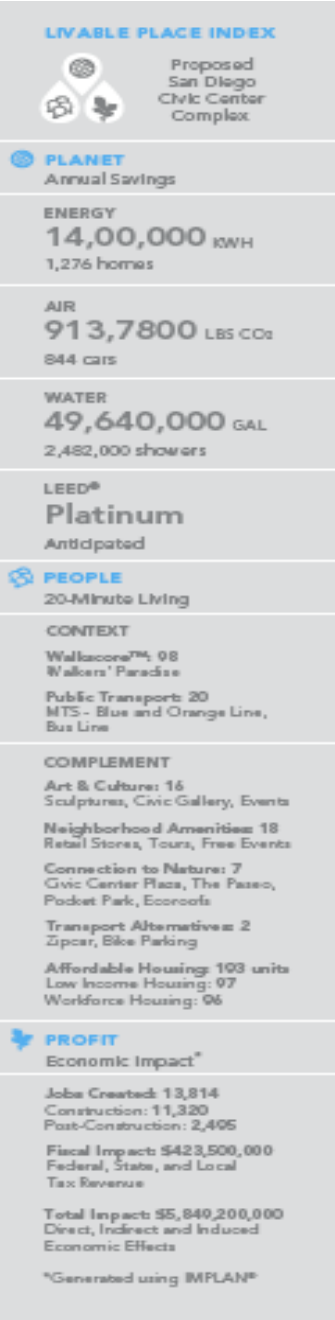

Figure 2. Livable Place Index

Livable Place Index (at left). They use the shorthand of People, Planet, and Profit to describe the social, environmental, and economic bottom lines. They state that the "communication of and transparency around these metrics will push us to achieve even greater energy savings and more community benefit, and to ensure that our projects have a broad, deep and lasting economic impact on the cities where they are located" (Edlen 2009).

In fact, when coupled with financial analysis, the Livable Place Index should be a great tool for attracting investment from funds and trusts looking to increase their RPI investments. Similar to a nutrition label on a box of food, the Livable Place Index quantifies their projects impact on planet, people, and profit. By clearly organizing and communicating the value of their project in terms of the triple bottom line, Gerding Edlen can assure investors, lenders, potential tenants, and perhaps most importantly, local government officials, that their projects meets social, economic, and environmental goals.

The Livable Place Index addresses a few concerns expressed in Pivo's 2005 paper. First, he notes that LEED and Energy Star rating systems are not ideally suited to SRI investment purposes because they are both designed to be applied to individual buildings. While the Livable Place Index is also applied to individual buildings, Gerding Edlen has made the same calculations for their development projects as a

whole. Therefore, if an investor wanted to know about the level of responsibility practiced by the company, not just the project, that information is available to them in the same convenient format. Secondly, Pivo points out that LEED and Energy Star focus primarily on environmental concerns, while "the SRI community is concerned with a wide ranging set of issue that extend beyond just environmental concerns."

Findings of the Literature Review

One significant finding of this literature review is that most of the literature on this topic was published in the last two years, and each successive search I perform seems to turn up exponentially more material. This rapid proliferation of new theory and research in the last two years indicates that event the most conventional of investors or developers will soon have to take note of the trend toward incorporating sustainability into financial decisions. As of now, the emerging field of Responsible Property Investment is still dwarfed by the world of conventional real estate investment. Within the literature there is some indication that Responsible Property Investment strategies have begun to infiltrate conventional funds, but this is a point that needs further research. The short survey that I describe in the next chapter will investigate the extent to which that change is occurring.

The other side of the literature—that which deals with valuation techniques and the relationship between sustainability and value—is also rapidly evolving. Between the studies that focus on regression analysis and those oriented around DCF valuation, there seems to be a consensus that sustainable properties are generally worth more than their conventional counterparts. Some of the causes for this increase in value, such as reduced energy consumption are easy to understand. Other causes, such as increased rents are harder to understand because it requires analysis of the motivation behind tenants willingness to pay those increases. The

literature shows that sustainable properties generally *do* fetch rent premiums—the question of *why* tenants are willing to pay for sustainability is one that is beyond the scope of the literature I reviewed, and beyond the scope of this thesis.

The ideas presented in Muldavin's 2009 work, and in personal communication with Scott, provide much of the basis for the sensitivity analysis discussed in the next chapter and performed in Chapter 4. While many of the regression studies I reviewed provide some insight about trends in sustainable building value, the DCF approach promoted by Muldavin provides a real-world framework that can be applied to individual buildings. It is for this reason that I believe performing DCF analysis in this thesis will be of more value than attempting to perform regression studies on value. Furthermore, even those with access to large property sales data sets (Miller, 2008) have had difficulty with selecting representative peers to draw conclusions about sustainable property value—since I do not have access to the same amount of data, I believe I would have an even more difficult time producing accurate data.

Chapter 3

METHODOLOGY

As discussed above, the relationship between sustainability and building investment value is two-fold. First, the value of a building is impacted by the type and quantity of sustainable features that have been incorporated into that building or property. Second, the type and quantity of capital available to a project can be affected by whole project sustainability with respect to the triple bottom line. As such, part 1 of this chapter focuses on describing the way that financial analysis can be modified to account for building sustainability, and how that will be tested in chapter 4. Part 2 of this chapter describes investor attitudes towards investing in sustainable properties and how those attitudes will be measured in chapter 4. This methodology is designed to test the strength of the two relationships between sustainability and building investment value. The first part, financial analysis including sensitivity analysis provides a methodology for examining the strength or magnitude of sustainable building on a cash flow model. This information can help investors and appraisers to more accurately assess investment potential for buildings, and help developers to numerically communicate the value that a sustainable project brings to investors. The second part of this chapter is a very basic method for gauging investor sentiment. While the short survey only has two respondents, they represent two of the largest real estate investment funds in the world, and as such their perspectives can help those seeking capital to know how the sustainable aspects of their projects will be evaluated.

Part 1—Valuation, underwriting and financial analysis

This section illustrates the way that indexing can be used to disaggregate sustainable building features. It then predicts the effect of each one of those features on building value.

Using LEED Credits to Index Building Features

The LEED rating system is by far the most recognized system in the United States to assess the environmental value of green buildings (USGBC.org). The US Green Building council awards LEED certification to buildings that demonstrate sustainability through their design and function. In recognition of the fact that buildings do not operate in isolation, a new LEED rating system known as LEED ND certifies various size development projects based on some of the same factors measured in other LEED systems, but with a larger-scale view of the impacts of development. This broader view incorporates aspects of walkability, access to transportation, and socio-economic considerations for mixed income communities. The advent of LEED ND creates a tool with which to measure broader, more integrated planning and site-design sustainability measures in addition to the building design features addressed by the other LEED rating systems. Since the LEED systems have categorized and created metrics for nearly every dimension of sustainability in the built environment, they create an excellent framework for the analysis of these various dimensions. This thesis will therefore use many of these categories and metrics to classify and evaluate the various aspects of sustainable design, both in their environmental or social impact (public value) and in their predicted economic impact (private value). However, this thesis will spend little time discussing the market value of LEED certification, since it has already been studied at length, and is an ineffective tool for the detailed financial analysis required by lenders and investors, as discussed below.

The Value of LEED Certification

LEED certification was designed as a tool for owners, operators, tenants, and investors to identify different levels of sustainability in a particular green building. LEED was also designed to help the market price the monetary value of building's sustainability when buildings are bought

and sold—a short supply of LEED certified buildings drives up their price, causing more builders to enter the market and produce more LEED buildings. Hence, the LEED label itself impacts a building's marketability and market value in and of itself. However, even buildings with the same level of LEED certification may have very few of the same sustainable features, so more detailed analysis is necessary for accurate building valuation (Muldavin, year).

Using the LEED Framework for More Detailed Analysis

One way to use the LEED system for more accurate building valuation is as a framework for that detailed analysis, instead of looking at the level of LEED certification. Below is an explanation of why the level of LEED certification does not necessarily add up to the sum of its parts, at least with respect to the financial analysis.

LEED assigns points to different design and technology features, depending on the impact of that feature on the environment. As such, the LEED system is an effective way of measuring the impact of a building on the environment. With the recent addition of LEED for Neighborhood Development, the LEED systems collectively serve as an effective proxy for the public (social and environmental) value of sustainable buildings.

However, while it is the USGBC's intent that two buildings with the same LEED certification have roughly equivalent overall impacts on the environment, in terms of valuation, the comparison between the buildings is apples and oranges. The points toward certification can be achieved in many different ways. As such, one building may have many features that can be quantified and underwritten in terms of private value, while another building with the same level of certification may have achieved most of its points in areas that are of public or environmental value, but have little or no impact on private value. In other words, the LEED rating system is an effective way to know the overall environmental impact of a building or neighborhood, but the level of LEED certification alone cannot accurately predict the incremental value added to a

building through the incorporation of sustainable design and features. In order to assess the private value of a particular sustainable building or project, the sustainable features need to be disaggregated and evaluated on an individual basis. This thesis will evaluate sustainable features on that more detailed, individual basis. The evaluations provided by this thesis can then be used as the basis for a property-specific evaluation of the unique features and conditions of a proposed sustainable project.

Analyzing the DCF Model on a Credit-by-Credit Basis

The chart below is a snippet of a larger chart that I provide shown in Chapter 4. The chart depicts all the categories for LEED credits and prerequisites and the type and magnitude of impact each building attribute is likely to have on value. At this time no researcher has succeeded, or to my knowledge, even attempted to distill quantifiable relationships between all of the different areas of sustainability and value. As such, many of the predictions will be speculative, and not provable. However, this exercise will be of value because it will illustrate the magnitude of change in overall building value associated with a predicted changes specific assumptions in a DCF model—level of building occupancy, for example. While researchers have had success in quantifying the value of certain aspects of sustainability, such as energy efficiency or walkability, each property is unique, and the results of these studies may or may not be useful in determining how to modify a discounted cash flow model. In the case that there is a known relationship between a sustainable attribute and value, that relationship will be used to determine how to modify the discounted cash flow model. Where the relationship is unknown, the author will use deductive reasoning to determine a probable impact on a particular part of the DCF model. The magnitude of this impact on total building value can then be predicted by running the DCF model to determine a NPV or Net Present Value.

How the LEED Credit Matrix Interacts with the DCF Models

The LEED matrix will serve as the basis for the sensitivity analysis by determining, what, if any, part of the DCF model will be affected by a particular sustainable attribute. In the first two columns, I have assigned a number between 0 and 3 to represent level of public and private value associated with a particular LEED credit, 3 being the highest. While all LEED credits have public value, not all have private value. Those categories are given a private value score of 0. If a credit has a private value score of one or more, I note the type and direction of impact achieving that credit will have on the DCF model, using descriptors such as higher, lower (when referring to monetary amounts), or shorter, longer (when referring to durations). Where supported by data, I also give a "percentage change" estimate of how much impact the sustainable feature is likely to have on building value.

It should be noted that the DCF models have both outflows and inflows that affect building value, so an *increase* in rent or a *decrease* in utilities both will cause an *increase* in building value. Since data showing the direct relationship between each aspect of sustainability and value are not available, the chart will instead show the expected impact each aspect might have. By evaluating what type of impact the particular attribute is likely to have on value, underwriters, appraisers, or investors will know specifically how to alter the assumptions in a discounted cash flow model.

Sensitivity Analysis

Once each sustainable attribute has been evaluated as to the type of impact it will have on cash flows, certain attributes will be selected for sensitivity analysis. Using a DCF model to perform sensitivity analysis will provide an example of how sustainability considerations can be

incorporated into investment decisions, and what the effect of including these considerations might be.

Encouraging Investment by Illustrating Risks and Rewards

Proponents of green building have already claimed that developers have learned to "game the system" in finding the cheapest (in terms of up-front costs) way to achieve LEED certification (Miller, Spivey et al. 2008). As such, there may be concern that the information in this analysis could be used in the same way—to find what sustainability measures provide the greatest financial gain, and to incorporate those features over other features that may provide greater environmental benefit, but less financial payoff. While this may be the case, giving developers and investors more information about the interface between sustainability and value will help them better understand risks and rewards, making green building investment safer and therefore more attractive (Muldavin 2009). While it is fine to advocate for green building, making broad, uninformed statements about the value of LEED buildings will not encourage more investment in the long run, as investors and lenders need property-specific analysis of costs, income potential, and risks to make informed decisions. Instead, the type of detailed analysis contained within this thesis will encourage investment from all types of investors seeking increased returns or reduced risk.

Building Valuation

At the heart of real estate investment decisions is building valuation. As real estate has gradually become to be recognized as an asset class for investors—in the way that, bonds, and commodities have long been understood—investors have wanted to find a way to measure returns that is equivalent to the measurement of yields that are used for other asset classes. This measure, the Internal Rate of Return, is a percentage that the investor should earn on the life of the

investment, and many investors equate a 10percent IRR to a 10percent yield on a stock. However, for the purposes of this thesis, I will use Net Present Value or NPV as the measure of building value for the sensitivity analysis. NPV is calculated by evaluating the series of cash flows expected from a building during a planned holding period. NPV also takes into account the reversionary value of a building, or the expected price at time of sale, which is equivalent to the final cash flow in the series. All of these cash flows are discounted to account for the time value of money. The discount rate that is selected for the model should be roughly equivalent to the interest rate or yield the investor could be getting from a different investment of equal risk. This accounts for the opportunity cost of investing in the building—since the investor could be earning returns in other investments if his money were not tied up in the building. The discount rate is one of many factors that could be adjusted in a DCF model to account for sustainability. For example, LEED certified buildings are likely to be a less risky investment, since they may avoid renovation costs due to future green building legislation, and will be less impacted by spikes in energy costs. As such, a lower discount rate can be applied to that building, which will increase the NPV of the building. These changes in assumptions will be examined in the next chapter by running multiple DCF models on the same project. By changing one assumption at a time, we can observe the impact on building value. Chapter 4 will show several iterations of a DCF for the same hypothetical building, with different assumptions changed based on sustainable building features or attributes being added to the building.

Methodology Part 2: Gauging Investor Sentiment

As mentioned above, sustainability has two distinct but interrelated interactions with property investment. The first interaction, which the exercised described in Methodology Part 1

is meant to investigate, is between sustainability and private value. This interaction involves changes to property value as a result of sustainable building features or attributes.

The second interaction, which is explored in this section, Methodology Part 2, is between sustainability and investor sentiment. In this interaction, investors may prioritize sustainable properties not based only on detailed financial analysis, but on institutional values and stakeholder accountability. As these investor sentiments can determine what real estate assets or projects receive funding, gauging investor sentiments toward sustainable building is an important counterpart to financial analysis of sustainable building. Together, financial analysis and investor sentiment combine to create a picture of green building finance that can help developers and finance professionals navigate the challenging task of acquiring funding for sustainable building projects.

Survey Participants

The world of real estate investing is vast, and investors range from public pension funds who own millions of square feet of real estate, to individual mom and pop investors who own a single apartment building. While it would be great to survey the entire range of investors to determine current trends and attitudes within the real estate investment world, that process would require resources far beyond the reach of this author. Fortunately, I have made contacts with two individuals who work at organizations that are generally regarded as leaders in investment, and as such should be ahead of the curve in their practice, giving a glimpse of where the rest of the market is headed.

Investor Attitudes Toward Green Building

In order to gauge present investor sentiment, I will conduct interviews with two real estate investment agents from two of the world's largest investment funds. In order to protect the

interviewees from any repercussions inside or outside of their organizations, I have identified them as “Participant #1 and Participant #2”. Participant # 1 holds a Masters in Real Estate Finance from NYU. He has worked as an investment agent/analyst at a private equity fund in New York since 2005. As a “fund of funds,” his firm allocates investment capital to various funds, which they evaluate based on the fund’s investment strategy. The firm has conducted surveys on the trends toward investment in sustainable property, but I am presently unaware of their sustainable investment policy, if any.

Participant #2 is a real estate investment analyst specializing in green building and sustainable development for a large US public pension fund. This unnamed pension fund directly invests their member’s retirement savings, while the private equity fund represents a variety of different pools of money, including insurance companies, foundations, and public pension funds. The fact that the pension fund is responsible only for public employees retirement funds may mean an increased level of scrutiny over their investment decisions. As such, I am interested in knowing how this increased scrutiny may or may not influence their investment decisions.

I have asked the two respondents to reply to the following questions. Their responses will be included in chapter 4.

1. Q. Has your organization changed its policy toward sustainable real estate investment since the downturn?
2. Q. Have you witnessed a higher level of performance from LEED certified or other sustainable investments through the real estate crash?
3. Q. What is your target for investment in green buildings? Have you met that goal?
4. Q. Who drives the development of your investing strategy? Is it a board of directors, or does staff have input in strategic decisions?

5. Q. Is your sole interest in sustainable property investment in finding ways to increase returns or is social responsibility a significant factor?
6. Q. Are you familiar with the concept of the Triple Bottom Line? Does your organization evaluate investments on each of the three bottom lines, or is there a focus on one?
7. Q. How are your investment decisions affected by the source of the money you are investing? Do you believe that you have a fiduciary duty to those whose pensions you invest to make socially responsible investments, or would you be failing to perform your fiduciary duty by considering factors other than financial returns?
8. Q. What role does LEED certification have in your investment decisions? Will you invest any new construction that is not pursuing LEED certification? Existing buildings?
9. Q. Do you apply a value premium to LEED certified buildings?
10. Q. Do you typically modify Discounted Cash Flow models to account for sustainable building features?

At the heart of these ten questions is the question of how these investment funds see themselves in the world of corporate social responsibility. Many large corporations—from early adopters like Interface Carpet, to household names like WalMart have adopted aggressive CSR and environmentally progressive policies. Within this context, the idea that going green will compromise a company's ability to make a profit does not seem to register. In fact, companies that adopt CSR policies generally seem to see it as a way to gain a competitive advantage in the marketplace. Although they may not openly admit it, many companies draw this conclusion because they believe that they will be held accountable by the buying public for failing to address environmental issues.

However, pension funds and other real estate investors may not have the same level of public accountability. Furthermore, one that invests only public employee's pensions may have a

different level of accountability than one that invests funds for a varied group of investors. The answers to these questions, therefore, will be condensed and evaluated on this main point: do these funds see themselves as accountable to their investors or the public to make sustainable real estate investments? If not, do they make such investments on the belief that they are fundamentally sounder or more profitable than conventional investments? Answering these basic questions will reveal the motivations of institutional investors toward sustainability in a way that can help project proponents know how to present green proposals—either as more profitable or just as the right thing to do.

Chapter 4

RESULTS

This chapter contains a LEED indexing matrix and several iterations of a discounted cash flow model for a hypothetical 350,000 square foot office building located in the Sacramento market. In Part 1, the LEED indexing matrix, I identify the relationship between different sustainable building attributes and the various inputs of a discounted cash flow model. In Part 2, the sensitivity analysis, I then examine the impact of each of these relationships on building valuation by altering one input assumption in the DCF model while holding the other assumptions constant. The sensitivity analysis is designed to reveal the magnitude of the impact on building value that each change in assumptions creates. In Chapter 5, I will discuss the significance of these findings.

Part 1—LEED Indexing Matrix

As discussed previously, looking at the level of LEED certification alone is not an effective way of evaluating the impact of unique sustainability attributes on building value. However, as a thoroughly vetted measure of sustainability, the LEED credit system is a good way to index a building's various sustainable attributes in order to keep track of how each of those features might be accounted for in a DCF analysis. The following chart does exactly that by describing how a particular attribute is likely to affect a DCF model. Of course, each building is unique, so it is impossible to know exactly what impact a particular feature will have on a particular cash-flow input. Despite this fact, by looking at the relationship between individual sustainable features and individual components of the DCF model, the cause and effect relationship between sustainability and value can be illustrated in a way that is difficult to capture

in less detailed studies such as those attempting to correlate LEED certification with selling price. Furthermore, for buildings that have attained some level of LEED certification, an appraiser or investor might want to examine what credits that building earned in order to become LEED certified, and then reference this matrix to explore how those credits might affect the building value.

How to Use the Matrix

The first two columns of the matrix are score from 0-3 on their relative level of public or private value. Since all LEED credits have some public value, they all score at least 1. The ratings are subjective and are subject to interpretation, especially with regard to public value. Some people may view climate change as a greater threat than watershed contamination, and may therefore rank energy credits as 3 and storm water management a 1. The private value ratings are less subjective as they are indirectly supported by data (no studies have attempted to draw direct correlations between individual credits and value). These ratings are the subjective opinions of the author, and do not correlate with dollar amounts. Anyone conducting investment analysis on a particular building should research the latest empirical data on this topic and draw their own conclusions about the affect of a particular LEED credit on value.

The remaining columns in the matrix correspond with different inputs of a cash flow model. If there is an interaction between a credit and a cash-flow input, that interaction is noted by a one-word descriptor of how a typical input might be modified to account for a particular credit, or equivalent measure of sustainability. If the cause of the change in input is not readily apparent, it is also noted below the expected change. The table does not tell an appraiser or investor how much to adjust the input, as that will be different for every property. The matrix is not intended to act as a formula to be applied to a sustainable property in order to arrive at a value

premium. Instead it is intended to point out value-sustainability interactions that might otherwise be overlooked and excluded from a valuation or investment analysis.

Sustainable Sites Part 1									
LEED Credit	Relative Value		Impact on DCF model						
	scale 0-3								
	Public Value	Private Value	Utilities	Maintenance	Rent	Occupancy	Cost of Capital (Investor Demand)	Regulatory Risk	Equipment life-cycle
Prerequisite 1 Construction Activity Pollution Prevention Required	3	1						lower--expedited permiting	
Credit 1 Site Selection	3	2					lower	lower	
Credit 2 Development Density and Community Connectivity	3	2			higher	higher occupancy in downtowns	lower interest rate--central and connected properties carry lower default risk		
Credit 3 Brownfield Redevelopment	3	1					lower interest rate--leveraging public brownfield funds	lower--expidited permiting	
Credit 4.1 Alternative Transportation—Public Transportation Access	2	2	lower--less electricity to light parking		higher--tenants prefer accesible locations	higher--less impacted by changes in fuel costs			
Credit 4.2 A alternative Transportation—Bicycle Storage and Changing Rooms	2	1	lower--less parking		higher--premium for attracting space users				
Credit 4.3 Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	2	0							

Table 1. Sustainable Sites Part 1

Although location is clearly an aspect of sustainability and a major driver of value in real estate, the relationship between value and sustainable locations is not always clear. A property that is accessible by foot and public transit is likely to be of more value than one that is harder to get to—but so is a less sustainable auto-oriented property with great freeway access.

Sustainable Sites Part 2									
LEED Credit	Relative Value		Impact on DCF model						
	scale 0-3								
	Public Value	Private Value	Utilities	Maintenance	Rent	Occupancy	Cost of Capital (Investor Demand)	Regulatory Risk	Equipment life-cycle
Credit 4.4 Alternative Transportation—Parking Capacity	1	0			25% lower parking garage revenue				
Credit 5.1 Site Development—Protect or Restore Habitat	3	1			higher--atractive surroundings			lower--expedited permitting	
Credit 5.2 Site Development—Maximize Open Space	3	0			higher--atractive surroundings				
Credit 6.1 Stormwater Design—Quantity Control	3	2				higher--atractive surroundings		lower--reduced sewer impact fees	lower-- reduced sewer maintenence costs
Credit 6.2 Stormwater Design—Quality Control	3	2						lower--reduced sewer impact fees	lower-- reduced sewer maintenence costs
Credit 7.1 Heat Island Effect—Nonroof	2	1	lower						
Credit 7.2 Heat Island Effect—Roof	2	1	lower						
Credit 8 Light Pollution Reduction	1	0							

Table 1.2. Sustainable Sites Part 2

Sustainable Sites also deals with the way that development occurs on the land. Many of the credits listed in this category deal with land use issues that are commonly regulated by state and local governments. Meeting these thresholds can create additional cash flows by reducing the permitting period and time to market for a new development, or by reducing impact fees.

Water Efficiency									
LEED Credit	Relative Value		Impact on DCF model						
	scale 0-3								
	Public Value	Private Value	Utilities	Maintenance	Rent	Occupancy	Cost of Capital (Investor Demand)	Regulatory Risk	Equipment life-cycle
Prerequisite 1 Water Use Reduction Required	2	1	lower						
Credit 1 Water Efficient Landscaping	2	1	lower	lower-reduction of lawn area					
Credit 2 Innovative Wastewater Technologies	2	1	unknown	unknown				higher--health and code concerns	unknown
Credit 3 Water Use Reduction	2	2	lower						

Table 2. Water Efficiency

While water may eventually become a limiting resource, it is presently too inexpensive to have much of an impact on the private value of a building. Since water scarcity is a less of an immediate threat than climate change, water efficiency also carries lower public value.

Energy and Atmosphere									
LEED Credit	Relative Value		Impact on DCF model						
	scale 0-3								
	Public Value	Private Value	Utilities	Maintenance	Rent	Occupancy	Cost of Capital (Investor Demand)	Regulatory Risk	Equipment life-cycle
Prerequisite 1 Fundamental Commissioning of Building Energy Systems Required	1	3	lower	lower					longer
Prerequisite 2 Minimum Energy Performance Required	3	3	lower						
Prerequisite 3 Fundamental Refrigerant Management Required	3	1							longer
Credit 1 Optimize Energy Performance	3	3	lower						
Credit 2 On-site Renewable Energy	2	2	unknown	unknown					shorter--additional equipment to replace
Credit 3 Enhanced Commissioning	1	3	lower	lower					longer
Credit 4 Enhanced Refrigerant Management	3	1							longer
Credit 5 Measurement and Verification	2	1						lower--compliance with gov't reporting standards	
Credit 6 Green Power	3	0							

Table 3. Energy and Atmosphere

Energy and Atmosphere is at the forefront of both private and public value in relation to buildings. Although energy comes from a variety of sources, only some of which directly impact the atmosphere, energy saved or generated from clean on-site sources reduces the amount of energy that must be produced from coal or other polluting sources.

Materials and Resources									
LEED Credit	Relative Value		Impact on DCF model						
	scale 0-3								
	Public Value	Private Value	Utilities	Maintenance	Rent	Occupancy	Cost of Capital (Investor Demand)	Regulatory Risk	Equipment life-cycle
Prerequisite 1 Storage and Collection of Recyclables Required	3	0							
Credit 1.1 Building Reuse—Maintain Existing Walls, Floors and Roof	2	0							
Credit 1.2 Building Reuse—Maintain Existing Interior Nonstructural Elements 1	2	0							
Credit 2 Construction Waste Management 1-2	2	0							
Credit 3 Materials Reuse 1-2	2	0							
Credit 4 Recycled Content 1-2	2	0							
Credit 5 Regional Materials 1-2	3	0							
Credit 6 Rapidly Renewable Materials 1	3	0							
Credit 7 Certified Wood 1	3	0							

Table 4. Materials and Resources

Materials and Resources is the one LEED category where there is no clear evidence of private value. While there may be some changes to the construction cost, such as increased cost of obtaining certified wood or cost savings associated with reuse of a structure, none of these costs are ongoing cash flows, and are therefore beyond the scope of this thesis.

Indoor Environmental Quality									
LEED Credit	Relative Value		Impact on DCF model						
	scale 0-3								
	Public Value	Private Value	Utilities	Maintenence	Rent	Occupancy	Cost of Capital (Investor Demand)	Regulatory Risk	Equipment life-cycle
Prerequisite 1 Minimum Indoor Air Quality Performance Required	1	3			higher	longer--higher worker productivity			
Prerequisite 2 Environmental Tobacco Smoke (ETS) Control Required	1	3		lower	higher			lower	
Credit 1 Outdoor Air Delivery Monitoring	1	2			higher	higher			
Credit 2 I increased Ventilation	1	3			higher	higher			longer
Credit 3.1 Construction Indoor Air Quality Management Plan—During Construction	1	0							
Credit 3.2 Construction Indoor Air Quality Management Plan—Before Occupancy	1	1				higher			
Credit 4.1 Low-Emitting Materials—Adhesives and Sealants	2	2			higher	higher		lower	unknown
Credit 4.2 Low-Emitting Materials—Paints and Coatings	2	2			higher	higher		lower	
Credit 4.3 Low-Emitting Materials—Flooring Systems	2	2			higher	higher		lower	
Credit 4.4 Low-Emitting Materials—Composite Wood and Agrifiber Products	2	2			higher	higher		lower	
Credit 5 I indoor Chemical and Pollutant Source Control	2	2			higher	higher		lower	
Credit 6.1 Controllability of Systems—Lighting	1	3			higher	higher			longer
Credit 6.2 Controllability of Systems—Thermal Comfort	1	3			higher	higher			
Credit 7.1 Thermal Comfort—Design	1	3			higher	higher			
Credit 7.2 Thermal Comfort—Verification	2	0							
Credit 8.1 Daylight and Views—Daylight	1	3			higher				longer
Credit 8.2 Daylight and Views—Views	1	3			higher				

Table 5. Indoor Environmental Quality

The public value score are low in this category because the only members of the public that benefit from most IEQ measures are those who happen to occupy or visit the building, in contrast to categories like Energy and Atmosphere that address the use of a public good.

Whole Building LEED Certification									
LEED Credit	Relative Value		Impact on DCF model						
	scale 0-3								
	Public Value	Private Value	Utilities	Maintenance	Rent	Occupancy	Cost of Capital (Investor Demand)	Regulatory Risk	Equipment life-cycle
Certified	2	2	lower	lower	higher	higher	lower	lower	longer
Silver	2	3	lower	lower	higher	higher	lower	lower	longer
Gold	3	3	lower	lower	higher	higher	lower	lower	longer
Platinum	3	3	lower	lower	higher	higher	lower	lower	longer

Table 6. Whole Building LEED Certification

While the level of LEED certification should not be the only basis for incorporating sustainability into investment decisions, it would also be a mistake to omit it entirely. Two buildings that are identical in every way other than the fact that one has been certified by the USGBC are clearly not of equal value. In this case the certification itself should be incorporated into the valuation and investment analysis.

Part 2—Sensitivity Analysis

The following sensitivity analysis is based on the interactions illustrated in the LEED Indexing Matrix above. The first "baseline building" table is a DCF model representing a typical office building, including assumptions about rents, occupancy, operating expenses, taxes and so on. In each of the tables following the base case, one input has been modified to test how sensitive the value of the building is to changes in cash-flows due to different aspects of green building. The modifications to the DCF models represent changes to inputs that would occur if the building were built or modified to add one or more sustainable attributes. In certain cases the model illustrates how the value of the building might change if sustainable strategies were *not* implemented. These are included to illustrate the risk of not future-proofing one's building though sustainable upgrades.

The assumptions in these models represent approximations of real-world changes in cash-flow amounts. They are not intended to be exact, and would need to be adjusted if applied to an actual building. While the LEED matrix is designed to explore the relationships between various sustainable building attributes and individual components of a DCF model, the following sensitivity analysis is designed to explore the relationships between the individual components of a DCF model and total building price. Neither the LEED matrix nor this exercise is intended to provide a "final answer" to the question "how much more is a green building worth?".

As such, most of the modifications to the DCF model are not based on hard data, but on logical assumptions, and estimates based on various studies. In certain cases, a particular study or article is cited as the basis for the modification to a DCF input.

Baseline Building DCF model							
Inputs are in grey							
	Begin	In terminal year					
Building space (in square feet)	350,000						
Occupancy rate (100-percent vacancy)	80%	80%					
Rent/square foot	25						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	2.50%	2.50%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	5.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		80%	80.00%	80.00%	80.00%	80%	
Rent/Square foot	$25.00	$25.25	$25.50	$25.76	$26.02	$26.28	
Rental Income		$7,070,000	$7,140,700	$7,212,107	$7,284,228	$7,357,070	$7,577,782
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$176,750	$178,518	$180,303	$182,106	$183,927	$189,445
Total Revenues		$7,807,300	$7,885,373	$7,964,227	$8,043,869	$8,124,308	$8,368,037
Expenses							
Water Per/square foot	$0.25	$88,375	$89,259	$90,151	$91,053	$91,963	$94,722
Gas and Electric/square foot	$3.00	$1,076,250	$1,103,156	$1,130,735	$1,159,004	$1,187,979	$1,223,618
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$3,134,175	$3,176,661	$3,219,974	$3,264,135	$3,309,162	$3,408,436
Operating income before depreciation		$4,673,125	$4,708,713	$4,744,252	$4,779,734	$4,815,146	$4,959,600
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$3,673,125	$3,708,713	$3,744,252	$3,779,734	$3,815,146	$3,929,600
Taxes	38%	$1,395,788	$1,409,311	$1,422,816	$1,436,299	$1,449,756	$1,493,248
Operating income after taxes		$2,277,338	$2,299,402	$2,321,436	$2,343,435	$2,365,391	$2,436,352
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$500,000	$505,000	$510,050	$515,151	$520,302	$525,505	$525,505
Cash flow to firm		$2,772,338	$2,789,352	$2,806,286	$2,823,133	$2,839,886	$2,940,847
Terminal value						$50,897,322	
Present value	**$48,233,464**	$2,596,356	$2,446,469	$2,305,083	$2,171,722	$38,713,834	
Cost of equity	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%
Cost of debt	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%
Debt ratio	60%	60.00%	60.00%	60.00%	60.00%	60.00%	60.00%
Cost of capital	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%
Present Value Under Baseline Assumptions	**$48,233,464**						
$ Change in Value	$0						
% Change in Value	**0.00**						

Table 7. ***Baseline Building DCF model***

Since there have been no modifications to this base case model, the change in value at the bottom of the sheet is 0$. Assumptions about rental prices and vacancy levels are based on 18.8percent average vacancy and $26.05/sq. ft. for class A office space in Sacramento for the 1st quarter 2010 (CoStar Sacramento, 2010)

Explanation of the Tables

The DCF model on the previous page uses a series of inputs determine yearly cash flows for a period of five years, including the presumed sale of the property at the end of the fifth year. The cash flows for the first five years are all calculated based on predicted cash inflows from rents and cash outflows from utilities, taxes, and so on. The "terminal year value" is also known as "reversionary value" is much greater than the previous 5 cash flows because it represents a predicted sale price, which is calculated by dividing the operating income in the 6^{th} (terminal) year by the cap rate, as described in chapter 2.

Discounting Within the Models

This reversionary value, as well as the yearly cash flows from operation are all discounted (reduced by a factor) using the discount rate to account for the time value of money. In this case it I am using the cost of capital, or 6.78 percent. This discount rate is raised to the power of the number of years in the future the cash flow will be received. So, the discounted cash flow for year 3, for example equals (cash flow to firm in year 3) / (1+cost of capital)^3. The Present Value is the sum of the present (discounted) values of all future cash flows from ownership of this property, and is the price a buyer would expect to pay for a property in order to achieve the yields he requires for the investment.

Interpreting the Sensitivity Analysis Iterations

In the preceding "baseline" example, all inputs are "baseline" inputs that represent typical costs and income for a conventional building. In each of the following iterations of the sensitivity analysis the input that has been changed to account for a potential effect on a particular cash flow. That change, as well as the overall change in building value are highlighted in large font. For most readers, the change in overall value will be the main point of interest. However, the entire

spreadsheet has been provided for each iteration for those who may be interested in knowing why the overall building value changed.

DCF analysis accounting for 10% lower vacancy rate--From 80% to 90%

Inputs are in grey

	Begin	In terminal year					
Building space (in square feet)	350,000						
Vacancy rate =	90%	90%					
Rent/square foot	25						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	2.50%	2.50%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	5.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		90%	90.00%	90.00%	90.00%	90%	
Rent/Square foot	$25.00	$25.25	$25.50	$25.76	$26.02	$26.28	
Rental Income		$7,953,750	$8,033,288	$8,113,620	$8,194,757	$8,276,704	$8,525,005
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$198,844	$200,832	$202,841	$204,869	$206,918	$213,125
Total Revenues		$8,668,956	$8,755,646	$8,843,202	$8,931,634	$9,020,951	$9,291,579
Expenses							
Water Per/square foot	$0.25	$88,375	$89,259	$90,151	$91,053	$91,963	$94,722
Gas and Electric/square foot	$3.00	$1,076,250	$1,103,156	$1,130,735	$1,159,004	$1,187,979	$1,223,618
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$3,134,175	$3,176,661	$3,219,974	$3,264,135	$3,309,162	$3,408,436
Operating income before depreciation		$5,534,781	$5,578,985	$5,623,228	$5,667,499	$5,711,789	$5,883,143
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$4,534,781	$4,578,985	$4,623,228	$4,667,499	$4,711,789	$4,853,143
Taxes	38%	$1,723,217	$1,740,014	$1,756,827	$1,773,650	$1,790,480	$1,844,194
Operating income after taxes		$2,811,564	$2,838,971	$2,866,401	$2,893,849	$2,921,309	$3,008,948
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$500,000	$505,000	$510,050	$515,151	$520,302	$525,505	$525,505
Cash flow to firm		$3,306,564	$3,328,921	$3,351,251	$3,373,547	$3,395,804	$3,513,443
Terminal value						$60,807,259	
Present value	**$57,617,972**	$3,096,672	$2,919,711	$2,752,717	$2,595,133	$46,253,738	
Cost of equity	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%
Cost of debt	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%
Debt ratio	60%	60.00%	60.00%	60.00%	60.00%	60.00%	60.00%
Cost of capital	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%
Present Value Under Baseline Assumptions	**$48,233,464**						
Change in Value	**$9,384,508**						
% Change in Value	**16.29**						

Table 8. ***10 percent change in occupancy***

Various factors affect the level of occupancy in a building. Studies have shown a wide range of results when attempting to correlate LEED certification and occupancy level (Miller, et. Al., 2008). For the purpose of this exercise, I have assumed that occupancy would be 10 percent higher than in a comparable non-LEED building. In this case would result in a 9.3 million dollar increase in asset value.

DCF analysis accounting for 4.8% increase in rents--from $25 to $26.20/per square foot/year

Inputs are in grey

	Begin	In terminal year					
Building space (in square feet)	350,000						
Vacancy rate =	80%	80%					
Rent/square foot	26.2						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	2.50%	2.50%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	5.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		80%	80.00%	80.00%	80.00%	80%	
Rent/Square foot	$26.20	$26.46	$26.73	$26.99	$27.26	$27.54	
Rental Income		$7,409,360	$7,483,454	$7,558,288	$7,633,871	$7,710,210	$7,941,516
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$185,234	$187,086	$188,957	$190,847	$192,755	$198,538
Total Revenues		$8,138,176	$8,219,558	$8,301,753	$8,384,771	$8,468,619	$8,722,677
Expenses							
Water Per/square foot	$0.25	$88,375	$89,259	$90,151	$91,053	$91,963	$94,722
Gas and Electric/square foot	$3.00	$1,076,250	$1,103,156	$1,130,735	$1,159,004	$1,187,979	$1,223,618
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$3,134,175	$3,176,661	$3,219,974	$3,264,135	$3,309,162	$3,408,436
Operating income before depreciation		$5,004,001	$5,042,897	$5,081,779	$5,120,636	$5,159,457	$5,314,241
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$4,004,001	$4,042,897	$4,081,779	$4,120,636	$4,159,457	$4,284,241
Taxes	38%	$1,521,520	$1,536,301	$1,551,076	$1,565,842	$1,580,594	$1,628,011
Operating income after taxes		$2,482,481	$2,506,596	$2,530,703	$2,554,794	$2,578,863	$2,656,229
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$500,000	$505,000	$510,050	$515,151	$520,302	$525,505	$525,505
Cash flow to firm		$2,977,481	$2,996,546	$3,015,552	$3,034,492	$3,053,358	$3,160,724
Terminal value						$54,702,738	
Present value	**$51,837,115**	$2,788,478	$2,628,194	$2,476,974	$2,334,312	$41,609,157	
Cost of equity	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%
Cost of debt	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%
Debt ratio	60%	60.00%	60.00%	60.00%	60.00%	60.00%	60.00%
Cost of capital	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%
Present Value Under Baseline Assumptions	**$48,233,464**						
Change in Value	**$3,603,651**						
% Change in Value	**6.95**						

Table 9. ***4.8 percent Change in Rent/Sq. Foot.***

Various factors affect the rents tenants are willing to pay for office space in a building. Studies have shown a willingness to pay a premium for LEED-certified and Energy Star labeled office space. This example shows how a 4.8percent rent premium for an Energy Star property (Pivo 2008) would affect building value. In this case would result in a 3.6 million dollar increase in asset value.

DCF analysis accounting for doubling of the annual energy inflation rate--From 2.5%/year to 5%/year

Inputs are in grey

	Begin	In terminal year					
Building space (in square feet)	350,000						
Vacancy rate =	80%	80%					
Rent/square foot	25						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	**5.00%**	5.00%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	5.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		80%	80.00%	80.00%	80.00%	80%	
Rent/Square foot	$25.00	$25.25	$25.50	$25.76	$26.02	$26.28	
Rental Income		$7,070,000	$7,140,700	$7,212,107	$7,284,228	$7,357,070	$7,577,782
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$176,750	$178,518	$180,303	$182,106	$183,927	$189,445
Total Revenues		$7,807,300	$7,885,373	$7,964,227	$8,043,869	$8,124,308	$8,368,037
Expenses							
Water Per/square foot	$0.25	$88,375	$89,259	$90,151	$91,053	$91,963	$94,722
Gas and Electric/square foot	$3.00	$1,102,500	$1,157,625	$1,215,506	$1,276,282	$1,340,096	$1,407,100
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$3,160,425	$3,231,129	$3,304,746	$3,381,413	$3,461,279	$3,591,919
Operating income before depreciation		$4,646,875	$4,654,244	$4,659,481	$4,662,456	$4,663,029	$4,776,118
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$3,646,875	$3,654,244	$3,659,481	$3,662,456	$3,663,029	$3,746,118
Taxes	38%	$1,385,813	$1,388,613	$1,390,603	$1,391,733	$1,391,951	$1,423,525
Operating income after taxes		$2,261,063	$2,265,631	$2,268,878	$2,270,723	$2,271,078	$2,322,593
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$500,000	$505,000	$510,050	$515,151	$520,302	$525,505	$525,505
Cash flow to firm		$2,756,063	$2,755,581	$2,753,728	$2,750,421	$2,745,573	$2,827,088
Terminal value						$48,928,490	
Present value	**$46,603,148**	$2,581,115	$2,416,850	$2,261,912	$2,115,787	$37,227,485	
Cost of equity	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%
Cost of debt	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%
Debt ratio	60%	60.00%	60.00%	60.00%	60.00%	60.00%	60.00%
Cost of capital	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%
Present Value Under Baseline Assumptions	**$48,233,464**						
Change in Value	**-$1,630,316**						
% Change in Value	**-3.50**						

Table 10. ***Change in Energy Inflation Rate***

Since 2000, the annual rate of inflation for electricity has been 2.5percent (Edison, 2006). However, a different rate of inflation could affect the value of a building. This model shows that if electricity were to instead increase in cost at 5percent/year, the building would lose $1.6 million in value. This table reflects the risk of not "future proofing" ones building by increasing energy efficiency.

DCF analysis accounting for 33% decrease in energy use--Gas and Electric from $3.00 to $2.00							
Inputs are in grey							
	Begin	In terminal year					
Building space (in square feet)	350,000						
Vacancy rate =	80%	80%					
Rent/square foot	25						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	2.50%	2.50%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	5.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		80%	80.00%	80.00%	80.00%	80%	
Rent/Square foot	$25.00	$25.25	$25.50	$25.76	$26.02	$26.28	
Rental Income		$7,070,000	$7,140,700	$7,212,107	$7,284,228	$7,357,070	$7,577,782
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$176,750	$178,518	$180,303	$182,106	$183,927	$189,445
Total Revenues		$7,807,300	$7,885,373	$7,964,227	$8,043,869	$8,124,308	$8,368,037
Expenses							
Water Per/square foot	$0.25	$88,375	$89,259	$90,151	$91,053	$91,963	$94,722
Gas and Electric/square foot	$2.00	$717,500	$735,438	$753,823	$772,669	$791,986	$815,745
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$2,775,425	$2,808,942	$2,843,063	$2,877,801	$2,913,169	$3,000,564
Operating income before depreciation		$5,031,875	$5,076,431	$5,121,164	$5,166,068	$5,211,139	$5,367,473
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$4,031,875	$4,076,431	$4,121,164	$4,166,068	$4,211,139	$4,337,473
Taxes	38%	$1,532,113	$1,549,044	$1,566,042	$1,583,106	$1,600,233	$1,648,240
Operating income after taxes		$2,499,763	$2,527,387	$2,555,122	$2,582,962	$2,610,906	$2,689,233
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$500,000	$505,000	$510,050	$515,151	$520,302	$525,505	$525,505
Cash flow to firm		$2,994,763	$3,017,337	$3,039,971	$3,062,660	$3,085,401	$3,193,728
Terminal value						$55,273,941	
Present value	**$52,347,857**	$2,804,662	$2,646,429	$2,497,032	$2,355,981	$42,043,753	
Cost of equity	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%
Cost of debt	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%
Debt ratio	60%	60.00%	60.00%	60.00%	60.00%	60.00%	60.00%
Cost of capital	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%
Present Value Under Baseline Assumptions	**$48,233,464**						
Change in Value	**$4,114,393**						
% Change in Value	**7.86**						

Table 11. ***33 percent Decrease in Energy Usage***

Payback on energy efficiency upgrades to buildings can justify the costs if power prices are high enough and the savings are significant. This model shows a $4.1 million increase in asset value if energy use were reduced by 33percent from baseline.

DCF analysis accounting for 1% decrease in risk premium--Cost of equity from 10.9% to 9.9%

Inputs are in grey

	Begin	In terminal year					
Building space (in square feet)	350,000						
Vacancy rate =	80%	80%					
Rent/square foot	25						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	2.50%	2.50%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	4.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		80%	80.00%	80.00%	80.00%	80%	
Rent/Square foot	$25.00	$25.25	$25.50	$25.76	$26.02	$26.28	
Rental Income		$7,070,000	$7,140,700	$7,212,107	$7,284,228	$7,357,070	$7,577,782
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$176,750	$178,518	$180,303	$182,106	$183,927	$189,445
Total Revenues		$7,807,300	$7,885,373	$7,964,227	$8,043,869	$8,124,308	$8,368,037
Expenses							
Water Per/square foot	$0.25	$88,375	$89,259	$90,151	$91,053	$91,963	$94,722
Gas and Electric/square foot	$3.00	$1,076,250	$1,103,156	$1,130,735	$1,159,004	$1,187,979	$1,223,618
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$3,134,175	$3,176,661	$3,219,974	$3,264,135	$3,309,162	$3,408,436
Operating income before depreciation		$4,673,125	$4,708,713	$4,744,252	$4,779,734	$4,815,146	$4,959,600
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$3,673,125	$3,708,713	$3,744,252	$3,779,734	$3,815,146	$3,929,600
Taxes	38%	$1,395,788	$1,409,311	$1,422,816	$1,436,299	$1,449,756	$1,493,248
Operating income after taxes		$2,277,338	$2,299,402	$2,321,436	$2,343,435	$2,365,391	$2,436,352
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$500,000	$505,000	$510,050	$515,151	$520,302	$525,505	$525,505
Cash flow to firm		$2,772,338	$2,789,352	$2,806,286	$2,823,133	$2,839,886	$2,940,847
Terminal value						$54,682,917	
Present value	**$51,832,871**	$2,606,119	$2,464,902	$2,331,183	$2,204,571	$42,226,096	
Cost of equity	9.90%	9.90%	9.90%	9.90%	9.90%	9.90%	9.90%
Cost of debt	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%
Debt ratio	60%	60.00%	60.00%	60.00%	60.00%	60.00%	60.00%
Cost of capital	6.38%	6.38%	6.38%	6.38%	6.38%	6.38%	6.38%
Present Value Under Baseline Assumptions	**$48,233,464**						
Change in Value	**$3,599,407**						
% Change in Value	**6.94**						

Table 12. ***10 Basis-Point Decrease in Risk Premium***

If an equity investor views a sustainable property as less risky, or have prioritized sustainable property within their portfolios, they may be willing to invest capital with a lower required rate or return. This model shows that a 10 basis point (1 percentage point) decrease in the cost of equity would add $3.6 million in value to the theoretical building.

DCF analysis accounting for reduced maintenance costs--$500,000 to $400,000 annual expense

Inputs are in grey

	Begin	In terminal year					
Building space (in square feet)	350,000						
Vacancy rate =	80%	80%					
Rent/square foot	25						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	2.50%	2.50%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	5.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		80%	80.00%	80.00%	80.00%	80%	
Rent/Square foot	$25.00	$25.25	$25.50	$25.76	$26.02	$26.28	
Rental Income		$7,070,000	$7,140,700	$7,212,107	$7,284,228	$7,357,070	$7,577,782
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$176,750	$178,518	$180,303	$182,106	$183,927	$189,445
Total Revenues		$7,807,300	$7,885,373	$7,964,227	$8,043,869	$8,124,308	$8,368,037
Expenses							
Water Per/square foot	$0.25	$88,375	$89,259	$90,151	$91,053	$91,963	$94,722
Gas and Electric/square foot	$3.00	$1,076,250	$1,103,156	$1,130,735	$1,159,004	$1,187,979	$1,223,618
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$3,134,175	$3,176,661	$3,219,974	$3,264,135	$3,309,162	$3,408,436
Operating income before depreciation		$4,673,125	$4,708,713	$4,744,252	$4,779,734	$4,815,146	$4,959,600
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$3,673,125	$3,708,713	$3,744,252	$3,779,734	$3,815,146	$3,929,600
Taxes	38%	$1,395,788	$1,409,311	$1,422,816	$1,436,299	$1,449,756	$1,493,248
Operating income after taxes		$2,277,338	$2,299,402	$2,321,436	$2,343,435	$2,365,391	$2,436,352
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$400,000	$404,000	$408,040	$412,120	$416,242	$420,404	$420,404
Cash flow to firm		$2,873,338	$2,891,362	$2,909,316	$2,927,193	$2,944,987	$3,045,948
Terminal value						$52,716,308	
Present value	**$49,968,369**	$2,690,945	$2,535,939	$2,389,712	$2,251,771	$40,100,002	
Cost of equity	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%
Cost of debt	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%
Debt ratio	60%	60.00%	60.00%	60.00%	60.00%	60.00%	60.00%
Cost of capital	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%
Present Value Under Baseline Assumptions	**$48,233,464**						
Change in Value	**$1,734,905**						
% Change in Value	**3.47**						

Table 13. ***20 percent Capital Maintenance Reduction***

As noted in the LEED Matrix, certain aspects of sustainable building design reduce workload on building systems, and can therefore extend equipment life and lower maintenance costs. In this example, a 20 percent decrease in those costs equates to a $1.7 million increase in asset value.

DCF analysis accounting for reducing water usage by 50%--From 25 cents/square foot to 12 cents/square foot

Inputs are in grey

	Begin	In terminal year					
Building space (in square feet)	350,000						
Vacancy rate =	80%	80%					
Rent/square foot	25						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	2.50%	2.50%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	5.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		80%	80.00%	80.00%	80.00%	80%	
Rent/Square foot	$25.00	$25.25	$25.50	$25.76	$26.02	$26.28	
Rental Income		$7,070,000	$7,140,700	$7,212,107	$7,284,228	$7,357,070	$7,577,782
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$176,750	$178,518	$180,303	$182,106	$183,927	$189,445
Total Revenues		$7,807,300	$7,885,373	$7,964,227	$8,043,869	$8,124,308	$8,368,037
Expenses							
Water Per/square foot	$0.12	$42,420	$42,844	$43,273	$43,705	$44,142	$45,467
Gas and Electric/square foot	$3.00	$1,076,250	$1,103,156	$1,130,735	$1,159,004	$1,187,979	$1,223,618
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$3,088,220	$3,130,246	$3,173,096	$3,216,788	$3,261,341	$3,359,181
Operating income before depreciation		$4,719,080	$4,755,127	$4,791,131	$4,827,081	$4,862,967	$5,008,856
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$3,719,080	$3,755,127	$3,791,131	$3,827,081	$3,862,967	$3,978,856
Taxes	38%	$1,413,250	$1,426,948	$1,440,630	$1,454,291	$1,467,927	$1,511,965
Operating income after taxes		$2,305,830	$2,328,179	$2,350,501	$2,372,790	$2,395,040	$2,466,891
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$500,000	$505,000	$510,050	$515,151	$520,302	$525,505	$525,505
Cash flow to firm		$2,800,830	$2,818,129	$2,835,351	$2,852,488	$2,869,535	$2,971,386
Terminal value						$51,425,852	
Present value	**$48,733,971**	$2,623,040	$2,471,709	$2,328,957	$2,194,304	$39,115,962	
Cost of equity	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%
Cost of debt	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%
Debt ratio	60%	60.00%	60.00%	60.00%	60.00%	60.00%	60.00%
Cost of capital	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%	6.78%
Present Value Under Baseline Assumptions	**$48,233,464**						
Change in Value	**$500,507**						
% Change in Value	**1.03**						

Table 14. ***50 percent Reduction in Water Use***

Water is one of the lowest costs of operation in a commercial building, and in some areas delivered for a flat rate. In those areas, saving water will not save money. This model shows that if water use was reduced by 50percent, the building value would be increase by $.5 million, a relatively small amount compared to other efficiency measures.

DCF analysis accounting for 5 basis point increase in cost of debt--from 6.5% to 7.0%

Inputs are in grey

	Begin	In terminal year					
Building space (in square feet)	350,000						
Vacancy rate =	80%	80%					
Rent/square foot	25						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	2.50%	2.50%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	5.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		80%	80.00%	80.00%	80.00%	80%	
Rent/Square foot	$25.00	$25.25	$25.50	$25.76	$26.02	$26.28	
Rental Income		$7,070,000	$7,140,700	$7,212,107	$7,284,228	$7,357,070	$7,577,782
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$176,750	$178,518	$180,303	$182,106	$183,927	$189,445
Total Revenues		$7,807,300	$7,885,373	$7,964,227	$8,043,869	$8,124,308	$8,368,037
Expenses							
Water Per/square foot	$0.25	$88,375	$89,259	$90,151	$91,053	$91,963	$94,722
Gas and Electric/square foot	$3.00	$1,076,250	$1,103,156	$1,130,735	$1,159,004	$1,187,979	$1,223,618
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$3,134,175	$3,176,661	$3,219,974	$3,264,135	$3,309,162	$3,408,436
Operating income before depreciation		$4,673,125	$4,708,713	$4,744,252	$4,779,734	$4,815,146	$4,959,600
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$3,673,125	$3,708,713	$3,744,252	$3,779,734	$3,815,146	$3,929,600
Taxes	38%	$1,395,788	$1,409,311	$1,422,816	$1,436,299	$1,449,756	$1,493,248
Operating income after taxes		$2,277,338	$2,299,402	$2,321,436	$2,343,435	$2,365,391	$2,436,352
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$500,000	$505,000	$510,050	$515,151	$520,302	$525,505	$525,505
Cash flow to firm		$2,772,338	$2,789,352	$2,806,286	$2,823,133	$2,839,886	$2,940,847
Terminal value						$49,309,981	
Present value	**$46,724,291**	$2,591,842	$2,437,968	$2,293,079	$2,156,656	$37,244,746	
Cost of equity	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%
Cost of debt	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%
Debt ratio	60%	60.00%	60.00%	60.00%	60.00%	60.00%	60.00%
Cost of capital	6.96%	6.96%	6.96%	6.96%	6.96%	6.96%	6.96%
Present Value Under Baseline Assumptions	**$48,233,464**						
Change in Value	**-$1,509,174**						
% Change in Value	**-3.23**						

Table 15. ***Increase in Cost of Debt***

Certain banks are now offering reduced interest rates for LEED certified or other sustainable properties. As sustainable properties become more prevalent there is likely to be a risk premium for non-LEED buildings. The 5 basis-point increase in the cost of debt in this model represents that premium, and shows that a building that does not meet sustainable standards may be worth $1.5 million less simply due to the increased cost of borrowing money.

DCF analysis accounting for increased loan-to-value ratio							
Inputs are in grey							
	Begin	In terminal year					
Building space (in square feet)	350,000						
Occupancy rate (100-percent vacancy)	80%	80%					
Rent/square foot	25						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	2.50%	2.50%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	5.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		80%	80.00%	80.00%	80.00%	80%	
Rent/Square foot	$25.00	$25.25	$25.50	$25.76	$26.02	$26.28	
Rental Income		$7,070,000	$7,140,700	$7,212,107	$7,284,228	$7,357,070	$7,577,782
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$176,750	$178,518	$180,303	$182,106	$183,927	$189,445
Total Revenues		$7,807,300	$7,885,373	$7,964,227	$8,043,869	$8,124,308	$8,368,037
Expenses							
Water Per/square foot	$0.25	$88,375	$89,259	$90,151	$91,053	$91,963	$94,722
Gas and Electric/square foot	$3.00	$1,076,250	$1,103,156	$1,130,735	$1,159,004	$1,187,979	$1,223,618
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$3,134,175	$3,176,661	$3,219,974	$3,264,135	$3,309,162	$3,408,436
Operating income before depreciation		$4,673,125	$4,708,713	$4,744,252	$4,779,734	$4,815,146	$4,959,600
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$3,673,125	$3,708,713	$3,744,252	$3,779,734	$3,815,146	$3,929,600
Taxes	38%	$1,395,788	$1,409,311	$1,422,816	$1,436,299	$1,449,756	$1,493,248
Operating income after taxes		$2,277,338	$2,299,402	$2,321,436	$2,343,435	$2,365,391	$2,436,352
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$500,000	$505,000	$510,050	$515,151	$520,302	$525,505	$525,505
Cash flow to firm		$2,772,338	$2,789,352	$2,806,286	$2,823,133	$2,839,886	$2,940,847
Terminal value						$57,765,611	
Present value	**$54,764,158**	$2,613,169	$2,478,256	$2,350,154	$2,228,523	$45,094,056	
Cost of equity	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%	10.90%
Cost of debt	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%
Debt ratio	**70%**	70.00%	70.00%	70.00%	70.00%	70.00%	70.00%
Cost of capital	6.09%	6.09%	6.09%	6.09%	6.09%	6.09%	6.09%
Present Value Under Baseline Assumptions	**$48,233,464**						
Change in Value	**$6,530,694**						
% Change in Value	**11.93**						

Table 16. ***Increased Loan to Value Ratio***

Sustainable properties may also be eligible for a loan-to-value ratio of up to 80percent. If the developer or equity investor were able to borrow just 10percent more, or 70percent of the project cost, that would mean a $6.5 million increase in property value for this particular building. (The total cost of capital is lower than the cost of debt due to the tax savings from deducting the interest).

DCF analysis accounting for increased loan-to-value ratio							
Inputs are in grey							
	Begin	In terminal year					
Building space (in square feet)	350,000						
Vacancy rate =	90%	90%					
Rent/square foot	26.2						
Inflation rate for water	1.00%	1.00%					
Inflation rate for gas and electric	**5.00%**	5.00%					
Inflation rate for rents	1.00%	1.00%					
Inflation rate for real estate taxes =	1.00%	1.00%					
Inflation rate for ground rent =	0.00%	3.00%					
Riskfree rate =	5.40%						
Risk premium =	4.50%						
Income		1	2	3	4	5	Terminal year
Building Space		350000	350000	350000	350000	350000	
Occupancy		90%	90.00%	90.00%	90.00%	90%	
Rent/Square foot	$26.20	$26.46	$26.73	$26.99	$27.26	$27.54	
Rental Income		$8,335,530	$8,418,885	$8,503,074	$8,588,105	$8,673,986	$8,934,206
Garage Income	$800,000	$808,000	$816,080	$824,241	$832,483	$840,808	$866,032
Common Area Maintenance fees	100.00%	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Credit Loss	2.50%	$208,388	$210,472	$212,577	$214,703	$216,850	$223,355
Total Revenues		$9,041,192	$9,131,604	$9,222,920	$9,315,149	$9,408,300	$9,690,549
Expenses							
Water Per/square foot	$0.12	$42,420	$42,844	$43,273	$43,705	$44,142	$45,467
Gas and Electric/square foot	$2.00	$735,000	$771,750	$810,338	$850,854	$893,397	$920,199
Real Estate Taxes	$3.00	$1,060,500	$1,071,105	$1,081,816	$1,092,634	$1,103,561	$1,136,667
Ground Rent	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$515,000
Common Area Maintenance	$0.30	$106,050	$107,111	$108,182	$109,263	$110,356	$113,667
Management fee	$300,000	$303,000	$306,030	$309,090	$312,181	$315,303	$324,762
Total Expenses		$2,746,970	$2,798,840	$2,852,698	$2,908,639	$2,966,759	$3,055,762
Operating income before depreciation		$6,294,222	$6,332,764	$6,370,222	$6,406,510	$6,441,541	$6,634,787
Depreciation	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
Operating income		$5,294,222	$5,332,764	$5,370,222	$5,406,510	$5,441,541	$5,604,787
Taxes	38%	$2,011,804	$2,026,450	$2,040,684	$2,054,474	$2,067,786	$2,129,819
Operating income after taxes		$3,282,417	$3,306,314	$3,329,537	$3,352,036	$3,373,756	$3,474,968
+ Depreciation		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,030,000
- Capital maintenance & Leasehold Improvement	$400,000	$404,000	$408,040	$412,120	$416,242	$420,404	$420,404
Cash flow to firm		$3,878,417	$3,898,274	$3,917,417	$3,935,795	$3,953,352	$4,084,564
Terminal value						$85,254,941	
Present value	**$80,922,897**	$3,666,113	$3,483,172	$3,308,671	$3,142,227	$67,322,714	
Cost of equity	9.90%	9.90%	9.90%	9.90%	9.90%	9.90%	9.90%
Cost of debt	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%	6.50%
Debt ratio	**70%**	70.00%	70.00%	70.00%	70.00%	70.00%	70.00%
Cost of capital	5.79%	5.79%	5.79%	5.79%	5.79%	5.79%	5.79%
Present Value Under Baseline Assumptions	**$48,233,464**						
Change in Value	**$32,689,433**						
%Change in Value	**40.40**						

Table 17. ***Compounding of Various Green Building Premiums***
This table shows the overall affect on building value that would occur if all of the previous inputs were changed in one property. While it would be difficult to predict all of these changes in cash flows occurring at once, this model does show that there is a significant opportunity to create monetary value through green building.

What the Results Provide

The preceding LEED matrix and sensitivity analysis describe many of the interactions between sustainability and property value. The LEED matrix focuses on questions about "how and why sustainability interacts with value", while the sensitivity analysis addresses the question "how much impact could sustainable attributes have on value?" Together, they provide those involved with real estate finance and development an organized framework within which to understand the financial aspects of sustainability.

By working through the LEED matrix it became clear that the relationship between sustainability and building cash flows is complex, and that additional, subtle relationships will continue to emerge as the relatively new stock of sustainable buildings begin to age. In conducting the sensitivity analysis, the magnitudes of changes to building value were often surprising, and generally substantial enough to warrant investment in many sustainable strategies. The significance of both of these exercises will be discussed at greater length in chapter 5.

Answers to Survey Questions

These questions were designed to gauge the attitudes and awareness of sustainability of staff members within two of the world's largest investment funds. While neither of the participants set policy for these funds, their answers reflect the extent to which sustainability has been integrated into the organization. I am providing these results as a compliment to the cash flow analysis I performed earlier in this chapter. Together, they provide a balanced perspective on the two main factors that impact green building investment; investor sentiment and financial analysis.

Survey Participant #1, Private Equity Investment Funds:

1. Q. Has your organization changed its policy toward sustainable real estate investment since the downturn?

Not specifically in reaction to the downturn, but we continue to increase efforts to orient the firm's activity towards sustainable investment in a variety of capacities.

2. Q. Have you witnessed a higher level of performance from LEED certified or other sustainable investments through the real estate crash?

Our group has not, but that is due to a lack of ownership positions in LEED certified property. In the U.S., we are more heavily invested in "value-add" oriented strategies which to date have not included a large amount of LEED certification elements.

3. Q. What is your target for investment in green buildings? Have you met that goal?

Depends upon the particular investment mandate, but I would generally say it far more oriented to core, lower yield, lower risk return targets (8% - 12% IRR over 5-10 year hold period with minimal leverage and high current yield (cash flow) component

4. Q. Who drives the development of your investing strategy? Is it a board of directors, or does staff have input in strategic decisions?

Our internal staff. Our global investment committee comprised of Global CIO and three regional heads (Americas, Europe and Asia) is ultimately responsible for strategy decisions.

5. Q. Is your sole interest in sustainable property investment in finding ways to increase returns or is social responsibility a significant factor?

Social responsibility is a significant factor – we have our own internal (Aviva) desire for sustainable but increasingly clients are mandating that we pursue such strategies.

6. Q. Are you familiar with the concept of the Triple Bottom Line? Does your organization evaluate investments on each of the three bottom lines, or is there a focus on one?

Yes. Reduce, expenses, increase NOI and be more environmentally friendly through sustainable programs (I think, right?). We are financial investors, so the ultimate focus will continue to be increasing risk adjusted returns for our clients.

7. Q. How are your investment decisions affected by the source of the money you are investing? Do you believe that you have a fiduciary duty to those whose pensions you invest to make socially responsible investments, or would you be failing to perform your fiduciary duty by considering factors other than financial returns?

Our investment decisions are discretionary, but within the realm of criteria that the clients sets forth from the mandate onset. If a client requires it, we will pursue sustainability but as fiduciaries, we will seek to achieve the risk / return profile that the client seeks. If that includes a sustainable component great, but unlikely that (we would) on our own, overlay a sustainable aspect without being asked to do by the client.

8. Q. What role does LEED certification have in your investment decisions? Will you invest any new construction that is not pursuing LEED certification? Existing buildings?

N/A

9. Q. Do you apply a value premium to LEED certified buildings?

I think our group does, but my particular group is typically not an individual property level investor so difficult to answer specifically….

10. Q. Do you typically modify Discounted Cash Flow models to account for sustainable building features?

Same as number 9

Participant #1's responses indicate that their organization is primarily concerned with adhering to an investment mandate defined by their clients, and that they will incorporate sustainability to the extent that the client demands they do so. The Private Equity Fund's website that those clients primarily fall into one of the following categories: Insurance companies, Public pension funds, Taft-Hartley plans, Financial institutions, Endowments, and Foundations (2010). He also notes that clients are increasingly requesting that sustainability be included into their investment criteria.

The fact that Participant #1 did not know the true definition of the "Triple Bottom Line", indicates that Socially Responsible Investment has not infiltrated into the real estate investment world to the same extent in has the world of corporate finance. That is, I would expect nearly anyone involved in corporate finance in 2010 to at least know of the concept of the "Triple Bottom Line", whether or not they incorporated it into their investment decisions.

Survey Participant # 2, Large US Public Pension Fund

1. Q. Has your organization changed its policy toward sustainable real estate investment since the downturn?

No.

2. Q. Have you witnessed a higher level of performance from LEED certified or other sustainable investments through the real estate crash?

No. There are numerous properties that we are invested in that have obtained LEED certification in the past few years, however, it would be difficult to measure if improved financial performance is attributable to LEED certification or other building features.

3. Q. What is your target for investment in green buildings? Have you met that goal?

N/A

4. Q. Who drives the development of your investing strategy? Is it a board of directors, or does staff have input in strategic decisions?

Overall Investment Policy is set by the Board, with input from the primary real estate consultant and staff. Individual investment decisions are made approved by two independent fiduciaries, one of whom is a staff member, the other and outside independent fiduciary.

5. Q. Is your sole interest in sustainable property investment in finding ways to increase returns or is social responsibility a significant factor?

Both are important.

6. Q. Are you familiar with the concept of the Triple Bottom Line? Does your organization evaluate investments on each of the three bottom lines, or is there a focus on one?

We are familiar with the concept, but it is not an integral part of the investment making decision process.

7. Q. How are your investment decisions affected by the source of the money you are investing? Do you believe that you have a fiduciary duty to those whose pensions you invest to make socially responsible investments, or would you be failing to perform your fiduciary duty by considering factors other than financial returns?

N/A

8. Q. What role does LEED certification have in your investment decisions? Will you invest any new construction that is not pursuing LEED certification? Existing buildings?

If we were investing in a property that was not yet LEED certified, the cost to achieve LEED certification will likely be factored into the underwriting analysis.

We might invest in new construction that is not pursuing LEED certification, although it is unlikely, as we believe most if not all new construction projects will be pursuing a LEED certification. This may be a mute point…If by some chance a new project under construction was not pursuing a LEED certification, then the cost to obtain LEED certification will likely be factored into the underwriting analysis.

Same for existing buildings.

9. Q. Do you apply a value premium to LEED certified buildings?

Yes and no. Obtaining LEED is becoming a "market" commodity. The premium is limited and quantifiable.

10. Q. Do you typically modify Discounted Cash Flow models to account for sustainable building features?

The DCF would be adjusted to account for the cost of obtaining LEED certification, and possibly to reflect cost savings (if any) resulting from obtaining (or lack of) LEED certification.

The responses from this analyst indicate that sustainability is further integrated into the culture of their organization than it is at the private equity fund. However, the responses did not indicate an interest in incorporating sustainability into financial analysis at a highly detailed level. His discussion of LEED indicates that they see it as a given—it seems that nearly every new construction project they will invest in will be pursuing LEED by default. While there was an indication that they factor the cost of achieving LEED into financial analysis of existing buildings that are not already LEED certified, he did not indicate that acquiring and upgrading to LEED was part of a value-added strategy.

Chapter 5

CONCLUSION AND IMPLICATIONS

Introduced in Chapter 1 is the concept that of the proliferation of green building is hindered by a lack of information about the interaction between sustainability and value. In Chapter 2, I reviewed a great deal of literature that has helped to shorten that informational gap. In Chapters 3 and 4, I designed and executed a few exercises that illustrate the real-world applicability many of the theories found in the literature, and conducted informal interviews with representatives of two of the largest real estate investors in the US. In this chapter I describe how the exercises and theories described in this thesis can be used by market participants, and suggest areas of further study on the topic.

Investment Funds

These interviews included in chapter 4, while brief, were revealing because they showed that sustainability has not been integrated into the real estate investment funds I interviewed. Despite the fact that one authors that I cited in this thesis works for the same private equity fund that Participant # 1 does, it does not seem that sustainability has been deeply integrated into that fund's investment process.

While the representative of the pension fund seemed to have a deeper institutional knowledge of sustainability in real estate investments, he was unfamiliar with the sustainable property-underwriting framework put forth by authors like Muldavin (2009). At this particular pension fund, it seemed that sustainability was identified as a priority, but there did not seem to be a target for investment, or any special consideration for how to evaluate the sustainable attributes of property.

What this indicates is that the information gap may exist within institutions, not just between industries. In order for sustainable property investment to have a significant impact on the way that the built environment is composed, large institutional investors will need to develop a culture of sustainability. In the corporate world, companies like Interface carpet have succeeded in implementing sustainability in all of the companies functions, and in generating an understanding of sustainability in all of their employees. Driven by the owner's belief that manufacturing processes are wasteful and outdated, Interface has redesigned its entire business model. As a result of this the owner of Interface claims, "Costs are down, not up, dispelling a myth and exposing the false choice between the economy and the environment, products are the best they have ever been, because sustainable design has provided an unexpected wellspring of innovation, people are galvanized around a shared higher purpose, better people are applying, the best people are staying and working with a purpose, the goodwill in the marketplace generated by our focus on sustainability far exceeds that which any amount of advertising or marketing expenditure could have generated – this company believes it has found a better way to a bigger and more legitimate profit – a better business model." (Anderson 2010)

Corporate Social Responsibility vs. Responsible Property Investing

In retrospect, I would have liked to do more research on corporate social responsibility, and explore the differences between businesses investments and real estate investments. One major difference between corporations and buildings is in the level of accountability. Corporations, especially those marketing consumer products, are often held accountable for their actions. Consequently, nearly every major US corporation has developed and disseminated a sustainability policy, and most regularly report on the measures they are taking to implement these policies. In contrast, real estate investments are much less visible, and generally held to less

account than business investments, although the impacts of real estate investments on the environment are quite significant.

Companies like Starbucks, which now has one of the strongest corporate social responsibility policies, often developed their sustainability strategies under pressure from their customers. As "going green" has become the norm for business, many businesses look for a variety of ways to demonstrate that they are "going green," one of which is leasing LEED office space. As such, the driver of sustainability in office building is a secondary function of the consumer-driven trend towards sustainability in business.

The Role of the Consumer

Other types of real estate, such as housing, also have significant impacts on the environment. Housing is one area of real estate where an educated consuming public could affect considerable change. However, much of the consuming public is either unaware of the impact of their housing choices on the environment, or unwilling to compromise their lifestyle to make a more sustainable housing choice. It is one thing to demand fair-trade coffee from Starbucks, and quite a different thing to relocate one's family to a smaller house in a more central location. Even those who care about the impact of their housing choices on the environment may not be willing or able to make the tradeoffs that come with sustainable housing. That said, educating consumers about the benefits of green building, and how they can use their dollar vote to encourage more sustainable development, is an area that needs further work and research. In fact, on preliminary expert surveys from Sacramento's Green Building Task Force, those experts identified consumer education as the most important tool for encouraging green building in the Sacramento region.

Sensitivity Analysis

The results of the sensitivity analysis of a typical office building help to illustrate the property-level value changes that investors can anticipate by integrating sustainable features in a project. While this might be useful to developers seeking funding for new construction, I now believe that it could be even more valuable to owners of existing buildings looking for a way to add value in a depressed marketplace. It could also be of use to a company such as Folsom, California's Envision Realty Service—the nation's largest LEED Existing Building consulting firm. In order to attract clients, they must provide some idea of the anticipated cost savings and payback period for the owner's investment. They traditionally have done this by showing their clients the dollar value of the energy savings they have accomplished on past projects. However, since LEED has many other interactions with value, a whole-building cash flow analysis such as the one I presented in Chapter 4 would be a more relevant tool for the initial conversation with their clients. Performing that type of analysis would allow clients to decide what approach to achieving LEED would provide them with the fastest payback. I plan to suggest to the CEO of Envision that he integrate some of this financial modeling into his proposals. While any assumptions Envision includes in a financial model they provide to their clients would need to be backed by empirical evidence, they could also simply encourage their clients to consider the fact that their building value may be increased by many different aspects of a LEED certification, not just cost savings.

LEED Indexing

Similarly, the LEED indexing matrix I created for this thesis can help investors and developers determine the most cost-effective way to achieve LEED certification, although a version of the matrix based on empirical evidence would more applicable. While a recent study

attempts to look at the relative cost of achieving each LEED credit, that study did not address value. A more developed version of my LEED indexing matrix could show a percentage range for the change in value of each cash-flow input. Thus, the developer looking for the most cost-effective approach to achieving LEED would be able to consider not only up-front costs of different credits, but also long-term financial benefits to each different credit.

Valuing Neighborhood Design

The LEED indexing matrix I included in this thesis only represented the LEED New Construction rating system. In order to evaluate more accurately the triple bottom line aspects of a proposed or existing development, a matrix representing the LEED for Neighborhood Development is also needed. LEED ND is a way of certifying that a neighborhood has been designed and built with New Urbanist, Smart Growth Principles. While these principles are more of a belief system than and tangible, quantifiable asset, many others and myself believe that good neighborhoods are essential to long-term property value. Since LEED ND has just been released, and only brand-new neighborhoods are going through the certification process, it would be difficult to conduct a study on the long-term value of LEED ND neighborhoods. However, a study looking at long-term property values in existing neighborhoods with LEED ND qualities could demonstrate that LEED ND neighborhoods are likely to hold more value over time.

Final Thoughts and Recommendations

The role of sustainability in real estate finance and investments is an important one, but we are only beginning to understand its nature. While it is clear that traditional tools for property valuation and investment analysis need not be discarded to evaluate sustainable property, they do need to be modified. Furthermore, the increased understanding gained by modifying these tools

needs to be disseminated throughout the institutions making these investment decisions. In the process of writing this thesis, I divided several of the chapters into two parts; one on valuation methods and one on sustainability as a priority of institutional investors. While it was important to make this division for the purpose of writing this thesis, it is the integration of those two parts that will facilitate a greater level of investment in sustainable properties. Large institutional investors like CalPERS, TIAA-CREF and Aviva have the power to drive sustainability in the built environment, and it seems that they have the desire to do so, at least at the top levels of management. However, in order for them to ensure their sustainable investments are profitable and that their analysts and fund managers understand what types of investments are most sustainable, they will need to provide training. I recommend that each of all large real estate investment funds provide sustainability training to educate their employees how their investments affect the environment, and how to incorporate sustainability into financial analysis.

The knowledge gap I mentioned in Chapter 1 is closing, but not fast enough. While the most sophisticated and worldly funds, developers, and building tenants have already written sustainability into their core values, they may still not fully understand how sustainable development practices affect value. Furthermore, sustainability is very low priority for still many other smaller developers, lenders, and investors, who do not have the resources, knowledge, or tenant base to accurately value sustainability.

For this segment of the market, it may take government regulation to ensure a sustainable built environment. For the more sophisticated segment of the market, informed space users may be enough to drive the change toward sustainable development.

In either market segment, the investors and appraisers who can most accurately assess the present and future value of property investments—sustainable or not—will reap the rewards of this accuracy by outperforming their less informed competitors. Green building has established a

firm place in the market, and is rapidly increasing in market share. Those who get ahead of the curve with respect to sustainable valuation and investment analysis will have the edge in this emerging market.

This thesis will give investors more confidence in their understanding of how to evaluate investment in green building. By providing the information I hope to encourage risk-averse investors who have been hesitant to invest in something they do not understand to take another look at green building investments. Whether the theories and exercises presented here encourage more investment in sustainable property, or just aid investors to more accurately evaluate the properties they already own, it is my belief that a more informed market for sustainable property investment is a more efficient market. Ultimately, space-user demand, cost-savings, and risk management will drive the value of sustainable buildings; it is the wise investor that will accurately price that demand, savings, and risk.

BIBLIOGRAPHY

(2006). Global Warming Solutions Act. AB 32. **GAAS:684:06**.

(2008). Redisigning Communities to Reduce Greenhouse Gasses. SB 375.

(2010). "Aviva Investors--Who We Serve." from http://www.avivainvestors.us/aboutus/whoweserve.aspx.

Anderson, R. (2010). "Toward a More Sustainable Way of Business." 4-29-2010, from http://www.interfaceglobal.com/Sustainability.aspx.

Baue, B. (2006). "The Growth of Green Building Funds." Retrieved 11-29-2009, from http://www.socialfunds.com/news/article.cgi/2172.html.

Boyd, T. and P. Kimmet (2004). The Triple Bottom Line Approach to Property Performance Evaluation. Brisbane, Australia, Queensland University of Technology.

Brueggeman, W. B. and J. D. Fisher (2008). Real Estate Finance and Investments. New York, NY, McGraw-Hill/Irwin.

Carpenter, G. and O. Meyer (2009). Energy efficiency and real estate: Opportunities for Investors, Ceres/Mercer.

Corps, C. and T. W. Chappell (2009). High Performance Green Building: What's it Worth? Seattle, WA, Cascadia Region Green Building Council
Vancouver Valuation Accord
Cushman and Wakefield.

Dixon, C. (2010). "Straight Green: Say Hello to CAL Green California's New Green Building Code." Retrieved 4-23-2010, from http://www.wconline.com/Articles/Column/BNP_GUID_9-5-2006_A_10000000000000764441.

Edlen, G. (2009). "Principles of Place." Retrieved 10-29-09, 2009, from http://www.gerdingedlen.com/files/pdf/principles_of_place.pdf.

Elkington, J. (2007). "Partnerships from Cannibals with Forks: The Triple Bottom Line of 21st-Century Business." Environmental Quality Management **8**(1): 37-51.

Ellison, L. and S. Sayce (2006). The Sustainable Property Appriasal Project. London, Kingston University.

Ewing, R., K. Bartholomew, et al. (2008). Growing Cooler: The Evidence on Urban Development and Climate Change, ULI-The Urban Land Institute.

Flora, R. L. and C. Smith (2008). U.S. GREEN BUILDING COUNCIL STRATEGIC PLAN 2009 – 2013. Washington D.C., USGBC**:** 3/20.

Hugins, M. (2008). "Banks Cultivate Green Loans." Retrieved 2-10-2010, from http://nreionline.com/brokernews/greenbuildingnews/banks_cultivate_green_loans_0602/ .

Krage, R. (2008). Is Green $ Chasing Green?

Majumdar, A. (2009). "Low-Hanging Fruits of Efficiency." 2009, from http://www.ecoworld.com/technology/low-hanging-fruits-of-efficiency.html.

Miller, N., J. Spivey, et al. (2008). Does Green Pay Off?, CoStar Real Estate Research.

Muldavin, S. (2009). More sensitivity analysis is needed.... G. Torvestad. San Francisco.

Muldavin, S. (2009). Underwriting Sustainable Property Investment. San Rafael, California, Green Building Finanace Consortium.

Munger, M., Ed. (2000). Analyzing Policy. The New Institutionalism in American Politics. New York, W.W. Norton and Company.

Nelson, A. J. (2009). How Green a Recession? --Sustainability Prospects in the US Real Estate Industry, RREEF Research.

Odell, A. M. (2008). "Making a Difference with Real Estate." Retrieved 11-29-2009, 2009, from www.socialfunds.com/news/print.cgi?sfArticleId=2446.

Pivo, G. (2005). "Is There A Future fo Socially Responsible Property Investments?" Real Estate Issues.

Pivo, G. (2009). Responsible Property Investing--What the Leaders are Doing, United Nations Environmental Programme.

Shinter, J. and D. Vrkic (2007). Sustainability: A Guide for the Corporate Real Estate Executive, Jones Lang LaSalle**:** 5.

Turner (2009). "Turner 2008 Green Building Market Barometer." 2009, from http://www.turnerconstruction.com/greenbuildings/content.asp?d=6552.

USGBC (2009). "About USGBC." Retrieved 10-16-2009, from http://www.usgbc.org/DisplayPage.aspx?CMSPageID=124.

USGBC (2010). A Local Government Guide to LEED for Neighborhood Development.

Woon, H. W. (2009). Sustainable Investment In Real Estate...You Fiduciary Duty. Geneva, Switzerland, United Nations Environment Programme Finance Initiatative