Analyzing Capital Allocation for Energy Efficiency Improvements by Commercial Real Estate Investment Managers

by

Kristian A. Peterson

B.S., Finance, 2003

Brigham Young University

Ross M. Gammill

B.A., Economics, 2002
B.A., Geography, 2002

University of California, Los Angeles

Submitted to the Center for Real Estate in Partial Fulfillment of the Requirements for the Degree of Master of Science in Real Estate Development

at the

Massachusetts Institute of Technology

September, 2009

Signature of Authors____

Kristian A. Peterson and Ross M. Gammill
Center for Real Estate
July 24, 2009

Certified by____

Sarah Slaughter
Senior Lecturer, MIT Sloan School of Management
Thesis Supervisor

Accepted by____

Brian A. Ciochetti
Chairman, Interdepartmental Degree Program in
Real Estate Development

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Abstract

Numerous studies have shown that retrofitting an office building with energy efficiency improvements can significantly reduce operating costs, yet many existing office buildings have not been retrofitted. The objective of this paper was to explore the incentives and motivations of various parties throughout the real estate management chain to better understand why investments in energy efficiency are not more prevalent. The paper focuses on investor-owned multi-tenant office properties.

The authors explored the question from a qualitative and quantitative methodology. The qualitative study consisted of interviews with key players in the real estate management chain including property managers, asset managers, portfolio managers, and institutional owners. The quantitative study consisted of a financial model to compare competing alternative capital investments. The competing investments consisted of a cosmetic improvement which was modeled to either increase rents or decrease leasing costs and an energy efficiency improvement which was modeled to decrease utility costs. Multiple permutations were tested in each scenario in order to gauge the sensitivity of returns in each scenario. Both methods were designed to understand how industry participants allocated capital to energy efficiency improvements.

The study determined that financial considerations are the primary drivers behind real estate investment decisions. Secondary factors that drive investments in energy efficiency improvements include fostering a positive public image, winning new business, and focusing on environmental responsibility. Recommendations to increase investment in energy efficiency conclude the paper. Increased investment in energy efficiency will result if managers recognize that energy efficiency projects can decrease the volatility of returns, and that these returns are maximized by making the investment in energy efficiency prior to significant lease rollover.

Thesis Supervisor: Sarah Slaughter
Title: Senior Lecturer

Acknowledgements

We would like to sincerely thank Professor Sarah Slaughter for her guidance and dedication as the supervisor of our thesis. Her perspective and enthusiasm on issues of sustainability in the built environment is contagious. It was a pleasure to conduct this work as an interdisciplinary link between the Center for Real Estate and the MIT Sloan School of Management.

We also would like to thank each of the property managers, investment managers, and real estate owners that participated in our thesis. A clear industry perspective on sustainability in real estate is critical to promoting energy efficiency and improving the quality of the built environment.

Our gratitude is also extended to our friends, classmates, instructors, and staff at the MIT Center for Real Estate and the wonderful year we shared together.

Finally, we are forever grateful to the sacrifices that our families have made over the course of the past year. Without their support this past year would not have been possible.

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Chapter 1: Introduction

1.1. Hypothesis

Globally, buildings are responsible for about one-third of the world's energy use (National Science and Technology Council [NSTC], 2008) and consume 20% of available water (McGraw_Hill Construction, 2009). A recent report by the United Nations estimates urban growth of 1.5 Billion people by 2030[1] which will place further demands on energy and water resources. The International Energy Agency estimates current energy demand for buildings will stimulate about half of energy supply investments in 2030 (World Business Council for Sustainable Development [WBCSD], 2007). China alone is adding two billion square feet (sq ft) of buildings a year; equivalent to one-third of Japan's existing building area (WBCSD, 2007).

Energy and water efficiency in buildings is clearly a pressing issue. Not only do buildings use more energy than any other industry, but their share of energy use is expected to grow ever-more intense. Numerous studies have proven that simple acts such as putting an aerator in a faucet or installing new light bulbs not only save resources but also pay for themselves in a relatively short time period. However, many office buildings in this country have not even implemented these simple retrofits, let alone more complex and expensive retrofits.

The objective of the paper is to explore the incentives and motivations of various parties throughout the real estate management value chain in order to understand why investments in energy and water efficiency are not more prevalent. The focus will be specifically on existing office buildings that are owned by real estate investors, rather than owner-users or government entities. The goal is to overcome the barriers to implementation of efficiency retrofits in existing commercial buildings by increasing collaboration between all building

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[1] United Nations. http://esa.un.org/unup/p2k0data.asp Retrieved July 23, 2009

stakeholders, including property managers, investment managers, portfolio managers, and owners. Energy efficiency retrofits need to permeate all levels of the real estate value chain and not be restricted to government, corporate users, and tenants in order to realize a significant reduction of energy use. To advance this cooperation, a comparative methodology is developed to assess and promote performance improvement upgrades to existing buildings as a profitable investment to improve cash flow and asset value.

1.2. Background

In order to get a clear picture of the current state of energy efficiency retrofits, this paper first examines the current state of energy efficiency in the commercial real estate market. This examination begins with the size of the commercial real estate market in general. It is important to understand how many buildings currently exist, the nature of those buildings, and who controls them. A definition of a high-performance building, the focus of this research, is then formed. This definition is used to frame a discussion of various government regulations that have been passed into law in recent years. The government regulations have a strong focus towards energy and water efficiency, so these two aspects of commercial buildings are explored in detail. Finally, realizing that the government cannot likely drive energy efficiency by itself, two private examples are examined in depth. These two case studies, the retrofits of the Sears Tower[2] and the Empire State Building, aim to be energy efficiency projects that other building owners will emulate.

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[2] As of July 16, 2009, the Sears Tower will officially change names to the Willis Tower. In order to remain consistent with announcements discussing the major renovations and the public's recognition of the original name, the authors continue to use the name Sears Tower throughout this paper.

1.3. Methodology

A complete examination of the motivations and incentives throughout the real estate management value chain is accomplished by approaching the issue from both a qualitative and quantitative perspective. The qualitative method consists of interviews with industry professionals including property managers, asset managers, portfolio managers, and owners. Through the interview process, the authors hope to uncover any differences in the ways that various industry players approach energy efficiency and whether or not there are structural inefficiencies present in the industry. The quantitative method consists of a financial model designed to compare an investment in a cosmetic improvement with an equal investment in an energy efficiency improvement. This model is not designed to predict exact financial returns. Rather, it is structured to provide a framework for discussing the pros and cons of each investment type.

1.4. Conclusion

After conducting numerous industry interviews and running various investment permutations through the financial model, the authors aim to draw conclusions about the current state of energy efficiency in the commercial real estate industry. Specifically, there exist many questions to be answered: How does an energy efficiency improvement get implemented? Who is the driver behind that decision? What financial metrics are used to determine if an investment makes economic sense? How does a real estate manager choose one investment type over another? And most importantly, the crux of this research; is there a better way? Can changes be made in the industry that would help further investment in energy efficiency improvements throughout the commercial real estate industry?

Chapter 2: Background

2.1 Characteristics of U.S. Commercial Real Estate

The U.S. commercial real estate market totals approximately 4.7 million buildings with an estimated 74.8 billion square feet of floor space, which includes all non-residential use of space (U.S. Department of Energy [DOE], 2008). The largest use of commercial floor space is considered non-government owned, estimated at 56.8 Billion sq ft. Non-government owned commercial floor space is split almost evenly between owner-occupied and non-owner occupied floor space, at 26.9 billion sq ft and 27.7 billion sq ft respectively[3]. Table 2.1 below displays the break-down of commercial floor space ownership and occupation (DOE, 2008).

Table 2.1 Commercial Real Estate Ownership

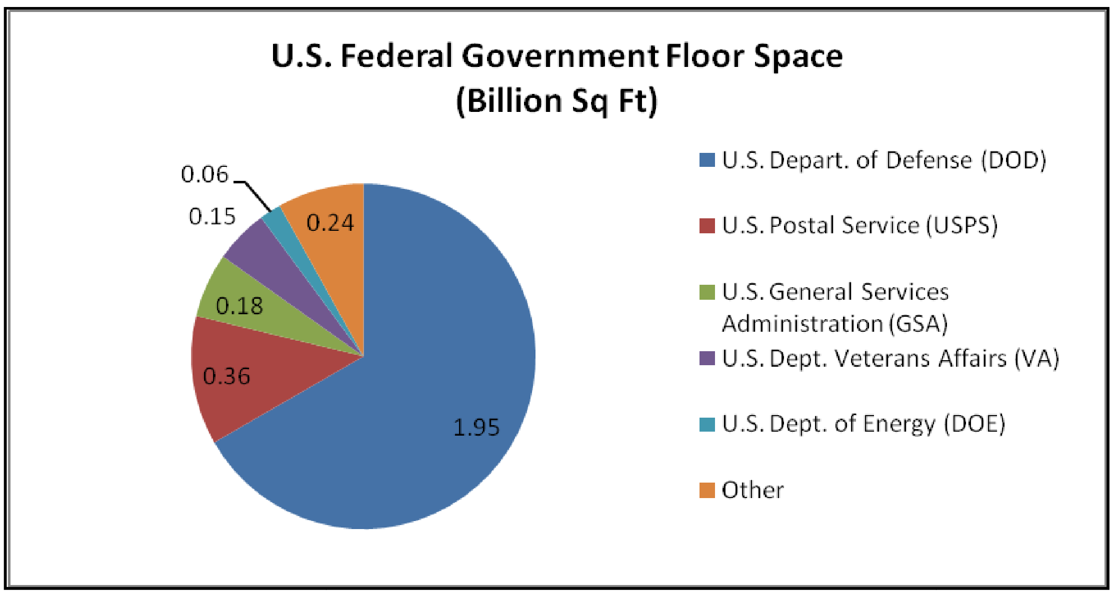
Commercial Property Ownership	Percentage	(Billions Sq Ft)
Non-Government Owned	**76.00%**	**56.8**
Owner-Occupied	36.00%	26.9
Non-owner-Occupied	37.00%	27.7
Unoccupied	3.00%	2.2
Government Owned	**24.00%**	**18**
Federal	3.00%	2.2
State	5.00%	3.7
Local	15.00%	11.2

(Source: Building Energy Data Book, U.S. Department of Energy, 2008)

[3] Approximately 2.2 billion sq ft is counted as “unoccupied space” (3% of total commercial floor space).

Federal, state, and local government agencies occupy 18 billion sq ft of commercial floor space or approximately 24% of the total commercial floor space. Local government is the largest occupant of government floor space (11.2 billion sq ft), followed by state government (3.7 billion sq ft) and Federal government (2.2 billion sq ft). The Federal government occupies space throughout the U.S. and because decisions are centralized there is general cohesion in space-use administration. For this reason the Federal government is generally considered to be the largest single user of commercial floor space. Figure 2.1 below shows a breakdown of U.S. Federal government floor space use (DOE, 2008).

Figure 2.1 U.S. Federal Government Floor Space by Agency



(Source: 2008 Building Energy Data Book, U.S. Department of Energy, 2008)

This paper is a study on the retrofit of existing commercial buildings to be more energy efficient. Accordingly, there are several defining characteristics of commercial buildings worth noting. Nearly 65% of the U.S. commercial floor space is in either a one or two story building. The number of stories of the building correlates with the amount of roof in proportion to the rest of the building. It is thought the character of the roof may be an important factor in reducing heat loss (or gain) in an existing building, indirectly affecting the retrofit capacity of the building (Warseck, 2009). The age of the commercial building stock is also important. Especially as it relates to mechanical equipment, age of the building may be a predictor of retrofit potential. Table 2.2 shows the total amount of commercial floor space by year of construction through 2003.

Table 2.2 U.S. Office Stock by Year of Construction

Year of	Percentage of	(Billions Sq Ft)
1919 or Before	5.00%	3.74
1920 to 1945	10.00%	7.48
1946 to 1959	10.00%	7.48
1960 to 1969	12.00%	8.976
1970 to 1979	17.00%	12.716
1980 to 1989	17.00%	12.716
1990 to 1999	20.00%	14.96
2000 to 2003	9.00%	6.732

(Source: 2008 Building Energy Data Book, U.S. Department of Energy, 2008)

2.2 Structure of Commercial Real Estate Investments

There are a number of ways to invest in commercial real estate including, but not limited to, individual investment, pooled fund investment, and through the public equity market such as a Real Estate Investment Trust (REIT). These are not the only investment structures of commercial real estate and there are a number of variations within each investment type.

Pooled funds are aggregated funds from many individual investors for the purpose of the investment[4]. There is a wide range of pooled funds available, generally characterized by the risk-return structure of the fund. Two common pooled funds are value-added funds and core funds. A real estate "value-added fund", also commonly referred to as an "opportunity fund" or "opportunistic fund" is the real estate equivalent of the private equity and "alternative investment" class that seek high returns and often focus on development or "turnaround" properties (Hahn, Geltner, & Gerardo-Lietz, 2005). With high return expectations, fund managers may focus on the capital appreciation at the sale of the property and by de facto hold periods average 2-4 years (Hahn et al., 2005). By comparison, a "core fund" is generally considered to be a lower-risk, lower-return investment that generally seeks stabilized assets in established markets or locations. Opportunity funds are considered one of the fastest growing segments of the real estate investment industry, growing from $5 billion in 1993 to over $100 billion by 2005 (Hahn et al., 2005).

By definition, a Real Estate Investment Trust is a security that invests directly in real estate and sells like a stock on a major stock exchange[5]. A REIT may invest in properties or mortgages and typically trades on a public stock-exchange, although smaller REITs may trade by privately. Special tax-considerations and the structure of a REIT shape the hold period of investments which is generally considered to be long-term, in the range of 7-10 years.

2.3 Commercial Real Estate Management Chain

The commercial real estate industry is a highly fragmented industry. Incentives and motivations in the decision making process are not always aligned. The real estate value chain

[4] Definition of "Pooled Fund" according to Investopedia. www.investopedia.com. Retrieved on July 18, 2009.

[5] Definition of "REIT" according to Investopedia. www.investopedia.com. Retrieved on July 18, 2009.

includes a diverse set of companies including designers, engineers, contractors, owners, financiers, and property managers, among others. There are a number of unique value chains throughout a building lifecycle including the design phase, operation phase, and disposition phase. Through any phase, the value chain may be horizontal or vertically integrated within a single company or across multiple companies.

In the operation phase the value chain might be analyzed on ownership structure: owner-user buildings and owner-investor buildings. The owner-user building is typically owned, occupied, and managed by a single entity. In the owner-investor value chain the owner leases the building to a tenant and the value chain may include tenant, property manager, asset or portfolio manager, and owner. In this value chain the ownership may be singular or may be a group of investors. In a vertically integrated real estate organization these business-lines may be structured as separate businesses within a holding company or structured as independent departments with different vice presidents. Different managers may compete for limited investment capital; for example leasing may compete with asset management for building improvements or a facility engineer may have to demonstrate a building improvement has a competitive return with other opportunities to invest capital. The investment may be managed directly or by a third-party property manager, asset manager, portfolio manager, or a combination of all three. The focus of this paper is on the owner-investor value chain and specific to the management, including portfolio manager, asset manager, and property manager.

The responsibilities of a property manager and asset manager may depend upon the management contract with the owner and scope of service. In generic terms the property manager is the caretaker of the property, responsible for the day-to-day management and upkeep of the property. Property management duties include recruiting tenants, managing day-to-day operations, maintaining buildings, keeping equipment functional, cleaning the building, and managing utilities, security, and other functions. Increasingly these activities are being outsourced to companies that are bundling services (Reed, Johnson, Riggert, & Oh, 2004). However, property managers may also perform annual budgeting and long-term planning, among other tasks (Sheridan, 1995). Industry practice is for property management companies to be paid a percentage of gross revenue.

An asset manager has traditionally had responsibility for making buy-sell decisions and strategic planning, but may also be involved in day-to-day property management decisions (Sheridian, 1995). An asset manager may redevelop a property, ranging from a simple change of building management, updating the building, decreasing vacancy, or changing tenants, to a full "gut rehab" (Reed et al., 2004). An asset manager also identifies properties with high potential locations that are undervalued because of building quality, high vacancy rate, wrong mix of tenants, or poor management. Asset managers also may be involved with the purchase of new property and preparation of existing property to be sold at a premium relative to purchase price, which may take anywhere from 3 months to 3 years. Some asset managers may redevelop a property for another company under a fee arrangement. Asset management companies are typically paid a percentage fee of assets under management (AUM).

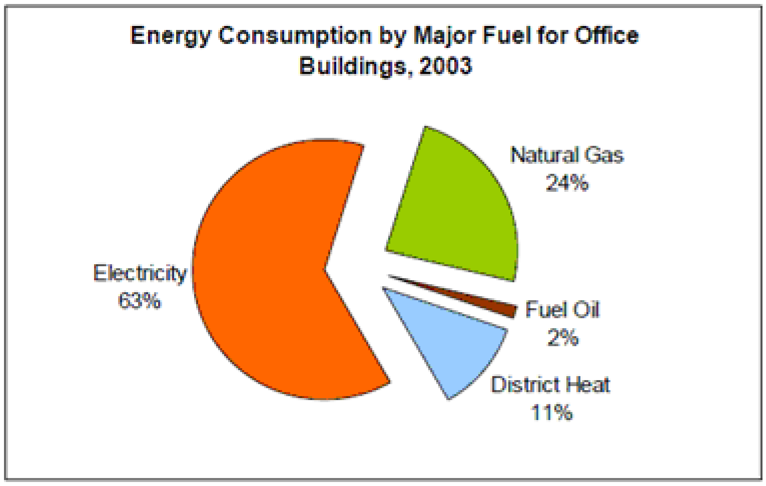
2.4 High Performance Buildings Attributes

According to the United States National Renewalable Energy Laboratory (NREL), a high performance building is one that "integrates and optimizes on a life cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations" (Torcellini, Pless, Deru, & Crawley, 2006). Other building attributes commonly associated with a high performance building may include material selection, occupant health, safety and well-being, or aesthetics, among other characteristics. The term "high performance building" is often used interchangeably with a "green" building or a "high performance green building." Accordingly, a common practice in the commercial real estate industry is to associate energy efficiency with performance metrics such as a United States Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) rating or U.S. EPA ENERGY STAR rating. For the purpose of this paper, the energy and water efficiency retrofits to existing buildings will be the primary focus.

The performance of a building or system is impacted by a number of external and internal factors. Individual components of a building are a complex set of diverse technologies in construction, operation, and maintenance. Many of these individual components are designed and implemented on standardized and independent criteria, not as a system (DOE, 2000). However, the overall performance of a building depends not on component optimization but depends on how efficiently the building as a system uses natural resources such as electricity, water, and natural gas.

An efficient building provides a desired level of comfort and performance with minimal amount of energy (Rocky Mountain Institute [RMI] and CoreNet Global, 2007). The efficiency of operating a building may be impacted by a variety of variables, including the design of the structure, location, orientation, material selection, mechanical systems, operating procedure, and climate factors. A recent report by the NREL concludes that energy efficiency improvements that use a whole building design approach and the best technologies available may decrease energy consumption by an average of 43% (Griffith, Long, Torcellini, Judkoff, Crawley, & Ryan, 2007). Laboratory studies indicate that new technology and design techniques may reduce energy consumption by as much as 70% (Griffith et al., 2007).

Figure 2.2 Energy Consumption by Major Fuel Type for Office Buildings



Source: Energy Information Administration

Figure 2.2 shows the major fuel sources of energy consumed by buildings by energy type: electricity (63%), natural gas (24%), fuel oil (2%), and district heat (11%). On average, the total energy cost alone to a commercial building accounts for as much as 30% of the overall operating cost (Murray, 2006). Sophisticated building owners and operators work on making buildings more efficient to realize operational savings.

The following sections discuss the various government regulations regarding high-performance buildings, current trends towards energy and water efficiency, the process to retrofit a commercial building, and certification of a high performance building.

2.5 Government Regulations

In the past few years, numerous government regulations have been passed that mandate certain reductions in energy use. These regulations are being mandated at all levels of government, including Federal, state, and city. These government regulations have encouraged energy efficiency in existing Federal buildings. In a recent post-occupancy evaluation of twelve high performance GSA buildings compared to national averages, energy use was 26% less, maintenance cost was 27% lower, and occupant satisfaction was 33% higher (General Services Administration [GSA], 2008).

The purpose of examining these regulations is to show that energy efficiency is not just an economic consideration. It is an issue that has recently garnered much attention from the public and lawmakers alike. As energy efficiency becomes a pressing issue in the real estate industry, property owners need to remain cognizant of government actions to ensure that their buildings remain complaint with current regulations.

The most prominent government actions of the past few years are summarized chronologically below:

Energy Policy Act of 2005

On August 8, 2005, the Energy Policy Act of 2005 (EPAct 2005) was signed into law by President George W. Bush. The vast majority of this act is focused on providing financing for renewable sources of energy such as solar, wind, and biofuels. However, there is also a significant focus on energy efficiency in commercial buildings. Some of the key provisions relating to real estate are listed below (Nadel, 2005):

- For new buildings, if building owners can reduce energy use to 50% or less of the ASHRAE 90.1 standard, then they are eligible for tax deductions of up to $1.80 per square foot. Additionally, upgrades do not have to be made all at once. A building owner can increase one of three major building systems (HVAC, lighting, envelope) to be 50% more efficient than ASHRAE 90.1 and receive a $0.60 per square foot tax deduction for each upgrade. While a study by prepared by ConSol for the National Association of Industrial and Office Properties (NAIOP) in 2008 claims that achieving these energy targets are prohibitively expensive and impossible to do with a payback period of less than ten years, the legislation still shows the extent to which politicians are prepared to tackle the issue of energy efficiency (ConSol, 2008).

- Lighting upgrades are specifically singled out in the EPAct 2005. If buildings can achieve an energy savings of 25% below ASHRAE 90.1 solely through lighting upgrades, a deduction of $0.30 per square foot can be taken by the building owner. Additionally, this deduction progressively increases to $0.60 per square foot as the lighting upgrades become more efficient.
- The tax deductions mentioned above were only applicable to upgrades made between the date that EPAct 2005 was enacted (August 5, 2005) and December 31, 2007. However, the tax deductions have since been extended through December 31, 2013 by the signing of the Emergency Economic Stabilization Act of 2008.

Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding

The Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (MOU) was signed by representatives of twenty-one Federal agencies in January and February of 2006. The purpose of the MOU was for these Federal agencies to make a commitment towards leadership in the "design, construction, and operation of High-Performance and Sustainable Buildings" (MOU, pg. 1). Though the MOU is not legally binding, it is intended to give prominence to the issue of sustainability. These Federal agencies recognized the impact that the government has on the built environment and wanted to ensure that sustainable practices were implemented in all real estate projects. The stated goals of the MOU are as follows:

- Reduce the total ownership cost of facilities;
- Improve energy efficiency and water conservation;
- Provide safe, healthy, and productive built environments; and,
- Promote sustainable environmental stewardship.

The key strategies cited for increased sustainability of Federal buildings in the MOU are:

I. Employ Integrated Design Principles

   a. Integrated Design

   b. Commissioning

II. Optimize Energy Performance

   a. Energy Efficiency

   b. Measurement and Verification

III. Protect and Conserve Water

   a. Indoor Water

   b. Outdoor Water

IV. Enhance Indoor Environmental Quality

   a. Ventilation and Thermal Comfort

   b. Moisture Control

   c. Daylighting

   d. Low-Emitting Materials

   e. Protect Indoor Air Quality During Construction

V. Reduce Environmental Impact of Materials

   a. Recycled Content

   b. Biobased Content

   c. Construction Waste

   d. Ozone Depleting Compounds

Executive Order 13423

On January 26, 2007, President George W. Bush signed Executive Order 13423—Strengthening Federal Environmental, Energy, and Transportation Management (EO 13423). The signing of this Executive Order largely made the previously-cited Memorandum of Understanding obsolete as it took those non-binding commitments and signed them into law.

In regards to commercial real estate, Section 2 of this Executive Order follows along similar lines as EPAct 2005:

- Improve energy efficiency by 3% annually through the end of fiscal year 2015 or 30% by the end of fiscal year 2015, relative to the baseline of the agency's energy use in fiscal year 2003 (EO 13423).

This Executive Order goes a step further than EPAct 2005 by specifying goals for reduced water consumption:

- Each agency shall reduce water consumption relative to fiscal year 2007 by 2% annually through fiscal year 2015 or by 16% total by the end of fiscal year 2015 (EO 13423).

Executive Order 13423 also reiterates many of the points made in the Memorandum of Understanding (MOU) signed by twenty-one different agencies in 2006. For example, all new construction and major renovations of agency buildings should comply with the MOU. Additionally, 15% of the existing Federal building inventory should comply with the MOU by the end of fiscal year 2015 (EO 13423).

Energy Independence and Security Act of 2007

The Energy Independence and Security Act of 2007 (EISAct 2007) was signed into law on December 19, 2007. The purpose of the act is to "move the United States toward greater energy independence and security, to increase the production of clean renewable fuels, to protect consumers, to increase the efficiency of products, buildings, and vehicles, to promote research on and deploy greenhouse gas capture and storage options, and to improve the energy performance of the Federal Government, and for other purposes[6]".

The EISAct 2007 has enormous repercussions for owners of commercial office buildings. Many of the provisions were developed with the specific intention of making commercial real estate more energy efficient. Additionally, the government is not just providing economic incentives such as tax deductions to motivate landlords to invest in energy efficiency. The government is using its clout as one of the country's biggest tenants to affect the demand side of the real estate market. By mandating that the government cannot occupy space that does not meet certain energy efficiency goals, the EISAct 2007 effectively forces a large number of landlords to update their buildings or lose tenants. The specific provisions of EISAct 2007 relating to office buildings are summarized below:

- Section 421 of EISAct 2007 establishes the position of Director of Commercial High-Performance Green Buildings. The stated duties of this position are to establish and manage the Office of Commercial High-Performance Green Buildings and to generally facilitate the development of high-performance green buildings and zero-energy commercial buildings nationwide. Additionally the Director will use funds in an effective manner to maximize investment of private funds to promote research and development of high-performance green buildings.
- Section 422 of EISAct 2007 sets forth the guidelines for a Zero Net Energy Commercial Buildings Initiative. A Zero Net Energy Building is one which generates enough energy over the course of a year to counteract any energy used of the course of that same year. The Director of Commercial High-Performance Green Buildings will be responsible for this initiative. The goal of this initiative is certainly ambitious, but once again demonstrates government's commitment to energy efficiency. "The goal of the

[6] Rahall, Nick (2007-01-12). "H.R. 6". THOMAS. Library of Congress. http://thomas.loc.gov/cgi-bin/bdquery/z?d110:h6:. Retrieved on June 28, 2009.

initiative shall be to develop and disseminate technologies, practices, and policies for the development and establishment of zero net energy commercial buildings for—

1) any commercial building newly constructed in the United States by 2030;

2) 50% of the commercial building stock of the United States by 2040; and

3) all commercial buildings in the United States by 2050."(EISAct 2007 Section 422)

The initiative will conduct research into building materials and techniques, perform simulations and demonstrations, and develop training materials to disseminate lessons learned.

- Section 423 shows that the authors of the EISAct 2007 were insightful in realizing that government alone cannot effectuate every required energy efficiency update in the building industry. This section provides for the creation of a public clearinghouse where government at all levels, along with the private sector, non-profits, and international organizations can share ideas and research.
- Section 431 demonstrates the ambition of the EISAct 2007 goals regarding energy efficiency. It requires each Federal agency to designate an energy manager responsible for reducing energy use by a certain amount over the usage in fiscal year 2003. The energy manager is tasked with performing an energy and water use audit for 25% of the designated agency's buildings each year. Additionally, all buildings under the energy manager's oversight must be benchmarked through a system such as the ENERGY STAR Portfolio Manager. The following Table 2.3 lists the energy reduction goals that energy managers must meet for Federal buildings:

Table 2.3 Annual Energy Reduction Goals for Federal Buildings

Fiscal Year	Percentage
2006	2.00%
2007	4.00%
2008	9.00%
2009	12.00%
2010	15.00%
2011	18.00%
2012	21.00%
2013	24.00%
2014	27.00%
2015	30.00%

(Source: Energy Independence and Security Act of 2007)

- In addition to taking aim at energy efficiency in general, EISAct 2007 aims to reduce the consumption of energy created by fossil fuels specifically (as opposed to renewable energy sources). Section 433 states that "new Federal buildings and Federal buildings undergoing major renovations….shall be designed so that the fossil fuel-generated energy consumption of the buildings is reduced, as compared with such energy consumption by a similar building in fiscal year 2003" (EISAct 2007). The following Table 2.4 states the required percentage reduction in fossil fuel-generated energy:

Table 2.4 Required Percentage Reduction in Fossil Fuel-generated Energy

Fiscal Year	Percentage Reduction
2010	55.00%
2015	65.00%
2020	80.00%
2025	90.00%
2030	100.00%

(Source: Energy Independence and Security Act of 2007)

- As hinted at previously, the government is using its influence as one of the largest tenants in the country to effectuate change in the building industry. The greatest example of this strategy can be seen in Section 435 which states "no Federal agency shall enter into a contract to lease space in a building that has not earned the ENERGY STAR label in the most recent year" (EISAct 2007). Given the influence of the government as a tenant, it is likely that many office building owners will strive for the ENERGY STAR label solely to ensure that their building is not excluded from consideration by the government.
- Section 436 creates an office of Federal High-Performance Green Buildings and the position of Federal Director who will act in a similar role as the Commercial High-Performance Green Buildings Director. This section also mentions an interesting role for the Federal Director—to study additional benefits of high-performance benefits "such as security" (EISAct 2007). This hints that perhaps the authors of this legislation recognized that besides being economically feasible, energy efficiency can help Federal buildings be more secure through less dependence on energy from the public grid.

California and Washington DC Energy Benchmarking

In addition to the Federal government, states have also been passing laws related to energy efficiency. Both California and Washington DC will require that the ENERGY STAR Portfolio Manager score of a particular building be reported prior to a major transaction. The Washington DC legislation was passed on July 2, 2008. This legislation, called the Clean and Affordable Energy Act of 2008, requires that all private and Federal buildings be benchmarked using ENERGY STAR Portfolio Manager. According to this Act, the benchmarking requirement will be phased on the following schedule (pg 18):

(A) All buildings over 200,000 square feet of gross floor area beginning in 2010 and thereafter;
(B) All buildings over 150,000 square feet of gross floor area beginning in 2011 and thereafter;

(C) All buildings over 100,000 square feet of gross floor area beginning in 2012 and thereafter;
(D) All buildings over 50,000 square feet of gross floor area beginning in 2013 and thereafter.

California Assembly Bill 11033 (AB1103) has very similar requirements that states (pg 3)

> *On and after January 1, 2010, an owner or operator of a nonresidential building shall disclose the United States Environmental Protection Agency's Energy Star Portfolio Manager benchmarking data and ratings for the most recent twelve-month period to a prospective buyer, lessee of the entire building, or lender that would finance the entire building.*

Both the California bill and Washington DC bill, while stopping short of actually mandating any specific energy use levels, could significantly impact the real estate markets in those regions. As the ENERGY STAR score becomes an accepted component of major real estate transactions, it will gain the attention of tenants, purchasers, and sellers alike. This increased attention will likely lead to increased investments in energy efficiency in order to maximize the ENERGY STAR score.

American Recovery and Reinvestment Act of 2009

On February 17, 2009, President Barack Obama signed into law the American Recovery and Reinvestment Act of 2009 (ARRAct 2009). Following a pronounced economic downturn, this act is intended to stimulate growth in all corners of the economy. At the time of printing, the measures in the Act are worth $787 billion. Though many Federal agencies are being allocated funds for building renovations, examining the funds allocated directly to the GSA demonstrates the government's commitment to high-performance buildings. Approximately $5.85 billion allocated to the GSA for high-performance green buildings initiatives (GSA, 2009). That $5.85 billion is divided as follows:

- $4.5 billion for Federal building conversion to high-performance green spaces;
- $750 million for Federal building and courthouse renovations;
- $300 million for fuel-efficient vehicles;
- $300 million for land ports of entry renovation and construction.

The first two items listed above are applicable to this study. The government is sending a signal about its commitment to implementing high-performance technologies into Federal buildings. Additionally, the GSA has stated that the spending resulting from the ARRAct 2009 bill will meet the requirements of both EISAct 2007 and Executive Order 13423(GSA, 2009))

The criteria for selecting projects will be a systematic focus on the most inefficient properties in the GSA portfolio. The criteria, in descending order of importance, are:

- High-performance features concentrating on energy conservation and renewable energy generation.
- Speed of construction start in order to have an immediate impact on job creation.
- Certainty of execution.
- Facility Condition—facilities in worse condition will be first to receive attention.
- Improving asset utilization.
- Return on investment.
- Avoiding lease costs.
- Historic significance. (GSA, 2009)

The primary methods of spending the money to convert Federal facilities to high-performance buildings will include:

1) Advanced meters for both electricity and water;

2) Roof replacement with

a) Integrated photovoltaic roof membranes (if appropriate geography)

b) Green roofs if integrated photovoltaic is not warranted

c) Cool roof membranes if neither a) nor b) is warranted. (GSA, 2009)

As is clearly shown through the EPAct 2005, MOU, EO 13423, EISAct 2007, and ARRAct 2009, the Federal government is showing commitment to high-performance buildings. Property owners need to remain cognizant of legislation in order to ensure that their buildings remain competitive in the marketplace and do not exclude one of the nation's largest tenants, the Federal government.

2.6 Property-Level Efficiency Strategies

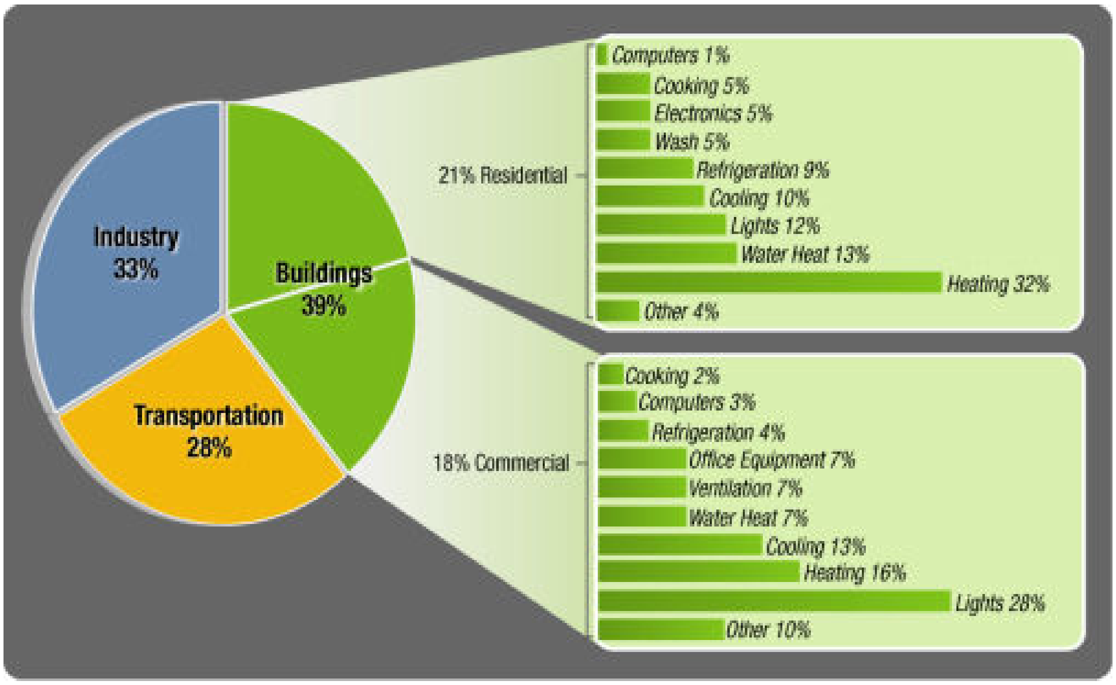
The government is mandating energy and water efficiency at an ambitious level. The following section addresses specific strategies that can be implemented in order to make a building more energy and water efficient.

2.6.1 Energy Efficiency

The energy efficiency of a building is limited by the how the building is designed, engineered, constructed, operated, and maintained. Achieving greater energy efficiency in an existing building depends on several factors, including the building envelope, system efficiency, and energy end-use such as plug loads. The efficiency of the building envelope impacts the energy load for the building, including the required energy used to heat, cool, and ventilate (WBCSD, 2007). Simple strategies to reduce heating and cooling loads include appropriate insulation, optimizing window glazing area, minimizing the infiltration of outside air (WBCSD, 2007), and using an opaque roofing material . Additionally, the envelope impacts the lighting load for the building, depending upon how much natural daylight penetrates through windows into the interior spaces. Common design features include the enhancement of natural daylight into a building which can be improved by the use of skylights, light shelves, tubular day-lighting, and other means of daylight harvesting.

The efficient use of energy impacts the operating cost of a building. The average cost of energy for a typical commercial building may depend on several factors, including the geography, climate, building type, and location. Energy costs are also one of the most controllable expenses unlike other major line items such as taxes and insurance. Figure 2.3 below shows the average end use of energy in both commercial and residential buildings. At the same time, energy prices have significantly increased over the past several years, underscoring the importance of energy efficient operations. Since the year 2000, average commercial energy prices have increased approximately 25% (Ciochetti & McGowan, 2009).

Figure 2.3 Overall Energy Consumption by Industry

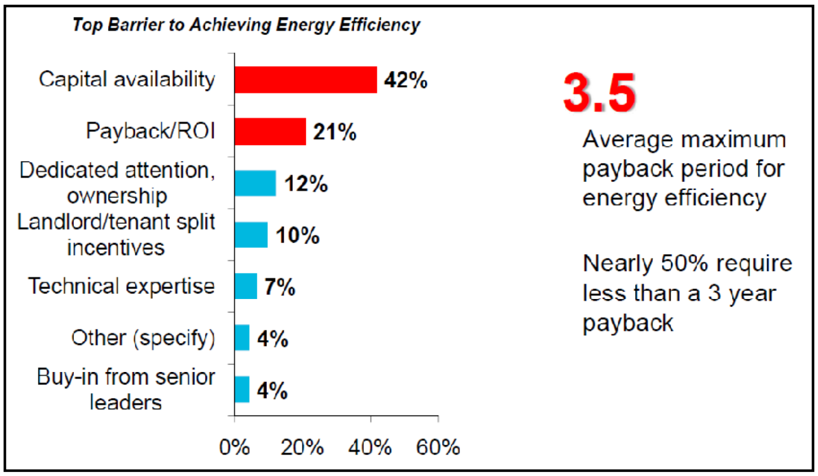


(Source: "Working Toward the Very Low Energy Consumption Building of the Future", Chen,2009)

According to a survey of real estate executives at major corporations fewer than half of those companies have energy policies or consumption targets in place (RMI & CoreNet Global, 2007). Somewhat paradoxically, 83% of the survey respondents ranked sustainability, which includes energy efficiency, as "important" to "most important" and 94% ranked energy efficiency as "important" to "most important" relative to other issues to impact commercial real estate over the next ten years (RMI & CoreNet Global, 2007). It is therefore implied that these corporate real estate professionals may not recognize the potential energy savings that are available or, perhaps other barriers to implementation exist. The authors of the survey suggest that a lot of the "low-hanging" fruit for energy efficiency, such as adjusting building scheduling, monitoring temperature control, and proper training of building facility managers has not taken place (RMI & CoreNet Global, 2007).

In a similar survey conducted by Johnson Controls in 2008, over 71% of the respondents indicated they are currently paying more attention to energy efficiency than they did last year while 58% continue to say energy management is “extremely important” to “most important” (Johnson Controls, 2009). The top two reasons for not achieving energy efficiency included capital availability (42%) and payback/return on investment (21%). Figure 2.4 below shows the results to the question about each barrier to achieving energy efficiency.

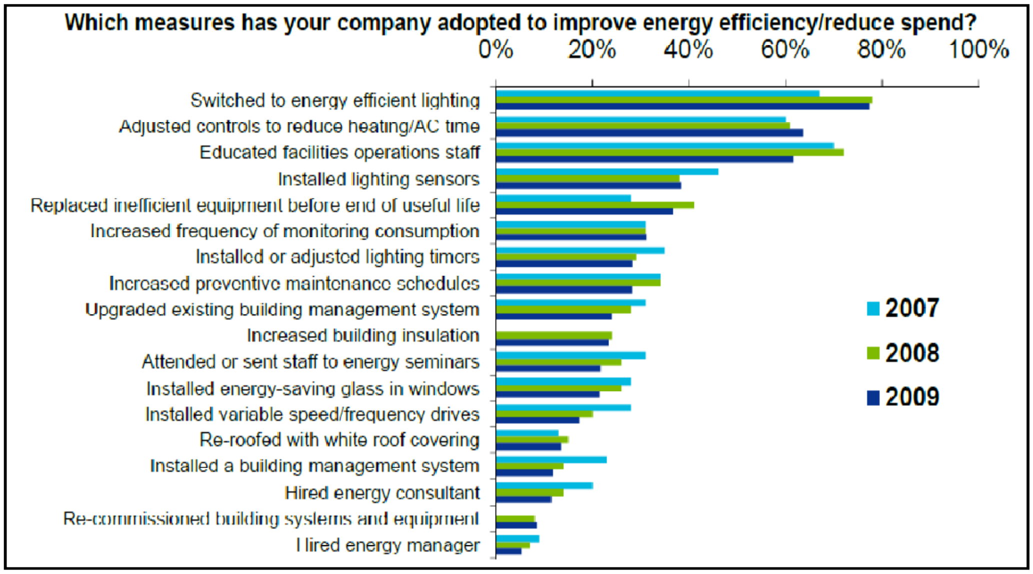
Figure 2.4 Top Barrier to Achieving Energy Efficiency Reported by Real Estate Decision Makers



(Source: Johnson Controls, 2009)

Companies that dedicated capital to energy efficiency projects generally targeted low-cost solutions such as switching to energy efficient lighting (77% response), adjusting HVAC controls (64% response), and educating facilities operators on efficient building management practices (62% response). Figure 2.5 shows a breakdown of which energy efficiency projects were undertaken by survey respondents (Johnson Controls, 2009).

Figure 2.5 Energy Efficiency Projects Reported by Real Estate Decision Makers



(Source: Johnson Controls, 2009)

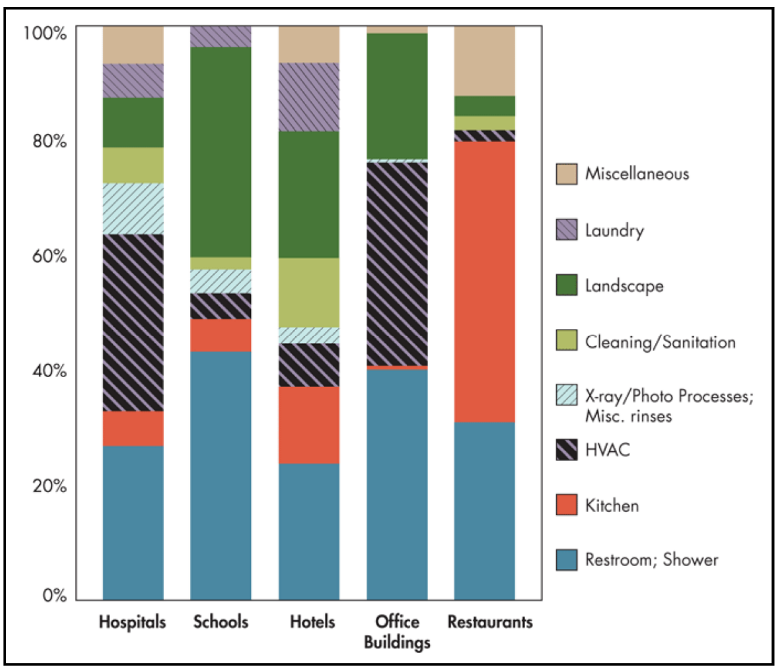
2.6.2 Water Efficiency

Between the years of 1950 and 2000 the U.S. population doubled but the amount of water used to support municipal, agricultural, and industrial activities increased three-fold (NSTC, 2008). The U.S. Census Bureau estimates the population over the next 50 years will grow by 56%, with much of the growth in the arid Western U.S. In recent years the region has suffered from severe drought, such as Lake Mead near Las Vegas which is down nearly 100 feet since 1990 (Wilson, 2008). In a current survey, at least 36 states anticipate local, regional, or statewide water shortages by 2013 (Wilson, 2008). The potential to conserve water in commercial buildings is not trivial. According to a GSA study, if commercial buildings reduced water consumption by just 10% then over 2 trillion gallons of water a year would be saved (GSA, 2008).

Buildings account for approximately 9% of total water use in the United States (DOE, 2008) and 20% of available drinking water (GSA, 2008). According to the United States Green

Building Council LEED Reference Guide for Existing Buildings Operation and Maintenance, a typical 100,000 sq ft office building in the U.S. uses more than 3 Million gallons of water per year (Roskoski, 2009). Water use is typically divided into two main uses: "potable water", such as drinking water and sink use; and "non-potable water" such as fire-suppression, toilet flushing, irrigation, and process loads such as mechanical loads and kitchen loads. Cooling towers are responsible for approximately 50% of the load on average in "make-up" water to replace inside the tower (DOE, 2008). Figure 2.6 below shows the end use of water in commercial buildings (Wilson, 2008).

Figure 2.6 Water Consumption by Use in Commercial Buildings



(Source: "Water: Doing More with Less", Environmental Building News, 2008)

Water resources, like energy resources, are a controllable expense. There are a number of low-cost efficient solutions on the market including waterless urinals, motion sensors on sinks, and faucet aerators. Low-cost improvements can yield big savings, such as placing 0.5

gallon per minute aerators in lavatory faucets which on average reduce water usage to 17% below a baseline threshold (Roskoski, 2009). Other water efficiency strategies include harvesting rainwater for augmenting traditional supply, optimizing in-building water use, and recycling in-building water. A recent industry report indicates the utilization of water efficient design and products decrease water use by 15%, energy use by 10-11%, and operating costs by 11-12% (McGraw_Hill Construction, 2009).

Real estate professionals are taking notice of water efficiency in commercial buildings. In a recent survey on water use by McGraw Hill, water efficiency is increasing at the most rapid pace when compared to other aspects of green building. According to the survey, over the next 5 years 85% of respondents reported water efficiency will be an extremely important aspect to green building (McGraw_Hill Construction, 2009).

In current real estate practice 42% of owners reported using water efficiency design in over 75% or more of projects (McGraw_Hill Construction, 2009). The top three triggers impacting the use of water efficient products and methods include energy cost increases, existing wastewater runoff government regulations, and existing water efficiency government regulations and standards (McGraw_Hill Construction, 2009). The top three important motivations for water efficient products and methods include energy-use reduction, operating cost reduction, and water use reduction (McGraw_Hill Construction, 2009). The two main reasons for owners to not use water efficient products and methods were better payoff for energy efficient design (73% response) and higher first costs (68% response) to implement (McGraw_Hill Construction, 2009).

2.7 Certification and Labeling of High Performance Buildings

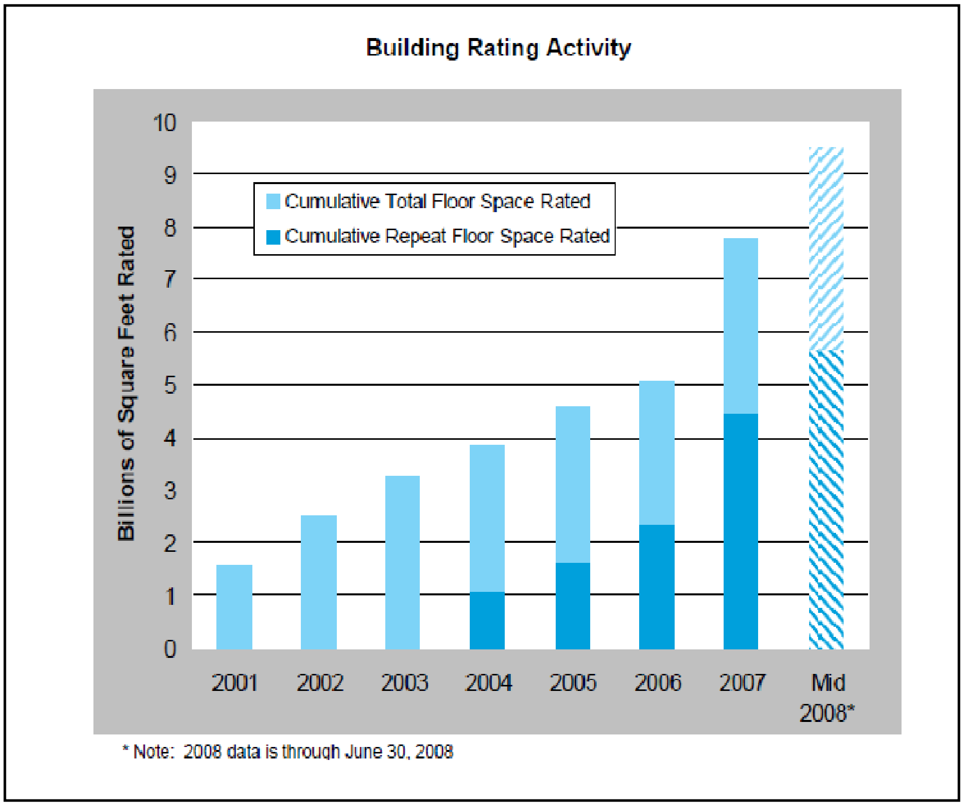
There are a number of processes and methods for conveying high performance building attributes to the commercial real estate market. The three most common methods in the U.S.

include the United States Green Building Council (USGBC) Leadership in Environment and Energy Design (LEED) program, U.S. Government Department of Environmental Protection Agency (EPA) ENERGY STAR© program, and Green Globes. Outside the U.S., other prominent programs include Green Star (Australia) and BREEAM (United Kingdom). While ENERGY STAR is predominately based on energy and water efficiency of buildings, the other certification programs cover a wider range of environmental impacts of a building including indoor air quality, material selection, and site location. These certificate programs are perhaps a precursor to the future: net zero energy buildings.

ENERGY STAR

The ENERGY STAR program is a voluntary public-private partnership with the U.S. Environmental Protection Agency (EPA) to help building owners understand and reduce building energy use. Unveiled in 1999, the ENERGY STAR program today reports that by mid-2008 approximately 2 billion new square feet was rated for energy use, bringing the total to 9.5 billion square feet in 71,000 buildings (EPA, 2007). Figure 2.7 shows the annual growth in rating building energy use since ENERGY STAR inception. Buildings that achieved the ENERGY STAR label, which is awarded to the top 25% of buildings in energy efficiency, also increased by 1,300 buildings to bring the new total for mid-2008 to 5,000 buildings. The leading states based on the total amount of ENERGY STAR rated floor space are California, Texas, New York, Illinois, and Florida. On average, the EPA estimates that “ENERGY STAR labeled buildings consume about 40% less energy than typical buildings, while providing required comfort and services” (Murray, 2006, pg 11).

Figure 2.7 Annual Growth in Total Sq Ft Rated by ENERGY STAR



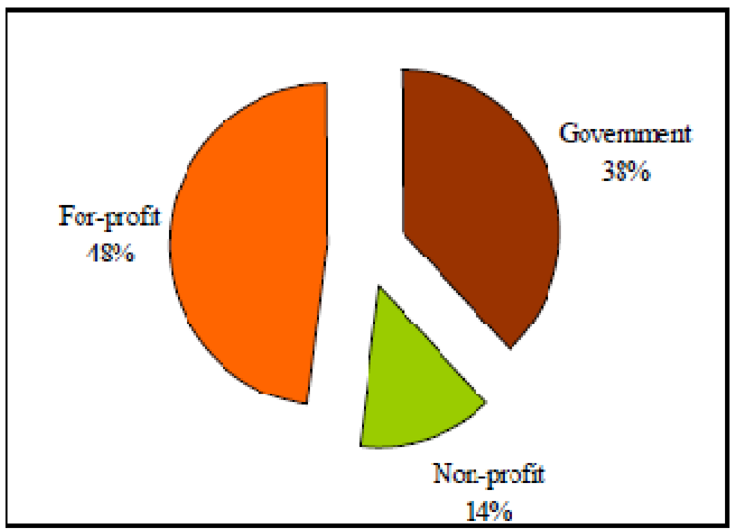
(Source: Energy Star Fall 2008 Snapshot, 2008)

LEED Existing Buildings: Operations and Maintenance

The Leadership in Energy and Environmental Design (LEED) rating system is a third-party certification with oversight by the United States Green Building Council (USGBC). The USGBC was founded in 1993 as a non-profit trade organization to promote sustainability. The USGBC established benchmarks for the LEED Green Building Rating System in 2000 which today has grown to include nine rating systems. The first rating system was LEED New Construction (LEED NC) and was applicable to built-to-suit or owner-occupied projects.

To address the large-scale impact of existing buildings on the environment, LEED Existing Buildings Operations and Maintenance (LEED EB O&M) and LEED Commercial Interiors (LEED CI) were introduced in 2004. As of April 2009, 2,490 buildings have been registered and 200 buildings certified under LEED EB O&M.[7] Figure 2.8 shows the breakdown of ownership types of LEED EB O&M rated buildings. LEED for Commercial Interiors (LEED CI) is the green benchmark for tenant improvements and was established in 2004. Since its inception the USGBC has registered 2,047 projects and certified 479 under the LEED CI rating system[8].

Figure 2.8 LEED EB O&M Certification by Ownership Type



Source: USGBC, 2005

Green Globes

Green Globes is based on the Building Research Establishment's Environmental Assessment Method (BREEAM) which was brought to Canada in 1996. The Canadian Standards

[7] Green Building Facts, USGBC, April 2009

[8] Et al.

Association adopted the system as BREEAM Canada for Existing Buildings. In 1999 the organization introduced a question-based tool called BREEAM Green Leaf eco-rating program which became an online assessment tool in 2000 and adopted the name of Green Globes for Existing Buildings. In 2004 the Green Building Initiative (GBI) acquired the rights to distribute Green Globes in the U.S. which became the first green building organization to be accredited as a standards developer by the American National Standards Institute (ANSI) in 2005.

Energy Performance Certificate (EPC)

The United Kingdom recently passed a regulation requiring a property owner to disclose a building's energy use at each transaction when a building is built or sold, or a lease turnover. Known as Energy Performance Certificates, the regulation follows a European Union Directive on Energy Performance of Buildings in 2003 (Department for Communities and Local Government, 2007). The objective of the Energy Performance Certificate is to allow building owners and tenants to evaluate the energy performance of a building to make purchasing decisions. Mychelle Lord of Lord Green Strategies compared energy disclosure to the transformation that Food Nutrition Labels had on consumer preference for food or miles per gallon disclosure had on vehicle choice. As discussed earlier in this chapter, both Washington D.C. and the state of California have passed similar requirements for energy disclosure to start in 2010.

Net Zero Energy Buildings

The next measuring stick to evaluate energy performance of a building is net zero energy use. According to a study completed by the National Renewable Energy Laboratory, a zero-energy building is defined as a building with reduced energy through efficiency gains such that the energy demands can be met with renewable energy technology (Torcellini, Pless, Deru,

& Crawley, 2006). The definition does not require a net zero energy building to be completely off the power grid; over a set time period (usually a year) the building should produce as much energy as it consumes (NSTC, 2008). Several net zero energy buildings have been built over the past several years, including Aldo Leopold Legacy Center (Baraboo, WI), Audubon Center at Debs Park (Los Angeles, CA), Challengers Tennis Club (Los Angeles, CA), Environmental Tech Center Sonoma State (Rohnert Park, CA), Hawaii Gateway Energy Center (Kailua-Kona, HI), IDeAs Z2 Design Facility (San Jose, CA), Oberlin College Lewis Center (Oberlin, OH), Science House (St. Paul, MN).

2.8 Retrofitting Process for an Existing Commercial Building

As discussed above, energy and water efficiency projects may yield substantial operational savings to a building owner. Understanding end-use energy and water consumption is a critical step in realizing value from an efficiency retrofit project. Examples of end-use measurements include utility sub-meters, data loggers, monthly utility tracking sheets, and annual energy audits. Many efficiency retrofit opportunities are overlooked because of inadequate end-user information. A worldwide study in 2007 found that only two-thirds of companies tracked energy data and approximately 60% tracked the cost of energy (WBCSD, 2007), although these numbers vary by the national origin of the company.

Building Commissioning

Another critical factor in an energy efficiency upgrade is commissioning or re-commissioning the performance of an existing building. Commissioning or re-commissioning a building is generally performed by an independent third party to verify that building systems operate according to design. Recommendations from a building commissioning may be simple like adjusting an air-handler unit to complex and costly like replacing an underperforming chiller. The Lawrence Berkeley Laboratory (LBL) estimates the median cost of commissioning existing buildings to be $0.27 PSF of floor space and the average annual energy savings to be about 15% with a 0.7 year simple payback period (Leonardo Academy, 2008). Despite the cost saving potential, anecdotal evidence suggests frequent building commissioning is not widely performed throughout the commercial real estate industry.

Efficiency Improvements Projects

There is a wide range of solutions available to increase the efficiency of a commercial building. One way to look at these solutions is to categorize projects by expected initial cost. Categories might include “No-Cost Improvements”, “Low-Cost Improvements”, and “Significant-Cost Improvements” (Dirksen & McGowan, 2008). A summary of several of these types of improvements is included in Table 2.5 below.

Table 2.5 Sample of Energy Efficiency Improvement Projects

No-Cost Improvements	Sealing window and door frames Regularly changing filters Replace washers & cartridges in leaking faucets Replace light bulbs Review current building op procedures
Low-Cost Improvements	Equipment tune-ups Reviewing sequence of operations Calibrating controls Performing minor equipment upgrades such as variable frequency drives for motors Installing occupancy sensors
Significant-Cost Improvements	Window replacement Faucet & toilet replacement PV installation New equipment installation

Many of the no-cost and low-cost improvements may provide significant reductions to building energy consumption. According to a recent report based on several case studies, energy consumption for HVAC can be reduced by 20% by detecting mechanical faults and ensuring systems operate correctly (NSTC, 2008). Many of the savings in mechanical systems relate not to retrofits but to changes in operational procedures.

Lighting is another low-cost improvement with significant energy reduction potential. A lighting retrofit may include replacing lamps, ballasts, luminaries or all three and the level of payback will vary. For example, simply replacing an area using 35-watt T-8 fluorescent tubes with 28-watt T-8 fluorescent tubes might reduce the wattage by 20% without significant loss of lumens (Roberts, 2009). Likewise, switching a wall-mount light switch with occupancy sensors, where appropriate, can offer 25% savings (Roberts, 2009). It should be noted that any solution should be evaluated not only on cost but holistically; for example, providing a tenant control over ventilation may reduce cooling loads and also improve occupant comfort.

2.9 Design Approaches

Retrofitting an existing commercial building may fall under two different design approaches. The first, a 'sequenced approach' is a step-wise approach which includes upgrading individual building components. The second, a 'holistic' or 'integrated design' approach suggests looking at the entire building as a system of components and finding solutions to optimize the system.

Sequenced Design Approach

In a sequenced design approach there are three main steps. Stuart Brodsky, a national manager for ENERGY STAR's Commercial Property Markets Program describes the process as a building tune-up, then a lighting upgrade, and finally significant upgrades to infrastructure, equipment, and materials (Murray, 2006). According to Brodsky, low-cost energy efficiency upgrades or changes to building management may yield an 8 to 12% reduction in energy demand. During a building tune-up an operator might discover such things like heating and air conditioning are working against each other, timer clocks are not set, or dampers are not opening and closing despite building management system indicators. The next step, lighting upgrades, offer the potential for substantial energy savings (Murray, 2006). Lighting in a commercial building is the largest single use of energy at 24.8% and accounts for 42% of the heating load on a building (DOE, 2008). The final step, making significant capital upgrades to building infrastructure and mechanicals is a progression upon the first two. Reducing the load on a building by maximizing efficiency and changing lighting will allow for a scaled-down version of a mechanical system: replacing mechanicals before load reduction may result in "over-sizing" the mechanical system (Murray, 2006).

Brodsky shares an example of a building operator performing the efficiency upgrade out of sequence. The building is a 1960 era property of approximately 1 million square feet located in New York City. The operator first replaced a chiller plant and then applied a substantial amount of solar film to single glazed windows. Had the operator first made improvements to the envelope of the building, or in this case the windows, then a chiller plant of less tonnage could have been purchased to meet the needs of building comfort. To make matters worse, the oversized chiller is inefficient for the building, leading to decreased occupant comfort and higher energy costs from greater on/off cycles of fan systems (Murray, 2006).

Integrated Design Approach

The second approach to a retrofit design is to look at all of the components of the building holistically, commonly referenced as an 'integrated design approach'. An integrated design approach analyzes the effect of making multiple changes to a building simultaneously to yield greater energy reductions than a sequenced approach. As an example, combining a lighting retrofit and high performance window glazing together may reduce space conditioning loads such that a smaller mechanical system is installed than previously designed. The savings from the reduced mechanical system design may justify the cost premium for installing the high performance windows (RMI & CoreNet Global, 2007). The Rocky Mountain Institute estimates the integrated design approach has been proven in $30 billion of projects in 29 sectors (RMI & CoreNet Global, 2007). A good example of an integrated design retrofit is the Empire State Building, which is discussed later in this chapter.

Integrated design approach can be a power tool to reduce energy consumption in a building. The Rocky Mountain Institute continues to champion integrated design and has compiled the following examples:

- A lighting shelf is considered to be eliminated from a design. Without the lighting shelf there is an increased need for lighting throughout the building, which results in higher energy costs and greater cooling demand on the mechanical systems. The additional cost of the lighting shelf would likely have been justified by these additional energy costs (RMI & CoreNet Global, 2007)
- Coordinating energy efficiency projects with needed building renovation may justify the higher initial costs. Coupling a lighting retrofit with super-efficient windows may reduce the size of the mechanical system that needs replacement. In this example, a costly window that insulates four times better, allows six times more light and one-tenth the wanted heat may be justified because it can decrease the required mechanical system by a fourth and hence a lower replacement cost. (RMI & CoreNet Global, 2007)

2.10 The Future of Energy Efficiency in Commercial Buildings

There are a number of new technologies on the horizon to improve energy efficiency in commercial buildings. Nanotechnology may one day improve individual occupant control and comfort level (Reed, Johnson, Riggert, & Oh, 2004). Another technology being developed at the Lawrence Berkeley Laboratory is the ability to benchmark individual building component efficiency to better optimize a system of components. The technology is being categorized as "building informatics" (Chen, 2009). Providing new measurement systems will enable an owner or occupant to evaluate real-time energy consumption segregated by end uses such as plug loads, lighting, appliances, and mechanical systems.

2.11 Benefits and Challenges to High Performance Buildings

There are several motivators for buildings owners and investors to operate high performance buildings. As discussed above, a high performance building generally has lower Operating Expenses compared to a peer group. Lower Operating Expenses and a resultant higher Net Operating Income may increase the sales price, assuming the landlord is responsible for collecting and paying the building expenses. In a typical commercial real estate transaction the value of the asset is based on the Net Operating Income stream divided by a capitalization rate; thus, the higher the net income of the property the greater the value.

There are several research reports that suggest a "green premium" for certified high performance buildings. A recent study by Pivo and Fisher (2009) compared two portfolios of buildings, one with ENERGY STAR labels and the other a control group without ENERGY STAR labels. Over a ten year period from 1998-2008 the ENERGY STAR labeled properties demonstrated a 5.9% higher net income psf, mostly attributable to an average 9.8% lower costs in utilities. Additionally, the portfolio of ENERGY STAR properties had a 13.5% higher market value and traded at cap rates 0.5% lower than the control group. It is interesting to note that the ENERGY STAR group did not have significantly lower total operating costs (Pivo & Fisher, 2009). Pivo (2009) cites several other studies on the value of a "green" building, including Wiley (2008) who found a 7.3% to 8.6% rent premium for ENERGY STAR and 10% to 11% higher occupancy rates; Fuerst and McAllister (2008) found an 11.6% rent premium in ENERGY STAR buildings; and Eichholtz (2008) found an 8.9% effective rent premium. Industry acceptance of these reports has been mixed.

Energy performance is a large component of green buildings. There are several studies that indicate a disparity between predicted energy performance and as-built performance. According to a report by Mills (2004) the life cycle energy savings for energy efficiency projects are often significantly less than projected. Mills' comprehensive study of building deficiencies found an average of 32 deficiencies in existing buildings and 67 deficiencies in new buildings (NSTC, 2008). A similar study by the U.S. Depart of Energy of six high-performance buildings indicated a gap between design intent and actual construction that results in reduced energy performance (Torcellini, Judkoff, & Crawley, 2004). Water efficiency projects have also been studied. Recent studies have shown that sensor-activated faucets *increase* water use by anywhere from 30-100% and sensor-activated toilets and urinals also increase water use through "phantom flushing" (Roberts, 2009). There are a number of reasons for these findings. Building technology for efficiency is evolving and the latest products build upon experience from past failures. Additionally, the effectiveness of building efficiency features depends upon tenant usage.

2.12 Examples of Owner-Investor Building Efficiency Retrofits

Perhaps a result of government spending or owner-occupied investment, in recent years there has been an increase in capital allocation to efficiency retrofits of existing buildings. These investments are made because the organization is either complying with current mandates or reducing the operating costs of an owned facility. However, energy efficiency has recently begun to become more mainstream in the multi-tenant office building sector. This section explores two prominent examples of multi-tenant buildings that are currently undergoing efficiency retrofits to become high-performance buildings.

2.12.1 The Sears Tower

On June 24, 2009, the Sears Tower announced a plan to upgrade the tallest building in the Western Hemisphere into a high-performance building (Sears Tower, 2009). One purpose for this upgrade is to reduce energy use from the electrical grid by up to 80% or the equivalent of 150,000 barrels of oil annually. As has previously been discussed, most energy efficiency upgrades are most effective when implemented through an integrated design approach. The team responsible for upgrading the Sears Tower clearly understands this concept and aims to prove it to other building owners. As stated by project architect Adrian Smith of AS+GG, "our goal in the Sears Tower greening project is to create a holistic approach that integrates high-performance building technologies and design strategies for maximum energy efficiency. In the process, we hope to set a benchmark for how high-rise buildings throughout the world can limit their impact on the environment (Sears Tower, 2009, pg. 2)." Though the Sears Tower currently meets LEED certification criteria, the ownership team plans to go above and beyond by implementing the following upgrades:

- Replacement of the tower's 16,000 windows.
- Fuel cell-based boilers that will generate electricity, heating and cooling at up to 90% efficiency.
- Replacement of the tower's 104 elevators and 15 escalators to high-efficiency models.
- Water efficiency through upgraded restroom fixtures and water efficient landscaping.
- Daylight harvesting, which uses sensors to reduce the time light fixtures operate on bright days, will be combined with advanced lighting control systems to save up to 40% of the lighting energy use.
- Renewable energy sources such as wind and solar will be tested along with green roofs.

The total cost of the project is estimated at $350 million dollars and the payback period for the majority of the improvement projects is modeled to be five years. The Sears Tower management and ownership are also using the building retrofit as a demonstration for the rest of the commercial real estate market. As Gordon Gill of AS+GG concludes, "we have to apply what we've learned to our existing stock of commercial buildings—especially iconic structures such as Sears Tower, which we hope will inspire similar initiatives around the globe. These will serve as great examples for building owners and managers and can reposition existing building stock to be as competitive as most new buildings or even better. (Sears Tower, 2009, pg. 2)"

2.12.2 Empire State Building

Another striking example of a high profile multi-tenant office building efficiency improvement comes from arguably the most famous office building in the world—the Empire State Building. Announced on April 6, 2009, the Empire State Building is anticipated to reduce energy use and greenhouse gas emissions by up to 38%[9]. While the retrofit is expected to cost approximately $20 million, annual energy savings are estimated at $4.4 million (Jones Lang LaSalle, 2009). The goal of this project may go beyond lowering operating costs and reducing the emissions from this building. The project team has also capitalized on the landmark status of the building in order to become a demonstration to building owners throughout the world. As stated in the Project Charter,

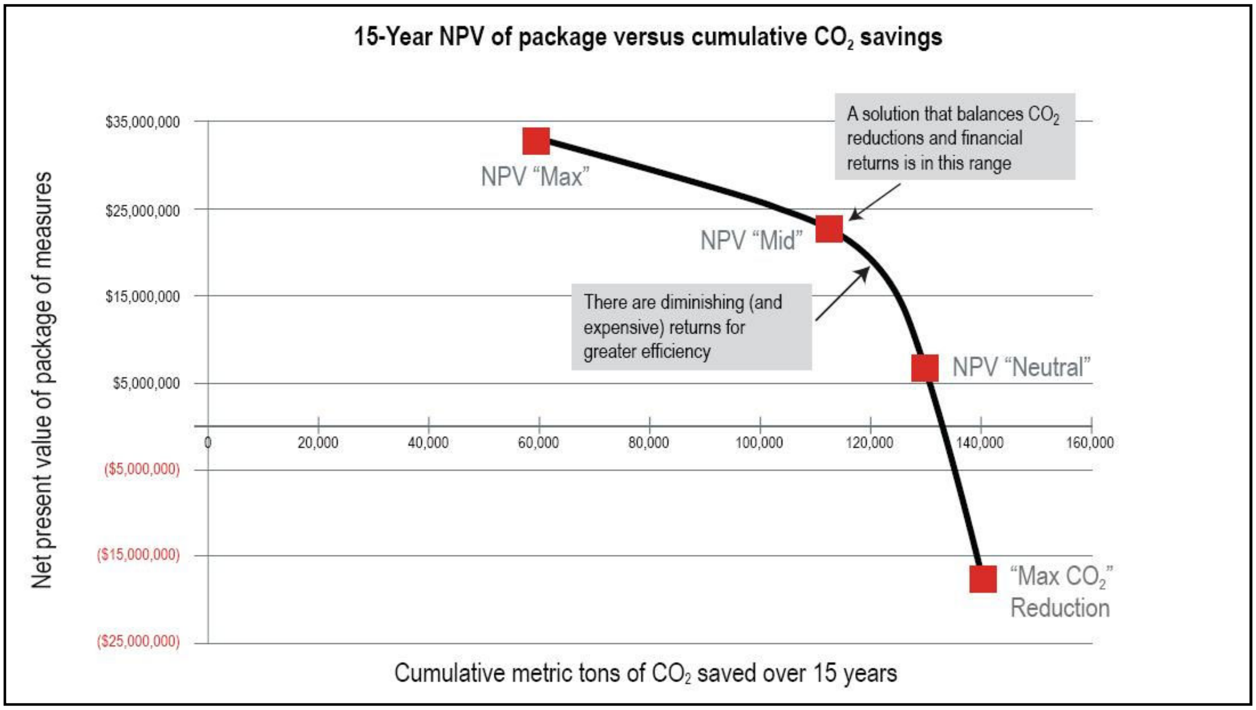
> *"The retrofit of the Empire State Building into a Class A pre-war trophy building will transform the global real estate industry by transparently*

[9] Jones Lang LaSalle Manages Landmark Empire State Building Sustainability Program to Reduce Energy and Carbon by 38% and Serve as Industry Model, April 7, 2009. http://www.reuters.com/article/pressRelease/idUS108213+07-Apr-2009+PRN20090407

> *demonstrating how to create a competitive advantage for building owners and tenants through profitably greening existing buildings."* (Jones Lang LaSalle, 2009)

The project team, consisting of Jones Lang LaSalle, Clinton Climate Initiative, Rocky Mountain Institute, Johnson Controls, and Empire State Building Operations is aiming to achieve a LEED Gold certification and an ENERGY STAR rating of 90. However, the team did not have an open-ended budget. As a for-profit corporation the Empire State Building Company had to ensure that the upgrades provided the maximum benefit at the most reasonable cost. To this end, the team analyzed over 60 potential projects and eventually settled on eight feasible projects to implement. The project team modeled the building to achieve energy savings of up to 45%, but the marginal cost of increasing savings from 38% to 45% proved to be prohibitively expensive under current market conditions. Wanting to be a demonstration for other building owners on how to be sustainable and profitable at the same time, the project team strived for a balance of cost vs. carbon reduction. Figure 2.9 shows a curve representing total net present value of the retrofits compared to the carbon reduction. The project team decided to settle at the point along the curve labeled "NPV Mid" which proved to be an appropriate balance between investment and carbon reduction.

Figure 2.9 Empire State Building: NPV versus Carbon Reduction



(Source: JLL Project Plan, 2009)

To reduce energy use by 38% the Empire State Building project team implemented a holistic design approach similar to the approach taken by the Sears Tower project team. The project team first reduced the cooling loads in the building so as to "right-size" the chiller plant rather than use one with too much capacity. The team settled on the following eight projects out of the 60+ projects considered for the retrofit[10]:

> ***"Digital demand controls.*** *These controls allow remote, web-based control of a building's energy systems to ensure that temperatures and energy use always remain in the optimum range.*

[10] Empire State Building Sustainability. http://www.esbsustainability.com/SocMe/?id=205&pid=194&sid=205&Title=Projects+in+Detail&Template=ContentWithTertiaryNavigation. Retrieved July 24, 2009.

Tenant Daylighting, Lighting, and Plugs. *This measure involves reducing lighting power density in tenant spaces using ambient, direct/indirect, and task lighting, installing dimmable ballasts and photosensors for perimeter spaces that can operate with electric lights off or dimmed depending on daylight availability, and providing occupants with a plug load occupancy sensor for their personal workstation.*

Variable air volume air handling units. *The Empire State Building management team is recommending a new air handling layout (two floor-mounted units per floor instead of four ceiling-hung units) as well as the use of variable air volume units instead of existing constant volume units.*

Upgraded window glazing. *This project involves upgrading the existing insulated glass (IG) within the Empire State Building's approximately 6,500 double-hung windows to include suspended coated film and gas fill.*

Tenant energy management. *This project will allow for the independent metering of a greater number of tenants in the Empire State Building. Tenants will have access to online energy and benchmarking information as well as sustainability tips and updates.*

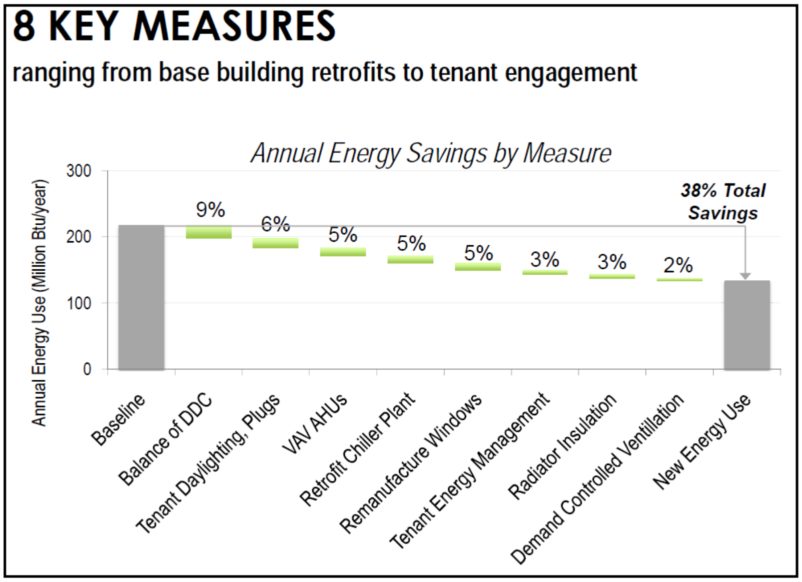
Radiative barrier. *This project will involve the installation of more than six-thousand insulated reflective barriers behind radiator units located on the perimeter of the building. In addition, the radiators will be cleaned and the thermostats will be repositioned to the front side of the radiator.*

Tenant demand-controlled ventilation. *This project involves the installation of CO2 sensors for control of outside air introduction to Chiller Water Air Handling and DX Air Handling Units. One return air CO2 sensor will be installed per unit in addition to removing the existing outside air damper and replacing it with a new control damper.*

Retrofit of the chiller plant. *The chiller plant retrofit project will include the retrofit of four industrial electric chillers in addition to upgrades to controls, variable speed drives, and primary loop bypasses. Due to the approach of reducing heating and cooling loads first, the project team was able to avoid replacing the chiller and could instead simply retrofit the existing chiller."*(esbsustainability.com)

The eight energy efficiency projects listed above individually each play a part in reducing energy consumption in the building. It is the integration of these projects into a building system that significant energy reduction is achieved. Figure 2.10 below shows the energy reduction of each project as a component of the integrated design.

Figure 2.10 Eight Key Measures to Retrofit Empire State Building



(Source: Johnson Controls, 2009)

As stated above, part of the impetus behind the Sears Tower and Empire State Building retrofits is to provide example projects for other building owners to follow. Not only are managers able to do the environmentally responsible thing through these retrofits, but both projects strive to prove that being environmentally responsible can be profitable. The type of energy efficiency retrofits seen in these two cases have just recently begun to happen in non-owner occupied buildings. With a firm background of commercial real estate and high performance building knowledge, the remainder of this paper will try to understand how energy efficiency retrofits can become more commonplace in the commercial real estate market.

Chapter 3: Methodology

The research focuses on the decision making process for allocating capital to retrofit existing office buildings with energy efficiency upgrades. In order to study this process, the authors devised both a qualitative study and a quantitative model. The qualitative method for analysis consists of interviews of key players in the real estate management value chain to understand both barriers and motivations to implementation. This study is intended to gauge the sentiment of the decision makers in charge of managing real estate to see how they view investments in energy efficiency. The quantitative method consists of a financial model that provides a framework for decision makers to compare investments in various projects. The model is not intended to provide exact returns for each investment. Rather, it is intended to facilitate discussion regarding competing investment alternatives.

3.1 Qualitative Methodology

The purpose of the industry interviews was to better understand the interactions and relationships between real estate managers and the decision-making process behind energy efficiency retrofits of existing commercial buildings. Real estate managers that share decision-making responsibility were selected, which included property managers, asset managers, portfolio managers, and institutional owners. In some cases, these decision makers may be vertically integrated in a single firm or they may a third-party service provider. Whether the decision makers were vertically integrated in one company or contracted as a third party provider, the overall decision-making process was adequately similar to make a comparison.

Selection of Interview Participants

In the commercial real estate industry the three primary categories of building occupancy are government occupied, owner-occupied, and non-owner occupied. This study focused on key decision makers of professionally managed commercial buildings occupied primarily by non-owner occupants.

Companies were selected primarily based on the amount of market share in their respective business. Speaking with some of the largest companies in each business ensured that a larger portion of the total real estate building stock was covered by the interview questions than would have been covered by speaking with smaller companies. Further, firms that have a significant share of their assets in office properties were targeted so that their management experience would be in line with the research topic. Overall nineteen firms participated located in thirteen different cities.

Interviews were primarily conducted with property managers and asset managers, although a few commercial real estate owners were selected because they had vertically integrated real estate management. Table 3.1 below displays the name of the company, location, and title of the person interviewed. Participant names were excluded from the list for anonymity. Overall, twenty seven individuals participated, including nine asset managers (33% of total participants), twelve property managers (44%), three investors (11%), one developer (4%), and two government officials (7%). Interview participants were selected from personal previous industry relationships, relationships of MIT's Center for Real Estate, alumni of MIT, referrals from industry relationships, and random selection. Most of the interviews were conducted on the telephone, with the exception of a few Boston-based companies which occurred at the company place of business. Interviews were pre-scheduled and in some cases the questionnaire was provided ahead of the interview so the participant could better be prepared. In general, most interviews averaged about an hour in length though they ranged from half an hour to two hours.

Table 3.1 List of Interview Participants

Company Name	Interviewee Title	Location
AEW Capital	Asset Management	Boston
AMB	Director of Sustainability	San Francisco
Boston Properties	Engineer	Boston
Boston Properties	Senior Vice President, Property Management	Boston
CB Richard Ellis	Senior Managing Director	Chicago
CB Richard Ellis	Senior Real Estate Manager	Denver
CB Richard Ellis	General Manager	Pasadena, CA
CB Richard Ellis	Associate Director, Asset Services	Phoenix
CB Richard Ellis	Director Asset Services	Pittsburgh
CB Richard Ellis	Director of Operations, Sustainability	San Francisco
Colliers	Director Property Services	Boise
Colony Realty Partners	Asset Management	Boston
Cushman Wakefield	Property Manager	Portland
Cushman Wakefield	Property Management	San Francisco
Grubb & Ellis	Portfolio Manager	Pittsburgh
Hines	Property Manager	San Francisco
INVESCO Real Estate	COO North America Real Estate	Dallas
J.P. Morgan Asset	Vice President, Real Estate	New York City
Jones Lang LaSalle	Property Manager	Boston
MIT Investment	Asset Management	Boston
New Boston Fund	Asset Management	Boston
Ohio STRS	Sr. Asset Management Officer	San Francisco
Principal Real Estate	Senior Asset Manager	Des Moines
Transwestern	Managing Senior Vice President	Dallas
U.S. General Services	Engineer	Washington D.C.
U.S. General Services	Energy Efficiency Group	Washington D.C.
UBS Realty Investors	Asset Management	San Francisco

The authors aimed to spread the interviews geographically across the country to prevent any possible bias towards energy efficiency in any one region. Firms were selected across each region of the United States, including the East Coast, West Coast, Southwest, Midwest, and Mountain states. Despite the geographic diversity of participants, there might be bias in the results because each region was not represented with an equal number of participants. For example, seven individuals from Boston participated and five from San Francisco – both locations considered enthusiastic towards sustainability. It follows that companies in these locations may be biased to sustainability and energy efficiency improvements.

In a few cases the interview participant was a manager of a sustainability group or department within a company. Inherently this may lead to bias towards energy efficiency improvements; however the perspective of the participant was valuable in explaining a particular company's sustainability policy. In general, the sustainability manager was responsible for a company's oversight and marketing of corporate commitment to sustainability. The position is not ubiquitous throughout the real estate industry so a comparison of these interview results across companies is difficult. Further, these same companies are likely to be knowledgeable of energy efficiency improvements and may be more likely to implement these improvements.

The level of decision-making responsibility among interview participants varied widely. Interview participants ranged from a Property Manager up through the Chief Operating Officer responsible for the management of multi-billion dollars of real estate. One potential bias is the level of decision making. For example, a Property Manager is making project-level decisions and a COO may be responsible for strategic management decisions across an entire portfolio. The perspective of each is not always in alignment but each individually offered valuable insight into the decision-making process.

Property Management Companies

According to a report by the National Real Estate Investor, the top twenty-five largest property management companies collectively manage approximately 8.3 Billion square feet of floor space[11] (National Real Estate Investor, 2008). See Appendix 6 for a complete listing of the Top 25 Property Managers and square feet under management. Of the top twenty five companies, we selected six to interview as illustrated in Table 3.2. These six companies collectively manage approximately 4.8 Billion sq ft of commercial property. Each company has a national platform and maintains offices in nearly all major metropolitan markets. Individual property managers were selected throughout these six companies in various geographic regions, including the East coast, West coast, and Midwest markets. Interview participant job responsibilities ranged from individual Property Managers to Senior Managing Directors.

Table 3.2 Participant Property Management Companies by Size

Rank	Property Management Company	Square Feet under Mgmt
1	CB Richard Ellis Group	1,900,000,000
2	Jones Lang LaSalle	1,200,000,000
3	Colliers International	868,000,000
5	Cushman Wakefield	500,000,000
7	Grubb & Ellis	265,600,000
20	Transwestern	124,000,000

(Source: National Real Estate Investor, 2008)

[11] Total property under management includes all commercial product types as well as multi-family residential.

Asset Management Companies

Selection of asset managers was based on the largest real estate investment companies by total asset value under management[12] (Pensions & Investments, 2006). Interviews were conducted at six of the top twenty five companies. A real estate investment management company may manage real estate assets, real estate securities, fund of funds, or other types of real estate investment vehicles; therefore not every real estate investment management company directly manages physical real estate. The authors selected real estate asset managers who have management responsibility for the performance of actual buildings. Companies were selected to provide a geographical range of both management office location and assets under management (AUM). The level of job responsibility of interview participants ranged from Asset Manager to the Chief Operating Officer (COO) of North America. Table 3.3 below is a summary of the companies interviewed and Appendix 5 includes a list of Largest Real Estate Investment Managers.

Table 3.3 Participant Asset Management Companies by Size

Rank	Real Estate Investment Managers	Total Assets Under Mgmt ($)
5	Principal Real Estate	32,511,000,000
6	UBS Global Real Estate	29,396,000,000
7	JP Morgan Asset Management	29,068,000,000
11	INVESCO Real Estate	17,347,000,000
25	AEW Capital	4,855,000,000
26	Colony Realty Partners	4,406,000,000

(Source: Pensions & Investments, 2006)

[12] Companies were ranked by taxable/tax-exempt assets, in millions, as of June 30, 2006.

Commercial Real Estate Owners

The ownership role in commercial real estate includes both passive investment management and active investment management. Owners of real estate were not a primary focus of the research topic. However some of the largest owners of commercial real estate have fully integrated real estate investment management, including portfolio management, asset management, and property management. Accordingly, a number of the largest real estate owners often are included on the list of the largest asset management companies and property management companies. The authors selected four real estate owners, including Hines, Boston Properties, New Boston Fund, and AMB Properties. Each of these firms has some level of vertical integration in either asset management, property management, or both. Additionally, two representatives in the U.S. General Services Administration were selected based on the Federal government being one of the largest property owners in the United States.

Interview Questions

Interview questions were developed to explore the decision making process for capital allocation to energy efficiency retrofits. Questions were designed to look at the incentives and motivations behind a decision to invest in energy efficiency improvements and how these incentives may shape the outcome. The relationship among decision makers was also analyzed. Further, the questions were designed to discover any perceived or real barriers in making the decision to invest in energy efficiency improvements.

Questions were tailored to the level of decision making responsibility for each group. As an example, a property manager was asked about specific improvements made at a property and an asset manager was asked about capital budget allocation to a portfolio of properties. Furthermore, within an organization, questions were tailored to specific level of responsibility: for instance, a different set of questions was asked for a firm-level manager of property managers and another set was asked for property-level property managers. See Appendix 1 for the interview questions.

3.2 Quantitative Methodology

Any real estate manager tasked with operating a building is focused on maximizing the Net Operating Income (NOI) of that building. Net Operating Income is essentially Gross Rental Revenues less Operating Expenses. Real estate managers focus on both sides of the equation by increasing Net Operating Income through increases to Gross Rental Revenues or decreases to Operating Expenses. There is a trend within the real estate industry for managers to focus on Gross Rental Revenue as a means to increase NOI. However, decreases to the Operating Expenses of a building may also create significant value. The following is a methodology whereby real estate managers can evaluate competing investment alternatives, including those that increase rental revenue and those that decrease expenses.

One of the biggest factors affecting investment in energy efficiency upgrades is the initial capital required to implement an upgrade. As previously discussed real estate managers may have conflicting goals for investment capital. For example, a portfolio manager may be motivated to keep the volatility of his portfolio to a minimum, which results in keeping major capital outlays to a minimum. Meanwhile, a property manager is motivated to increase operational efficiency, which may involve significant capital improvements. The objective of the methodology is to apply return metrics that various real estate managers in the value chain use to analyze an investment, and develop a model to analyze the impact of that investment to cash flow and capital appreciation. The sensitivities of those returns will also be analyzed by establishing upper and lower boundary limits and running several permutations.

The intention of the financial model is not to produce precise return estimates for various capital improvement projects. The model is based on a fictitious suburban office building and uses industry averages for inputs. The purpose of the model is to provide a framework to analyze various potential investments and compare the order of magnitude of the various returns. The results will inform a discussion regarding cosmetic versus energy efficient capital expenditures.

Financial Model

The financial model consists of a basic set of facts and figures regarding a fictitious building. These figures are then compiled to produce a "Base Case" ten year pro forma detailing cash flows for this building. The authors then make a hypothetical capital investment of $200,000 in the building. This investment can either be in the form of a cosmetic upgrade (e.g. remodeling a lobby) or an energy efficient upgrade (e.g. retrofitting all of the light fixtures). Several permutations of each investment and the effect to cash flow are examined through a sensitivity analysis. Comparing the amount of the initial investment with the change in cash flow and capital appreciation will reveal the order of magnitude of returns provided by each investment.

Return Metrics

The following are return metrics common to the real estate industry. The financial model will incorporate many of these metrics to reach the broadest audience of real estate professionals.

Simple Payback Period

The simple payback period of an investment is the amount of time that the returns from the investment take to payback the initial cost of the investment. A basic example would be a $100 investment that pays $25 per year. In this case, the simple payback period is four years, and the discounted payback period would be slightly less (since the value of future cash flows is discounted using a market discount rate).

Net Operating Income (NOI) Increase

The reason for making a capital investment in a building is to increase the Net Operating Income created by that building. By analyzing the upfront investment in comparison to the annual increase in NOI, decision makers can decide if the investment will meet their return criteria. Further, dividing the increased NOI by a capitalization rate determines how much an investment adds to the total value of a property.

Internal Rate of Return

The Internal Rate of Return (IRR) is the discount rate established by an organization as the threshold for which an investment is considered economically viable. It is calculated using the value of future cash flows in an investment where the Net Present Value is greater than or equal to zero. It can also be thought of as the annual compounded rate of return one can expect on an initial investment.

Net Present Value

The Net Present Value (NPV) of an investment is the sum of all future cash flows from an investment discounted back to the time of the initial investment. The discount rate should be equal to the rate of return that could be achieved in an alternate investment with similar risk characteristics.

Key Assumptions

- **Fictitious Building:** The facts and figures used in the model are rough estimates for an average suburban office building located in the U.S. The building is fictitious and not based on any actual project.

- **No Financing:** It is assumed that the upfront cost for the capital investment will be paid by the property owner out of a cash reserve. This simplification removes the question of the costs to borrow capital. Additionally, no interest is charged to the tenant for any improvements that are being billed to the tenant.

- **Employee Productivity:** In predicting the effects of various investments, it is assumed that none of the investment alternatives will affect employee productivity either positively or negatively. Measuring productivity or changes to productivity is beyond the scope of this paper.

- **Lease Type:** The leases in the model are assumed to be a Modified Gross lease with a Base Year Stop. This means that "the tenant agrees to pay all Operating Expenses above a specified annual level known as the "stop"(David, Miller, Clayton, & Eichholtz, 2001, p. 809). For example, if a tenant's lease specifies gross rent of $20.00 per square foot (psf) with a $5.00 psf Base Year Stop, the landlord is agreeing to pay for the first $5.00 psf worth of Operating Expenses, which may include water, electricity, solid waste, property insurance, real estate taxes, property management fees, and other general property Operating Expenses. If the expenses were to rise to $5.50 psf in year two, the landlord would pay the first $5.00 psf and the tenant would pay the extra $0.50 psf.

- **Expense Reductions:** If the Operating Expenses in any one year decrease below the Base Year Stop, depending on the lease structure the landlord may keep all or some of the savings. Using the example above, if the expenses decrease to $4.50 psf, the landlord only pays $4.50 psf and the tenant does not share in the $0.50 psf savings. The tenant is still responsible for paying the entire $20.00 psf gross rent.

- **Base Year Reset:** It is assumed that when a tenant renews their lease, their Base Year Stop resets to the current year's actual Operating Expenses. Additionally, when a new tenant signs a new lease, their Base Year Stop is also set at the current year's actual expenses. These two actions simplify the model so that whenever a lease is expired, the Base Year Stop for that space will always reset to the current year's expenses.

- **Lease Expiration:** For simplification, the model assumes five tenants of equal size. Lease expirations are as follows: two tenants' leases expire in Year 2 of the analysis, three more tenants' leases expire in Year 3, and one tenant's lease expires in Year 5. The tenant with the lease expiration in Year 5 is assumed to have signed a three-year lease in Year 2. The tenant expiration is staggered to show the effect of investment in the property with varying rollover percentages.

- **Lease Term:** Four leases are assumed to be 5 year leases and one lease is assumed to be a 3 year lease for the reason stated above.

General "Base Case" Proforma Assumptions

The Base Case Proforma assumes a suburban office building using national averages for revenues and expenses published by the Institute of Real Estate Management (IREM). The averages reported to IREM are based on a detailed survey compiled from the responses of real estate managers from 1,799 properties throughout the United States (IREM, 2007). Table 3.4 below shows a summary of the averages for all U.S. Suburban Office Buildings in 2006.

Table 3.4 Average U.S. Suburban Office Building Revenue & Expense (2004-2006)

Suburban Office Building (2006)			
	Total $ PSF	**Percentage Change 2005-2006**	**Percentage of Total Operating Costs**
Total Collections	$19.43	2.50%	
Utilities	$1.96	5.40%	23.60%
Janitorial/Maintenance	$2.11	2.90%	25.40%
Admin/Benefits	$1.08	-3.60%	13.00%
Insurance Services	$1.04	-1.90%	12.50%
Net Operating Costs	$6.02	2.90%	
R.E. / Other Taxes	$1.90	4.40%	22.90%
Total Operating Costs	$8.30	3.50%	
Occupancy Levels	95.00%	0.00%	
Operating Ratio	0.43		2006
U.S. Median Management Fee			3.24%
Source: IREM Median Income & Expenses (2004-2006)			

The IREM average for U.S. suburban office buildings is used as the basis for the financial analysis model outlined in this section. The national average is used to limit bias in the results that might exist if a single market average was used (e.g. Boston, Atlanta, etc). Table 3.5 below shows the financial model input assumptions for the Base Case Proforma, followed by a description of each input.

Table 3.5 Base Case Proforma Input Assumptions

Input Assumptions	
Gross Rentable Office Area	100,000
Average Tenant Size	20,000
Average Suburban Office Rent	$19.43
Average Sub Op Expense	$8.30
Op Expense Growth	3.50%
Rent Growth	2.50%
Reversion Cap Rate	9.00%
Tenant Renewal Probability	75.00%
Absorption (Mos)	6

Building Size

The financial model assumes a suburban office building with 100,000 sq ft gross rentable office area as a representation of the average professionally managed suburban office building. According to a report by IREM Median Income and Expenses (2004-2006) published in 2007 the average suburban commercial office building was approximately 140,000 sq ft.

Average Tenant Size

The average size of the tenant is 20,000 sq ft or 20% of the building. This standardized tenant size allowed for simplistic financial modeling of tenant rollover of 20%, 40%, and 60%.

Average Suburban Office Rent

Data selected from the 2007 report IREM Median Income and Expenses (2004-2006).

Average Suburban Operating Expense

Data selected from the 2007 report IREM Median Income and Expenses (2004-2006). Individual line item expenses, with the exception of utilities, are ignored in the financial model for simplicity.

Operating Expense Growth

Data selected from the 2007 report IREM Median Income and Expenses (2004-2006). An Operating Expense growth of 2% to 3% is common industry practice for commercial real estate financial underwriting.

Rent Growth

Data selected from the 2007 report IREM Median Income and Expenses (2004-2006). Rental rate growth of 2% to 4% is common industry practice for commercial real estate financial underwriting.

Cap Rate

A cap rate of 9% was arbitrarily chosen. Given the current market conditions at the time of this paper, there is almost no investment sales activity to establish a market cap rate assumption. The cap rate remains fixed for all scenario analysis.

Tenant Renewal Probability

The tenant renewal probability refers to the likelihood an existing tenant would renew a lease in the building at lease expiration. The selection of a 75% probability is common to commercial real estate financial underwriting.

Absorption

The absorption period is the number of months an office suite may sit vacant from the time an existing tenant lease expires and a new tenant lease starts. It represents the lost revenue to the landlord and is often referred to as “downtime” throughout the commercial real estate industry. Assuming a normal real estate market cycle, six months absorption is common to commercial real estate financial underwriting.

Using the above assumptions, the first year's Base Case cash flow is as follows:

Table 3.6 Base Case Proforma Year 1 Cash Flow

		Year 1
Gross Rental Revenues	$	1,943,000
Less Vacancy & Absorption	$	-
Plus Expense Reimbursements	$	29,050
Effective Gross Income	$	1,972,050
Total Operating Expenses	$	(859,050)
Net Operating Income	$	1,113,000

The ten year Base Case Proforma is available in Appendix 7.

Capital Investment

The Base Case Proforma is used to analyze the impact of a capital investment to the Net Operating Income and capital appreciation of the building. Two types of capital investments are analyzed: a cosmetic improvement and an energy efficiency improvement. For comparison, either improvement project is assumed to cost $200,000. Any impact to the financial model is realized in the year following the improvement project. Conventionally, the deployment of capital and completion of a project is assumed to take one full year. For example, an improvement project in time period Year 0 does not have any measurable effect on rental revenue or expenses until time period Year 1. Sensitivity analysis is run on different permutations for both a cosmetic improvement and an energy efficiency improvement.

Cosmetic Improvement

An investment of $200,000 in a cosmetic improvement is assumed for the building. The cosmetic improvement is assumed to raise the aesthetic quality of the building and could include projects like a lobby upgrade, bathroom renovation, landscaping, or a mixture of these and various other projects. The purpose of the improvement is to increase the gross income generated by the building. In practice many of these improvements are made to either raise the building to a market standard or prevent the building from market obsolescence. The decision may also be made to reposition a building within a market. Gross income could increase as a result of the following three scenarios:

1. *Increased Average Rent.* The cosmetic improvement raises the quality of the building and increases the achievable rents for the building.

2. *Increased Renewal Probability*. The improvement increases the probability that an existing tenant will renew a lease upon expiration.

3. *Decreased Absorption Period*. The improvement is expected to enhance the aesthetic quality of the building thereby making it more attractive to a prospective new tenant. The effect is a decrease in absorption time.

A sensitivity analysis was run with three permutations to average rent, tenant renewal probability, and absorption. The model assumes that both renewal probability and absorption behave in tandem: if lease renewal probability of an existing tenant increases the same attributes of the building may also decrease the absorption time for a new tenant to sign a lease. The effect of the increase to the average office rent in the building is assumed to raise the rent in the building into the future years of the cash flow. Table 3.7 below shows the inputs used to perform the sensitivity analysis for Scenario 1 where the $200,000 investment leads to increases of the average rent.

Table 3.7 Permutations for Rent Increase Scenario

Scenario 1	**Percentage Rent Increase**	**$ PSF Increase**
Permutation 1	0.83%	$ 0.25
Permutation 2	1.67%	$ 0.50
Permutation 3	2.50%	$ 0.75

Table 3.8 below shows the inputs for Scenario 2 where the $200,000 investment is assumed to increase the renewal probability and decrease the absorption period in tandem.

Table 3.8 Permutations for Lease-up Improved Scenario

Scenario 2	**Renewal Probability**	**Absorption Period**
Permutation 1	80.00%	5
Permutation 2	85.00%	4
Permutation 3	90.00%	3

Energy Efficiency Improvement

There are many possible energy efficiency projects including, but not limited to, building commissioning, lighting retrofits, and HVAC mechanical retrofits, among others. The financial model assumes the landlord spends $200,000 in energy efficiency retrofits to decrease the energy consumption of the building. For simplicity, the building is assumed to consume only electricity as the primary source of energy (e.g. no natural gas, distributed steam, etc.)

Rather than choose one particular energy efficiency project, the author assumes the integrated design approach using the Empire State Building as a case study. In the Empire State Building retrofit project the landlord is budgeting $13.2 million to reduce overall energy consumption by 38% and expects a 3 year simple payback. Electricity consumption for the subject building used in the Base Case financial model is assumed to be 15.7 kWh, based on the average consumption for a suburban office building published by the U.S. Energy Information Administration (EIA, 2006). Further, the model assumes the average commercial price of electricity to be $0.106 / kWh (DOE, 2008). The electricity cost and consumption for the subject building is summarized in Table 3.9 below. Using the Empire State Building assumption of an electricity use decrease of 38%, the adjusted annual energy consumption for the subject building after the retrofit is 9.73 kWh. At the stated electricity cost of $0.106 / kWh, the electricity bill for the subject building before the retrofit is approximately $166,000 ($1.66 psf) and after the retrofit is $103,000 ($1.03 psf). The savings of the energy retrofit is approximately $0.63 psf per year. Assuming a 3 year payback period as seen in the Empire State Building case, the total cost of the project for the subject building would be approximately $1.90 PSF. For simplicity, the financial model assumes a $2.00 psf or a $200,000 capital investment in an energy efficiency retrofit.

Table 3.9 Building Energy Assumptions

Electricity Consumption (kWh)	15.7
Electricity Price (price per kWh)	0.106
Electricity Price Annual Growth	2.55%

Electricity Consumption

Data selected from the 2003 Commercial Building Energy Consumption Survey (CBECS) reported to be the national average for a suburban office building (EIA, 2006).

Electricity Price

Data selected from the U.S. DOE 2008 Building Energy Data Book reported to be the national average price for commercial electricity (DOE, 2008).

Electricity Price Annual Growth

U.S. average commercial electricity price data provided by the Energy Information Agency was analyzed between 1997 and 2006. Over that time period, the average annual electricity rate increase was 2.55%.

The following scenarios demonstrate the ways in which an investment in energy efficiency projects could reduce a building's Operating Expenses:

1. *Electricity Consumption Decrease.* The energy efficiency improvement is expected to decrease electricity consumption below the 15.70 kWh in the Base Case. The energy reduction is realized in the cash flow in the year following the improvement (e.g. if the improvement is made in Yr 0 the decrease is in Yr 1).

2. *Rebates.* Utility companies, in addition to many local, state, and Federal government agencies, offer rebates to building owners that reduce electricity consumption. These rebates typically cover a portion of the upfront retrofit cost. In this model, rebates of $.60 psf, $1.20 psf, and $1.80 psf are analyzed according to recommendations from industry participants.

The model ignores any effect on Gross Revenue that may result from an energy efficiency improvement. There is considerable talk in the industry about a "green" premium in rental rates between a high performance building (in this case LEED certified or ENERGY STAR rated) and an office building not rated to be high performance. The result of these reports is the topic of much discussion in the real estate industry, and outside the scope of this paper.

A sensitivity analysis was run to the energy efficiency improvement using three different permutations. As discussed in Chapter 2, the performance of the energy efficiency improvement does not always align with the original design specification. The sensitivity analysis tests an energy efficiency improvement at various performance levels. The baseline energy reduction used in the analysis is 30%, a slight adjustment downward from the assumed 38% of the Empire State Building retrofit. Table 3.10 below shows the inputs used to perform the sensitivity analysis.

Table 3.10 Permutations for Energy Efficiency Scenario

Scenario 3	**Electricity Expense Decrease**	**First Year Decrease Op Expense PSF**
Permutation 1	25.00%	$ 0.44
Permutation 2	30.00%	$ 0.53
Permutation 3	35.00%	$ 0.61

Scenario Comparisons

The objective of the model is to show relative changes in payback period, internal rate of return resulting from a change to Net Operating Income, and the net present value of each project. Each scenario will be evaluated on the basis of a complete 10 year proforma. Further, it is intended to demonstrate the ways in which each investment affects the return metrics. A summary table and bar graph will be presented that demonstrate the results of the analysis. The outcome of the analysis will allow decision makers to see the order of magnitude of the returns that they can expect to receive from one investment versus another alternate investment.

Chapter 4: Results

4.1 Interview Results

The primary purpose of this paper is to analyze from a managerial perspective how capital allocation decisions are made. Specifically, energy efficiency as a capital improvement project was studied. After conducting 27 interviews with decision makers in property management and asset management companies, many trends regarding energy efficiency improvements become apparent. These trends are analyzed by topic rather than by type of business, individual roles within a company, or by question asked. By grouping the topics together, the salient trends in managerial thinking become apparent. First, the authors examine the reasons behind making investments in energy efficiency; from the person driving the process to the companies' motivations behind initiating the process. Second, is a broad look both at corporate sustainability initiatives that are present throughout the industry and how various corporations are reacting to government sustainability initiatives. Next, the authors analyze the substantive metrics that firms use to choose between various capital improvement projects and the way in which firms prioritize which projects to complete. Finally, these results conclude with a macro look at how the cyclicality of real estate and the structure of the real estate industry both advance and hinder investments in energy efficiency improvements.

The focus of this paper is on energy efficiency improvements. However, a vast majority of interview participants are focused on LEED certification as one metric to measure the overall efficiency of a particular building. Participants, therefore, used the term "sustainability" and "energy efficiency" interchangeably. In an effort to be consistent with interview responses, these two terms are used interchangeably throughout the discussion below.

Table 4.1 Summary of Interviews

Interview Results Summary	
Category	**Key Points**
Drivers of Energy Efficiency Projects	**Visibility** Large tenants and large owners with high public visibility are most interested in sustainability. Larger companies are more likely to have the available capital to invest in energy efficiency projects. **Geography** Attitudes vary depending on location. The coastal cities report much more focus on energy efficiency than central cities.
Motivations Behind Energy Efficiency Projects	**Economics** Projects must show a positive financial return or they will not be implemented. **Market Advantage** Property managers can use their expertise in energy efficiency to win new clients (both in property management and sustainability consulting). **Shifting Class Standard** Class A buildings are almost expected to have efficienct lighting and automatic faucets. These improvements are partially motivated by economics and partially by cosmetics. Efficiency improvements indicate to potential purchasers and tenants that a building is well-managed.
Coporate Policies	**Benchmarking** Over half of companies have a sustainability policy. Most are benchmarking every building to Energy Star. **Compensation** Most companies do not tie compensation to energy efficiency. Property managers are expected to focus on efficiencies as part of their job.
Government Policies	**Lack of Awareness** Few companies are preparing their buildings to be in compliance with government energy efficiency regulations.

Interview Results Summary	
Category	**Key Points**
Value of Energy Efficiency	**Payback Period** After implementing no-cost strategies, managers evaluate expenditures based on a payback period. Acceptable payback is 2-3 years. Government, owner-occupiers, and owners with longer hold periods will accept slightly longer payback periods. **Effect of Lease Structure** Owner is much more likely to make investments if the leases are Gross or Modified Gross and the landlord can capture much of the savings from energy efficiency. Many leases allow landlord to amortize the cost of improvements back to tenants. This helps increase landlords return on investment. **Rebates** Many states and municipalities provide rebates to help pay for energy efficiency improvements.
Capital Allocation Decision	**Priorities** Top priority is always life safety and required code issues. Second is tenant retention which usually consists of "front of the house" cosmetic improvements rather than "back of the house" energy efficiency.
Real Estate Cycle	**Decreased Investment** When the market is in decline, there is less capital in general to spend on energy efficiency projects. Companies are preserving what capital they have available.
Industry Structure	**Fund Structure** Opportunistic funds are focused on minimizing capital investment and selling quickly. They have shorter hold periods and a higher cost of capital. Core funds are more willing to invest capital due to their longer hold period and lower cost of capital. **Reporting Period** Fund managers report returns on monthly or quarterly basis. They are motivated to keep large investments and return volatility low. **Lack of Education/Belief** Managers either have not seen studies showing that energy efficiency makes economic sense or are not convinced by these studies. Time will tell if the technologies pay off.

4.1.1 Drivers of Energy Efficiency Improvement Retrofits (Sustainability)

One recurring theme with energy efficiency retrofits was that these improvements are driven by the most visible players in the real estate industry, primarily corporate tenants and institutional real estate investors. Most of the interviewed property managers reported that high profile tenants, such as large corporations or Fortune 500 companies, are more likely to request sustainability features in a building that they are considering to lease. Public corporations publish annual reports that are scoured by both industry analysts and shareholders. These reports often include a section on corporate responsibility, including a commitment to sustainable business practices. Some companies herald the selection of sustainable real estate as a visible commitment to their constituents. In contrast, property managers reported that less-visible, smaller tenants focus on total occupancy cost first and sustainability may not even be a consideration.

Large institutional real estate owners are likewise very visible companies to the investment community. Many investment managers reported a growing number of investors – albeit small in number – are enquiring about corporate sustainability policy, including investment and management of sustainable buildings. The Director of Sustainability for a large REIT described how some potential investors request the company to fill out a 'sustainability policy survey.' To facilitate raising capital from these investors, fund managers may have an incentive to invest in energy efficiency.

Aside from being a marketing tool for large, high-profile companies, these same companies are more likely to have capital available to invest in energy efficiency. In discussing the impact of the current economic crisis on energy efficiency investments, one astute asset manager pointed out, "In this economy, the little guys are just trying to hold on". This person recognized that smaller investors likely did not have the excess capital available to invest, while some larger, well-capitalized firms were able to continue making investments as long as they created value.

Geography also appears to plays a significant role in both the industry awareness of sustainable real estate management practices and a manager's willingness to invest in energy efficiency projects. Interview participants in San Francisco and Boston, cities known to be extremely environmentally conscious, were near unanimous in stating that improving energy efficiency in existing buildings was a major driver in their real estate markets. These participants stated that tenants, investors, and potential purchasers alike are asking about the energy performance of a building. Some tenants in these coastal markets are inserting clauses into Request for Proposals that address the property's sustainability program. One asset manager summarized such language: "What green features exist in this building? If none, what green features are planned for this building?" In contrast, participants managing assets in markets such as Dallas, Denver, and Houston stated that the environmental impact of a building was not a frequent request by existing or new tenants.

4.1.2 Motivations Behind Energy Efficiency Improvements

Financial consideration was the primary factor affecting capital allocation to energy efficiency improvements. As expected with any investment, the interview responses indicate that if it makes sense from an economic perspective and capital is available, then managers will allocate money to the investment. Likewise, some property managers reported that tenants are willing to spend money on their own space if the improvements pay for themselves during the term of their lease. Similarly, property owners are willing to invest in energy efficiency if they are able to recover these initial costs and make a suitable return on investment. Other factors influencing the financial decision include average hold period, cost of capital, and expected return on investment. These additional factors will be examined in greater detail below.

Property managers stated several non-financial motivations towards energy efficiency improvements. As a service provider, more than one property manager stated that increasing their knowledge of energy efficiency was a strategic move to win business. One poignant example consisted of a property manager buying a half page advertisement in the local newspaper touting the energy expense reductions he had created for property owners. Further, some management firms not only use their knowledge to win property management contracts, but also to win consulting contracts. Most institutional owners do not have the specialized staff in place to implement complicated projects, including the certification process for LEED-Existing Building Operations and Maintenance (EBOM). One property management firm is capitalizing on the consulting fees for taking a building through the LEED certification process - which can be quite lucrative. The same firm was in favor of the various Federal, state, and local government initiatives on energy efficiency requirements[13] because these regulations may increase the firm's consulting business. Other property management firms considered the efficient management of a building merely as a "service" to their clients – something a good manager should be doing anyway.

Energy efficiency improvements are not only considered as a way to decrease Operating Expenses, but also as a way to differentiate one building from others. Multiple managers stated that energy efficient features are part of a new shifting class standard for Class A buildings. For example, a restroom that does not have automatic toilets, faucets, and paper towel dispensers may appear outdated compared to a similar building with these features. Likewise, energy-conscious tenants on a property tour look for an updated ceiling grid with efficient lighting compared to older, outdated lighting. Understood in this context, energy and water efficient features become tangible, visible qualities of a building.

An efficient building may also be a market signal to tenants and prospective buyers of competent asset management. As one interviewee put it, "any good property manager should be on top of it." This was a recurring theme as managers involved in acquiring properties expressed that they may be more cautious purchasing a property lacking energy efficient retrofits. Not only was this a signal that there may be significant capital costs to upgrade the building after the acquisition, but may indicate the previous owner likely either did not have enough capital to properly maintain the property or was simply inexperienced.

Several managers shared stories of tangential benefits to making energy efficiency improvements. In one example a property manager changed out inefficient fans in the HVAC

[13] For an overview of recent U.S. Government federal requirements for energy efficiency please refer to Chapter 2 of this report.

distribution for smaller more efficient fans. The newer fans were quieter and tenants were pleased with the decrease in noise level. Another property manager switched the janitorial service to a daytime cleaning schedule. Not only did this save energy from needing to light the building at night, but tenants were able to request specific cleaning assignments and monitor quality. One astute manager commented that energy efficiency retrofits of mechanical equipment before the end of the expected useful life may very well avert a crisis before the system does fail. This is contrary to much of the current ownership mentality which is "if it ain't broke, don't fix it."

4.1.3 Corporate Policy Regarding Energy Efficiency

Recent corporate marketing campaigns tout sustainability initiatives. Such campaigns include oil companies highlighting their investments in renewable energy or automobile manufacturers calling themselves the "green" car company. As part of the interview process, the authors aimed to discover how much of this sustainability mindset had permeated into commercial real estate. Questions included specifics of a company's corporate policy and how the company ensured the policy was followed.

More than half of the companies interviewed claimed an official corporate sustainability policy that ranged from energy consumption reductions in buildings to recycling programs or printing on both sides of a sheet of paper. The most common stated policy is to benchmark managed buildings with ENERGY STAR Portfolio Manager. Then, upon obtaining an ENERGY STAR score, many companies will perform a LEED gap analysis to determine the feasibility of upgrades that could lead to the LEED EBOM certification. However, several managers cautioned that chasing LEED certification may be a detractor to the real estate industry from making significant energy specific improvements. The reasoning was that firms were spending money on LEED consultants that otherwise could have been spent on efficiency upgrades.

Some companies are very serious about their corporate policy while others are merely trying to keep up with peers. For example, one large property management company has a ten point sustainability checklist that every manager is to implement at each property (see Appendix 3). In contrast, other firms only recently issued the directive to establish an ENERGY STAR benchmark for every building within the past few months.

Despite the laudable efforts of a sustainability program, execution and implementation are not without challenge. One national property manager stated that often a corporate initiative distributed by senior management went straight to the bottom of the proverbial "inbox". Other property managers considered energy efficiency and sustainability his or her personal responsibility to educate both owners and tenants. Only one company interviewed ties a small portion of an employee's annual bonus to sustainability. When others companies were asked why there is no compensation tied directly to a property manager's energy efficiency performance, the majority of respondents simply stated that it is a property manager's job to keep Operating Expenses low. Further, a number of respondents reported that since so much of a building's performance is beyond the property manager's control, it would be unfair to tie compensation to energy efficiency. For example, a property manager cannot be faulted for having an inefficient HVAC system if the owner refuses to allocate capital to upgrading the HVAC. The result is that compensation tied to efficiency or sustainable management cannot be uniformly applied across all property managers and effectively implemented company wide.

4.1.4 Government Policy Regarding Energy Efficiency Improvements

Interview participants were also asked about the increasing number of Federal, state, and local government regulations on energy efficiency requirements in buildings. Less than half of all respondents stated they are current on these regulations. Of those that are aware, they are paying close attention to government policies regarding energy efficiency. They are well aware that the government has specific requirements regarding energy use reduction, but they are also realistic about just how much effect these regulations can have. One government employee explained that “there’s the law, and then there’s what actually happens” when describing that the government ideally wants an energy efficient building, but that desire is not a reality in all markets. He further implied that in smaller markets without any buildings that meet the government regulations regarding energy use, the government is likely to still sign a lease. For this reason, the responses indicated that government regulations are a tertiary consideration behind economics and corporate policy.

4.1.5 Valuing Energy Efficiency Improvements

Nearly every asset and portfolio manager stated that if a capital improvement was accretive to asset value, they would make the investment. Part of the interview process was a survey of the metrics that managers use to gauge if a project makes ‘economic sense’.

Most interviewees described a number of operational changes that require no cost and thus do not require a return metric. As previously discussed, shifting the janitorial staff to clean during the day rather than late at night can save hours of lighting use. Alternatively, if tenants do not like daytime cleaning, another solution is to have the janitorial staff work as a team and move through one floor at a time, preventing the whole building being lit during cleaning hours. Another no-cost efficiency improvement is to decrease the hours when the air conditioning operates on weekends. One participant noted a drastic decrease in energy costs after reducing air conditioning hours to just Saturday morning rather than a full day on Saturday – proudly noting that “not one tenant” issued a complaint about the change.

When it came to actual financial metrics that were used to analyze potential energy efficiency improvements, the interviewees were unanimous in citing payback period as the most important factor. A hypothetical example to illustrate payback period is a $100 investment that saves $25 per year in energy expenditure. In this example the payback period would be four years since that is how long it takes the savings to match the initial cost. It is also interesting to note that the vast majority of participants cited a payback period hurdle of 2-3 years maximum. If an energy efficiency project takes more than 2-3 years to payback, it will likely not be implemented. When pressed on the issue of calculating a payback period, nearly all respondents said that they just use a simple payback analysis such as the example above. However, this type of simple payback analysis, which excludes the time value of money, actually over estimates the payback period. A discounted payback analysis, which takes into account the time value of money and is slightly more complicated, would be more accurate and decrease the time required to recoup the initial investment.

There were two notable exceptions to the payback rule of 2-3 years. First was the General Services Administration (GSA) which owns many Federal Government facilities. According to a GSA interviewee, the GSA can receive funding to implement projects with a payback of up to 10 years. This period can be extended to 15 years in the case of renewable energy projects, such as solar photovoltaic, wind, or geo-thermal. The other exception is a REIT which invests solely in core assets and has a hold period of 7-10 years. One group stated that they could consider payback periods of up to 4-5 years. The common thread with these exceptions is the extended hold period in comparison to most of the other interviewees.

Besides making a return on capital invested, there were various other reasons for a manager to invest in energy efficiency. One property manager with a national REIT stated that some improvements may provide opportunities to reduce staff through automation of security and energy management systems. In fact, this group had a central control room that allowed just one person to monitor an entire portfolio of buildings. Though overhead reductions are not typically included when analyzing energy efficiency investments, they make for an interesting ancillary benefit to the property owner.

The structure of the lease between tenants and landlords also has a large effect on whether or not investment in energy efficiency was made. Not only do leases dictate who is to benefit from a reduction in energy costs, but they also dictate who pays the initial cost. Lease structures range from gross leases where the landlord pays all expenses to triple net (or NNN) where the tenant pays all expenses. A modified gross lease, where the landlord pays all expenses up to an expense stop, with the tenant paying any expenses above the expense stop, falls between the previous two structures. The leases in place were considered a major factor in whether or not a landlord is willing to make investments in energy efficiency. In the case of a gross lease, the landlord is more likely to make the investment because the landlord may capture energy savings. In a NNN lease, the landlord is very unlikely to make an energy efficient improvement because they would be paying for the improvement but the tenant would be realizing any savings.

Most interviewees stated that the leases in their office buildings are modified gross leases with an expense stop. As a result, managers analyze tenant rollover in the property to evaluate when to make investments in energy efficiency. If there is significant upcoming rollover, the landlord may take the opportunity to reduce energy expenses thereby reducing the expense stop for any new leases or lease renewals. A lower expense for the building flows through to a higher Net Operating Income and greater capitalization of the income at property disposition. This concept will be explored in greater detail in the quantitative results section of this paper.

Many leases also allow the landlord to amortize the cost of capital improvements to the tenant, provided that the capital improvements have a direct positive impact to the tenant through the reduction of Operating Expenses. This lease clause may apply to energy efficiency improvements if the tenant’s energy costs decrease as a result of the improvement. While the interviewees were split on whether to amortize the cost of the improvement over the life of the lease or the payback period of the improvement, they all confirmed that getting the tenant to share in the cost of any improvements helped make the decision to invest in energy efficiency easier. The following is sample language that explains how a landlord can amortize the cost of improvements to a tenant:

> *Amortization of the cost of capital investment items which are installed primarily to reduce Operating Expenses for the benefit of all of the Project's tenants or which may be required by any governmental authority. All such costs, including interest costs, shall be amortized over the reasonable life of the capital investment items, with the reasonable life and amortization schedule being determined by Landlord according to generally*

> *accepted accounting principles, but in no event to extend beyond the reasonable useful life of the Building.*

In recent years local utility companies and municipalities have been offering rebates to building owners that make energy efficiency improvements to their properties. The presence of rebates was frequently cited as a major financial consideration when deciding whether or not to make investments in energy efficiency. One national manager stated that they would make investments in renewable energy (mostly photovoltaic), but that these investments were being made only in states that provided rebates. Along similar lines, a Director at a property management firm illustrated this point with a lighting retrofit project that cost $1.80 psf but was more than paid for by $2.00 psf in rebates.

4.1.6 Capital Allocation Decision Making Process

A significant focus of the interviews was to analyze how property managers, asset managers, and owners select among competing capital improvement projects. Interviewees were asked to rank order their priorities when setting a capital budget each year. The unanimous top priority was any life safety issue or code compliance. Cosmetic improvements that were thought to increase building occupancy were the next priority, followed by investments in energy efficiency. As has been discussed, many participants felt that in the difficult economy seen today, getting and retaining tenants would be much more important than investments in energy efficiency.

Similarly, respondents prioritized capital expenditure, in part, on the timing of the disposition. If an owner felt that they would either recoup the cost or be forced to reduce the sales price at disposition, they were more willing to spend money on energy efficiency, such as a new, efficient boiler.

The structure of the investment vehicle, whether it was a single asset account, pooled fund, or REIT was also a factor in energy efficiency improvements was another consideration. The managers of opportunity funds stated that since their cost of capital was so high, the time value of money has an impact on the decision. A simple present value calculation will show that spending a dollar tomorrow is preferable to spending a dollar today. As a result, short term fund managers indicated they might try to push any major capital investments into the future. One manager of a value-add fund explained this concept quite succinctly: "If my hurdle rate is 20% [per year], I'm not going to spend $500,000 to upgrade the building unless somebody will pay me $600,000 for that upgrade when I sell the building next year".

Other factors influencing capital allocation were asset quality and market position. If an asset was seen to be of a lesser image in the market, capital was allocated to improving the aesthetic appeal of the building, or the "front-of-the-house" improvements. Energy efficiency improvements, with the exception of a few regional markets, are by and large "back-of-the-house" expenditures which often take a second position in capital planning. Further, several property managers stated that many buildings lack the structural or mechanical qualities to realize significant value from efficiency improvements. Many owners simply do not have the capital to make the necessary improvements to these buildings. For one property manager, 80% of his buildings had energy efficiency improvements of some kind, while the remaining 20% of owners had no available capital.

4.1.7 Real Estate Cycle Impact

The real estate industry is marked by good times consisting of high sales prices and low cap rates to bad times of depreciating assets and lack of financing. At the time of this research, the real estate market is experiencing an almost unprecedented downturn. Interviewees were unanimous in stating that the down market is having an effect on investments in energy efficiency and sustainability. However, interviewees differed on the direction of that effect. The majority of participants stated that investments in energy efficiency have decreased substantially in the current market. The reasoning behind this decrease is that when the economy is bad, real estate managers focus on preserving cash flow and retaining current tenants. The expenditures that typically attract tenants are cosmetic upgrades and generous tenant improvement allowances, rather than energy efficiency improvements. On a day when layoffs were occurring at his firm, a Managing Director summed up the feelings of most interview participants with the following paraphrased comment: “in today’s economy my choice is between saving jobs or changing the light bulbs. I’d rather save jobs”.

Contrasting this point of view, however, several interviewees noted that the down market has essentially frozen real estate transactions. With no market to sell their real estate assets, fund managers commented that average hold periods for properties are lengthening, rather than retaining the shorter hold period seen when markets are hot. Due to the longer hold period, some fund managers are turning to investment in energy efficient projects to create long-term value rather than the opportunistic flipping of properties common in a hot market. The effect of hold period on energy efficiency investments will be explored further below.

4.1.8 Industry Structure

The financial structure of a real estate investment has a pronounced effect on capital expenditure in energy efficiency improvements. There are a number of financial instruments today to invest in real estate, including but not limited to single asset investment, fund investment, or REIT investment. Many of the interviewees own or manage real estate in a real estate investment fund. As described previously in the paper, investment funds are categorically described as either “core funds”, which have longer hold periods of 7-10 years and invest in strong, Class A office properties, or “opportunity funds”, also known as “value-add funds”, which typically have shorter hold periods of 3-5 years and invest in less proven assets with the hope of adding value to create a higher return. One industry veteran whose company manages multiple billions of dollars worth of real estate assets stated that over half of his real estate funds are value-add funds. It is this proliferation of value-add funds that may be acting as a barrier to energy efficiency investments.

With a hold period of just 3-5 years, there is often little incentive for value-add funds to make improvements to a building’s energy efficiency. One reason is the investors may not realize a return on investment prior to disposition of the asset. Another reason is the investment is focused on high risk, high return capital appreciation, as opposed to lower, stable cash flow yields. Additionally, due to the high cost of capital for such funds, any capital allocated to a project needs to immediately show a strong return on investment as indicated by several asset managers. With such high return hurdles to cross, many fund managers are not willing to make investments in technologies where the return is considered by many to be unproven. Further, real estate funds, whether core or opportunistic, generally report earnings to investors either on a monthly or quarterly basis. A senior-level manager at a property management firm summed it accordingly: "the commitment to sustainability [for the investment community] needs to be stronger than the commitment to quarterly earnings." A fund manager is evaluated on the performance of a collective set of assets. For this reason, a manager is very risk averse, preferring to keep the volatility of their returns to a minimum. As such, they have a natural tendency to avoid capital expenditures which show up as a large negative number on a fund's profit and loss statement.

Another way in which the real estate industry structure may be inhibiting energy efficiency improvement is the differing goals amongst management players. Accountable to owners and investors, portfolio managers are generally making decisions that will both increase returns and smooth their volatility. The consensus among real estate managers is that a stand-alone capital improvement project cannot decrease the overall fund performance. Asset managers, on the other hand, stated that their objective is to maximize the value of various real assets at a specific point in time so that each will fetch the highest price at disposition. In a strong real estate investment market, significant value is created through capital appreciation at sale, which inevitably leads to a high 'churn-rate' of buildings being sold. As one asset manager stated, "the real estate industry lacks proper long-term planning." Meanwhile, property managers are focused on maximizing revenue and decreasing costs in just one asset. Each one of these objectives leads to slight, but differing goals in the real estate management business.

A recurrent theme among interviewees was the real estate industry lacks proper education on the issue of energy efficiency which further inhibits a wide-scale adoption of energy efficiency retrofits. Most respondents stated that it would be very difficult to make a capital investment, such as an energy efficient chiller, and realize the full value of that investment at disposition. Purchasers and appraisers alike underwrite the historical utility bills of the property and thus improperly discount the future performance of a retrofit. An energy efficiency investment therefore needs to show a decrease in energy consumption of a significant magnitude. At the same time, that decrease in energy use needs to be sustained for a number of years before the value will be capitalized into the value of the building. Knowing how the industry underwrites acquisitions, many owners are hesitant to invest in efficient technologies if they cannot recoup that investment in a reasonable timeframe. Several managers committed to sustainability described the education process as "incremental": investing in increasing capital intensive efficiency projects as performance of lower-cost improvements in their buildings is proven.

Further, the idea of sustainability as it relates to real estate is a relatively recent concept. Though various studies suggest a 'green premium' whereby tenants or purchasers will pay a premium for efficient or sustainable buildings, there is still much skepticism regarding these studies. Over time, more examples of energy efficient improvements will prove their worth either to the positive or the negative. For the time being, however, as the industry does not feel that many of the studies are conclusive, property owners are hesitant to invest in these technologies.

4.2 Quantitative Results

The primary purpose of creating a quantitative financial model was to show how various capital investments affect the financial returns at the property. While the measurements in the model are not intended to provide precise returns, the model is useful for determining an appropriate order of magnitude of returns. Further, within each investment scenario, multiple permutations have been run. The purpose of these permutations is to gauge the sensitivity of returns to changes in the underlying assumptions. The following tables summarize the various scenarios that were tested and the permutations within each scenario.

Base Case Scenario

No investment is made in either a cosmetic upgrade or an energy efficiency upgrade (Table 4.2).

Table 4.2 Base Case Scenario Inputs

Base Building Assumptions			Base Electricity Assumptions	
Average Suburban Office Rent (2006)	$ 19.43		Electricity Consumption (kWh)	15.7
Average Sub Op Expense (2006)	$ 8.30		Electricity Price (price per kWh)	0.106
Op Expense Growth (05-06)	3.50%		Electricity Price Annual Growth	2.55%
Rent Growth (05-06)	2.50%		Electricity Expense PSF Building	$ 1.66
Tenant Renewal Probability	75.00%		Electricity % Operating Expenses	20.05%
Absorption (Mos)	6			

Investment Scenario 1 ("Rent Increase")

An investment of $200,000 is made in cosmetic upgrades to the building (such as the lobby, restrooms, etc.). The building improvement is expected to position or re-position the building to receive a higher rent than the Base Case rent of $19.43 psf. All other variables stay fixed. The following Table 4.3 summarizes the specific rent increase permutations that were tested within Scenario 1.

Table 4.3 Permutations for Rent Increase Scenario

Scenario 1	Percentage Rent Increase	$ PSF Increase
Permutation 1	0.83%	$ 0.25
Permutation 2	1.67%	$ 0.50
Permutation 3	2.50%	$ 0.75

Investment Scenario 2 ("Lease-up Improved")

Similar to Investment Scenario 1, an investment of $200,000 is made in cosmetic upgrades to the lobby. In Scenario 2, however, the improvement is expected to both increase tenant retention and decrease the absorption time for any vacant space. No other variables are changed. Renewal Probability will increase from the Base Case of 75% and at the same time Absorption Period will decrease from the Base Case of 6 months. The following Table 4.4 summarizes the three permutations within Scenario 2.

Table 4.4 Permutations for Lease-up Improved Scenario

Scenario 2	Renewal Probability	Absorption Period
Permutation 1	80.00%	5
Permutation 2	85.00%	4
Permutation 3	90.00%	3

Investment Scenario 3 ("Energy Decrease")

In Investment Scenario 3, rather than investing in cosmetic upgrades to the lobby, an investment of $200,000 is made in energy efficiency upgrades to the building (such as a lighting retrofit, mechanicals, etc). No other variables are changed. Energy consumption will decrease from the Base Case of 15.70 KwH which will results in Energy Cost decreasing from the Base Case of $1.66 psf. The following Table 4.5 summarizes the three permutations that were analyzed within Scenario 3.

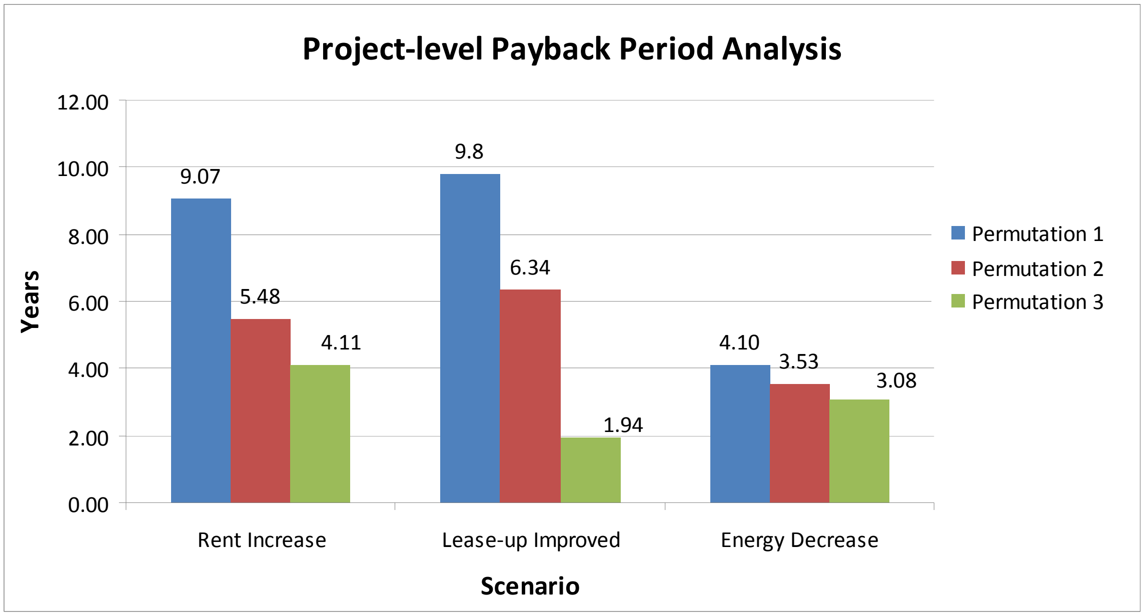
Table 4.5 Permutation for Energy Decrease Scenario

Scenario 3	Electricity Expense Decrease	First Year Decrease Op Expense PSF
Permutation 1	25.00%	$ 0.44
Permutation 2	30.00%	$ 0.53
Permutation 3	35.00%	$ 0.61

4.2.1 Simple Payback Period Analysis

The majority of the interview respondents stated payback period is the most important metric when analyzing an investment in a building. The following Figure 4.1 shows the simple payback periods for each permutation within each Investment Scenario.

Figure 4.1 Project-level Payback Period Comparison

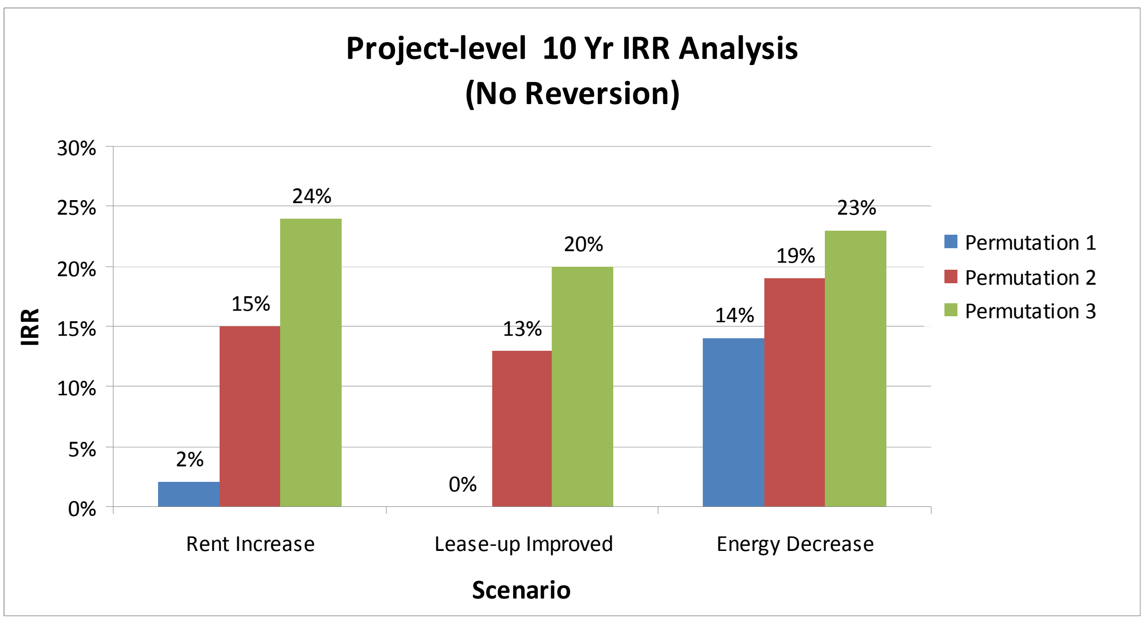


As Figure 4.1 demonstrates, investment in a cosmetic upgrade can be less predictable than investment in an energy efficiency upgrade. The Rent Increase scenario is very sensitive to whether rent increases $0.25, $0.50, or $0.75 per square foot with payback periods ranging from 9.07 years to 4.11 years. Similarly, the Lease-Up Improved scenario is also very sensitive to each permutation with the potential for the quickest payback at 1.94 years, but also the longest payback at 9.8 years. Contrasting with the other two scenarios, the Energy Decrease scenario results are clustered very close together with little difference between the various permutations. This analysis suggests that though investing in energy efficiency improvements may not provide the quickest possible payback, it may be a better investment for managers interested in keeping volatility of returns to a minimum.

4.2.2 Project-level IRR Analysis

Each Investment Scenario and permutation was also evaluated on merit of Internal Rate of Return (IRR) over a 10 year time horizon. Figure 4.2 below shows a comparison of the IRR for each Investment Scenario and permutations within the scenario. The IRR below is calculated on the initial cost of the improvement project and uses the incremental increase to the Net Operating Income as the stream of cash flows. This is a project-level IRR and does not take into account reversion value which will be analyzed later in this section.

Figure 4.2 Project-level 10 Yr IRR Comparison



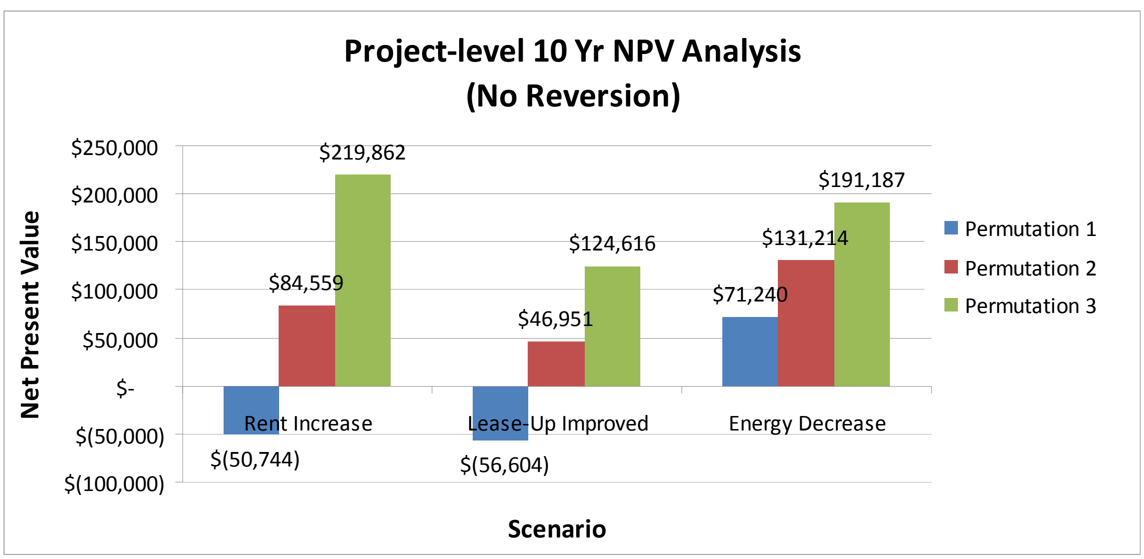
As displayed in Figure 4.2, both the Rent Increase Scenario and Lease-up Improved Scenario have a negligible return in Permutation 1, while the Energy Decrease Scenario returns a 14% IRR. In the Energy Decrease Scenario the decrease to Operating Expense is realized in the cash flow the year following the improvement (See Appendix 10). The result is a higher Net Operating Income realized earlier in the ten year time horizon which increases the overall IRR.

In contrast, the Rent Increase does not impact the cash flow until there is significant rollover and lease rates are reset to the higher rents. The Lease-Up Improved Scenario is highly sensitive to the rollover in the building in impacting the cash flow.

4.2.3 Project-level NPV Analysis

The third metric to evaluate the financial impact of each Investment Scenario is a Net Present Value (NPV) analysis. The NPV assumes a discount rate of 7.5% (assumes a U.S. Ten Year Treasury (3.49%) plus a risk premium (400 bps)). Figure 4.3 below shows the project-level NPV of each Investment Scenario based on a 10 year cash flow. The NPV is calculated using the initial cost of the project, the discount rate, and incremental increase to NOI as the cash flow stream and does not take into account reversion.

Figure 4.3 Project-level 10 Yr NPV Comparison



As shown in Figure 4.3 above, the Rent Increase Scenario nets the highest positive NPV to the project and the Lease-UP Improved Scenario nets the lowest positive NPV. The Energy Decrease Scenario is the only scenario to return a positive NPV in permutation one. Likewise, the Energy Decrease Scenario is shown to be the lowest in return volatility, measured by the difference between the lowest and highest outcomes.

4.2.4 Annual NOI Analysis

The following analysis compares all three Investment Scenarios against each other. For simplicity, only the middle permutations (Permutation 2) are used for comparison. The middle permutations were selected as those that were most likely to occur in each Scenario.

Each Investment Scenario is analyzed based on how much the Net Operating Income (NOI) increases each year. The following Figure 4.4 shows the annual NOI increase for each type of improvement as lines with the units on the left Y-axis. The graph also shows the percentage of tenant lease rollover each year; shown as bars with the units on the right Y-axis.

Figure 4.4 Annual NOI Increase vs. Rollover Percentage

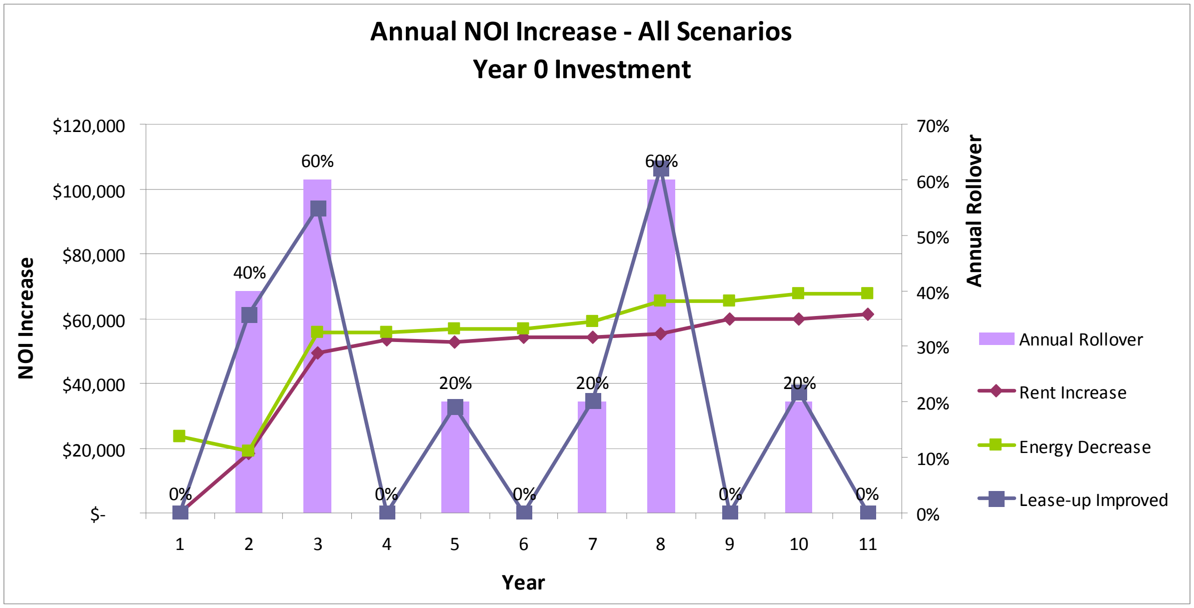
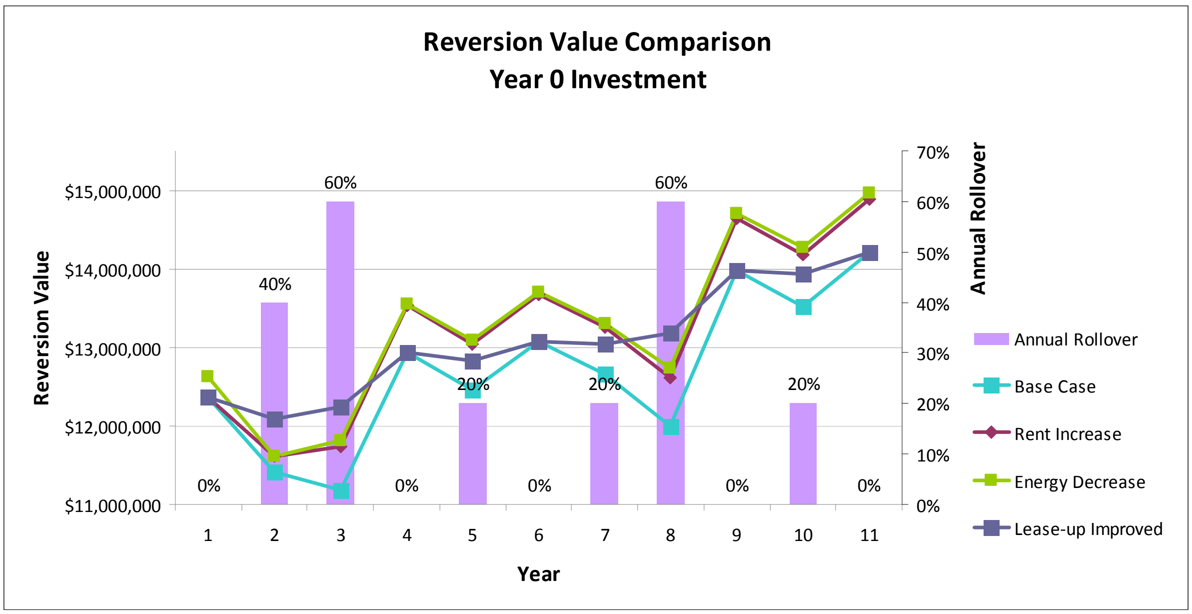


Figure 4.4 clearly shows that whenever a tenant lease rolls over, the annual NOI for the Lease-Up Improved Scenario increases drastically. During years when there is no tenant rollover, however, NOI does not increase at all. In contrast, the NOI for both the Rent Increase and Energy Decrease Scenarios increases as tenant leases roll over, then gradually grows over time. This comparison shows that an investment decision for a cosmetic upgrade to increase tenant retention exhibits volatile returns. If the intent of the investment is to raise rents or decrease expenses, however, these returns are less volatile and more predictable.

4.2.5 Reversion Value Analysis

The NOI analysis was extended to calculate the financial impact on asset value. This was done by applying a capitalization rate to the NOI during each year of the analysis. As can be seen in Figure 4.5 below, the Base Case, Rent Increase, and Energy Decrease scenarios are all quite volatile because the reversion value dips whenever significant lease-up costs are incurred. However, the Lease-up Improved scenario actually decreases the volatility of reversion value because it decreases the severity of lease-up costs. Managers should recognize that while changes to NOI is more volatile under the Lease-up Improved scenario, decreasing lease-up costs can actually smooth the volatility of total returns. Figure 4.5 below shows the asset value at each year by Investment Scenario.

Figure 4.5 Reversion Value Comparison



4.2.6 The Effect of Tenant Rollover on Investment Returns

The financial model also tested for sensitivity to lease rollover on the Rent Increase Scenario and Energy Decrease Scenario. The Lease-up Improved Scenario was not tested because returns in this Scenario are driven solely by tenant rollover. The impact of lease rollover was tested by varying the timing of the investment against lease rollover of 60%, 40%, and 20%.

Energy Efficiency Improvements

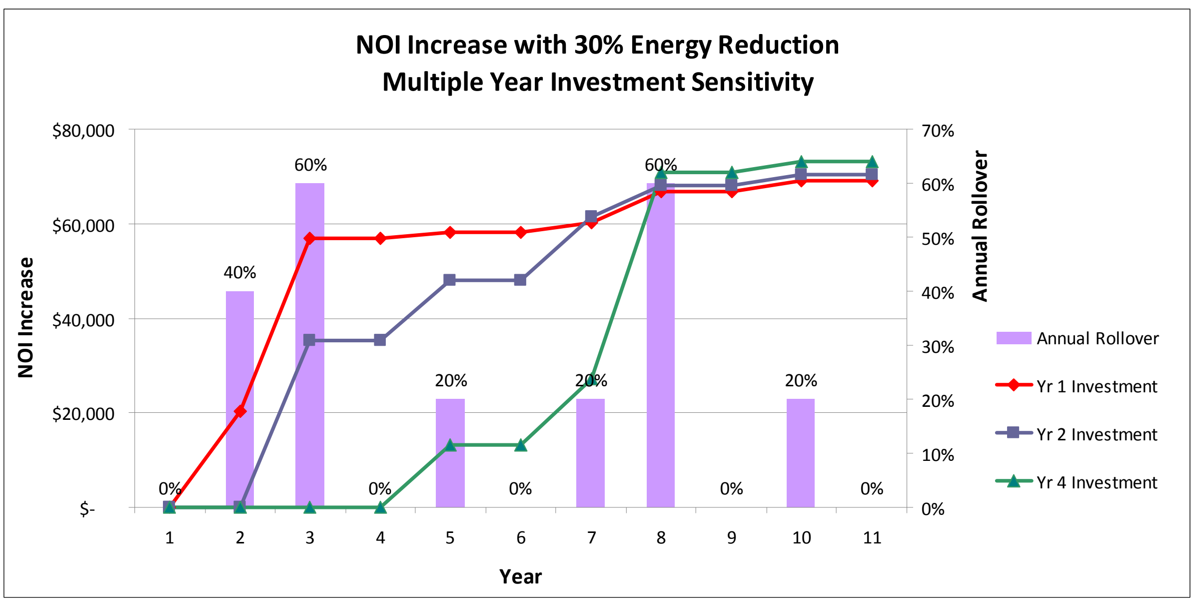
Many interview respondents stated that tenant lease rollover was a deciding factor in considering an energy efficiency improvement. The energy efficiency improvement lowers the overall Operating Expense in the building thereby increasing the NOI. By reducing Operating Expenses just prior to a rollover, any new lease that is signed will have a lower Expense Stop. Therefore, with a lower Operating Expense in the building and a lower Expense Stop to reimburse expense escalations, the landlord would benefit from savings created by the energy efficiency improvement. To test this assertion, the model was run with the energy efficiency improvement being completed in one of three years: Year 1, Year 2, and Year 4. The rollover schedule was kept fixed in all of these tests in order to see when the landlord would benefit most from making this investment. The increase to NOI was used as the financial metric to measure the results. Figure 4.6 below plots the changes to NOI in each test against the rollover schedule.

- When the investment is made in Year 1, 40% of tenants rollover within one year and the remaining 60% rollover the next year. In this case, the NOI increases very rapidly and remains at this high level throughout the life of the analysis.
- When the investment is made in Year 2, 60% of tenants rollover within one year, but the remaining 40% do not rollover until Year 7. In this case, it takes much longer for the NOI to climb to the maximum achieved when the investment is made in Year 1.

- When the investment is made in Year 4, only 20% of tenants rollover within one year and the remaining tenants are not fully rolled over until Year 8. In this case, NOI is clearly lower than either of the other two scenarios for a much greater time.

This analysis confirms the assertions being made by most real estate managers. In order to fully realize the value of an energy efficiency improvement, it is most beneficial to have tenants rolling over sooner, rather than later, after the improvement is made.

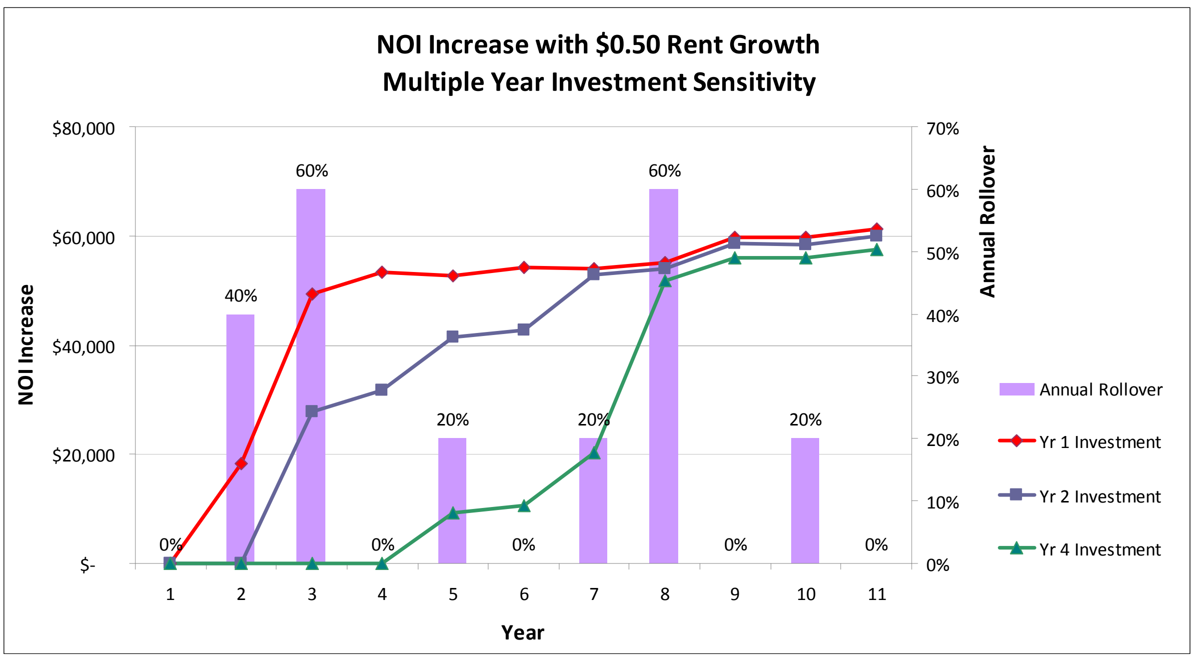
Figure 4.6 Sensitivity of Energy Efficiency Improvement to Rollover



Cosmetic Improvements

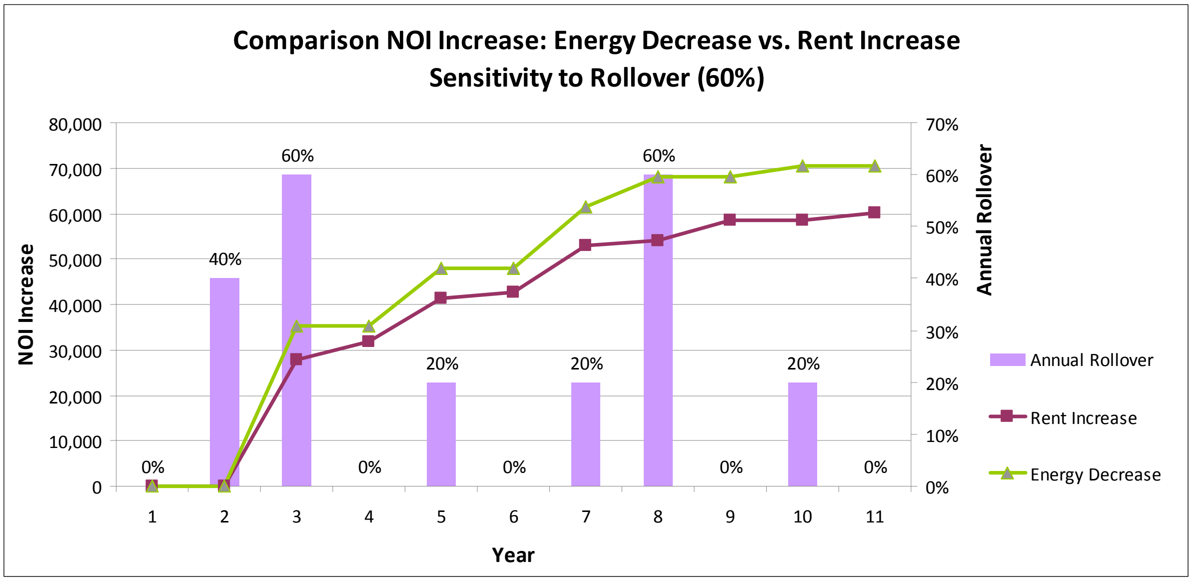
The impact of rollover was also analyzed for the Rent Increase Scenario. Similar to the rollover analysis on an energy efficiency improvement, the timing of the cosmetic improvement was varied depending on the rollover schedule of the building. The increase to the NOI exhibits similar characteristics to the decrease in energy with respect to rollover sensitivity: the increase to NOI is proportionately related to rollover in the building. Figure 4.7 below shows this effect.

Figure 4.7 Sensitivity of Rent Increase to Rollover



To compare the order of magnitude for each scenario on increase to NOI, each was analyzed with a 60% tenant rollover. Figure 4.8 below shows a comparison of the Energy Decrease Scenario and the Rent Increase Scenario. The return volatility is similar; however, the Energy Decrease Scenario shows a greater increase to NOI earlier in the cash flow and persists throughout each year.

Figure 4.8 Comparison of NOI Increase Energy Decrease to Rent Increase Scenario



4.3 Rebates

Utility companies and various government entities routinely provide rebates in exchange for property owners performing energy efficiency improvements. Though rebates may not always be available as funding sources in the future, many interviewees stated that they play a role in deciding whether or not to invest in energy efficiency. Guided by recommendations from various interviewees, rebates of $0.60 psf, $1.20 psf, and $1.80 psf have been analyzed in the model to determine their effect on simple payback period with a $2.00 psf investment. Starting from a Base Case assumption where the energy efficiency improvement reduces energy consumption by 30%, rebates in Year 1 of the analysis had the following effect on simple payback period as shown in Table 4.6:

Table 4.6 Energy Efficiency Rebates on Payback Period

Rebate Amount	Payback Period (Years)
$ -	3.53
$ 0.60	2.53
$ 1.20	1.48
$ 1.80	0.86

Rebates clearly have a large impact on the payback period of an investment. While utility companies and government entities may not continue to offer rebates in perpetuity as energy efficient improvements become more prevalent in the industry, one can clearly see why they are currently such a driving force behind the investment decision.

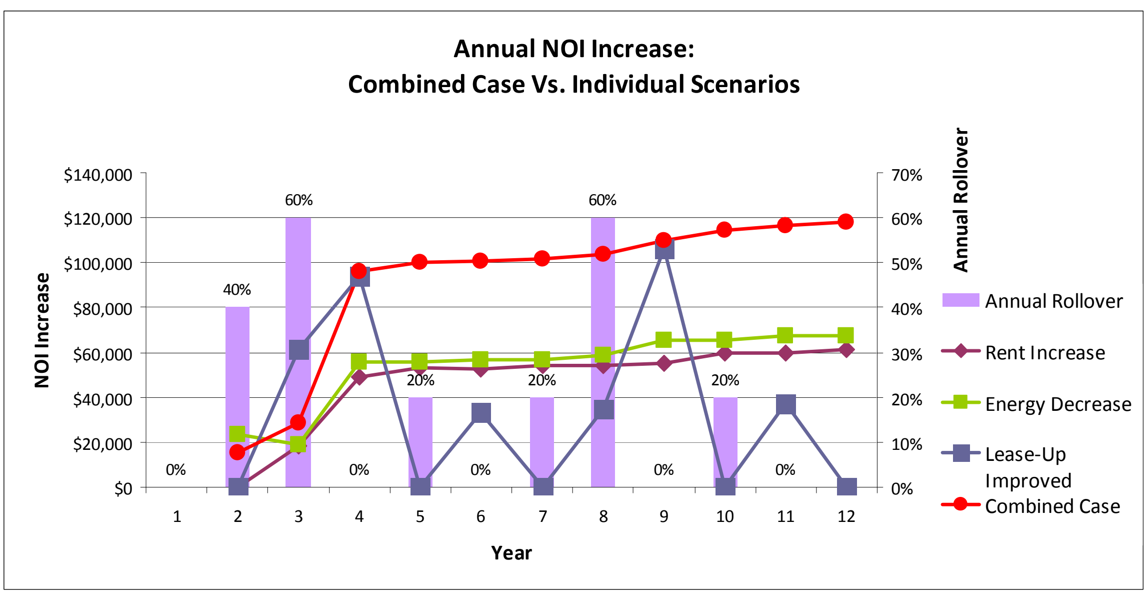
4.4 Combined case

An investment in a building does not have to be categorized as either a cosmetic improvement or an energy efficiency improvement. If a lobby is retrofitted, it will likely receive updated, more efficient light fixtures. Similarly, a lighting retrofit not only saves energy but may enhance the aesthetic quality of a building. To analyze this effect, the two types of investments might be combined with the assumption being that, similar to the Empire State Building retrofit, an integrated design approach will achieve results above and beyond those achievable if each investment was completed on its own. A cosmetic upgrade is presumed to already incorporate some energy efficient features. However, since construction will already be taking place, the incremental cost to improve energy efficiency to an even greater degree is relatively small in comparison to completing an energy efficiency improvement alone.

In the Combined Case Scenario for the subject building, a $200,000 cosmetic improvement is assumed. An additional investment of $100,000 to upgrade these improvements to be more energy efficient is added to this cost, an approximate cost increase of 50%. Assuming that much of the cost of the energy efficiency improvement may already be in the cosmetic improvement, an additional 50% cost is a conservative estimate. The combined case is assumed to have both a positive effect on rents by an increase of $0.50 psf and lower operating costs by a decrease in energy consumption of 30%.

In the Combined Case the return would be expected to be greater than if each project had been undertaken separately. Spending the additional $100,000 in the cosmetic improvement yields approximately the same return as if each project was completed independently. In this scenario, spending $300,000 today provides a similar return to spending $400,000 in two separate projects. Figure 4.9 below shows the incremental effect of the Combined Case in comparison to each individual case Investment Scenario.

Figure 4.9 Comparison of NOI Combined Case vs. Individual Scenarios



4.5 Summary of Results

The quantitative model ran through three potential scenarios for investing $200,000 in a fictitious building: 1) invest $200,000 in a cosmetic improvement which results in a rent increase, 2) invest $200,000 in a cosmetic improvement which results in increased tenant renewal probability and decreased absorption time, and 3) invest $200,000 in an energy efficiency project which reduces operating expenses. Further, each scenario had three separate permutations in order to test the sensitivity of each scenario. All three scenarios showed that any capital investment has a high sensitivity to tenant rollover. In general, the value of the investment is not captured until a new lease is signed, so a manager would be wise to make any investments prior to signing new leases. The lease-up scenario was particularly volatile compared to the other scenarios as value creation is high when a lease rolls over and zero at all other times. Keeping the prior point about rollover in mind, if a building is already near full occupancy, the landlord may be wise to not invest until a tenant rollover gets close. Finally, the returns of both cosmetic scenarios vary widely in magnitude and timing of the return.

In contrast, the investment in energy efficiency, while not having the highest return in all scenarios, is benefited by low volatility and a narrow range of returns. In a time of general uncertainty in the real estate markets, the predictability afforded by energy efficiency investments may be well-suited for many real estate managers.

Analyzing the issue of energy efficiency from both a qualitative and a quantitative perspective allowed the authors to discover the industry practice and attitude towards energy efficiency improvements and then confirm if these views were warranted using the financial model. A recurring theme among decision makers was that getting tenants into the building would always be a top priority. This will likely always remain the case because without tenants, it does not matter how efficient a building is. However, most portfolio managers stated that they are concerned with showing a steady return and keeping return volatility to a minimum. Accordingly, an energy efficiency improvement which is accretive to NOI each year should be considered alongside more volatile investment strategies, such as trying to increase tenant retention, which is only accretive to NOI when a lease rolls over.

One counter-intuitive result was regarding the timing and volatility of returns to each scenario. The estimated payback periods for both cosmetic improvement scenarios (Rent Increase and Lease-up Improvement) exhibited great variation between each permutation. In contrast, while the energy efficiency scenario did not exhibit payback periods as low as some of the other scenarios, the payback period was less volatile overall. Similarly, the spread of NOI possibilities varied widely between permutations in the cosmetic investment scenarios. Meanwhile, the spread of possible NOI increases resulting from energy efficiency improvements was much less volatile.

Interview participants also said they were more likely to make investments in energy efficiency just prior to leases rolling over. The financial model demonstrates why this is such a large factor and shows the drastic effect that rollover has on NOI increases resulting from both cosmetic and energy efficiency improvements. In sum, the dual-focused approach of interviews coupled with a financial model was able to confirm much of the industry sentiment while also bringing forward several issues that may have been overlooked by the real estate industry overall.

Chapter 5: Conclusion & Recommendations

The purpose of the research in this paper was to discover whether there is a misalignment of incentives and motivations throughout the real estate management value chain that prevent investment in energy efficiency retrofits to existing buildings. The methodology of the research was through interviews of real estate managers and through the development of a financial model to facilitate a discussion regarding capital allocation to energy efficiency improvements or cosmetic improvements. The following conclusions and recommendations call attention to inefficiency and offer recommendations for correction. Finally, topics for further research are suggested.

Conclusion #1: Transparency of Energy Use in Buildings is Lacking

One of the most frequently cited reasons from interview participants for investing in energy efficiency was to better the corporate image. Many firms use real estate to showcase corporate commitment to sustainability to their shareholders, clients, and partners. LEED EBOM certification is taking hold for multi-tenant office buildings but critics point to the lack of emphasis on energy use and the prescriptive nature of the point system. Both LEED EBOM and ENERGY STAR are mostly voluntary programs. Currently, when tenants and purchasers are evaluating a building it is difficult for them to know how much energy the building actually uses and therefore the overall energy efficiency of the building. As previously discussed in Chapter 2, California and Washington DC will require property owners to disclose a building's ENERGY STAR rating prior to any major transaction starting in 2010.

These disclosure laws will likely advance investments in energy efficiency as current owners strive to get their ENERGY STAR rating higher prior to a transaction. Further, as shown through the quantitative model developed above, these investments in energy efficiency will not only make a building with low energy consumption attractive to buyers, but they provide a positive financial return on their own merit. With energy disclosure, tenants and buyers will become informed in making decisions about the operational performance of a building which may result in a higher valuation for energy efficient buildings. Owners and landlords may find investments in energy efficiency projects to be more liquid as the improved building performance becomes visible and desirable to the market.

Conclusion #2: Education and Proof of Concept Required

A recurring perception from the interviewees regarding energy efficiency retrofits is that many improvements require the use of new technologies that are not yet proven. The case can also be made that the technologies are actually well-proven; rather it is the certainty of returns from those technologies that is unproven. Regardless of whether it is the technologies that are unproven or the financial returns from those technologies that are unproven, hesitation from real estate managers does exist. Along similar lines, in a period where investment capital is scarce, projects that are more visible, such as aesthetic improvements to a property, are selected over energy efficiency projects.

As energy efficiency improvements are proven to reduce expenses and create a positive return on investment, adoption of these improvements can be expected to become more mainstream. In addition, as the quantitative analysis above has shown, energy efficiency projects have the added benefit of decreasing the volatility of returns. Knowledge of these benefits, both decreased volatility and decreased expenses, needs to spread throughout the industry, specifically to lenders and appraisers so that they make funding available for these projects. A clearing house of data, perhaps in the form of a third-party research firm, would help in the dissemination of information between parties.

With greater proof of energy savings and increased lender willingness to lend for energy efficiency projects, these improvements will become more frequent.

Conclusion #3: Proper Valuation of Energy Efficiency Improvements is Needed

Proper valuation of energy efficiency improvements is lacking in the real estate investment market. Interviewees were split roughly equal between those who believe energy efficiency retrofits are a capital expense and those who recognize that these retrofits can be a profitable investment. As such, an often cited reason for making investments in energy efficiency improvement projects is to decrease Operating Expenses thereby increasing the NOI to a building. A related reason for energy efficiency investment is that buildings with improvements are viewed to have potentially increased NOI in the future, and therefore a lower sales cap rate should be considered when capitalizing NOI to a purchase price. However, buyers and sellers should not count on realizing both of these effects at the same time.

Value is created through energy efficient investments in buildings because either:

a) Expenses decrease for a sufficient time to increase NOI. A market cap rate would be used in converting this increased NOI to a purchase price, or

b) The energy efficiency investments have not had enough time to prove that they permanently increase NOI. In this case, a slightly lower than market cap rate would be applied based on the potential that NOI will increase in the near future.

To use an increased NOI and a lower cap rate at the same time when valuing a building would be trying to capture the value of one energy efficiency investment twice. Recognizing the relationship between cap rates and NOI will help buyers, sellers, lenders, appraisers, and others place an appropriate value on energy efficient investments without "double counting" any potential increase in value.

Recommendation #1: Restructure Investment Capital Structure

A recommendation to real estate investors, particular those investing in opportunity funds, is the need to understand that the structure of investment capital may be a deterrent to energy efficiency improvements. The structure of the real estate investment capital may influence capital allocation to energy efficiency improvement projects. As previously discussed, the structure of an opportunity fund is characterized by short-term hold periods which may discourage investments with payback periods longer than two to three years. Additionally, any request to fund investment in energy efficiency is costly because many funds pay a preferred return on this capital which may be as high as 15-25% or higher (although this may change given the current real estate market). To encourage investment in energy efficiency, the cost of capital has to be a rate that is risk-adjusted to match an energy efficiency investment. Real estate investment funds should differentiate between capital expenses to energy efficiency and other types of capital expenses. Energy efficiency projects, as shown through the quantitative model, have relatively low volatility within a narrow range of returns. As such, the cost of capital for these projects should be lower than for other riskier capital expenses.

When a rebate is used to cover a portion of the cost for an energy efficiency retrofit, an investment fund should pay a risk-adjusted return on the borrowed capital. The amount of a utility rebate is relatively low risk to the investors because of the certainty of payback by the utility company. Therefore, a fund could be structured to pay investors a lower return on capital equal to the portion of the improvement covered by the rebate. For example, if an energy efficiency project cost $2.00 psf and a rebate was available for $1.80 psf, the investors should be paid a lower interest on the less-risky $1.80 psf and a higher interest on the riskier $0.20 psf. Overall, the real estate industry should recognize that both the volatility and spread of returns to an energy efficiency project is low. As such, the cost of capital for these projects should be at a lower level commensurate with their level of risk.

Recommendation #2: Paradigm Shift in Portfolio Management

A recommendation to portfolio managers is that the value of an individual asset needs to be re-established in investment portfolio management. In recent years, real estate assets, through financial tools such as securitization, have been treated more like a commodity than a physical asset in a fixed location. However, it is a portfolio manager's fiduciary duty to investors to maintain both the returns of the portfolio and the efficient management of the physical assets. Portfolio managers need to manage real estate as unique assets where value is specific to both location and building attribute. In the current value chain of real estate asset management, the portfolio manager may be removed from the efficiency of individual properties; however, major capital allocation decisions are assigned at the portfolio level and may not be the best suited for individual buildings. Improvement in communicating building performance, including the transparency of energy consumption, may lead to more informed capital allocation decisions at the portfolio manager level.

Recommendation #3: Lease Strategies

A recommendation to both tenants and landlords is to consider separating energy efficiency from the base year lease expenses. Splitting base year lease expenses may provide a landlord more incentive to invest in the energy efficiency of the building. A Modified Gross lease is generally structured such that a tenant pays for any expenses above a base year expense amount. This base year expense may be composed of multiple line-item expenses aggregated into a single number. A base year expense could include expense categories as disparate as utilities, real estate taxes, property insurance, and janitorial staff. An increase in any one of these categories could increase the total expenses above the base year. When expenses rise above the base year, the landlord has less incentive to invest in energy efficiency improvements because a decrease in the utilities expenses will simply benefit the tenant. In essence, a decrease in utility cost could simply be offsetting an increase in real estate taxes.

However, if the lease prescribed a base year expense amount for energy separately, this conflict would be eliminated. The landlord would have a greater incentive to increase investments in energy efficiency because this expense line item would drop below the expense stop quicker—a level at which all savings begin to accrue to the landlord. The landlord would further benefit by using this arrangement as a market differentiator. Providing tenants with an estimate of their energy expenses, and the ability to control them, could help increase lease-up and decrease vacancy in a building.

This structure would also prove beneficial to tenants that desire more transparency into their annual expenses. Current industry practice is for landlords to group all expenses together. This arrangement leaves the tenant with little insight into how much energy they are using. If the energy was a separate line item, not only would they feel more comfortable with the figures being reported by landlords, but they would also be well-position to monitor and decrease their own energy use.

Topics for Further Research

Sub-metering

The lease structure between a tenant and landlord determines who pays for electricity use and this has a large effect on whether or not a landlord will invest in energy efficiency projects. Triple net leases are structured such that the tenant pays all of the Operating Expenses, which leaves the landlord little incentive to decrease the operating costs of the building. Gross leases are the exact opposite; the landlord pays all operating costs, which leaves the tenant with little incentive to decrease their electricity consumption. These lease structures may in part reflect the way the office stock in the US was developed. Many office buildings have one central electricity meter and installing individual submeters to monitor individual tenant electricity usage is expensive. However, emerging technologies are rapidly decreasing the cost of specific tenant energy use monitoring. If each tenant knew how much energy they were using in real time, and were being billed directly for that use, perhaps they would decrease consumption on their own accord. It would be an interesting study to quantify the effect on electricity usage that arises from switching from a central meter to submeters. Similarly, a Return on Investment could likely be calculated based on the cost to install submeters vs. the electricity cost savings generated. This idea could also be extended to study the effect of real time energy use monitoring, which provides immediate feedback, versus submeters that only inform tenants of their energy when their monthly energy bill arrives.

Capital Allocation: Depreciation vs. Appreciation

In deciding how to allocate capital to competing investments in a building, a real estate manager may have to select among cosmetic upgrades and energy efficiency upgrades. It is assumed that a cosmetic upgrade provides an immediate impact to the value of a property because it is immediately visible to current tenants in the building and future tenants looking to lease space. In contrast, energy efficiency upgrades typically do not increase the value of a property until a time period has passed to sufficiently prove that expenses did actually decrease. This brings forth an interesting discussion regarding depreciation and appreciation: cosmetic improvements seem to have a limited lifespan on the financial impact to the building and thereby depreciate over time. In contrast, energy efficient improvements theoretically grow in value as the decrease to Operating Expenses is realized over time. An analysis of the tax effects of each type of investment is warranted. Further research might address how quickly a new lobby can be depreciated compared to the depreciation schedule for upgraded lighting or HVAC systems; or how these depreciation rates and tax effects affect payback periods and return on investment.

Market Volatility and Energy Efficiency Improvements

Another topic for study is the analysis of volatility in total returns for a portfolio of buildings heavily invested in energy efficiency improvements. The research might look at the long-term performance of this portfolio and any effect energy efficiency had on lowering the volatility of the return. The short-term return from an energy efficiency project may be low but the long-term effect on decreasing return volatility may be significant.

Conclusion

As noted previously, commercial real estate consumes massive quantities of energy. The level of energy consumption is only expected to increase as demographic trends point to the world population moving into cities in ever-greater numbers. Though increasing energy consumption worldwide is a macro issue, it has to be approached on a micro level building by building. The government is starting to offer incentives and pass mandates related to energy efficiency in buildings. Several prominent examples, such as the Sears Tower and Empire State Building, have demonstrated the feasibility of energy efficiency retrofits in investor-owned office buildings. However, the research in this paper was built on the premise that there is a misalignment of incentives in the real estate management chain that is hindering wide-scale investment in energy efficiency retrofits.

The research shows that the real estate industry is divided in its perception of energy efficiency projects. On one hand, there are those managers that view energy efficiency as a capital expense to maintain a building. This may explain why payback period is used to evaluate energy efficiency projects: a manager is evaluating the capital outlay but not the potential for value creation. In contrast, other managers recognize energy efficiency projects as an investment opportunity that provides a significant financial return. Similarly, there are geographical differences in how energy efficiency is perceived. In general, managers on the East and West coasts, markets that typically look more favorably on environmental issues, recognize that there is value in energy efficiency projects while managers in the middle of the country may not recognize this value.

Though there are still a number of participants throughout the real estate industry that focus little on energy efficiency, perception seems to be changing quickly. The perception that energy efficiency projects are risky, that they use unproven technologies, is being dispelled as successful projects gain recognition throughout the industry. Many managers could cite projects and initiatives that they have recently undertaken at both the property and portfolio level. While many energy efficiency initiatives are being used to market buildings to tenants, investors, and potential purchasers, the industry is shifting to also recognize the financial benefits of these initiatives. As technology improves, and the industry as a whole realizes that these technologies can improve financial returns in addition to being a marketing tool, energy efficiency improvements will continue to permeate the industry on an upward trajectory.

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Appendix

Appendix 1: Interview Questions

Interview questions were tailored to each interviewee depending on the duties and level of responsibility of the interviewee (e.g. Property Managers were asked about specific projects on an individual property whereas Portfolio Managers were asked about portfolio-wide initiatives).

General Expenditures Questions

1. In the last calendar year (2008), how many building improvement projects did you or your organization complete?
    a. What was the total aggregate cost of those building improvement projects?
    b. What was the average cost of those building improvement projects?

2. Of those building improvement projects, how many were completed in the following category:
    a. Lobby renovation (includes painting, flooring, artwork, furniture, etc)
    b. Common Area renovation (includes painting, flooring, artwork, etc)
    c. Bathroom renovation (includes sinks, floors, toilets, partitions, etc)
    d. Exterior renovation (includes façade, painting, artwork, signage, etc)
    e. Landscaping
    f. Addition of amenities (gym, valet service, child care)
    g. Mechanical systems
        i. HVAC (water chiller, cooling tower, package units, etc)
        ii. Water heater
    h. Plumbing systems (low-flow toilets, motion-sensor sinks, etc)
    i. Lighting (new lamps, ballasts, increased day-lighting, sensors, etc)
    j. Windows (glazing, replacement with higher efficiency, etc)

k. Insulation (wall insulation, mechanical insulation, etc)

Motivations/Expectations

3. What was the motivation/expectation behind completing the building improvement project?

    a. Increase rents

    b. Decrease costs

    c. Scheduled capital expenditure (i.e. every 5 years update the lobby)

    d. Market competitiveness (follow the competition, new market standard, etc)

    e. Tenant requirement (retention, corporate governance, etc)

    f. Job performance measurement

    g. Code requirement (city, state, other)

    h. Lender requirement

    i. Management decision (i.e. boss told you to)

    j. Change in building ownership

    k. Other

4. Describe the decision making process:

    a. Who were the people involved in originating the project?

    b. Who has the ultimate authority to authorize the project?

    c. How many authorizations are involved in the process?

    d. To what extent could you make the authorization? Is there a maximum dollar amount?

Energy Efficiency

5. How many building improvement projects were completed specifically as part of an efficiency upgrade? (vs. just buying a more efficient item that needed upgrading anyway)

6. Do you consider building efficiency upgrades part of the asset management plan?

    a. What do you consider to be an "efficiency upgrade"?

b. When making a capital expenditure do you consider an efficiency upgrade?

c. When making a cosmetic improvement to the building, do you consider an efficiency upgrade?

d. Why do you do efficiency improvements to a building? (i.e. social/corporate responsibility)

Personal Role/Motivations

7. How long have you been in your current role?

8. Describe the financial incentive structure:

   a. How is your compensation structured? (% of net revenue, % savings, etc)

   b. How is your superior compensated? (see above)

   c. If there is a bonus, how is the bonus structured?

   d. Is the nature of the incentive tied to building performance? (i.e. operations)

Context

9. What is the current hold-period for a building in your portfolio?

   a. How does this affect the capital allocation decision?

10. What other significant changes occurred at the property in the past calendar year?

    a. Change in property management / leasing group

    b. Change in building ownership

    c. Significant changes to the market building inventory (i.e. new construction, etc)

    d. Significant changes to the demand for space (i.e. new company to town, etc)

11. Changing market sentiment towards efficient buildings.

    a. Are you aware of the GSA requirement to lease space in energy efficient buildings?

    b. What do you know about the Energy Independent Security Act signed in 2008?

    c. (If known) How are you or your organization planning on improving your building? Is a plan in place?

    d. Are you aware that STATE (CA/MA/NY/DC, etc) has a regulation or code requirement to reach a certain level of building efficiency?

e. Why / Why not have you or your company considered an Energy Star rating for the building?

f. Why / Why not have you or your company considered a LEED EB O&M rating for the building?

12. Current perception of efficient buildings

  a. What do you perceive the value to be in operating an efficient building?

  b. Why / Why not does your company perform efficiency improvement projects?

  c. Is there a ‘first-mover’ advantage in the market for operating efficient buildings?

  d. How can operational efficiency be a potential source of revenue? (particularly today)

  e. How can operational efficiency create value in your building? (i.e. capitalization of savings)

  f. If you were to do an efficiency improvement, who realizes the majority of the benefit – tenant or landlord?

  g. How can the landlord realize the value of efficiency improvements?

  h. What steps are you or your company taking to mitigate the risk of rising energy prices and the rise in the cost of water?

  i. There is a growing number of tenants with corporate governance policy requiring “green” space – what does your company do to compete for these tenants?

  j. What are some of the barriers (financial or otherwise) to doing energy efficiency improvements?

If company is already focused on energy efficiency, ask:

13. Do you use benchmarking to analyze performance compared to other buildings?

  a. Is compensation structure tied to benchmarks?

Conclusions/Recommendations

14. Are there any obvious roadblocks and/or disconnects that you face regularly?
15. Do these roadblocks prevent investments in energy efficiency projects?
16. Do you have any suggestions for removing these roadblocks?
17. Would a change in the incentive structure be useful?

Appendix 2: Corporate Sustainability Policy #1

Sample Sustainability Policy 1 (actual policy from an interview participant)

Policy: [COMPANY] will evaluate existing office building investments to maximize operational efficiencies and sustainable operating practices while minimizing environmental impacts. The expenditure of capital will be consistent with the investment goals and criteria for each individual asset and investor.

Goal: To obtain at least the basic level of LEED certification for buildings that meet established criteria, including prerequisites. Higher levels (Silver, Gold, Platinum) are preferred, and will be pursued when cost effective.

Implementation Steps:

1. Confirm that each building is registered and benchmarked under the EPA Energy Star program. Each property manager should review the current Energy Star rating and make recommendations to the [COMPANY] asset manager on how to improve the current rating. All potential energy-saving measures should be discussed with the asset manager, even those that appear to have a payback period longer than what would typically be cost effective. Asset managers should be continually evaluating cost-effective ways to decrease utility costs and improve each property's Energy Star rating.

2. Property management firms should research the availability of any retro commissioning services, rebate programs or subsidies that are being provided for existing buildings by the current energy provider or municipality and submit a summary and recommendation to the asset manager.

3. Property management firms should implement all green policies such as recycling programs and sustainable purchasing, except those programs that are not cost effective.

4. Property management firms should require all vendors (janitorial, landscaping, etc.) to implement green procedures, except those procedures that are not cost effective.

5. Property management firms should review the existing Construction Guidelines & Buildings Standards and Rules & Regulations for each property and recommend changes to the asset manager

that will cost effectively maximize sustainable operating practices while minimizing environmental impacts.

6. Register each office building for LEED Certification. Registration can be completed online at www.usgbc.org. [COMPANY] properties are eligible for a discount as a result of [COMPANY] being a member of the United States Green Building Council (USGBC).

7. Evaluate the building's potential for certification by reviewing the potential credits under the LEED for High Performance Operations. Specific attention should be paid to meeting the prerequisites (water efficiency, energy efficiency, non-CFC refrigerants, green cleaning, recycling).

8. Have either the property manager or chief engineer, or both, obtain LEED AP (Accredited Professional) Certification. A LEED point is awarded for having this certification.

9. Identify the external resources (primarily consultants and engineers) to assist in the application, implementation of sustainability measures, performance period evaluation and certification efforts. These consultant fees should be evaluated to determine if costs can be reduced by utilizing a time and materials contract in place of a fixed price contract.

10. As part of the capital budgeting process, in addition to evaluating the potential future cost savings resulting from improved efficiency, capital expenditures should be evaluated for the LEED certification impact or sustainability benefit.

Appendix 3: Corporate Sustainability Policy #2

Sample Sustainability Policy 2 (actual policy from an interview participant)

Sensible Sustainability is founded on the principles of cost-effective and environmentally conscious property management for all [COMPANY]-managed buildings. The program strives to minimize the carbon footprint and operational impact of these properties through rewarded behaviors, encouraging all [COMPANY] employees and service partners to:

- Provide guidance and advice to clients, assisting them in making financially appropriate environmental decisions for their assets
- Work diligently to minimize the waste stream and preserve natural resources, particularly through energy and water conservation
- Participate in educational and training programs offered to employees in a curriculum consistent with the program needs
- Comply with all environmental legislation and strive to follow best practices
- Make environmental considerations an important aspect of decision making
- Identify areas for improvement and innovation at the property level and support efforts of the Green Knights within each region
- Review the Sensible Sustainability program's objectives regularly

Through Sensible Sustainability, [COMPANY] is raising the standard of building efficiency in a way that conserves valuable resources while supporting the industry's growth through sensible business practices.

OUR COMMITMENT is that all **OFFICE** buildings will:

1. Register and benchmark to EPA ENERGY STAR® inputting **monthly** all metered utilities including energy and water. Pursue certification plaques for all eligible buildings upon Client approval.

2. Complete "No Cost-Low Cost" Operations and Maintenance checklist, implementing all initiatives applicable to the property.

3. Complete [COMPANY]/BOMA BEEP training.

4. Adopt and adhere to approved [COMPANY] Green Cleaning protocols, including products and processes and utilize Green Seal Certified Chemicals where available. Update Janitorial service contract to include green cleaning specifications and terms.

5. Conduct and report a central collection waste audit and submit quarterly copies to recycling@[COMPANY].com.

6. Using the waste audit report results, develop and implement the approved [COMPANY] recycling program which includes batteries, lamps, ballasts, paper, cardboard, glass and aluminum products. Complete a monthly waste diversion report for all buildings. Submit copies quarterly to recycling@[COMPANY].com for data tracking purposes.

7. Develop and implement a low impact exterior site maintenance plan utilizing green landscape management practices combined with an integrated pest control program.

8. Distribute the 101 Tips to Sustainability checklist to all tenants so they may individually implement environmental solutions for their operations.

9. Communicate Sustainability message monthly to tenants through [COMPANY] standard newsletters, lobby placards, portal postings, etc. using [COMPANY] prepared and distributed materials and update Building Rules and Regulations to reflect required sustainability practices.

10. Include an update on Sustainability in each monthly report to ownership, incorporating the 9 steps above as a guide. Submit copies quarterly to sustainability@[COMPANY].com for data tracking purposes.

Appendix 4: Top 25 Office Property Owners

TOP 25 Office Property Owners

National Real Estate Investors, Decemeber 31, 2007

Rank	Company Name	Total SF (Millions)	Location
1	REEF	93.6	New York
2	Brookfield Properties	59.5	New York
3	The Blackstone Group	57.9	New York
4	Hines	55.4	Houston
5	CB Richard Ellis Investors	49.8	Los Angeles
6	TIAA-CREF	47	New York
7	ING Clarion Partners	46.8	New York
8	Vornado Realty Trust	44.2	New York
9	Boston Properties	43.8	Boston
10	LaSalle Investment Management	39	Chicago
11	Duke Realty Corp.	36.3	Indianapolis
12	HRPT Properties Trust	35.3	Newton, MA
13	Mack-Cali Realty Corp.	33.3	Edison, NJ
14	SL Green Realty Corp.	32.2	New York
15	Brandywine Realty Trust	31.9	Radnor, PA
16	Behringer Harvard	30.4	Addison, TX
17	J.E. Roberts Cos.	27.7	McLean, VA
18	Highwoods Properties	25.7	Raleigh, NC
18	Liberty Property Trust	25.7	Malvern, PA
19	Shorenstein Properties	21.3	San Francisco, CA
20	Wells Real Estate Funds	20.5	Norcross, GA
21	KBS Realty Advisors	18.7	Newport Beach, CA
22	The Inland Real Estate Group of Cos.	18	Oak Brook, IL
23	AEW Capital Management	15.3	Boston
24	Lincoln Property Co.	14.6	Dallas
25	Forest City Enterprises	13.4	Cleveland
	TOTAL	937.3	

Appendix 5: Top 25 Largest Real Estate Investment Managers

Largest Real Esate Investment Managers Pensions & Investments, October 2006		
Rank	**Company Name**	**Total (Millions)**
1	ING Clarion/ING RE	$82,845
2	Prudential Real Estate	$52,228
3	TIAA-CREF	$46,417
4	RREEF/DB Real Estate	$39,552
5	Principal Real Estate	$35,211
6	UBS Global Real Estate	$29,396
7	JPMorgan Asset Mgmt.	$29,068
8	LaSalle Investment	$25,229
9	CB Richard Ellis Investors	$20,420
10	Morgan Stanley	$18,578
11	INVESCO Real Estate	$17,347
12	New York Life Invest. Mgmt.	$15,415
13	Henderson Global Investors	$13,600
14	Blackstone Real Estate	$10,986
15	Heitman	$9,576
16	BlackRock Realty Advisors	$8,050
17	Kennedy Associates	$7,621
18	General Motors Asset Mgmt.	$7,150
19	Citigroup Alternative	$6,214
20	Cornerstone Real Estate	$6,186
21	Russell Investment Group	$6,031
22	Goldman, Sachs	$5,880
23	MacFarlane Partners	$5,468
24	Hancock Timber	$5,200
25	AEW Capital	$4,855
	TOTAL	$508,523

Appendix 6: Top 25 Largest Property Managers

TOP 25 Property Managers

National Real Estate Investors, Decemeber 31, 2007

Rank	Company Name	Total SF (Millions)	Location
1	CB Richard Ellis Group	1,900.0	Los Angeles
2	Jones Lang LaSalle	1,200.0	Chicago
3	Colliers International	868.0	Boston
4	ProLogis	510.2	Denver
5	Cushman & Wakefield	500.0	New York
6	RREEF	274.4	New York
7	Grubb & Ellis	265.6	Santa Ana
8	NAI Global	250.0	Princeton, NJ
9	Lincoln Property Co.	241.1	Dallas, TX
10	Simon Property Group	238.0	Indianapolis
11	General Growth Properties	207.0	Chicago
12	PM Realty Group	171.5	Houston
13	GVA Worldwide	154.0	Evanston, IL
14	Developers Diversified Realty	163.0	Beachwood, OH
15	TIAA-CREF	150.0	New York
16	AMB Property Corp.	148.8	San Francisco
17	Equity Residential	148.0	Chicago
18	Duke Realty Corp.	142.2	Indianapolis
19	Kimco Realty Corp.	124.7	New Hyde Park, NY
20	Transwestern	124.0	Houston
21	Hines	120.1	Houston
22	Centro Properties Group	106.5	New York
23	The Inland Real Estate Group of Cos.	105.6	Oak Brook, IL
24	First Industrial Realty Trust	104.3	Chicago
25	Vornado	94.6	New York
	TOTAL	8,311.6	

Appendix 7: Base Case Property Before-Tax Cash Flow

INPUTS

		Year Zero Operating Costs	$ 8.30		
Net Rentable SF	100,000	Electricity % Op Costs	20.05%	Project Total Cost	$ 200,000
Average Tenant Size	20,000	Electricity Costs Year Zero	$ 1.66	Project Cost PSF	$ 2.00
Discount Rate	7.50%	Electricty Price per kWh	$ 0.106		
Purchase Cap Rate	9.00%	Electricity Usage (kWh)	15.70	Tenant Renewal Probability	75.0%
Exit Cap Rate	9.00%	Electricity Price Growth	2.55%	Absorption	6.0

Base Case Property Before Tax Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10	11
Gross Rental Revenues		1,943,000	1,982,346	2,071,985	2,071,985	2,103,377	2,103,377	2,157,028	2,322,003	2,322,003	2,379,778	2,379,778
Less Vacancy & Absorption		0	(102,068)	(156,930)	0	(54,958)	0	(57,740)	(177,552)	0	(62,180)	0
Plus Expense Reimbursements		29,050	35,470	12,448	44,656	58,659	93,161	95,496	28,826	67,080	69,668	110,646
Effective Gross Income		1,972,050	1,915,748	1,927,503	2,116,641	2,107,078	2,196,538	2,194,783	2,173,277	2,389,082	2,387,266	2,490,424
Total Operating Expenses		(859,050)	(889,117)	(920,236)	(952,444)	(985,780)	(1,020,282)	(1,055,992)	(1,092,952)	(1,131,205)	(1,170,797)	(1,211,775)
Net Operating Income		1,113,000	1,026,631	1,007,267	1,164,197	1,121,298	1,176,256	1,138,791	1,080,326	1,257,877	1,216,469	1,278,650
Sale Reversion		12,366,667	11,407,009	11,191,853	12,935,518	12,458,870	13,069,516	12,653,238	12,003,619	13,976,416	13,516,328	14,207,218
Total Return (Yr 4 Sale)	(12,366,667)	1,113,000	1,026,631	1,007,267	1,164,197	12,458,870						
Total Return (Yr 10 Sale)	(12,366,667)	1,113,000	1,026,631	1,007,267	1,164,197	1,121,298	1,176,256	1,138,791	1,080,326	1,257,877	1,216,469	14,207,218
IRR (Yr 4 Sale)	7.3%											
IRR (Yr 10 Sale)	9.4%											
NPV (Yr 4 Sale)	$ (76,322)											
NPV (Yr 10 Sale)	$ 1,612,684											

Appendix 8: Cosmetic Upgrade Increases Rents $0.50 psf

After Upgrade (Cosmetic Upgrade Increases Rents) Property Before Tax Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10	11
Gross Rental Revenues		1,943,000	2,003,358	2,125,304	2,125,304	2,157,504	2,157,504	2,212,535	2,381,756	2,381,756	2,441,018	2,441,018
Less Vacancy & Absorption		0	(104,695)	(160,968)	0	(56,372)	0	(59,226)	(182,121)	0	(63,780)	0
Plus Expense Reimbursements		29,050	35,470	12,448	44,656	58,659	93,161	95,496	28,826	67,080	69,668	110,646
Effective Gross Income		1,972,050	1,934,134	1,976,783	2,169,960	2,159,791	2,250,665	2,248,805	2,228,461	2,448,835	2,446,906	2,551,664
Total Operating Expenses		(859,050)	(889,117)	(920,236)	(952,444)	(985,780)	(1,020,282)	(1,055,992)	(1,092,952)	(1,131,205)	(1,170,797)	(1,211,775)
Net Operating Income		1,113,000	1,045,017	1,056,548	1,217,516	1,174,011	1,230,383	1,192,813	1,135,510	1,317,630	1,276,109	1,339,889
Sale Reversion		12,366,667	11,611,297	11,739,418	13,527,954	13,044,567	13,670,927	13,253,480	12,616,774	14,640,338	14,178,991	14,887,660
Total Return (Yr 4 Sale)	$ (12,366,667)	1,113,000	1,045,017	1,056,548	1,217,516	13,044,567						
Total Return (Yr 10 Sale)	$ (12,366,667)	1,113,000	1,045,017	1,056,548	1,217,516	1,174,011	1,230,383	1,192,813	1,135,510	1,317,630	1,276,109	14,887,660
IRR (Yr 4 Sale)	8.4%											
IRR (Yr 10 Sale)	10.0%											
NPV (Yr 4 Sale)	$ 392,029											
NPV (Yr 10 Sale)	$ 2,168,976											
Incremental NOI is the difference between Base Case NOI and After Upgrade NOI.												
Incremental NOI	$ (200,000)	$ -	$ 18,386	$ 49,281	$ 53,319	$ 52,713	$ 54,127	$ 54,022	$ 55,184	$ 59,753	$ 59,640	$ 61,240
Project NPV (10 Yrs)	$ 84,559											
Project IRR					-14%	-4%	3%	7%	11%	13%	15%	16%

Permutation #2: Lease Rates Increase $0.50 psf

Year	0	1	2	3	4	5	6	7	8	9	10	11
Rent Increase		$ 0.50	2.57%	2.57%	2.57%	2.57%	2.57%	2.57%	2.57%	2.57%	2.57%	2.57%
Base Case: Avg Gross Rent PSF		$ 19.43	$ 19.82	$ 20.72	$ 20.72	$ 21.03	$ 21.03	$ 21.57	$ 23.22	$ 23.22	$ 23.80	$ 23.80
Base Case: Cash Flow Operations		$ 11.13	$ 10.27	$ 10.07	$ 11.64	$ 11.21	$ 11.76	$ 11.39	$ 10.80	$ 12.58	$ 12.16	$ 12.79
Adj: Avg Gross Rent PSF		$ 19.43	$ 20.03	$ 21.25	$ 21.25	$ 21.58	$ 21.58	$ 22.13	$ 23.82	$ 23.82	$ 24.41	$ 24.41
Adj: Cash Flow Operations		$ 11.13	$ 10.45	$ 10.57	$ 12.18	$ 11.74	$ 12.30	$ 11.93	$ 11.36	$ 13.18	$ 12.76	$ 13.40
Incremental Cash Flow Operations	$ (2.00)	$ -	$ 0.18	$ 0.49	$ 0.53	$ 0.53	$ 0.54	$ 0.54	$ 0.55	$ 0.60	$ 0.60	$ 0.61
Annual Capitalized Value	9.00%	$ -	$ 2.04	$ 5.48	$ 5.92	$ 5.86	$ 6.01	$ 6.00	$ 6.13	$ 6.64	$ 6.63	$ 6.80
Project NPV	$0.85											
Project IRR					-14%	-4%	3%	7%	11%	13%	15%	16%

Appendix 9: Lease-up Improved (85% / 4 mos)

After Upgrade (Lease-Up Improved) Property Before Tax Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10	11
Gross Rental Revenues		1,943,000	1,982,346	2,071,985	2,071,985	2,103,377	2,103,377	2,157,028	2,322,003	2,322,003	2,379,778	2,379,778
Less Vacancy & Absorption		0	(40,827)	(62,772)	0	(21,983)	0	(23,096)	(71,021)	0	(24,872)	0
Plus Expense Reimbursements		29,050	35,470	12,448	44,656	58,659	93,161	95,496	28,826	67,080	69,668	110,646
Effective Gross Income		1,972,050	1,976,989	2,021,661	2,116,641	2,140,053	2,196,538	2,229,427	2,279,808	2,389,082	2,424,575	2,490,424
Total Operating Expenses		(859,050)	(889,117)	(920,236)	(952,444)	(985,780)	(1,020,282)	(1,055,992)	(1,092,952)	(1,131,205)	(1,170,797)	(1,211,775)
Net Operating Income		1,113,000	1,087,872	1,101,425	1,164,197	1,154,273	1,176,256	1,173,436	1,186,857	1,257,877	1,253,778	1,278,650
Sale Reversion		12,366,667	12,087,464	12,238,052	12,935,518	12,825,257	13,069,516	13,038,174	13,187,297	13,976,416	13,930,862	14,207,218
Total Return (Yr 4 Sale)	(12,366,667)	1,113,000	1,087,872	1,101,425	1,164,197	12,825,257						
Total Return (Yr 10 Sale)	(12,366,667)	1,113,000	1,087,872	1,101,425	1,164,197	1,154,273	1,176,256	1,173,436	1,186,857	1,257,877	1,253,778	14,207,218
IRR (Yr 4 Sale)	24.3%											
IRR (Yr 10 Sale)	9.6%											
NPV (Yr 4 Sale)	$ 9,214,429											
NPV (Yr 10 Sale)	$ 1,845,681											
Incremental NOI is the difference between Base Case NOI and After Upgrade NOI.												
Incremental NOI	$ (200,000)	$ -	$ 61,241	$ 94,158	$ -	$ 32,975	$ -	$ 34,644	$ 106,531	$ -	$ 37,308	$ -
Project NPV (10 Yrs)	$ 46,951											
Project IRR				-9%	-9%	-2%	-2%	3%	11%	11%	13%	13%

Permutation #2: Renewal Probability Increase to 85%; Absorption Period Decrease to 4 Months

Year	0	1	2	3	4	5	6	7	8	9	10	11
Tenant Renewal Probability		85.0%										
Absorption (Mos)		4.00										
Base Case: Vacancy & Absorption		$ -	$ (1.02)	$ (1.57)	$ -	$ (0.55)	$ -	$ (0.58)	$ (1.78)	$ -	$ (0.62)	$ -
Adj Vacancy & Absorption		$ -	$ (0.41)	$ (0.63)	$ -	$ (0.22)	$ -	$ (0.23)	$ (0.71)	$ -	$ (0.25)	$ -
Increased Operational Cash Flow	$ (2.00)	$ -	$ 0.61	$ 0.94	$ -	$ 0.33	$ -	$ 0.35	$ 1.07	$ -	$ 0.37	$ -
Project NPV	$0.47											
Project IRR				-9%	-9%	-2%	-2%	3%	11%	11%	13%	13%

Appendix 10: Electricity Consumption Decreases by 30%

After Upgrade (Lighting Retrofit Decreases Operating Expenses) Property Before Tax Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10	11
Gross Rental Revenues		1,943,000	1,982,346	2,071,985	2,071,985	2,103,377	2,103,377	2,157,028	2,322,003	2,322,003	2,379,778	2,379,778
Less Vacancy & Absorption		0	(102,068)	(156,930)	0	(54,958)	0	(57,740)	(177,552)	0	(62,180)	0
Plus Expense Reimbursements		0	0	11,683	41,912	55,055	87,437	89,629	27,055	62,958	65,388	103,848
Effective Gross Income		1,943,000	1,880,278	1,926,738	2,113,897	2,103,474	2,190,815	2,188,916	2,171,506	2,384,961	2,382,986	2,483,626
Total Operating Expenses		(806,270)	(834,489)	(863,696)	(893,926)	(925,213)	(957,596)	(991,112)	(1,025,800)	(1,061,703)	(1,098,863)	(1,137,323)
Net Operating Income		1,136,730	1,045,788	1,063,041	1,219,971	1,178,261	1,233,219	1,197,804	1,145,706	1,323,257	1,284,123	1,346,303
Sale Reversion		$ 12,630,334	$ 11,619,869	$ 11,811,570	$ 13,555,236	$ 13,091,785	$ 13,702,431	$ 13,308,937	$ 12,730,062	$ 14,702,860	$ 14,268,032	$ 14,958,922
Total Return (Yr 4 Sale)	$ (12,366,667)	$ 1,136,730	$ 1,045,788	$ 1,063,041	$ 1,219,971	$ 13,091,785						
Total Return (Yr 10 Sale)	$ (12,366,667)	$ 1,136,730	$ 1,045,788	$ 1,063,041	$ 1,219,971	$ 1,178,261	$ 1,233,219	$ 1,197,804	$ 1,145,706	$ 1,323,257	$ 1,284,123	$ 14,958,922
IRR (Yr 4 Sale)	8.5%											
IRR (Yr 10 Sale)	10.0%											
NPV (Yr 4 Sale)	$ 450,352											
NPV (Yr 10 Sale)	$ 2,245,550											
Incremental NOI is the difference between Base Case NOI and After Upgrade NOI.												
Incremental NOI	$ (200,000)	$ 23,730	$ 19,157	$ 55,775	$ 55,775	$ 56,962	$ 56,962	$ 59,013	$ 65,380	$ 65,380	$ 67,653	$ 67,653
Project NPV (10 Yrs)	$ 131,214											
Project IRR				-25%	-8%	2%	8%	12%	15%	17%	19%	20%

Permutation #2: Electricity Consumption Decreases 30%

Year	0	1	2	3	4	5	6	7	8	9	10	11
Decrease Electricity Consumption	30.0%											
Base Case: Avg Operating Cost	$ 8.30	$ 8.59	$ 8.89	$ 9.20	$ 9.52	$ 9.86	$ 10.20	$ 10.56	$ 10.93	$ 11.31	$ 11.71	$ 12.12
Other Operating Expense		$ 6.87	$ 7.11	$ 7.36	$ 7.61	$ 7.88	$ 8.16	$ 8.44	$ 8.74	$ 9.04	$ 9.36	$ 9.69
Base Case Electricity Cost		$ 1.72	$ 1.78	$ 1.85	$ 1.91	$ 1.98	$ 2.05	$ 2.12	$ 2.19	$ 2.27	$ 2.35	$ 2.43
Market Electricity Price ($/KwH)	$ 0.106	$ 0.109	$ 0.111	$ 0.114	$ 0.117	$ 0.120	$ 0.123	$ 0.126	$ 0.130	$ 0.133	$ 0.136	$ 0.140
Electricity Consumption (KwH/SF)	15.70	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99
Adjusted Electricity Cost	$ 1.66	$ 1.19	$ 1.23	$ 1.26	$ 1.29	$ 1.32	$ 1.35	$ 1.39	$ 1.42	$ 1.46	$ 1.50	$ 1.54
Savings (Base Case - Adjusted)		$ 0.53	$ 0.56	$ 0.59	$ 0.62	$ 0.66	$ 0.69	$ 0.73	$ 0.77	$ 0.81	$ 0.85	$ 0.89
Annual Tenant Level Savings		$ 0.29	$ 0.35	$ 0.01	$ 0.03	$ 0.04	$ 0.06	$ 0.06	$ 0.02	$ 0.04	$ 0.04	$ 0.07
Annual Landlord Level Savings		$ 0.24	$ 0.20	$ 0.58	$ 0.59	$ 0.62	$ 0.63	$ 0.67	$ 0.75	$ 0.77	$ 0.81	$ 0.82
	$ (2.00)	$ 0.53	$ 0.56	$ 0.59	$ 0.62	$ 0.66	$ 0.69	$ 0.73	$ 0.77	$ 0.81	$ 0.85	$ 0.89
Project NPV (10 Yrs)	$2.34											
Project IRR			-32%	-8%	6%	14%	19%	23%	25%	27%	28%	29%
Adj Actual Op Exp/Base Year		$ 8.06	$ 8.34	$ 8.64	$ 8.94	$ 9.25	$ 9.58	$ 9.91	$ 10.26	$ 10.62	$ 10.99	$ 11.37

Appendix 11: Year 1 Investment Energy Efficiency

Investment Made in Year 1 Instead of Year 0

After Upgrade (Lighting Retrofit Decreases Operating Expenses) Property Before Tax Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10	11
Gross Rental Revenues		1,943,000	1,982,346	2,071,985	2,071,985	2,103,377	2,103,377	2,157,028	2,322,003	2,322,003	2,379,778	2,379,778
Less Vacancy & Absorption		0	(102,068)	(156,930)	0	(54,958)	0	(57,740)	(177,552)	0	(62,180)	0
Plus Expense Reimbursements		29,050	0	11,667	41,855	54,980	87,318	89,507	27,018	62,873	65,299	103,707
Effective Gross Income		1,972,050	1,880,278	1,926,722	2,113,840	2,103,399	2,190,696	2,188,794	2,171,469	2,384,875	2,382,897	2,483,485
Total Operating Expenses		(859,050)	(833,354)	(862,522)	(892,710)	(923,955)	(956,293)	(989,764)	(1,024,405)	(1,060,260)	(1,097,369)	(1,135,777)
Net Operating Income		1,113,000	1,046,923	1,064,200	1,221,130	1,179,444	1,234,402	1,199,030	1,147,064	1,324,616	1,285,528	1,347,709
Sale Reversion		$ 12,366,667	$ 11,632,479	$ 11,824,445	$ 13,568,111	$ 13,104,934	$ 13,715,580	$ 13,322,560	$ 12,745,155	$ 14,717,952	$ 14,283,649	$ 14,974,540
Incremental NOI is the difference between Base Case NOI and After Upgrade NOI.												
Incremental NOI		$ (200,000)	$ 20,292	$ 56,933	$ 56,933	$ 58,146	$ 58,146	$ 60,239	$ 66,738	$ 66,738	$ 69,059	$ 69,059
Project IRR				-41%	-16%	-1%	7%	13%	17%	19%	21%	22%

Permutation #2: Electricity Consumption Decreases 30%

Year	0	1	2	3	4	5	6	7	8	9	10	11
Decrease Electricity Consumption	30.0%											
Base Case: Avg Operating Cost	$ 8.30	$ 8.59	$ 8.89	$ 9.20	$ 9.52	$ 9.86	$ 10.20	$ 10.56	$ 10.93	$ 11.31	$ 11.71	$ 12.12
Other Operating Expense		$ 6.87	$ 7.11	$ 7.36	$ 7.61	$ 7.88	$ 8.16	$ 8.44	$ 8.74	$ 9.04	$ 9.36	$ 9.69
Base Case Electricity Cost		$ 1.72	$ 1.78	$ 1.85	$ 1.91	$ 1.98	$ 2.05	$ 2.12	$ 2.19	$ 2.27	$ 2.35	$ 2.43
Market Electricity Price ($/KwH)	$ 0.106	$ 0.109	$ 0.111	$ 0.114	$ 0.117	$ 0.120	$ 0.123	$ 0.126	$ 0.130	$ 0.133	$ 0.136	$ 0.140
Electricity Consumption (KwH/SF)	15.70	15.70	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99
Adjusted Electricity Cost	$ 1.66	$ 1.72	$ 1.23	$ 1.26	$ 1.29	$ 1.32	$ 1.35	$ 1.39	$ 1.42	$ 1.46	$ 1.50	$ 1.54
Savings (Base Case - Adjusted)		$ -	$ 0.56	$ 0.59	$ 0.62	$ 0.66	$ 0.69	$ 0.73	$ 0.77	$ 0.81	$ 0.85	$ 0.89
Annual Tenant Level Savings		$ -	$ 0.35	$ 0.01	$ 0.03	$ 0.04	$ 0.06	$ 0.06	$ 0.02	$ 0.04	$ 0.04	$ 0.07
Annual Landlord Level Savings		$ -	$ 0.20	$ 0.58	$ 0.59	$ 0.62	$ 0.63	$ 0.67	$ 0.75	$ 0.76	$ 0.81	$ 0.82
		$ (2.00)	$ 0.56	$ 0.59	$ 0.62	$ 0.66	$ 0.69	$ 0.73	$ 0.77	$ 0.81	$ 0.85	$ 0.89
Project IRR				-30%	-6%	8%	16%	21%	25%	27%	29%	30%
Adj Actual Op Exp/Base Year		$ 8.59	$ 8.33	$ 8.63	$ 8.93	$ 9.24	$ 9.56	$ 9.90	$ 10.24	$ 10.60	$ 10.97	$ 11.36

Appendix 12: Year 2 Investment Energy Efficiency

Investment Made in Year 2 Instead of Year 0
After Upgrade (Lighting Retrofit Decreases Operating Expenses) Property Before Tax Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10	11
Gross Rental Revenues		1,943,000	1,982,346	2,071,985	2,071,985	2,103,377	2,103,377	2,157,028	2,322,003	2,322,003	2,379,778	2,379,778
Less Vacancy & Absorption		0	(102,068)	(156,930)	0	(54,958)	0	(57,740)	(177,552)	0	(62,180)	0
Plus Expense Reimbursements		29,050	35,470	(11,104)	19,044	43,528	75,823	89,386	26,982	62,788	65,211	103,567
Effective Gross Income		1,972,050	1,915,748	1,903,951	2,091,029	2,091,947	2,179,200	2,188,673	2,171,433	2,384,790	2,382,809	2,483,345
Total Operating Expenses		(859,050)	(889,117)	(861,358)	(891,506)	(922,708)	(955,003)	(988,428)	(1,023,023)	(1,058,829)	(1,095,888)	(1,134,244)
Net Operating Income		1,113,000	1,026,631	1,042,593	1,199,523	1,169,239	1,224,197	1,200,245	1,148,410	1,325,962	1,286,921	1,349,101
Sale Reversion		12,366,667	11,407,009	11,584,372	13,328,037	12,991,547	13,602,194	13,336,057	12,760,108	14,732,906	14,299,123	14,990,013
Incremental NOI is the difference between Base Case NOI and After Upgrade NOI.												
Incremental NOI		$ -	$ (200,000)	$ 35,327	$ 35,327	$ 47,941	$ 47,941	$ 61,454	$ 68,084	$ 68,084	$ 70,452	$ 70,452
Project IRR						-21%	-7%	4%	11%	15%	18%	20%

Permutation #2: Electricity Consumption Decreases 30%

Year	0	1	2	3	4	5	6	7	8	9	10	11
Decrease Electricity Consumption	30.0%											
Base Case: Avg Operating Cost	$ 8.30	$ 8.59	$ 8.89	$ 9.20	$ 9.52	$ 9.86	$ 10.20	$ 10.56	$ 10.93	$ 11.31	$ 11.71	$ 12.12
Other Operating Expense		$ 6.87	$ 7.11	$ 7.36	$ 7.61	$ 7.88	$ 8.16	$ 8.44	$ 8.74	$ 9.04	$ 9.36	$ 9.69
Base Case Electricity Cost		$ 1.72	$ 1.78	$ 1.85	$ 1.91	$ 1.98	$ 2.05	$ 2.12	$ 2.19	$ 2.27	$ 2.35	$ 2.43
Market Electricity Price ($/KwH)	$ 0.106	$ 0.109	$ 0.111	$ 0.114	$ 0.117	$ 0.120	$ 0.123	$ 0.126	$ 0.130	$ 0.133	$ 0.136	$ 0.140
Electricity Consumption (KwH/SF)	15.70	15.70	15.70	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99
Adjusted Electricity Cost	$ 1.66	$ 1.72	$ 1.78	$ 1.26	$ 1.29	$ 1.32	$ 1.35	$ 1.39	$ 1.42	$ 1.46	$ 1.50	$ 1.54
Savings (Base Case - Adjusted)		$ -	$ -	$ 0.59	$ 0.62	$ 0.66	$ 0.69	$ 0.73	$ 0.77	$ 0.81	$ 0.85	$ 0.89
Annual Tenant Level Savings		$ -	$ -	$ 0.24	$ 0.26	$ 0.15	$ 0.17	$ 0.06	$ 0.02	$ 0.04	$ 0.04	$ 0.07
Annual Landlord Level Savings		$ -	$ -	$ 0.35	$ 0.37	$ 0.50	$ 0.52	$ 0.67	$ 0.75	$ 0.76	$ 0.80	$ 0.82
			$ (2.00)	$ 0.59	$ 0.62	$ 0.66	$ 0.69	$ 0.73	$ 0.77	$ 0.81	$ 0.85	$ 0.89
Project IRR					-28%	-3%	10%	18%	23%	27%	29%	31%
Adj Actual Op Exp/Base Year		$ 8.59	$ 8.89	$ 8.61	$ 8.92	$ 9.23	$ 9.55	$ 9.88	$ 10.23	$ 10.59	$ 10.96	$ 11.34

Appendix 13: Year 4 Investment Energy Efficiency

Investment Made in Year 4 Instead of Year 0
After Upgrade (Lighting Retrofit Decreases Operating Expenses) Property Before Tax Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10	11
Gross Rental Revenues		1,943,000	1,982,346	2,071,985	2,071,985	2,103,377	2,103,377	2,157,028	2,322,003	2,322,003	2,379,778	2,379,778
Less Vacancy & Absorption		0	(102,068)	(156,930)	0	(54,958)	0	(57,740)	(177,552)	0	(62,180)	0
Plus Expense Reimbursements		29,050	35,470	12,448	44,656	6,234	38,443	52,444	26,910	62,620	65,037	103,291
Effective Gross Income		1,972,050	1,915,748	1,927,503	2,116,641	2,054,653	2,141,820	2,151,731	2,171,361	2,384,623	2,382,635	2,483,069
Total Operating Expenses		(859,050)	(889,117)	(920,236)	(952,444)	(920,249)	(952,458)	(985,794)	(1,020,296)	(1,056,007)	(1,092,967)	(1,131,221)
Net Operating Income		1,113,000	1,026,631	1,007,267	1,164,197	1,134,404	1,189,363	1,165,937	1,151,064	1,328,616	1,289,668	1,351,848
Sale Reversion		12,366,667	11,407,009	11,191,853	12,935,518	12,604,493	13,215,140	12,954,858	12,789,605	14,762,403	14,329,646	15,020,536
Incremental NOI is the difference between Base Case NOI and After Upgrade NOI.												
Incremental NOI		$ -	$ -	$ -	$ (200,000)	$ 13,106	$ 13,106	$ 27,146	$ 70,739	$ 70,739	$ 73,199	$ 73,199
Project IRR									-13%	-1%	7%	12%

Permutation #2: Electricity Consumption Decreases 30%

Year	0	1	2	3	4	5	6	7	8	9	10	11
Decrease Electricity Consumption	30.0%											
Base Case: Avg Operating Cost	$ 8.30	$ 8.59	$ 8.89	$ 9.20	$ 9.52	$ 9.86	$ 10.20	$ 10.56	$ 10.93	$ 11.31	$ 11.71	$ 12.12
Other Operating Expense		$ 6.87	$ 7.11	$ 7.36	$ 7.61	$ 7.88	$ 8.16	$ 8.44	$ 8.74	$ 9.04	$ 9.36	$ 9.69
Base Case Electricity Cost		$ 1.72	$ 1.78	$ 1.85	$ 1.91	$ 1.98	$ 2.05	$ 2.12	$ 2.19	$ 2.27	$ 2.35	$ 2.43
Market Electricity Price ($/KwH)	$ 0.106	$ 0.109	$ 0.111	$ 0.114	$ 0.117	$ 0.120	$ 0.123	$ 0.126	$ 0.130	$ 0.133	$ 0.136	$ 0.140
Electricity Consumption (KwH/SF)	15.70	15.70	15.70	15.70	15.70	10.99	10.99	10.99	10.99	10.99	10.99	10.99
Adjusted Electricity Cost	$ 1.66	$ 1.72	$ 1.78	$ 1.85	$ 1.91	$ 1.32	$ 1.35	$ 1.39	$ 1.42	$ 1.46	$ 1.50	$ 1.54
Savings (Base Case - Adjusted)		$ -	$ -	$ -	$ -	$ 0.66	$ 0.69	$ 0.73	$ 0.77	$ 0.81	$ 0.85	$ 0.89
Annual Tenant Level Savings		$ -	$ -	$ -	$ -	$ 0.52	$ 0.55	$ 0.43	$ 0.02	$ 0.04	$ 0.05	$ 0.07
Annual Landlord Level Savings		$ -	$ -	$ -	$ -	$ 0.13	$ 0.14	$ 0.30	$ 0.75	$ 0.76	$ 0.80	$ 0.82
					$ (2.00)	$ 0.66	$ 0.69	$ 0.73	$ 0.77	$ 0.81	$ 0.85	$ 0.89
Project IRR							-23%	2%	15%	23%	28%	31%
Adj Actual Op Exp/Base Year		$ 8.59	$ 8.89	$ 9.20	$ 9.52	$ 9.20	$ 9.52	$ 9.86	$ 10.20	$ 10.56	$ 10.93	$ 11.31

Appendix 14: Electricity Consumption Decrease by 25%

After Upgrade (Lighting Retrofit Decreases Operating Expenses) Property Before Tax Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10	11
Gross Rental Revenues		1,943,000	1,982,346	2,071,985	2,071,985	2,103,377	2,103,377	2,157,028	2,322,003	2,322,003	2,379,778	2,379,778
Less Vacancy & Absorption		0	(102,068)	(156,930)	0	(54,958)	0	(57,740)	(177,552)	0	(62,180)	0
Plus Expense Reimbursements		0	0	11,806	42,356	55,638	88,363	90,577	27,342	63,625	66,080	104,947
Effective Gross Income		1,943,000	1,880,278	1,926,861	2,114,341	2,104,057	2,191,740	2,189,865	2,171,792	2,385,627	2,383,678	2,484,725
Total Operating Expenses		(814,803)	(843,321)	(872,837)	(903,387)	(935,005)	(967,730)	(1,001,601)	(1,036,657)	(1,072,940)	(1,110,493)	(1,149,360)
Net Operating Income		1,128,197	1,036,956	1,054,024	1,210,954	1,169,051	1,224,009	1,188,263	1,135,135	1,312,687	1,273,185	1,335,365
Sale Reversion		$ 12,535,521	$ 11,521,737	$ 11,711,378	$ 13,455,043	$ 12,989,459	$ 13,600,105	$ 13,202,927	$ 12,612,615	$ 14,585,412	$ 14,146,501	$ 14,837,391
Total Return (Yr 4 Sale)	$ (12,366,667)	$ 1,128,197	$ 1,036,956	$ 1,054,024	$ 1,210,954	$ 12,989,459						
Total Return (Yr 10 Sale)	$ (12,366,667)	$ 1,128,197	$ 1,036,956	$ 1,054,024	$ 1,210,954	$ 1,169,051	$ 1,224,009	$ 1,188,263	$ 1,135,135	$ 1,312,687	$ 1,273,185	$ 14,837,391
IRR (Yr 4 Sale)	8.3%											
IRR (Yr 10 Sale)	9.9%											
NPV (Yr 4 Sale)	$356,522											
NPV (Yr 10 Sale)	$2,134,552											
Incremental NOI is the difference between Base Case NOI and After Upgrade NOI.												
Incremental NOI	$ (200,000)	$ 15,197	$ 10,326	$ 46,757	$ 46,757	$ 47,753	$ 47,753	$ 49,472	$ 54,810	$ 54,810	$ 56,716	$ 56,716
Project NPV (10 Yrs)	$ 71,240											
Project IRR					-15%	-5%	2%	6%	10%	12%	14%	15%

Permutation #1: Electricity Consumption Decreases 25%

Year	0	1	2	3	4	5	6	7	8	9	10	11
Decrease Electricity Consumption	25.0%											
Base Case: Avg Operating Cost	$ 8.30	$ 8.59	$ 8.89	$ 9.20	$ 9.52	$ 9.86	$ 10.20	$ 10.56	$ 10.93	$ 11.31	$ 11.71	$ 12.12
Other Operating Expense		$ 6.87	$ 7.11	$ 7.36	$ 7.61	$ 7.88	$ 8.16	$ 8.44	$ 8.74	$ 9.04	$ 9.36	$ 9.69
Base Case Electricity Cost		$ 1.72	$ 1.78	$ 1.85	$ 1.91	$ 1.98	$ 2.05	$ 2.12	$ 2.19	$ 2.27	$ 2.35	$ 2.43
Market Electricity Price ($/KwH)	$ 0.106	$ 0.109	$ 0.111	$ 0.114	$ 0.117	$ 0.120	$ 0.123	$ 0.126	$ 0.130	$ 0.133	$ 0.136	$ 0.140
Electricity Consumption (KwH/SF)	15.70	11.78	11.78	11.78	11.78	11.78	11.78	11.78	11.78	11.78	11.78	11.78
Adjusted Electricity Cost	$ 1.66	$ 1.28	$ 1.31	$ 1.35	$ 1.38	$ 1.42	$ 1.45	$ 1.49	$ 1.53	$ 1.57	$ 1.61	$ 1.65
Savings (Base Case - Adjusted)		$ 0.44	$ 0.47	$ 0.50	$ 0.53	$ 0.56	$ 0.59	$ 0.63	$ 0.66	$ 0.70	$ 0.74	$ 0.78
Annual Tenant Level Savings		$ 0.29	$ 0.35	$ 0.01	$ 0.02	$ 0.03	$ 0.05	$ 0.05	$ 0.01	$ 0.03	$ 0.04	$ 0.06
Annual Landlord Level Savings		$ 0.15	$ 0.12	$ 0.49	$ 0.51	$ 0.53	$ 0.55	$ 0.58	$ 0.65	$ 0.67	$ 0.71	$ 0.73
	$ (2.00)	$ 0.44	$ 0.47	$ 0.50	$ 0.53	$ 0.56	$ 0.59	$ 0.63	$ 0.66	$ 0.70	$ 0.74	$ 0.78
Project NPV (10 Yrs)	$1.74											
Project IRR				-15%	-1%	8%	13%	17%	20%	22%	23%	24%
Adj Actual Op Exp/Base Year		$ 8.15	$ 8.43	$ 8.73	$ 9.03	$ 9.35	$ 9.68	$ 10.02	$ 10.37	$ 10.73	$ 11.10	$ 11.49

Appendix 15: Electricity Consumption Decrease by 35%

After Upgrade (Lighting Retrofit Decreases Operating Expenses) Property Before Tax Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10	11
Gross Rental Revenues		1,943,000	1,982,346	2,071,985	2,071,985	2,103,377	2,103,377	2,157,028	2,322,003	2,322,003	2,379,778	2,379,778
Less Vacancy & Absorption		0	(102,068)	(156,930)	0	(54,958)	0	(57,740)	(177,552)	0	(62,180)	0
Plus Expense Reimbursements		0	0	11,559	41,469	54,472	86,512	88,680	26,769	62,292	64,696	102,749
Effective Gross Income		1,943,000	1,880,278	1,926,614	2,113,453	2,102,891	2,189,889	2,187,967	2,171,220	2,384,295	2,382,294	2,482,527
Total Operating Expenses		(797,737)	(825,657)	(854,556)	(884,465)	(915,421)	(947,461)	(980,622)	(1,014,944)	(1,050,467)	(1,087,233)	(1,125,286)
Net Operating Income		1,145,263	1,054,620	1,072,059	1,228,989	1,187,470	1,242,428	1,207,345	1,156,276	1,333,828	1,295,061	1,357,241
Sale Reversion		$ 12,725,148	$ 11,718,000	$ 11,911,763	$ 13,655,428	$ 13,194,111	$ 13,804,757	$ 13,414,947	$ 12,847,510	$ 14,820,307	$ 14,389,564	$ 15,080,454
Total Return (Yr 4 Sale)	$ (12,366,667)	$ 1,145,263	$ 1,054,620	$ 1,072,059	$ 1,228,989	$ 13,194,111						
Total Return (Yr 10 Sale)	$ (12,366,667)	$ 1,145,263	$ 1,054,620	$ 1,072,059	$ 1,228,989	$ 1,187,470	$ 1,242,428	$ 1,207,345	$ 1,156,276	$ 1,333,828	$ 1,295,061	$ 15,080,454
IRR (Yr 4 Sale)	8.7%											
Irr (Yr 10 Sale)	10.2%											
NPV (Yr 4 Sale)	$544,182											
NPV (Yr 10 Sale)	$2,356,549											
Incremental NOI is the difference between Base Case NOI and After Upgrade NOI.												
Incremental NOI	$ (200,000)	$ 32,263	$ 27,989	$ 64,792	$ 64,792	$ 66,172	$ 66,172	$ 68,554	$ 75,950	$ 75,950	$ 78,591	$ 78,591
Project NPV (10 Yrs)	$ 191,187											
Project IRR				-18%	-2%	8%	13%	17%	20%	22%	23%	24%

Permutation #3: Electricity Consumption Decreases 35%

Year	0	1	2	3	4	5	6	7	8	9	10	11
Decrease Electricity Consur	35.0%											
Base Case: Avg Operating Cc	$ 8.30	$ 8.59	$ 8.89	$ 9.20	$ 9.52	$ 9.86	$ 10.20	$ 10.56	$ 10.93	$ 11.31	$ 11.71	$ 12.12
Other Operating Expense		$ 6.87	$ 7.11	$ 7.36	$ 7.61	$ 7.88	$ 8.16	$ 8.44	$ 8.74	$ 9.04	$ 9.36	$ 9.69
Base Case Electricity Cost		$ 1.72	$ 1.78	$ 1.85	$ 1.91	$ 1.98	$ 2.05	$ 2.12	$ 2.19	$ 2.27	$ 2.35	$ 2.43
Market Electricity Price ($/K	$ 0.106	$ 0.109	$ 0.111	$ 0.114	$ 0.117	$ 0.120	$ 0.123	$ 0.126	$ 0.130	$ 0.133	$ 0.136	$ 0.140
Electricity Consumption (Kw	15.70	10.21	10.21	10.21	10.21	10.21	10.21	10.21	10.21	10.21	10.21	10.21
Adjusted Electricity Cost	$ 1.66	$ 1.11	$ 1.14	$ 1.17	$ 1.20	$ 1.23	$ 1.26	$ 1.29	$ 1.32	$ 1.36	$ 1.39	$ 1.43
Savings (Base Case - Adjusted)		$ 0.61	$ 0.65	$ 0.68	$ 0.71	$ 0.75	$ 0.79	$ 0.83	$ 0.87	$ 0.91	$ 0.96	$ 1.00
Annual Tenant Level Savings		$ 0.29	$ 0.35	$ 0.01	$ 0.03	$ 0.04	$ 0.07	$ 0.07	$ 0.02	$ 0.05	$ 0.05	$ 0.08
Annual Landlord Level Savings		$ 0.32	$ 0.29	$ 0.67	$ 0.68	$ 0.71	$ 0.72	$ 0.76	$ 0.85	$ 0.86	$ 0.91	$ 0.92
	$ (2.00)	$ 0.61	$ 0.65	$ 0.68	$ 0.71	$ 0.75	$ 0.79	$ 0.83	$ 0.87	$ 0.91	$ 0.96	$ 1.00
Project NPV (10 Yrs)	$2.95											
Project IRR			-26%	**-2%**	12%	**20%**	25%	28%	30%	32%	**33%**	34%
Adj Actual Op Exp/Base Year		$ 7.98	$ 8.26	$ 8.55	$ 8.84	$ 9.15	$ 9.47	$ 9.81	$ 10.15	$ 10.50	$ 10.87	$ 11.25