“Energy Efficiency Improvements: Do they Pay?”

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Abstract

The past decade has seen a marked increase in our awareness of the effect of climate change on the global environment. Real estate is directly responsible for 43% of all annual carbon emissions related to energy consumption. Yet in the commercial real estate markets our attention has been primarily focused on new construction and green buildings as the solution to improve our carbon footprint. In this study we attempt to quantify the economic gains associated with investment in energy efficiency improvements (EEI) for commercial real estate. We discuss reasons and challenges associated with taking on this endeavor. Benchmarking the performance of these improvements is discussed through an explanation of the Leadership in Energy and Environmental Design (LEED) program. A series of projects for which investment in EEI has been conducted are reviewed and suggest that economic gains can be significant for these improvements. While data limitations preclude the ability to generalize our results, we believe they demonstrate an area of real estate investment that should not be overlooked. Results of the study will appeal to owners and operators of commercial real estate, as well as tenants who occupy space in these buildings.

Introduction

There is a growing interest in the effect of global warming and climate change on our environment and they are at the forefront of scientific, business, and political discourse. While the two terms have slightly different definitions, there is good reason to pay attention to them. The term climate change is often used interchangeably with the term global warming, but according to the National Academy of Sciences, the phrase 'climate change' is preferred to 'global warming' because it helps convey that there are other changes in addition to rising temperatures (National Academy of Sciences, 2009). Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind), and lasting for an extended period (decades or longer). This can result from natural factors (changes in the Earth's orbit, intensity of the sun), natural processes within the climate system (changes in ocean circulation), and human activity that changes the atmosphere (burning of fossil fuels) or land surface (deforestation, reforestation and urbanization). Global warming is an increase in the average temperature of the atmosphere near the Earth's surface, which can contribute to changes in global climate patterns. This can occur from a variety of causes, both natural and human induced, although it is most commonly thought of as warming that occurs as a result of increased emissions of greenhouse gases from human activities. Regardless of the definition, any change to our global environment is of great importance to us all.

As Thomas Friedman recently stated in his book, 'Hot, Flat, and Crowded: Why We Need a Green Revolution--and How It Can Renew America'; "It only takes a small increase in global average temperatures to have a big effect on weather, because what drives the winds and their circulation patterns on the surface of the earth are differences in temperature. So when you start to change the average surface temperature of the earth, you change the wind patterns - and then before you know it you change the monsoons. When the earth gets warmer you also change the rates of evaporation - which is a key reason we will get more intense rainstorms in some places and hotter dry spells and longer droughts in others" (Friedman, 2008). A lack of sustainability of our actions in

daily life mean we need to think of ways to better manage our use of resources, and the impact of those uses on the environment.

Greenhouse Gas Emissions

While other countries in the world have taken a more proactive stance on this topic, the U.S. has remained somewhat idle in comparison. Measures such as the Kyoto Protocol, adopted in 2005, and which requires members to reduce global greenhouse gas emissions to 1990 levels, has helped accelerate a global awareness of the issue (Kyoto Protocol, 1999). The European Union Emission Trading Scheme (EU-ETS) governs the 27 EU members that have adopted a Kyoto-based compliance market on greenhouse gas emissions[1]. The U.S. was neither a party to the Kyoto Protocol, nor have we taken a firm stance on regulating our carbon emissions as a country. This is in spite of the fact that the U.S. emits more carbon dioxide from the consumption of fossil fuels than any other county in the world (except China), 25% more than all of Europe, and more than the Middle East, Africa and Eurasia combined (EIA, 2006).

The issue of carbon emissions is receiving much more attention in the U.S. today, and the federal government continues to investigate the merits of a regulated cap and trade system for large carbon emitters (The Economist, 2009). Many states and some regions have now implemented their own greenhouse gas systems, but largely on a voluntary basis. Some public and private industries are beginning to acknowledge and address their own greenhouse gas footprints, and are increasingly looking for ways to offset their 'carbon footprint' (CBRE, 2007). Other companies in the U.S. have taken a proactive stance in dealing with their role in the environment. For example, Google, the U.S. based firm that is the world's large information manager, reported in 2007 that it would seek to

[1] Adding more greenhouse gases to the atmosphere, increases the chances for more heat to be trapped and creates the potential for further increases in average global temperatures. CO_2 is the most abundant greenhouse gas in the atmosphere after water vapor (NOAA, 2009). There has been a natural processing system in place for the past 10,000 years in which carbon dioxide is taken out of the atmosphere by plants and is almost perfectly balanced with the amount put back into the atmosphere by respiration and decay. Humans have been changing that since the pre-industrial period (1750) from our burning of fossil fuels, and deforestation practices. In the United States, greenhouse gas emissions come primarily from the combustion of fossil fuels to create energy (EIA, 2008).

become carbon neutral starting in 2008 (Google, 2007). The Carbon Disclosure Project, a UK based group that seeks to 'collect and distribute information to motivate investors, corporations and governments to take action to prevent dangerous climate change', found a 48% increase in the number of the world's largest companies that initiated greenhouse gas emission reductions from 2006 to 2007 (Carbon Disclosure Project, 2007). Many of these companies look to real estate as an initial entry point to create better corporate image and do their part to help reduce their carbon footprint. Between cities, regional markets, and the numerous bills, resolutions and amendments focusing on greenhouse gas emissions and climate change-regulation in Congress today, most agree that a regulated carbon market in the U.S. is not a matter of *if*, but *when*, and *how*. (Mufson, 2007).

Real estate is directly responsible for 43% of all annual carbon emissions related to energy consumption. This figure dominates transportation at 32% and industry at 25% (Brown, 2005). As the EU and other Kyoto Protocol-compliant countries look beyond the 2008-2012 round of trading, they will most surely focus on the role of real estate in carbon emission reductions (Lend Lease, 2007). It is highly probable that the U.S. real estate industry will come under scrutiny as well.

Most in the commercial real estate sector would agree that the industry needs to be more proactive on the sustainability front. This view has led to a significant increase in our awareness and interest in green building and building technology. The predominant green building program in the U.S. is the United States Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) program (Doan, 2006). This program has a number of standards for achieving environmentally balanced, resource-efficient, and healthy buildings. Green buildings are laudable for their positive impact on working and living environments, but because of their *whole* building focus, only *part* of their criteria focus on energy and carbon emissions.[2] Moreover, new construction represents less than 2% of the entire stock of commercial buildings in the U.S. today (EIA, 2003). Of the nearly 4.6 million commercial buildings in the U.S., 75%

[2] For example, to obtain LEED certification of 'Silver' in new construction, one needs to capture 33 points. Of these, 17 relate directly to energy issues.

(3.4 million) were built prior to 1990 (EIA, 2006). Not surprisingly, most of these buildings have much larger carbon footprints and energy consumption needs due to design inefficiencies, outdated systems, and a general lack of understanding of the benefits that may accrue to investment in EEI.[3] The quickest and most immediate steps can be taken by looking at the efficiency of our current real estate operations and consumption patterns, and exploring opportunities to improve on them.

Academic research on the topic of energy efficiency improvements as they relate to the commercial real estate market is almost non-existent. Prior research in the area has focused primarily on facilities management applications, or the more technical aspects of system design and operational management efficiency. While a large market exists for the products of Energy Service Companies (ESCO's), much of their work is focused on government entities, non-profits and single purpose industrial users.[4] Due to the competitive nature of this work, ESCOs have little incentive to share proprietary data for purposes of academic work.

The market for energy efficiency upgrades is sizeable. Anecdotal evidence from the commercial real estate market suggest that upgrades can realize returns of 15-25% on capital invested, and that the overall market in terms of energy savings range from $40 to $200 billion annually (Binkley, 2007). When combined with potential carbon emission offsets, the annual savings for commercial real estate could range from $45 to $275 billion annually. By way of comparison, the market capitalization of the entire U.S. public REIT industry currently stands at approximately $191 billion.

The main objective of this study is to provide a background and better understanding of the issues associated with investment in energy efficiency improvements (EEI) in

[3] A carbon footprint is defined as "the representation of the effect that human activities have on the planet's climate in terms of the total amount of greenhouse gases produced, as measured in units of carbon dioxide (CO_2)." (Royal Geographical Society, 2008).

[4] An Energy Service Company, or ESCO, is a business that develops, installs, and finances projects designed to improve the energy efficiency and maintenance costs for facilities over a seven to twenty year time period. ESCOs generally act as project developers for a wide range of tasks and assume the technical and performance risk associated with the project (National Association of Energy Service Companies, 2009).

commercial real estate. While EEI and carbon emission offsets are inter-twined and both relate to the world of commercial real estate, our focus in this paper will be on investment in EEI.[5] To do so, we will discuss energy prices, operational savings and potential U.S. regulatory actions around carbon emissions. We also explore various options for benchmarking the performance of buildings with special emphasis on motivations, costs, and financing of LEED for existing buildings (LEED-EB). We then review a series of examples to illustrate costs and savings associated actual energy efficiency improvements and conclude by discussing the implications of our findings.

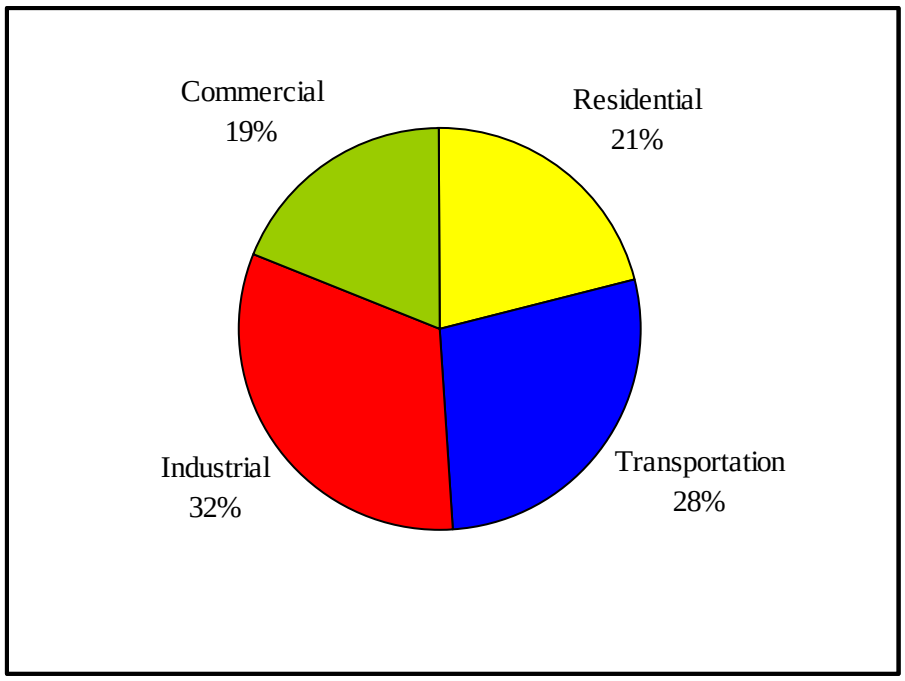
Real Estate and Energy Efficiency Improvements

Energy efficiency can be defined as the reduction in energy which is sought in order to affect some level of service or activity. Broad reasons to adopt such measures include: improved energy security (less dependence on fossil fuels or sources of energy), employment creation (jobs resulting from such activities), new business opportunities, and cost savings (Klessmann, et. al. 2007). Energy efficiency measures can be undertaken at a broad economic level, or within a certain sectors of the economy. Examples include a desire to reduce the U.S. consumption of oil and gas, the creation of more efficient distribution lines for electricity transmission, or the creation and development of more efficient lighting for use in businesses and homes. As with many terms associated with 'sustainability', energy efficiency has different meanings to different people. Common to most is the notion that energy efficiency is about 'doing more with less', not 'doing without'.[6] Of the many reasons for undertaking energy efficiency measures, perhaps one of the most compelling is the speed and cost at which many energy efficiency improvements may be implemented. Examples in the area of real estate include changes in lighting, installing insulation and thermostats, use of more efficient blinds and shades, re-commissioning of systems and the like.

[5] For more information on carbon emission offsets, see Binkley and Ciochetti, 2009.
[6] See DiBona (2008) for additional information on the definition and applications of energy efficiency concepts.

Buildings constitute the largest users of energy in the U.S., with 40% of the market (*Figure 1*). This dominates energy use by both the transportation and industrial sectors which comprise 28% and 32% of the total consumption in the U.S., respectively.[7] As one might expect, consumption of energy is highly correlated with CO_2 emissions as well.[8]

Figure 1: Consumption of U.S. Energy in 2008



Source: U.S. Energy Information Administration, 2009

While residential buildings consume the majority of energy in the building sector, this is due to the sheer number of homes in the U.S. The approximate size of the residential market is 225 billion square feet, nearly nine times that of the office market which comprises approximately 12.2 billion square feet.[9] Yet, when energy consumption is compared on a relative per square foot basis, residential buildings lag all other uses, with the exception of religious institutions and warehouse and storage buildings (*Figure 2*).

[7] U.S. Energy Information Administration, 2009.
[8] Buildings produce 43% of all carbon dioxide emissions (CO_2) from fossil fuel consumption, as compared to 32% from transportation and 25% from industry. Within the building sector, industrial buildings produce 11.6%, commercial 39.5%, and residential 48.9% (Pew Center on Global Change, 2005).
[9] U.S. Energy Information Administration, 2005.

Of particular note is the fact that residential energy consumption is almost half that of commercial office buildings, at 43,700 BTU/Sq. Ft. as compared to 92,889 BTU/Sq. Ft. for office. In this study we focus our attention on office buildings since they: 1) constitute the largest investable commercial real estate sector in the U.S., and 2) since office buildings have a high level of energy consumption, there may be more opportunity for energy efficiency improvement (EEI) investments in this product type.[10]

Figure 2: Energy Consumption of Buildings

Principal Building Activity	Consumption per Sq Ft. (BTU)	Number of Buildings (000)	Total Sq Ft (mn)	Total Energy Consumption (Btu) (bn)
Residential	43,700	111,100	225,800	10,550,000
Commercial				
Education	83,046	386	9,874	820,000
Food Sales	200,000	226	1,255	251,000
Food Service	258,162	297	1,654	427,000
Health Care	187,796	129	3,163	594,000
- Inpatient	249,343	8	1,905	475,000
- Outpatient	94,594	121	1,258	119,000
Lodging	100,078	142	5,096	510,000
Retail (Non-Mall)	73,893	443	4,317	319,000
Office	92,889	824	12,208	1,134,000
Public Assembly	93,932	277	3,939	370,000
Public Order & Safety	115,596	71	1,090	126,000
Religious Worship	43,420	370	3,754	163,000
Service	77,037	622	4,050	312,000
Warehouse & Storage	45,247	597	10,078	456,000
Other	164,556	79	1,738	286,000

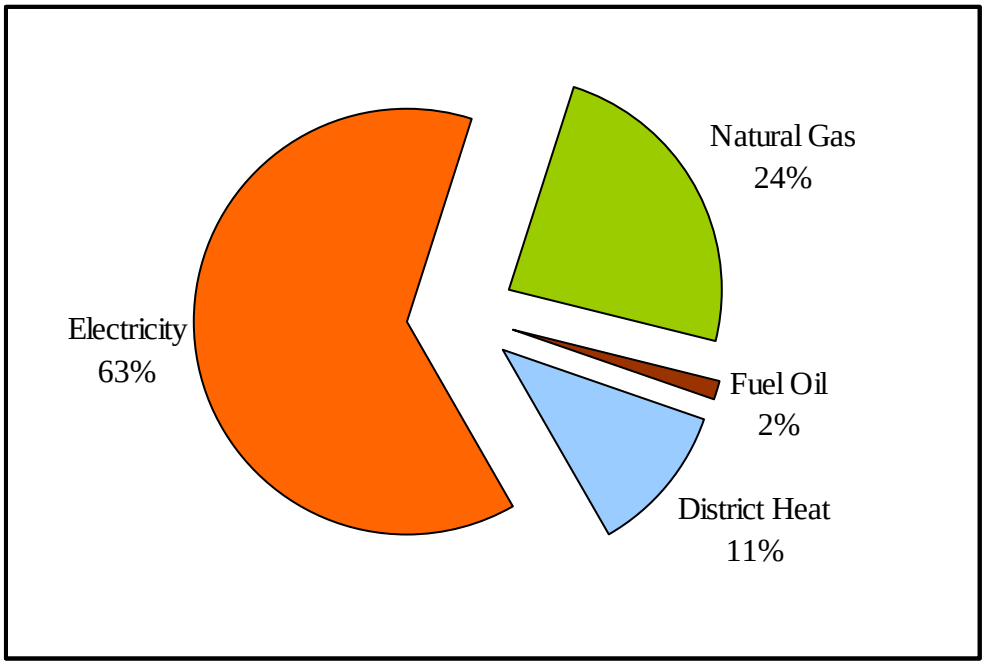
Source: U.S. Energy Information Administration, 2005[11]

The impact of energy improvements on buildings can be measured, monitored and improved upon, and because buildings are major consumers of energy, opportunities for efficiency improvements are ongoing. The type of energy consumed in the operations of

[10] By market capitalization, office product constitutes approximately 40% of institutional investment holdings in real estate (National Council of Investment Fiduciaries, 2008).
[11] The Energy Information Administration conducts energy consumption surveys for residential and commercial buildings every 4 years, and it can take 2 to 4 years for the EIA to process and release the data.

office buildings is shown in *Figure 3* and consists of four major categories: electricity, natural gas, fuel oil and district heat.[12]

Figure 3: Energy Consumption by Fuel Type



Source: U.S. Energy Information Administration, 2003

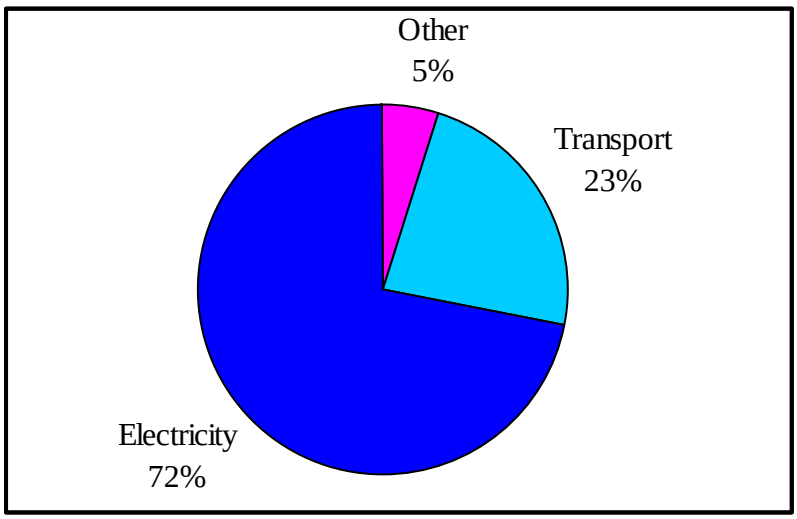
As shown, electricity represents by far the most dominant form of energy consumed in office buildings in the U.S. today. This type of power is typically purchased from utility companies and is produced by the burning of coal, oil, natural gas, or through sources such as hydropower, wind, solar or nuclear. Most of these sources create some form of emission, typically in the form of CO_2, and consumption of electricity comprises nearly 80% of the total amount of CO_2 emissions within the commercial building sector.[13]

When News Corporation announced in 2007 that it had set a goal to reach carbon neutrality by 2010, they conducted a study on their existing use of energy for all

[12] District heat refers to a source emanating from outside the building in a central plant and then being piped into a building for distribution and use.
[13] U.S. Energy Information Association, 2008.

operations within the company and their effect on greenhouse gas emissions.[14] As shown in *Figure 4*, electricity was by far the most significant contributor to greenhouse gases, comprising 72% of total emissions.[15]

Figure 4: News Corps' Greenhouse Gas Emissions by Source



Source: News Corporation (2007)

In the role of real estate decision-making, one often encounters a conflict between a 'top-down' or 'bottom-up' approach as to *whether* and *how* decisions are made. Typically, strategic and tactical decisions about investing in real estate come from mixed-asset portfolio managers and/or those with overall responsibility for real estate operations. Individual investments are often made by acquisition teams with support of others in the organization, and management of the assets generally is handled by asset and property managers. In the case of real estate investment motivated primarily by sustainability concerns, it is often the operations managers or onsite facilities managers that see the opportunity for value enhancement at the individual building level.[16] Only over the past few years has awareness increased to a level that those with overall control of portfolios

[14] News Corporation, 2007.
[15] Each company (and building) will have its own 'energy' signature. Notwithstanding this however, the role of potential energy savings in the construction and operations of real estate products are significant.
[16] Increasingly, the path to sustainability is being motivated by those in facilities and operations management (Real Estate Weekly, 2008).

understand the economic and marketing benefits associated with a ‘greening’ of their portfolios.

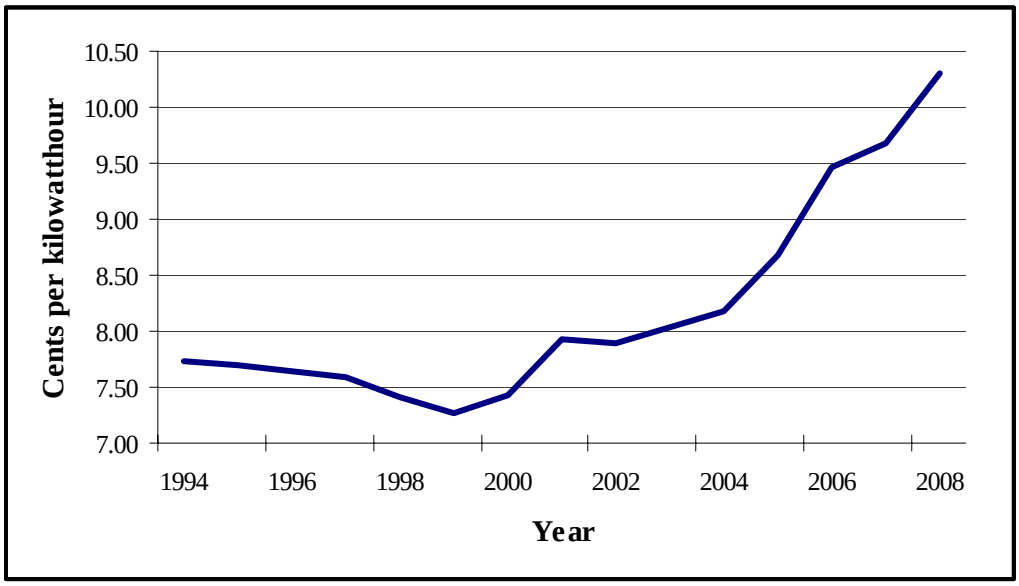
Why Energy Efficiency Improvements?

While there are many ways to measure the ‘greening’ of a building and associated benefits, investment in EEI stand out because of three important reasons: 1) the upward trend of energy prices, 2) the potential for operational savings that increase net operation income, and 3) potential U.S. regulatory actions around carbon emissions.

Energy Prices

One of the most compelling motivations for investment in EEI is to lessen the reliance on energy and hence its’ cost in building operations. While crude oil prices have ranged from $38 to $144 per barrel over the past two years, most consumer energy prices in the U.S. have experienced a continued upward climb over the past fifteen years. *Figures 5 and 6* provide an historical view of commercial electricity and natural gas prices as experienced by commercial users since 1994. Note that while prices were stable for both products in the mid 1990’s, electricity pricing declined slightly in the late 1990’s and has increased continuously since that time. Overall, commercial electricity prices have increased approximately 25% since 2000 and most economists believe that the days of low cost energy are a thing of the past (Lave [2008]).

Figure 5: Average Retail Price of Electricity to Commercial Sector

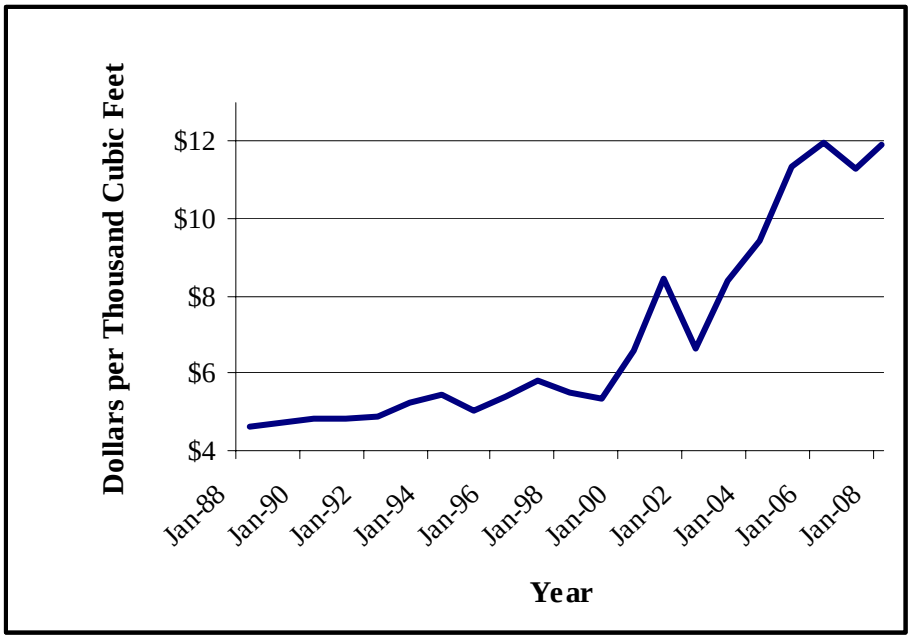


Source: U.S. Energy Information Administration, 2008

Natural gas prices increased slowly from the mid to late 1990's before also increasing at a more rapid rate since 1999. In fact, natural gas pricing at the commercial level has increased from $6.59 per cubic foot in 2000 to $11.91 per cubic foot in 2008, an increase of 77% (EIA [2008]). This is not lost on those in areas of the U.S. where electricity is produced through the combustion of natural gas.[17] For both of these ubiquitous sources of energy, prices are expected to increase in the future and thus impact the operational performance of commercial real estate.

[17] For example, in the New England region of the country, nearly 42% of electricity production comes from the combustion of natural gas.

Figure 6: Average Retail Price of Natural Gas to Commercial Sector



Source: U.S. Energy Information Administration, 2008

Clearly one benefit to building owners is that by paying attention to the efficiency of building systems and consumption of energy, they will be better positioned to benefit from the volatility in energy prices.

Savings in Operating Expenses

In a typical urban office building, energy costs can range from 15% to 25% of operating expenses. This variance depends on a number of factors such as building age, systems employed, location of property and predominate form of energy used in the building.[18] Depending on lease structure the landlord and/or tenant could be responsible for part, or all of those costs. Any efforts to decrease controllable expenses, like energy use, fall directly to the bottom line and can increase net income by 2-3%.

[18] From a small survey conducted, we determined that office buildings of the 90's vintage had energy costs averaging between 15% and 17% of total operating expenses (excluding real estate taxes), while those from the 70's averaged 22% to 26%. Large buildings in major urban centers averaged between 26% and 28%.

Regulating Carbon

On February 24th, 2009 President Obama invigorated the debate on climate change issues when he called on Congress to send him "legislation that places a market-based cap on carbon pollution and drives the production of more renewable energy in America."

The Obama-Biden energy plan calls for the implementation of an economy-wide cap-and-trade program to reduce greenhouse gas emissions 80 percent by 2050. On the campaign trail the Obama-Biden team discussed a cap-and-trade policy that would require all pollution credits to be auctioned, ensuring that all industries pay for every ton of emissions they release. A small portion of the proceeds would go to investments in clean energy, energy efficiency improvements, wildlife habitat protections, and rebates and other transition relief to ensure that families and communities are not adversely impacted by the transition to new energy low carbon economy.[19] The President has asked Congress for legislation establishing a cap-and-trade program, an important step towards curbing greenhouse gas emissions. The President followed up his request to Congress with numbers, identifying a yearly revenue stream in the budget of $79 billon, beginning in 2012, from the sale of greenhouse-gas emission permits. Congress responded on March 31, 2009 with the House Democrats introducing the *The American Clean Energy and Security Act of 2009* that includes a cap and trade program (Johnson, 2009). This draft bill includes language on updating state building energy efficiency codes, but to date the bill has not specified how it will treat commercial real estate.

Benchmarking Performance

The real estate industry's effort to combat climate change and reduce greenhouse gases requires measurement and a more definitive understanding of environmental impact. For better or worse there is a growing tendency by building owners (or their representatives) to declare their property "green" or as having certain sustainable features with little more than their word and experience to document their assertions. This presents a challenge to

[19] Obama - Biden Campaign, 2008.

an observer looking to understand a particular building's green design or operational features or compare one building to another. The presence of an objective third-party monitoring system can provide an opportunity to assess and certify a building's performance. Across the globe, there are many third-party rating systems by which a building can benchmark its design, construction and operations. In this section, we will identify and summarize some of the major green building rating systems in use and the issues they seek to address. We will provide detail on LEED for Existing Buildings, which is focused on the upgrading and greening of existing properties in the U.S.

Energy Star

In the U.S., the Environmental Protection Agency released the Energy Star program for Office Buildings in 1999. This program allows a building owner to measure the energy efficiency of a building and compare it to other buildings across the U.S. Under the program, the energy performance of a building is scored on a 1-100, scale and buildings that achieve a score of 75 or above are eligible for the Energy Star designation (Energy Star, 2008). For example, a building that has a score of 80 means the building is in the top 20% of facilities in the country for energy performance. The score is calculated by estimating how much energy the building would use if it were the best- or worst - performing building of its type (along with levels in between) in terms of its size, location, and number of occupants. The rating system then compares the actual energy data input to the internal database in order to determine where the building ranks relative to other similar buildings. For existing buildings, applicants can use the Portfolio Manager tool on the Energy Star website to organize, evaluate and track energy (and, more recently, water) consumption.[20] While the move to include water consumption has broadened the scope of Energy Star it still does not address or rate many of the sustainable or green aspects surrounding a given building, and isn't considered a comprehensive green building rating system.

[20] For more information on Portfolio Manager and Energy Star see https://www.energystar.gov.

NABERS (National Australian Built Environment Rating System)

The NABERS is a performance based rating system for existing buildings that measures their overall environmental performance during operation. The system is managed by the New South Wales Department of Environment and Climate Change and incorporates the Australian Building Greenhouse Rating that was launched in 2001 to assess of the greenhouse intensity of office buildings. Currently NABERS provides ratings for existing office buildings, office tenants, residential homes and hotels while ratings for hospitals, schools and retail centers are still under development. The system looks at three key categories; the impact of the building on its occupants, on its local environment, and on the broader environment. The measurement categories are dependant on the type of property being rated and include indoor air quality, water, energy use and greenhouse gas emissions, storm water runoff and pollution, sewage, landscape diversity, transport, waste, toxic materials and refrigerants (NABERS, 2008). This system is one of the most comprehensive in the world today for the management and monitoring of existing buildings.

BREEAM (Building Research Establishment's Environmental Assessment Method)

BREEAM was developed in the United Kingdom in 1990 by the Building Research Establishment, and claims to be the most widely used environmental assessment (rating) method for buildings in the world (Bevan, 2003). It covers many product types including office, retail, healthcare, industrial, residential, prisons, and courts (BREEAM, 2008). BREEAM also has a customizable tool that is meant for buildings falling outside standard categories, such as hotels, resorts, laboratories and university buildings. As of October 2007, approximately 100,000 buildings have been certified and nearly 700,000 homes and buildings have been registered for assessment under BREEAM. The assessment criteria are divided into 9 categories: Management, Energy Use, Health and Well-being, Pollution, Transport, Land Use, Ecology, Materials and Water.[21]

[21] Three other rating systems and assessment methods of note are reviewed and summarized in a report entitled "Sustainable Building Rating Systems" (Fowler, et. al. 2006): the CASBEE (Comprehensive Assessment System for Building Environmental Efficiency), developed in Japan in 2001; the GBTool,

Leadership in Energy and Environmental Design (LEED)

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is a third-party certification program, overseen by a non-profit organization, the United States Green Building Council (USGBC). LEED promotes a whole-building approach to sustainability by recognizing performance in five categories of human and environmental health: sustainable site development, water efficiency, energy efficiency, materials selection and indoor environmental quality (USGBC, 2009). New and creative strategies and solutions that exceed credit requirements or are not recognized in other categories receive points in the 'innovation' section.

In each of the five categories, there are requirements and performance criteria. The USGBC calls these requirements prerequisites and these stipulate the minimum conditions that need to be met in order for the project to be considered under the rating system. The performance criteria are called credits, and there are a certain number of credits within each category that have points assigned to them; the better you perform (and document) the more points you can achieve. In order to achieve a point, the applicant has to demonstrate compliance with the credit to the USGBC. For example, in the Energy & Atmosphere category of the LEED for New Construction rating system, one of the three prerequisites in this category calls for a minimum level of energy efficiency. The prerequisite sets forth specific sections of ASHRAE/IESNA Standard 90.1-2004 with which the project must comply with in order to get certified.[22] One of the optional *credits* in the Energy & Atmosphere category encourages increased levels of

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developed by the International Framework Committee for the Green Building Challenge; and the Green Globes™ US adapted from the Green Globes Canada rating system in 2004. The report was created for the U.S. General Services Administration and while not recommending a given system, does prove to be a good resource to further understand the issues associated with various rating systems.

[22] According to the American Society of Heating, Refrigerating, and Air-Conditioning Engineers/ Illuminating Engineering Society of North America Standard 90.1 User Manual, Standard 90.1 provides minimum requirements for the energy-efficient design of buildings and building systems. It applies to all buildings except low-rise residential buildings (low-rise means three habitable floors or less). The Standard is written in building code language and is intended for adoption by national, state/province, and local code jurisdictions.

energy performance, and, depending on the demonstrated level of performance, a project can earn additional points.

LEED has 9 separate rating systems: LEED for New Construction and Major Renovations, Existing Buildings: Operations & Maintenance, Commercial Interiors, Core & Shell, Schools, Retail, Healthcare, Homes, and Neighborhood Development. In *Figure 7*, we provide the information on each program, as well as the most applicable development type for the given rating system.

Figure 7: LEED Rating Systems and Status

Rating System	Year Adopted/Drafted	Applicable Development
New Construction (NC)	2000	Built-to-suit or owner occupied
Existing Buildings (EB)	2004	Renovations or reposition
Commercial Interiors (CI)	2004	Tenant Improvements
Core & Shell (CS)	2006	Speculative development[23]
Schools	2007	K - 12 schools
Homes	January 2008	Single family homes (multi-family possible)
Healthcare	[Draft] First comment period closed in Spring 2008	Healthcare facilities
Retail: New Construction	[Draft] Second comment period opened Spring 2008	Shopping Centers and retail spaces
Retail: Commercial Interiors	[Draft]First comment period slated for Summer 2008	Retail interiors
Neighborhood Development (ND)	Pilot program closed, public version expected in 2009	Planned developments

Source: USGBC and RREEF Research, 2008

Throughout the 9 rating systems, applicants can achieve 4 levels of certification; Certified, Silver, Gold and Platinum. The number of points needed to achieve the various

[23] Speculative development involves a developer taking a risk and constructing a building under the assumption that, once complete, the market will absorb the product. Office tenants have different

levels differs within each rating system and does not correspond to the level of compliance (*Figure 8*).

Figure 8: LEED Points Associated with Different Rating Systems

		Rating System			
		NC	**EB**	**CI**	**CS**
Certification Level	**Certified**	26-32	34-42	21-26	23-27
	Silver	33-38	43-50	27-31	28-33
	Gold	39-51	51-67	32-41	34-44
	Platinum	52-69	68-92	42-57	45-61

Source: USGBC, 2008

Also note that the point scales do not relate across rating systems, an issues that the USGBC does hope to address in the near future.[24]

A third-party green building rating system gives owners, managers and tenants, along with their professional team of engineers, architects and contractors, the ability to benchmark building design and performance. The purpose of assessing and benchmarking the performance of a design or operations of a building is largely to make measurement possible. Whether to comply with a government mandate or to differentiate a product, the more a developer or owner is able to measure green building performance, the better the a management team can do its job. This adoption of standards, along with compelling financial savings, brings clarity and organization to the greening of construction and building operation within the commercial real estate arena.

requirements and wishes for fitting out their space, and LEED CS offers developers the option to get certified without involving the future occupant of the space.

[24] One of the fundamental changes in the proposed LEED 2009 Rating Systems will be to align the rating systems to a 110 point scale and to re-weigh the scaling of credit points.

LEED-EB

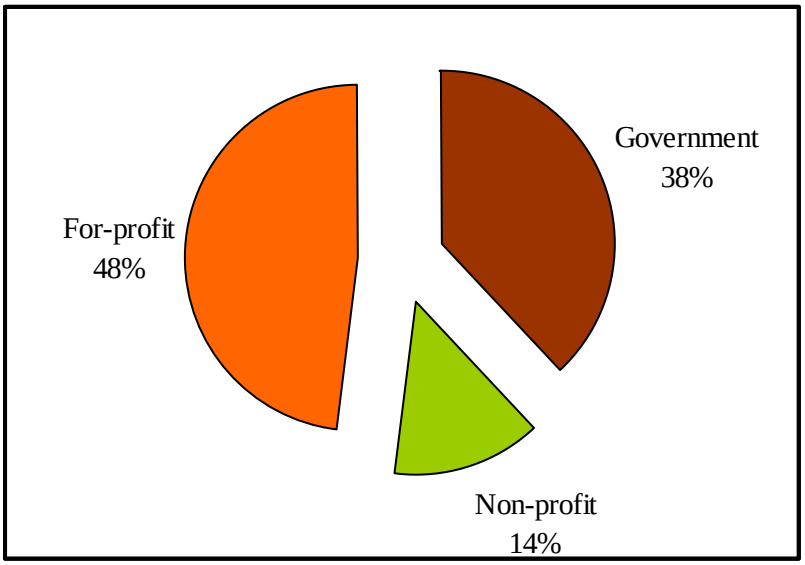
The LEED for Existing Buildings (LEED-EB) Rating System was created to assist owners and operators to maximize their building's operating efficiency as well as minimize its environmental impact. Although the LEED-EB Rating System has been in existence since 2004, there are currently only 191 LEED-EB certified buildings in the U.S.[25] Compared with the success of the LEED for New Construction program (LEED-NC), LEED-EB has had a slow start. However, there appears to be a substantial shift in the market towards embracing LEED-EB, particularly in the investor-owner Class A, urban office building sector. Currently there are 2,346 total buildings which are registered for LEED-EB designation.[26]

Participants

By 2005, 33 million square feet of building space was registered under LEED-EB, and 19 buildings had earned LEED-EB certification. Of these, approximately 48 percent were owned and occupied by for-profit corporations, 38 percent by local, state, and federal government and 14 percent by nonprofit organizations (*Figure 9*).[27]

[25] USGBC data as of March 1, 2009.
[26] There are three terms commonly used when discussing LEED approval. Registered buildings are those under consideration for approval by LEED. Certified buildings are those that have received LEED approval for the proposed designation, and certifiable means that the owner has constructed/upgraded the building in accordance with LEED designation, but has not sought approval. This is often done to signal to the market/tenants that the building complies with LEED standards, but that the certification process has not been completed.
[27] Hicks, 2005.

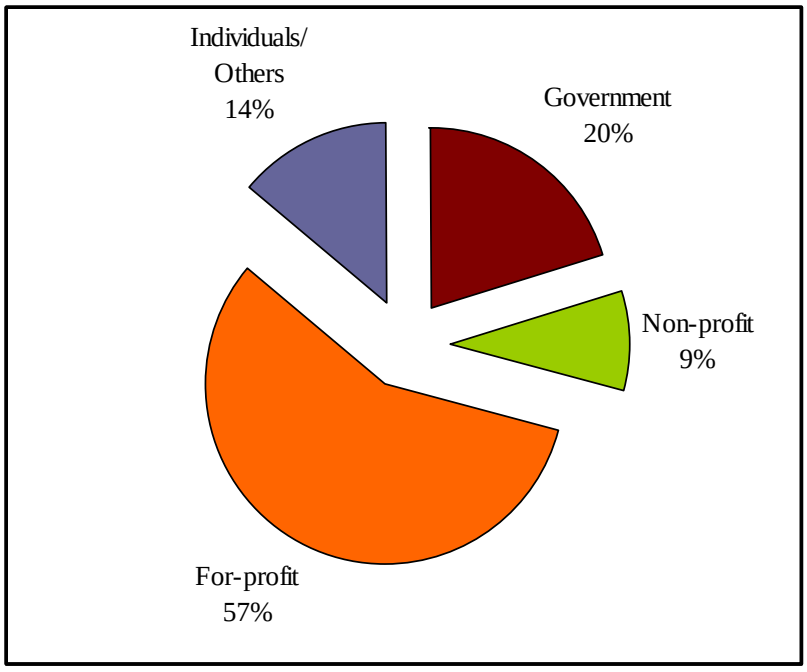
Figure 9: Breakdown of Ownership of LEED-EB Projects, 2005



Source: USGBC, 2005

Since 2005, the number of for-profit owners registering and certifying their buildings has increased 9% and now makes up a majority of the participants (*Figure 10*). This brings market legitimacy to the LEED-EB rating system and indicates that companies sensitive to the bottom line of operations are placing value in LEED-EB certification.

Figure 10: Breakdown of Ownership of LEED-EB Projects, 2008



Source: USGBC, 2008

Currently, there are a growing number of mixed-occupancy (multi-tenant) LEED-EB projects, demonstrating an increasing awareness and acceptance of the LEED-EB rating system by those other than owner occupiers (*Figure 11*).

Figure 11: Occupancy for LEED-EB Certified and Registered Projects, 2008

Occupant Type	Certified	Percentage	Registered	Percentage
Fed Gov't	4	2.4%	134	6.5%
State Gov't	15	8.9%	183	8.9%
Local Gov't	8	4.8%	78	3.8%
Non-profit	9	5.4%	181	8.8%
For-Profit	106	63.1%	636	30.8%
Mixed Occupancy	24	14.3%	775	37.6%
Individual	2	1.2%	76	3.7%
Total	168		2,063	

Source: USGBC, 2008

Major office owners in the U.S., such as Beacon Capital Partners, Boston Properties, Brookfield Properties, Hines Interests, Liberty Property Trust, Tishman Speyer and Vornado Realty Trust, are currently registering and certifying their investor-owned office buildings under the LEED-EB program. Typically these properties are Class A buildings located in core urban markets, such as Boston, New York, Washington D.C., Chicago, and San Francisco. Brookfield Properties Corporation, which has one of the world's largest office portfolios, plans to retrofit at least one building in each U.S. market every year to LEED-EB certification.[28] Many of the companies spoken to have commented on their plans to upgrade selected properties within their portfolios in the coming months, but few had specific timeframes, and nearly all mentioned that they currently had no LEED-EB certified properties in their portfolio.

Those in the property management business are also taking a more proactive stance in registering and certifying properties that they manage on behalf of third parties. Some in the management business have commented that knowledge of the LEED-EB process provides a differentiating factor in this very competitive market place. For example, CB Richard Ellis and Transwestern have registered 100 and 51 U. S. office buildings, respectively, in the USGBC LEED-EB Pilot Portfolio Program (Burr, 2008).[29]

Motivations

Since July of 2008, nearly 1,070 buildings have been registered under the LEED-EB rating system, second only to LEED-NC, which has had approximately 3,766 registrations over the same time period. Many of these new applicants for LEED-EB are investor-owners, while the majority of prior applicants for LEED-EB were owner-occupiers. Owner-occupiers were the early adopters of LEED-NC and LEED-EB, since they tend to have a longer term outlook on their real estate holdings, including a general awareness of the benefits inherent in EEI upgrades, including: higher employee productivity, retention and recruitment, lower absenteeism, and lower operating costs.

[28] Brookfield Properties, 2008.

Thus, one could argue that perhaps owner-occupiers have more of a vested interest in improving their space in order to provide more comfort and a better environment for their employees.

Investor-owners may have less of an incentive to invest in EEI for their properties. They incur the initial costs for energy upgrades – while only being able to recoup savings if their leases allow them to pass through the upgrade costs or recoup energy savings from the tenants. Moreover, they have until recently received little or no additional monetary reward for the improvements incurred from the marketplace. What, then, are the reasons for the recent shift towards securing LEED-EB approval for investor-owned buildings? Many reasons could be put forth for this shift, but five of the most compelling are as follows:

1) The Threat of New Green Construction

In the past decade, a growing majority of newly constructed buildings have been designed and built to green standards, such as LEED-NC. With regulatory forces in many cities across the U.S. requiring buildings over a specified size to be "certifiable," and markets such as San Francisco, where nearly 100% of new commercial buildings (either under construction, approved, or in the planning stages) are seeking LEED certification, there seems to be shift in the 'standard' for new commercial space (Nelson, 2008). Many building owners, and especially those with large portfolios of Class A space, have indicated a strong preference in having their existing buildings comply with LEED (or other) levels of certification in order to compete with newly created stock.

2) Green is a New Amenity

Owners often feel that LEED certification is another amenity or seal of approval that sets their buildings apart from the rest. In a competitive market place, having an amenity like

[29] The pilot Portfolio Program has been set up by the USGBC as a way to help companies register multiple properties at a single time, thereby eliminating much of the repetitive paper work involved with

LEED-EB certification can make the difference between capturing tenant interest and not. Thus far, buildings with EEI improvements are treated in a similar way to those with fitness clubs, cafeterias, proximity to transportation or additional parking; LEED-EB is another amenity. Others contacted for this research echoed this sentiment, indicating that LEED would be a powerful marketing tool in attracting tenants, many of whom are becoming increasingly aware of their environmental footprint.

3) Tenant Demand

Tenants are beginning to ask for more energy efficient space, particularly that which carries LEED certification. These tenants tend to be corporations with socially responsible investment (SRI) goals, government agencies, and technology companies that have stated sustainability initiatives. Companies that place a very high value on the recruitment and retention of their employees also see the importance of being able to point to a healthy and sustainable work environment. Many companies, especially those in the technology and biotech areas compete aggressively for human resources and often use their physical space as a recruiting tool. Clearly if employees are being asked to spend significant amounts of time at work, having a building with good air quality and other environmental enhancements is essential. The old adage that 'people are firm's most expensive and valuable asset' rings true, especially in today's economy.

Many tenants, however, adhere to more traditional selection criteria when searching for office space. Since the search for space happens at infrequent intervals (typical office leases range from 3-7 years) tenant awareness of space needs may take some time to change.[30] Yet, even though many tenants do not occupy or insist upon LEED (or equivalent) space, many employees carry out sustainable practices within existing space. Examples include replacing disposable coffee cups with personal mugs, use of paper

registration.

[30] Most brokers and leasing agents contacting during this research reported that while more and more tenants are asking about the potential for LEED certified space, supply continues to be restricted, so finding properties that meet their requirements could be difficult.

products with recycled content, or separating trash products into disposables and recyclables.

4) Investor Demand

Investors are beginning to ask about and for sustainability. Results from a conversation with an international developer who polled both foreign and American investors indicated that over half said they would pay a premium for a green building; and that the premium would range from 2 to 5%. Foreign investors, especially Europeans, seem to be leading the pack in terms of sustainably oriented investments, as they have more knowledge and background on the issues and benefits. Moreover, many foreign investors have experienced the impact of regulatory activity in the area of sustainability. Conversations with one of the respondents to our request for data indicated that one of their clients, a Canadian investor, was highly receptive to LEED, since it was comparable to the ISO certification in Europe.[31]

Many investors are focused on the bottom line; a return on their investment. Increasingly, evidence is mounting that energy efficient and 'green' buildings can offer competitive, or even superior, returns. According to a recent study by CoStar, "demand in the marketplace for sustainability creates higher occupancy rates, stronger rents and sale prices in 'green' buildings."[32] Specifically, the CoStar Study stated that LEED buildings command rent premiums of $11.33 per square foot over their non-LEED peers while also enjoying a 4.1% higher occupancy rate. Additionally, rental rates in buildings with Energy Star ratings are shown to capture $2.40 per square foot in premium and have a 3.6% higher occupancy than their non-Energy Star counterparts.[33]

[31] ISO (International Organization for Standardization) certification identifies and establishes general principles for sustainability in building construction. It is based on the concept of sustainable development as it applies to the life cycle of buildings and other construction works, from their inception to the end of life.
[32] Burr, 2008.
[33] Note this study does not separate new from existing buildings, so the ability to make definitive comments about LEED-EB are not possible from this study.

5) Responding to Climate Change

Many professionals indicated that improving the state of the built environment was 'the right thing to do,' and that one area in which participants can take an active role is in the area of real estate. Others are conscious of the impact that real estate has on the environment, in terms of energy use and carbon emissions and would like to lessen the environmental impact of their professional activities.

Obstacles

Given the opportunities associated with investment in EEI, one would surmise that all participants would be active in trying to improve their entire inventory of property holdings. This is not the case, as a number of outstanding issues need to be addressed before the market for EEI investments will grow. A few of these include:

1) Minimum Level of Energy Efficiency Performance

One of the largest obstacles for owners to deal with when considering an improvement of their existing properties is the LEED-EB's minimum energy efficiency performance prerequisite. In order to qualify for EB certification, a building needs to achieve a pre-determined number of LEED points. One of the criteria for certification is that the building needs to achieve an Energy Star rating of 69. If not, the road to certification through LEED is much more difficult, timely and costly. While buildings often have a number of components to their energy efficiency strategy, and many have payback periods of less than three or four years, a building with poor prior energy efficiency performance usually needs more comprehensive and costly upgrades to achieve LEED-EB certification. Many of those comprehensive upgrades have longer payback periods and lower returns, which can make them less attractive economically and thus less likely to be carried out. Therefore, a building's prior energy efficiency performance, or Energy Star rating, is generally seen as the first indicator of whether or not the building owner should attempt to secure LEED-EB certification.

2) Water Efficiency

Efficient use of potable water is another obstacle associated with LEED-EB approval. When a building has a large number of well-functioning toilets and urinals that consume too much potable water, a challenge arises as to whether it makes financial or ecological sense to dispose of them all, and purchase new ones.[34] Nor does it seem to make ecological sense to replace the well-functioning equipment, when the new ones consume substantial raw material and energy to manufacture, transport, and install. In some drought-stricken locations and nations, such as Australia, the decision to change well-functioning toilets for new water-efficient ones may be wise; however, in most locations there are more financially and ecologically sound solutions for saving potable water on or off site, such as xeriscaping or a condenser water loop.[35]

3) Education

LEED-EB may require the introduction of new procedures and policies that tenants and building staff are not used to. An example of this challenge would be how to motivate and break the habits of building staff who are accustomed to turning on a heating or cooling system to high first thing in the morning, as opposed to slowly ramping up the systems with the help of technology. Additionally, the culture or modus operandi of the building's vendors and contractors must be changed. While more and more people are hearing about sustainability, the challenge is getting them to incorporate it into the service or products that they provide, such as green cleaning or landscaping. This trend is growing as peoples' perception of effective recycling is on the increase in modern industrial societies.

[34] It rarely makes financial sense to replace well functioning toilets with new water-efficient ones, as the monetary savings from reduced water consumption is minor compared to the cost of the new equipment.
[35] Xeriscaping refers to landscaping that does not require supplemental irrigation. It uses plants whose natural requirements are appropriate to the local climate thus eliminating or reducing water needs, and takes care to avoid losing water to evaporation and run-off. A Condenser water loop moves water between

4) Verification

Another item that is challenging in the measurement of performance and operations is the isolation of variables (the procedures, operations and equipment) that the team changes. For example, one could change paper products and the water flow of the toilets in restrooms at the same time, which may cause problems with the plumbing. It would therefore be difficult to determine whether it was the switch to recycled content paper (which uses more glue to bind the paper), or the low-flow toilets that caused the plumbing to back up.

5) The LEED-EB Paperwork and Documentation

One of the most frequently cited hurdles in undertaking the LEED-EB process is the amount of documentation required when submitting an application to the USGBC. The need to document 'before and after' operations is thought to be particularly onerous. Recently, however, the USGBC has introduced a new streamlined and user friendly LEED-EB Rating System, called LEED-EB Operations and Maintenance.[36] LEED-EB Operations and Maintenance (O&M) not only has fewer prerequisites (9 as opposed to 13), but also has realigned the focus of the program more closely with the industry's concerns, such as energy and water efficiency. While this new streamlined LEED-EB O&M version has helped significantly, several owners have voiced a desire for more human interaction with the USGBC. Feedback indicates that while the amount of paperwork for LEED-EB O&M is now approximately 2,000 pages (a decrease of 2,000 pages from version 2.0 of O&M), documentation is still a considerable task. In spite of the fact that much of LEED-EB's documentation is warranted, owners claim that a site visit, or at least some telephone correspondence, would not only reduce potential paperwork, but also increase the transparency and effectiveness of the program.

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the chiller's condenser and the cooling tower and has the ability to use recycled water to cool space rather than potable water.

6) Time

Securing LEED-EB approval is not meant to be a race against time. The rating system is a continual process, not an all-or-nothing event, like LEED-NC. LEED-EB is ongoing, which allows owners and managers to improve the performance and operations of a building over time. Even after a building is LEED certified, the documentation, procedures, monitoring, and verification continue, since the building needs to reapply for certification every five years. The range of time reported for completion of the LEED-EB certification process ranges from 12 to 18 months.

Implementation

The major cost of pursuing LEED-EB relates to energy and water efficiency projects. Some owners justify the costs by projecting higher tenant satisfaction and retention, while others expect value creation. Regardless of their rationale, building owners, in general, are interested in efficiency projects with short payback periods of one to three years or periods shorter than their holding period – that is, shorter than the length of time a real estate investor holds or intends to hold the asset before selling it. With the current prevalence of total return (IRR) funds, the typical holding period is five to seven years. The observed practice by owners is to compute the IRR of their energy and water efficiency upgrades and, if the efficiency projects have a higher IRR than their cost of capital, they will undertake the efficiency upgrade. It is obviously a "home run" when the efficiency projects return close to the investment company's target returns, especially since efficiency projects are seen as seen as very low-risk investments.

Most building owners fund improvement projects internally and for upgrades with direct operational savings and usually attempt to pass through the capital cost of the upgrades to their tenants in some type of amortized fashion. This of course becomes a function of the type of lease arrangement between landlord and tenant, or other agreements made

[36] LEED-EB was first released in pilot version in January of 2002, and then formally as LEED-EB v2.0 in October of 2004. In November of 2007, the USGBC introduced an updated version entitled LEED for Existing Building: Operations & Maintenance (LEED-EB O&M).

subsequent to the implementation of EEI investments. The ability to pass through energy or water efficiency improvement costs – amortized over time to be equal to the tenants' direct operational savings can be of economic benefit to both landlords and tenants.

Costs

Many variables influence the cost of upgrading a building to LEED-EB's standards, but the most significant factors are two-fold: the building's prior energy or water efficiency performance level and the building owner/management team's knowledge and time constraints. As discussed earlier, a poor baseline energy performance level (significantly below an Energy Star 69 rating) leads to more comprehensive and costly upgrades. The base knowledge of the owner and management team can vary widely and can impact LEED-EB costs in various ways. Some motivated management teams take it upon themselves to become experts in understanding the framework, process, and particulars of the LEED-EB rating system. This information allows them to navigate the process and achieve credits towards the rating with greater ease, less assistance, or capital investment. This is not to say that an educated team will not need any outside assistance; nearly all teams need assistance with one process or another, such as analyzing outdoor light pollution levels or measuring air delivery levels. Overall, the building's prior energy and water efficiency and the owner/management team's knowledge and experience with LEED are often used as a good determining factor as to the feasibility and cost of pursuing LEED-EB.

How much does the process of obtaining LEED-EB cost? In a recent study, overall costs of implementation and certification were found to range from $0.02 to $5.01 per square foot of gross floor space, with an average of $1.61 per square foot (Leonardo Academy, 2008). While the range might appear to be large, this is a result of the wide variety of existing performance and upgrades associated with buildings used in the study.

Does It Pay?

As the cost and procedures to green an exiting building to LEED standards can vary greatly, real world examples can shed light on the economics associated with EEI investment. In this section we will illustrate a number of examples, each of which has varying level of detail. One of the challenges with this study was the shortage of data that were available for analysis. As shown earlier in *Figure 11*, the stock of certified buildings at the end of 2008 stood at 106. While many buildings are registered for certification, the number available for analysis is very small. Over the course of this study, we were able to access owners of 38 of these properties. Eleven were willing to share and/or discuss details of their projects. Of these we were able to secure enough information for some level of discussion on six, which are presented in this section. We will focus on one building and provide discussion on four others.

Case Study

The property used in this example is owned by a real estate investment firm that develops, owns, and manages properties throughout the U.S. and Europe. We believe it is typical of urban Class A projects and is a good representative of the type of project that would be well suited for investment in EEI upgrades. The owner has a stated goal of benchmarking and certifying 60% of their portfolio to a LEED Silver rating level and achieving LEED Certified rating for the remaining 40%. The firm's motivations include; 1) an internal push at the firm to make LEED a part of their platform and provide market leadership in the area of EEI, 2) an awareness of the high returns in energy and water efficiency investments, 3) to hedge operating risk against rising energy prices. The building is located in a U.S. metropolis on the East Coast and has recently received a LEED Silver certification.

Team

The owner championed the LEED-EB efforts and worked closely with the building's management staff to seek certification. The owners also incentivized the building's

engineers to achieve higher energy efficiency by offering bonuses based on increased energy performance. The owner elected to use a LEED-EB consultant for assistance in both the management of the process and the documentation collection and completion.

Property

The building is a multi-tenant Class A office tower in a Central Business District in the Northeast, was completed in 1972 and is comprised of approximately 1,015,000 square feet.

Costs

The total cost of the project was $938,613. The cost associated with a LEED-EB consultant was approximately $60,000. The registration and certification costs were $450.00 and $12,500, respectively, however, it is important to note that there were no estimates of staff time used or the cost of the staff time to obtain certification. Other costs obtained were related to energy conservation measures. In *Figure 12* we display operational changes that had no initial outflow, but that but produced operational savings.

Figure 12: 'No Cost' Operational Changes

Description	**Cost**	**Savings**	**Electrical Savings**	**Steam Savings**	**Actions**
	$	**$/Yr**	**kWh / year**	**Mlb / year**	
Decommission General Exhaust Fans	$0	$2,241	13,183	--	General Exhaust Fans turned off.
Decommission Cooling Towers for Winter Season	$0	$18,226	--	701	Draining cooling towers for winter season reduces steam consumption for freeze protection.
Temperature Control in Garage	$0	$19,500	--	750	Project involves installing temp control on garage heaters.

Return on Investment (ROI) = infinite (no upfront costs)

Payback Period = 0, Savings were immediate

The savings column for all of the figures in this case study was calculated by multiplying the kilowatt hour (kWh) per year savings by cost per kilowatt hour at the time of investment, which for this building was $0.17/kWh. The same methodology was used for steam, multiplying the thousand pound (Mlb) per year savings by the cost of steam per thousand pounds, or $26.00 per Mlb. In the event that a measure produced both electricity and steam savings, they were added together.

In *Figure 13* we provide a breakdown of the costs and savings associated with reprogramming the Energy Management System (EMS) to heat and cool water more efficiently.

Figure 13: Costs and Savings Associated with Reprogramming the EMS

Description	**Cost**	**Savings**	**Electrical Savings**	**Steam Savings**	**Actions**
	$	**$/Yr**	**kWh / year**	**Mlb / year**	
Reset Chilled Water Supply Temp. Setpoint on Outdoor Air Temperature	$6,500	$44,590	--	1,715	By reprogramming the EMS system they can raise the set point of the Chilled Water Temp during optimal conditions depending on dewpoint.
Reset Secondary Hot Water Supply Temp. for Night Setback	$7,286	$51,454	--	1,979	By reprogramming the EMS system they can lower the set point of the hot water in the secondary loop.

Return on Investment (ROI) =697%

Payback = <2 months

The energy conservation measures in *Figure 14* were completed concurrently during a period of 6 months and the cost includes engineering fees and utility rebates. The owner stated that these energy efficiency projects would have been done regardless of LEED-EB because of their quick paybacks.

Figure 14: Concurrent Energy Conservation Measure Projects

Description	Cost	Savings	Electrical Savings	Steam Savings	Comment
	$	$/Yr	kWh / year	Mlb / year	
Convert Perimeter Fan Systems to Return Air	$359,827	$225,212	--	8,662	This will allow us to eliminate the heating & cooling of outside air for an extended period of time.
Reset Variable Air Volume (VAV) Supply Fan Static Pressure Setpoint on Outside Air Temp		$16,965	99,796	--	By reprogramming the EMS system we can slow down the supply fan motors to achieve power savings.
Parking Garage Temperature and Ventilation Control		$78,958	138,847	2,129	Install thermostats and VFDs to reduce power and steam.
Variable Frequency Drives (VFDs) for Secondary Water Pumps		$33,976	199,856	--	Installing VFDs will provide power savings by reducing the speed of the pumps.
CO_2 Sensors for Demand Ventilation Control		$51,116	--	1,966	Adding CO_2 Sensors to all return systems will allow for reduced outside air intake in the summer months
Install Variable Frequency Drives on Perimeter Supply Fans		$79,671	468,651	--	Installing VFDs will provide power savings by reducing the speed of the 4 Supply fans.
VFDs for Reheat/Radiation pumps on Service Level		$11,255	66,208	--	Installing VFDs will provide power savings by reducing the speed of the pumps.

Return on Investment (ROI) =138%

Payback = 9 months

The energy conservation measures (ECMs) in *Figure 15* have higher costs related to their associated savings and have paybacks of 3 years or less.

Figure 15: ECM Measures with Less Than 3-Year Payback

Description	Cost	Savings	Electrical Savings	Steam Savings	Comment
	$	$/Yr	kWh / year	Mlb / year	
Common Area Lighting Retrofit	$142,874	$70,152	--	--	Project involves replacing ballasts and fixtures with Super T-8 ballasts and lamps. (Tenant Space Excluded)
Variable Frequency Drives (VFDs) for Condenser Water Pumps	$69,460	$33,559	--	--	Installing VFDs will provide power savings by reducing the speed of the pump.
VFDs for Chilled Water Pumps with Freeze Protection Modification	$74,945	$35,046	--	--	Installing VFDs will provide power savings by reducing the speed of the pump.
VFDs for Cooling Tower Fans & CWS Temp. Setpoint Reset on OAT	$52,720	$22,005	--	--	Installing VFDs will provide power savings by reducing the speed of the cooling tower fans.
District Utility Steam Condensate Heat Recovery	$225,000	$74,982	--	--	Very rough estimate. Project includes recovering 180 degree condensate water and using it in parking garage and other applications.

Return on Investment (ROI) =42%

Payback = 2 years, 5 months

As described in *Figures 12-15*, total costs for the LEED-EB certification project were $1,011,562 (including the cost on the consultant, registration and certification) and the total savings were $ 868,908.[37] This results in an overall economic performance of:

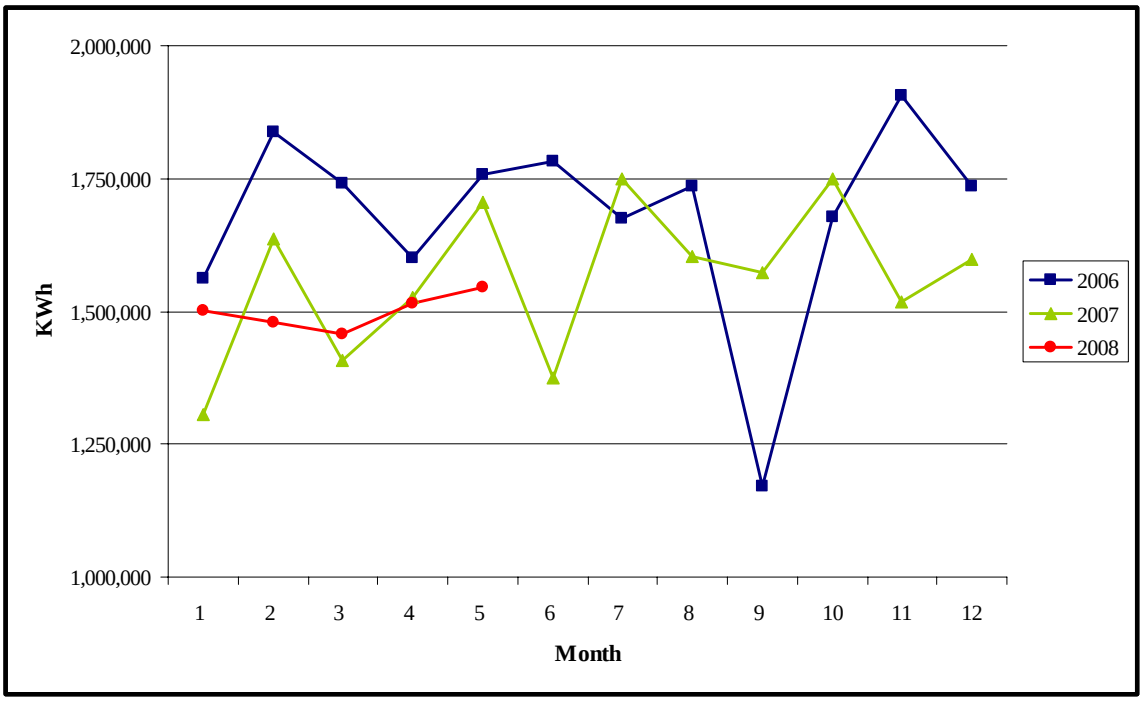
Total Return on Investment (ROI) =86%

Total Payback = 14 months

Clearly in this example, the investment in EEI has paid off handsomely. But what about the long term impact on energy consumption? In *Figure 16* we provide the monthly energy cost and consumption data for the building for 2006, 2007, and up to May 2008.

[37] While we were not able to identify the costs of management and staff time, the owners said it was done as an investment in a knowledge base to be applied to future upgrades projects.

Figure 16: Electricity Consumption for Case Study



Note that the electricity consumption for the first 5 months of 2008 is showing signs of being less volatile compared to the two years prior. The kilowatt-hour consumption for 2008 nearly looks as if it can serve as a trend line for the electricity consumption for 2007. A major benefit that can be inferred from *Figure 16* is that less volatile electricity consumption reduces the management and operational risks for building and can help managers and owners budget and manage cash flows in a more predictable fashion.

Additional Projects

Gathering additional data on building upgrade projects has proven difficult. The following 5 LEED-EB project summaries are an assemblage of information gathered from owners, published news information, and posted presentations. For these, we highlight components of each project dealing with, or related to, investment in energy efficiency improvements.

1) Project: Mixed-Use
   Location: Midwest
   Size: 4.2 million square feet
   Year built: 1930

In this project, the building owner instigated efforts to improve the efficiency of the building's cooling system. The project included replacing a pair of one-speed electric motors and installing variable-speed upgrades. The overall cost of these improvements was $350,000. Resulting energy savings were approximately $50,000 a year, for payback period of 7 years, and a 14% return on investment. In another project the owner had meters installed on different equipment and fixtures in the common areas. A $16,000 sensor was installed to monitor leaks in the cooling system that was causing air compressors to work overtime. Once building staff identified and patched leaks, the compressor was running more efficiently and consumed $4,000 less energy per year. While a simple improvement, the return on investment was 25%, with a payback of 4 years.

2) Project: Office
   Location: California
   Size: 990,000 square feet (3 buildings)
   Year built: 1996, 1998, 2003

A corporate group with a headquarters complex in California spent $1.2 million on energy and water efficiency projects over the course of 5 years (*Figure 17*). The projects ranged from replacement and upgrades of equipment to installing monitors and controls. The project also directed a significant amount of capital to load management, undertaking efforts to effectively spread out the peaks and valleys in energy demand. The project received $389,000 in rebates and reduced operating costs by $1.03 million per year. This is an average payback of approximately 10 months and an overall return on investment of 121%.

Figure 17: Upgrade and Performance Statistics

Description	Cost	Rebate	Savings	ROI
Load Management	$445,248	$205,437	$729,185	304%
Lighting	$300,701	$44,918	$155,616	61%
Equipment	$298,439	$122,575	$107,976	61%
Monitor & Controls	$39,472	$11,000	$12,001	42%
Water Management	$145,732	$5,396	$31,287	22%
Total	$1,229,592	$389,326	$1,036,065	123%

3) Project: Office
   Location: California
   Size: 950,000 square feet
   Year built: 2000

Energy efficiency improvements are not the only upgrade that commands a return. This owner of this building in California planted native, drought-resistant grasses, plants, and trees to minimize storm water runoff and reduce heat build up on the roof. Municipalities across the country dedicate resources and personnel to maintaining adequate storm water management systems, so there is a cost that the tax payer covers for the unmitigated impacts of development. Another upgrade project installed low-flow toilets, water-free urinals, and water-efficient fixtures. These measures have decreased exterior water use by 50 % and interior water use by 20 %. Water is a resource that has different values depending on the region of the country. Regardless of the location there is a price to consuming water, and owners that manage this consumption will be in a better position as water costs increase. One innovative and cost cutting effort used by the property management team was to initiate a vermicomposting program which ended up diverting over 10 tons of waste from landfills and saves approximately $10,000 annually. Other non-traditional improvements include eliminating garbage can liners and using reusable cloth bags in centrally located recycling bins, which together save nearly $80,000 per year. While these projects aren't classified as investments in energy efficiency improvements, they do illustrate examples of how resources can be utilized in a more efficient manner and thereby save operating costs.

4) Project: Office
   Location: Washington DC
   Size: 840,000 square feet
   Year Built: 4 interconnected buildings ranging from 20 to 100 years old

The energy efficiency improvements for this project included upgrading the heating, cooling, and interior lighting systems. The result was a reduction in energy consumption of 20%. One specific improvement included an overhaul of an existing HVAC system. The owners utilized an energy savings performance contract to implement the project, and rather than doing it themselves they brought in a third party vendor, an Energy Service Company (ESCO). This approach allowed the $5.5 million HVAC system improvements to be financed and carried by the ESCO, and included a guaranteed level of energy savings.

5) Project: Convention Center
   Location: Midwest
   Size: 250,000 square feet
   Year Built: 1997

In this project the local municipality decided to obtain LEED certification on an existing, but relatively new convention center. The cost to obtain LEED certification was approximately $111,000. As a result of being 'LEED Certified', the convention center was able to book eight additional events from groups seeking venues that with a focus on sustainability. This translated into additional net revenue of approximately $292,000, for return on investment of nearly 270%. This, in addition to the operational savings being enjoyed by the Municipality.

Summary and Conclusions

As the environmental impact of buildings seep into the consciousness of the real estate industry, the efficiency and environmental performance of the existing building stock is receiving a much closer look. There are many factors responsible for this rising level of

awareness – from an expanding knowledge of greenhouse gases and their impact on climate change, to the rising prices of electricity and natural gas. Municipalities and state governments are playing a more active role in regulating the "green" standard to which new development projects will be built. Add to this a national overlay of a proposed cap and trade program, and it is easy to see that the real estate industry will experience to significant changes going forward. This will impact how building owners perceive and value the consumption of energy.

Energy efficiency improvements are a direct and relatively simple way to reduce the carbon footprint of real estate. Steps taken to measure and monitor energy consumption can lead to efficiency improvements that translate into real economic savings, not only through a decrease in operating expenses, but also the increase in value associated with an increase in property level revenue. Determining whether energy efficiency improvements pay is very much related to how and where an owner or investor places value. While some owners/managers seeking LEED-EB certification may be doing it as risk management and others because of tenant demand, the characteristic that is consistent through all these early adopters is the desired result: a building of superior quality. The LEED for Existing Building program appears to be working as designed, helping building owners and managers to deliver efficient, healthy, and environmentally friendly space.

While data representing the impact of investing in energy efficiency improvements continues to pose a challenge, we have demonstrated that investment in these projects produce a return on investment, increase the predictability of energy consumption and add value by decreasing operating costs. Our climate can't afford for us to continue to pass up on these opportunities.

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