



**An Analysis of
the U.S. Real Estate Value Chain
with Environmental Metrics**

Report Prepared for Environmental Defense Fund

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April 22, 2008

The authors thank Jennifer Kim and Ryan Denniston for research assistance with this project, and Greg Andeck of Environmental Defense Fund for valuable input on early drafts.

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I. Overview

The Center on Globalization, Governance & Competitiveness undertook this research project to create a value chain for the U.S. real estate industry on behalf of the environmental advocacy group Environmental Defense Fund, which has identified buildings as a significant contributor to global greenhouse gas emissions. One of the organization's strategies is to identify a potential corporate partner that has the power to reduce these negative impacts on a large scale, similar to its previous collaborations with key corporations in other industries.

In the 1990s, for example, Environmental Defense Fund partnered with McDonald's to eliminate polystyrene clamshell packaging. Once McDonald's took this step many other fast-food companies followed suit, transforming the industry. Environmental Defense Fund is seeking a corporate partner with similarly transformative leverage in the area of real estate.

CGGC's research task is to map out the U.S. real estate market so as to identify powerful leverage points—in other words, the type of companies that, by adopting best practices themselves or offering new services to their clients, will provoke a positive transformation across the real estate industry.

Environmental Impact of Buildings

Consensus is growing that buildings in the United States have a substantial impact on the environment and natural resources, and that considerable untapped potential exists for reducing this impact. According to the EPA, U.S. buildings account for:

- 12 % of total water consumption
- 40 % of total energy use
- 68 % of total electricity consumption¹
- 38 % of carbon dioxide emissions

For the purposes of this research consultancy, it was agreed that energy use, and the resultant greenhouse gases, would be used as a proxy for the relative environmental impact of buildings. Data collected by the U.S. Department of Energy indicate that out of total annual U.S. primary energy consumption of approximately 100 quadrillion Btus (British thermal units), residential buildings account for 22 percent, and commercial buildings account for 18 percent. While DOE data do not break out energy use by industrial buildings as separate from the industrial sector (which includes energy used in manufacturing processes and accounts for approximately 32 quadrillion Btus), we estimate that, subtracting the energy used in manufacturing, industrial buildings themselves account for less than 10 percent of U.S. primary energy use. This report will therefore focus on residential and commercial buildings.²

¹ EPA website, <http://www.epa.gov/greenbuilding/pubs/whybuild.htm>; energy figure, referring to residential and commercial buildings, is from U.S. Department of Energy, 2007 Buildings Energy Data Book, September 2007 <http://buildingsdatabook.eren.doe.gov/>

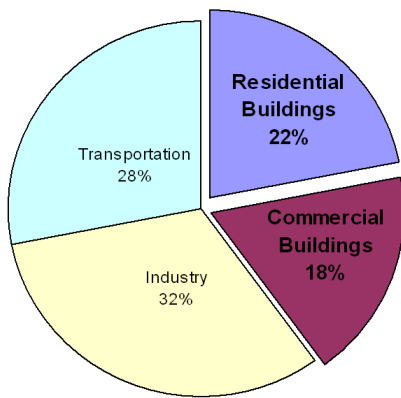
² The DOE Energy Information Agency's Commercial Buildings Energy Consumption Survey can be found on the website, <http://www.eia.doe.gov/emeu/cbecs/>, accessed April 21, 2008. Additional building energy data can be found in U.S. Department of Energy, 2007 Buildings Energy Data Book, September 2007 <http://buildingsdatabook.eren.doe.gov/>, accessed April 21, 2008.

Residential and Commercial Building Energy Use

The data in **Figure 1** (continued on page 4) suggest several key points:

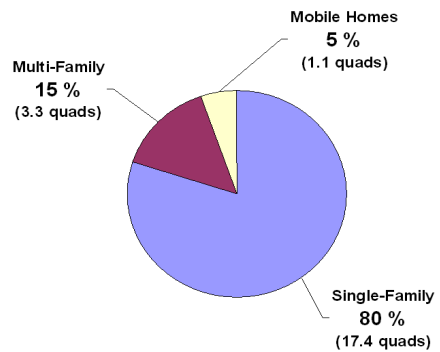
- Out of total U.S. energy use (100 quadrillion Btus), residential buildings account for a greater share of energy use than commercial buildings³
- In the residential sector, the vast majority of energy use is in single family homes
- In the residential sector, the greatest energy end use is space heating and cooling
- In the commercial sector, most energy use is in retail, service, and office buildings
- In the commercial sector, the greatest energy end use is lighting

**Residential and Commercial Buildings
Share of U.S. Primary Energy Consumption, 2005**



Data from U.S. Department of Energy, 2007 Buildings Energy Data Book, September 2007
<http://buildingsdatabook.eren.doe.gov/>

U.S. Residential Building Energy Use, by Housing Type, 2001

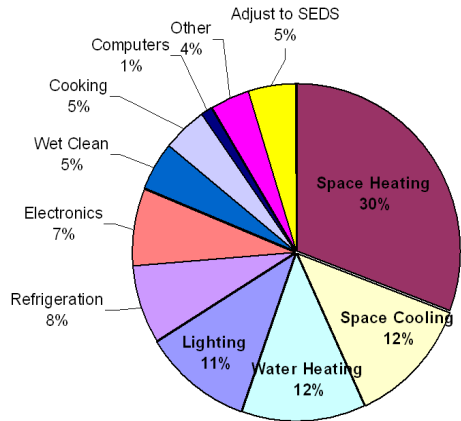


Total energy consumption by U.S. residential buildings is 21.78 "quads," or quadrillion BTUs.
Source: U.S. Department of Energy, 2007 Buildings Energy Data Book, September 2007, <http://buildingsdatabook.eren.doe.gov/>

Figure 1. Energy Use in U.S. Commercial and Residential Buildings

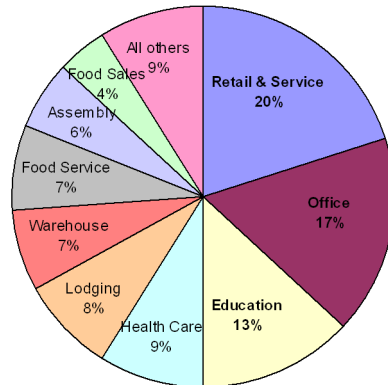
³ All building energy figures are from U.S. Department of Energy, 2007 Buildings Energy Data Book, September 2007 <http://buildingsdatabook.eren.doe.gov/>

Energy Consumption in Residential Buildings, by End Use, 2005



Data from U.S. Department of Energy, 2007 Buildings Energy Data Book, September 2007
<http://buildingsdatabook.eren.doe.gov/>

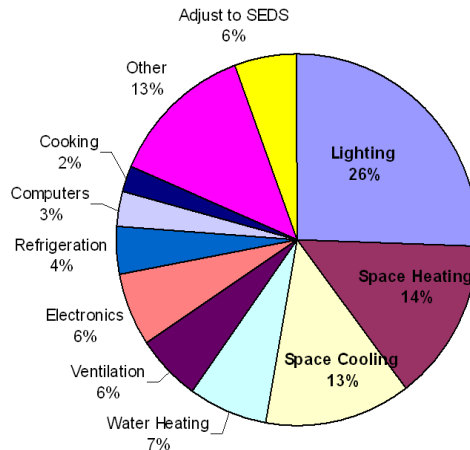
Energy Consumption by Commercial Buildings by Building Type, 2003



Data from U.S. Department of Energy, 2007 Buildings Energy Data Book, September 2007
<http://buildingsdatabook.eren.doe.gov/>



Energy Consumption in Commercial Buildings, by End Use, 2005



Data from U.S. Department of Energy, 2007 Buildings Energy Data Book, September 2007
<http://buildingsdatabook.eren.doe.gov/>



Figure 1 (cont'd). Energy Use in U.S. Commercial and Residential Buildings

Misalignment of Incentives

It has been widely recognized that one of the greatest barriers to the adoption of energy-efficient technologies in buildings is the mismatch between building owners and tenants. Building owners have little financial incentive to pay the upfront costs of energy-saving technologies, since the cost savings accrue over a period of years, and it is the tenant, not the owner, who often pays the utility bills and thus reaps these energy cost savings. Major studies that have acknowledged this misalignment of incentives include a recent report by McKinsey & Company, “Reducing U.S.

Greenhouse Gas Emissions: How Much at What Cost?”⁴ and a 2003 report by the Organization for Economic Cooperation and Development (OECD).⁵

Key Finding #1: It is important to give a building owner the financial incentive to purchase energy-saving technologies despite the fact that it is the tenant, not the owner, who pays the utilities.

In this report we will analyze the overall structure of the U.S. real estate industry and present this structure in the framework of a value chain.

II. Real Estate Industry Value Chain

The value chain for the U.S. real estate industry, depicted in **Figure 2**, is divided here into five segments, beginning with Ownership and Development. The economic activity moves from left to right, the actors in each color-coded segment providing inputs via a series of transactions. Most owners and developers must go through the financing segment before they can acquire a property, and subsequently use a real estate broker to effect the property sales transaction. Large property owners either perform their own property management or pay a management firm to perform this service. Similarly, if the transaction involves new construction, the owner/developer may have its own construction capabilities or hire a construction management firm to build the building. The final segment in the value chain is Tenant Use, which represents the final product, or a building devoted to a specific residential, commercial, or industrial use.

The five functional segments of the value chain have the following characteristics:

- Ownership and Development. These are companies that develop and own real estate, including Developers, Real Estate Investment Trusts (REITs), and Homebuilders.
- Finance (Equity). The equity portion of the finance segment consists of the large institutions, private firms, and individuals that invest in real estate, thus providing the capital that owners and developers need in order to undertake their next real estate project. The National Association of Realtors estimates that total investment in U.S. commercial real estate in 2007 was \$325 billion, up from \$307 billion in 2006, and \$268 billion in 2005.⁶
- Finance (Debt). The debt portion of the Finance segment, representing commercial and residential mortgage loans, includes Mortgage Brokers, who connect borrowers with direct mortgage lenders such as Commercial Banks. In the residential market, many individual home mortgages are originated by commercial banks and then sold on the secondary market (consisting of the Government Sponsored Enterprises Fannie Mae and Freddie Mac). This is

⁴ “Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?” McKinsey and Company, December 2007, http://www.mckinsey.com/client-service/ccsi/pdf/US_ghg_final_report.pdf

⁵ OECD, “Environmentally Sustainable Buildings: Challenges and Policies,” (Paris: 2003).

⁶ Scott MacIntosh, Senior Economist, Commercial/Investment Real Estate, “Commercial Real Estate Fundamentals Strong But Investment Slowing,” Real Estate Insights, National Association of Realtors website, <http://www.realtor.org/reinsights.nsf/pages/infocus?opendocument>, accessed 01/04/08.

what provides liquidity in the market for home lending, giving the home mortgage originators the capital necessary to continue making future loans. In the commercial market, this secondary market function is filled by Investment Banks, which buy commercial mortgages, bundle them, and sell them as securities to investors.

- Property Sales, Leasing and Management. Agents and brokers act as intermediaries between entities that buy, sell and lease real estate. Many brokerage firms also provide property management services to commercial real estate owners. This segment includes Energy Service Companies (ESCOs), such as Siemens or Johnson Controls, which perform an energy audit of a building and present savings and costs for each item, then prepare a finance package based on the energy savings over time.
- Construction. This segment includes companies that perform construction management for large property owners. They are often responsible for every phase of construction from the initial idea through design, construction, and commissioning (making sure the building is built to specifications), to the completion of the building for its end use. Also included is a service called “Build to Suit/Lease Back,” in which a corporation hires a construction management firm to build a building to suit its particular needs, but upon completion, the corporation sells the building immediately to a new owner and leases it back.
- Tenant Use. The final output of the chain is a part of the built environment devoted to a specific use. An example of a company in the tenant category might be a retail store such as Wal-Mart, Home Depot or Lowe’s, each of which occupies hundreds of millions of square feet of retail space. For purposes of this research project, the tenant use categories of real estate will be divided into three groups:
 - Industrial
 - Residential - consisting of multi-family housing including apartments and condominiums, and single-family housing, which can be built and sold individually or by large-tract commercial developers
 - Commercial – consisting of Retail, Office, Education, Health Care, and Hotels

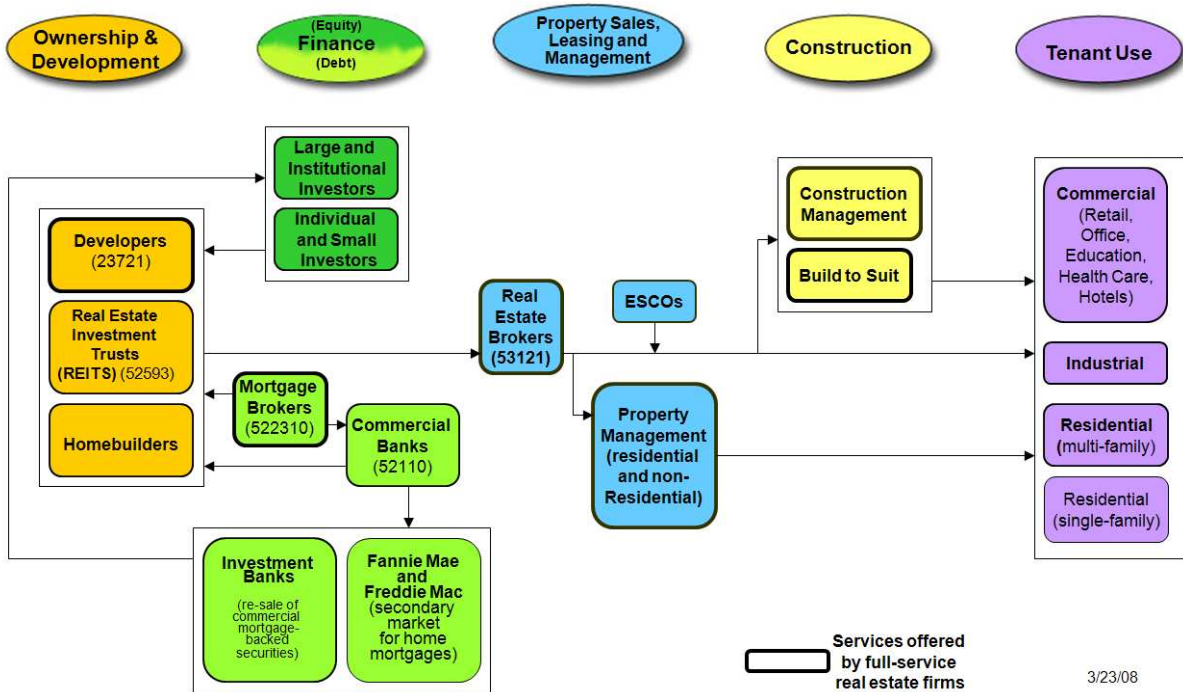


Figure 2. U.S. Real Estate Industry Value Chain⁷

III. Key Sectors (Boxes) and Leverage

Our analysis led us to eliminate several sectors, or boxes, in the value chain for lack of significant leverage, for reasons that included industry fragmentation, poor market timing, and lack of meaningful influence over decisions relevant to building energy use. For a full description of the factors initially considered, please see **Appendix A**.

As shown in **Figure 3**, we further compared each value chain segment according to whether they met the following five criteria for leverage:

- Segment includes firms with direct control over significant real estate. The only firms in this category are the owner/developers: Developers, REITs and Homebuilders; all other players have, at best, only indirect control over building decisions with respect to energy use.
- Segment includes firms with indirect control over significant real estate. Players that have significant influence over the decisions of building owners are those that invest in them, build or manage property for them, or, to a lesser extent, lease property from them as tenants.
- Top five firms in the segment control at least 50% of the market. Firms in this category are limited to financial institutions, including Commercial Banks, Investment Banks, and Fannie Mae and Freddie Mac.

⁷ 5-digit numbers in parenthesis refer to North American Industry Classification System (NAICS) codes.

- Single player in the segment controls at least 20% of the market. Fannie Mae and Freddie Mac are the only two players in the U.S. secondary market for residential mortgages.
- Segment includes players with significant name recognition. Among the several firms with significant name recognition, the best known are likely the top financial firms, such as commercial banks Citigroup and Bank of America; investment banks Goldman Sachs and Morgan Stanley; and government-sponsored enterprises Fannie Mae and Freddie Mac.

Types of Leverage in the U.S. Real Estate Value Chain

Value Chain Box	Direct control of significant real estate	Indirect control of significant real estate	Top five firms have at least 50% market share	Single player has at least 20% market share	Includes players with significant name recognition
Developers	+				+
REITs	+				
Homebuilders	+				+
Large and Institutional Investors		+			+
Individual and Small Investors					
Mortgage Brokers					
Commercial Banks			+		+
Investment Banks			+		+
Fannie Mae and Freddie Mac			+	+	+
Real Estate Brokers					+
ESCOs			?	?	
Property Management		+			
Construction Management		+			+
Commercial Tenant		+			+
Industrial Tenant		+			+
Residential Tenant		+			

Source: CGGC. Market concentration and market share based on data from DataMonitor, Hoovers, company websites, and Wholesale Access.

Figure 3. Types of Leverage in the U.S. Value Chain

Eliminated Boxes

Based on the above-mentioned criteria, we eliminated the following boxes from our analysis for lack of significant potential leverage:

- **Developers** This is a fragmented category in which most players do not intend to hold and operate properties. It is likely that many developers are not in control of properties long enough to find it cost-effective to invest in energy efficiency.
- **Homebuilders** The residential real estate market is the one most directly affected by the sub-prime mortgage crisis that began with a wave of home foreclosures in the United States in the fall of 2006. Home construction has plummeted and homebuilders are currently suffering huge losses. The Levitt Corporation, which declared bankruptcy in November 2007, was the oldest U.S. homebuilder and the first large one to fail in this housing crisis.⁸
- **Individual and Small Investors** This category is highly fragmented. It would be difficult to identify a single entity with sufficient scale to have a significant impact on building energy use.
- **Mortgage Brokers** and **Commercial Banks** These institutions, by participating in the origination of mortgage loans, would have the same type of leverage as those in the secondary market box, only with far less scale.
- **Real Estate Brokers** Brokers occupy a central position in the value chain, since most real estate sales and leasing transactions must go through them. However, they have no influence over decisions regarding energy use in buildings. By definition, they play a neutral role in which it is not in their best interest to limit or define the building choices they provide to their clients.
- **Construction Management** Large construction management firms include Bovis Lend Lease and Skanska, companies that undertake every aspect of building construction on behalf of large clients such as universities, or corporations such as McDonald's. Apart from these firms, the U.S. construction industry is dominated by a large number of very small firms, with 81% employing fewer than 10 persons.⁹ In addition, new construction was eliminated as a category in favor of a focus on existing buildings, which account for a far greater square footage of real estate.
- **Tenant Use** This category includes corporations such as Wal-Mart or Home Depot, which have significant scale and direct control over large amounts of real estate. However, this box was eliminated in favor of seeking leverage with firms whose principal focus is real estate, as well as firms that have an impact across all buildings, not just those in one single tenant use.

⁸ David Streitfeld, "With Builder in Bankruptcy, Buyers Are Left Out," New York Times, January 3, 2008.

⁹ OECD, "Environmentally Sustainable Buildings: Challenges and Policies," (Paris: 2003), citing the U.S. Census Bureau, 2000.

Key Boxes

Our analysis led us to identify four key boxes in the value chain that have the most potential leverage. They are REITs, Large and Institutional Investors, the Secondary Market, and Property Management (See **Figure 4**).

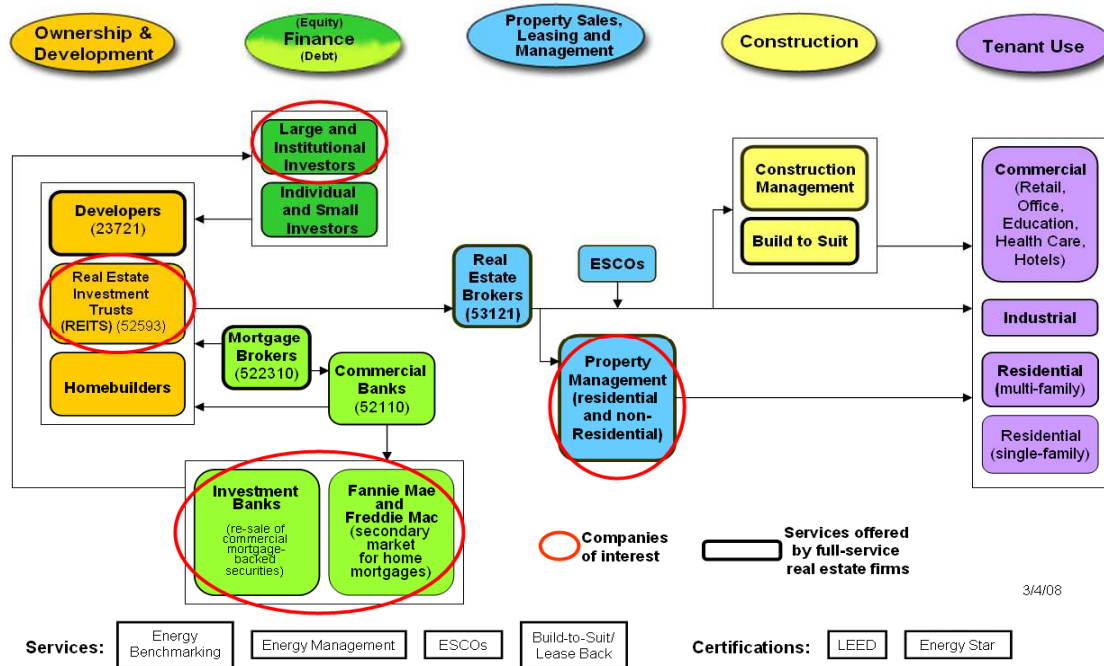


Figure 4. U.S. Real Estate Industry Value Chain, Companies of Interest

REITs

Real Estate Investment Trusts (pronounced “REETZ”) are companies that own, operate, and, in some cases, develop real estate, making their money by renting property to consumers or businesses. Created in 1960 by an Act of Congress to give small investors a chance to invest in large real estate, REITs assemble large real estate holdings, which they make available to investors similar to a mutual fund. To qualify as a REIT, a company must pay out 90% of annual income to shareholders in exchange for relief from corporate taxes. In the United States there are some 152 REITs, controlling an estimated \$312 billion.¹⁰

Since REITs are an investment vehicle, they could occupy a box in the Finance (Equity) segment of the value chain; however, because they are also large real estate entities that have an advantage over developers and homebuilders in that they typically operate and manage their own properties, we chose to include them in the Ownership and Development segment. In terms of the amount of leverage they wield, REITs offer several advantages as well as tradeoffs.

¹⁰ Brandon Benjamin, National Association of REITs (NAREIT), personal interview 12/10/2007.

Advantages:

- Footprint in many categories of real estate, including office, retail, hotel, industrial, healthcare, and residential
- Large scale, through owning and operating hundreds of properties and hundreds of millions of square feet
- Involvement principally in existing buildings, but with some new construction
- Considerable interest in green building initiatives and LEED certification¹¹

Trade-offs:

- Some REITs turn over their properties quickly, similar to developers and homebuilders
- A large buyer can buy out all the properties in a REIT and flip them, as Blackstone did in 2007 with Equity Office Properties, the largest office REIT¹²
- The REITs with the most scale are those that specialize in a single real estate type, so would not have leverage across categories such as office, retail, hotels, and so on

Large and Institutional Investors

Investors have a great deal of influence over owners and developers, who go to them to raise capital so they can qualify for the debt needed to make future real estate deals. The largest investors include pension funds, insurance companies, venture capitalists, mutual funds, hedge funds, and trust funds of individual companies. Since investors' main selection criterion is usually financial returns, the question is whether they are willing to incorporate energy efficiency or other "green building" criteria into their investment decision making.

Our research suggests that this type of investment focus is not yet well developed, although it is receiving increasing attention. The New York times reported in April 2007 that large institutions have recently begun to invest billions of dollars into real estate with sustainable building practices, notably the large pension fund, California Public Employees' Retirement System, known as CalPERS, which "has a goal of reducing energy use in its real estate holdings by 20 percent over the next five years."

The article further notes,

At the same time, private equity funds and partnerships focused on green developments are being formed, like the Hines Calpers Green Development fund and the Rose Smart Growth Investment Equity fund. These funds are marketed to institutions and high-net-worth individuals.¹³

¹¹ Many REITs are actively involved in green building initiatives, according to Brad Case, Vice President of Research, NAREIT, personal interview 1/9/08

¹² REAlert, January 9, 2008 <https://www.realert.com/Security/SubscriberSecurity/index.cfm?Files=LoginForm>

¹³ Vivian Marino, "A Starring Role for Green Construction," New York Times, April 29, 2007.

Approaches to influencing large institutional investors include the following:¹⁴

- 1) Have shareholders file a resolution with a company—say, a building owner or manager—to try to get them to adopt a specific green building practice
- 2) Persuade an investor to adopt a certain green building “screen,” where they will reject any property that doesn’t meet certain green standards
- 3) Persuade an investor to proactively adopt certain criteria for investment; for example, to set a goal that X percent of their real estate portfolio should be in LEED-certified buildings

Out of these three, 2) is the weakest. Years ago it was the main tool of this kind of advocacy, starting with asking companies to divest from South Africa. In real estate, however, much better results can be gained with pro-active criteria; in other words, investors will not pass on a good deal just because it’s not a green building. Pension funds in particular are not willing to pose restrictions on their investments because they feel it violates their fiduciary responsibility.¹⁵

There is, however, potential in option 3). Investors are much likelier to be willing to seek out win-win opportunities to make a good return on investments in green buildings.¹⁶ The U.S. Green Building Council is currently completing a pilot program to perform volume LEED certification for companies that have large real estate portfolios, and it has 40 participating companies and organizations that are interested in this investment angle. One of these is Principal Real Estate Investors, a larger player with \$40 billion in assets under management. The company is considering adding energy analysis to its due diligence, motivated by the possibility that energy-inefficient buildings will be obsolete in the future.¹⁷

Secondary Market

Two types of entities provide liquidity to direct lenders so that they have the capital to continue making future loans. These firms include investment banks such as Goldman Sachs or Lehman Brothers, which buy commercial mortgage loans from the direct lenders who originated them; they then bundle and securitize the loans and sell them to investors. Two Government Sponsored Enterprises (GSEs), the Fannie Mae Corporation and the Freddie Mac Corporation, were chartered by the federal government to play a similar role in the home mortgage market. Fannie Mae and Freddie Mac are direct competitors. Unlike investment banks, which may or may not originate loans, these two GSEs’ exclusive role is to provide liquidity through their secondary market function; they are not permitted to originate loans. For a full profile of Fannie Mae, please see **Appendix B**.

The flow of capital through this financial segment of the real estate value chain appears in **Figure 5**.

¹⁴ Tim Smith, Senior Vice President of Walden Asset Management, personal interview January 9, 2008.

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ Marc Heisterkamp, U.S. Green Building Council, personal interview February 5, 2008.

Investors buy property from owners and developers, thus providing them the capital they need to do the next real estate deal.

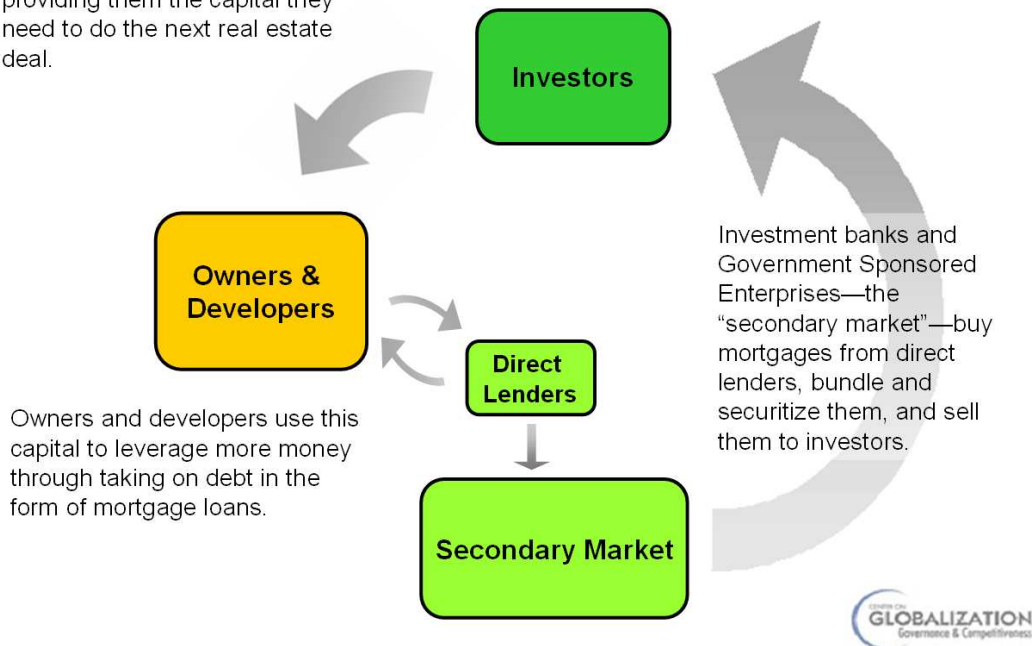


Figure 5. Flow of Capital in the U.S. Real Estate Market

One opportunity to promote energy efficient building practices is the notion of “green mortgages,” or loans that offer financial incentives for investing in energy-efficient building features. These incentives typically come in the form of discounts on closing costs or by factoring the purchase of energy-saving features into the loan amount. The Federal Housing Administration promotes the EEM, or Energy-Efficient Mortgage, but few borrowers take advantage of it; in 2007 such loans amounted to some 800 mortgages nationwide. At Fannie Mae, green mortgages are not treated as an official loan product, but rather are available by special arrangement on the request of specific lenders who can promise a certain minimum volume of such loans.¹⁸

In a recent speech at North Carolina State University, Bank of America chief executive Ken Lewis gave three reasons why green or energy-efficient mortgage loans are not catching on widely in the residential market:¹⁹

1. While LEED is a national standard for commercial buildings, there is no comparable guideline for single-family homes, so banks do not have a systematic way of knowing exactly what they are underwriting
2. This kind of loan product does not sufficiently motivate the borrower or lender, i.e., it does not make a profit for the bank, and neither does it allow the borrower to qualify for a greater loan amount

¹⁸ Marilyn Kornfeld, Communications Director, Fannie Mae, personal interview February 21, 2008.

¹⁹ Ken Lewis, speech at the 2008 Emerging Issues Forum, NC State University, February 11-12, 2008.

3. Because of 1) and 2), there is not sufficient scale for banks to make these transactions attractive to the GSEs, who are only willing to undertake such arrangements at a certain minimum volume of loans

The market for commercial mortgages, on the other hand, may offer investment banks more opportunities to address the above-mentioned limitations via the market for commercial mortgage-backed securities. Certification standards such as LEED, combined with the large scale and greater uniformity of commercial residential developments, enable lenders to devise more replicable underwriting requirements for green building practices. Perhaps more important, this may also facilitate standard arrangements that allow the borrower to leverage more debt, which would be much more attractive to commercial owners and developers.

Key Finding #2: In the finance segment of the value chain there is greater leverage on the equity side than on the debt side. In other words, when it comes to influencing building owners and developers, investors have greater leverage than lenders.

Property Management

A property management firm operates a property on behalf of the owner, including renting, collecting rent, performing maintenance, and so on. Since the property manager takes care of the operation and tenant use of the building, it is in a position to affect decision making by the owner. Many property management companies also serve as real estate brokers, thus acting as agents who perform the transactions to buy, sell, and lease properties.

In July 2007 the Building Owners and Managers Association International (BOMA) introduced a 7-Point Challenge to its members, focusing on green building and aiming to achieve market transformation in the commercial real estate industry. The 7-Point Challenge seeks to reduce the use of natural resources, non-renewable energy sources and waste production in commercial buildings, with the goal of decreasing energy consumption by 30 percent across portfolios by 2012. Major companies that have endorsed this challenge include Carr Services, CB Richard Ellis, Colonial Properties Trust, Cousins Properties, Cushman & Wakefield, Glenborough, Hines, LBA Realty, Opus, Parmenter Realty Group, PM Realty Group, Stream Realty Partners, Transwestern and USAA Real Estate Company.²⁰

By far the most dominant players in the U.S. property management industry are the full-service real estate firms, the largest of which have a footprint in nearly every box of the real estate value chain, including development, mortgage brokerage, investment management, real estate brokerage, property management, and construction management. These full-service firms serve corporate clients that occupy large amounts of building space but are highly outsourced in terms of real estate, doing virtually nothing real estate-oriented in house.

²⁰ Laura Horsely, Director of Communications, BOMA, personal interview January 9, 2008; see BOMA website <http://www.boma.org/AboutBOMA/pressroom/press022108.htm>

The full-service real estate firm takes on such companies as “corporate real estate” clients, and thus is closely involved in nearly all of the important real estate decisions they make.

Key Finding #3: The greatest leverage in the value chain is found in a) companies that own and operate real estate, and b) firms that either invest in them or manage property for them

Important Services and Certification Programs

It is worth noting that there are several services and certifications that are important to energy-efficient building practices. The services are listed below in order of increasing involvement, or potential level of investment, in energy-efficient technologies and best practices:

Energy Benchmarking. Building owners can choose to measure and monitor the actual energy performance of their buildings and compare these data with results for functionally similar buildings. This provides an energy performance rating that is the first step toward making informed decisions regarding investments in energy efficiency.

Energy Management. Another aspect of property management can be to actively make continuous improvements in a building’s energy performance. Steps include upgrading technologies and performing ongoing preventative maintenance on equipment throughout its lifetime. Typically, a savings of 10-30% is attainable with an energy management program.²¹

ESCOs (Energy Service Companies). Energy service companies offer building owners services ranging from energy audits, to heating, ventilation and air-conditioning (HVAC) upgrades, to lighting retrofits. ESCOs often offer “performance contracting,” in which the energy service company bears the cost of an upgrade or a new product. The ESCO then recovers the costs, and makes a profit, from the resulting savings in energy costs. Large manufacturing companies such as Siemens and Johnson Controls include an ESCO function among their service offerings. Several other large companies specialize exclusively in energy services, including Noresco, based in Westborough, Massachusetts, and Ameresco, with headquarters in Framingham, Massachusetts. Ameresco has several corporate commercial clients, including Bank of America, Carr America, and Prudential Insurance.²²

The concept of ESCO-type energy management can be used in creative ways. The City of Cambridge, Massachusetts, for instance, has undertaken a pilot project, still in the initial stages, in which it will work with local businesses to offer low-interest loans to building owners for making capital improvements toward energy efficiency. ESCOs will be used to devise the improvements and, perhaps more important, to guarantee the cost savings.²³

²¹“Energy Management Eliminates Waste,” <http://www.mepol.org/site180.php>

²² Ameresco webpage on commercial clients: <http://www.ameresco.com/commercial.asp>

²³ Jeanne Wolf, Executive Director of the Real Estate Finance Association, Boston, MA. Personal interview, January 30, 2008.

Build to Suit/Lease back. Construction management firms offer this arrangement, in which a company may decide to build a new building to its own specifications. Upon taking occupancy, the company then sells the building to a new owner and leases it back. This enables corporations to occupy buildings designed exactly to suit their needs, including an energy-efficiency focus if they so choose. The lease-back arrangement thus broadens the category of companies that can initiate energy-conscious new construction, expanding it well beyond companies that are interested in holding real estate.

The lease-back arrangement also removes what has been widely identified as a major disincentive to invest in energy efficient buildings, a mismatch of incentives in which an owner has little reason to pay the upfront costs of an energy-saving technology, since the pay-back in saved energy costs typically accrues not to the owner, but to the tenant, who pays the utility bill. In other words, build-to-suit/lease back creates a single economic actor who makes the initial investment in an energy-saving technology and also reaps the long-term cost savings.

In addition to the above services, the following certification programs play an important role in energy efficiency in U.S. buildings:

LEED (Leadership in Energy Efficiency and Design). The non-profit U.S. Green Building Council has established a nationally recognized certification system to “promote integrated, whole-building design practices in the building industry.”²⁴ Criteria are comprehensive, including not only energy efficiency but also water use, construction waste, transportation impacts, and indoor air quality. Building owners can seek LEED certification on several levels, including basic certification, Silver, Gold, and Platinum.

Energy Star.²⁵ The U.S. Environmental Protection Agency (EPA) offers this certification program to encourage energy efficiency in buildings. It emphasizes actual energy performance, as opposed to building design. Building owners use Energy Star to do energy benchmarking, which allows a comparison with buildings that are functionally similar. Energy Star has established performance percentiles based on buildings nationwide. A building that performs in the top 25 percentile receives certification.

There are several important differences between LEED and Energy Star that suggest that building owners and property managers can achieve better results by pursuing the two certification programs in tandem. These differences include the following:

- LEED is more comprehensive, addressing many more green building practices than just energy efficiency; Energy Star focuses solely on energy
- LEED emphasizes design more than performance; Energy Star, by emphasizing actual performance, determines whether a building is performing up to its design
- LEED certification is awarded on a one-time basis; Energy Star certification is good for only one year and thus has to be continuously re-earned

²⁴U.S. Green Building Council website: <http://www.usgbc.org/DisplayPage.aspx?CategoryID=19>

²⁵Energy Star website: <http://www.energystar.gov/>

In sum, improving the energy efficiency of buildings involves a combination of design and best practices with active energy management of the type provided by Energy Service Companies (ESCOs), to ensure actual performance.

IV. Companies of Interest

We identified several companies of interest for each key box in the value chain and compared them in terms of scale, type of leverage, and environmental initiatives. A brief summary for each key box is shown in Figures 6-10. For the full comparisons from which these summaries were taken, please see **Appendix C**.

Perhaps the single most useful metric for comparing these companies of interest is the square footage of real estate associated with each company. It is necessary, however, to determine whether the company owns the space, occupies it for its own operations, or influences it as a property manager (see **Figure 11**). In our comparison of companies of interest, it became clear that the companies that have the most direct impact on real estate, i.e., through ownership, are associated with the least square footage.

For example, among the companies of interest in the category of owner/developers (REITs), square footage ranged from 60 million square feet for Vornado Realty, up to 244 million square feet for Simon Property Group. This represents building space that is under the relevant company's direct ownership and control.

Among property management companies, by contrast, square footage figures are much higher, including up to one billion square feet of U.S. real estate under management by the largest full-service real estate firm, CB Richard Ellis. This figure, however, represents indirect control, and it is unclear how much leverage the property management function asserts over a building owner's decisions.

Key Finding #4: There are trade-offs between a real estate company's scale and the nature of its leverage. For example, a full-service firm may have a large number of square feet under management, but it has only indirect influence. A single developer/owner, in contrast, may have less total square footage, but by virtue of ownership it has direct control over property decisions.




Company	Annual Revenue	Scale in Square Feet	Environmental Initiatives
 Simon Property Group	\$3.3 billion	244 million ft ² Primarily existing buildings	<ul style="list-style-type: none"> • Reducing electricity use • won top NAREIT award for reducing electricity usage • gaining reputation for “green” construction
 Equity Residential	\$2 billion	128 million ft ² Residential and condo operations	<ul style="list-style-type: none"> • No apparent initiatives
 Vornado Realty	\$2.7 billion	60.2 million ft ² Retail, office, merchandise mart operations	<ul style="list-style-type: none"> • No apparent initiatives

Figure 6. Summary of Key Real Estate Investment Trusts (REITs)



Company	Annual Revenue	Type of Leverage	Environmental Initiatives
 Fannie Mae	\$43.4 billion	Provides funds to mortgage lenders by issuing and guaranteeing mortgage related securities	<ul style="list-style-type: none"> • Offers an Energy Efficient Mortgage program for financing cost-effective, energy-saving measures as part of mortgage.
 Freddie Mac	\$44 billion	Purchases and bundles mortgage related securities and sells them to investors	<ul style="list-style-type: none"> • \$550 million commitment to build 8,500 environmentally friendly multifamily and single-family homes • Buying housing tax credits that will provide funding for green rental housing development which has resulted in the creation of over 250,000 affordable apartments to date

Figure 7. Summary of Secondary Market for Home Mortgages




Company	Annual Revenue	Type of Leverage	Environmental Initiatives
 Goldman Sachs	\$69.4 billion	Buys commercial mortgages and sells them as securities to institutional investors	<ul style="list-style-type: none"> • In 2005 invested \$1 billion in renewable energy and energy efficiency • Funded \$2.3 million of market-based solutions to climate change
 Morgan Stanley	\$85.3 billion	Buys commercial mortgages and sells them as securities to institutional investors	<ul style="list-style-type: none"> • Tightened financing terms for power plants by setting "carbon principles" • Owns and finances solar electric power systems for Walmart
 Lehman Bros.	\$46.7 billion	Buys commercial mortgages and sells them as securities to institutional investors	<ul style="list-style-type: none"> • Company has released several research papers analyzing the implications of climate change policy for businesses • Member of the U.S. Climate Action Partnership

Figure 8. Summary of Investment Banks




Company	Assets/ Real Estate Assets	Type of Leverage	Environmental Initiatives
 CalPERS	\$241.7 billion \$20.6 billion in real estate	<ul style="list-style-type: none"> • Largest pension fund in United States • Known for shareholder activism; recently turned its attention to responsible real estate investments 	<ul style="list-style-type: none"> • Goal of reducing energy use in its real estate holdings by 20 percent • \$500 million earmarked for investment in stock portfolios that use environmental screens
 TIAA CREF	\$140.9 billion \$67 billion in real estate	<ul style="list-style-type: none"> • Large private retirement system with extensive investments in real estate 	<ul style="list-style-type: none"> • Applied EnergyStar benchmarking program across real estate portfolio • Seeking LEED certifications for some new construction projects
 AIG	\$862.5 billion \$34.5 billion in mortgage loans & real estate	<ul style="list-style-type: none"> • Leading international insurance organization with extensive investments in real estate 	<ul style="list-style-type: none"> • Sustain-a-Build Initiative provides discounts for LEED certified properties • Supporting greenhouse gas reduction by buying 310,000 carbon credits

Figure 9. Summary of Large Institutional Investors




Company	Annual Revenue	Scale in Square Feet	Environmental Initiatives
 CBRE CB RICHARD ELLIS CB Richard Ellis	\$4 billion	1 billion ft ² (US) 1.7 billion ft ² (World) New and existing buildings	<ul style="list-style-type: none"> • Plan to be carbon neutral by 2010. • Plan for establishment of standards consistent with LEED, BREEAM, and Green Star.
 JONES LANG LASALLE Jones Lang LaSalle	\$2 billion	675 million ft ² New and existing buildings	<ul style="list-style-type: none"> • 2007 “Star of Energy Efficiency” recipient for reducing costs by \$33 million • 2007 Energy Star Partner of the Year
 CUSHMAN & WAKEFIELD Global Real Estate Solutions™ Cushman & Wakefield	\$1.4 billion	No information available Primarily existing buildings	<ul style="list-style-type: none"> • No apparent initiatives

Figure 10. Summary of Key Property Management Companies (Full-service Firms)

Company	Real Estate Space: Ownership, Occupancy, and Influence					
	Annual Revenue (in millions)	Employees	Occupy* million ft ²	Own** \$million million ft ²		Influence million ft ²
Simon Properties	\$3,332	4,300	1		244	
Prologis	\$2,464	1,270	0.3		437	
AIG	\$1,131,942	106,000	27	\$1.4		
TIAA CREF	\$12,378	5,500	1	\$12.4	65	
Goldman Sachs	\$37,665	26,467	7	\$0.6		
Lehman	\$17,583	25,936	6	\$9,400		
Fannie Mae	\$45,352	6,400	2		1.5	
Freddie Mac	\$44,002	5,400	1			
CBRE	\$4,032	24,000	6	\$0.7		1,730
Jones Lang LaSalle	\$2,014	25,500	6	\$0.1		1,024

Sources: [Merqents](#), company websites, annual reports.
 *Occupancy figures are estimates calculated by multiplying the number of employees by an average office space figure of 250 square feet.
 **Space owned for Simon Properties and Prologis from Buildings.com, "2007 Buildings Census: building Ownership and Development," September 2007, <http://www.buildings.com/articles/detail.aspx?contentID+5098>

Figure 11. Real Estate Space: Ownership, Occupancy, and Influence

Top Three Companies of Interest

In the final analysis, we chose to focus on three companies with the greatest potential leverage to effect widespread change in the energy used by commercial buildings in the United States: Simon Property Group, TIAA-CREF, and CB Richard Ellis (See **Figure 12**). For a full profile on each of these companies, please see **Appendix D**.

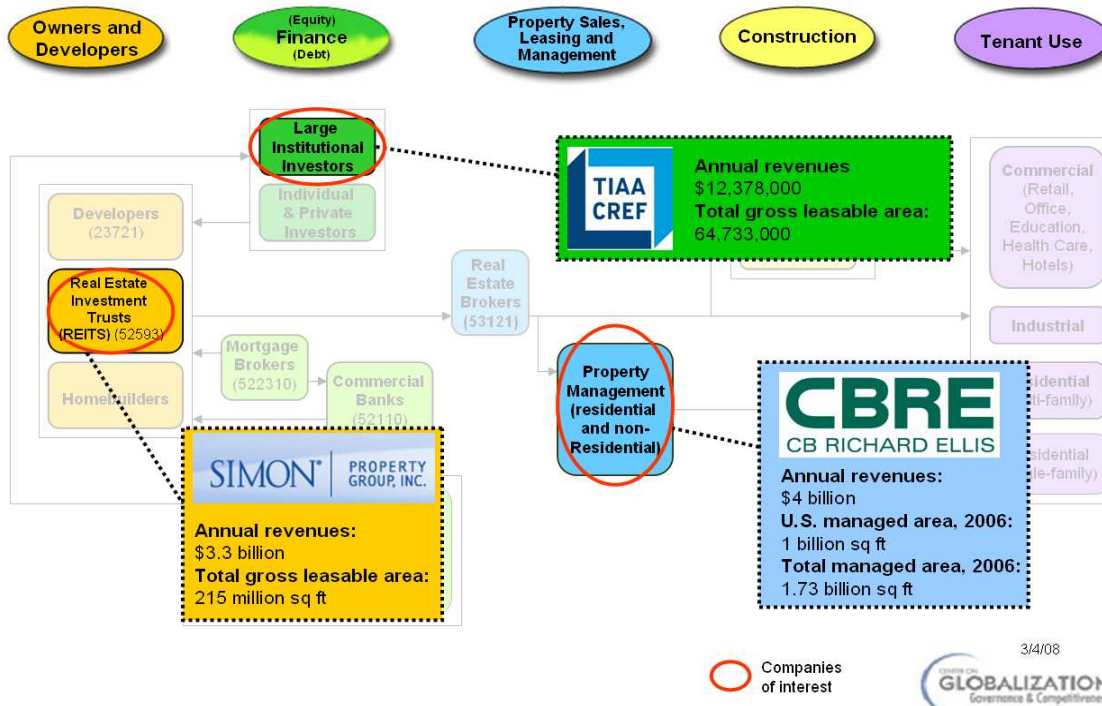


Figure 12. Top Three Companies of Interest

Simon Property Group

Operating as a retail REIT, Simon Property is the largest U.S. owner, developer and manager of high quality retail real estate. It owns and operates regional shopping malls and community shopping centers and is also involved in office and mixed use developments. In terms of leverage and willingness to play a leadership role in green building practices, Simon offers the following advantages:

- Owns retail real estate and/or provides leasing, management, and development services
- Owns and controls far greater square footage than its closest competitors
- Has focused on energy efficiency since 2004, reducing electricity use by over 10% and saving more than \$11 million annually
- Received the Leader in the Light Gold Award in 2007 from the National Association of Real Estate Investment Trusts (NAREIT) in collaboration with the EPA

- Currently testing pervious concrete in the parking lot of one of its shopping malls in the Midwest to help reduce runoff

TIAA-CREF

Known as the teachers' retirement fund, TIAA-CREF is one of the largest private retirement systems in the United States. In addition to providing for more than 3 million members of the academic community and other investors, it also serves some 15,000 institutional investors. The system is a not-for-profit organization and also manages a line of mutual funds. Among its advantages are the following:

- Although one of world's largest retirement systems with more than \$400 billion in assets under management, operations are concentrated in the United States
- Investments in some 65 million square feet of real estate, not including residential properties
- Implemented Energy Star benchmarking program across real estate portfolio to evaluate and identify viable strategies to reduce energy intensity of properties in its portfolio
- Seeking LEED certifications for some new construction projects
- Partnership with Arbor Day Foundation (an environmental non-profit) to support reforestation and e-delivery

CB Richard Ellis

CBRE is a full-service real estate firm that serves tenants, owners, lenders and investors in office, retail, industrial, multi-family and other commercial real estate assets. It offers the following advantages:

- World's largest full-service real estate firm, with 1.73 billion square feet of property under management
- Has a footprint in nearly every box of the real estate value chain
- Claims the greatest U.S. market share, with 12.6% of the U.S. commercial real estate services market; closest competitors are Cushman Wakefield, with 3.8% and Jones Lang LaSalle with 2.4%
- Owns total value of \$727 million in real estate assets
- Plans to be carbon neutral by 2010.
- Will enroll 100 buildings in U.S. Green Building Council Portfolio Program

V. Environmental Metric

As a reasonable metric for comparing relative leverage across companies, it is useful to consider pounds of carbon dioxide emitted per square foot of real estate. This calculation is based on CO2 emissions per million Btus, and also applies a co-efficient for each of the major relevant fuel types, electricity and natural gas. This co-efficient was weighted to reflect each fuel type's share of total energy used in a given type of real estate, (office, retail, and so on). The electricity co-efficient also reflects the extra step of calculating the weighted average of fuel stocks used across the U.S. electric grid. These calculations are based on the U.S. Energy Information Agency 2007 Commercial Buildings Energy Consumption Survey, as shown in **Figure 13**.

Commercial Buildings CO2 Emissions, by Major Fuel, 2003				
	Retail (Other than Mall)	Enclosed and Strip Malls	Office	Warehouse and Storage
Total energy use (million Btus)	728,000,000	1,750,000,000	2,585,000,000	879,000,000
Floor space (million square feet)	4,317	6,875	12,208	10,078
Energy use (Btus per square foot)	168,636	254,545	211,746	87,220
Electricity*				
Primary usage (million Btus)	637,000,000	1,578,000,000	2,170,000,000	738,000,000
Coefficient (lbs CO2 per million Btus)**	131.2	131.2	131.2	131.2
Estimated CO2 emitted (million tons U.S.)	41.8	103.5	142.3	48.4
Natural Gas				
Usage (million Btus)	91,000,000	172,000,000	269,000,000	132,000,000
Coefficient (CO2 per million Btus)	117.1	117.1	117.1	117.1
Estimated CO2 emitted (million tons U.S.)	5.3	10.1	15.7	7.7
Fuel Oil				
Usage (million Btus)	n/a	n/a	18,000,000	9,000,000
Coefficient (CO2 per million Btus)	153.3	153.3	153.3	153.3
Estimated CO2 emitted (million tons U.S.)	n/a	n/a	1.4	0.7
Other				
Usage (million Btus)	n/a	n/a	128,000,000	n/a
Coefficient not available				
Floor space (million square feet)	4,317	6,875	12,208	10,078
Total estimated CO2 emitted (million tons U.S.)	47	114	159	57
Estimated CO2 (pounds per square foot)	21.8	33.0	26.1	11.3
*Electricity figures refer to primary electricity, which includes thermal and transmission losses. Site electricity reflects the amount of electricity delivered to the site, and thus is used to calculate the totals for all fuels used on-site.				
**Coefficient represents a weighted average for all fuel stock inputs to electric generation.				
Sources: Energy Information Agency, Commercial Buildings Energy Consumption Survey, 2006; Perry Lindstrom, Energy Information Agency, personal communication, 2/6/08				
http://www.eia.doe.gov/ accessed 02/05/08				

Figure 13. Co-efficients Used to Calculate CO2 Emissions per Square Foot

VI. Conclusion²⁶

Our research has resulted in the following key findings:

- 1) In real estate it is important to find ways to address the misalignment of incentives, so that a building *owner* is motivated to purchase energy-saving technologies even though it is the *tenant* who pays the utilities and thus reaps the long-term cost savings.
- 2) The greatest leverage in the value chain is found in a) companies that own and operate real estate, and b) companies that either invest in them or manage property for them.
- 3) In the finance segment of the value chain there is greater leverage on the equity side than on the debt side, i.e., investors have greater leverage than lenders.
- 4) There are trade-offs between a company's scale and the nature of its leverage.

Our analysis identified a final three companies of interest, which are compared in **Figure 14**. This comparison yields the following:

- TIAA-CREF has the greatest scale in dollar terms but the least scale in square feet and potential for reducing CO₂ emissions
- Simon Property group has scale similar to CB Richard Ellis in dollar terms and has direct control over real estate by virtue of ownership, but it has far less scale in terms of total square feet of real estate influenced and CO₂
- CB Richard Ellis has the largest scale in terms of dollars, square feet of real estate indirectly influenced, and CO₂




Company	Annual Revenue	Space Owned or Influenced	CO ₂ Emissions
 Simon Property Group	\$3.3 billion	215 million ft ²	3.5 million tons CO ₂
 CB RICHARD ELLIS CB Richard Ellis	\$4 billion	1 billion ft ²	13 million tons CO ₂
 TIAA CREF	\$12.4 billion	64.7 million ft ²	.8 million tons of CO ₂

Figure 14. Summary of Top Three Companies of Interest, with Estimated Carbon Footprint²⁷

²⁶ For a summary of how this research was conducted, please see **Appendix E**. For list of important primary contacts, see **Appendix F**.

²⁷ Simon Property CO₂ figure was calculated using co-efficient for mall retail space (see **Figure 12**). CBRE and TIAA-CREF figures were calculated using co-efficient for office space.