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Abstract

Most hotels maintain resource-intensive operations in order to serve guests around the clock. Therefore, it is important to consider lodging properties with respect to environmental concerns. Though the public has become increasingly cognizant of the environmental impact of real estate in general, it has, for a long time, ignored the specific contributions of hotels to today's environmental decay. However, a growing number of hoteliers realize that a shift in demand towards more sustainable practice has occurred, and the recent introduction of lodging properties to green rating systems testifies to this shift. The present study is intended to provide convincing evidence of the economic value of green certifications through the lens of the lodging industry.

Keywords

Cornell, real estate, hotel, environmental impact, environmental decay, hotelier, lodging properties, green rating system, green certifications, value-added, Green-labeled, green washing, Environmental Sustainability, fossil fuel, U.S. Environmental Protection Agency (EPA), U.S. Green Building Council (USGBC), Leadership in Energy and Environmental Design (LEED), Water Conservation, Energy Conservation, Waste Minimization, compact fluorescent light bulbs (CFLs)

Green Initiatives in the U.S. Lodging Industry

by Peng Liu and Zied Sanhaji

Introduction

Most hotels maintain resource-intensive operations in order to serve guests around the clock. Therefore, it is important to consider lodging properties with respect to environmental concerns. Though the public has become increasingly cognizant of the environmental impact of real estate in general, it has, for a long time, ignored the specific contributions of hotels to today's environmental decay. However, a growing number of hoteliers realize that a shift in demand towards more sustainable practice has occurred, and the recent introduction of lodging properties to green rating systems testifies to this shift. The present study is intended to provide convincing evidence of the economic value of green certifications through the lens of the lodging industry.

Green-labeled commercial real estate has benefited from a considerable value-added factor. This claim has been supported by numerous studies measuring the discrepancies in operating performance and value differentials between non-certified properties and so-called green buildings, which will be reviewed later. Yet, most of the earlier studies focused solely on one asset class: office properties. This leads us to wonder whether this positive relationship between eco-labels and market prices holds true for other commercial assets influenced by the green movement, such as lodging properties. Since hotel spaces are occupied at every hour of the day for a short period (usually daily)-as opposed to other commercial properties which spaces are rented out to tenants via mid- to long-term leases and typically occupied during regular working hours-it is fair to expect a natural divergence in tenants' perception and appreciation of a property's "greenness."

Nonetheless, the green movement has conquered the lodging industry over a relatively short period of time. In fact, the rapid proliferation of green hotels gave birth to a wave of "green-washing" campaigns.¹ The term "green washing" is often referred to as the practice of using green language in order to create a positive image without necessarily possessing any sustainable attributes. Hotel operators favored green washing because it allowed them to capitalize on their brand value at a relatively low cost. Operators' lack of transparency regarding their green efforts prevented the market from accurately valuing its sustainable practices. Yet, the introduction of the lodging industry to official certification programs eventually enabled the assessment of green efforts beyond reputational and promotional benefits.

In the rest of the paper, we provide a preliminary analysis of the trading premiums on recent green hotel property transactions. Following a brief overview that contextualizes the emergence and evolution of the green building movement over time as well as in the current market, we review the precedent literature regarding value generation as a result of green certifications within the commercial real estate sector at large and more specifically within the lodging industry. In the third section of this paper, we summarize the data collected to conduct this research as well as the underlying methodology employed to analyze the data. Finally, we discuss preliminary results and conclude the paper.

Author

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¹ Cornell University School of Hotel Administration. "Sustainability Roundtable: The Hotel Industry Seeks the Elusive 'Green Bullet'," *Center for Hospitality Research*, 2009.

Historical Background on Environmental Sustainability

Building operations in the United States account for approximately 40% of both nationwide carbon emission and energy consumption, 70% of the total electric usage, and more than 10% of the total water consumption.² Figure 1 below illustrates the magnitude of the U.S. building sectors' emissions.

Over time, these alarming figures have concerned the public and have given property developers rising incentives to embrace the green building ideology both in the United States and around the world. The upward momentum in the green trend is expected to drive the U.S green real estate market, from \$36-49 billion in 2009 to \$96-140 billion in 2013.³ Similarly, the sustainable lodging industry has experienced substantial growth, despite its late start.

The origins of American environmentalism can be traced as far back as the 19th century,⁴ yet the period 1960-1970 was what marked a stronger focus on and rebirth of the environmental movement. Thought-provoking literature, such as Rachel Carson's *Silent Spring*, coupled with OPEC's 1973 oil embargo, served as major catalysts for an era of self-questioning and public environmental awareness.⁵ As Hazel Erskine puts it in *The Polls: Pollution and Its Costs*, "ecological issues have burst into American consciousness [with] unprecedented speed and urgency."⁶ As a result, the reduction of fossil fuels in transportation and construction surfaced as one of the most pressing concerns of the 20th century, indelibly marking the real-estate industry. Henceforth, several measures were taken to foster research in the sustainable building field and to stimulate technological advances in energy conservation techniques. As documented by the U.S. Environmental Protection Agency (EPA), the early 1990s allowed various federal initiatives and private programs to formally structure the foundations of the green building movement in America.⁷ The following timeline presents some of these initiatives:



Source : Ed Mazria.

figure 1

U.S. Carbon Emissions by Sector

Author

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² Department of Energy (DOE). Building Energy Data Book, 2009.

³ McGraw Hill Construction. 2009. *Green Outlook 2009: Trends Driving Change*.

⁴ McCormick, J. *Reclaiming Paradise: The Global Environmental Movement*. London : Belhaven Press, 1992.

⁵ U.S Green Building Council. <http://www.usgbc.org/Docs/Resources/BDCWhitePaperR2.pdf>. (accessed March 10, 2009)

⁶ Erskine, Hazel.1972. The Polls: Pollution and Its Costs. *Public Opinion Quarterly*, 35:120-135

⁷ Environmental Protection Agency (EPA). <http://www.epa.gov/greenbuilding/pubs/about.htm>. (accessed March 10, 2009)

While these advancements were proudly taking place in the United States, other countries throughout the world were making similar progress: British Research Establishment Environmental Assessment Method (BREEAM) in 1990, the Building Environmental Performance Assessment Criteria (BEPAC) in 1994, and the Green Star rating system established by the Australian Building Council (GBCA) in 1999. As the sustainability trend continues to evolve and gain popularity in twenty-first century world economies, new third-party certifications are surfacing in an attempt to complement existing labels. However, the emergence of these numerous green building programs only serves to underline how “innately subjective” (Katz 2003) the definition of “sustainable” is.

Despite the lack of a uniform methodology to assess diverse green characteristics (Katz 2003), two organizations stand out as the leading references of the green movement: the private non-profit U.S Green Building Council (USGBC) and the government-run Energy Star.

Major Initiatives in Green Certifications in the United States

The Leadership in Energy and Environmental Design (LEED) and Energy Star designations are nationally accepted as the forefront of the green certification initiative. Not only do both of these rigorous certification programs provide market participants with more efficient building benchmarks, but they also connote a certain level of social prestige. The two following sub-sections describe the fundamentals of each these two programs and outline their main differences.

USGBC’s Leadership in Energy and Environmental Design (LEED)

Since its inception in 1993, the USGBC has played an instrumental role in formalizing and democratizing the green building movement. Its main objective is to foster the use of sustainable building techniques through its Leadership in Energy and Environmental Design (LEED) program. LEED certifications authenticate green buildings according to their compliance with current environmental standards and required high performance measures. As of 2010, USGBC counts more than 4.5 billion square feet of building space participating in LEED around the world.⁸ Though USGBC essentially endeavors to promote a socially responsible use of resources as well as the improvement of real estate environmental standards, it also prides itself on the economic benefits underlying its sustainable framework.

LEED is based on a scoring point system that accounts for five main categories: Sustainable Sites (SS), Water Efficiency (WE), Energy and Atmosphere (EA), Materials and Resources (MR), and Indoor Environmental Quality (IEQ). According to the number of points earned in each of these categories, a green building may be granted one of four different certification levels:⁹

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

“Since its inception in 1993, the USGBC has played an instrumental role in formalizing and democratizing the green building movement.”

⁸ U.S Green Building Council. <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=124>. (accessed March 15, 2009)

⁹ U.S Green Building Council. <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=124>. (accessed March 15, 2009)

Environmental Protection Agency's Energy Star

Energy Star emerged from a joint effort between the EPA and the U.S. Department of Energy (DOE). The purpose of this government-backed initiative is to offer a strategic energy management program to help reduce the environmentally deleterious use of energy. Unlike LEED, the EPA's rating system measures the energy efficiency of a building by means of a benchmarking system. Energy Star ranks the performance of buildings on a scale of 1 to 100 relative to the efficiency of comparable facilities.¹⁰ The rating is designed so that each point earned equals 1 percentile of the U.S. building population for a specific asset class.¹¹ For instance, a hotel rated at 75 is more efficient than 75% of all hotels in the country. Energy Star's requirements have, in fact, become market standards for green buildings; as of 2008, more than 11.5 billion square feet of commercial space have been rated by Energy Star or approximately 16% of U.S. total building space. Energy Star's strong business case continues to attract numerous participants throughout the nation and displays a year-over-year growth superior to 100% from 2007 to 2008.¹²

Certifications	LEED	Energy Star
Governing Body	Non-profit organization: USGBC	Governmental: Joint venture EPA and DOE
Year of inception	1998	1992
Green focus	Broad focus on triple bottom line: Environmental, Social, Economic	Specific focus on energy efficiency
Rating criteria	Based on USGBC's pre-determined credit scoring system	Based on relative performance with other Energy Star partners
Main benefits	Positive externalities on ecosystems Regulatory and zoning allowances Health and community benefits	Reduction of greenhouse gas (GHG) Direct economic benefits National recognition

“Depending on the ownership structure and leasing terms and conditions, the value of cost savings as a direct benefit from certifications will vary.”

Several factors can justify the impressive demand for these certifications. Cost savings and branded goodwill earned by firms in tenancy seem to be the two main motivations for developers to embark upon a green venture. As the inescapable green phenomenon expands across industry sectors, consumers adjust their purchasing behavior towards greener products and companies.¹³ Naturally, companies feel increasingly compelled to echo their patrons' values and social awareness by acquiring or leasing green building facilities, thereby signaling the firm's long-term commitment to Corporate Social Responsibility (CSR) (Eichholtz *et al.* 2009).

Depending on the ownership structure and leasing terms and conditions, the value of cost savings as a direct benefit from certifications will vary. Assuming that the owner occupies its facilities, hence bearing the entirety of the operating and maintenance costs, the acquisition of a green certification makes perfect economic sense. It has been shown that, relative to conventional properties, green-certified buildings experience average savings of 30% on energy cost, typically the largest of utility expenses (Katz 2003). The recent adherence to green certifications is all the more warranted as these financial benefits are incurred at virtually no additional cost of construction (i.e. approximately 2% incremental cost of construction) (Langdon 2007).

¹⁰ EnergyStar, U.S Environmental Energy Protection Agency. http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager. (accessed March 10, 2009).

¹¹ EnergyStar, U.S Environmental Energy Protection Agency. http://www.energystar.gov/ia/business/hospitality/Hotel_Rating_FAQs.pdf. (accessed March 25, 2009).

¹² Energy Star, U.S Environmental Energy Protection Agency. http://www.energystar.gov/ia/partners/annualreports/2008_achievements.pdf. (accessed March 10, 2009).

¹³ REEF Research. Globalization and Global Greening Trends in Green Real Estate Investment, 2008.

Some hypothesize that, thanks to the influence of major green organizations such as USGBC and Energy Star, the rapid spread of environmental awareness will eventually render green certifications obsolete.¹⁴ Albeit low in absolute terms, the relative growth in certified buildings has undoubtedly surpassed all expectations and, in turn, set a standard in the commercial real estate industry of the early twenty-first century. LEED and Energy Star have become so prominent in a short period of time that property owners may be obliged to comply with the market's future conventions and eventually apply pricing discounts to account for the eventual functional obsolescence of non-certified buildings.¹⁵

The Current State of Green Buildings in the Lodging Industry

Unlike residential and office properties, green building in the hospitality industry is still in its early developmental stage. Due to both the intricacy of the lodging business model and the "24/7" nature of its operations, lodging properties have maintained a resource-intensive performance. Lodging properties comprise one of the least sustainable asset classes; the ecological implications of this have long been ignored. Despite the late introduction of the lodging industry to the green movement, a strong positive momentum now drives the evolution of sustainability in this field. The two subsequent sections highlight hotels' singularity as a heavy environmental burden and delineate the influence of the green movement on the lodging industry.

Hotels: A Resource-Intensive Class

Prior to the early 1990s, the hospitality industry was never really considered a major polluting industry within the global economy. Because the environmental impact arising from the consumption of a service product is indirect, the public has hardly fathomed the extent of hotels' ecological externalities. Customers' general ignorance of these issues has, in fact, justified the delay in the rising demand for more sustainable services. Additionally, hotel operators have been reluctant to responsibly alter their service delivery for fear of interfering with guests' comfort. In practice, successful implementation of sustainable service standards requires guests' direct involvement and cooperation. However, hotel operators have been hesitant to confront customers with sustainability decisions that may clash with their upscale guests' expectations.¹⁶ As a result, there has been a significant delay in the supply of green lodging properties: the first hotels to earn the Energy Star and LEED accreditation were the Sheraton Boston, in Boston, MA in 2002 and The Inn and Conference Center by Marriott, in College Park, MD in 2005.

These small advances notwithstanding, the environmental repercussions attributable to the lodging industry are considerable. According to Sloan *et al.* (2009), a hotel discharges, on average, 160-200 kg of CO₂ per square meter of room floor area per year, 1kg of waste per guest per night and 170-440 liters of used water per guest per night within the luxury segment.¹⁷ The significance of hotels' consumption behavior is further reinforced when contrasted against other asset classes. As the chart below illustrates, the consumption of all major fuels per hotel notably outweighs the one for other asset classes. In fact, each lodging property consumes more than 2.5 times the level of fuels consumed by individual office properties.

"Prior to the early 1990s, the hospitality industry was never really considered a major polluting industry within the global economy."

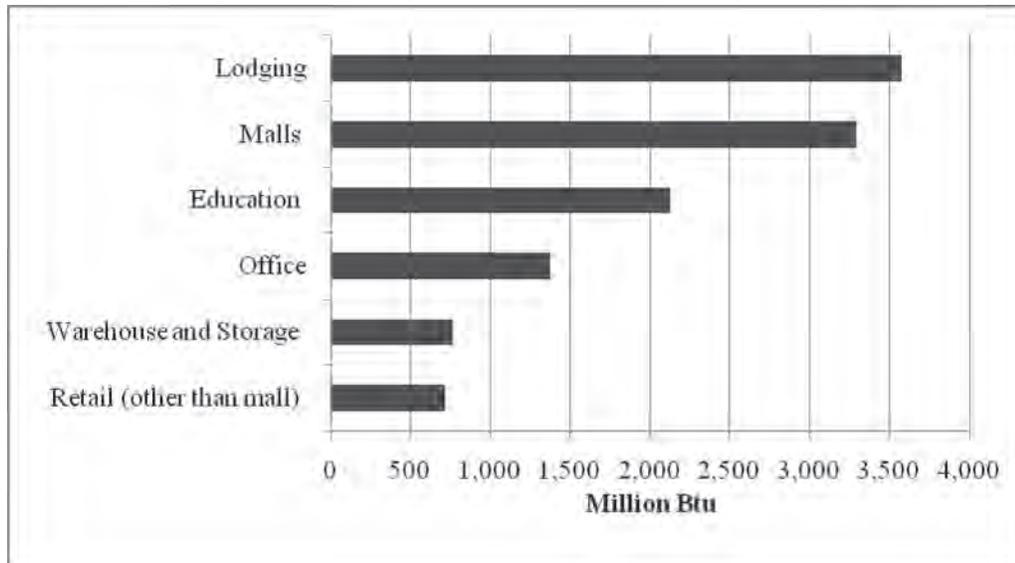
¹⁴ Miller N.G, H.G., Pogue D., 2009. Do Green Buildings Make Dollars and Sense? Burnham-Moores Center for Real Estate, University of San Diego, CB Richard Ellis

¹⁵ Pramerica Real Estate Investors. To be Green or Not to Be Green? Why That Is Not the Question, 2007.

¹⁶ Cornell University School of Hotel Administration. "Sustainability Roundtable: The Hotel Industry Seeks the Elusive 'Green Bullet'," *Center for Hospitality Research*, 2009.

¹⁷ Sloan P., Legrand W., Chen J.S. *Sustainability in the hospitality industry*. 1st edition. Oxford: Butterworth-Heinemann, 2009. Page 14.

Hotel operations are inherently costly to the environment which places the hospitality asset class among the least sustainable. How significant is their environmental impact in aggregate? Judging by its sheer size, the lodging industry has a tremendous impact on the environment: the travel and tourism industry accounts for 9.5% the U.S GDP and about 10% of total employment in the U.S, according to the World Travel & Tourism Council (WTTC 2009).¹⁸



Source : U.S. Department of Energy. Energy Information Administration. Sept 2008

figure 2

Major Fuel Consumption per Building in 2003

The Greening of the Lodging Industry

The emergence of programs such as Hotels Initiative and the appearance of publications such as the Annual Report of the World Travel and Tourism Environmental Review in the early 1990s marked the ascension of an environmentally sensitive hospitality industry.¹⁹ Independent hotels and major international hotel chains were gradually encouraged to take the responsibility for their use of environmental resources and to demonstrate new standards of best practices.²⁰ The progression towards environmental conservation was nothing but rational when considering the emphasis placed on natural landscapes as a longstanding, competitive advantage. Not only is the encouragement of ecological standards a means of preserving one of hotels' core differentiating factors within a highly competitive industry (i.e. hotels' natural surroundings), but it is also a way of integrating technology to achieve higher operating efficiency relative to competitors.

Due to the highly competitive nature of the hospitality industry, owners and operators prioritize the better management of operating costs as a long-term necessity. Typically, management tends to struggle with reducing the cost of utilities—one of the largest operating expenses for any hotel. On average, hotels in the United States spend \$2,196 per available room per year on energy consumption; this is equivalent to 6% of total operating costs.²¹ Overall, U.S. hotels spend nearly \$4 billion on energy each year. Thus, the necessity for

¹⁸ World Travel & Tourism Council (WTTC). Progress And Priorities, September 2008.

¹⁹ Kirk D. 1997. *Environmental Management for Hotels*. 2nd edition. Oxford: Butterworth-Heinemann, page 9.

²⁰ Sloan P., Legrand W., Chen J.S, 2009. *Sustainability in the hospitality industry*. 1st edition. Oxford: Butterworth-Heinemann, page 10.

²¹ Energy Star, U.S Environmental Energy Protection Agency. http://www.energystar.gov/ia/business/challenge/learn_more/Hotel.pdf. (accessed March 25, 2009).

utility costs savings becomes clear. In fact, the EPA estimates that a reduction of 10% in energy consumption yields a \$1.35 increment to the average daily rate (ADR).²²

Despite the breadth and rapid evolution of sustainability, the following three programs are commonly identified as major green initiatives executed in the lodging industry:

1. **Water Conservation Program**

The primary objective of this program is to reduce water wastage by means of water recycling systems. An apt example of an effective water conservation program is the one-million-gallon rainwater storage tank, installed by the luxury resort Fairmont Southampton that supplies the property's water needs during low occupancy.²³

2. **Energy Conservation Program**

Thanks to the installation of compact fluorescent light bulbs (CFLs) and light-emitting diodes in various properties as well as the implementation of a company-wide energy management strategy (i.e. carrying out load shedding schemes to reduce peak demand charges), Marriott International was able to reduce its greenhouse gas (GHG) emissions by 70,000 tons. Marriott's energy conservation program also led to nearly \$6 million in cost savings.²⁴

3. **Waste Minimization Programs**

Kimpton hotels has become identified as a leading sustainable hotel company by focusing on matters such as waste reduction. Waste minimization may entail a variety of sustainable measures ranging from placing recycling bins in guest rooms to offering guests a linen reuse alternative.²⁵

The variety of programs aimed at reducing costs through more sustainable service operations demonstrates hoteliers' inclination to creatively integrate green efforts in their daily operations. Indeed, hoteliers began to realize that sustainability is no longer a social movement and that the expansion of customers' choices for greener products does have a material impact on hotels' revenue-generating ability.²⁶ Hoteliers' realization of customers' untapped demand for sustainable services substantiates the recent surge of green certifications in the lodging industry.

The International Greening Practice in the Lodging Industry

Since the hospitality industry is international in scope, it is crucial to acknowledge the sustainable advancements that have been taking place all around the world. Amidst the spontaneous development of green independent hotels, the establishment of international chain operators in foreign countries has contributed greatly to sustainability's global spread. Hotel operators have been increasingly integrating sustainability in their CSR programs as well as in their brand standards. The magnitude of the investments deployed by these international operators has prompted governments in both developed and developing nations to provide further incentives for green hotel developments. Table 2 below presents key characteristics of the sustainable trend in major areas around the world such as Europe,

²² Energy Star, U.S Environmental Energy Protection Agency. http://www.energystar.gov/ia/business/hospitality/fact-sheet_0804.pdf. (accessed March 29, 2009).

²³ Fairmont Hotel & Resorts. www.fairmont.com/en_fa/articles/recentnews/waterconservation.htm. (accessed March 25, 2010)

²⁴ Energy Star, U.S Environmental Energy Protection Agency. http://www.energystar.gov/ia/business/challenge/learn_more/Hotel.pdf. (accessed March 25, 2009).

²⁵ Kimpton Hotels & Restaurants. www.kimptonhotels.com/programs/earthcare-business.aspx. (accessed March 26, 2010).

²⁶ Cornell University School of Hotel Administration. "Sustainability Roundtable: The Hotel Industry Seeks the Elusive 'Green Bullet'," *Center for Hospitality Research*, 2009.

	Status of Green Trend	Stage in Greening	Main Green Property type	Recognized Local, Sustainable Brands/Properties	Major Environmental Policies	Active Governmental Initiatives ?	Outlook	Challenges
Europe	Stagnant	Growth	Lifestyle Hotels	Hilton Hotels Europe	German Renewable Energy Heating Law (EEW/ärmeg)	Yes	■	High rehabilitation costs for traditional, landmark
Asia	Actively Greening	Growth	Luxury, business hotels,	Banyan Tree Hotels&Resorts, and Six Senses Resorts&Spas	Asia-Pacific Hotels Environmental Initiative (HEI), 1997	Yes	■	No major challenges at this point.
Latin America	Rising	Infancy	Ecologde	Four Seasons, Peninsula Papagayo	Certification in Sustainable Tourism (CST), 1998	No	■	Weak know-how to "go-green"
India	Rising	Infancy	Independent Resorts	Orchid Mumbai, and Taj Hotels&Resorts	Energy Conservation Building Code, 2007	No	■	Unaffordable green technology
Middle East	Actively Greening	Growth	Luxury Resort	Emirates Hotel, Al Maha Resort Resort&Spa	Public/private eco-initiatives	Yes	■	No major challenges at this point.
Oceania	Global Leader	Growth	Resort	Kingfisher Bay Resort	Australian Green Building Council: Green Star, 2003	Yes	■	Lack of awareness of green financial incentives
Caribbean	Stagnant	Growth	All-inclusive Resorts	Maho Bay Camp	Caribbean Alliance for Sustainable Tourism (CAST), 1997	No	■	Limited financing granted to small scale operations

Source : Ernst & Young 2010 Industry Report, Hospitality Going Green

Asia, Latin America, India, the Middle East, Oceania, and the Caribbean.

Because the lodging industry's success hinges on patrons' trust in the service delivery system, intangible benefits have also represented an important incentive for the acquisition of green certifications. A positive business image in a people-to-people service industry is a crucial factor contributing to a highly motivated workforce, a potential higher demand, constructive relationships with neighboring communities, and satisfied shareholders. Though ecolabels would appear to be the utmost attestation of hotels' reputational viability, options for green certification have, until now, remained fairly limited.

Previous Research on Green Office Buildings

There is sparse but growing literature on green commercial buildings. An example of recent state-of-the-art research is the article in *American Economic Review* by economists Piet Eichholtz, Nils Kok and John M. Quigley. Using a sample of 1,360 transactions of green-certified office buildings in the United States, they study whether green certified buildings yield higher effective rents and transactional premiums. Eichholtz, Kok and Quigley (2009) show that occupancy levels for certified properties under LEED and Energy Star were 5.2% and 3.3% higher than their non-rated counterparts, respectively. They also found, through the use of a hedonic regression analysis—a model typically used in real estate investigations to control for building-specific characteristics—average premiums of 6% on effective rents and 15.8%-16.8% on transacted values. Though Eichholtz *et al.* recognize the importance of intangible value generators, including tenants' positive social images, they found that on average a dollar saved in energy cost translates into an 18.32% improvement in market values. Overall, the study revealed that green-rated buildings would benefit from an incremental value of \$5.7million relative non-rated buildings.

Eichholtz *et al.*'s (2009) findings are confirmed by Fuerst and McAllister (2009), who find similar results regarding rental premiums for LEED-certified buildings. Akin to Eichholtz *et al.*'s study, fairly small discrepancies were observed between LEED's value-generating potential and Energy Star's. However, the magnitude of the sales premium appears to reach 35% for LEED-rated office space and 31% for Energy Star, about twice as high as the ones presented by Eichholtz *et al.* In terms of occupancy, Fuerst and McAllister showed occupancy attaining levels 8% and 3% higher for green buildings under LEED and Energy Star, respectively, than for conventional buildings.

Similarly, Miller, Spivey and Florance (2008) collected data from a sample of 2.4 million properties to find that, on average, LEED creates a 10% premium on sales price per square foot while 5.76% are attributed to the Energy Star label. This incremental value on sales prices is translated into a 55 basis points decrement in cap rates. Miller *et al.* also found that a particularly low correlation (-.064) lies between premiums attributable to LEED and Energy

Star; which suggests that rewards from LEED and Energy Star are independent from one another and could be cumulated.

Would hotel guests perceive the same benefits from eco-labels under a (renewable) daily lease contract and would corresponding premiums still apply? In spite of the evident interest this question sparked, no previous research has been done on green lodging properties. The lack of empirical studies assessing certification premiums on lodging properties is most likely due to the novelty of the green hotel movement and, consequently, the difficulty in sampling ample and adequate data. Due to varying design and construction requirements, real estate, in general, suffers from an intrinsic heterogeneity. Therefore, finding appropriate benchmarking references within a sample remains a limiting concern requiring control. The heterogeneous aspect of real estate is maximized in the hotel sector-aside from franchised hotel chains that experience heavy standardization.

Another limiting factor warranting the lack of previous research on green hotel investment lies in the fact that LEED is currently in the process of revamping its ecological standards to create a hospitality- specific certification. Challenges may arise once the market is populated with green lodging properties certified under two sets of altered criteria.

The Price Premium of Green Hotels Evidenced from Recent Transactions

To investigate whether the benefits of hotel green initiatives are capitalized in the market, we performed a hedonic regression analysis using a recent sample of hotel transactions. The major course of data used in this study is from CoStar group, a leading provider of commercial real estate data and service in the United States. As of March, 2010, 9,561 (19,719) commercial buildings in the United States had been awarded Energy Star

figure 3A

Transactions of LEED Hotel Properties by Region

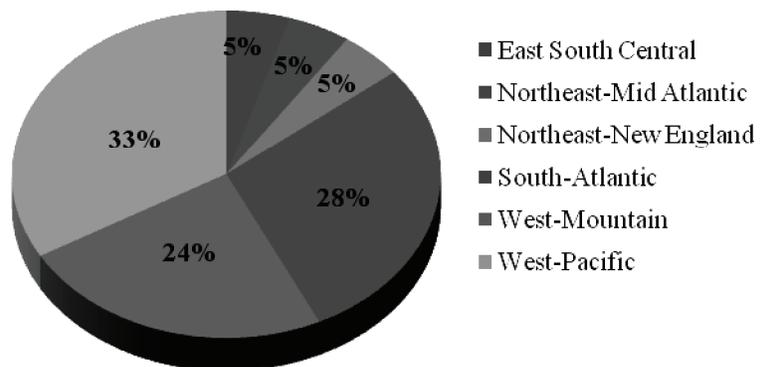
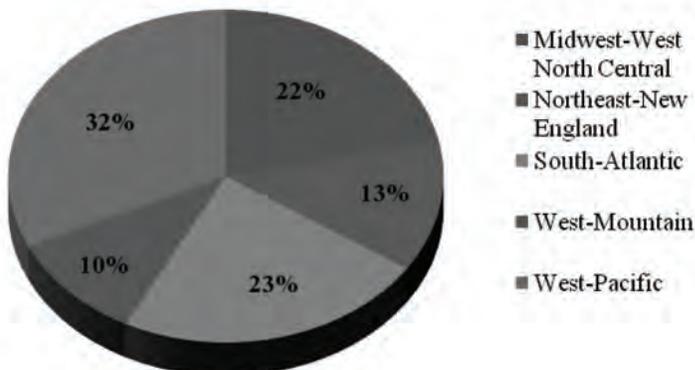


figure 3B

Transactions of EnergyStar Hotel Properties by Region



(LEEDs) designation, among which 127 (20) are transacted hotels. Figure 3 A and figure 3B display the geographical distribution of green hotel transactions by region for LEED and EnergyStar certified hotels.

Table 3 provides a geographic summary of green-hotel transactions by region. Table 4, by contrast, compares the average differences of major hotel characteristics, such as price per room, price per square foot, property size, and building age.

Region	EnergyStar	LEED
East South Central	1	-
Northeast-Mid Atlantic	1	-
Midwest-West North Central	27	1
Northeast-New England	16	1
South-Atlantic	29	6
West-Mountain	13	5
West-Pacific	40	7
Total	127	20

table 3

Green Lodging
Property Transactions

	Median Comparison		Mean Comparison	
	Green Hotels	Non-green Hotels	Green Hotels	Non-green Hotels
Hotel Sale Price	\$ 10,417,104	\$ 850,000	\$ 38,450,287	\$ 14,397,472
Price Per Room	\$ 79,707	\$ 67,143	\$ 109,473	\$ 132,247
Price Per SF	\$ 139.69	\$ 80.18	\$ 172.19	\$ 185.27
Number of Rooms	149	110	230	198
Bulding Age (Years)	23	27	35	36
Bulding Size (sqft)	80,274	55,622	167,155	141,799

table 4

Comparison of Average Hotel
Transaction Characteristics

Regions as defined by the U.S Census Bureau.

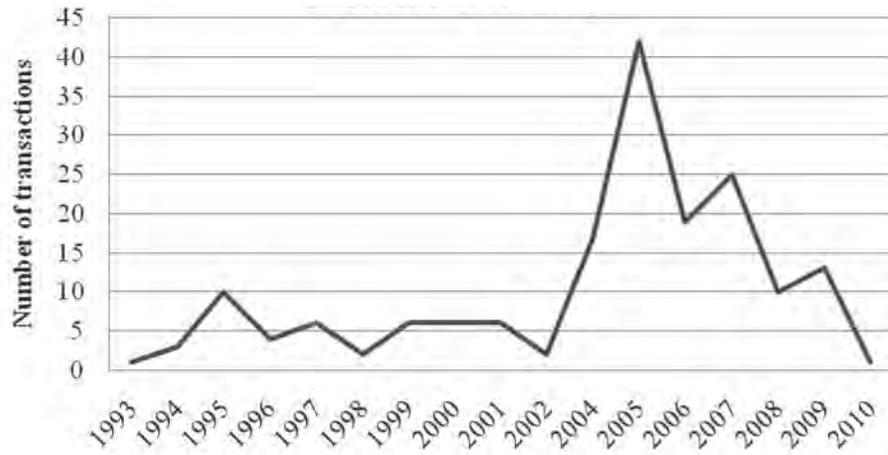
To analyze the effect of green designation on the transaction prices, we matched each of the green (LEED-rated and Energy Star) hotel transactions in our sample to nearby hotel transactions within the same period. Based upon the longitude and latitude of each green hotel, we used a GIS system to identify, in the CoStar database, all other lodging properties within a one-mile radius²⁷ from the selected green hotels. We thus created 147 clusters of comparable sales, totaling 862 transacted lodging properties. Furthermore, we hand-collected information on hotel type (i.e. luxury, upscale, midscale, budget/limited service, boutique) and management style (i.e. branded vs. independent). After removing observations that were missing data on at least one variable, we ended up with 532 observations. On average, between 1 and 5 hotel comparable sales are used to analyze the premium in green hotel transactions.

As shown in figure 4A, green hotel transactions remain stable until 2003, when the average trading volume jump to more than 40 per year. It is not surprising that trading volumes have declined due to credit crisis in 2007-2009.

²⁷ When the initial search resulted in less than three comparable properties, we expanded the radius to 3 miles.

figure 4A

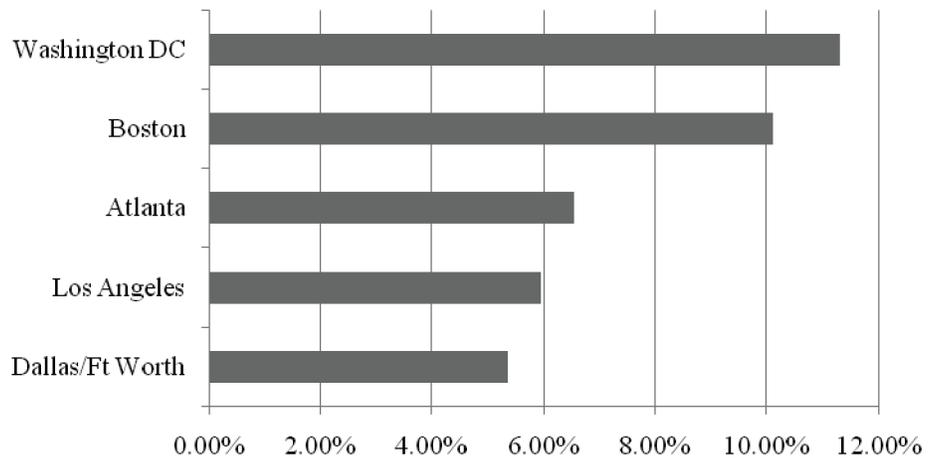
Average Transaction Volume of Green Certified Hotels



Source : CoStar. March 2010

figure 4B

Top Five Most Active Markets in Green Hotel Transactions



Source : CoStar. March 2010

Figure 4B ranks the most active areas of green loading property transactions. Washington D.C., Boston, Atlanta, Los Angeles and Dallas are the top five most active markets for green hotels.

Following Eichholtz, Kok, and Quigley, (2009), we apply ordinary least squares to perform hedonic regressions in equation (1).

$$(1) \log P_{in} = \alpha + \beta_i X_i + \sum_{n=1}^N \gamma_n C_n + \delta g_i + \epsilon_{in}$$

In the above formulation,²⁸ the dependent variable is the logarithm of the sale price per square foot. Xi is a vector of the hedonic characteristics of hotel i, including building age, number of rooms, type of hotel and management style, and so on. To control for locational effects, a set of market cluster dummy variables (Cn) are used, where a value equals 1 if a hotel i is located in cluster n, and zero if otherwise; gi is an indicator variable with a value of 1 if a building i is rated as LEED (including certified, silver, gold, or platinum) or Energy Star hotel, and zero if otherwise; $\alpha, \beta_i, \gamma_n,$ are estimation coefficients and ϵ_{in} is an error term.

²⁸ We use an identical notation to that which appeared in Eichholtz, Kok, and Quigley, 2009 to draw a comparison.

The preliminary regression shows that, for a sample of 66 hotel properties transacted in the 2005-2010 (Feb) period, the sale prices for green buildings were much higher than for non-rated buildings, *ceteris paribus*. The transactional premium is approximately 35% for green hotel properties. Consistent with most of the results in the office market, selling prices per square foot are higher when buildings are larger. Not surprisingly, the transactions conducted during 2009-2010 all suffered big discounts; the sale year dummy of 2009 is highly significant. Furthermore, some hotel management characteristics seem to be priced *apropos* of their styles. For example, luxury hotels tend to have sale discounts whereas branded hotels tend to trade at a premium. The empirical result is statistically significant with adjusted R-squares of 61%.

Although beyond the scope of this study, future research should investigate the sources of this transactional premium. Eichholtz, Kok, and Quigley (2009) conclude that the sources of transactional premiums of green office buildings come from the tenants in oil, banking industry, and government-related organizations who are willing to pay higher rents. We are in the process of obtaining the performance data from Smith Travel Research, which is a leading research firm tracking daily lodging performances nationwide. With detailed information on Average Daily Price (ADR), Revenue Per Available Room (RevPAR), vacancy, and so on, we will be able to distinguish different potential sources of this premium. Furthermore, it is important to distinguish a hotel property's sustainability (i.e. building's functional efficiency) from a hotel's operational sustainability (i.e. green service delivery and consumption). Since operators are contractually bound to a hotel property over a limited timeframe, transaction premiums over green hotel properties must not account for the green performance of hotel management. We hypothesize that the major source of green hotel premiums comes from the reduction of vacancy rates, not from increase in ADR, because hotels with green initiatives are perceived as being of better quality and thus attract more business travelers. With lower vacancy rates, the hotel capitalization rate tends to be lower.

Concluding Discussion

A review of the existing literature on green investment shows the lack of evidence acknowledging the positive relationship between eco-certifications and lodging properties' investment values. Since eco-labeling in the lodging industry has rapidly gained momentum, it seems logical to perform a similar analysis on lodging properties. Additionally, the intricate operation of lodging properties as well as their inherently higher volatility in returns, relative to other asset classes, highlights the uniqueness of hotels as an asset class and the relevance of such analysis.

A preliminary analysis shows that the sale prices per square feet of lodging properties with green certifications (LEED or EnergyStar) are on average higher than non-green hotel properties, *ceteris paribus*. The transactional premium can be as high as 35% and the results are significant and robust across different specifications.

Our working hypothesis is that the greater sale price of green hotels is attributed to the increase in daily occupancy (or capitalization rate compression). We leave the investigation of the relationship between green hotel initiatives and hotel operational performance to our future work.

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