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## Cornell Hospitality Report

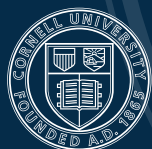
### The Impact of LEED Certification on Hotel Performance

by Matthew C. Walsman, Rohit Verma, Ph.D., and Suresh Muthulingam, Ph.D.

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Cornell University  
School of Hotel Administration



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537 Statler Hall  
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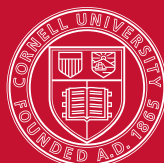
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# The Impact of LEED Certification on Hotel Performance

by Matthew C. Walsman, Rohit Verma, and Suresh Muthulingam

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## EXECUTIVE SUMMARY

**T**he LEED certification standard for green buildings has gained considerable acceptance since its launch in 2000. However the question as to whether LEED certification provides business benefits has remained largely unanswered, particularly for the hotel industry. On the one hand, many scholars and practitioners claim that organizations pursuing LEED certification realize costs savings and increase revenues. On the other hand several scholars have returned results that are inconclusive. This study contributes evidence to this debate by calculating a differential revenue for LEED certified hotels, compared to those that are not certified. This comparison of the performance 93 LEED-certified hotels (representing the population of such hotels in 2012) to that of 514 comparable competitors finds that the certified hotels obtained superior financial performance as compared to their non-certified competitors, for at least the first two years after certification. Unfortunately, most hotels' certification is so recent that there is insufficient data at this time to gauge whether the revenue advantage continues after two years.

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## ABOUT THE AUTHORS

**Matthew C. Walsman** is a doctoral candidate in service operations management at the Cornell University School of Hotel Administration (mcw237@cornell.edu). His research interests include empirical research and behavioral operations management in the context of professional services. Prior to coming to Cornell he received an MBA from Brigham Young University. He worked 4 years in New York City as a consultant in the commercial construction industry where he advised clients on LEED certification and construction disputes, as well as performing scheduling, estimating, and project management services. He has studied membership-based loyalty programs, constrained service capacity allocation, and the implications of LEED certification in the hotel industry.



Since 2008 he has been a LEED Accredited Professional.

**Rohit Verma**, Ph.D., is a professor of service operations management at the Cornell School of Hotel Administration (rv54@cornell.edu). He served as the executive director of the Cornell Center for Hospitality Research during 2009–2012 and is currently the coordinator of



MBA–MMH dual degree programs. Prior to joining the Cornell faculty, he was the George Eccles Professor of Management, David Eccles School of Business (DESB) at the University of Utah. He has also taught MBA and executive development classes at several universities around the world, including DePaul University, German Graduate School of Business and Law, Helsinki School of Economics, Indian School of Business, Norwegian School of Logistics, Nyenrode University, and University of Sydney. Verma has published over 50 articles in prestigious journals and serves on the editorial review boards of *Production and Operations Management*, *Cornell Hospitality Quarterly*, and *Journal of Service Research*. He has co-edited special issues of *Cornell Hospitality Quarterly*, *Decision Sciences*, *Journal of Operations Management*, and *Journal of Service Management*. He is the co-author of *Operations and Supply Chain Management for the 21st Century*, and co-editor of *Cornell School of Hotel Administration on Hospitality: Cutting Edge Thinking and Practice*.

**Suresh Muthulingam**, Ph.D., is an assistant professor of operations management at Samuel Curtis Johnson Graduate School of Management. His research interests lie at the intersection of operations management and sustainability. In one stream of research, he examines how behavioral factors influence the adoption of sustainable operating practices. In another stream, he investigates how operational knowledge can be leveraged to enhance operational practices within firms or supply chains. He previously worked on the leadership team that established the Operations Consulting practice for IBM Global Services, PricewaterhouseCoopers, and Coopers & Lybrand in



India.



The authors express their appreciation to STR for supporting this research study by providing the necessary data.

# The Impact of LEED Certification on Hotel Performance

by Matthew C. Walsman, Rohit Verma, and Suresh Muthulingam

**T**he United States Green Building Council (USGBC)—a non-profit organization established in 1993—designed the LEED certification program to support their express mission “to promote sustainability in the building and construction industry.”<sup>1</sup> In their efforts to achieve this mission the USGBC has two primary functions: (1) certify buildings as environmentally sustainable structures, and (2) qualify experts in sustainable building practices. In the 14 years since the first building was certified in 2000, the USGBC has grown into a global organization with over 65,000 participating projects and over 188,000 certified professionals.<sup>2</sup>

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<sup>1</sup> [www.usgbc.org/about/history](http://www.usgbc.org/about/history), viewed 4/21/14.

<sup>2</sup> [www.usgbc.org/profile](http://www.usgbc.org/profile); and [www.usgbc.org/about](http://www.usgbc.org/about). Viewed 4/21/14

## LEED v4 rating system categories

Building Design and Construction	Interior Design and Construction	Building Operations and Maintenance	Neighborhood Development
New Construction	Commercial Interiors	Existing Buildings: Operations & Maintenance	Neighborhood Development Plan
Core & Shell	Retail	Schools	Neighborhood Development
Schools	Hospitality	Retail	
Retail		Hospitality	
Hospitality		Data Centers	
Data Centers		Warehouses & Distribution Centers	
Warehouses & Distribution Centers			
Healthcare			
Homes			
Midrise			

Source: [www.usgbc.org/leed/v4/](http://www.usgbc.org/leed/v4/). Viewed 4/24/14

The LEED certification system for buildings is designed around “credits” that pertain to sustainable construction and operating practices. Although these credits vary across project types (see Exhibit 1), they are all organized under the following seven categories: location and transportation, sustainable sites, water efficiency, energy and atmosphere, material and resources, indoor environmental quality, and innovation. Although the LEED standards were not initially directed specifically at hotels, the newest version (LEED v4) includes a scorecard for new hospitality industry construction (Exhibit 2).

Despite the initial absence of direct standards, numerous hospitality projects have sought LEED certification since 2004 when the Len Foote Hike Inn in Dawsonville, Georgia, became the first LEED hotel. At that time, the certification program was just beginning and few hoteliers even considered it. In 2005 the University of Maryland Inn & Conference Center was the just second to certify, and in 2006 the Hilton Vancouver Conference Center and Hotel became the third. Since 2007, there has been an increased acceptance of the LEED standards in the hotel industry and a substantial number of hotels have been certified (see Exhibit 3), although as we explain next, the pace has slowed.

In the U.S. the number of hotels certified to the LEED standard showed an increasing trend that seems to have peaked in 2010, when 29 hotels were certified. However, from 2011 on, there has been a decline in the number of newly certified hotels. This trend suggests that although the LEED standard has gained increased acceptance in the hotel industry the potential benefits from LEED are not clear—

perhaps inhibiting wider implementation. More to the point, while practitioners and advocates have been promoting the virtues of LEED since its advent, there is little empirical evidence demonstrating a link between LEED certification and performance, especially in the hospitality industry. Moreover, most studies have examined the benefits of LEED from a cost perspective, with a focus on whether certification will reduce energy costs. In this study, we empirically examine the impact of LEED certification on revenue performance on a substantial sample of U.S. hotels.

### Past Research Feeds the Debate

Scholars and practitioners have debated the financial impact of LEED certification since the start of the program in 2000.<sup>3</sup> What we have seen is a controversy in the research findings, with some studies showing a business advantage,<sup>4</sup> and

<sup>3</sup> For example, see: Dermisi, S. V. (2009). Effect of LEED ratings and levels on office property assessed and market values. *Journal of Sustainable Real Estate*, 1(1), 23-47; Eichholtz, P., Kok, N., & Quigley, J. M. (2009). Why Companies Rent Green: CSR and the Role of Real Estate. Paper presented at the Academy of Management Proceedings; and Kok, N., McGraw, M., & Quigley, J. M. (2011). The diffusion of energy efficiency in building. *American Economic Review*, 101(3), 77-82.

<sup>4</sup> Several interesting studies show an advantage, such as: Eichholtz, P., Kok, N., & Quigley, J. M. (2010). Doing well by doing good? Green office buildings. *American Economic Review*, 100(5), 2492-2509; Miller, N., Spivey, J., & Florance, A. (2008). Does Green Pay Off? *Journal of Real Estate Portfolio Management*, 14(4), 385-399; and Newsham, G. R., Mancini, S., & Birt, B. J. (2009). Do LEED-certified buildings save energy? Yes, but... *Energy and Buildings*, 41(8), 897-905. doi: <http://dx.doi.org/10.1016/j.enbuild.2009.03.014>.

# LEED hospitality construction scorecard

## LEED for New Construction and Major Renovations ( )

	POSSIBLE: 1
IP102 Integrative process	1
<b>LOCATION &amp; TRANSPORTATION</b>	<b>POSSIBLE: 32</b>
LT101 LEED for Neighborhood Development location	16
LT102 Sensitive land protection	1
LT103 High priority site	2
LT104 Surrounding density and diverse uses	5
LT107 Access to quality transit	5
LT108 Bicycle facilities	1
LT110 Reduced parking footprint	1
LT111 Green vehicles	1
<b>SUSTAINABLE SITES</b>	<b>POSSIBLE: 78</b>
SS101 Construction activity pollution prevention	REQUIRED
SSp1 Construction activity pollution prevention	REQUIRED
SS104 Site assessment	1
SSc1 Site selection	1
SS105 Site development - protect or restore habitat	2
SSc2 Urban redevelopment	1
SS107 Open space	1
SSc3 Brownfield redevelopment	1
SS108 Rainwater management	3
SSc4.1 Alternative transportation - public transportation access	6
SSc4.2 Alternative transportation - bicycle storage and changing rooms	1
SSc4.3 Alternative transportation - alternative fuel vehicles	1
SSc4.4 Alternative transportation - parking capacity	1
SS110 Heat island reduction	2
SSc5.1 Site development - protect or restore habitat	1
SSc5.2 Reduced site disturbance - development footprint	1
SS112 Light pollution reduction	1
SSc6.1 Stormwater management - rate and quantity	1
SSc6.2 Stormwater management - treatment	1
SSc7.1 Landscape and exterior design to reduce heat islands - non-roof	1
SSc7.2 Landscape and exterior design to reduce heat islands - roof	1
SSc8 Light pollution reduction	1
<b>WATER EFFICIENCY</b>	<b>POSSIBLE: 36</b>
WE101 Outdoor water use reduction	REQUIRED
WEp1 Water use reduction	REQUIRED
WE102 Indoor water use reduction	REQUIRED
WE104 Building-level water metering	REQUIRED
WE901 Outdoor water use reduction	2
WEc1 Water efficient landscaping	4
WEc1.1 Water efficient landscaping - reduce by 50%	1
WEc1.2 Water efficient landscaping - no potable water use or no irrigation	1
WE902 Indoor water use reduction	6
WEc2 Innovative wastewater technologies	1
WE110 Cooling tower water use	2
WEc3 Water use reduction	4
WEc3.1 Water use reduction - 20% reduction	1
WEc3.1-3.2 Water use reduction	2
WEc3.2 Water use reduction - 30% reduction	1
WE112 Water metering	1
<b>ENERGY &amp; ATMOSPHERE</b>	<b>POSSIBLE: 119</b>
EA101 Fundamental commissioning and verification	REQUIRED
EAp1 Fundamental commissioning of building energy systems	REQUIRED
EA103 Minimum energy performance	REQUIRED
EAp2 Minimum energy performance	REQUIRED
EA106 Building-level energy metering	REQUIRED
EAp3 CFC reduction in HVAC/R equipment	REQUIRED
EA108 Fundamental refrigerant management	REQUIRED
EA110 Enhanced commissioning	6
EAc1 Optimize energy performance	19
EAc1.1-1.5 Optimize energy performance	10
EA903 Optimize energy performance	18
EAc2 On-site renewable energy	3
EAc2.1 Renewable energy - 5%	1
EAc2.1-2.3 Renewable energy	3
EAc2.2 Renewable energy - 10%	1
EAc2.3 Renewable energy - 20%	1
EA118 Advanced energy metering	1
EAc3 Enhanced commissioning	2
EA121 Demand response	2
EAc4 Ozone depletion	1
EA123 Renewable energy production	3
EAc5 Measurement and verification	1
EA126 Enhanced refrigerant management	1
EAc6 Green power	2
EA128 Green power and carbon offsets	2

	CONTINUED
MRC1.3 Building reuse - maintain 100% of shell/structure and 50% of non-shell/non-structure	1
MR112 Building product disclosure and optimization - environmental product declarations	2
MRC2 Construction waste management	2
MRC2.1 Construction waste management - divert 50% from landfill	1
MRC2.1-2.2 Construction waste management	2
MRC2.2 Construction waste management - divert 75% from landfill	1
MR114 Building product disclosure and optimization - sourcing of raw materials	2
MRC3 Materials reuse	2
MRC3.1 Resource reuse - 5%	1
MRC3.1-3.2 Resource reuse	2
MRC3.2 Resource reuse - 10%	1
MR115 Building product disclosure and optimization - material ingredients	2
MRc4 Recycled content	2
MRc4.1 Recycled content - 5% (post-consumer + 1/2 pre-consumer)	1
MRc4.1-4.2 Recycled content	2
MRc4.2 Recycled content - 10% (post-consumer + 1/2 pre-consumer)	1
MR123 Construction and demolition waste management	2
MRc5 Regional materials	2
MRc5.1 Local/regional materials - 20% manufactured regionally	1
MRc5.2 Local/regional materials - 50% extracted regionally	1
MRc6 Rapidly renewable materials	1
MRc7 Certified wood	1

	POSSIBLE: 76
EQ101 Minimum IAQ performance	REQUIRED
EQp1 Minimum IAQ performance	REQUIRED
EQ104 Environmental tobacco smoke control	REQUIRED
EQp2 Environmental Tobacco Smoke (ETS) control	REQUIRED
EQ110 Enhanced IAQ strategies	2
EQc1 Outdoor air delivery monitoring	1
EQ112 Low-emitting materials	3
EQc2 Increased ventilation	1
EQ113 Construction IAQ management plan	1
EQc3.1 Construction IAQ management plan - during construction	1
EQc3.2 Construction IAQ management plan - after construction	1
EQ114 IAQ assessment	2
EQc4.1 Low-emitting materials - adhesives and sealants	1
EQc4.2 Low-emitting materials - paints and coatings	1
EQc4.3 Low-emitting materials - flooring systems	1
EQc4.4 Low-emitting materials - composite wood	1
EQ115 Thermal comfort	1
EQc5 Indoor chemical and pollutant source control	1
EQ117 Interior lighting	2
EQc6.1 Controllability of systems - perimeter spaces	1
EQc6.2 Controllability of systems - thermal comfort	1
EQ121 Daylight	3
EQc7.1 Thermal comfort - design	1
EQc7.2 Thermal comfort - verification	1
EQ123 Quality views	1
EQc8.1 Daylight and views - daylight 75% of spaces	1
EQc8.2 Daylight and views - views	1
EQ124 Acoustic performance	1

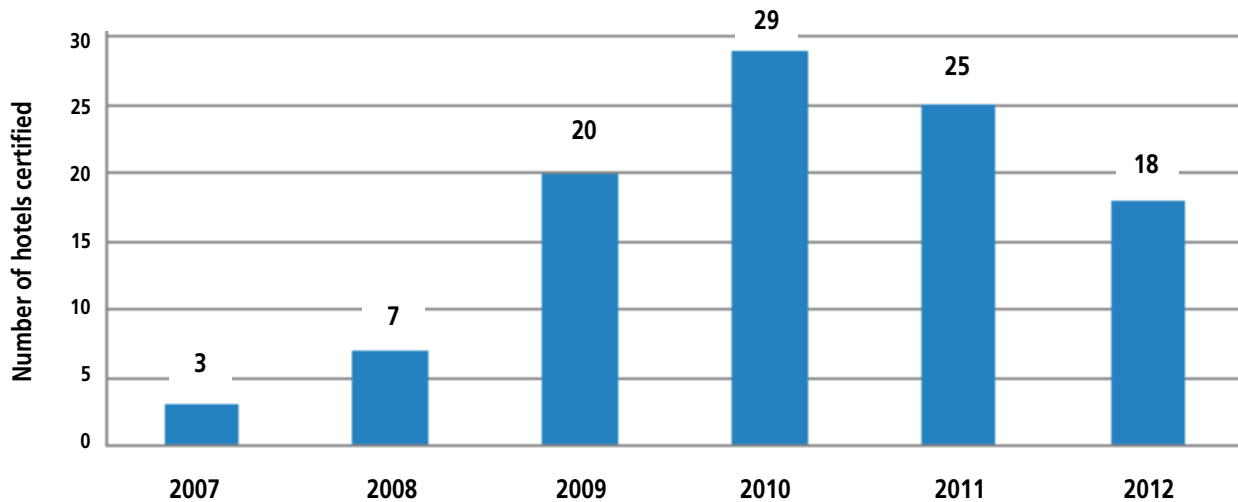
	POSSIBLE: 27
IDc1 Innovation in design	5
IN101 Innovation	5
IDc2 LEED Accredited Professional	1
IN102 LEED Accredited Professional	1

	POSSIBLE: 8
RPc1 Regional priority	4

**TOTAL** 443



## U.S. hotels: LEED certification by year



others presenting an inconclusive outcome.<sup>5</sup> Since LEED was designed for commercial properties at the outset, it's not a surprise that most of this research has focused on commercial properties, rather than hotels specifically. In perhaps the most recognized study in this area, Eichholtz, Kok, and Quigley demonstrated a 3-percent increase in rental rates and a 6-percent increase in sales prices of "green" commercial buildings when compared to their "non-green" competitors.<sup>6</sup> The properties these authors define as "green" were those certified under LEED or Energy Star. Looking closer at the results, however, it was actually the Energy Star certification that signaled the price increases, while LEED certification proved to be inconclusive. Although these results are surprising, they may not necessarily translate to the hotel industry because of the different business realities between hoteliers and commercial real estate owners.

The scholarly journal *Energy and Building* tackled the cost-savings issue when they investigated the energy savings potential of LEED certification by printing two competing studies in the same volume. While the first set of authors demonstrate energy cost savings of 18 to 39 percent due to LEED certification,<sup>7</sup> the second set of authors call into ques-

tion the methods used in the first study, by demonstrating errors in the calculations.<sup>8</sup>

Another study examines the investment trends in LEED certification during the turbulent post-2008 economic conditions.<sup>9</sup> Contrary to the hotel industry experience, these authors say that there has not been a reversal in LEED certification investment since the economic downturn, demonstrating its financial justification.

One challenge hoteliers faced in the past with LEED certification was that hotels were grouped with other commercial properties in the rating system and certified as either "new construction" or "existing buildings." These early rating systems failed to acknowledge hotels' distinctive characteristics. We suspect that hoteliers did not feel there was a good match for certification. As we said above, with the most recent rating system, LEED v4, hoteliers no longer have to certify using the same criteria as other commercial buildings, and instead they have their own ratings system specifically crafted for the hotel industry. This and other changes may encourage more hoteliers to seek LEED certification. In fact, we have already seen this happen. Even without conclusive financial support, many large hotel companies have adopted LEED certification as part of their development programs. Marriott, for example, has created a "LEED Volume Program" with a pre-certified prototype that they can build all

<sup>5</sup> See: Scofield, J. H. (2009). Do LEED-certified buildings save energy? Not really... *Energy and Buildings*, 41(12), 1386-1390. doi: <http://dx.doi.org/10.1016/j.enbuild.2009.08.006>

<sup>6</sup> Eichholtz *et al.*, *op cit.* A similar study examining the impact of four different environmental certification programs on commercial real estate is found in: Fuerst, F., & McAllister, P. (2011). Green Noise or Green Value? Measuring the Effects of Environmental Certification on Office Values. *Real Estate Economics*, 39(1), 45-69. doi: 10.1111/j.1540-6229.2010.00286.

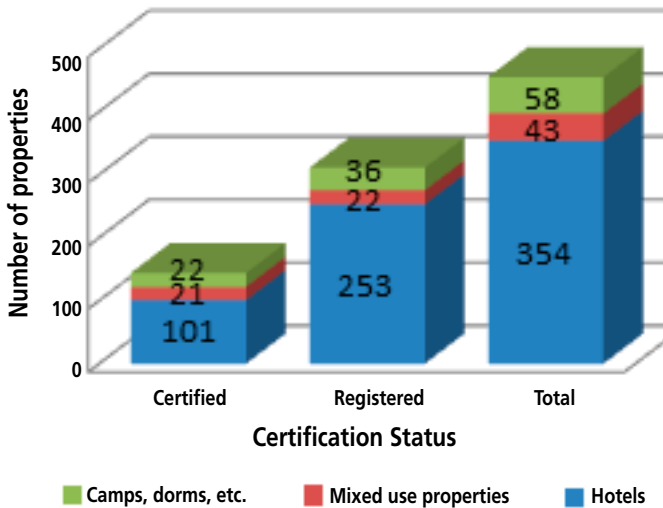
<sup>7</sup> Newsham *et al.*, *op.cit.*

<sup>8</sup> Scofield, *op.cit.*

<sup>9</sup> Fuerst, F. (2009). Building momentum: An analysis of investment trends in LEED- and Energy Star-certified properties. *Journal of Retail & Leisure Property*, 8(4), 285-297. doi: 10.1057/rlp.2009.18.

EXHIBIT 4

U.S. LEED hotel projects registered with USGBC as of 2012 (including hotel-like projects)



over the world.<sup>10</sup> Many independent hoteliers have also adopted LEED to differentiate their properties.

Research Approach: Data Collection

Data for this study come from a combination of public and private sources. The USGBC—along with certifying properties and professionals—maintains a public database of all LEED projects around the world. The LEED database included over 35,000 properties as of December 2012, when we downloaded it for this study. This list includes completed projects, projects that were under construction at the time, and those that were planned but later abandoned. For our study, we drew the data for the U.S. hotel properties, not including confidential projects, for a total of 455 potential properties. On examination, we discovered that 43 were development projects in which a hotel was only a small part of the project and another 58 were dorms or camps listed by the USGBC as hotels. Removing these, our resulting sample from the USGBC database included 101 certified properties and 253 registered but not yet certified hotels.

With the assistance of STR, a Center for Hospitality Research partner, we added seven hotels to this list. Of the 108 certified properties, STR was able to provide (confidential) data for 93 of these hotels. We should note, that STR’s data collection is nearly a census of the U.S. industry’s branded properties, as roughly 75 percent of all U.S. hotels contribute their operating data. We collected financial data on hotels between 2005 and 2012, although financial data was only one variable of interest.

<sup>10</sup> www.marriott.com/corporate-social-responsibility/leed-hotels.mi. Viewed 4/22/14.

Methodology

A seemingly simple approach to evaluate the impact of LEED certification on hotel performance would be to compare the performance of a hotel before and after its LEED certification. However, this approach is not as simple as it might seem, since isolating the impact of LEED certification using such an approach can be problematic. For example, a hotel might have received certification just before an economic boom. One could not then determine whether the hotel’s improved financial performance was on account of the better economic conditions or on account of the LEED certification. To remedy this potential conflict, we adopt an approach that can isolate the impact of LEED certification—in this case, the difference-in-difference methodology outlined by Barber and Lyon.<sup>11</sup> This method involves comparing the differences in performance of a specific hotel with those of comparable hotels, using three distinct steps. In the first step, we identify for each LEED certified hotel other properties that have similar characteristics. These characteristics correspond to those used by STR to identify a particular hotel’s competitive set, most notably, the opinion of the hotel’s managers. In the second step, we assess the change in annual performance of the LEED-certified hotel and that of its competitive set for a period that starts one year before a hotel was certified and ends two years after the LEED certification. Finally, we examine whether the change in annual performance observed for the LEED-certified hotel is significantly different from the change in annual performance observed for the competitors. If we observe that there is no substantial difference between the change in annual performance of the LEED certified hotel and its competitors before the LEED certification but that there is a notable difference between the changes in annual performance after certification, then we can infer that the hotel’s performance has been influenced by LEED certification. In our analysis we measure hotel performance using occupancy, average daily rate (ADR), and revenue per available room (RevPAR).

Results

In addition to the 93 LEED-certified hotels, our sample includes 514 non-certified competitors. The hotels in both subsamples come from various classes, locations, operation types, and sizes (Exhibit 5), although we see more certified hotels among the higher chain scales. Thirty-one percent of certified hotels are luxury hotels and 84 percent are upscale or above. We see no noticeable difference in ownership structure between the two subsamples, as 42 percent of the LEED hotels were franchised properties, and the remainder were split evenly between chain operators and independents.

<sup>11</sup> Barber, B. M., & Lyon, J. D. (1996). Detecting abnormal operating performance: The empirical power and specification of test statistics. *Journal of Financial Economics*, 41(3), 359-399.

**EXHIBIT 5**

**Demographic statistics of population of LEED certified hotels (N = 93)**

Variable	Number	Percentage
<b>Class</b>		
Economy	1	1.1%
Midscale	0	0
Upper Midscale	14	15.1%
Upscale	31	33.3%
Upper Upscale	18	19.4%
Luxury	29	31.2%
<b>Operation</b>		
Chain Management	27	29.0%
Franchise	39	41.9%
Independent	27	29.0%
<b>Size (rooms)</b>		
< 75	6	6.5%
75 -149	43	46.2%
150 - 299	26	28.0%
300 - 500	11	11.8%
> 500	7	7.5%
<b>Location</b>		
Airport	5	5.4%
Interstate	2	2.2%
Resort	9	9.7%
Small Metro/Town	11	11.8%
Suburban	33	35.5%
Urban	33	35.5%

Most certified hotels are in suburban or urban markets (71%), which is consistent with what the certification criteria of LEED would suggest (e.g., points given for serving densely populated areas with public transportation options). Finally smallish hotels seem to be best suited for LEED certification, as 46 percent of the sample's certified hotels fall in the range of 75 to 149 rooms, with another 28 percent between 150 and 299 rooms. These statistics could also be simply because these are the most common hotel sizes in the U.S.

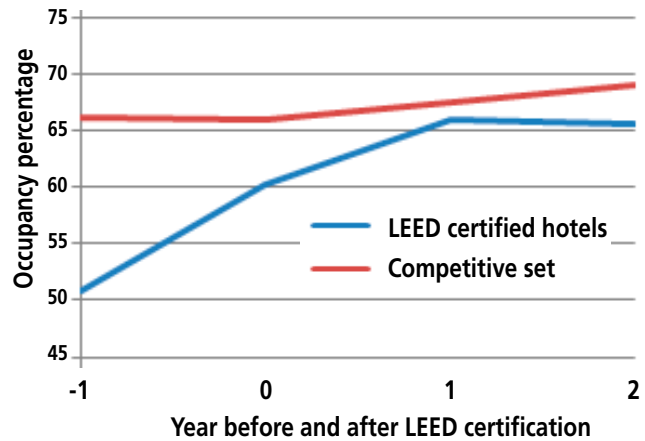
**EXHIBIT 6**

**Mean occupancy, ADR, and RevPAR, full sample (N = 607)**

Classification	n	Occupancy	ADR	RevPAR
<b>LEED</b>	93	63.1%	\$ 169.13	\$ 110.09
<b>Certified</b>	17	57.1%	\$ 133.91	\$ 79.19
<b>Silver</b>	40	65.9%	\$ 165.84	\$ 111.81
<b>Gold</b>	34	62.9%	\$ 181.74	\$ 117.70
<b>Platinum</b>	2	61.1%	\$ 319.79	\$ 208.95
<b>Non-LEED</b>	514	67.1%	\$ 159.84	\$ 109.41

**EXHIBIT 7**

**Occupancy comparison before and after certification**

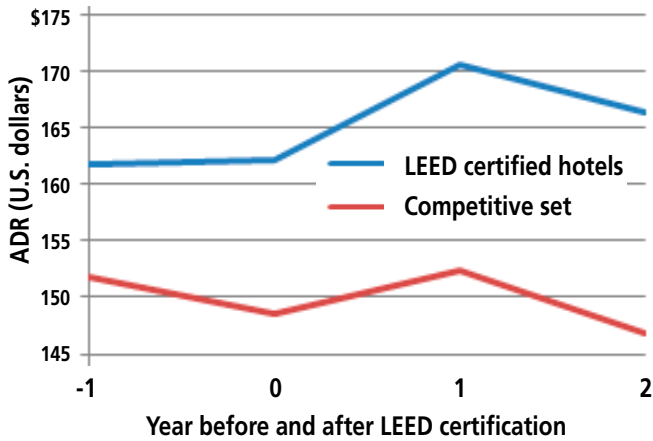


Compiling the raw data we notice a general trend toward superior financial performance for LEED certified hotels (see Exhibit 6). As a group, the 93 LEED certified hotels had a somewhat lower occupancy rate (63% for the LEED group versus 67% for the non-certified hotels), but a higher ADR (\$169 vs. \$160). With the greater ADR, the LEED hotels had a slight RevPAR advantage over the non-certified hotels in this dataset (\$110 to \$109).

While the mean values are interesting, they don't tell us much. To obtain a more accurate indication, we apply the difference-in-difference analysis, in which we measure the difference in performance for matched subjects and competitors before and after the LEED certification occurred. This analysis is shown in the charts in Exhibits 7, 8, and 9. Our analysis was able to span only three years, in part because we were not able to measure the effect of certification beyond two years for many of the hotels in our database, since their certification was too recent. Moreover, as we explain below, we also do not have a full year's data in advance of certification for some LEED hotels since they were either

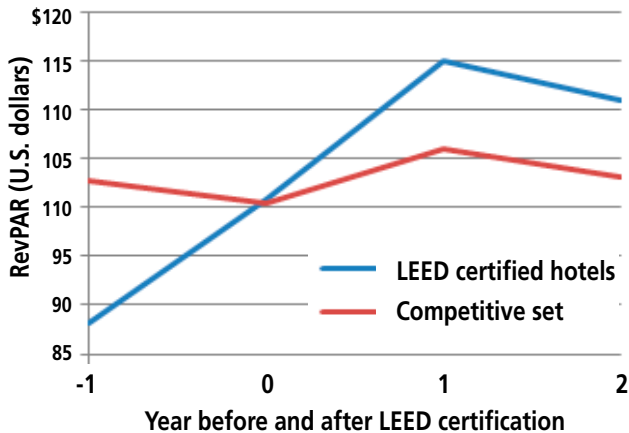
### EXHIBIT 8

#### Mean ADR comparison before and after certification



### EXHIBIT 9

#### Mean RevPAR comparison before and after certification



new properties under construction or existing hotels under renovation during that time.

For the year prior to certification, hotel occupancy is lower for hotels that subsequently earned LEED certification as compared to competitive hotels (Exhibit 7). However, subsequent to certification we find that there are no significant differences in occupancy between the two groups. Here, we undoubtedly see the occupancy effects of including new hotels (which, of course, have no data for the year prior to certification) and those that were likely undergoing renovation. Once the renovation was done or once the hotel opened, we would expect a period of time where occupancy would ramp up to reach existing competitor levels. Considering these challenges, it is remarkable that LEED certified hotels match competitors' occupancy levels within a year

of certification. As shown in Exhibit 8, the LEED hotels gained an additional advantage in average daily rate after the achieved certification. For the year prior to certification, the 93 hotels that were eventually certified had an ADR that was on average \$10 higher than the non-LEED hotels. For the two years after obtaining LEED certification, the mean ADR for LEED hotels is \$20 higher than that for non-LEED hotels. This difference is surprising considering the importance of cost competitiveness in the U.S. hotel industry. Many hoteliers have difficulty justifying higher rates to price-conscious customers, and yet these LEED hotels were able to collect a substantially higher rate than their non-LEED competitors.

The RevPAR figures for the two groups, shown in Exhibit 9, depict the negative effect of low occupancy for the LEED hotels in the year prior to certification (despite their higher ADR), but that disadvantage was equalized after certification. Following certification, LEED hotels demonstrate a clear advantage in RevPAR over their non-LEED competitors.

### Discussion and Future Research

Academics and practitioners have debated the merits of LEED certification in various industries since the establishment of the program in 2000, but we have seen few empirical studies that measure its impact, particularly on the hotel industry. Our analysis of the population of LEED certified hotels in the United States shows that LEED hotels do in fact outperform their non-certified competitors in the industry's common revenue benchmarking metrics, ADR and RevPAR. The LEED hotels quickly made up the occupancy deficit recorded in the year prior to certification, and they outperformed competitors for two years following certification. Due to insufficient data, it is still too early to know the effects of LEED certification beyond the first two years.

### Limitations

We acknowledge that the sample size of 93 for U.S. LEED certified hotels from 2007 through 2012 is relatively small. However, this is nearly a census of the population of certified hotels as of the time we drew the data. Thus, we affirm that the strength of these data lies in the fact that this is not a sample, but a population. Because it is a population that we are studying and not a sample we are able to suggest that these findings apply to the industry as a whole.

Another limitation to the study is that we are relying on the subject properties to identify competitors that are operationally similar, as is the procedure used by our data supplier, STR. While hoteliers have an economic incentive to choose competitors who resemble closely their hotel, we cannot control which competitors they choose. That said, we are certain that the hoteliers are well aware of which properties are their direct competitors.

## Future Research

One other limitation of this paper is that we analyzed only the revenue side of the profitability equation. The next step is to look at the cost side. While it is the express mission of LEED to reduce consumption of operating resources—and therefore costs—there can be a premium on the initial investment. The payback period for LEED certification from a cost perspective is unclear and requires additional investigation. We may also be interested in segmenting the dataset further to see whether there are differences in impact among hotel chain scales, locations, or sizes. To be sure, we need a longer operating period than two years to fully assess the effects of LEED certification, on both costs and revenues.

As a final note, another interesting question might be what happens when a hotel begins the LEED certification process, but for some reason never follows through to certification? As we analyzed the LEED database, we noted that many projects register with the USGBC, demonstrating their intention to certify, but for various reasons do not finish the certification process. Does the act of registration have an effect on the project, even though final certification was never achieved? This is an interesting question because it's possible that the advantage is created in the learning that

goes on through the certification process and not in actually holding the certificate itself. We wonder then, could a hotel that goes through the process but never obtains the certificate enjoy the same profitability advantages as those that do hold the certificate? Or is there something about holding the certificate that is important to signal to customers that this is a LEED hotel?

With regard to resource use, one indication of a potential answer to these questions is found in a study conducted by Jie Zhang, Nitin Joglekar, Rohit Verma, and Janell Heineke.<sup>12</sup> These researchers analyzed the financial results of hotels that had received the Travelocity eco-friendly hotel designation, which is based on any of a dozen different certifications. They found that the “green” hotels recorded higher resource efficiency for both hotel operations and customer activities, as compared to those that had not earned the designation. Thus, it may be that regardless of the certification, hotels that are involved in sustainability activities are operated more efficiently than typical properties. ■

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<sup>12</sup> J. Zhang, N. Joglekar, R. Verma, and J. Heineke, “Exploring the Relationship between Eco-certifications and Resource Efficiency in U.S. Hotels,” *Cornell Hospitality Reports*, Vol. 14, No. 7 (2014). Cornell Center for Hospitality Research.

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Cornell University  
School of Hotel Administration  
The Center for Hospitality Research  
537 Statler Hall  
Ithaca, NY 14853

607.255.9780  
shachr@cornell.edu

[www.chr.cornell.edu](http://www.chr.cornell.edu)