How Risky Are Sustainable Real Estate Projects? An Evaluation of LEED and ENERGY STAR Development Options

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Abstract Recent empirical evidence on rent and occupancy premiums associated with sustainable buildings is used to evaluate risks and returns associated with green real estate development projects. Green building premium estimates are derived from four recent empirical studies while incremental green construction costs are based on a review of existing literature. Monte Carlo analysis is applied to determine the expected return and risk associated with two green building certifications. Findings reveal a mean internal rate of return for Leadership in Energy and Environmental Design (LEED) buildings of 126% with a 10% probability of achieving an IRR of 50% or less. Buildings with an ENERGY STAR certification achieve a mean IRR of 140% with virtually no probability (1.6%) of achieving an IRR less than 50%.

Recent public focus on sustainability issues has raised the visibility of Leadership in Energy and Environmental Design (LEED) and ENERGY STAR-certified real estate development projects. The U.S. Green Building Council's (USGBC) LEED certification requires achievement of a minimum number of points from a scoring system based on sustainable design and construction practices. ENERGY STAR is a joint Environmental Protection Agency and Department of Energy Program that certifies buildings as ENERGY STAR if their energy use is in the best quartile of buildings in their business category.[1]

The objective of this study is to apply recently available empirical evidence on sustainable building rent and occupancy differentials and sustainable building cost premiums to provide the first assessment of returns and risks associated with both LEED and ENERGY STAR sustainable real estate development projects.

A growing body of empirical literature indicates that LEED and ENERGY STAR-certified buildings do command higher rents and greater occupancy rates relative to conventional buildings. For example, rent premium estimates from four recent studies using the CoStar national real estate database range from 4.4% to 51%. Occupancy premiums range from 4.2%% to 17.9%. Each of these studies attempted to control for other factors such as building age.

Many advocates promote LEED certification as a no-cost or minimal cost option. Indeed, the cost-consultancy firm of Davis Langdon (2007) evaluated costs of

LEED-certified buildings and found no statistical difference in cost/square foot between samples of LEED and non-LEED buildings for five different building types.

Considering this information from the developer's perspective would seem to make the choice of sustainable versus conventional project development a rather easy choice. However, developer views of sustainable building projects are considerably less enthusiastic. A recent survey by Building Design and Construction (2007) in August 2007 found that while 94% of respondents thought the trend in sustainable building projects was ''growing,'' 78% thought sustainable design added ''significantly to first costs.'' Thirty-two percent of respondents estimated additional costs to be from 6% to 10%, while 41% estimated sustainable construction premiums to be 11% or greater.

These results are consistent with other surveys of developers and industry participants. For example, a recent survey by the World Business Council for Sustainable Development (2007) determined that U.S. building professionals estimated an average cost increase of 16% associated with sustainable buildings. CB Richard Ellis (Gomez, 2008), the largest real estate developer in the world, reports cost increase estimates of 5%–20% from design and construction consultants.

These developer views of significant incremental cost help explain why, despite prominent media coverage of LEED and ENERGY STAR projects provided by local media (U.S. Green Building Council, 2009), LEED and ENERGY STAR-certified buildings still reflect a small fraction of commercial building. New building LEED-certified construction projects totaled just 1,361 and existing building certifications number 162 as of November 2008 (U.S. Green Building Council, 2008). ENERGY STAR-certified buildings number 7,299 as of June 1, 2009 (Environmental Protection Agency, 2009). By comparison, the U.S. building stock includes over 5.5 million buildings with more than 120,000 buildings greater in size than 100,000 square feet (Market Analysis and Information System, 2009). Conventional building design is still the predominant design choice in most markets.

The discrepancy between the views of sustainable building advocates and general developer attitudes is the result of a variety of factors. While case study results make a compelling argument that some LEED building designs cost no more than conventional designs, these costs often do not include the ''soft costs'' associated with the extra cost of certification and issues such as code-compliance delays and related additional design and engineering support costs. In addition, promotion of the no-cost position is often viewed as biased because it is a common assertion of sustainable building advocates.

Until recently, the only information on sustainability premiums for building rents and occupancy was based on anecdotal information, which likely explains the perception by 60% of the respondents to the Building Design and Construction survey that markets are ''not willing to pay a premium'' for sustainable building.

The recent availability of empirical results from four national studies on sustainability rent and occupancy impacts along with an application of incremental cost data derived from a variety of sources provides a new opportunity to evaluate the financial risks and returns associated with sustainable real estate projects.

Assessing financial returns on sustainable construction investments requires consideration of both the stream of benefits and the additional initial cost of sustainable construction and certification. If discounted rent and occupancy premiums are greater than the initial cost premium, sustainable real estate projects provide greater returns compared to conventional projects.[2] On the other hand, if there is limited recognition of actual sustainable building benefits, like reduced energy costs, market forces will prohibit landlords from increasing rents sufficiently to cover costs.

The risks associated with sustainable real estate are determined by the uncertainty surrounding market-determined rent and occupancy premiums and cost premiums associated with sustainable buildings.

Developers considering sustainable projects also face an additional decision concerning certification options. Should they aspire to the more comprehensive, expensive, and stringent LEED certification process or the alternative ENERGY STAR certification that focuses only on energy use?

The next section discusses empirical data from four national studies on sustainable building premiums along with a summary of the literature on incremental cost differentials. The section that follows provides estimates of internal rates of return implied by each of the four studies. The next section applies Monte Carlo analysis to evaluate sustainable real estate development investment returns and risk based on simultaneous consideration of data from all four studies and information on LEED and ENERGY STAR costs. The final section provides several caveats and a summary of the analysis.

Empirical Evidence on Green Premiums and Costs

Rent and Occupancy Premiums

Four studies of sustainable building rent and occupancy premiums have been conducted with national CoStar Data (Fuerst and McAllister, 2008; Miller, Spivey, and Florance, 2008; Eichholtz, Kok, and Quigley, 2009; and Wiley, Benefield, and Johnson, forthcoming). CoStar is the leading collector of commercial property data providing information on hundreds of building attributes including rent, occupancy, value, and LEED and ENERGY STAR certification. Information on rent and occupancy premiums from the four studies is provided in Exhibit 1.

The Miller, Spivey and Florance (2008) study applied the CoStar ''peered'' data where each LEED or ENERGY STAR-certified building was matched to a non-green building with similar characteristics to provide one non-certified building for each certified building. The Fuerst and McAllister (2008), Eichholtz, Kok, and Quigley (2009), and Wiley, Benefield, and Johnson (forthcoming) studies analyzed certified buildings and a larger sample of non-sustainable buildings extracted from the CoStar database. Since the same basic data source is used for each of the

Exhibit 1 | Comparison of Sustainability Rent, Occupancy, and Value Results

	MSF	FM	EKQ	WBJ
Rent Premium (%)				
ENERGY STAR	8.93	18.88	8.90	8.62
LEED	50.54	9.68	4.40	17.3
Occupancy Premium%				
ENERGY STAR	4.21	2.72	9.39	11.03
LEED	4.78	2.72	9.39	17.92

Notes: The sources: MSF (Miller, Spivey, and Florance, 2008), FM (Fuerst and McAllister, 2008), EKQ (Eichholtz, Kok, and Quigley, 2009), WBJ data are two-stage least squares estimates from Wiley, Benefield, and Johnson (forthcoming).

studies, differences in parameter values are a result of model specification and the estimation data sample developed from the CoStar properties.

Incremental LEED Costs

As indicated above, developers consistently refer to substantial incremental costs associated with sustainable buildings. Estimates of 10% to 15% are not unusual. However, reported developer and designer estimates may reflect a desire to accept ''high-side'' costs compatible with an extra hurdle requirement added to reflect the real option value of delaying the investment (Holland, Ott, and Riddiough, 2000; and Bulan, Mayer, and Somerville, 2009) or decision-maker loss aversion (Camerer, 2005), both of which are associated with investment uncertainty.

A variety of independent estimates of incremental green costs is available. The Miller, Spivey, and Florance (2008) study estimates a hard cost of about 2.5% based on a survey of 26 projects. Soft costs that include design, documentation, commissioning, modeling, and other costs associated with a green project probably range from about 0.5% (General Services Administration, 2004) to 1.5% (Simpson, undated). Using a soft cost midpoint of 1.0% (Choi and Scott, 2007) gives a Miller, Spivey, and Florance total (hard plus soft) certification cost of 3.5% of construction costs.

The Kats (2003) study reported costs of 0.66%, 2.11%, 1.82%, and 6.5% for certified, silver, gold, and platinum LEED buildings with an average of 1.84% for a sample of 33 buildings. These estimates, however, are based on data derived from a literature review, architects, building personnel, and members of California's Sustainable Building Task Force USGBC staff and others and appear not to include a variety of soft costs. Adding an additional 1% for soft cost provides a middle range estimate of about 3%.

A more recent study by Kats (2006) found incremental LEED costs of 2% for educational buildings; however, the study did not incorporate all soft costs, which likely would increase the average to around 3%.[3]

The General Services Administration (2004) conducted a LEED cost study and estimated ranges of 0.03% to 1.45%, 0.14% to 4.94%, and 1.96% to 8.83% for certified, silver, and gold certifications. The average of the middle range is 2.5%.

Several sources point to higher costs. The American Chemistry Council (2003) estimated incremental construction costs of 3% to 8% with an additional soft cost estimate ranging from 1.5% to 3.1% to provide an overall average range of 4.5% to 11.1%. CB Richard Ellis (Gomez, 2008) reports incremental cost estimates of 5% to 20% from consultants for their sustainability initiatives; however, these estimates reflect both U.S. and international green applications.

Many LEED advocates suggest that LEED buildings actually cost less to construct than conventional buildings; primarily through savings associated with purchasing smaller chillers and savings in lighting and other HVAC costs. However, these savings are also associated with ''best-practice'' conventional design and construction, which is the appropriate baseline for identifying incremental costs of LEED and ENERGY STAR construction.

As indicated above, a wide range of LEED cost estimates exists. A developer considering a LEED project can reduce costs by planning for the lower LEED certification levels, since most tenants are unlikely to be aware of distinctions between certified, gold, silver, or platinum LEED designations.

After considering the 3.5%, 3%, 3%, 2.5%, 4.5%–11%, and 5%–20% estimates for incremental costs described above, 3% was selected as a reasonable ''expected'' estimate of a lower LEED certification cost. The studies mentioned above also suggest that a range of 1% to 5% is likely to capture most outcomes for a cost-conscious developer to achieve a LEED certification.

Other LEED Cost Issues

It is important to note one issue related to LEED costs that has caused considerable confusion. Several studies by the firm Davis Langdon (2004, 2007) have compared mean cost estimates for a sample of LEED and a sample of non-LEED construction projects for individual building types. Davis Langdon (DL) concludes in both the 2004 and 2007 report that ''there is no significant difference in average costs for green buildings as compared to non-green buildings.'' These statements are, understandably, generally interpreted to mean there is no additional cost associated with applying a LEED building design to what would have been a conventional building design.

While the DL statement is technically correct, the common interpretation is not. To see this distinction, consider the test used to evaluate the statistical difference between the two sample means shown below.

$$t = \frac{\textit{Difference in sample means}}{\textit{Standard error of the difference}}.$$

A *t*-value of about 2.0 or more establishes a statistical difference between the means. If the difference in sample means is $30/square foot but the standard error of the difference is $20/square foot, no statistical difference will have been established even though the measured difference is $30/square foot. The standard error of the difference is a measure of the variation in costs/square foot within each of the two samples. The greater the variation in $/square foot within each sample, the more difficulty the test has in distinguishing true difference in the sample means. A brief look at the DL report shows that costs/square foot variations within the samples are large, varying by a factor of two or more, resulting in large standard errors. In other words, the variation within the two samples swamps whatever true variation exists in LEED and non-LEED samples in the statistical test.

An analysis with data approximated from the DL report graph of academic buildings indicates that a true difference of about $50/square foot is required to overcome the variation inherent in the two samples. Since the true cost is certainly less than $50/square foot, the DL methodology virtually guarantees from the outset that the statistical test will fail to establish a statistically significant difference. This misapplication can be corrected by regressing building costs on all identifiable cost attributes and determining the incremental cost associated with those that are required for LEED certification.

Incremental ENERGY STAR Costs

Little direct information is available on incremental costs of achieving ENERGY STAR certification. However, the nature of the ENERGY STAR program lends itself to reasonably straightforward development of an incremental cost estimate. ENERGY STAR certification requires a building to achieve energy use in the best quartile of buildings in their business category based on an analysis of a national sample of commercial buildings.

The ENERGY STAR requirement is a relatively easy target to achieve, primarily because most commercial buildings are relatively inefficient. Two energy efficiency initiatives are typically sufficient for most new buildings to meet an ENERGY STAR target. The first is appropriate lighting design. Most commercial building lighting systems are overlit and undercontrolled. Since waste heat from lighting must be removed by the air conditioning and ventilation system, careful lighting design can dramatically reduce building energy use, reduce the size and cost of the air conditioning system, and reduce lighting system costs. Appropriately-designed lighting systems including task lighting, bi-level controls, low-cost daylight, and occupancy controls can reduce total building electricity by as much 20% or more.

The second efficiency initiative is building commissioning, which is the assessment and adjustment of building energy systems after construction to insure optimal performance given current occupancy characteristics and other factors. Building systems are rarely commissioned. Design flaws, neglected maintenance, equipment performance degradation, equipment failures, post construction modifications, and other factors typically result in poor energy efficiency performance in most commercial buildings.

Commissioning for new buildings, which incidentally is required for LEED certification, costs around 0.7% of construction cost (Mills, et. al., 2004). Careful lighting design, including analysis of impacts on HVAC system requirements, is similar in many ways to commissioning efforts; consequently, we assume that the sum of lighting design and commissioning costs total 1.5% of new construction cost. This estimate is likely to be on the high side since lighting design savings in fixtures, ballasts, and lamps and resulting reduction in air conditioning and ventilation system costs can potentially pay for a significant portion of lighting controls and extra design costs.

A lower bound ENERGY STAR cost reference of 0.5% is provided in a recent Lawrence Berkeley National Laboratory study (Brown, Borgeson, Koomey, and Biermayer, 2008) that identified 34% savings potential (9% more than required for ENERGY STAR) in existing commercial buildings at a cost of about $1.25/square foot, or about 0.5% of a new building cost of $250/square foot.

We specify an ENERGY STAR mean incremental cost value of 1.5% of costs with a likely range from 0.5% to 2.5%. Exhibit 2 summarizes estimated incremental costs of LEED and ENERGY STAR certification.

Sustainable Real Estate Investment Returns: Expected Values

Financial benefits of a sustainable building option can be calculated with data on conventional building rent (*R*, $/square foot), the green rent premium (*RP*, $/square foot), conventional building occupancy (*O*, %), the green occupancy premium (*OP*, %, difference between conventional and sustainable occupancy rates), the mean incremental cost of sustainable construction (*CP*, $/square foot) from Exhibit 2, and the discount rate, *r*, with the following equation:

$$NPV = \sum_{t=1}^{T} \frac{O * RP + OP * (R + RP)}{(1 + r)^t} - CP. \qquad (1)$$

Exhibit 2 | Incremental Costs of Sustainability Certification as a Percentage of Construction Cost

	Low	Mean	High
LEED	1.0	3.0	5.0
ENERGY STAR	0.5	1.5	2.5

Where NPV is the net present value in $/square foot of the sustainability option, the first term to the right of the equal sign discounts and sums future annual financial benefits to a present value over the life of the asset, *T*. *CP* is incremental cost of the sustainability option. An NPV greater than zero is a profitable investment, showing the present value of benefits and costs of developing a sustainable project rather than a conventional project. That is, NPV shows the value of the discounted financial premium stream beyond the cost premium required to develop a sustainable building.

Another measure of the return on the incremental sustainability investment is the internal rate of return (IRR). The IRR is the discount rate, *r*, required to make the discounted benefits exactly equal the incremental sustainability cost (i.e., NPV = 0). That is, the IRR is the return implied by the investment cost and the future discounted benefits. Mathematically, the IRR is determined by solving the following equation for *r*:

$$CP = \sum_{t=1}^{T} \frac{O * RP + OP * (R + RP)}{(1 + r)^t}. \tag{2}$$

IRR values greater than the firm's cost of capital are considered profitable investments since the return on the investment is greater than the cost of funding the investment. This calculation is more complicated in reality because other factors such as tax issues enter the equation. However, the IRR calculation used here is indicative of the pre-tax return on an investment in the sustainability option.[4]

While rent and occupancy premiums can be expected to vary over time in response to the market demand and supply for commercial space generally and the demand for and supply of sustainable space in particular, we assume here that these costs are constant in real terms. Under these conditions, all of the variable values under the summation signs are constant over time providing the following Equation 2 simplifications:

$$CP = (O * RP + OP * (R + RP)) \sum_{t=1}^{T} \frac{1}{(1 + r)^t}. \tag{3}$$

Equation 3 is used in this study to determine the IRR implied by sustainability rent and occupancy premiums and incremental sustainability costs. A financial asset life *T* of 25 years is used for these calculations. It is important to note that Equation 3 does not require that assets actually be held for 25 years; rather it reflects the fact that benefits of a sustainability investment continue throughout the life of the asset. Individual developers can capitalize the stream of rent and occupancy premiums by selling the building; however, from a market perspective, this transaction reflects only a transfer of the asset from one owner to another without changing the underlying value of the rent premiums or capital value.

The values for the variables in (3) reflect expected values. Data from the MSF, FM, EKQ, and WBJ studies in Exhibit 1 and mean incremental costs in Exhibit 2 are applied to Equation 3 and presented in Exhibit 3. As indicated in Exhibit 3, financial analysis using empirical results from the four studies shows significant IRR for both LEED and ENERGY STAR buildings, though LEED results from the FM and EKQ studies may be too small to tempt developers.

Results in Exhibit 3 provide interesting insights on the financial returns implicit in the empirical results reported in the four studies; however, except for a general comparison of IRRs between the four studies, these results provide little guidance in assessing the financial risks of undertaking a sustainability project. For example, an average return of 97% on a sustainability development option is certainly attractive; however, if there is a 30% chance that the return will actually fall below a developer's hurdle rate of 50%, the sustainability option is not attractive after all.

Real estate developers are certainly attuned to risk; consequently, a risk analysis is a more appropriate framework for addressing developer sustainability choices. Before turning to risk analysis, it is interesting to note that Exhibit 3 provides conflicting LEED versus ENERGY STAR comparisons across the four studies with MSF favoring LEED certification and the other three showing greater IRRs for ENERGY STAR certification.

Sustainable Real Estate Investment and Risk Analysis

Viewing the results of the four studies as independent samples from the population of CoStar buildings suggests a strategy for assessing sustainability investment risk. One can view the occupancy differentials for LEED buildings of 2.34%, 4.2%, 7.64%, and 17.0% across the studies as four estimates of the true population parameter. In this way it is possible to combine information from the studies into a single empirical framework.

LEED Risk and Return

Information from Exhibits 1 and 2 along with occupancy and rental rate data from the four studies is used to define distributions of likely population values for each parameter. Low, mean, and high distribution values for each of the variables are

Exhibit 3 | Internal Rates of Returns (%)

	LEED	Energy
MSF	189	89
FM	36	125
EKQ	42	115
WBJ	97	106

shown in Exhibit 4 for LEED analysis. Low and high rent and occupancy premium values are derived from low and high values for each parameter reported in Exhibit 1. Low and high values for incremental costs are discussed in a previous section and are shown in Exhibit 2. Normal distributions are applied with low and high values viewed as spanning 90% of the population values. Mean values are the average of the low and high values.

It should be noted that cost distributions are specified as normal rather than lognormal as often used to reflect distributions of actual construction costs (Davis Langdon, 2009). Lognormal distributions include a tail to the right that reflects the tendency of costs to vary more in the high-cost direction than in the low-cost direction. However, a priori, one would expect the ''best practice'' cost of achieving a lower-LEED or ENERGY STAR certification to exhibit a random variation around a mean representing variations in well-executed projects as a result of local market costs and other factors. The extended right-hand tail in actual cost distributions is likely to reflect unnecessarily high costs associated with project difficulties, an inexperienced design team, or other design objectives. Since this study assumes that costs reflect best practice, minimum certification sustainable design and construction, a normal cost distribution is applied in the empirical analysis. In addition, a normal distribution for green costs reduces the likelihood that the results will be biased in favor of conventional construction practices.

Monte Carlo analysis draws sample values simultaneously from each variable distribution, computes the IRR by solving Equation 3, saves the result, and continues the process many times. One million sample draws and calculations are completed. The resulting distribution of IRRs provides expected or mean IRR and the probabilities of IRRs less than a specific IRR (risk measure). These results reflect a distribution of likely outcomes for a single LEED project.

While occupancy and rents are simultaneously determined within local real estate markets (Wiley, Benefield, and Johnson, forthcoming), data are not available and an empirical estimation of a joint distribution is well beyond the scope of this study. Consequently, the occupancy and rent distributions are assumed to be independent. Positively correlated occupancy and rent distributions can be expected to result in a wider dispersion of Monte Carlo outcomes.

Exhibit 4 | Distribution Parameters for LEED Monte Carlo Analysis

	Low	Mean	High
Occupancy (*O*)	76.30	82.05	87.80
Occupancy Premium (*OP*, %)	2.72	10.32	17.92
Rent (*R*)	24.68	26.42	28.16
Rent Premium (*RP*, %)	4.40	27.47	50.54
Cost Premium (*CP*, %)	1.00	3.00	5.00

Results of this Monte Carlo analysis are provided as a probability density function of IRR shown in Exhibit 5. By definition, the area under a probability density function sums to 1.0. The sum of the area between the two IRR values, irr1 and irr2, is the probability that the IRR will be greater than irr1 and less than irr2. Exhibit 5 shows IRR ranges and probabilities for a number of outcomes based on one million draws from the cost, rent, and occupancy distributions.

As indicated in the Exhibit 5, the curve is skewed to the right reflecting the fact that distributions of occupancy, rent, and cost premiums are assumed to remain positive. The mean IRR on a LEED development is 126.4% (Exhibit 6), a healthy return on investment. Risk analysis shows the probability that the realized IRR will be less than a specific amount. For example, the results show that there is a 10.1% chance that the IRR will be less than 50% (that is, greater than 0 and less than 50) and a 20.7% chance that the IRR will be less than 70%. Depending on the firm's risk tolerance and other investment opportunities, these returns may reflect an investment that carries too great a chance of falling short of required IRR targets in today's capital-constrained world.

ENERGY STAR Risk and Return

The same Monte Carlo analysis process is applied to ENERGY STAR results from the four studies using the low, mean, and high values in Exhibit 7. Exhibit 8 shows the distribution of ENERGY STAR investment outcomes. Exhibit 9 verifies the results that are obvious from Exhibit 8: investment returns are even more attractive for ENERGY STAR opportunities based on results drawn from the four studies. The mean IRR for ENERGY STAR investments is 139.7% with

Exhibit 5 | IRR Distribution for LEED Sustainability Option

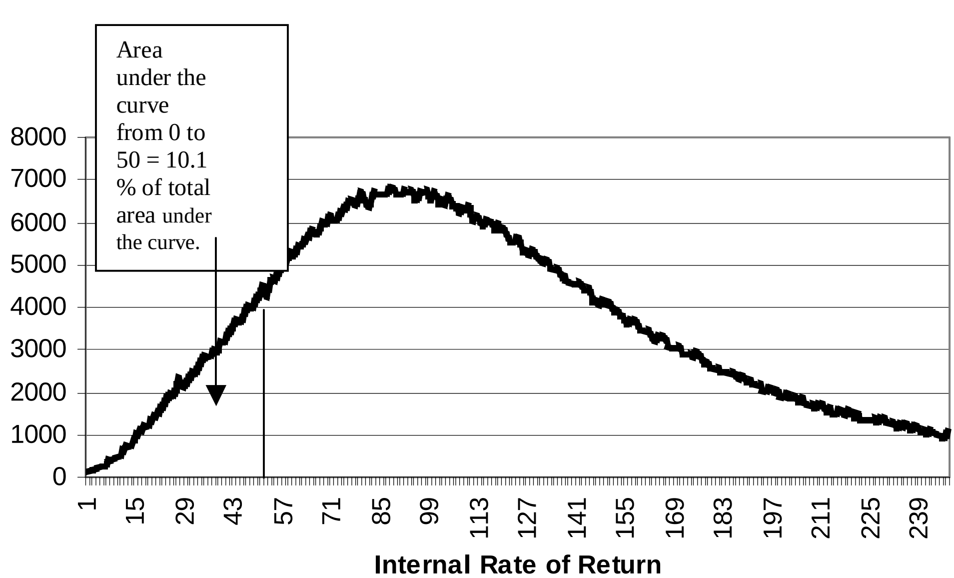

Exhibit 6 | Monte Carlo IRR Outcomes and Probability of Occurrence: LEED

Risk Analysis	
<IRR	Probability
25	2.3%
30	3.4%
35	4.8%
40	6.3%
45	8.1%
50	10.1%
55	12.4%
60	14.9%
65	17.7%
70	20.7%

Notes: The mean IRR = 126.4. The median IRR = 116.0.

Exhibit 7 | Distribution Parameters for ENERGY STAR Monte Carlo Analysis

	Low	Mean	High
Occupancy (*O*)	76.30	82.05	87.80
Occupancy Premium (*OP*, %)	2.72	6.88	11.03
Rent (*R*)	24.68	26.42	28.16
Rent Premium (*RP*, %)	8.62	13.75	18.88
Cost Premium (*CP*, %)	0.50	1.50	2.50

little risk (1.6%) of achieving an IRR of less than 50% and only a 9.9%% of achieving a 70% IRR or less.

Comparison of LEED and ENERGY STAR Risks and Returns

The LEED and ENERGY STAR results provide interesting insights on the current state of the sustainable building market. The results show that, on average, both ENERGY STAR and LEED projects enjoy rent and occupancy premiums with attractive returns on incremental sustainability costs.

A rather surprising finding is that despite its more exclusive positioning and the additional claims of productivity and environmental achievements, LEED projects currently provide slightly smaller financial returns than ENERGY STAR projects while incurring greater risks of achieving unacceptable investment outcomes. The

Exhibit 8 | IRR Distribution for ENERGY STAR Sustainability Option

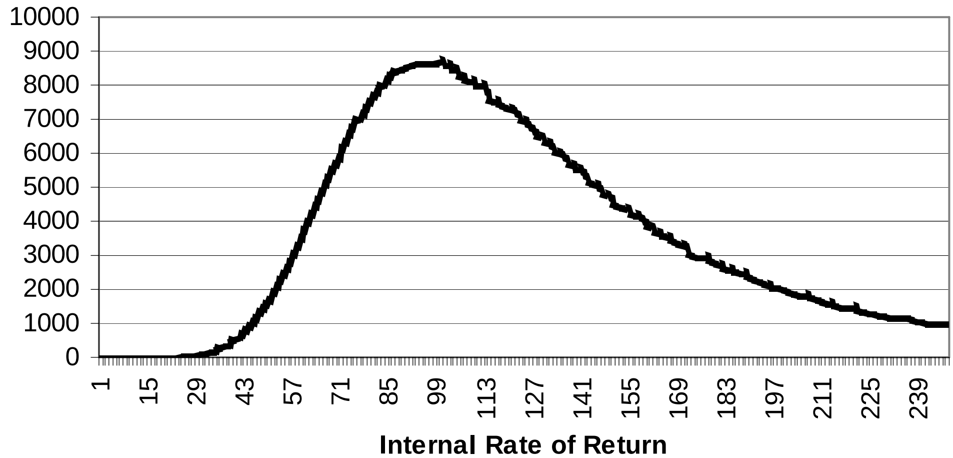

Exhibit 9 | Monte Carlo IRR Outcomes and Probability of Occurrence: ENERGY STAR

Risk Analysis	
<IRR	Probability
25	0.0%
30	0.1%
35	0.2%
40	0.4%
45	0.8%
50	1.6%
55	2.8%
60	4.6%
65	7.0%
70	9.9%

Notes: The mean IRR = 139.7. The median IRR = 119.0.

mean IRR for ENERGY STAR investments is only slightly greater than those for LEED (139.7% vs. 126.4%); however, the risks of poor ENERGY STAR investment outcomes are less than LEED investments. For example, the risk of achieving an IRR of 50% or less is only 1.6% with an ENERGY STAR project but 10.1% with a LEED project.

The general implications for developers are clear. In general, expected rates of return on green investments are less risky and slightly greater for ENERGY STAR projects than for LEED projects. Green building investment advantages, at least those revealed to date in the four studies, can, on average, be achieved with ENERGY STAR investments for about half the cost of LEED investments (an ENERGY STAR mean of 1.5% of construction costs compared to a 3.0% premium for LEED construction).

Caveats and Summary

This study has sidestepped a variety of issues that determine risks and returns for individual sustainability projects such as the availability of utility and state financial incentives, conditions of excess demand or excess supply for sustainable space or space in general in local markets and other issues. As market supply and demand for green space changes over time, the rent and occupancy premiums observed at any point in time will also change, although comparisons of rent and occupancy premiums over time provided by CoStar (2009) suggest that currently observed rent and occupancy premiums reflect a reasonably robust picture of green premiums.

To the extent that LEED practices become less expensive to incorporate and/or productivity and health benefits that may be associated with LEED buildings are recognized and reflected in LEED building rents and occupancy, ENERGY STAR may loose its advantage relative to LEED as a real estate development option.

However, to the extent that ENERGY STAR buildings continue to capture a significant portion of the green benefit established jointly by ENERGY STAR and LEED promotional efforts, the less costly ENERGY STAR certification process and the law of diminishing returns may continue to provide an advantage to ENERGY STAR developments.

Finally, every project is unique and capabilities and costs of support resources as well as sustainable space demand and supply vary by market so the results in this study should be viewed as representative of the general market for sustainable real estate development and should not be applied as a fixed rule for individual real estate projects.

Despite these caveats, this study accomplishes its objective of utilizing results from four recent CoStar-based empirical analyses to assess the risks and returns associated with sustainability projects. The results show that, on average, both ENERGY STAR and LEED projects enjoy rent and occupancy premiums that not only pay for the additional green development costs but also provide attractive IRR on green investments. On average, ENERGY STAR projects provide slightly greater returns and less risk of poor outcomes compared to LEED projects.

Developers looking for a comprehensive commitment to sustainability can obtain an IRR with LEED that is nearly as great as that from an ENERGY STAR development though the risk of falling short of any given risk threshold is greater. The fact that incremental costs of ENERGY STAR investments are about half of LEED investments makes ENERGY STAR an attractive option for developers who desire a more cautious approach to sustainable project development.

Endnotes

[1] LEED and ENERGY STAR differ in several other aspects. ENERGY STAR certification requires monitoring a year of energy use for certification whereas LEED certification is based only on design and construction. LEED requirements are provided for both new construction and existing building, though only 162 existing buildings certifications have been completed through 2008 (U.S. Green Building Council, 2008).

[2] In other words, market processes determine whether or not developers recover increased costs of sustainable development. This situation provides considerably greater risk for developers compared to building owner-occupiers. A building owner who occupies the building will capture all energy saving and other benefits associated with green investments. While these investment decisions are still subject to uncertainty associated with technology performance, weather, energy prices, and other factors, risk management approaches have been developed to assess risks and returns of these investments for building owner-occupiers (Jackson, 2008).

[3] Most studies are not specific about what soft costs are included. These costs include additional design, engineering, commissioning, and costs associated with permitting and other possible delays.

[4] Component lifetimes also impact this calculation. While anecdotal evidence suggests that well-designed buildings are less costly to maintain, no reliable empirical information exists on the net cost of replacement/maintenance requirements of sustainable buildings. The IRR specification applied here assumes that the net impact of these factors is negligible.

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