



ENERGY EFFICIENCY & FINANCIAL PERFORMANCE: A Review of Studies in the Market

March 2014

Impact of Energy Efficiency on the Financial Performance of Commercial Buildings

Key Barrier

- Lack of information about how energy efficiency upgrades may improve a property's financial performance leads to underinvestment in energy efficiency



Purpose of Study

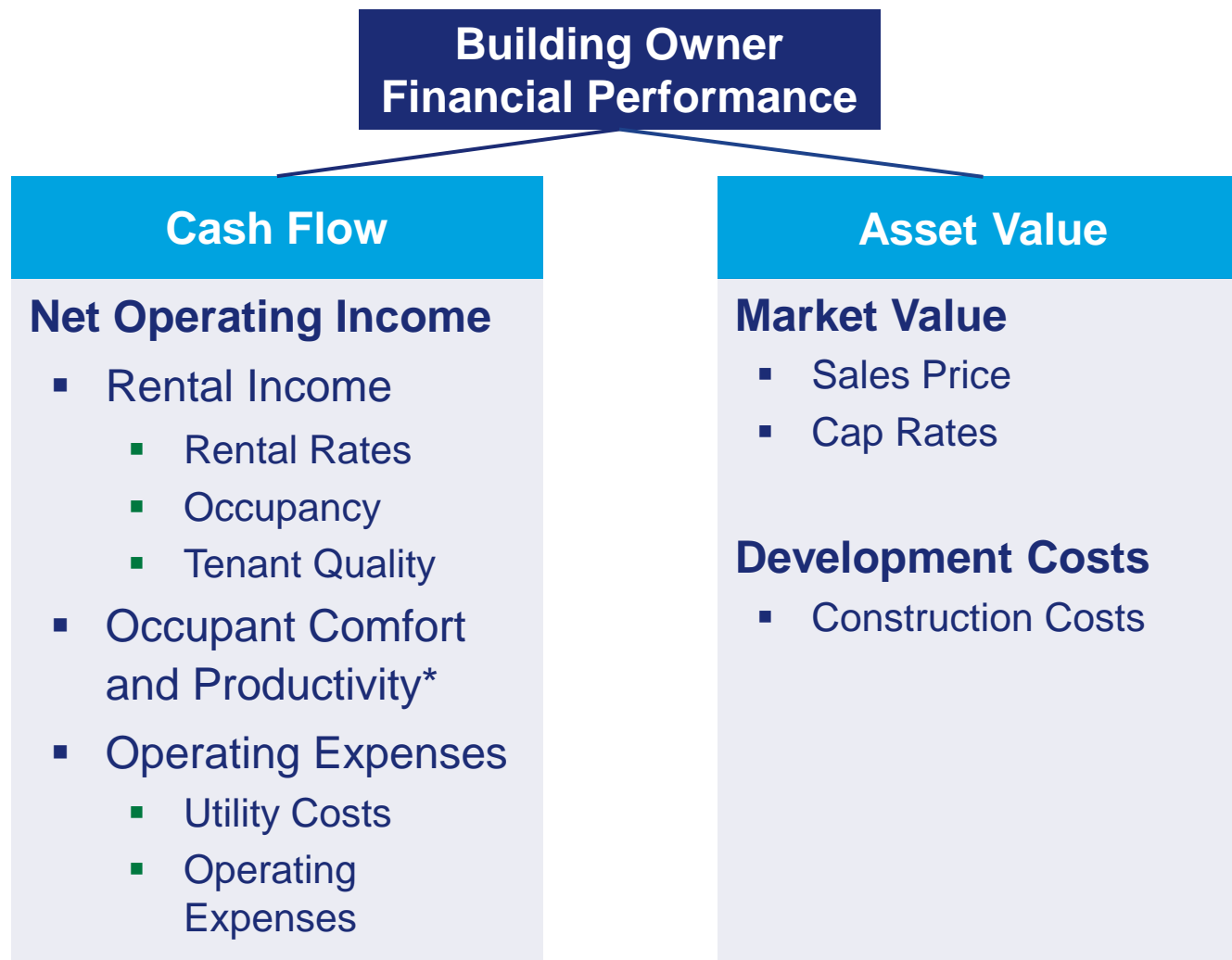
- The goal of the study was to determine the extent to which empirical evidence gathered via existing studies demonstrates that efficiency contributes to better financial performance



Methodology

- Over 50 relevant studies from the market were reviewed and compiled into this summary

Energy Efficiency Could Impact a Building's Financial Performance Through a Number of Channels



**This can directly generate profits for businesses occupying the building and potentially drive higher rental income*

Methodology

- While this review originally sought to cover all research on energy efficiency and financial performance, the final product focuses on “green labeled” buildings
 - The majority of research to date uses LEED or ENERGY STAR certifications as the means of distinguishing between efficient or sustainable buildings and conventional buildings
 - Specific energy efficiency measures, while proven to result in energy cost savings, have not yet been extensively evaluated for broader impacts
- **This study does not represent new analysis conducted by DOE.** It is a comprehensive survey and summary of the current body of research on the impacts of green labels on key components of commercial buildings’ operating statements. It does not exclude any studies or evaluate the quality of analysis.
- While most studies’ scope covered the U.S. commercial real estate industry, some focused on regional and/or international markets
 - 44 different organizations generated the 51 studies reviewed in this analysis
 - Many studies share the same authors and may draw conclusions from overlapping data sets

Current State of Research

There is an increasing body of evidence demonstrating green labels' impacts on some areas of financial performance, while others need more research

Greater Evidence (More than 7 studies)

- Rental Rates
- Occupancy Rates
- Utility Expenses
- Sales Price
- Construction Costs

Preliminary Evidence (7 or fewer studies)

- Tenant Quality
- Occupant Health, Comfort and Productivity
- Capitalization Rates

Mixed Evidence

- Total Operating Expenses

Key Conclusions

Studies sampling thousands of buildings nationwide found that buildings with LEED and ENERGY STAR certifications have:

- **Higher Rental Rates** – LEED buildings display a 15.2-17.3% premium and ENERGY STAR buildings display an 7.3-8.6% premium over similar* non-rated buildings⁵⁰
- **Higher Occupancy Rates** – LEED buildings have 16-18% higher occupancy than non-rated buildings, while ENERGY STAR buildings have 10-11% higher occupancy.⁵⁰
- **Lower Utility Costs** – Electricity and gas expenses in ENERGY STAR buildings are more than 13% lower compared to similar* non-rated buildings⁴²
- **Increased Sales Prices** –LEED buildings exhibit a 10-31% premium and ENERGY STAR buildings exhibit an 6-10% premium over non-rated buildings^{20,35}
- **Low Construction Cost Premiums** – Construction costs for LEED buildings are typically equal to or only slightly greater than the costs for non-rated buildings, primarily due to the costs of certification (approximately 2%)²³

Areas for Further Research

There is still a need to better quantify the actual impacts of energy efficiency at a more granular level. Further research needs have been identified based on limitations in the existing body of evidence, including:

- Sector-specific study limitations:
 - Break-downs by geographic markets
 - Sub-sectors such as retail malls, multifamily, warehouse, healthcare
- More granular information on efficiency or sustainability measures:
 - Specific LEED level or ENERGY STAR Score, as well as energy use intensity (EUI) or specific equipment investments, independent of labels
- Financial impacts with minimal research conducted to date:
 - Tenant-related aspects: occupancy, leasing velocity, tenant quality and turnover, tenant improvement (TI) allocations
 - Occupant health, comfort, and productivity
 - Operating expenses, emergency maintenance and repair costs
 - Overall cash flow stability and market price risk
 - Cap rates on building sales and REIT stock prices
 - Building insurance rate premiums

Greater Evidence: Rental Rates are higher for green-labeled buildings

Rental Rate: The cost per square foot (sq. ft.) that a tenant/occupant pays the building owner to rent the building space

Key Findings:

- A 2011 study of over 21,000 U.S. rental buildings reports LEED buildings achieve a rent increment of 7.9%, and ENERGY STAR buildings gain 3.5% average higher rent¹⁶
- One 2010 study of CoStar Class A Office Data from 46 U.S. Markets (7,308 properties) found that Energy Star buildings achieve rent premiums of 7.3-8.6%, and LEED labeled buildings achieve 15.2-17.3%⁵⁰
- A 2011 study of 123 buildings in San Francisco and Washington, D.C. reports a 2.4% rent premium for LEED buildings in down markets vs. a 0.1% premium in up markets, suggesting LEED buildings maintain more stable rental rates in real estate down cycles¹²
- Another 2012 study of 6,518 buildings in Colorado reports a higher rent premium for LEED buildings than ENERGY STAR buildings (\$3.54 vs. \$2.87 per sq. ft.)²³
- 13 additional studies support the concept of rental rate premiums, yet warn that other factors may influence rental rates as well^{2, 4, 8, 16, 18, 20, 22, 23, 25, 26, 29, 35, 37, 42, 47, 51}
 - Some but not all of these studies statistically controlled for other market factors such as building size, location, class, and age

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Greater Evidence: Occupancy Rates are higher in green-labeled buildings

Occupancy Rate: The percentage of rentable space in a building that is currently leased and occupied by a tenant

Key Findings:

- One 2010 study found that LEED buildings have 16-18% higher occupancy than a non-rated building, while ENERGY STAR buildings have 10-11% higher occupancy.⁵⁰
 - *Green Design and the Market for Commercial Office Space (2010)*: examined CoStar class A office data across 46 markets (7,308 properties) in the U.S.⁵⁰
- Another 2010 study of 286 LEED office buildings and 1,045 ENERGY STAR office buildings in 45 U.S. markets found an occupancy rate premium of 11% for both LEED and ENERGY STAR^{18*}
- A 2009 study of 292 LEED and 1,291 ENERGY STAR buildings across the nation found occupancy rates are 8% higher in LEED offices and 3% higher in ENERGY STAR offices²¹
- 12 additional studies support occupancy rate premiums, yet caveat that effects can be concentrated in certain market segments^{2, 4, 8, 15, 16, 17, 20, 23, 24, 25, 26, 29, 35, 42, 46, 51}
 - Some but not all of these studies statistically controlled for other market factors such as building size, location, class, and age

Preliminary Evidence: Green-labeled buildings attract High Quality Tenants

Tenant Quality: The likelihood of rental payment collection or longer occupancy periods, reflected in a tenant's credit rating or finances

Key Findings:

- A 2012 nationwide study of 11,179 tenant organizations (3,179 tenants in 1,180 green office buildings and 8,000 tenants in 4,390 nearby control office buildings) found that certain industries, such as financial services, oil, mining, and construction industries or government agencies, are more likely to seek out green office space (controlling for building quality and location)¹⁷
- Examples of prominent organizations that are among the largest consumers of green office space include: Wells Fargo Bank, Bank of America, ABN-AMRO, Department of Health and Human Services, U.S. EPA, Shell, and Chevron¹⁷
- Organizations with high employee skill levels and compensation levels are also positively correlated to the propensity to lease green office space,¹⁷ particularly corporations with socially responsible investment (SRI) goals, government agencies, and technology companies that have stated sustainability initiatives⁹
- Additional studies hypothesize that rental payment collection loss and vacancy risk are minimized by leasing to higher quality tenants^{2, 20}

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Preliminary evidence: Green labeled buildings increase Occupant Health, Comfort, and Productivity

Occupant Productivity: An occupant organization's employee performance measured by output per unit of input

Key Findings:

- One 2009 study found that 55%* of 534 tenants across the U.S., who moved into LEED and ENERGY STAR buildings managed by CBRE, agreed that employees were more productive, and 45% thought there were an average of 2.88 fewer sick days taken (resulting in an average impact of \$1,228 per worker or \$4.91 per sq. ft.).³³
- A 2012 study of 494 facilities of PNC Bank found PNC Bank's LEED certified facilities annually opened up 458 more consumer deposit accounts and had \$3,032,000 more in consumer deposit balance per facility per year. LEED certified facilities also opened up 25.5 more consumer loan accounts and had \$994,900 more in loan balance per facility per year.¹¹
- IMT and the Appraisal Institute (2012) suggest that daylighting can make indoor spaces more pleasant for occupants, and has been shown to increase productivity in offices and even to increase sales in retail settings²⁵
- Most studies primarily link improved employee productivity to factors such as enhanced environmental air quality, temperature control, lighting/daylighting and noise reduction in LEED and ENERGY STAR buildings^{2, 4, 7, 8, 15, 16, 17, 18, 19, 20, 25, 37, 41, 44, 46, 48, 51} but there is no universally accepted measure of office productivity

*12% of tenants surveyed strongly agreed and 42.5% agreed that employees were more productive
Sources: 2, 4, 7, 8, 11, 15, 16, 17, 18, 19, 20, 25, 28, 33, 37, 41, 44, 46, 48, 51. See Appendix.

Greater Evidence: Green-labeled buildings have lower Utility Expenses

Utility Expenses: Building operating expenses for electricity, gas, or other utilities

Key Findings:

- A 2013 nationwide study of 1,199 properties showed utility expenses were 12.9% lower per sq. ft. for ENERGY STAR office buildings⁴²
- Another 2013 study of 2,760 office buildings in 4 U.S. markets found an average discount of 13.1% on electricity bills across both LEED and ENERGY STAR buildings^{47*}
- A 2010 national study of 154 ENERGY STAR CBRE office buildings compared to 105 CBRE buildings with no green label found lower electricity expenses per sq. ft. (\$1.84 vs. \$2.19, or 16%) and lower gas expenses per sq. ft. (\$0.14 vs. \$0.22, or 36%)³⁴
- A 2012 study of 494 U.S. facilities of PNC Bank found that its LEED-certified facilities annually saved \$675.26/employee in utility costs compared to the firm's non-green facilities¹¹
- One 2009 study of 23 LEED-EB buildings shows lower utility expenses than average buildings listed in the BOMA 2007 Experience Exchange Report (\$1.76 vs. \$2.09, or 16%)³¹
- 20 additional studies support utility expense reductions, yet caveat results may have been impacted by variation of tenant occupancy schedules^{2, 4, 5, 7, 8, 9, 11, 16, 19, 22, 23, 28, 29, 37, 41, 44, 46, 47, 48, 51}

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*Did not differentiate between LEED and ENERGY STAR.

Sources: 2, 4, 5, 7, 8, 9, 11, 16, 19, 22, 23, 28, 29, 31, 34, 37, 41, 42, 43, 44, 46, 47, 48, 51. See Appendix.

Mixed Evidence: Sources do not yet agree on effects of green labels on Total Operating Expenses

Operating Expenses (OpEx): The ongoing, generally periodic, operating costs associated with the occupation of space over and above the base rent

Key Findings:

- Three national studies (2010, 2010, 2013) sampling over 15,000 green-labeled buildings (mix of LEED and ENERGY STAR) and associated transaction data observed no statistically significant effect on total operating expenses^{27,34,42}
- Another 2013 study of 2,760 Class A, B, and C LEED and ENERGY STAR buildings in New York City, Washington, D.C., Los Angeles, and Northern New Jersey found operating expenses to be 11.2% higher based on operating expense estimates from CoStar⁴⁷
 - The authors of this study acknowledged difficulties in measuring the effect of green labels on OpEx, specifically that “aside from energy, few other cost items can be objectively measured independently of their financial value”⁴⁷
- A different 2011 study of 12 nationwide LEED and ENERGY STAR buildings showed actual operating expenses to be 19% lower from a sample of GSA buildings¹⁹
 - The authors defined “aggregate operating cost” to include water utilities, energy utilities, general maintenance, grounds maintenance, waste and recycling, and janitorial costs.¹⁹
- All five of these studies did not distinguish between LEED and ENERGY STAR

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Greater Evidence: Market Values for green-labeled buildings reflect a premium over non-certified buildings

Market Value: The current value of a real estate asset as determined by a market sale or appraisal

Key Findings:

- A 2012 study of 128 U.S. REIT portfolios, mainly office (36% of portfolio) and retail (20% of portfolio), including 708 LEED buildings and 919 ENERGY STAR buildings, showed that for every 1% increase in green buildings in a REIT portfolio, the REIT earned a 3.5% (LEED) or 0.31% (ENERGY STAR) increase in return on assets and 7-8% increase in return on equity¹⁵
- A 2010 study of CoStar Class A office data in 46 U.S. markets (7,308 buildings) found that ENERGY STAR and LEED properties sell at \$30/ft² and \$129/ft² premiums, respectively⁵⁰
- A 2009 study of 351 LEED buildings in 36 states found that LEED-EB Silver is associated with a 118% increase in asset value compared to other LEED properties¹⁴
- One 2008 national study of 580 LEED* and 643 ENERGY STAR buildings found sales premiums of 10% for LEED and 6% for ENERGY STAR buildings³⁵
- One 2008 national study of 127 LEED and 559 ENERGY STAR buildings found sales premiums of 25% for LEED buildings and 26% for ENERGY STAR buildings²⁰
- 16 additional studies support market value premiums, yet more granular research is needed on the effects of different levels of LEED or ENERGY STAR certification on market values^{2, 4,}

¹⁴ 8, 9, 16, 18, 23, 25, 27, 29, 30, 37, 42, 44, 48, 51

Preliminary Evidence: Capitalization Rates may be better for green-labeled buildings

Capitalization (Cap) Rate: Net Operating Income as a percentage of a real estate asset's sales price

Key Findings:

- A 2010 study of 15,230 office building transactions in 43 metropolitan U.S. markets found ENERGY STAR labels do not explain additional variance in property prices once the key asset pricing factors of expenses, income and capitalization rates were included^{27*}
- However, other studies have found that green-labeled buildings have a higher sale value proportional to net operating income (lower cap rate) than non-certified buildings.³⁵
 - A national 2011 study of 209 LEED buildings and 1,719 ENERGY STAR buildings found a \$1 saving in energy costs associated with average increase in transaction price of \$13/ft² – a capitalization rate of about 8%¹⁶
 - A 2008 study of 643 nationwide Class A ENERGY STAR office buildings displayed a differential in terms of lower cap rates by about 55 basis points suggesting higher selling price values by just under 10%³⁵
 - Two additional studies suggest that green-labeled buildings may sell at lower cap rates due to more stable cash flows attributed to lower energy costs and higher occupancy rates; however other factors may also influence cap rates 37,42

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Greater Evidence: Construction Costs for green-labeled buildings are comparable to conventional buildings

Construction Costs: The hard and soft costs associated with developing new buildings or renovating existing buildings

Key Findings:

- A 2012 study of 6,518 LEED and ENERGY STAR buildings in Colorado noted that the small extra costs for LEED are primarily due to the costs of certification (approximately 1.5-2%)²³, rather than added hard construction costs for a more efficient building.
- A 2008 study of 6 markets across the U.S. found little significant cost difference for building to meet LEED Certified, Silver, or Gold standards; building to LEED Platinum standards costs slightly more³⁵:
 - LEED Certified: 0-0.6%
 - LEED Silver: 1.0-3.7%
 - LEED Gold: 2.2-6.3%
 - LEED Platinum: 7.8-10.3%
- A national 2007 study comparing construction costs of 221 buildings, including 83 buildings designed to achieve LEED certification, found no significant difference in construction cost¹³
- 6 additional studies found that construction costs for LEED buildings are typically equal to or only slightly greater than the costs for non-certified buildings.^{6, 7, 8, 28, 46, 51}

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Appendix: Research Reviewed (1 of 4)

Source	Author(s)	Title	Organizational Affiliation/Sponsor(s)	Regional Markets Scope	Year
1	Addae-Dapaah, Kwame and Su Jen Chieh	Green Mark Certification: Does the Market Understand?	National University of Singapore	Singapore	2011
2	Austin, Grant W.	Sustainability and Income- Producing Property Valuation: North American Status and Recommended Procedures	American Valuation, Inc.	North America	2012
3	Beach, Robert	Facility Sustainment and Firm Value: A Case Study Based on Target Corporation	East Tennessee State University	Target Corporation	2011
4	Bernstein, H.M. and Russo, M.A.	Business Case for Energy Efficient Building Retrofit and Renovation	McGraw Hill Smart Market Reports	U.S.	2011
5	BetterBricks, NEEA	Kalispell Regional Medical Center: A Case Study of Energy-Saving Operational Improvements	BetterBricks, NEEA	U.S.	2010
6	Building Design & Construction	White Paper on Sustainability	USGBC	U.S.	2003
7	Building Design & Construction	Green Building Research White Paper	USGBC	U.S.	2007
8	Chappell, Theddi Wright, and Chris Corps	High Performance Green Building: What's It Worth?	Washington State Department of Ecology, The Real Estate Foundation of British Columbia, Evergreen Business Capital	International	2009
9	Ciochetti, Brian A. and Mark D. McGowan	Energy Efficiency Improvements: Do they Pay?	MIT, Skanska USA Commercial Development Inc.	U.S.	2010
10	CNT Energy, National Home Performance Council	Unlocking the Value of an Energy Efficient Home	CNT Energy, National Home Performance Council	U.S.	2013
11	Conlon and Glavas	The Relationship Between Corporate Sustainability and Firm Financial Performance	Notre Dame Business School	U.S.	2012
12	Das, Prashant, Alan Tidwell, and Alan Ziobrowski	Dynamics of Green Rentals over Market Cycles: Evidence from Commercial Office Properties in San Francisco and Washington DC	Georgia State University, Columbus State University	San Francisco and Washington DC	2011
13	Davis Langdon	Cost of Green Revisited	Davis Langdon	U.S.	2007
14	Dermisi, Sofia V.	Effect of LEED Ratings and Levels on Office Property Assessed and Market Values	Roosevelt University	U.S.	2009

Appendix: Research Reviewed (2 of 4)

15	Eichholtz, Piet, Nils Kok, and Erkan Yonder	Portfolio greenness and the financial performance of REITs	Maastricht University	International	2012
16	Eichholtz, Piet, Nils Kok, and John H. Quigley	The Economics of Green Building	Fisher Center for Real Estate and Urban Economics - UC Berkeley	U.S.	2011
17	Eichholtz, Piet, Nils Kok, and John H. Quigley	Why do companies rent green? Ecological responsiveness and corporate real estate	University of California and Maastricht University	U.S.	2012
18	Eichholtz, Piet, Nils Kok, and John M. Quigley	Doing Well by Doing Good? Green Office Buildings	Maastricht University, University of California Energy Institute, RICS	U.S.	2010
19	Fowler, Kim M. and Emily M. Rauch	Re-Assessing Green Building Performance: A Post Occupancy Evaluation of 12 GSA Buildings	PNNL	U.S.	2011
20	Fuerst, Franz and Patrick M. McAllister	Green Noise or Green Value? Measuring the Price Effects of Environmental Certification in Commercial Buildings	University of Cambridge, University of Reading	U.S.	2008
21	Fuerst, Franz and Patrick M. McAllister	An Investigation of the Effect of Eco-Labeling on Office Occupancy Rates	University of Reading	U.S.	2009
22	Goering, John	Sustainable Real Estate Development: The Dynamics of Market Penetration	City University of New York	U.S.	2009
23	Gripne, Stephanie, J.C. Martel, and Brian Lewandowski	A Market Evaluation of Colorado's High-performance Commercial Buildings	University of Denver	Colorado	2012
24	Harrison, David M. and Michael J. Seiler	The Political Economy of Green Industrial Warehouses	Texas Tech University, Old Dominion University	U.S.	2011
25	IMT, Appraisal Institute	Recognition of Energy Costs and Energy Performance in Real Property Valuation; Considerations and Resources for Appraisers	IMT, Appraisal Institute	U.S.	2012
26	Jackson, Jerry	Sustainable Real Estate Projects? An Evaluation of LEED and ENERGY STAR Development Options	Journal of Sustainable Real Estate	U.S.	2009
27	Jaffee, Dwight, Richard Stanton, and Nancy Wallace	Energy Factors, Leasing Structure and the Market Price of Office Buildings in the U.S.	UC Berkeley	U.S.	2010

Appendix: Research Reviewed (3 of 4)

28	Kats, Gregory H.	Green Building Costs and Benefits	Massachusetts Technology Collaborative	Massachusetts	2003
29	Kok, Nils, Norman G. Miller and Peter Morris	The Economics of Green Retrofits	Maastricht University, University of San Diego, Davis Langdon	U.S.	2012
30	Kontokosta, Constantine E.	Is There a Link Between Energy Performance and Investment Performance? Evidence from New York City Benchmarking Data	NYU	New York City	2013
31	Leonardo Academy Inc.	The Economics of LEED for Existing Buildings: For Individual Buildings	Leonardo Academy Inc.	U.S.	2008
32	Mcallister, Andrew	Draft Action Plan for the Comprehensive Energy Efficiency Program for Existing Buildings	California Energy Commission Efficiency and Renewable Energy Division	California	2013
33	Miller, Norman G., et al.	Green Buildings and Productivity	University of San Diego, CBRE, University of Baltimore, University of British Columbia	U.S.	2009
34	Miller, Norman G., et al.	The Operations and Management of Green Buildings in the United States	University of San Diego, CBRE, University of Baltimore, University of British Columbia	U.S.	2010
35	Miller, Norman G., Jay Spivey and Andy Florance	Does Green Pay Off?	Burnham-Moores Center for Real Estate, CoStar	U.S.	2008
36	Mills, Evan	Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions	LBNL	U.S.	2009
37	Muldavin, Scott	Value Beyond Cost Savings	Green Building Finance Consortium	U.S.	2010
38	Nadel, Steven and Kate Farley	Modifying How Energy Costs Are Treated for Business Tax Purposes in Order to Decrease Subsidies and Increase Energy Efficiency	ACEEE	U.S.	2012
39	Nadel, Steven and Kate Farley	Tax Reforms to Advance Energy Efficiency	ACEEE	U.S.	2013
40	Northbridge Environmental Management Consultants	Analyzing the Cost of Obtaining LEED Certification	The American Chemistry Council	U.S.	2003

Appendix: Research Reviewed (4 of 4)

41	Peterson, Kristian and Ross Gammill	The Economics of Sustainability in Commercial Real Estate	IFMA Foundation	U.S.	2010
42	Pivo, Gary, and Jeffrey D. Fisher	Income, Value, and Returns in Socially Responsible Office Properties	University of Arizona, Indiana University	U.S.	2013
43	Ray, David	Healthcare: A Business and Ethical Case for Sustainability	BetterBricks, NEEA	U.S.	2010
44	Runde, Timothy P., and Stacey Thoyre	Integrating Sustainability and Green Building into the Appraisal Process	Carnegi Blum & Partners	U.S.	2010
45	Sachs, Harvey et al.	Depreciation: Impacts on Tax Policy	The American Chemistry Council	U.S.	2012
46	Syphers, Geof, et al.	Managing the Cost of Green Buildings	KEMA	Northern California	2003
47	Szumilo, Nikodem and Franz Fuerst	The Operating Expense Puzzle of US Green Office Buildings	University of Cambridge	U.S.	2013
48	Twill, Jason, et al.	Economics of Change: Phase One Report	Living Building Institute	U.S.	2011
49	Warren-Myers, Georgia and Richard Reed	The Challenges of Identifying and Examining Links between Sustainability and Value: Evidence from Australia and New Zealand	RMIT	Australia & New Zealand	2010
50	Wiley, Jonathan A., Justin D. Benefield and Ken H. Johnson	Green Design and the Market for Commercial Office Space	College of Charleston, Florida International University	U.S.	2010
51	World Green Building Council	The Business Case for Green Building: A review of the Costs and Benefits for Developers, Investors and Occupants	World Green Building Council	International	2013

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Waypoint Building Group delivers utility and public services for the commercial real estate sector. Waypoint's core mission is to significantly decrease energy usage within the commercial sector through advanced energy analytics and innovative market deployment programs.