

RESEARCH ANTHOLOGY:

HIGH PERFORMANCE BUILDING BENEFITS AND INVESTMENT COSTS

Expert Knowledge Synthesis
Population-Based Studies
Project-Based Studies
Market-Based Studies
Early Research

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GBIG



Dear Colleague,

After more than a decade of market experience a robust knowledge base has emerged on the benefits and investment costs associated with high performance green building. Industry practitioners including construction costing experts, commercial portfolio owners, and valuation professionals have joined with leading academics in a persistent effort to describe, catalogue, and quantify the financial and economic value proposition of high performance buildings.

This **GBIG Insight** research anthology briefly summarizes over 30 of the most cited works from the National Academies of Science, industry leaders including AECOM / Davis Langdon, Skanska USA, Cushman & Wakefield and CBRE, academic papers published in finance and economic journals, owner experience with large diverse portfolios, and financial-oriented practices by market professionals.

This knowledge base includes cost-benefit analyses, portfolio valuation techniques, resources on strategic and tactical business considerations, and financial underwriting practices applicable to high performance buildings. Collectively, these selections and related resources represent a substantial body of economic evidence that encompass multiple hundreds of high performance projects and span a full range of property types, geographic locations, and end-user demands.

These works are distilled into five distinct categories:

1. Expert Knowledge Synthesis
2. Population-Based Studies
3. Project-Based Studies
4. Market-Based Value Studies
5. Early Research [2005 and earlier]

Within each category are well-vetted articles authored by top industry professionals that articulate the range of benefits stemming from high performance building. Some describe industry best practices and financial returns on investment, while others show how project costs have surprisingly little correlation to whether or not the asset is a green building. Given that each individual building is a complex phenomena with many component parts, real estate professionals understand that a multi-observation portfolio-based view can best gauge the effectiveness of investments necessary to climb the high performance curve.

At the core of economics is the notion of “no free lunch”. Pursuing the benefits of high performance building requires both marginal investment – typically time and money – and an assessment on the likelihood of realizing the benefits from this investment. Every investment decision comes with two risks, namely 1) the risk that the benefits sought fail to materialize, and 2) the less obvious but real risk that **not pursuing** these benefits results in opportunity costs, accelerated obsolescence, or structural competitive disadvantage. Effectively navigating the risk-reward paradigm is the essence of the capitalist system.

Of course, to err is human and industry experience has shown that not all high performance outcomes sought are achieved in every instance, or at every moment in time. Portfolio owners can limit exposure to episodes of asset underperformance through a continued commitment to investing in high performance buildings, taking corrective operational management, and continually implementing best practices.

This compilation of current industry knowledge serves to provide a full mosaic of insights into the investment value offered by green building. The economic picture is clear, and experienced industry leaders find themselves in prime strategic position to reap outsized economic rewards as strong market forces continue driving high performance green building.

Respectfully yours,

Dan Winters

USGBC Senior Fellow – Business Strategy & Finance

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CATEGORY I: Expert Knowledge Synthesis

Expert knowledge synthesis includes comprehensive literature reviews and findings on the costs and benefits of high performance green buildings in the real estate industry as brought forward by expert panels of industry professionals.

National Academies of Science

Title: [Energy Efficiency Standards and Green Building Certification Systems](#)



NATIONAL ACADEMY OF SCIENCES

The [National Research Council](#) of the [National Academies of Science](#) [NAS] issued the most comprehensive and authoritative industry analysis on high performance building benefits and investment costs. A panel of experts engaged a comprehensive literature review of the state-of-the-art knowledge on investment costs, benefits, return on investment, and long-term paybacks of green building rating systems. Within the NAS report, Section I summarizes the Academies' conclusions; Section IV details the full list of studies analyzed and contains an overview of the [National Research Council's findings](#).

Following a thorough review of a wide range of topical literature on high performance buildings along with additional relevant materials from the building and real estate industries the NAS concluded:

“The preponderance of available evidence indicates that green building certification systems and their referenced building standards offer frameworks for reducing energy and water use in buildings compared to design approaches and practices used for conventional buildings.”

This review was ordered by the US Department of Defense [DoD] at the request of the United States Congress as they sought guidance to affirm the [DoD's 2010 policy](#) requiring LEED Silver® or higher for their portfolio. Besides [upholding](#) the basis for DoD's policy, the Academies [findings](#) asserted that the [DoD's policy is sound](#), green buildings provide long-term economic savings for DoD and value to US taxpayers, and that LEED® projects provide positive net returns on investment at all certification levels.

World Green Building Council

Title: [The Business Case For Green Building](#)



WORLD GREEN BUILDING COUNCIL

The [World Green Building Council](#) is a network of 90+ national green building councils from around the globe representing over 25,000 worldwide organizations driven to create more sustainable buildings, communities and cities.

This 2013 report incorporates credible evidence from around the world into a definitive resource on the business considerations for green building including [case study examples](#) and thought pieces by [leading experts](#). The report reviews industry experience with the benefits and costs inherent to high performance building design and construction, opportunities to reduce operating costs, impacts on workplace productivity and occupant health, and implications for real estate asset value and risk exposure.

Section One highlights the wide perception gap [p.26] between the estimated marginal investment requirements to build a green building versus the actual investment cost premiums experienced by the market. The report features discussion on how industry maturation and professional experience has resulted in declining marginal investment requirements needed to achieve ever-higher levels of green building. Additional sections address performance gaps [Figure 10], the importance of commissioning, and the opportunities to impact workplace health and productivity. The report concludes with an impressive list of references on a certified green building's effect on rental rate and sale price, occupancy and time on market, operational cost savings and payback periods, and investment yield requirements.

Business Resources

Harvard Business Review

Title: ["Sustainability" Articles - HBR Blog Network](#)

Harvard Business Review contains over a decade of business and finance knowledge on sustainability topics including nearly 400 thematic posts on the HBR Blog Network and [hundreds of sustainability focused business case studies](#) from Harvard Business School, along with books, magazine articles, and other resources.



Harvard Business Review

Of this vast collection, [over 90 works](#) are specifically focused on green building while the remaining serve to provide broad-based business strategic and tactical implications. One short blog post non-specific to the real estate industry – [Companies That Invest in Sustainability Do Better Financially](#) – opens the gateway to the broader topic of sustainability and its impact on company value and investor returns derived from investment in equity securities.

Robert Eccles and George Serafiem, industry thought leaders from [Harvard Business School](#), are driving this topic through capital market analyses. Their working paper – ["The Impact of a Corporate Culture of Sustainability on Corporate Behavior and Performance"](#) – found a dramatic long-term out-performance of stock returns between high and low sustainability-oriented firms. Their most recent book – ["Promoting Corporate Sustainability Through Integrated Reporting: The Role of Investment Fiduciaries and the Responsibilities of the Corporate Board"](#) – provides tools and corporate reporting constructs to better understand capital market challenges and opportunities to reflect the financial essence of sustainability.

[Michael Porter](#), the long-acknowledged guru of competitive strategy at Harvard Business School, authored a compelling Big Idea article in Harvard Business Review [Jan-Feb 2011] titled, ["Creating Shared Value"](#). The lead-in video includes an interview captioned "Rethinking Capitalism" while the article itself highlights the linkages between sustainable corporate economic success and societal well being.

MIT Sloan Management Review

Title: ["Sustainability" Management Articles](#)

Boston Consulting Group [[BCG](#)], one of the leading corporate strategy consulting firms in the US, began publishing a series of articles and surveys focused on the [business of sustainability](#) in conjunction with [MIT Sloan Management Review](#) starting fall of 2009.



Of note are the findings of the 2010 senior executive survey titled ["The Embracers Seize Advantage"](#) which identified a growing gap between sustainability leaders ("Embracers") and laggards ("Cautious Adopters"). Embracers have largely succeeded in making robust business cases for their sustainability investments and include both tangible and intangible financial benefits when incorporating these initiatives into 'core' business practices. Companies across all industries showed a strengthened commitment to sustainability and innovation regardless of the challenged prevailing economic environment.

[MIT Sloan Management Review](#) has developed deep content focused on the business of sustainability. Currently, MIT's subject matter has grown to exceed 70 articles from a range of industry experts encompassing sustainability from a strategy, innovation, and economics perspective.

CATEGORY II: Population-Based Studies

Population-based studies are expansive in scope and include cross sections of both third-party rated green buildings and conventional buildings within the analysis.

Davis Langdon

Title: [The Cost of Green Building](#)



When AECOM [purchased](#) Davis Langdon in 2013 they acquired the world's premier construction cost estimating firm. As the leading expert in the field, Davis Langdon issued this 2004 report which became the first in a 3-part series detailing the actual costs to pursue a high performance building.

By analyzing three perspectives including 1) the total cost of incorporating individual sustainable elements, 2) overall cost of green buildings compared to a population of buildings with a similar program, and 3) the cost of green buildings compared to their original budget, [the authors](#) concluded **no significant difference in average cost for green buildings as compared to non-green buildings**.

This analysis of 138 buildings [see graphs p18-22] concludes that conventional building cost drivers and green building budgets are dictated primarily by owner's project requirements, and not by 'green' factors.

Davis Langdon

Title: [The Cost & Benefit of Achieving Green Buildings](#)



In 2005, the authors took the cost methodology from their earlier 2004 report and applied it to the Australian property market using Australia's [Green Star](#) program as proxy for green building. This study expands the cost narrative to encompass the value generated by pursuing green building strategies including higher occupancy rates, increased demand from both tenants and investors, and lower operating costs among other relevant factors.

Davis Langdon

Title: [The Cost of Green Revisited](#)



The authors of the original 2004 report on green building costs revisited this work in 2006 to include a larger sample size of 221 buildings, and new information on incorporating sustainable design features. Using the LEED® rating system as the green building parameter, their findings remained consistent:

1. Many projects achieve LEED® within their budgets, and within the same average cost range as similar non-LEED projects.
2. Construction costs increased dramatically since the first study in 2004, but projects still achieved LEED®.
3. The idea that 'green' / high performance is a separate, added feature and not a primary objective within owner's requirements continues to be a problem [industry perception].

Peter Morris, the study's lead author, published follow-on work including "[What Does Green Really Cost?](#)" in PREA Quarterly and served as advisor to "[Value Beyond Cost Savings: How to Underwrite Sustainable Properties](#)".

Davis Langdon's early efforts with green building cost studies inspired [Reed Construction Data](#) to develop and publish a dedicated cost reference guide for high performance buildings – [Green Building: Project Planning and Estimating](#). Reed recently published its second edition and is the de facto reference guide to project cost estimating for industry professionals.

Enterprise Community Partners

Title: [Incremental Cost, Measurable Savings](#)



Started in 1982 by [Jim Rouse](#), one of the great real estate developers of the post-WWII generation, Enterprise Community Partners was an early innovator and market leader as seen by the integration of [green building criteria](#) throughout their affordable housing development and financing portfolio.

Enterprise engaged two comprehensive studies from across their investment portfolio. The first study of 27 green building affordable housing projects – “[Incremental Cost, Measurable Savings](#)” – resulted in [key findings](#) that demonstrated the ongoing energy and water cost savings achieved by an incremental average investment of \$4,500/unit yielded positive returns on investment across the portfolio while also delivering intangible health benefits.

Enterprise Community Partners

Title: [Incremental Cost, Measurable Savings Update](#)



In 2012, Enterprise joined with Davis Langdon to release an update to the prior study. This follow-on work expands the original 27 asset data set to include 52 affordable workforce housing projects for both new construction and existing asset rehabilitation work.

[Findings are consistent](#) with prior studies, primarily that investments in energy efficiency and healthy building environments drive most incremental costs, and that average lifetime savings exceeded average investment costs. The authors note a trend of high variability in actual vs. predicted energy consumption stemming from occupant behavior and increased plug loads.

These two studies serve as the foundation for the [2020Green](#) challenge, a joint effort by Enterprise Foundation and Citi Foundation with the goal of ensuring that all housing with public subsidy and long term affordability requirements can benefit from green building practices.

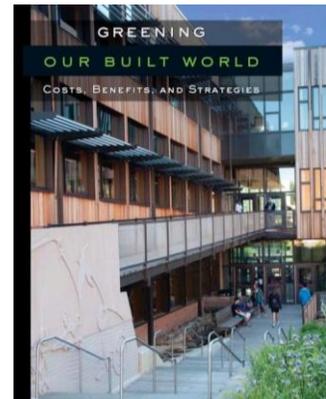
Greg Kats – CapitalE

Title: [Greening our Built World – Costs, Benefits and Strategies](#)

This hardcover textbook details 171 green buildings worldwide, providing an extensive financial and technical analysis to include marginal investment requirements and benefits achieved. In aggregate, [these buildings](#) reduced energy use by 33% at an average marginal investment cost premium of roughly 2% while simultaneously providing a wide range of other financial, social and health benefits. The book serves to debunk the cost premium perception gap and includes interviews with leading practitioners along with specific case-studies of leading green building solutions.

[Greg Kats](#) is the author of the first-ever benefit/cost analysis of certified green buildings as reported in 2003 to the [State of California Sustainable Task Force](#) and separately to the [State of Massachusetts](#).

In 2006, Kats followed on his prior efforts and published “[Greening America’s Schools: Costs and Benefits](#)” which analyzed 30 schools experiencing operational energy and water savings exceeding 30% annually at an average marginal investment cost premium of 1.65%.



CATEGORY III: Project-Based Studies

Project-based studies seek to track and analyze outcomes at the individual asset level including the marginal investment amounts allocated and operational savings achieved.

U.S. General Services Administration

Title: [Green Building Performance: A Post-Occupancy Evaluation of 22 GSA Buildings](#)



The [GSA](#) is the country's largest landlord, owning or leasing over 9,600 assets exceeding 370 million square feet. As part of [GSA's](#) ongoing [Greening Federal Buildings](#) program, the federal agency published a 2011 white paper detailing a post-occupancy evaluation of 22 [LEED](#)[®] and/or [ENERGY STAR](#) certified buildings.

This [applied research](#) report showcases aggregated portfolio findings including 25% less energy use, 19% lower operational costs, 36% lower CO2 emissions, and 27% higher occupant satisfaction.

The substantial progress demonstrated by GSA on these metrics served to inform the GSA's [Strategic Sustainability Performance Plan FY2012](#) outlining ambitious economic, environmental and social targets. GSA's portfolio now includes [over 125](#) [LEED](#)[®] certified facilities with dozens of detailed [case studies](#).

International Living Future Institute

Title: [Living Building Challenge Financial Study](#)



This comprehensive cost estimation study brings together leading green building firms and consultancies including [Interface Engineering](#), [Skanska USA](#), [SERA Architects](#), [Gerding Edlen Development](#), and the [New Buildings Institute](#).

Together these leading firms developed a roadmap for zero-net-energy/water/waste buildings using 12 LEED Gold[®] buildings as baseline. The study determined that with building technology poised to take a significant step forward, zero-net-energy/water/waste buildings are achievable, and financial paybacks on the majority of net-zero buildings across property types is less than 20 years.

Financial ROI was dependant on building type, client type, prevailing energy/water rates, and climate zone. This report contains schematic drawings by property type detailing the marginal investments required to achieve net-zero, followed by a categorical breakdown of estimated construction costs.

Urban Green Council

Title: [Cost of Green in NYC](#)



In 2009, Urban Green Council released the [Cost of Green in NYC](#), a data-driven analysis of recent construction projects in New York City.

The study, conducted in conjunction with Davis Langdon with financial support from [NYSERDA](#) and [Urban Green Council members](#), found no significant statistical difference in the per-square-foot cost of green vs. non-green buildings. The study focused on 38 luxury high-rise residential projects and 25 commercial interior projects certified to the LEED[®] rating system.

**Center for Neighborhood Technology /
USGBC-Chicago Research Subcommittee**
Title: [A Post-Occupancy Study of LEED Projects in Illinois](#)



This collaborative work measured the performance results of 25 LEED® projects located in Illinois across multiple metrics including energy and water consumption, construction and operating costs, health and productivity impacts, and greenhouse gas emissions. The study makes several important findings including the correlation of a higher number of LEED® credits achieved in the Energy and Atmosphere [EA] category to better energy performance outcomes.

Journal of Sustainable Real Estate
Title: [The Cost of LEED – An Analysis of the Construction Costs of LEED and Non-LEED Banks](#)



This study by Mapp, Nobe and Dunbar does a fine job summarizing prior research on LEED® construction costs, then examines in detail 37 bank branches constructed by Alpine Banks in Colorado. This study concludes building costs of LEED® banks are similar to and within the same range as non-LEED® banks.

Building Green
Title: [Understanding the Cost of LEED-NC Project Certification](#)

This 47-page technical guide breaks down individual LEED® credits on a credit-by-credit basis and explores potential marginal investment requirements and alternative scenarios for achieving specific LEED® credits. The report, published by experienced professionals at [LEEDuser](#), details common approaches to achieving the high-performance thresholds under the LEED-NC rating system through the lens of an experienced cost estimator.



Real Estate Valuation Resources

Cascadia Green Building Council | Cushman & Wakefield
Title: [High Performance Green Building: What's It Worth?](#)



Published by the Cascadia Green Building Council in conjunction with real estate valuation professionals at Cushman & Wakefield, [this collaborative effort](#) focuses on three specific building types and utilizes basic valuation methodologies including Cost Approach, Sales Comparison Approach, and Income Capitalization Approach to assess high performance value.



Appraisal Institute | IMT
[Green Building and Property Value](#)

This white paper, published by the Appraisal Institute in conjunction with the Institute for Market Transformation, details the private market value dynamics for high performance buildings.



Valuation has four key components: 1) top-line effective rents, 2) total occupancy over time, 3) fixed and variable operating expense reduction, and 4) risk reduction. This paper provides a playbook for private market owners seeking to capture the value inherent to green building and builds on the [Appraisal Institute's earlier work](#) to recognize energy costs and operational performance in real property valuation.

CATEGORY IV: Market-Based Value Studies

Market-based value studies analyze the market dynamics for commercial buildings from an economic and financial perspective including comparisons of effective rents, occupancy rates, and asset values.

Kok, Eichholtz and Quigley

Title: [*The Economics of Green Building*](#)

This academic paper by three renowned real estate professors examines the financial performance of a large sample of US commercial real estate properties, separating certified green buildings from non-certified buildings.

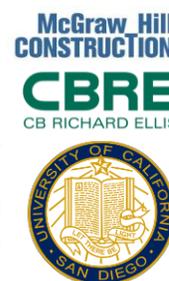


Their findings show buildings as denoted by [LEED](#)[®] or [ENERGY STAR](#) certification secure substantial market premiums in rent and asset values. This paper was originally presented at the [Federal Reserve Bank of Atlanta](#), with follow-on presentations at the [Regenerative Network 2011 Spring Forum \[video\]](#).

CBRE | UC San Diego | McGraw Hill Construction

Title: [*Green Buildings Make Dollars and Sense*](#)

[CBRE](#) engaged 156 buildings and 588 tenants occupying 52 million SF in a [survey](#) co-authored with [UC San Diego](#) and [McGraw Hill Construction](#). The study covered ten major US metropolitan areas and analyzed operating costs, worker productivity, and the benefits of LEED[®] certification when applied to a commercial office portfolio. The work showed both higher occupancy and higher rental rates experienced by LEED[®] certified buildings as compared to non-LEED buildings and the broader competitive market.



Journal of Sustainable Real Estate

Title: [*The Economics of Green Retrofits*](#)



[Nils Kok](#), [Norm Miller](#) and [Peter Morris](#) combined efforts to research and publish the first study focused on the economics of green renovations using the [LEED EB:OM](#) certification standard. The study focuses on rents and occupancy rates, investigates the scope and budget of capital improvements, and reveals the amount of investment required at the asset level to increase performance.

The study uses [CoStar](#) market data in 14 major US markets as control data, then compares rent and occupancy levels of LEED[®] buildings before and after renovation. Empirical results reveal a \$2.00/SF rent premium for LEED[®] buildings which translates to a roughly \$25.00/SF value premium.

CoStar, Inc.

Title: [*Does Green Pay Off?*](#)



Executives at [CoStar](#), the world's leading real estate data provider, combined with UC San Diego's [Burnham-Moores Center for Real Estate](#) to develop the industry's first systematic study based on the entire [CoStar US database](#) of over 2.8 million properties. Using LEED[®] and ENERGY STAR certified buildings, they compared these assets to similar buildings filtering based on Class A multi-tenant assets >200,000 SF standing over five stories built since 1970.

The authors found LEED[®] and ENERGY STAR buildings consistently achieved higher rental rates, occupancy rates, and sales prices. Survey results also showed a \$0.50/SF operating cost advantage, a 50 basis point cap rate differential, and evidence of faster market absorption rates. This study was published in the [October 2008](#) edition of the Journal of Real Estate Portfolio Management, then updated in 2010 – "[Does Green Still Pay Off?](#)" – to reflect two more years of market experience.

Journal of International Money and Finance

Title: [Property Portfolio Greenness and the Financial Performance of REITs](#)

[Eichholtz](#), [Kok](#) & [Yonder](#) investigated the effects of LEED® and ENERGY STAR certified property holdings on the financial performance of REIT equity returns. Using a 2-stage regression model, the study finds that over more than a full market cycle (2000-2011) the 'greenness' of a REIT is positively related to three key financial measures – Return on Assets [ROA], Return on Equity [ROE] and Funds From Operations in relationship to a unit of Revenue [FFO/Revenue].



A [related article](#) is published on **GBIG Insight**.

Institute for Market Transformation

Title: [Home Energy Efficiency and Mortgage Risks](#)

The [Institute for Market Transformation](#) is a Washington, DC-based think-tank focused on developing [market conditions](#) for greater capital investment into energy efficient buildings. [This study](#) of the residential housing market examines loan performance data from 71,000 single family homes consisting of both ENERGY STAR rated homes and non-ENERGY STAR homes across a wide section of neighborhood, household and demographic characteristics. Results showed [32% lower default risk](#) for the energy efficient home segment.



San Francisco Department of the Environment

Title: [The Value of Green Labels in the California Housing Market](#)

This study by [Matthew Kahn](#) and [Nils Kok](#) of 1.6 million homes sold in California over the 2007-2012 time frame determined that homes labeled with the [ENERGY STAR Homes](#), [LEED for Homes](#), and/or [GreenPoint Rated](#) rating systems sell at an aggregated 9% premium compared to non-labeled homes.



The research controlled for amenities, size, location and vintage and pointed to other potential benefits beyond energy savings including health components. An interesting conclusion is the correlation between the rate of hybrid vehicle registration and home value premiums suggesting the existence of intangible financial value drivers in [certain markets](#).

Conlon & Glavas

Title: [Relationship Between Corporate Sustainability and Firm Financial Performance](#)

This academic journal article from two University of Notre Dame professors samples 494 bank branches of a large US consumer financial institution. The sample was broken down to compare 52 LEED® certified branches and 442 non-LEED® certified branches. Data collected over the 2008-2010 time frame revealed that transparency on firm financial practices positively correlated to an increase in consumer-based financial transactions.



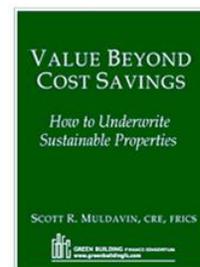
Further analysis showed that environmental practices had a stronger impact on consumer-based transactions as compared to transactions by business clients. The study also found the utility operating costs of LEED®-certified branches were lower for these 52 branches on a per employee basis as compared to the non-certified branches.

Additional Market-Based Resources

Green Building Finance Consortium

Title: [Value Beyond Cost Savings: How to Underwrite Sustainable Properties](#)

This textbook is designed as a guide to assist private investors in making better financially based sustainable property investment decisions. The [600+ page book](#) properly identifies the real estate industry's failure to appropriately incorporate revenue and risk considerations into sustainable investment decisions, which has led to the predictable outcome of a macro-scale underinvestment in sustainability to date.



This thorough text highlights how sustainability considerations permeate the underwriting and valuation process, and details suggested modifications to prevailing underwriting methods common in today's real estate capital markets. [Chapters II – VI](#) contain critical resources including an assessment checklist, methodologies for financial underwriting, risk assessment frameworks, and an in-depth look into special considerations applicable to high performance real estate.

The [Green Building Finance Consortium](#) is an independent research organization focused on enabling private sector participants to make sustainable property investment decisions from a financial and fiduciary perspective.

International Society of Sustainability Professionals

Title: [Quantifying the Hidden Benefits of High-Performance Building](#)



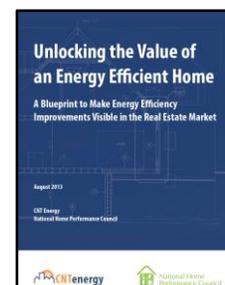
The ISSP is a member-driven interdisciplinary organization bringing together sustainability professionals to advance best practices through education, research, and workshops. This cooperative study in conjunction with the Texas A&M Mays Business School showcases how factoring intangible benefits into the return on investment equation can yield strong paybacks to sustainability-oriented investments.

Of particular note is Exhibit 3 in the Appendix which uses financial assumptions specific to employee productivity via assumed costs of capital, benefit duration assumptions, and other factors which support a more robust sensitivity analysis of the potential financial return scenarios.

National Home Performance Council

Title: [Unlocking the Value of an Energy Efficient Home](#)

This white paper, developed by CNT Energy and the National Home Performance Council, provides methods to document efficiency improvements and incorporate them into the real estate value chain. Making information about energy efficiency improvements transparent to residential buyers and transaction professionals is necessary to realize the market value of investments made in high performance building attributes.



The Appraisers Research Foundation

Title: [Various – Topical Research on Green Buildings](#)

The [Appraisers Research Foundation](#) ["TARF"] is a 501c6 not-for-profit foundation providing industry direction and grant funding for research benefiting all of the disciplines of the appraisal profession and the public. TARF's work is primarily residential focused, and they maintain a collection of studies and articles useful to valuation professionals focused on green building valuation issues.

CATEGORY V: Early Research

Royal Institute of Chartered Surveyors

Title: [Green Value Report](#) [2005]

London-based [RICS](#) is the world's leading body of real estate appraisal and valuation professionals totaling 100,000+ members qualified under rigorous standards in land and construction valuation, surveying, and consulting. This early 2005 report compiled a literature review of topical work, then reviewed the cost and value performance of 12 specific assets across five (5) property types.

The analysis covered initial construction costs, operating performance metrics and operating expenditures, occupant satisfaction levels, vacancy and rental rates, and overall market positioning. The study concluded that green building features add value, while identifying barriers to a better understanding of green building attributes from a valuation perspective.

Steven Winter Associates

Title: [GSA LEED Cost Study](#) [2004]

Since the [first LEED® certification](#) in March 2000, LEED® has become the [global standard](#) for defining a high-performance green building. After adopting the LEED® best-practice framework, the GSA commissioned a study to analyze and estimate the costs required to develop 'green' facilities. This study showed cost-neutral for LEED Silver®, with minor marginal investments required to climb the LEED® ladder. These results informed [GSA's continued expansion](#) of their successful engagement with LEED®.

State of California Consumer Services Agency

Title: [Managing the Cost of Green Building](#) [2003]

The State of California has long been at the [forefront of adopting](#) green building practices with the earliest program initiated by the City of San Francisco's program dating back to [1999](#). This pioneering work from October 2003 details general strategies for navigating cost factors and highlights barriers to controlling and managing incremental investment costs. Early works such as this provided significant groundwork, leading to the implementation of California's [CalGreen](#) building code in 2010.

Paladino & Company

Title: [LEED Certified Buildings in Seattle: Analysis and Projections](#) [2005]

This study analyzes 15 LEED® certified projects in Seattle, WA through the review of documentation submitted during the LEED® certification process. Although there is no cost information available, the study served to 1) analyze trends in LEED® credit achievement, 2) identify key strategies implemented to achieve LEED® credits, and 3) utilize these observed trends to project future benefits vs the status quo on new construction in the City of Seattle.

US Department of Energy

Title: [The Business Case for Sustainable Design in Federal Facilities](#) [2003]

The Federal Energy Management Program of the US Department of Energy was an early leader in incorporating sustainability efforts into the federal government's building stock. This report addresses the special meaning sustainable design takes when discussed in context of the Federal government including the multi-layered impact Federal leadership has on the private market, and provides concrete examples of how Federal agencies can make sustainable design a standard practice rather than the exception.

Capital E

Title: [The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force](#)

This seminal work completed in 2003 represented the most definitive cost benefit analysis of green buildings at this point in the industry's maturation. This report established significant, causal connection between a nominal marginal investment averaging 2% and significant long-term financial benefits accruing to asset owners and tenants setting the stage for the market's embrace of the LEED building rating system.

More Resources

GBIG

Title: [The World](#)

Based upon this early research and the collective efforts of tens of thousands of real estate industry professional including 12,000+ USGBC members, over 190,000 LEED Accredited Professionals, a decade of Greenbuild exhibitors and attendees, and government leadership at the federal, state, and local levels, LEED has grown to become a major presence in real estate markets worldwide.

The graph below shows the annual amount of LEED certified square feet and demonstrates the results of over 20,000 projects spanning all property types, sizes and ownership structures that found a compelling economic value proposition to certify adherence to the LEED building rating system.

